



AUGUST 21-23, 2018 • CLEVELAND, OHIO

# The Future is Now: Emerging Technologies in Manufacturing

Thursday, August 23<sup>rd</sup>

2:00 – 3:30pm



# Panelists:

- Fernando Reyes-González, Johnson Controls
- Logan Olds, VVWRA
- Steve Schultz, 3M

# The Future is Now – Emerging Manufacturing Technologies

Steve Schultz

3M

# The Future is Now – Emerging Manufacturing Technologies

- Steve Schultz, Corporate Energy Manager
- 3M Energy Management

# 3M at a glance



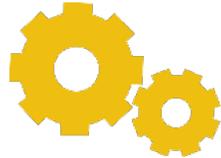
- Sales in ~200 countries
- \$32 billion in sales
- Five business groups
- 90,000 3Mers globally
- 113,000 patents
- 101 straight years of dividends
- One of 30 companies on the Dow Jones Industrial Index

# 3M's fundamental strengths



## Technology

Ability to share and combine elements of 3M's broad technology portfolio to produce unique, differentiated products, translating to premium margins



## Manufacturing

Utilization of 3M manufacturing footprint and technology, including process trade secrets, leading to higher-performing products and lower unit costs



## Global capabilities

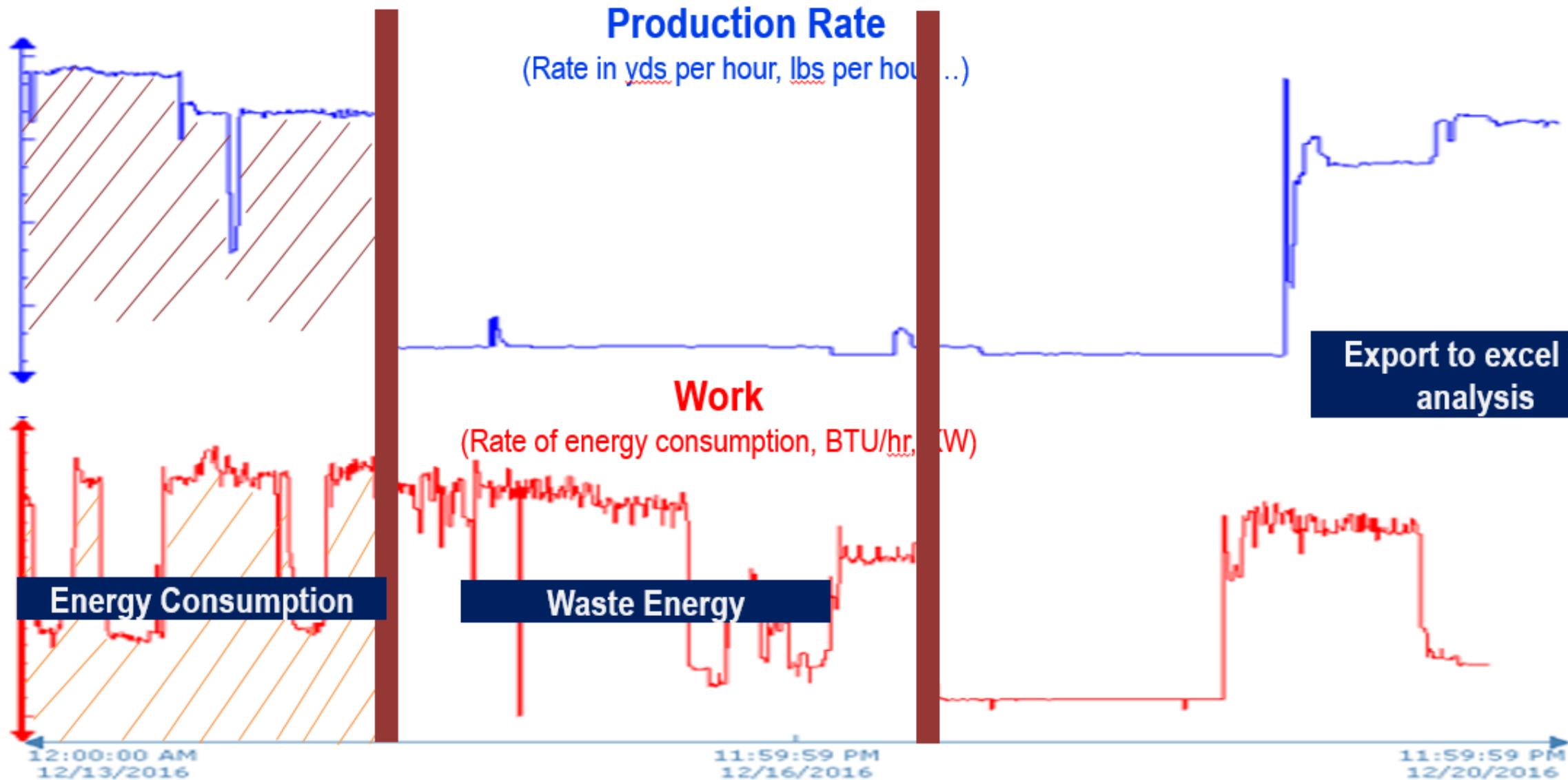
Subsidiary front- and back-office footprint that allows for the effective development, adaptation and commercialization of products



## Brand

Brand equity in the 3M brand and in strategic brands that are shared across business groups

# Why energy sub-metering?



**Make energy visible**

# Decision tree for project engineers

**START**  
(AFE in draft)

Is the investment location a manufacturing facility?

Yes

Is the project category CP, CR, FE, FN, ME, MN, NP, ST ?

Yes

Does the project work breakdown include energy consuming equipment, energy distribution equipment, utility generation equipment, or controls upgrade to existing equipment?

Yes

Do equipment design/nameplate utility rating(s) exceed threshold criteria?

Yes

**Meter(s) required.**

Contact Facilities Engineering or PI&CS to select appropriate meter and implement meter installation.

