Better Buildings®
U.S. DEPARTMENT OF ENERGY

Intelligent Efficiency: Delivering 21st Century Energy Savings

Panelists:

Theresa Spurling-Wood, Alachua County Public Schools

Marshall Runkel, Clean Energy Works

Paul Hamilton, Schneider Electric

U.S. DOE Better Building Summit
May 28th, 2015: 10:00 am to 11:30 am

Moderator: Ethan A. Rogers, ACEEE

U.S. DEPARTMENT OF ENERGY
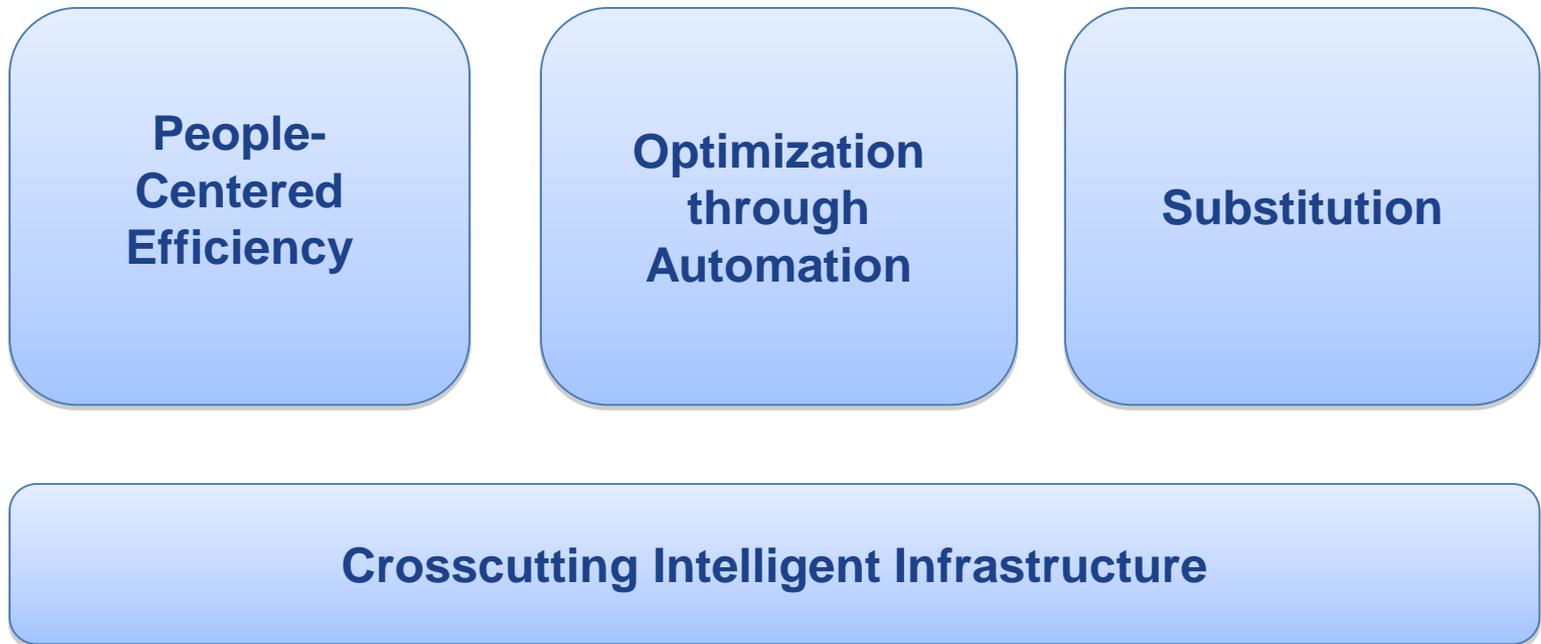
Focus of this Session

Low-cost sensors, ubiquitous internet connectivity, and other technological advances are opening new doors for energy efficiency in homes, buildings and factories. Sometimes called "intelligent efficiency," this network-based, high-tech approach could cut the nation's energy use by 12 to 24%.
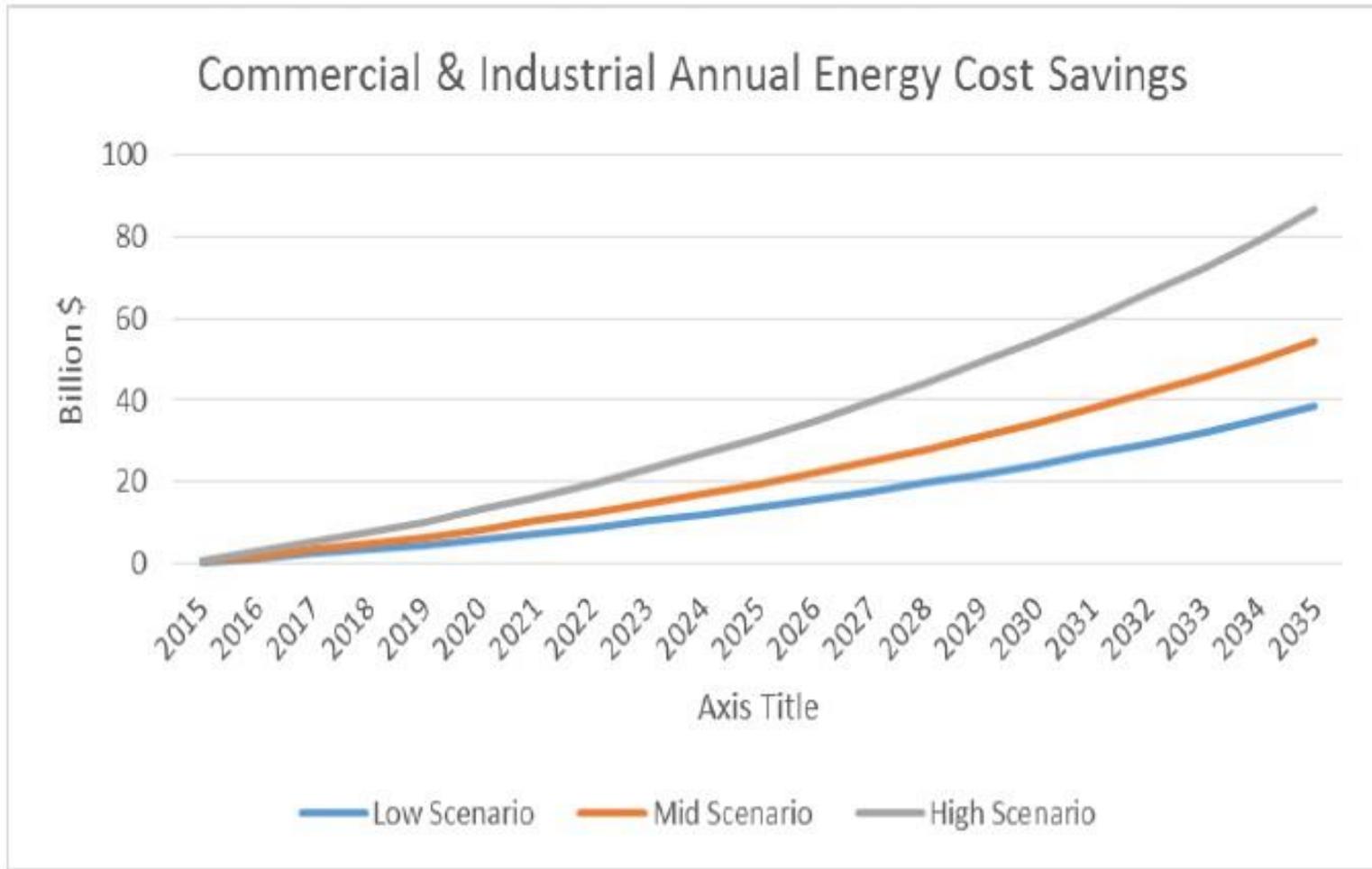
What? When? Where? Who? How?

Intelligent Efficiency
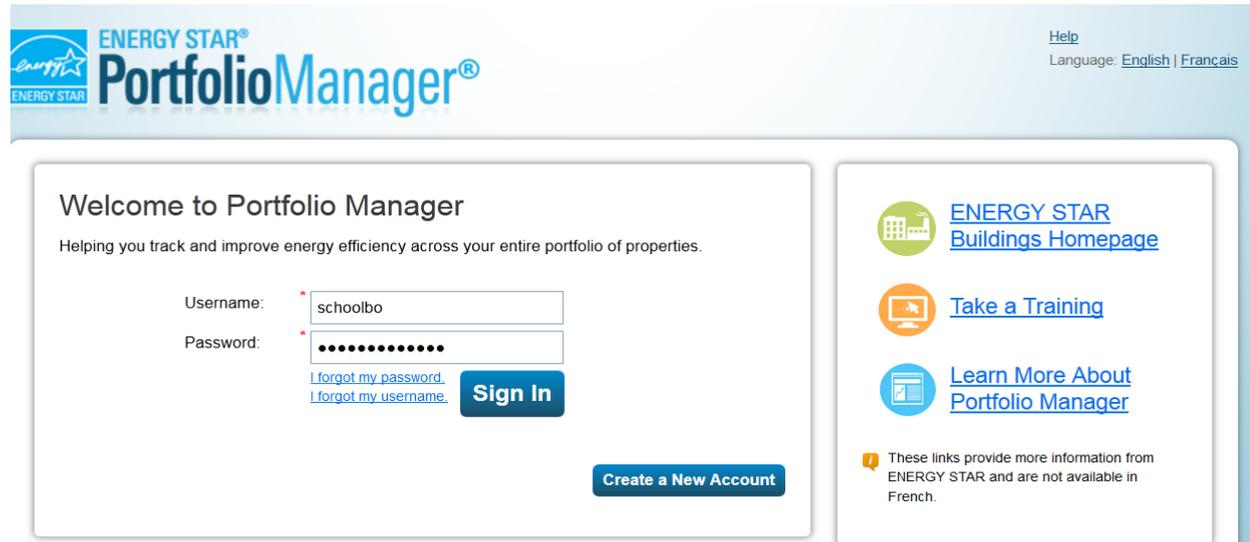
- a systems-based, holistic approach to saving energy.

People-Centered Efficiency	Optimization through Automation	Substitution

Crosscutting Intelligent Infrastructure

Opportunity:

Commercial & Industrial Annual Energy Cost Savings

Intelligent Efficiency:
Delivering 21st Century Energy Savings

Alachua County Public Schools

Theresa A Spurling-Wood, CIE, GGP, LEED AP

- **Free** tool

- Helps you find out how your local schools (buildings) are performing compared to similar building profiles.

- Helps locate unusual data – which assists with locating issues that need investigation.

- https://portfoliomanager.energystar.gov/pm/login.html

67% of schools in our portfolio are on target

Better Buildings Challenge
20% energy use reduction by 2020

42 Different Sites

- Locate and confirm location of "all" your utility meters

- ACPS has 6 different electric utility providers

- Confirm the associated fees and rates

- Partner with your utility providers

Yes 67%
No 33%
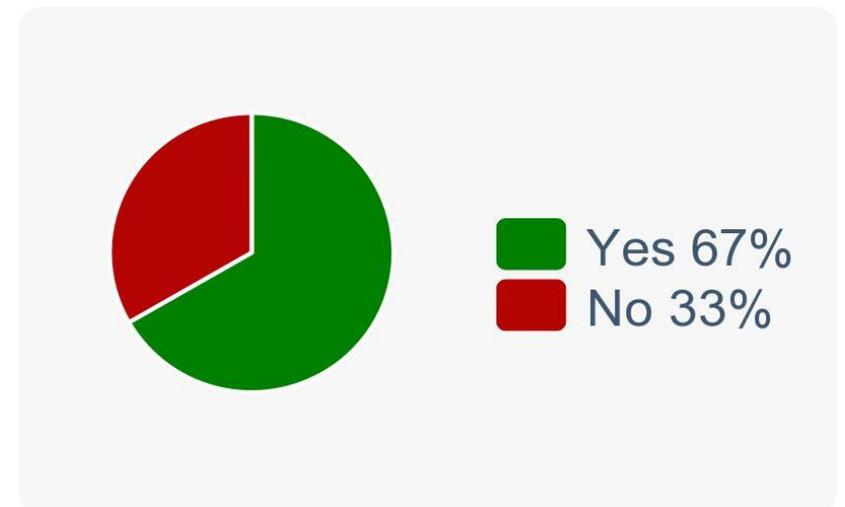
Allows **Site Comparisons** of similar design and build
Why data so different?

Glen Springs Elementary

2826 NW 31st Avenue, Gainesville, FL 32605 | Map It

Portfolio Manager Property ID: 3167504 | Primarily: K-12 School

Year Built: 1968

Apply for ENERGY STAR Certification

ENERGY STAR Score (1-100)

Current Score: 75

Baseline Score: 22

Summary | Details | Meters | Goals | Design

Metrics Summary — Change Time Period

Metric	Baseline (Dec 2010)	Current (Feb 2015)	Change
ENERGY STAR score (1-100)	22	75	53(240.9%)
Source EUI (kBtu/ft²)	212.3	126.3	-86.0(-40.5%)
Site EUI (kBtu/ft²)	70.2	42.8	-27.4(-39.0%)
Energy Cost ($)	156,570.07	115,021.84	-41548.23(-26.5%)
Total GHG Emissions (Metric Tons CO2e)	685.2	407.5	-277.7(-40.5%)

Rawlings, M.K. Elem

3500 NE 15th StREET, Gainesville, FL 32609 | Map It

Portfolio Manager Property ID: 3167505 | Primarily: K-12 School

Year Built: 1966

Apply for ENERGY STAR Certification

ENERGY STAR Score (1-100)

Current Score: 90

Baseline Score: 54

Summary | Details | Meters | Goals | Design

Notifications (0)

You have no new notifications.

Property Profile

You haven't created a profile for your property yet. Profiles are a way to supplement the information in Portfolio Manager with additional information about your property, including a photo.

+ Create Profile

Metrics Summary — Change Time Period

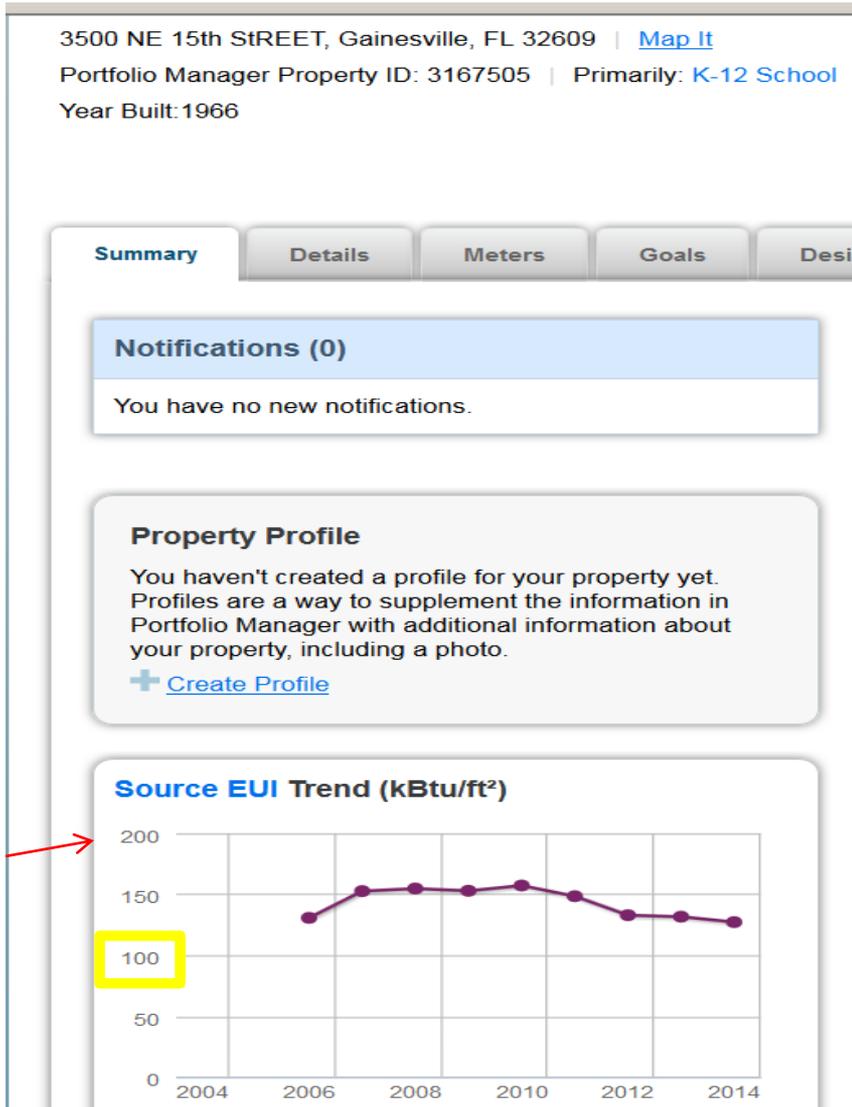| Metric	Baseline (Dec 2010)	Current (Feb 2015)	Change
ENERGY STAR score (1-100)	54	90	36(66.7%)
Source EUI (kBtu/ft²)	157.2	105.0	-52.2(-33.2%)
Site EUI (kBtu/ft²)	53.4	35.1	-18.3(-34.3%)
Energy Cost ($)	137,340.00	118,716.81	-18623.19(-13.6%)
Total GHG Emissions (Metric Tons CO2e)	550.2	367.6	-182.6(-33.2%)

Rawlings Elem
used for comparison

Glen Springs Elem
Retro-commissioning results

3500 NE 15th StREET, Gainesville, FL 32609 | Map It
Portfolio Manager Property ID: 3167505 | Primarily: K-12 School
Year Built:1966

2826 NW 31st Avenue, Gainesville, FL 32605 | Map It
Portfolio Manager Property ID: 3167504 | Primarily: K-12 School
Year Built:1968

Summary | Details | Meters | Goals | Desig

Notifications (0)
You have no new notifications.