No

No

No

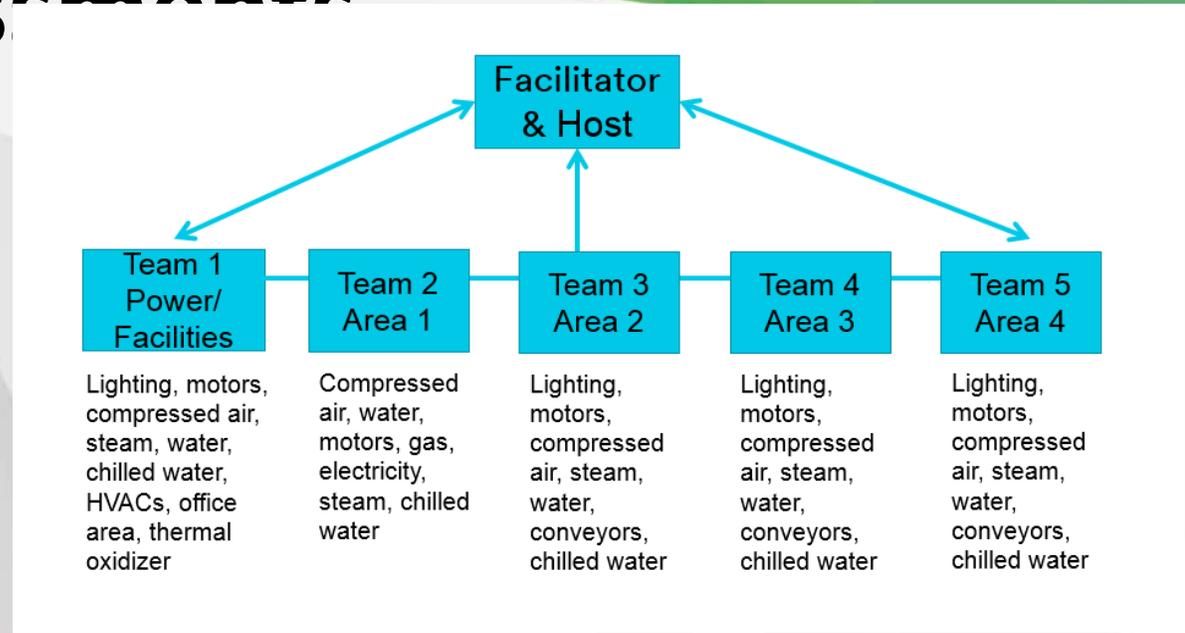
No

**Meter(s) not required.**

Utility	Threshold Criteria
Chilled Water	> 50 TONS
Compressed Air	> 75 SCFM
Natural Gas / LP	> 400 MBtu / hr
Electrical	> 35 KW
Steam	> 900 lbs / hr

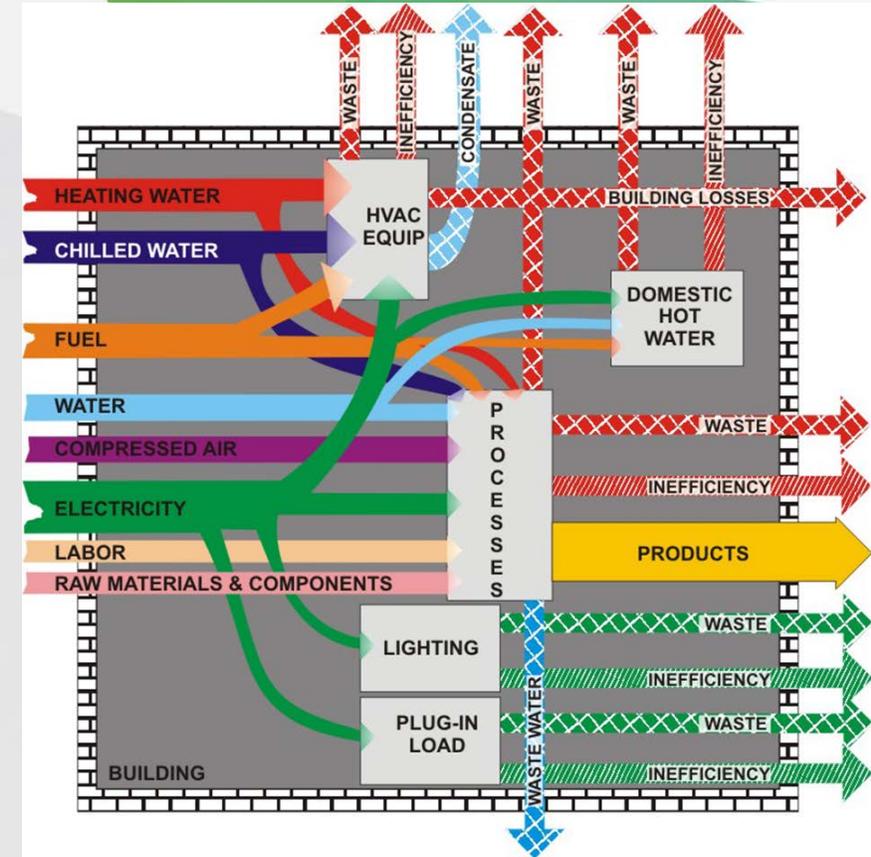
# Treasure Hunts/Assessments

- Go and See



# Treasure Hunts/Assessments

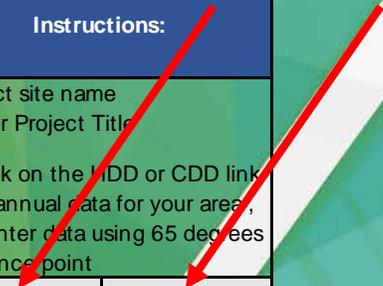
- Barriers to project identification
  - End users not engaged, unfamiliar with energy terms and concepts
- Barriers to project follow-up and implementation
  - Understanding the magnitude of the savings potential
  - Assigning resources for further study and investigation
  - End users not engaged in idea generation
  - Everyone is already busy, this isn't their regular job, they are not Energy Experts, ...



# Treasure Hunts/Assessments

Quick Analysis Tool

Energy Management		3M Energy Quick Analysis		Instructions:	
Site Name		Total 2017 Cost	\$1,264,895	1) Select site name 2) Enter Project Title 3) Click on the HDD or CDD link to get annual data for your area, then enter data using 65 degrees as balance point	
Bangor		2017 Electric Cost / MMBtu	\$35.38		
		2017 Electric Cost / KW	\$0.121		
		2017 Natural Gas Cost / MMBtu	\$11.78		
Project Title				<a href="#">HDD</a>	<a href="#">CDD</a>
Description:				6902	679



# Treasure Hunts/Assessments

## Quick Analysis Tool

Motor HP Savings			MMbtu Savings		
Enter HP	Hours of Reduction/week	# of weeks per year	Motor Savings/Yr	Natural Gas/LP	Electricity
			\$0		0.0
Steam Load					
Enter lbs/hr	Hours of Reduction/week	# of weeks per year	Annual Steam Savings	Natural Gas/LP	Electricity
			\$0	0.0	
Compressed Air					
Enter CFM	Hours of Reduction/week	# of weeks per year	Annual Compressed Air Savings	Natural Gas/LP	Electricity
			\$0		0.0
Lighting-Electrical					
Enter Watt Reduction	Hours of Reduction/week	# of weeks per year	Annual Electrical Reduction	Natural Gas/LP	Electricity
			\$0		0.0
Gas Heat Only					
CF Gas	Hours of Reduction/week	# of weeks per year	Annual Heat Load Only Savings	Natural Gas	Electricity
			\$0	0.0	
Chilled Water Reduction					
Enter Cooling Reduction-Tons	Hours of Reduction/week	# of weeks per year	Annual Chilled Water Savings	Natural Gas/LP	Electricity
			\$0		0.0
Conditioned Exhaust Air Reduction					
Reduced Exhaust Rate-CFM	Hours of Reduction/week	# of weeks per year	Annual Exhaust Savings	Natural Gas/LP	Electricity
			\$0	0.0	0.0
Non-Conditioned Exhaust Air Reduction					
Reduced Exhaust Rate-CFM	Hours of Reduction/week	# of weeks per year	Annual Exhaust Savings	Natural Gas/LP	Electricity
			\$0	0.0	0.0

Estimated Cost to Implement	Payback in Years
	0.0

Total Project Savings	Total MMBtu Savings
\$0	0.0

Additional Resources:
<a href="#">VFD Calculator</a> <a href="#">Steam Calculator</a> <a href="#">Insulation Calculator</a> <a href="#">Compressed Air Calculator</a>



# Treasure Hunts/Assessments

<b>Site Name</b>	Total 2017 Cost		\$1,264,895	1) Select site name 2) Enter Project Title  3) Click on the HDD or CDD link to get annual data for your area , then enter data using 65 degrees as balance point	
Bangor	2017 Electric Cost / MMbtu		\$35.38		
	2017 Electric Cost / KW		\$0.121		
	2017 Natural Gas Cost / MMBtu		\$11.78		
<b>Project Title</b>					
<i>Description: Air to feeder system doesn't stop when process stops. The program could be changed to only run air when the machine needed the parts. This opportunity was seen on multiple machines.</i>					
				<a href="#">HDD</a>	<a href="#">CDD</a>
				6902	679
<b>Motor HP Savings</b>				<b>MMbtu Savings</b>	
Enter HP	Hours of Reduction/week	# of weeks per year	Motor Savings/Yr	Natural Gas/LP	Electricity
0			\$0		0.0
<b>Steam Load</b>					
Enter lbs/hr	Hours of Reduction/week	# of weeks per year	Annual Steam Savings	Natural Gas/LP	Electricity
			\$0	0.0	
<b>Compressed Air</b>					
Enter CFM	Hours of Reduction/week	# of weeks per year	Annual Compressed Air Savings	Natural Gas/LP	Electricity
360	100	52	\$42,147		1,191.2

Three inputs



# Treasure Hunts/Assessments

- Training activity to learn Treasure Hunt culture
  - Need senior management support
  - Engage all employees in energy activities
  - Always ask questions (continuous improvement)
- 
- Best ideas are still ideas unless implemented
  - Share best practices
  - Make part of day to day activities
  - Continue internal Treasure Hunts

# Treasure Hunts/Assessments

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Remember: Everything can always be improved!

# Lighting



Picture courtesy LEDVANCE

- Technology keeps improving
  - Higher and higher lumen per watt ratios

Don't wait: retrofit projects installed one or two years ago can justify replacement yet again

Quick Analysis tool for lighting projects

# Lighting



Please take a moment to fill in the requested information in the white boxes. With this information, estimations on how much your facility could save this year with the easy installation of energy efficient lighting will be provided.

1. Select your facility name in the drop down list.
2. List the estimated number of T8 bulbs currently utilized at your facility.
3. What is the existing wattage of these light bulbs?
4. How many hours does your lighting operate in a given year?
5. What would be the estimated labor costs to install new bulbs at your facility?

## Relevant Variables:

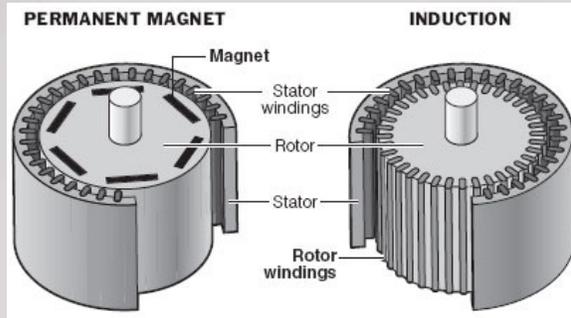
- |                              |                                     |
|------------------------------|-------------------------------------|
| Replacement Bulb Wattage     | <input type="text" value="18"/>     |
| Current electrical Cost / Kw | <input type="text" value="\$0.14"/> |
| Cost of New T8 bulb          | <input type="text" value="\$3.50"/> |

## Potential Savings:

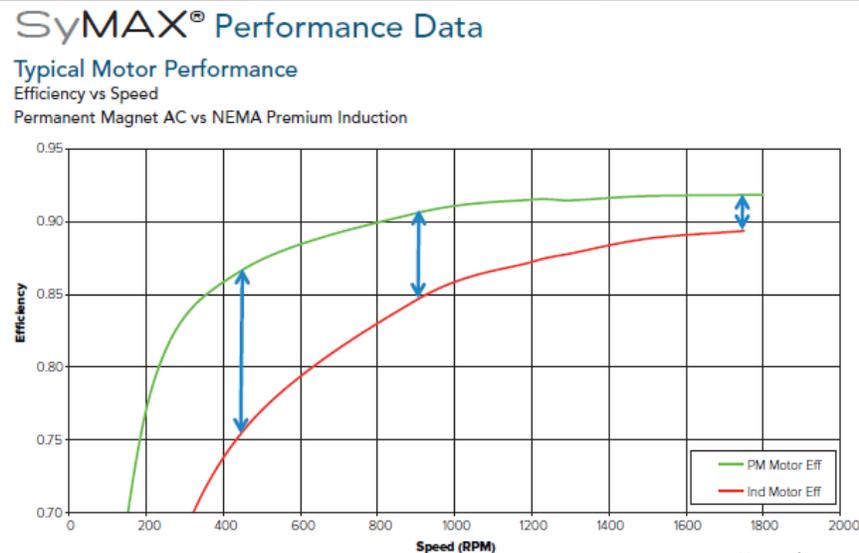
- |  |                                      |
|--|--------------------------------------|
| Estimated Potential Electrical Savings:                          | <input type="text" value="\$2,472"/> |
| Simple Payback in Years (without Utility Rebates or Incentives): | <input type="text" value="1.8"/>     |