Property Profile
You haven't created a profile for your property yet.
Profiles are a way to supplement the information in
Portfolio Manager with additional information about
your property, including a photo.
+ Create Profile

Source EUI Trend (kBtu/ft²)

Summary | Details | Meters | Goals | De

Notifications (0)
You have no new notifications.

Property Profile
You haven't created a profile for your property yet.
Profiles are a way to supplement the information in
Portfolio Manager with additional information about
your property, including a photo.
+ Create Profile

Source EUI Trend (kBtu/ft²)

Actual real dollars saved every month forever in addition to monies refunded through negotiations using EPA Portfolio Manager data
- by finding an electric meter multiplier error

- The City agrees to credit monthly against the School Board's "Account #xxxxx Elementary School" up to $5,187.36, but no more than the amount of that month's electric bill, per month until the **$186,745.10** is paid in full.

- If the School Board's monthly electric bill is less than $5,187.36, the City will apply the excess credit against the Board's next month's electric bill.

17,425 Computers in District
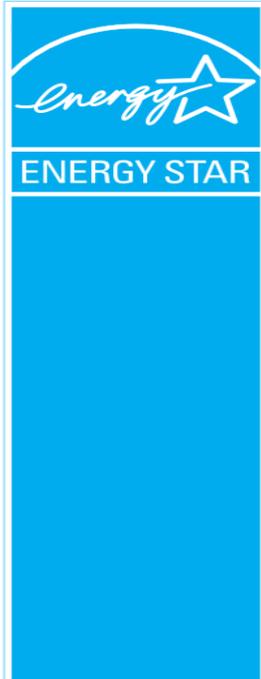
CERTIFICATE OF RECOGNITION

PRESENTED TO

Alachua County School Board

By the United States Environmental Protection Agency in recognition of their commitment to a better environment and reducing greenhouse gas emissions as a participant in the **Low Carbon IT Campaign**.

Awarded in April 2013.

Steven J. Ryan
Steven Ryan
ENERGY STAR
U.S. Environmental Protection Agency

Additional
Computers
13,000 in 2010
17,000 in 2015

Turn off non-critical loads in unoccupied areas.
Match school schedules, usage patterns, and upgrades needed by IT on PC's using KACE system by DELL

17,000 are on nightly shut down program

Notes:
1. Additional Software may be necessary for PC's.
2. Cost of shut down program has now escalated by charging for *number of computers using program
   * this runs up costs

Why Intelligent Controls?
Behavior modification vs automation controls

Source EUI Trend (kBtu/ft²)
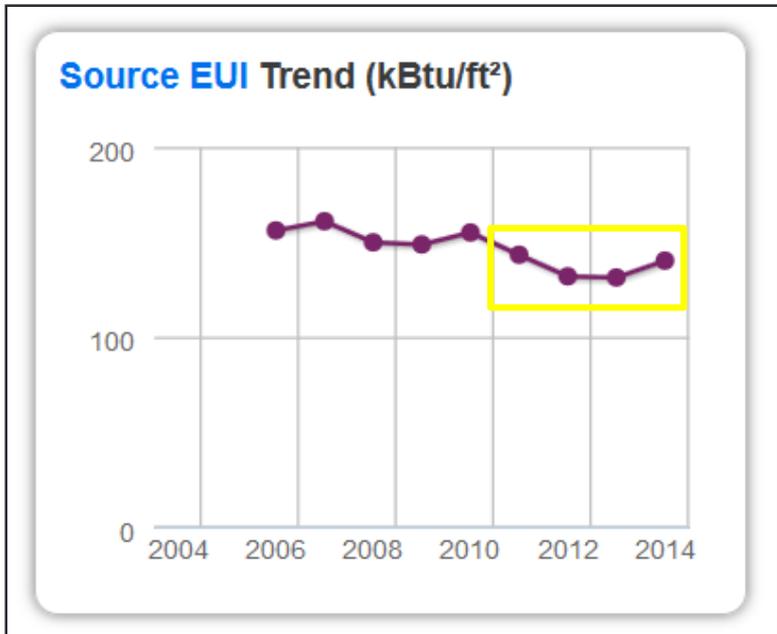
Energy Use in Office Buildings
US Department of Energy

Other 12%
Heating & Cooling 34%
Lighting 30%
Office Equipment 24%
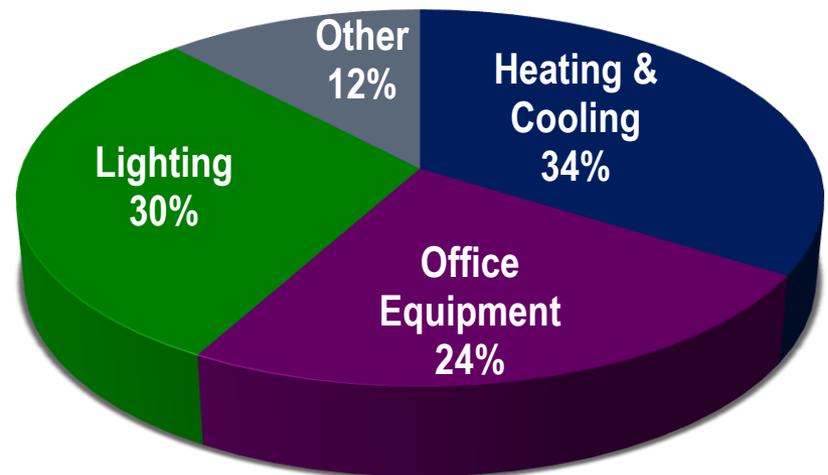
Why Intelligent Controls?

Key requirements:

- An unlimited number of schedules

- Local or remote web-based access

- Thermostat grouping for rapid re-programming and monitoring

- Temperature setback by area, based on a user definable combination of schedule, occupancy and events

- Set point override based on occupancy status and door/window openings

- Limited local range settings at thermostat keypad

- *Managed Systems can double the efficiency of unmanaged controls, including:*

  - **Occupancy Sensors**
  - **Photocells**
  - **Programmable Thermostats**
  - **"Smart" Plug Strips**

  - Out of the box solution that is easy and cost-effective to install

  - Scalable solution for projects of all sizes, including facilities which do not have the budget for PLC Systems.

  - Wireless networking provides a managed system with the installation cost of unmanaged equipment

  - Ability to transform basic, unmanaged devices into parts of a "smart" networked solution.

Why Intelligent Controls?

- **Baseline:**

System that provides real-time energy consumption for lighting, HVAC equipment, and plug loads

- **Stand-alone Controls:**

Occupancy-based decisions to turn on/off lighting, plug loads and easily over-ridden programmable thermostats (if people remember)

- **Intelligent Controls:**

Off site scheduling of all lighting, set points, and plug loads

kWh Per day

Work Day **Non-work day** **Facility Closed**

■ No Controls
■ Unmanaged Controls
■ **Managed Controls**
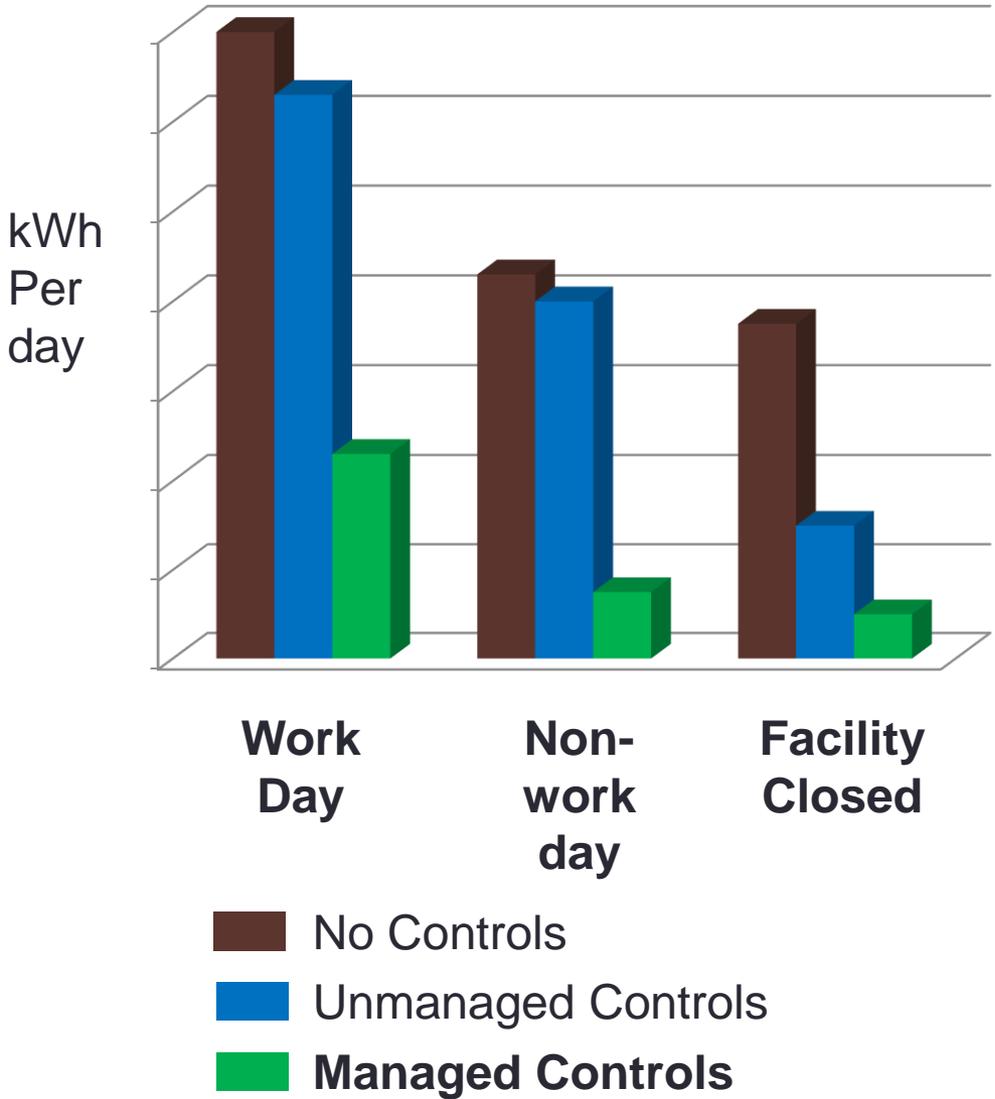
- ## Easy to Install:
  - Reduced wiring and labor cost
  - Automated, self-discovering "plug and play" set up
  - Wireless communication between devices
  - Wizard-based installation and scheduling

- ## Easy to Manage:
  - Simple interface for monitoring and control
  - Remote connectivity anytime and from anywhere
  - Automated system alerts and alarming

- ## Easy to Own:
  - Scalable solution that grows
  - Self-healing mesh network
  - Expandable platform that provides HVAC, lighting, metering and plug load capability.

Exterior Renderings:
Produced in BCN6785 – Construction Information Systems
Gavin Hancock, Daniella Daswatta, Pranav Agrawal and Jerry Hong

Installation – Managed Solution

Remote Temperature Probe

24 VAC

Thermostat

Door/ Window Contact

Occupancy or Vacancy Sensor

**Devices operate as stand alone
if there is a wireless system malfunction**

Provides:

Centralized and remote management of packaged HVAC via wireless thermostats. Management based on schedule, occupancy and events.

- Input Voltage: 24VAC 50/60 HZ
- Relay Rating: 24VAC @ 1 Amp max. per relay
- Keyboard and/or set point lock out
- Remote / onboard senor averaging
- 3 V Lithium battery for power failure only
- Operates in either network or stand alone mode.

Incorporate door/window switch to change inefficient habits

Signal Range
1000' Unobstructed

Equipment Compatibility
- 1 Heat/ 1 Cool
- 2 Heat/ 2 Cool
- 3 Heat/ 2 Cool Heat Pump
- 3 Heat/ 2 Cool Dual Fuel

Typical Classroom Lighting

Turning off lights when unoccupied in 2000 classrooms means savings varies with occupants habits

Classroom 1

- 20 light fixtures
- ON 12 hours
- 3 lamps x 32 watts = 96 watts
- = $746.49 per year

Classroom 2

- 20 light fixtures
- ON 12 hours
- 3 lamps x 32 watts = 96 watts
- = $746.49 per year

Classroom 3

- 20 light fixtures
- ON 12 hours
- 3 lamps x 32 watts = 96 watts
- = $746.49 per year

Installation – Typical Unmanaged Controls

Lighting Fixture or Circuit

Standard Occupancy Sensor

20A Power Pack

120 or 277vAC 20A Power Feed

Local Switch
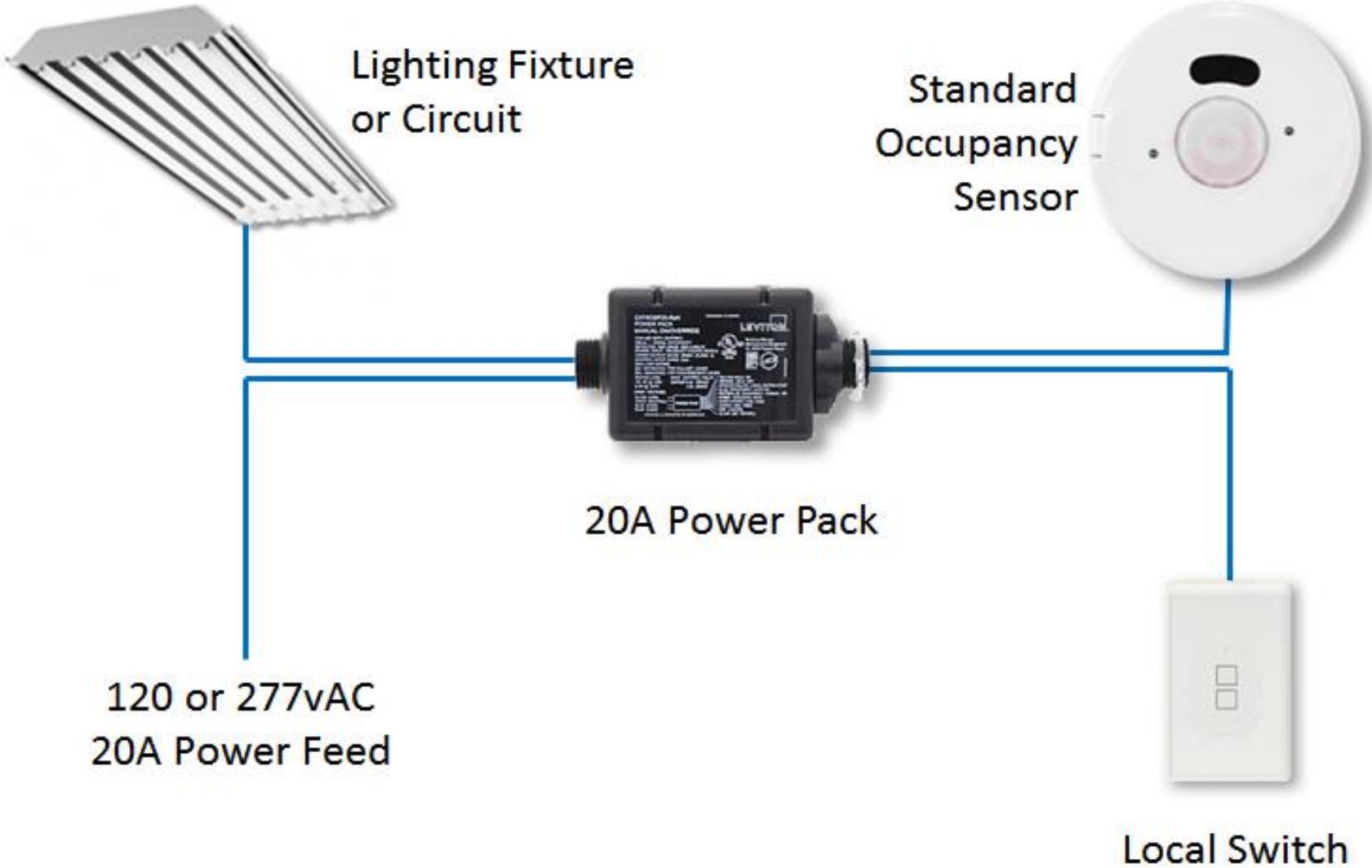
Installation –Simple Managed Solution

Lighting Fixture or Circuit

Standard Occupancy Sensor

WHITE (NEUTRAL)   (P1) POWER PACK
BLACK (LINE)
RED (LOAD)   (P2) DC OUT
RED (LOAD)
BLUE (WALL SW COM)   (P3) AUX INPUT
YELLOW (WALL SW1)
ORANGE (WALL SW2)   (P4) SENSOR

Autani ARC Series Room Controller

120 or 277vAC 20A Power Feed

Local Switch
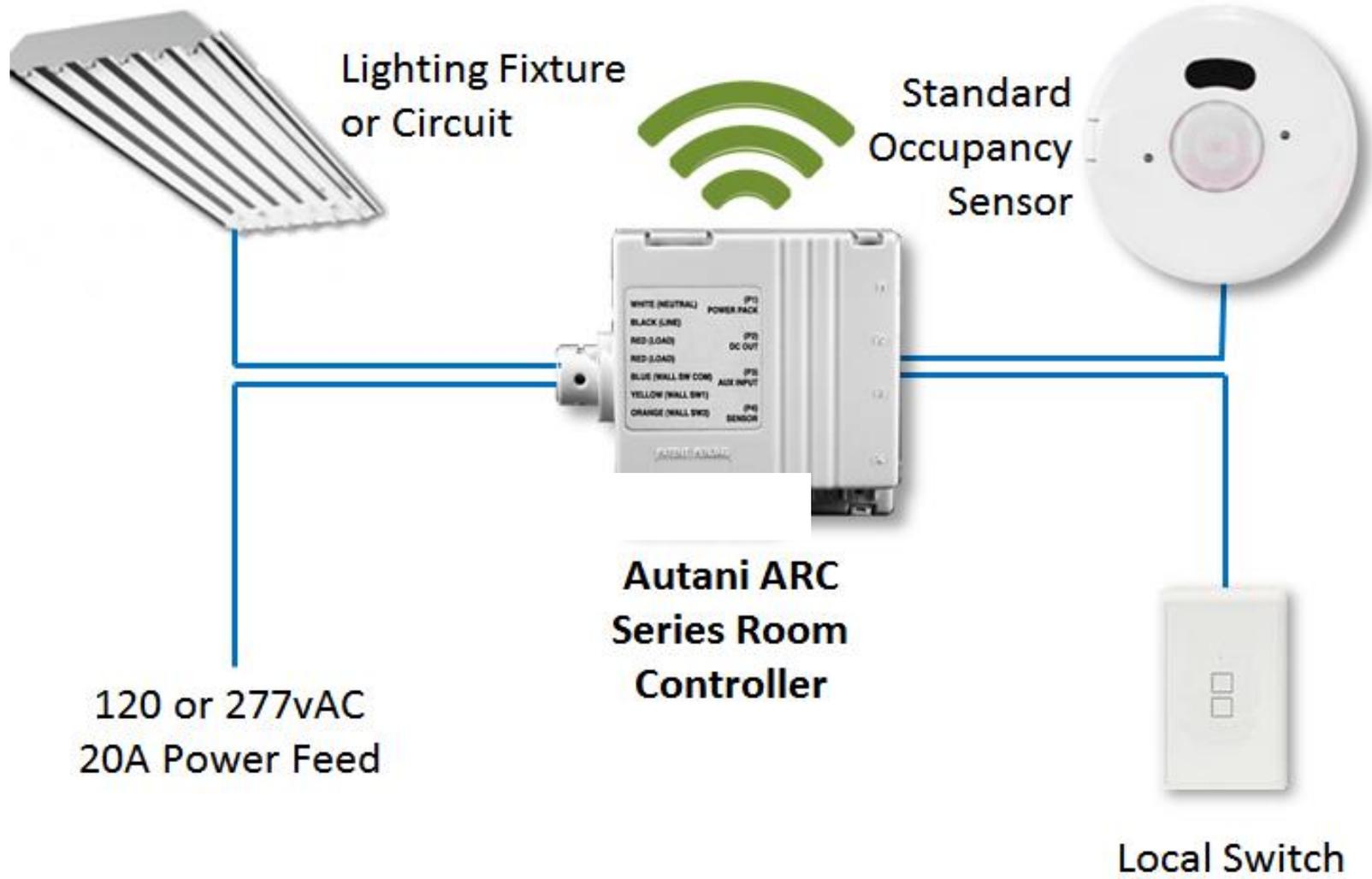
What is needed to make it all work?

- Software that is reliable, powerful, and easy to use.
- Hardware that includes a variety of innovative devices that are also stand alone if wireless system has a failure
- ZigBee wireless communication system because it eliminates network wiring with a secure, reliable self healing mesh network.
- Internet connectivity is an option, not a requirement. WAN/LAN

Software system coordinates thermostat management based on schedule, occupancy, and curtailment events.

- Up to the minute consumption and savings data represented through charts, graphs and reports
- Real-time alerting for user defined and system events via email or smart phone
- Temperature set points and overrides are dynamically scheduled, and can be modified by demand response events

ROI – SmartLet with Scheduling

Appliance	Electric Space Heater	PC, Monitor, & Printer	Incandescent Desk Lamp	Large Copier - Standard	Large Copier - Energy Star	Vending Machine/ Soda	Vending Machine/ Chips
Load (watts)	1440	163	100	310	109	438	120
Avg $ per kWH	$ 0.10	$ 0.10	$ 0.10	$ 0.10	$ 0.10	$ 0.10	$ 0.10
Est Rebate per kWH	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05
Unmanaged Operation							
Hours on per day	24	24	24	24	24	24	24
Days on per year	180	365	365	365	365	365	365
kWH per day	34.56	3.912	2.4	7.44	2.616	10.512	2.88
kWH per year	6221	1428	876	2716	955	3837	1051
CO2 Footprint/ year	*9580*	*2199*	*1349*	*4183*	*1471*	*5909*	*1619*
Cost per Year	**$ 620.23**	**$ 142.37**	**$ 87.34**	**$ 270.79**	**$ 95.21**	**$ 382.55**	**$ 104.78**
Managed Operation							
Hours on per day	12	12	12	12	12	12	12
Days on per year	180	365	365	365	365	365	365
kWH per day	17.28	1.956	1.2	3.72	1.308	5.256	1.44
kWH per year	3110.4	713.94	438	1357.8	477.42	1918.44	525.6
CO2 Footprint/ year	*4790*	*1099*	*675*	*2091*	*735*	*2954*	*809*
Cost per Year	**$ 310.11**	**$ 71.18**	**$ 43.67**	**$ 135.37**	**$ 47.60**	**$ 191.27**	**$ 52.40**
Managed Savings							
kWH Saved/ Year	3111	714	438	1358	478	1919	525
$ Saved/ Year	**$ 310.13**	**$ 71.19**	**$ 43.67**	**$ 135.41**	**$ 47.61**	**$ 191.28**	**$ 52.38**
lbs CO2 saved/ year	*4791*	*1100*	*675*	*2091*	*736*	*2955*	*809*
Estimated Payback - without rebates							
Avg Cost/ SmartLet	$ 125.00	$ 125.00	$ 125.00	$ 125.00	$ 125.00	$ 125.00	$ 125.00
Avg Cost/ MINI Sensor	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Avg Cost/ EMC PC Client	$ -	$ 25.00	$ -	$ -	$ -	$ -	$ -
Payback (months)	**5**	**25**	**34**	**11**	**31**	**8**	**29**

Intuitive Scheduling

Light: Lobby (Room Controller - AU100900558 - On/Off Light-1)

| General | Charts | Event Logs | Schedule | Sensors |

Name: Normal Operating Schedule

Description: Weekday Operating Hours

☐ Disable this schedule

Events for Schedule: Normal Operating Schedule

Name	Lighting Mode	M	T	W	T	F	S	S	Time
Default	Turn lights off after 15 minutes of inactivity	☑	☑	☑	☑	☑	☑	☑	06:00 AM
Prep	Lights On - Keep lights on regardless of oc...	☑	☑	☑	☑	☑	☐	☐	10:30 AM
Closed	Lights Off - Keep lights off regardless of oc...	☑	☑	☑	☑	☑	☐	☐	10:00 PM

+ New   📋 Copy   ✏ Edit   🗑 Delete

Copyright © 2011 A...   Save   Cancel   Apply

24 x 7 Schedule Events

Define device behavior based on occupancy

Define when behavior occurs

Edit Event: Default

Name: Default

Lighting Behavior

● Delayed - turns off lighting if occupancy is not detected within the set delay time.

Delay: 15 ↕ (minutes)

○ Lights On - Keep lights on regardless of occupancy.
Note: A light configured for Switch mode cannot be turned on by a schedule if the wall switch is in the "Off" position.

○ Lights Off - Keep lights off regardless of occupancy.

Effective Days

☑ Monday   ☑ Saturday
☑ Tuesday   ☑ Sunday
☑ Wednesday
☑ Thursday
☑ Friday

Weekday
Weekend
All

Effective Time

Start: 06 ▼ : 00 ▼ AM ▼

End: Next Event

Save   Cancel   Apply

Graphical Data Logging
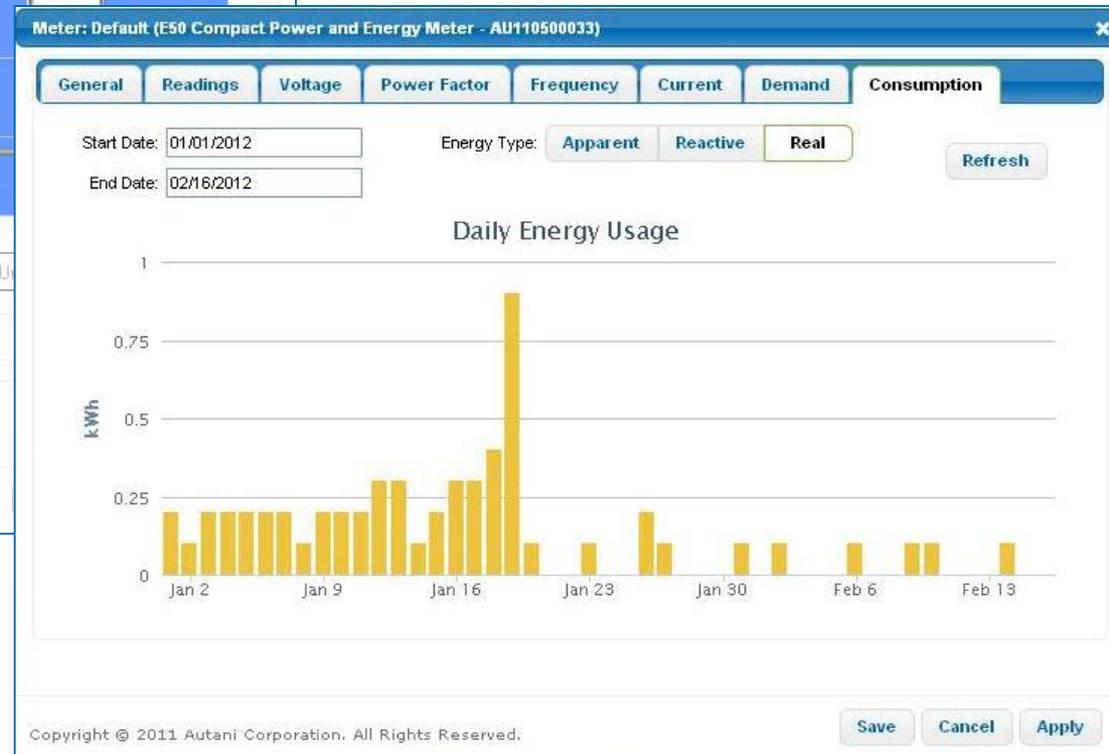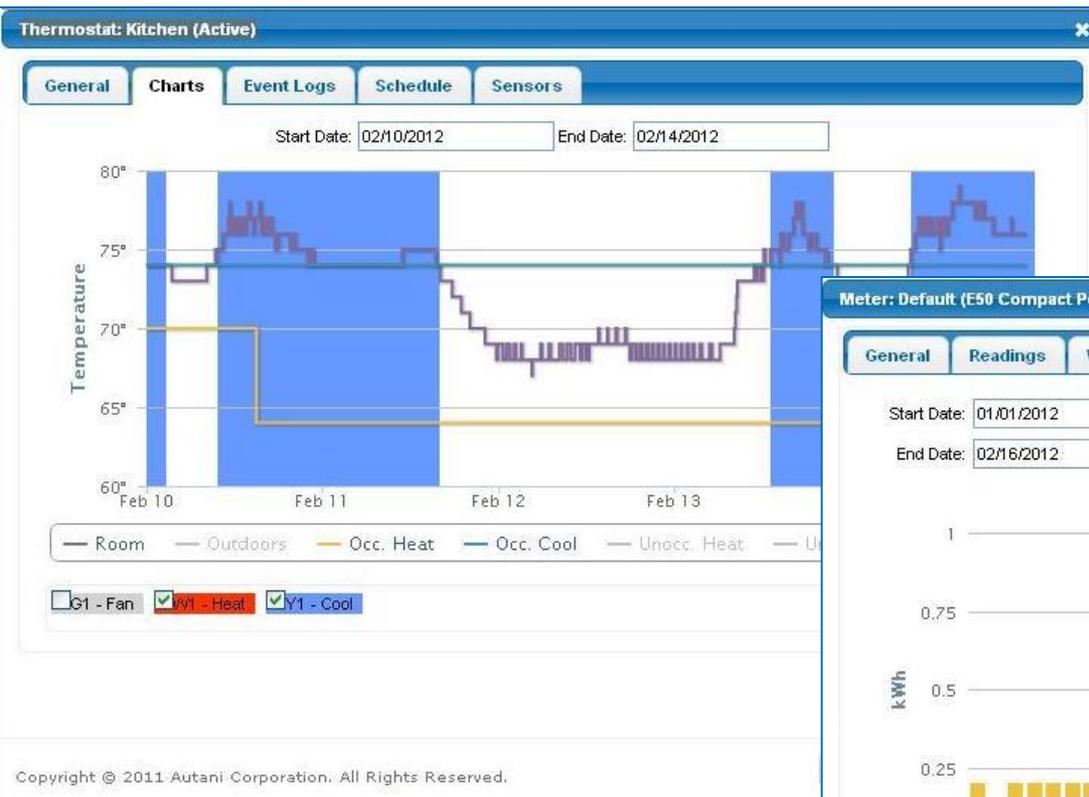
BUILDING INFORMATION MODELING (**BIM**).