- Quick Analysis Tool - Lighting

# Permanent Magnet Motors



Graphic courtesy of newenergyandfuel.com



Graphs and data courtesy of Marathon Motors

## SyMAX® Motor Energy Payback Calculator

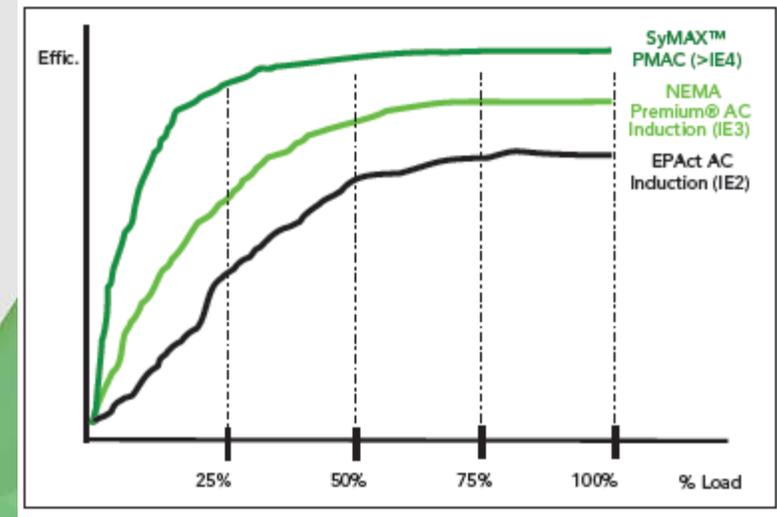
Based on 1800 RPM, Totally Enclosed

NEMA Premium AC Induction versus SyMAX "Ultra Efficient" Permanent Magnet AC

Cost / kWh	\$0.101
Hours / Day	24
Days / Year	365

HP	Calculation of Payback						Payback
	NEMA Premium AC Induction			Ultra Efficient SyMAX			
	Effic.	Price	Energy Cost	Effic.	Price	Energy Cost	
5	89.5%	\$ 550	\$ 3,669	91.7%	\$ 665	\$ 3,581	1.3
10	91.7%	\$ 812	\$ 7,162	93.6%	\$1,000	\$ 7,017	1.3
20	93.0%	\$1,300	\$14,124	95.0%	\$1,600	\$13,827	1.3
30	93.6%	\$1,799	\$21,050	95.4%	\$2,300	\$20,653	1.3



# Benefits

- Significant Energy Savings
  - Motor + VFD
- Variable frequency drive with direct mechanical drive can eliminate additional losses in belts, sheaves, gearboxes and external flow control devices.
- Longer bearing and winding life
- Higher power to size ratio
- Less waste heat and reduced cooling requirements

# Drawbacks

- Need variable frequency drive with PMAC compatibility
- Availability in larger sizes

# 3M's Approach to Improving Energy Productivity

## New Product Development

- Design new manufacturing processes to maximize energy
- Develop products that promote principles of Sustainability

## New Capital Projects

- Incorporate energy efficiency into new project design
- Develop internal engineering expertise in areas related to energy

## Existing Operations

- Energy Champions leading Energy Teams at 3M facilities globally
- Corporate Energy Management providing guidance, resources and accountability



# Emerging Technologies in Wastewater

Logan Olds

Victor Valley Wastewater Reclamation Authority

# Emerging Technologies

in  
Wastewater



L o g a n O l d s  
G M - V V W R A

# VVWRA

Victorville, CA



4 4 6 a c r e s



# Subregional Treatment Approach



Victorville



Apple Valley



Hesperia



# What do we manufacture?



Recycled water



Biogas





# Energy Production

- Natural gas consumption reduced by 94%
- Grid consumed power reduced by 76%
- Net Annual Savings \$885,620



# Managing our do do



# What we are doing about...

- Solids control
- Ammonia based DO control in air bays
- Increasing Digester Gas Production
- Renewable Energy Credits



# Energy Production and Management



2G Generators  
800 kwh each



Microgrid &  
Battery Storage



# Energy Production and Management

## *Net Energy Metering*



AV Subregional



Hesperia  
Subregional





**Logan Olds**

**General Manager, VVWRA**

**[lolds@VVWRA.com](mailto:lolds@VVWRA.com)**

# Emerging Technologies in Manufacturing: Advanced Energy Metering

Fernando Reyes-González  
Johnson Controls



# Emerging Technologies in Manufacturing: Advanced Energy Metering

**Fernando Reyes-Gonzalez**

*Manager, Global Environmental Sustainability*



# Leading Markets

## Buildings

Leading provider of building technology, products and solutions—controls, equipment and services for HVAC, security, fire and refrigeration.



## Power Solutions

Global leader and largest manufacturer of automotive batteries, powering nearly every type of vehicle.