A unique ongoing cost savings partnership between Higher Ed and K12 Sector

Following slides are provided by:

Dr. R. Raymond Issa

Hamzah Shanbari

Nathan Blinn

University of Florida, M.E. Rinker, Sr. School of Construction Management

BCN6785 - Construction Information Systems Students

THE Center for Advanced Construction Information Modeling (CACIM)
is a research center at the M.E. Rinker, Sr. School of Construction Management and has collaborated with Alachua County Public Schools to complete Building Information Models.

BIM

3-Dimensional representation of the built environment with embedded information regarding materials & system selections with their associated properties.
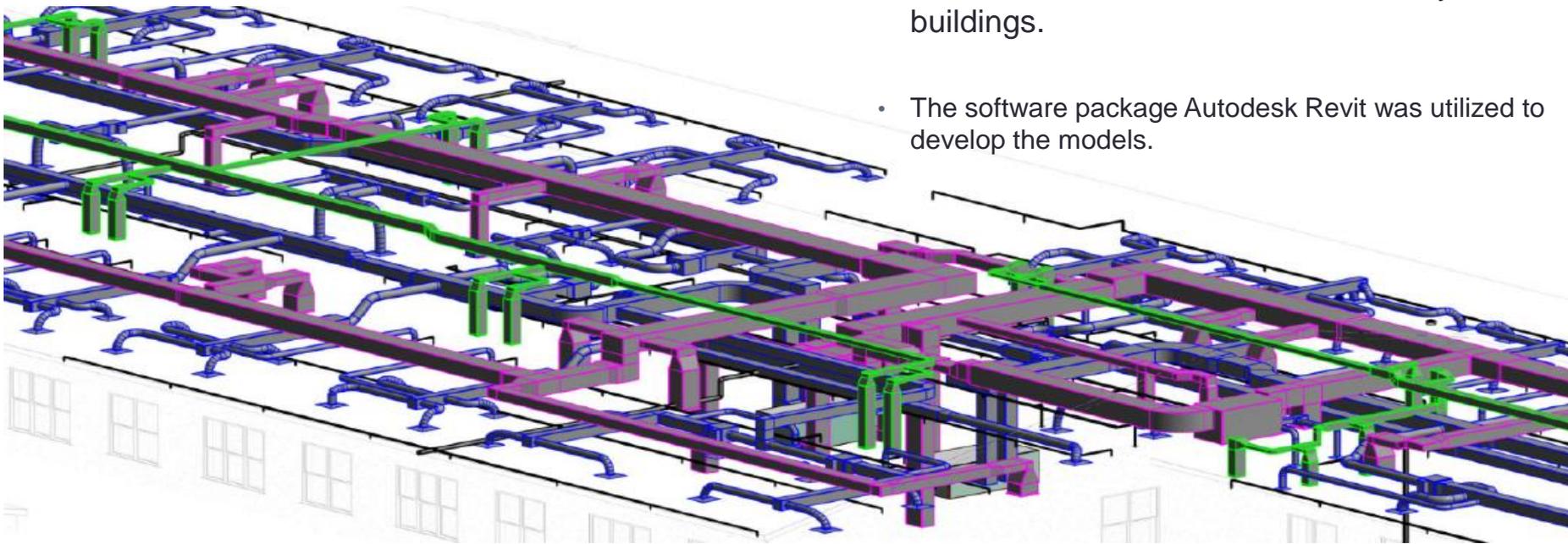
- All building systems are modeled to be dimensionally accurate and represent the defined specifications.

- Architectural, structural, mechanical and plumbing models are linked together to provide a complete virtual representation of the building.

- Collaborative process used to aid in the construction, documentation and analysis of buildings.

- The software package Autodesk Revit was utilized to develop the models.

MEP Model: Produced in BCN6785 – Construction Information Systems
Gavin Hancock, Daniella Daswatta, Pranav Agrawal and Jerry Hong

Actual School Models

Glen Springs Elementary

Complete Model:
Produced in BCN6785 – Construction Information Systems
Hamed Hakim, Hengyao Huang, Chankyu Lee and Peng Ren

Idylwild Elementary School

Complete Model:
Produced in BCN6785 – Construction Information Systems
Mark Dunn, James Sorce, Yifan Su and Ebenezer Tackey-Otoo

Gainesville High School
Collaborative BIM Project
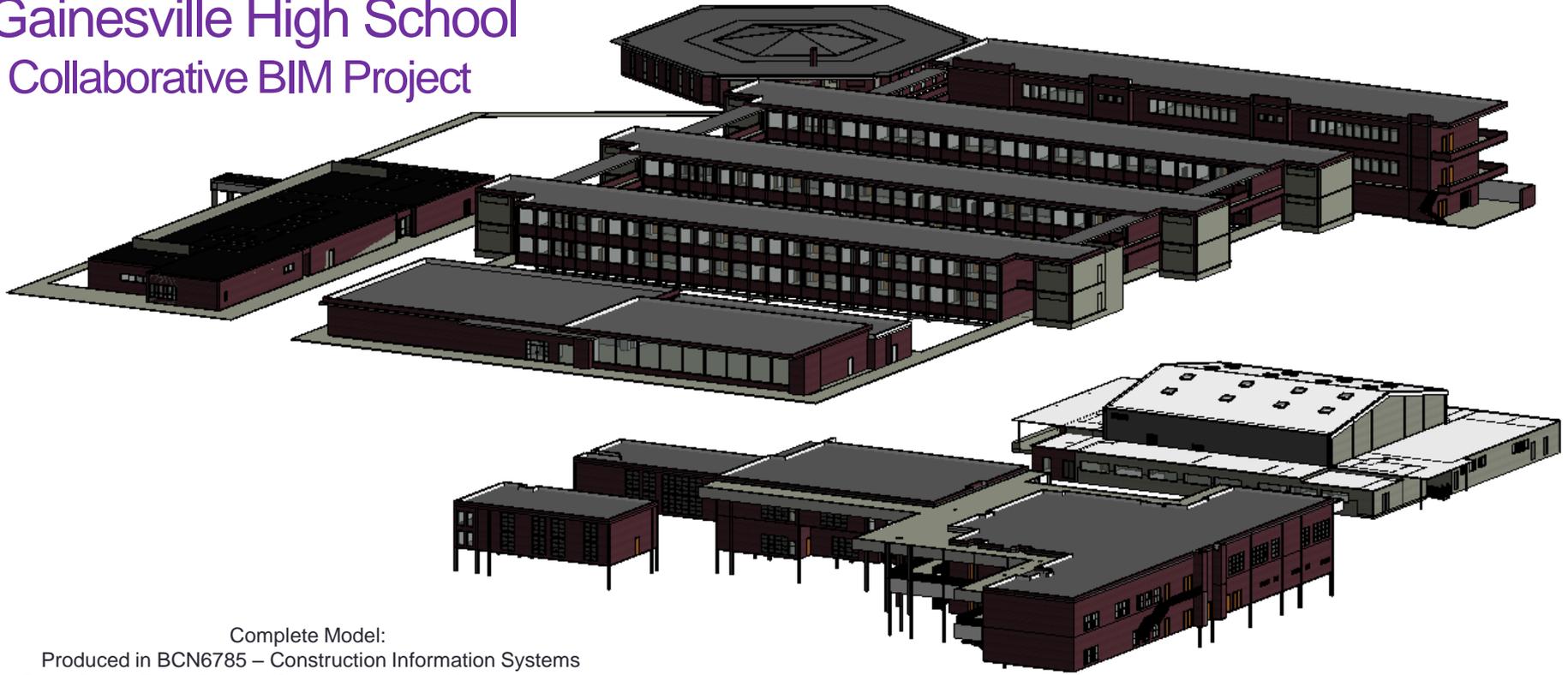
Complete Model:
Produced in BCN6785 – Construction Information Systems
Ade Fadli, Soheil Fathi, Deepak Sivasamy, William Watson and Nan Xie

- Many school blueprints are complex because site buildings usually have been renovated many times over their 80 plus years and the site capacity changes with population growth.

- Students are provided a unique real-world experience developing their models from as-built drawings. Local on-site visits are beneficial to interpret data

- Upon completion of the models, the BIM models are turned over to the school district at no cost.

- The district can use them for Energy Modeling and equipment changeout simulations.

SPECIAL THANKS:

DR. RAYMOND ISSA
UNIVERSITY OF FLORIDA

JD BRAKE
SLIDE MATERIALS
WEBCOMFORT SYSTEMS

KIK KOPPITCH
GAINESVILLE REGIONAL UTILITIES
WEBCOMFORT HVAC CONTROL SYSTEM PROJECT

Theresa A Spurling-Wood, CIE, GGP, LEED AP

spurlita@gm.sbac.edu

Home Performance Meets Home Automation

Marshall Runkel

Director of Contractor Services

clean energy works

IoT Market = Big Growth

Estimated Number of Installed IoT Devices by Sector

BI INTELLIGENCE

76%
72%
56%
43%
40%
33%

Home
Government/Infrastructure
Enterprise

Total Device Growth YOY
Billions of Devices

2014E 2015E 2016E 2017E 2018E 2019E

Source: BI Intelligence Estimates
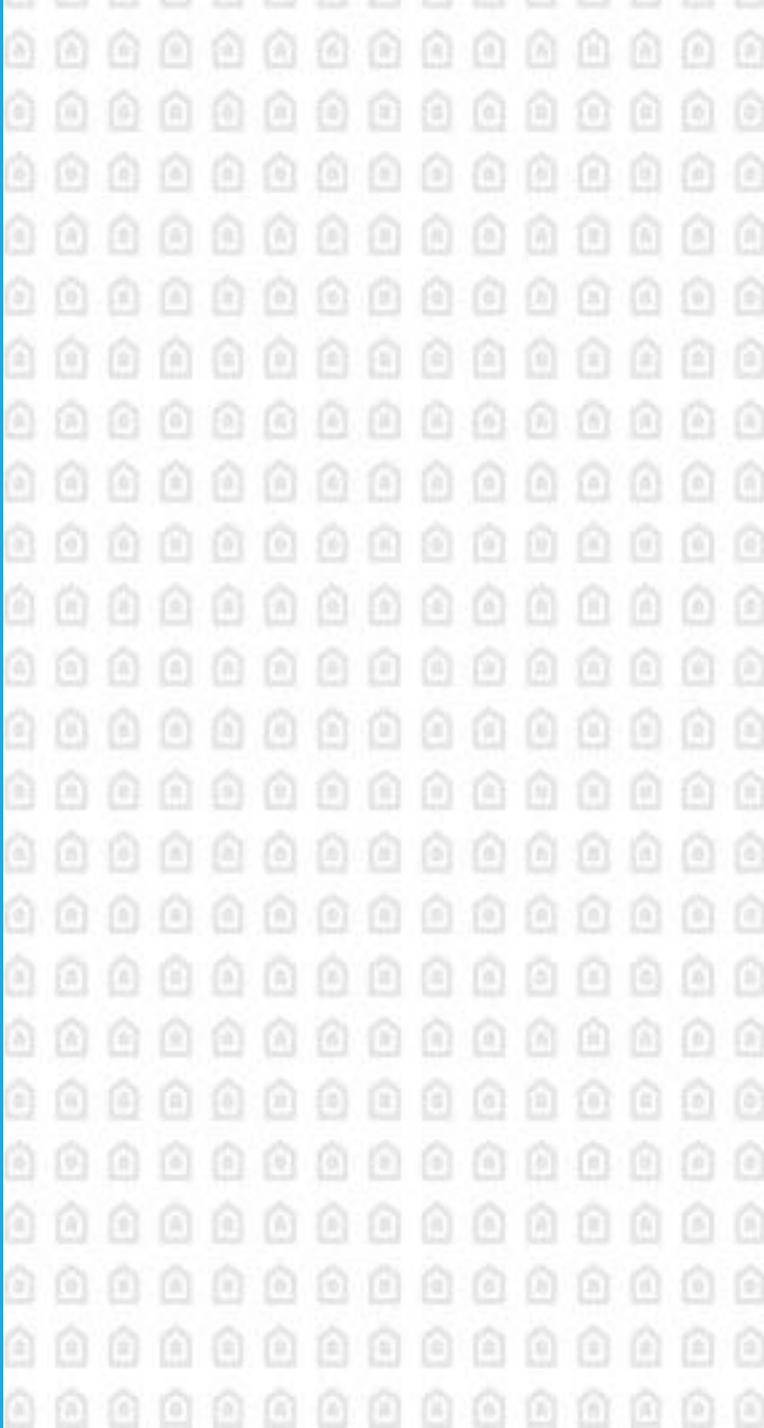
CEW Goal
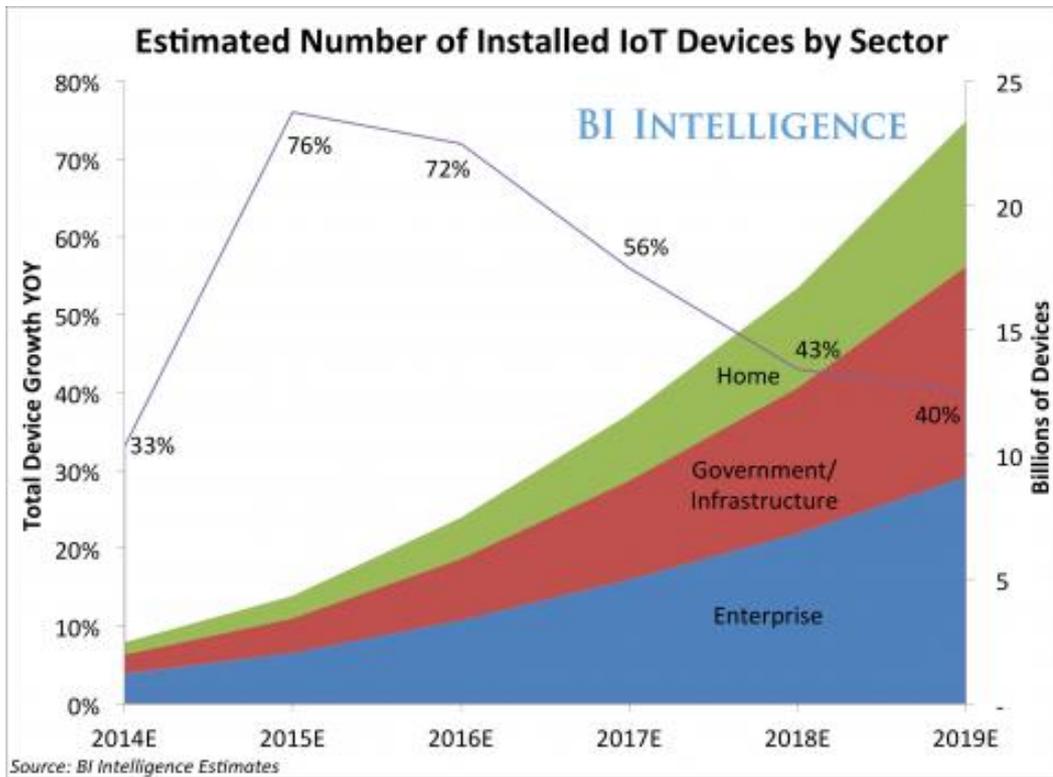
Borrow momentum from IoT (Internet of Things) market to attract Home Performance customers.

32

clean energy works

No Longer Fiction

New Products

Thermostats

CO+Smoke Detectors

Lighting

Security

Locks

Coffee!!!

Etc…

clean energy works

New and Existing Brands

CEW Nest Pilot

➔ Offer free Nest thermostat (or smoke+CO detector) as incentive for signing up with CEW and executing a Home Performance project.

➔ Use existing and new marketing channels to communicate offer.

➔ Train staff and contractors.

➔ Evaluate outcomes.

Why Nest?

➜ Nest Pro network initiative.

➜ Brand recognition.

➜ Integrated CO+smoke alarm aligns with Home Performance.

➜ Willingness to partner on marketing.

clean
energy
works
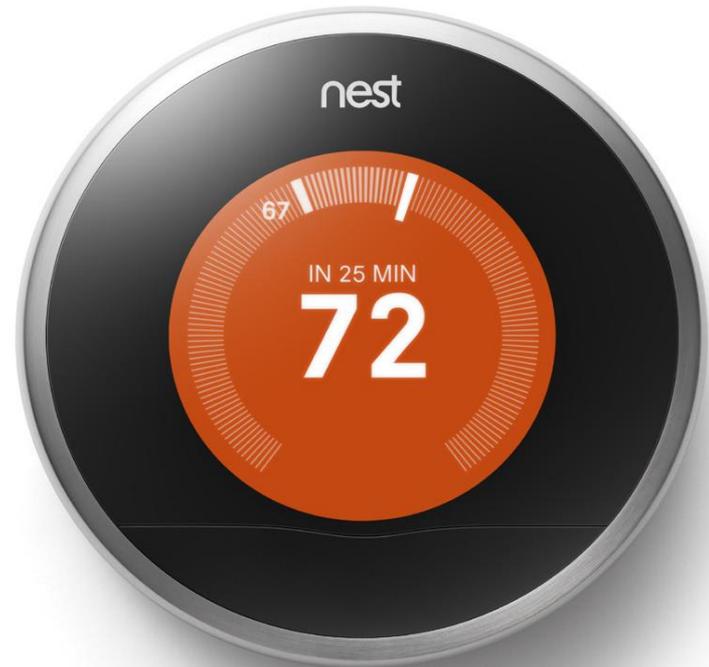
User Interface Home Page

Thermostat and CO+Smoke detector.
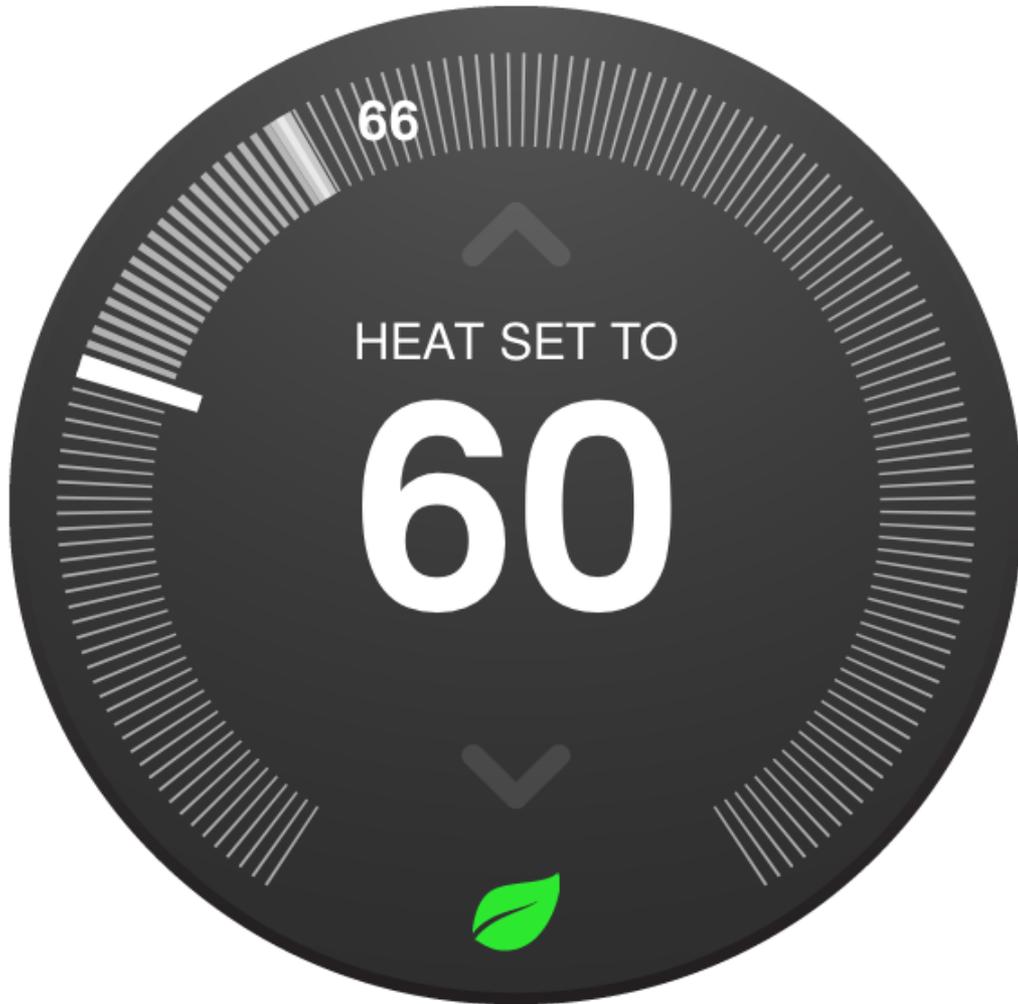
User Interface Energy Home

Intuitive

Allows remote control/monitoring of thermostat settings.
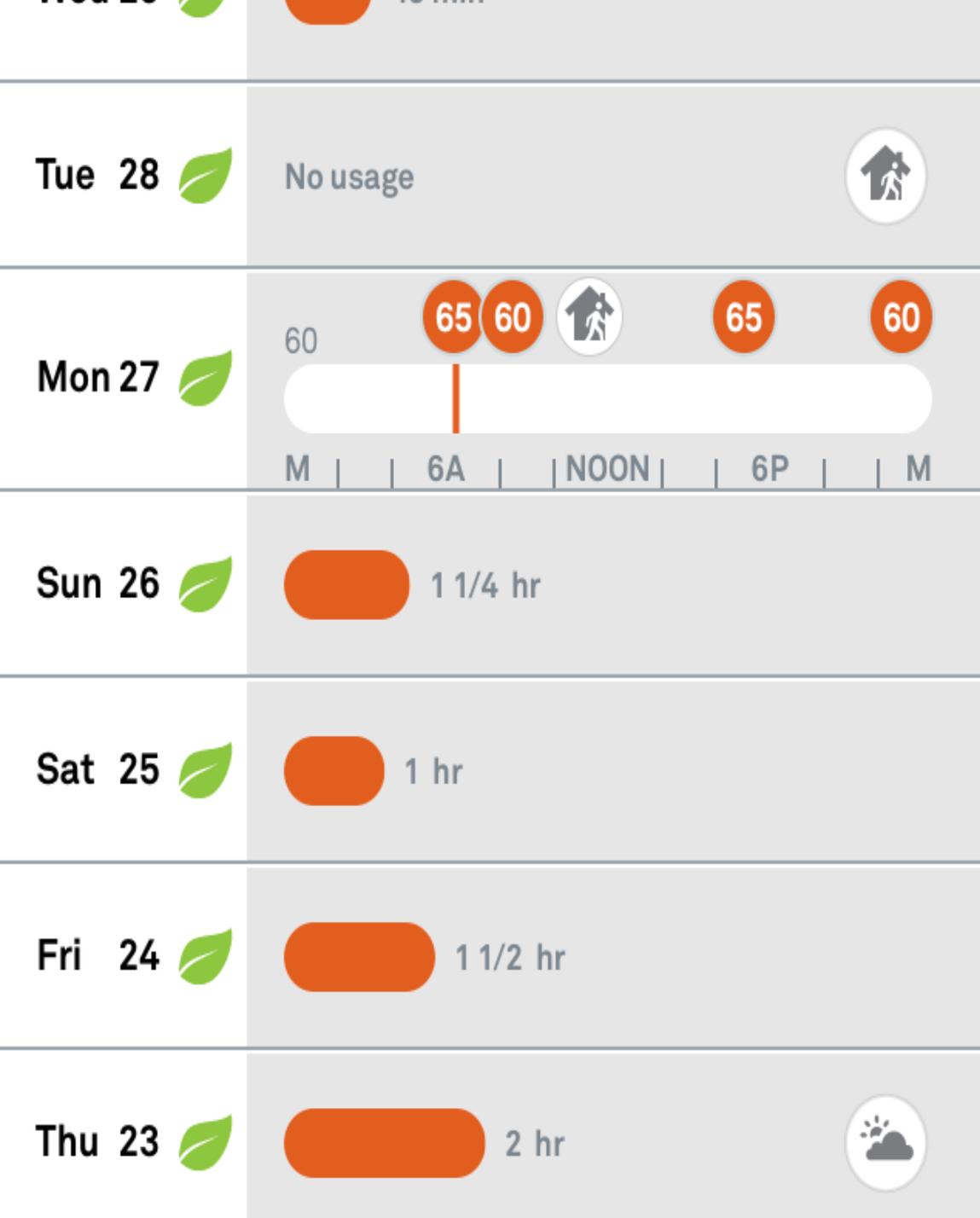
User Interface
Energy History

Enables homeowner to easily analyze and understand energy usage.

Auto-away documentation.

Leaf reward signal for efficient usage pattern.

Accounts for weather.

User Interface
Protect Home

Monitor multiple sensors.

Sensors connect with thermostat.
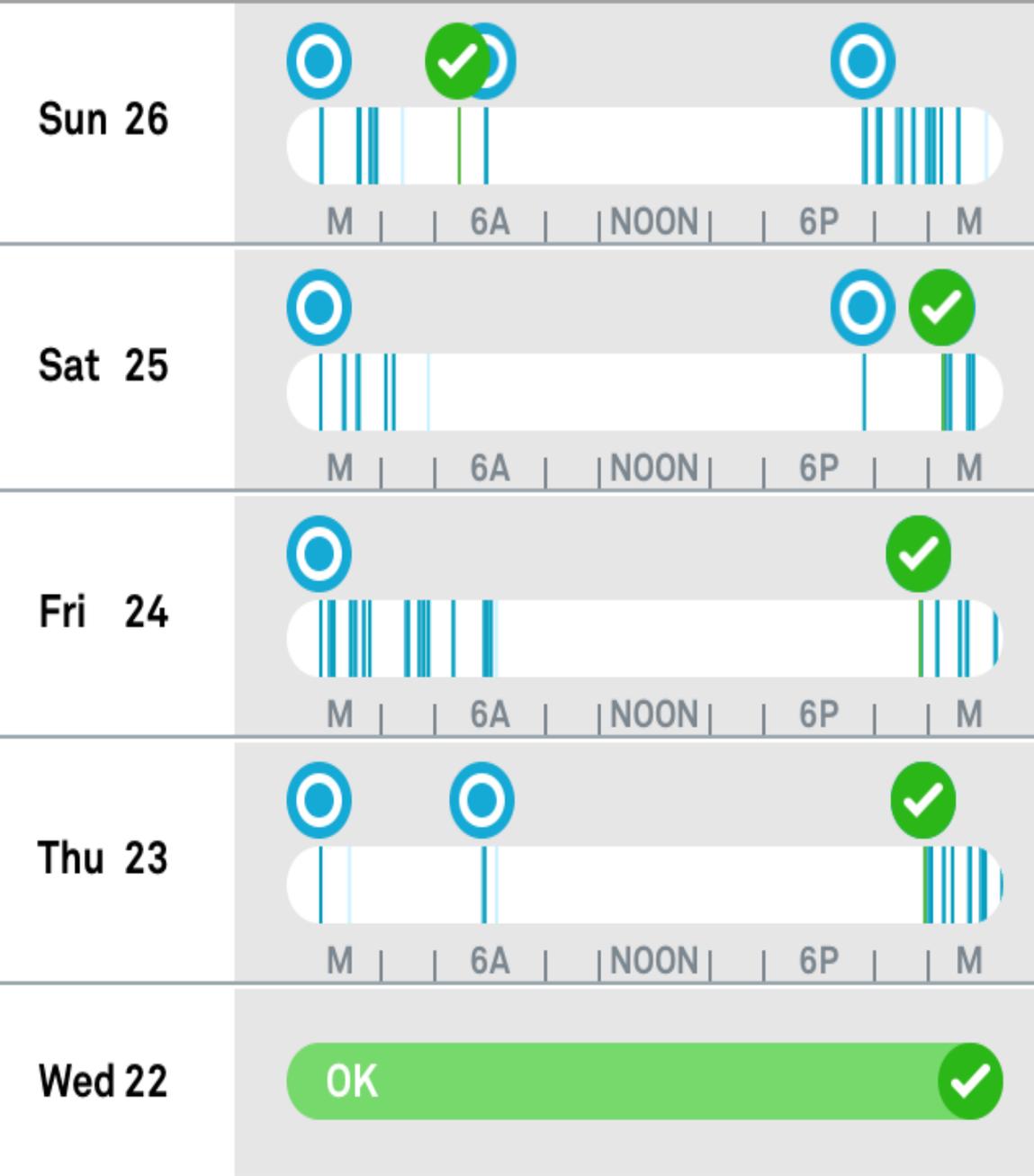
User Interface History Page

Shows activity sensor history.

Verifies smoke/CO sensors are working properly.

nest

Meet the next generation thermostat.

Most people leave the house at one temperature and forget to change it. So the Nest Learning Thermostat learns your schedule, programs itself and can be controlled from your phone. Nest Thermostat can lower your heating and cooling bills up to 20%. Complete home energy upgrades with Clean Energy Works and your nest is free.*

*Limited time offer. See letter for details. Apply at cewo.org/nest

Program Promotion

All CEW Markets:
Nov/Dec 'Apply By'
Jan/Feb – sign work proposal

Professionally installed Nest at no cost to customer ($450 value)

Promotion driven by Direct Mail, Social Media, Local Newspaper outreach

Public Relations

Nest Promotion

Winter Weather

Direct Mail

A/B Test: Standard offer vs. nest giveaway – higher response rate

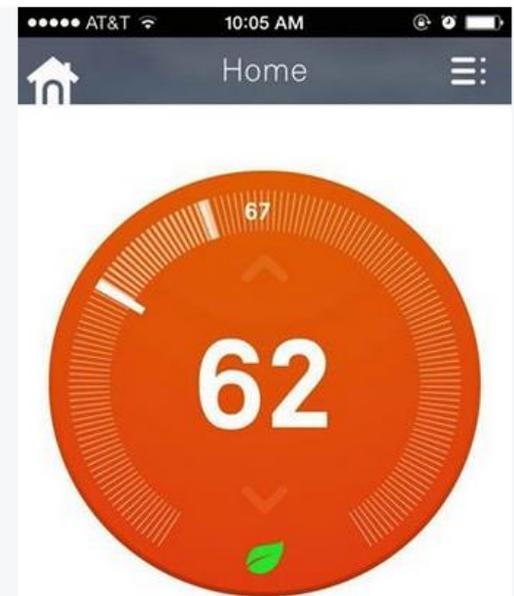Same promo $250

All CEW Markets

Ongoing Facebook Campaign

➔ Nest Promotion
➔ Seasonal campaigns to drive online eValuations and applications
➔ Touches all markets
➔ Boosted posts

Clean Energy Works Oregon
Posted by Mike French [?] · Yesterday · Edited [?]

Make it toasty when you get home! With Nest, turn on your home's heating and cooling right from your smartphone or tablet. Get a Nest Learning Thermostat for yourself with your CEW home upgrade - for a limited time!
http://goo.gl/mmcITS

Energy Savings Results

Table 1. Gas and Electric Savings Results

| | | Pre-Nest Usage | | Energy Savings | |
Fuel	N	Total	HVAC	Total	% of HVAC
Natural Gas (therms/yr)	735	774	584	56 ±12	**9.6% ±2.1%**
Electricity (kWh/yr)	624	12,355	3,351	585 ±97	**17.5% ±2.9%**

Link to Nest White Paper on energy savings: https://nest.com/downloads/press/documents/energy-savings-white-paper.pdf

clean energy works

Outcomes

➔ Internet advertising was more effective than direct mail.

➔ Offer was more powerful as a conversion tool than an inducement to sign up for CEW.