# Global Sustainability Strategy

Improve the sustainability of our high impact products and services



People



Foster a culture of sustainability that engages, attracts and retains people who want to make a difference

Lead in global partnerships that significantly increase the scale of our sustainability impact



Performance



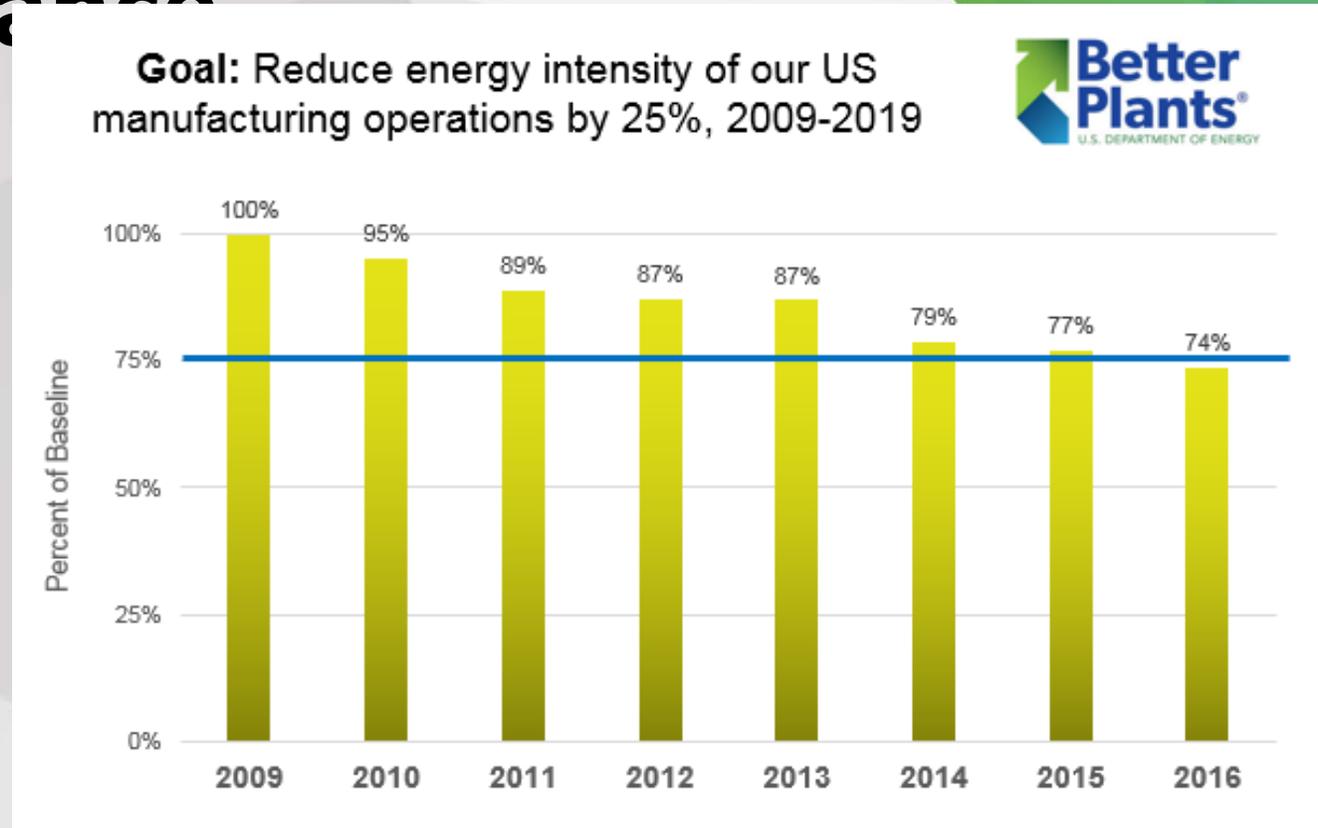
Performance measures identified to meet stakeholder needs and track progress towards our sustainability vision and goals

Formalize a sustainability governance process that drives accountability and achieves objectives