➔ Contractors are now offering Nest and/or other IoT products on most proposals.

Thank You!

Marshall Runkel

marshall.runkel@cewo.org *971.544.8713*

Intelligent Efficiency: Delivering 21st Century Energy Savings

Advancing Intelligent Efficiency Technology in the Industrial Sector

Paul Hamilton

*VP Government Relations*

Schneider Electric

May 28, 2015

Schneider Electric

The Driver

The intersection of IT and Energy Management will create new opportunities to accelerate energy efficiency

Energy Infrastructure

Intelligent Efficiency

Information Technology

Data will make Energy Visible

A convergence of technologies in the Data Enabled Factory

Information & communications technology

Internet of Things

Intelligent efficiency

Smart manufacturing
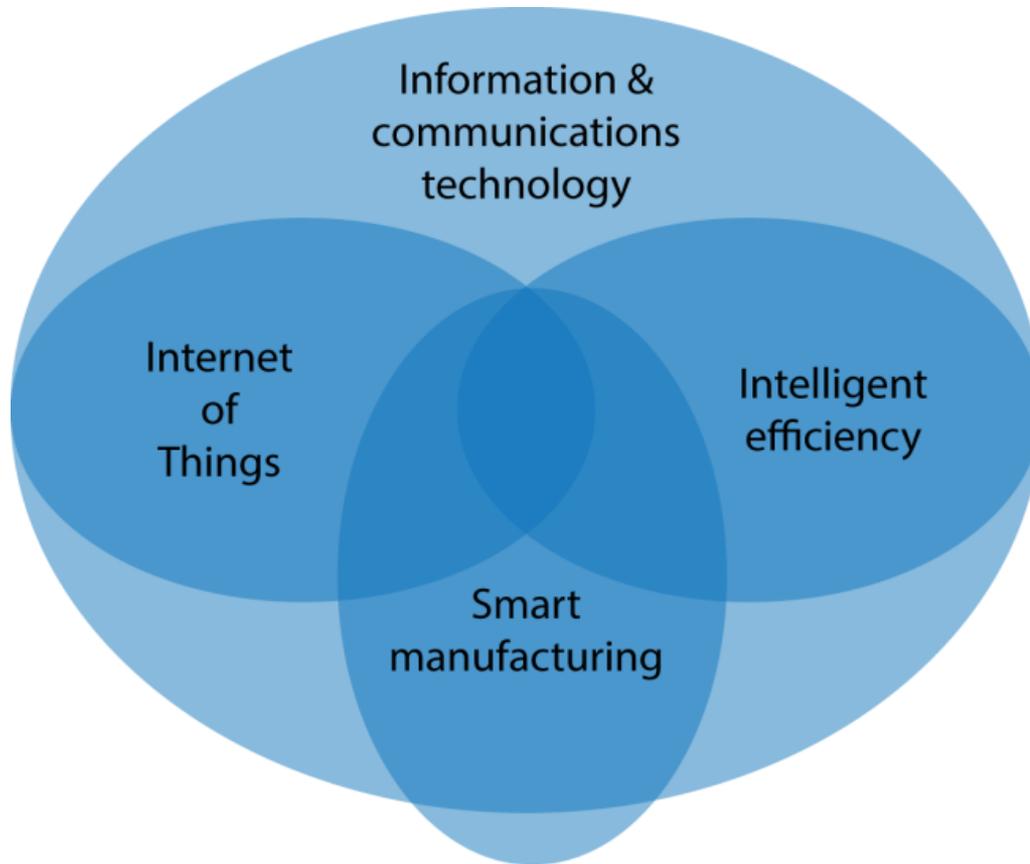
- *Intelligent efficiency. Energy savings resulting from ICT-enabled connection of sensors, devices, systems, facilities, and users.*

- *Smart manufacturing. Superior productivity resulting from the integration of all aspects of manufacturing.*

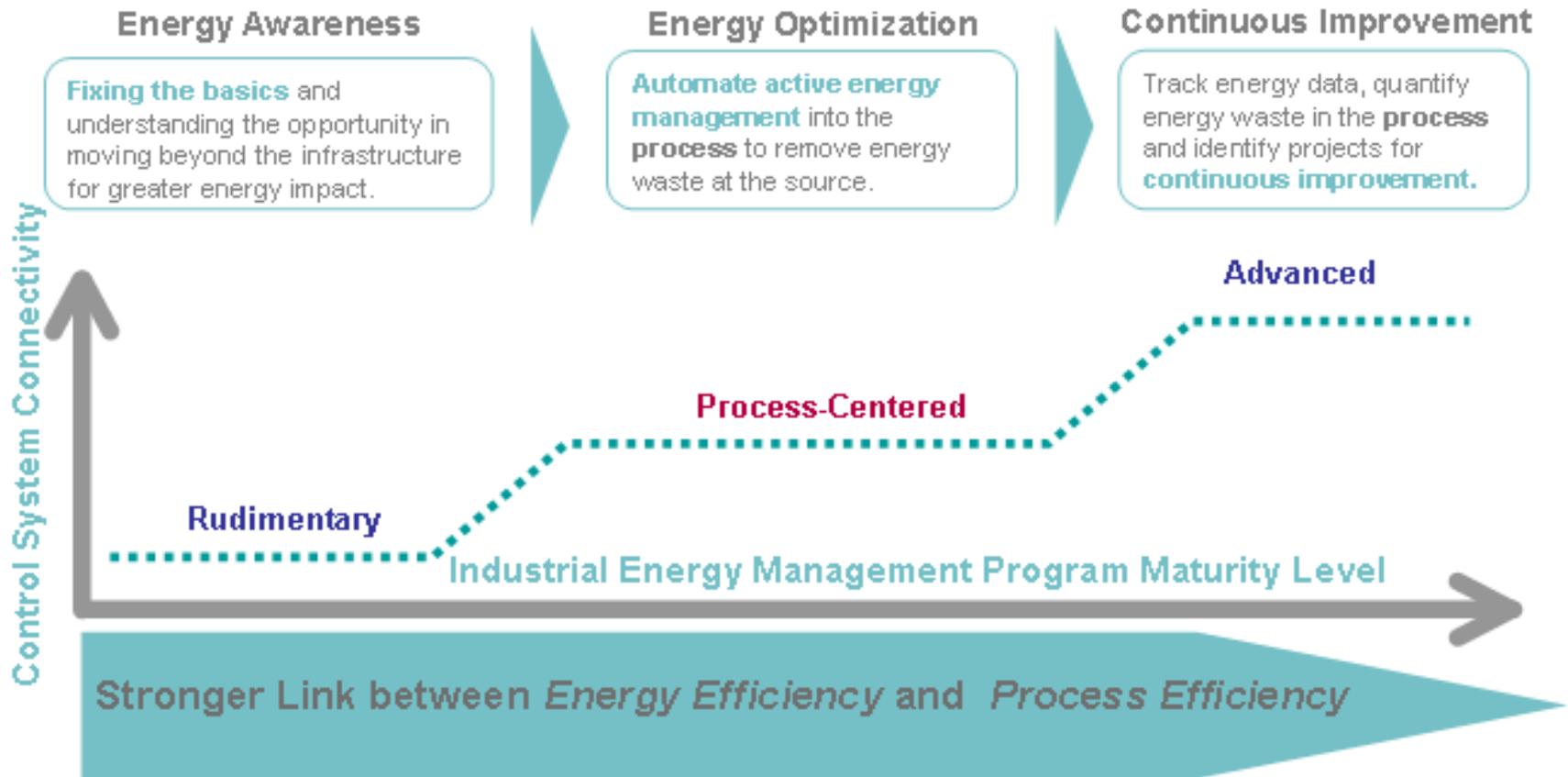- *Internet of Things. Machine to Machine (M2M) interaction through the Internet*

Source: ACEEE

Where is Energy Used in Industry?

## Proportions of Energy Used in Manufacturing (MECS)

Other Facility/Non Process Use 3%

Facility Lighting 3%

84% of Energy Consumed in Manfacturing is PROCESS Related

Facility HVAC (g) 10%

Other Process Use 3%

Electro-Chemical Processes 4%

Machine Drive 27%

Process Heating 46%

Process Cooling and Refrigeration 4%

EIA Manufacturing Energy Consumption Survey (MECS)
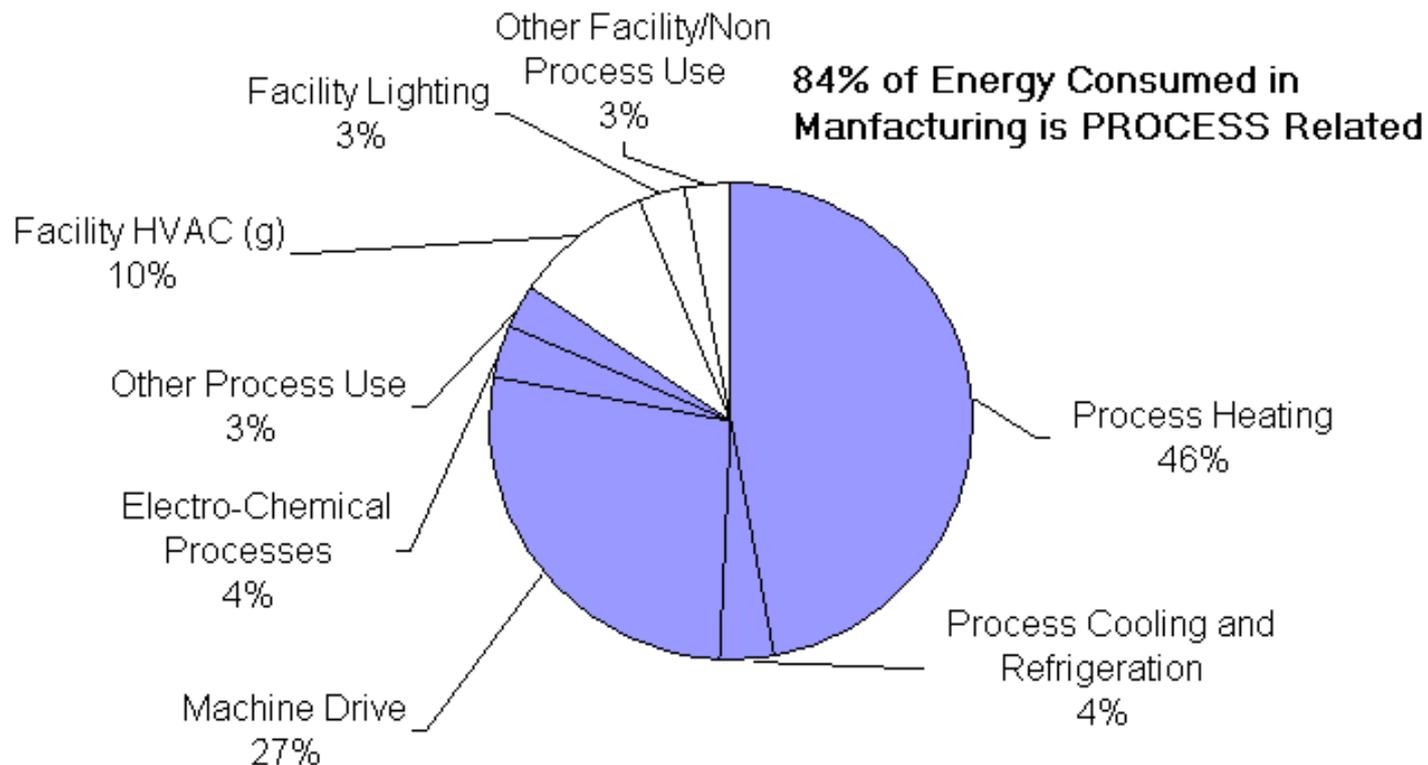
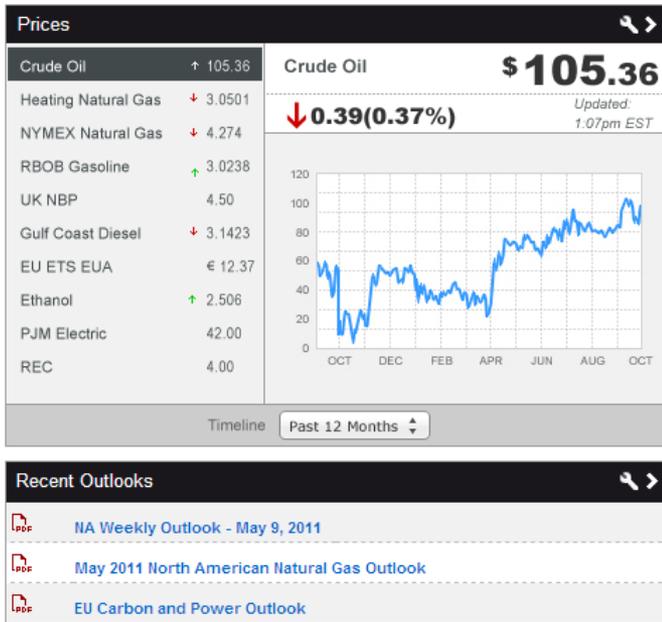# Maturity Levels of an Industrial Energy Management Program

Driving Efficiency across the Enterprise.

The collection of data across the enterprise in cloud based systems will drive intelligent efficiency

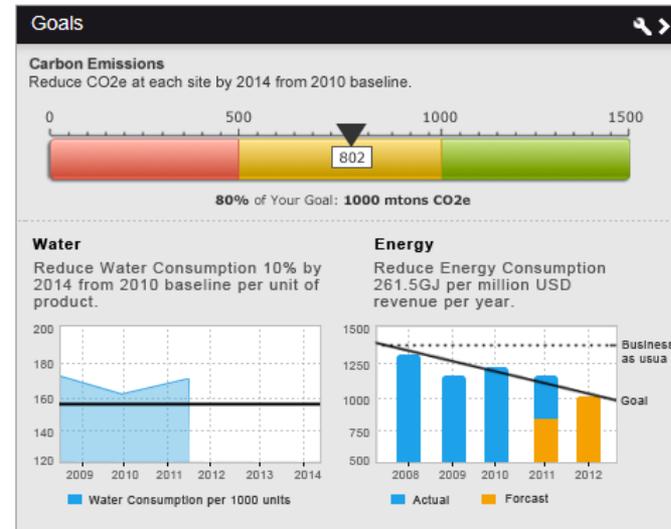**Source: Time Magazine, What is Smart Manufacturing**
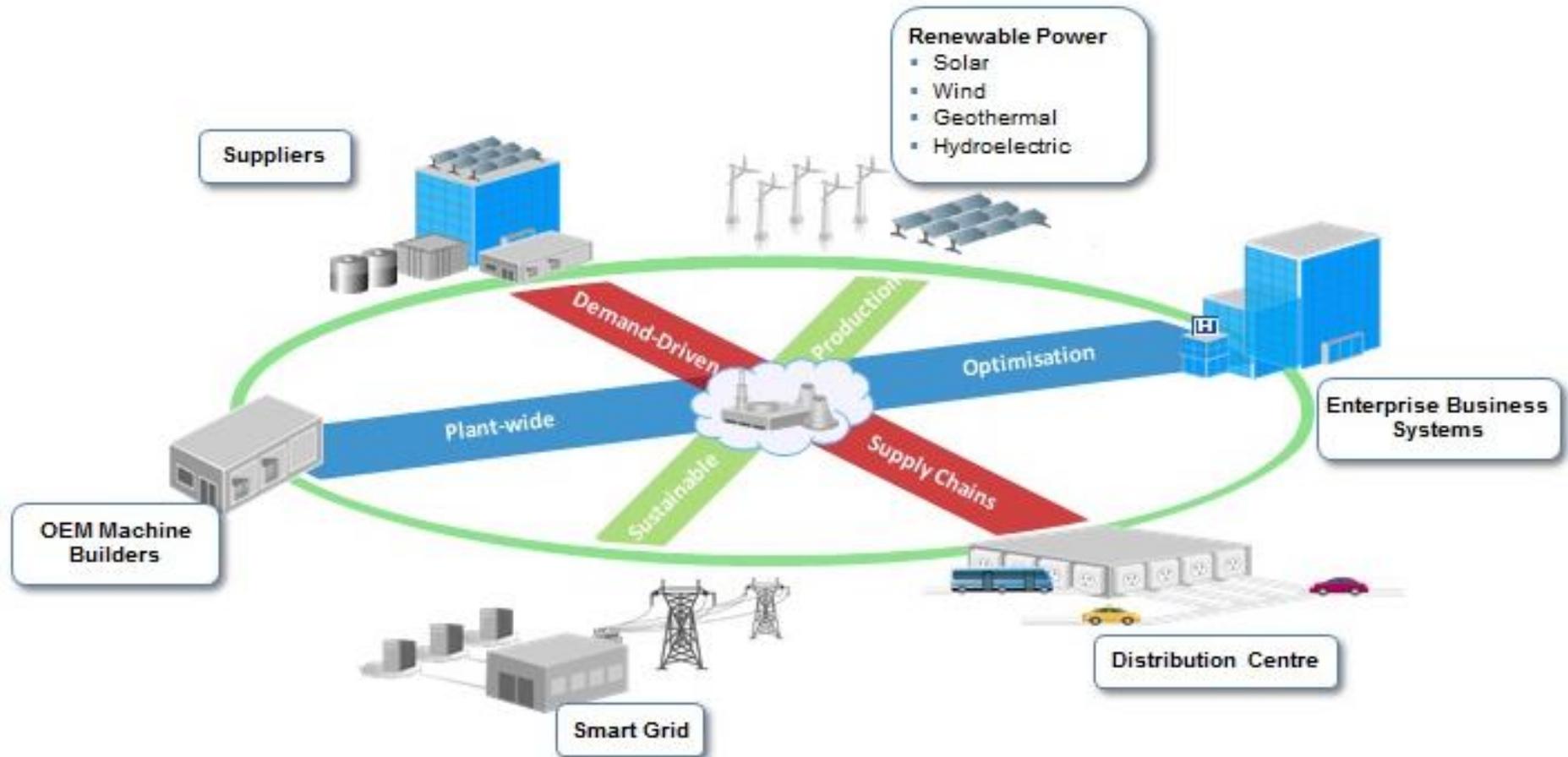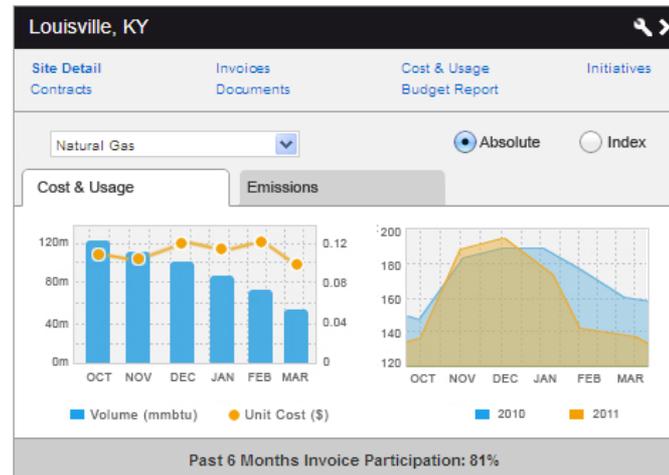
Energy Management Dashboards

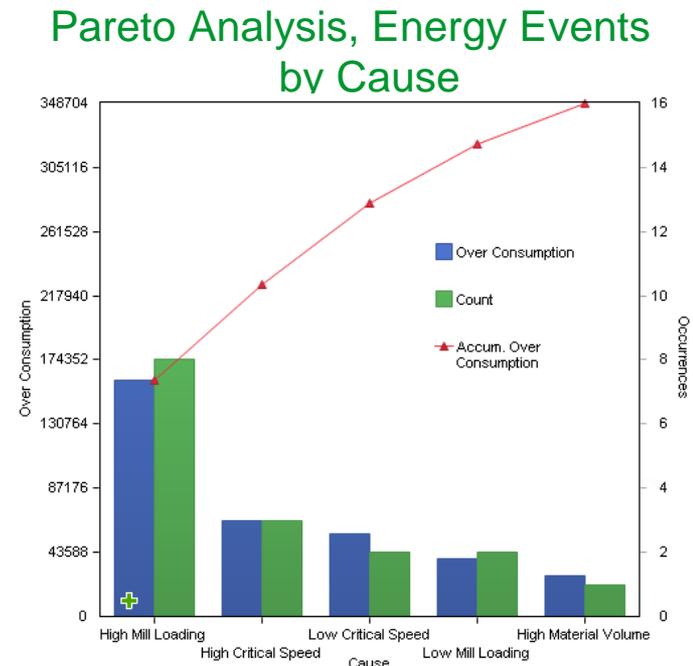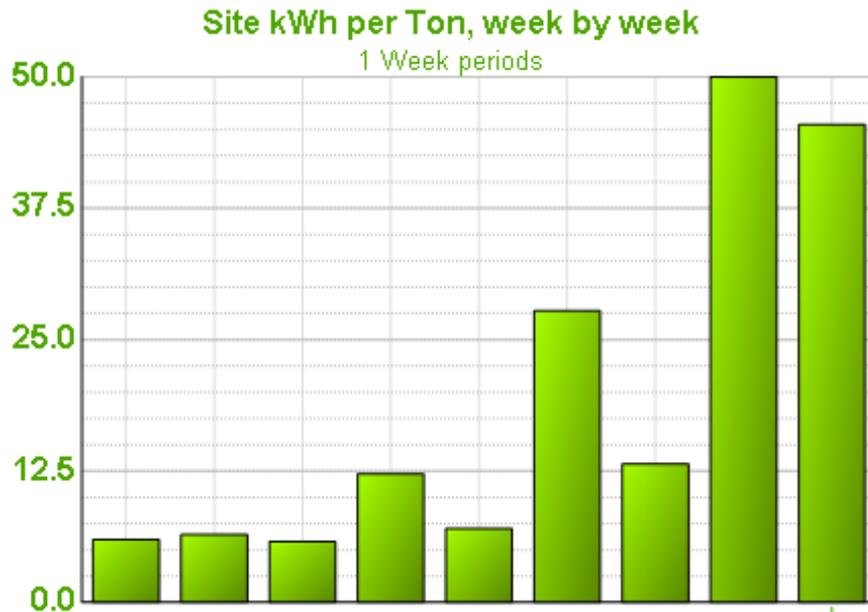Enterprise Level Dashboard- Commodities Purchasing Data

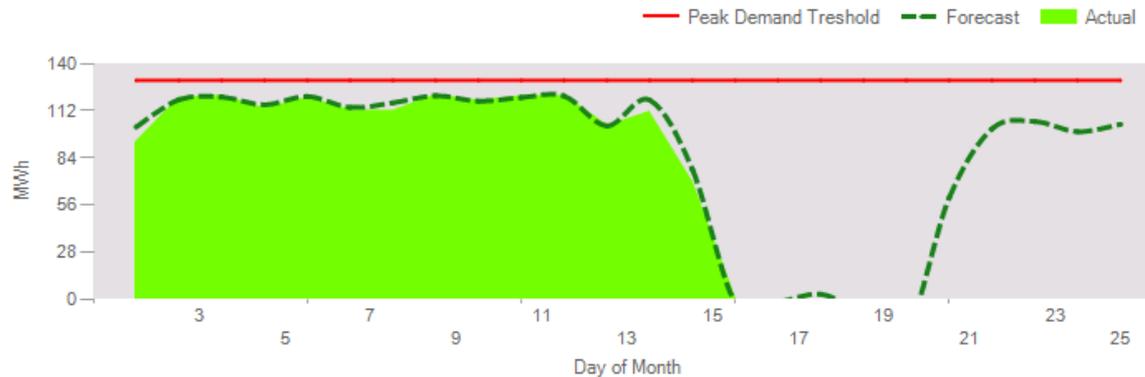Enterprise Level Dashboards: Sustainability Metrics

Per-site Energy and Emissions Measurements with Invoice Participation Status

Operational Level Dashboards

Site kWh per Ton, week by week

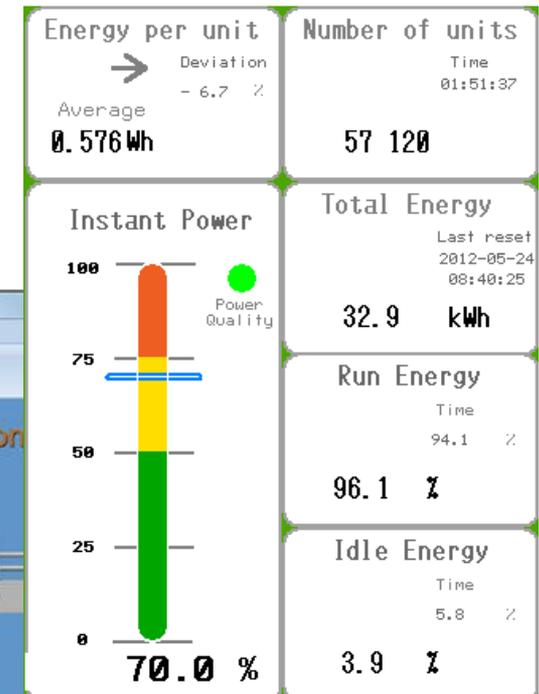
Pareto Analysis, Energy Events by Cause

Control of Peak Demand Threshold Based on Energy Forecast
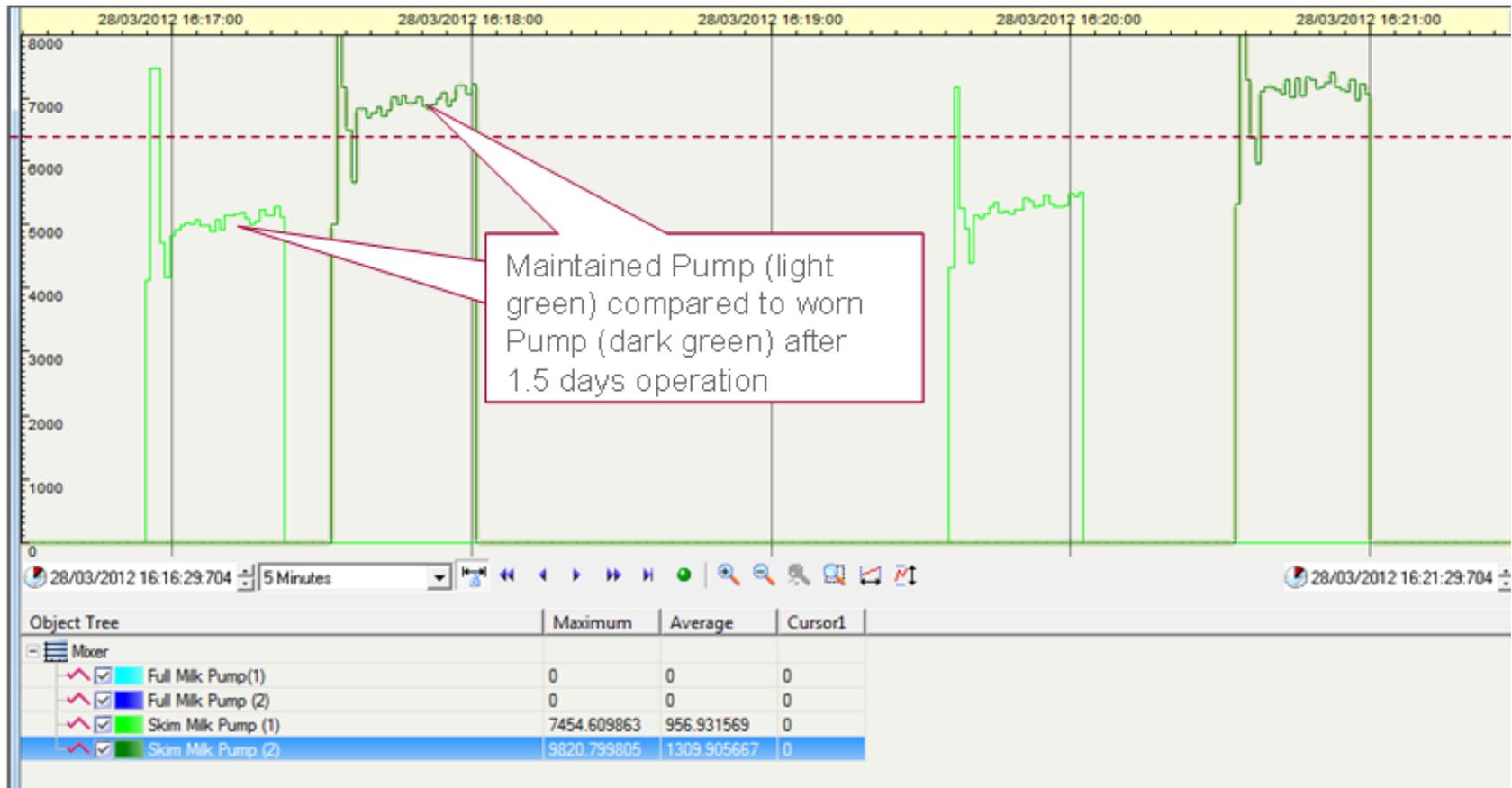
Control Level Dashboards

Machine-level Energy Data Showing
Real-time Energy Consumption
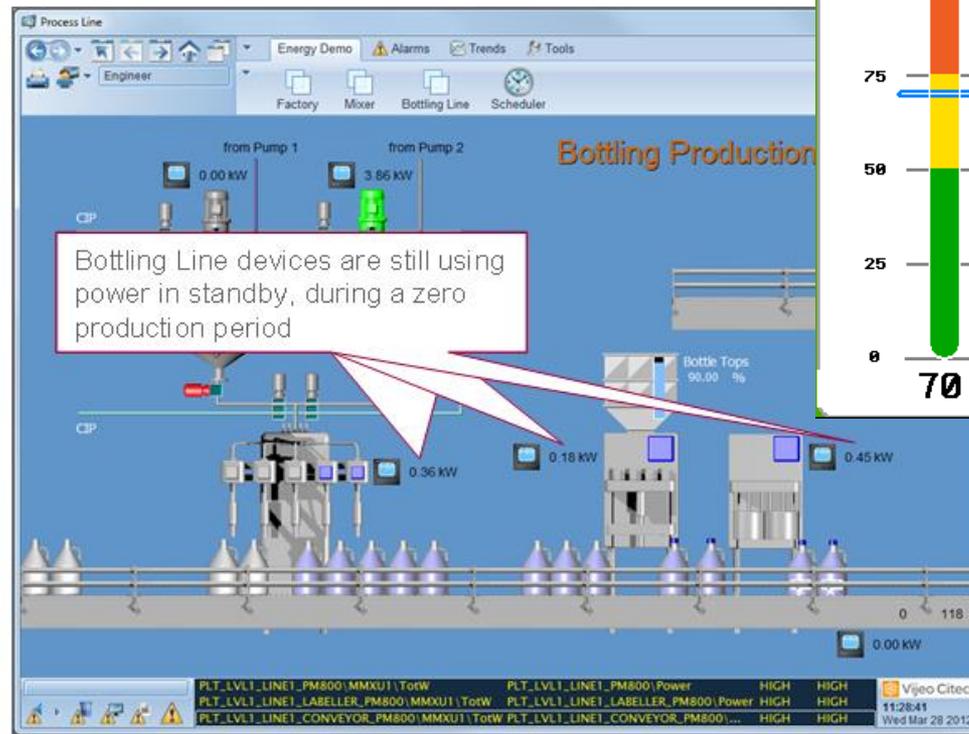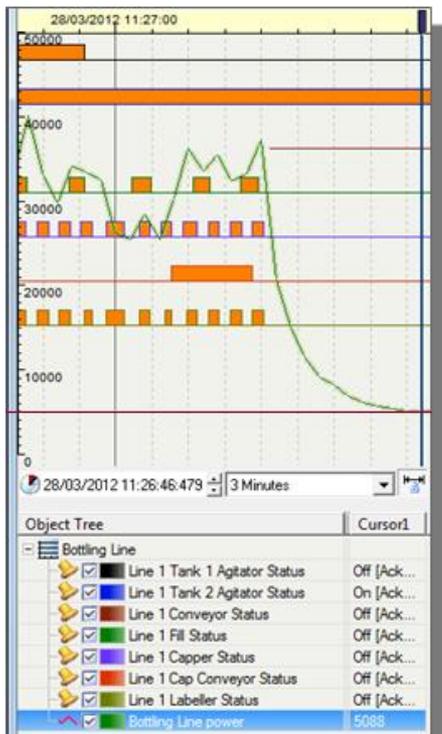
Control Level Dashboards

Energy Profiles of Two Pumps, Compared Side-by-Side

The Challenges & Evolutions

Cyber Physical Systems (CPS) change the existing automation hierarchy

- Over the last ~30 years a well-defined 5-layer automation architecture has formed.
  - Field devices (e.g., sensors) level send data via analog signals to logical controllers.
  - SCADA systems perform (remote) control.
  - Manufacturing Execution Systems perform tasks such as production scheduling.
  - Top-level ERP systems facilitate management reporting and business management.