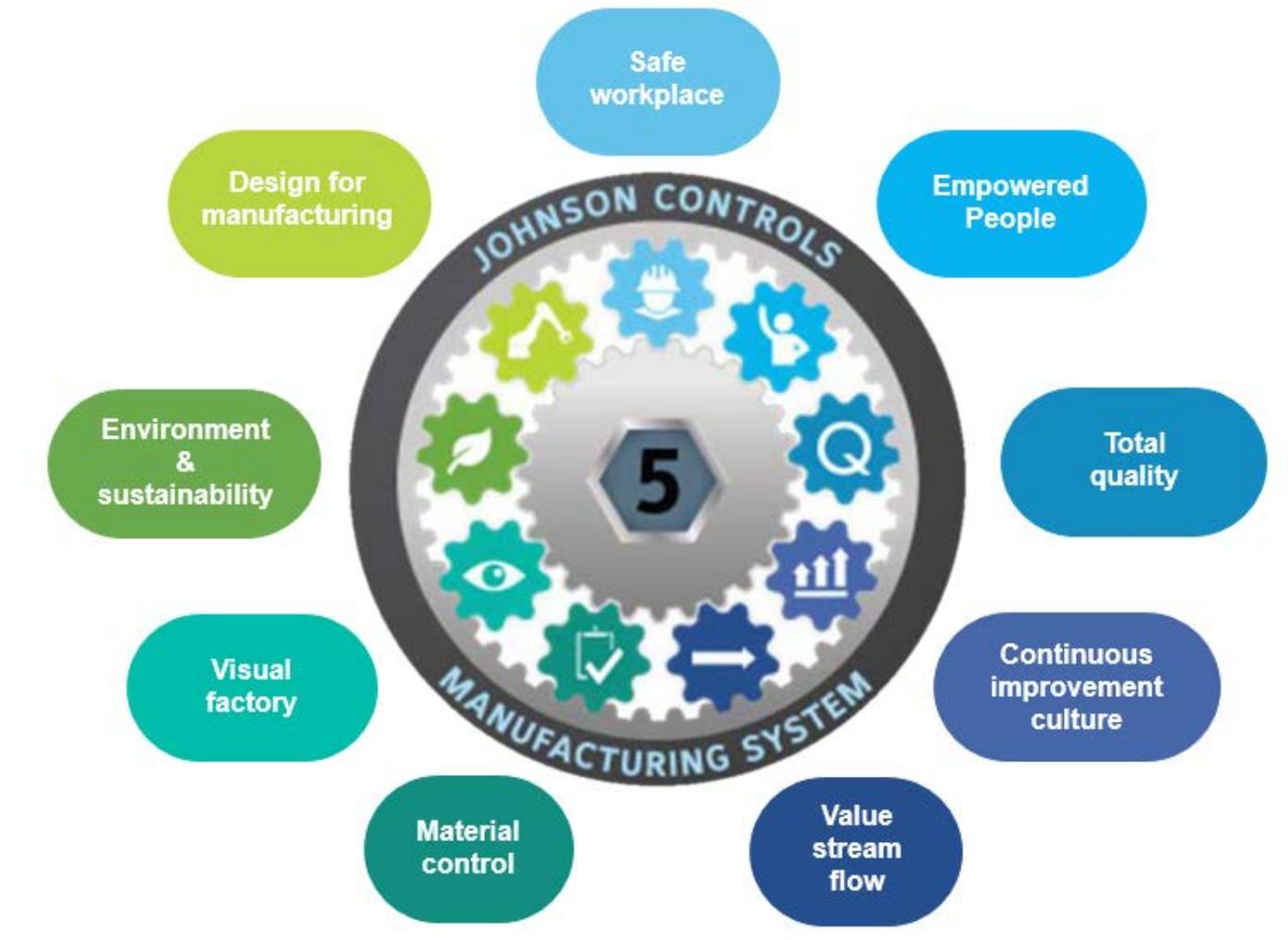
Johnson Controls

# Our US Manufacturing Energy Intensity Performance



Achieved our energy intensity goal in 2016, 3 years early

# Johnson Controls Manufacturing System (JCMS)



# JCMS: Environment & Sustainability Principle



## Environment & Sustainability

We promote the safe, efficient, and responsible use of global resources and our employees actively support their communities.

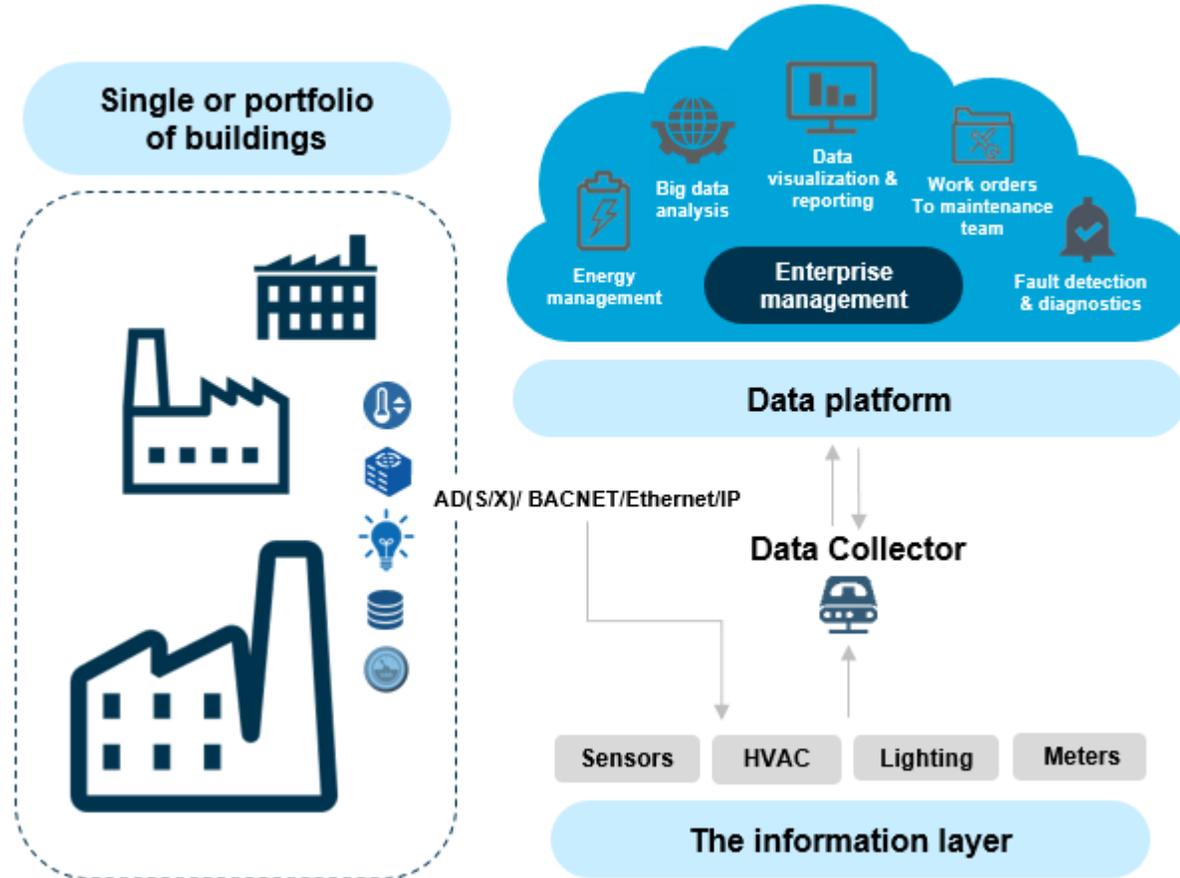
### Objectives

- Risk assessment
- Air, water, waste management
- Emergency preparedness
- Community engagement
- Energy & sustainability

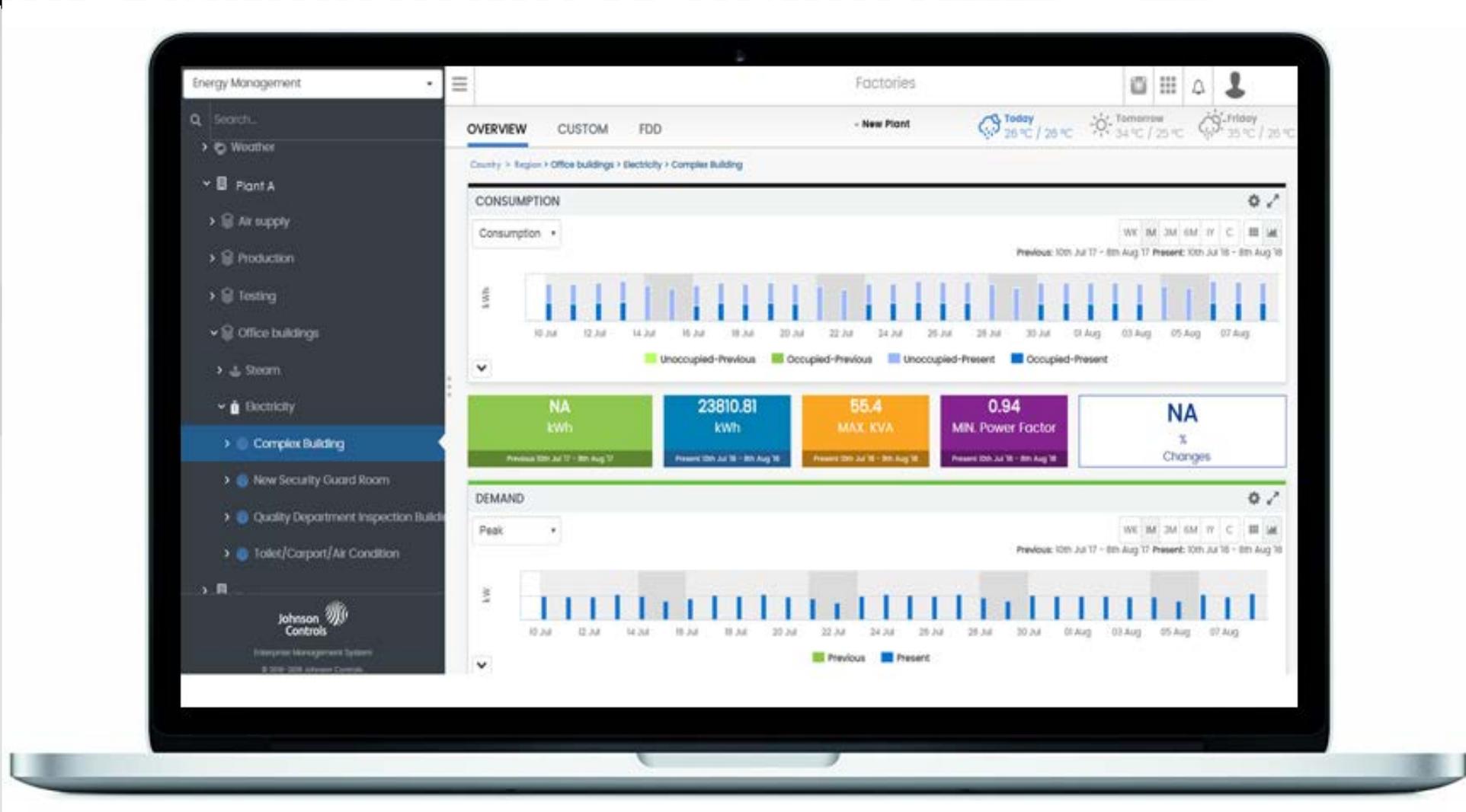
### Maturity Model

- 1) Energy Champion & Training
- 2) Energy Plan
- 3) Energy Hunt
- 4) Energy Metering System
- 5) ISO50001

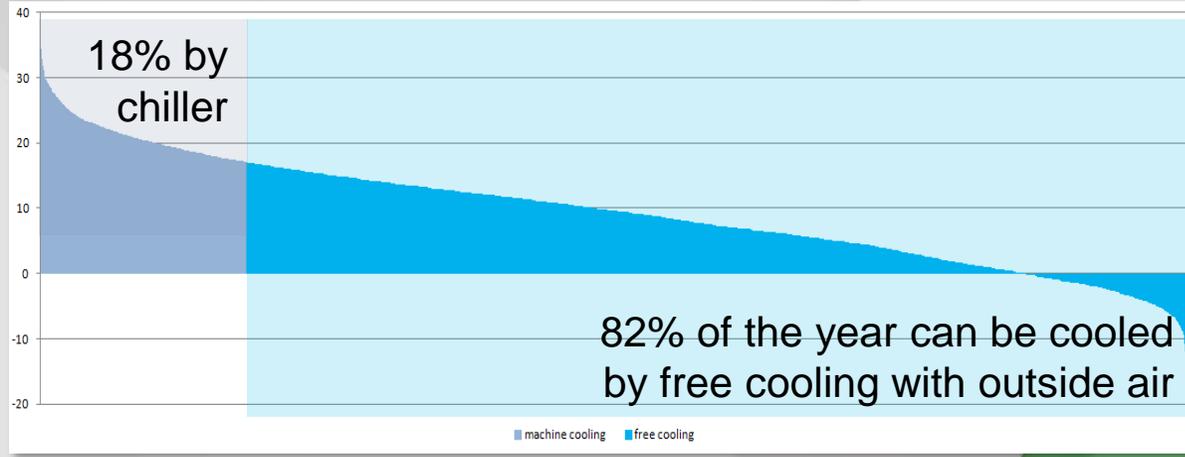
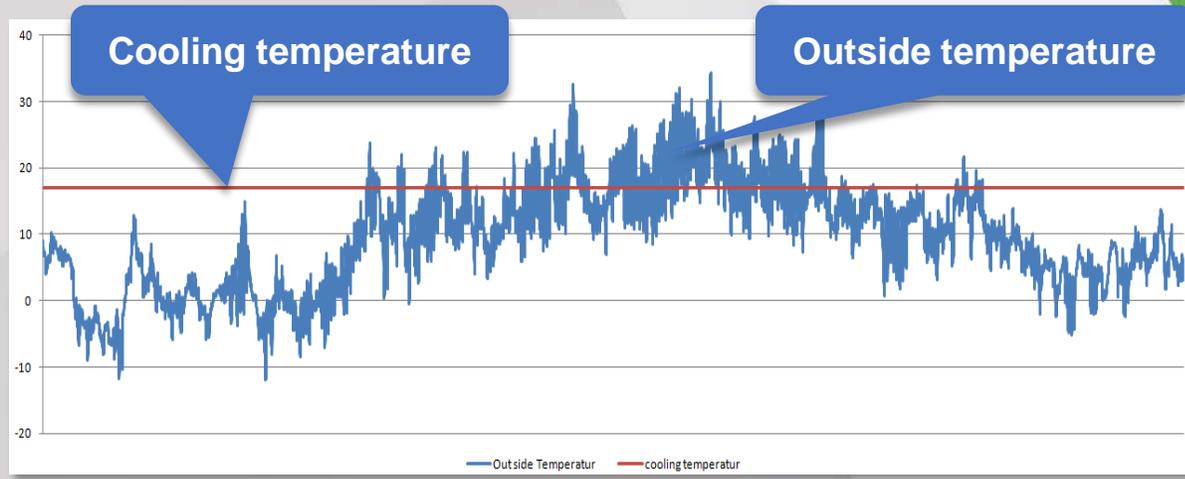
# Metering System Architecture: Johnson Controls Enterprise Management System (JEMS)