- 5 layers might not be needed in the future
  - sensors send data directly to the cloud.
  - Services (e.g., production scheduling) automatically subscribe to necessary data in real-time

Today > **Future**

5-layer architecture

Cyber-physical system (CPS) based automation

ERP

MES

SCADA

PLC

I/O

SMLC

Affordable, Accessible, Innovative and Secure
Intelligent, Seamless & Collaborative
Networked-Based, Smart Manufacturing
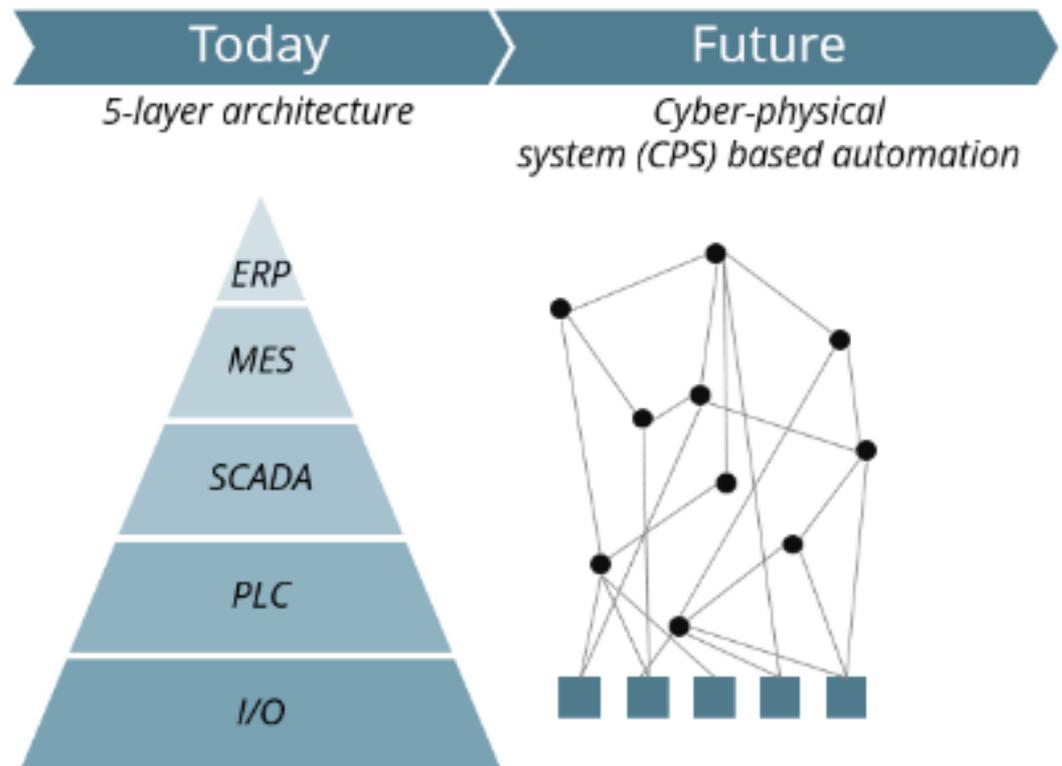
Connected Supply Chain
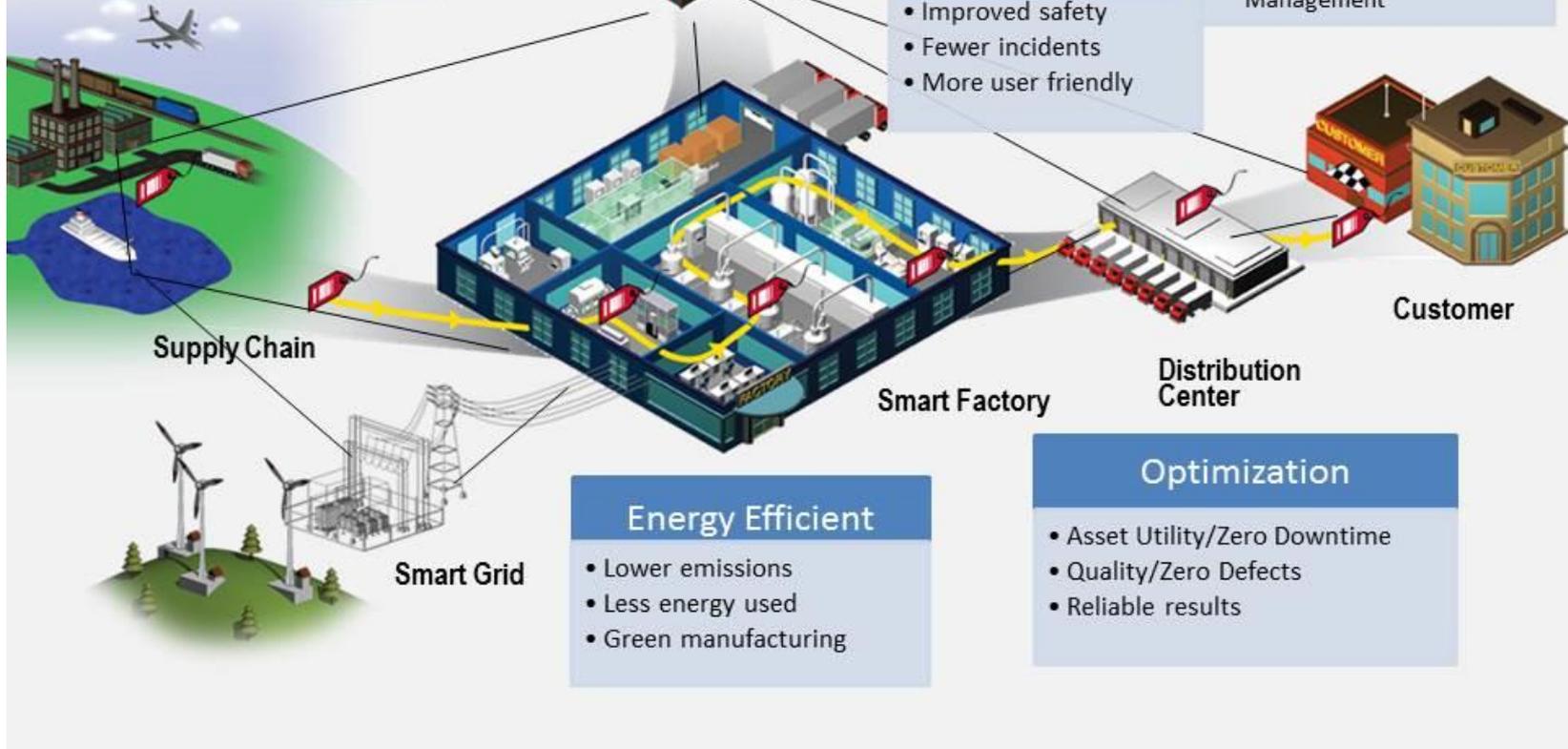- Agile
- Demand Driven
- Raw Material to Finished Product

Business Systems, ERP

Sustainable Production
- Higher value products
- Data for decision making
- Product Lifecycle Management

Safe Production
- Improved safety
- Fewer incidents
- More user friendly

Supply Chain

Smart Factory

Distribution Center

Customer

Energy Efficient
- Lower emissions
- Less energy used
- Green manufacturing

Smart Grid

Optimization
- Asset Utility/Zero Downtime
- Quality/Zero Defects
- Reliable results

"Smart manufacturing marries information, technology and human ingenuity to bring about a rapid revolution in the development and application of manufacturing intelligence to every aspect of business. It will fundamentally change how products are invented, manufactured, shipped and sold. It will improve worker safety and protect the environment by making zero-emissions, zero-incident manufacturing possible". −Jim Davis, SMLC (Warren 2011)

Bringing Context to Data

Collect data from disparate sources
Accessibility of information
Connect information to people
Speed to deployment

Operations Management
Equip. Health Management
Quality Management
Performance Management
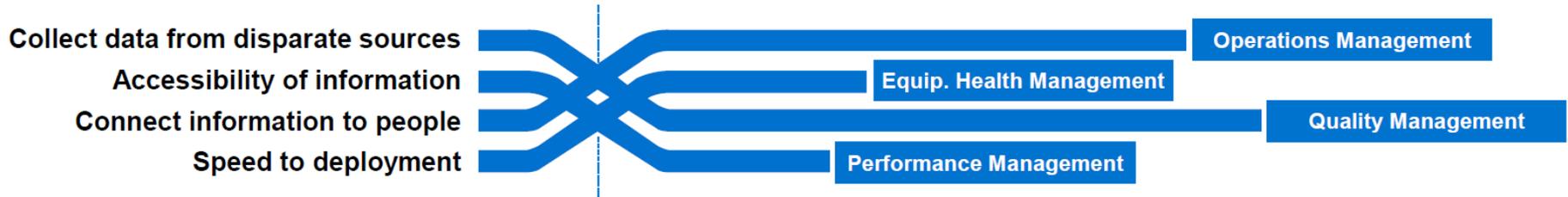
Real-time values
- Inlet pressure
- Inlet flow
- Ambient temperature

Real-time Values
- Exhaust temperature
- Exhaust flow
- Measured MW output

Asset details
- Name
- Make
- Model

Notifications
- Performance excursions
- Temperature difference
- High temperature

External Databases
- Performance curves
- Last service date
- Design documents
- Inspection best practice

Calculations
- Performance calculations
- KPI's

Business Events
- Downtime
- Startup
- Excursions

Source:: OSI Soft

Capturing the broader IEE Opportunity

What is required to capture broad based IEE delivered through continuous improvement in process and site management?

- Use of an international standard specifying requirements for an industrial energy management system (EnMS)
- Requirements for establishing, implementing, maintaining and improving 3rd party certification

- Use of a U.S. standard to establish metrics and verify energy performance improvement.
- Rigorous M&V system for industrial use 3rd party audits to verify achievement

Source:: ISO and DOE

Conclusion

- Intelligent Efficiency drives data towards information the will enable better energy management in industry

- Adoption of energy management dashboards and business management processes will be critical to intelligent efficiency

- Evolution of data enabled sensors and Internet of Things will bring massive new sets of data to manage across an enterprise

- Cloud services and data analytics coupled with new business processes and dashboards will allow industry to get significant gains in energy management through intelligent efficiency.

What is Intelligent Efficiency?

Intelligent efficiency (IE) refers to a systems-based, holistic approach to saving energy.

People-Centered Efficiency (Real-Time Feedback):

Providing real-time information and management tools that enable consumers, building operators, manufacturers, and other users to lower energy consumption in response to changing information.

Digital Energy Management (Automation and Optimization):

Using sensors, controls, and computer software to automate business processes or building or vehicle operations in order to optimize energy use. This bypasses much of the need for people to respond.

Substitution with Energy-Saving ICT Services (Dematerialization):

Shifting behaviors, services and structure of the economy in ways that displace more energy-intensive activities in ways that reduce energy usage, i.e. e-commerce and telecommuting.

## Crosscutting Intelligent Infrastructure

Together, all types of IE enable more integrated, smarter and more reliable infrastructure: power grids, smart cities, transportation, and communications networks

Source: ACEEE

Opportunity

Projected Cost Savings from Intelligent Efficiency per ACEEE
The industrial sector could save between $7B and $25B in energy costs per year by 2035

Commercial & Industrial Annual Energy Cost Savings
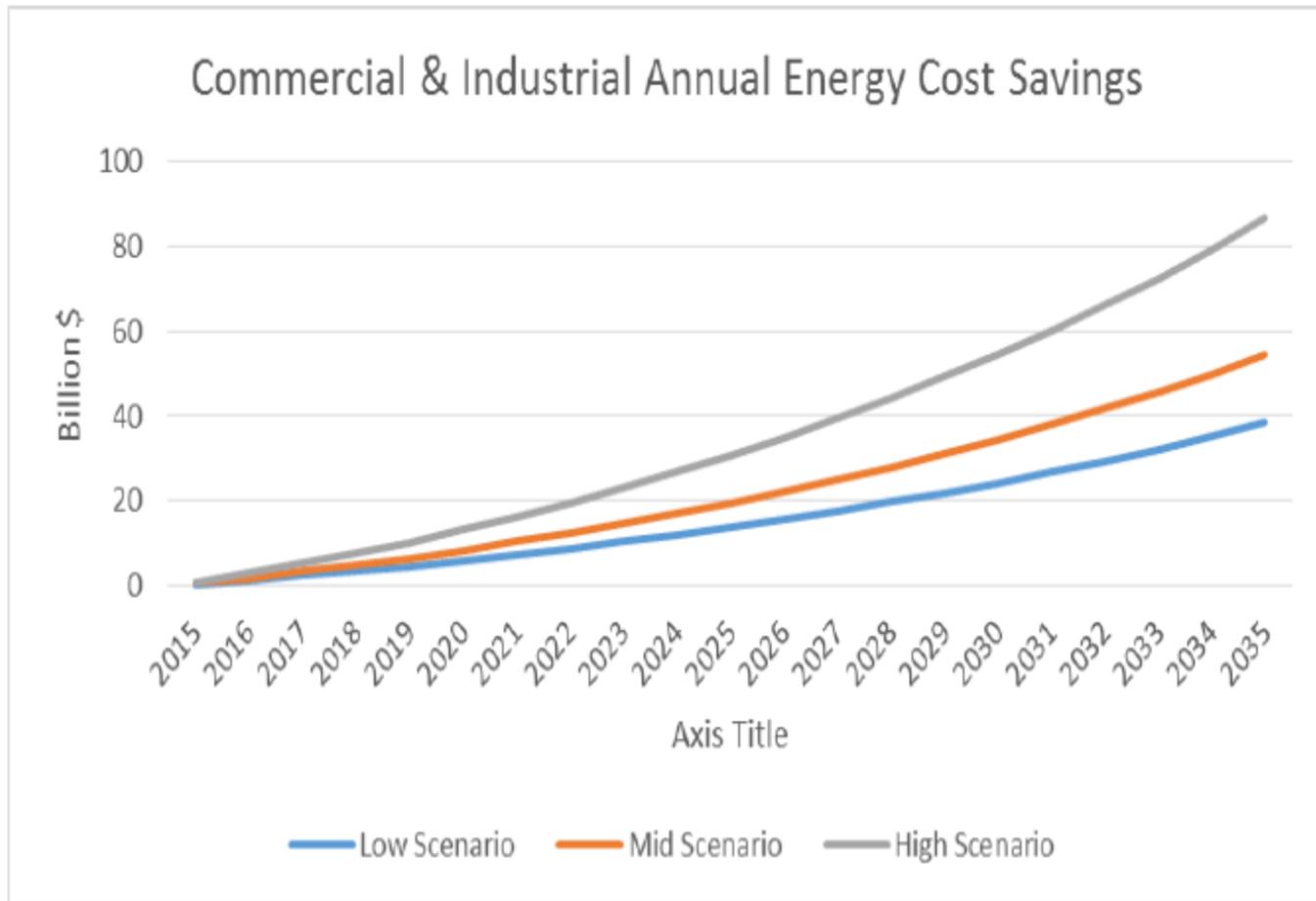
Source: ACEEE

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