# Data Visualization & Reporting

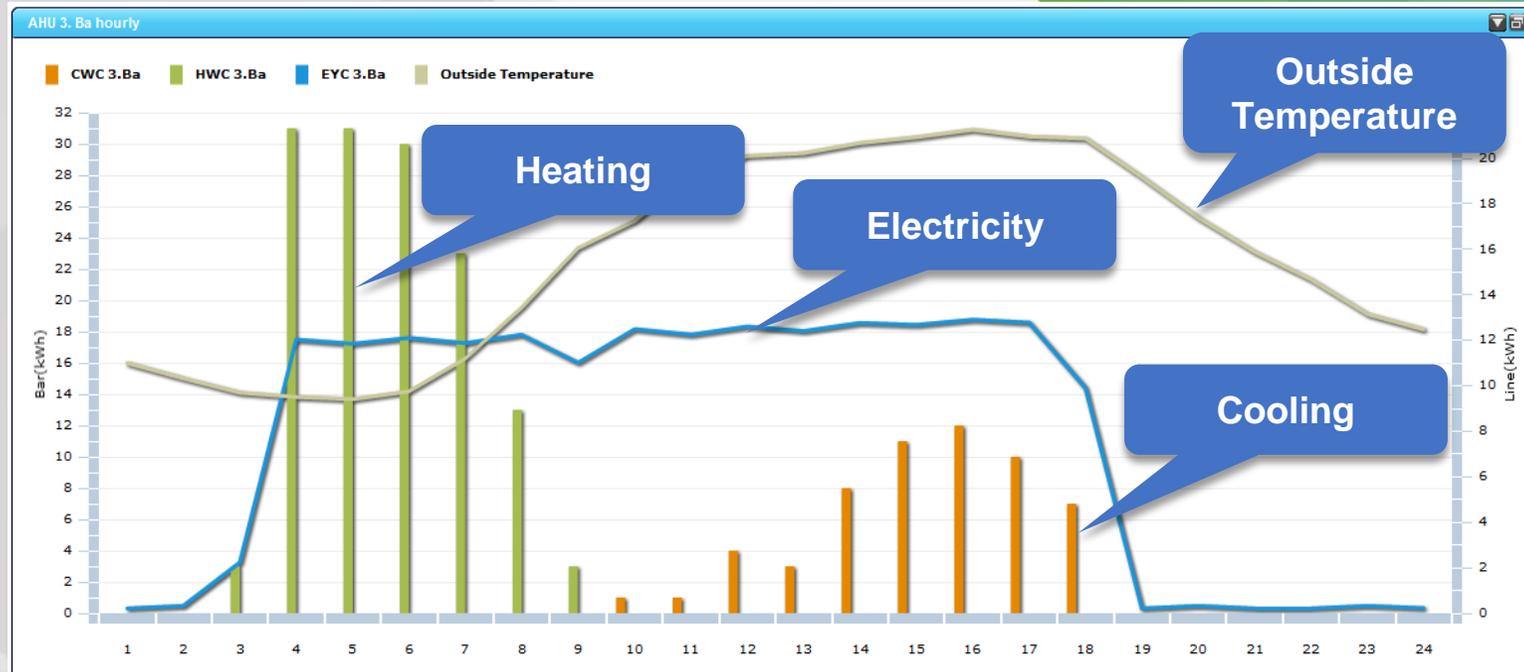


# Example – Detection of Faulty Free Cooling Logic



- 12,500 €/a in wasted energy for the past 1, 2, 5...10 years?

# Example – Detection of Air Handling Unit Malfunction



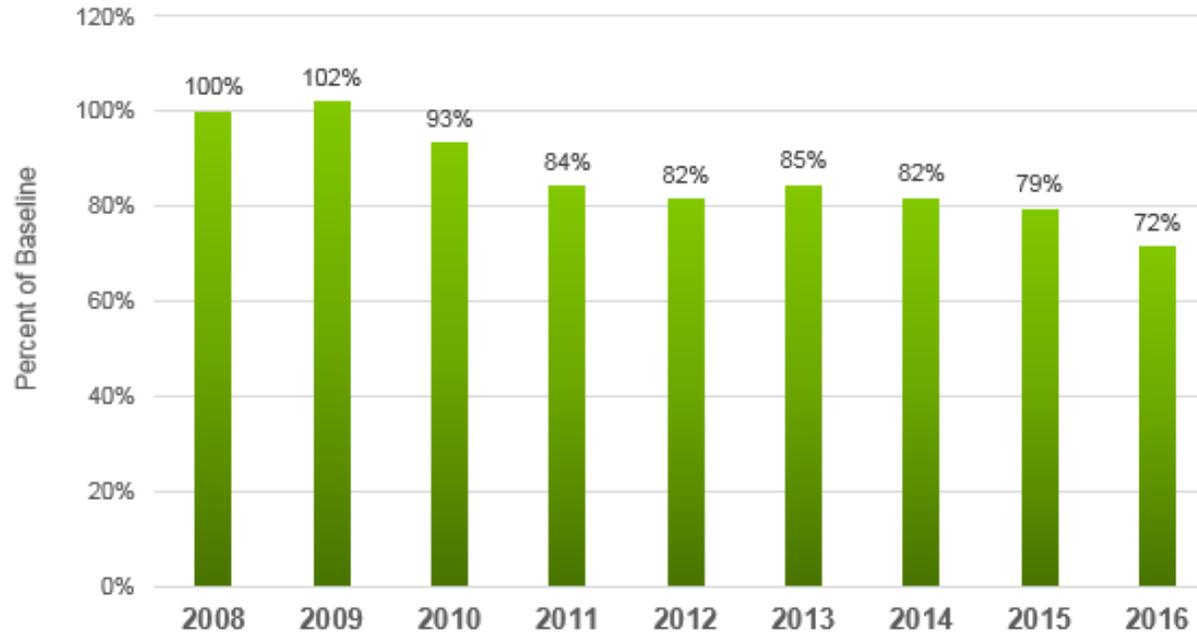
- Consumption values over a day indicate a defect in the heat-recovery system and that the air handling unit starts too early in the morning.
- The saving potential is around 35% of the consumption.

# More than 700 projects implemented in Europe from 2008 through 2016

- Lighting
- Air compressor
- Water Savings
- Boiler system
- Recycling
- Roof insulation
- Ventilation system
- Floor heating
- New motors
- High efficient drivers
- Waste heat recovery
- Cooling system



# Results from implementing energy metering & ISO50001



28% reduction in energy intensity from implementation of ISO50001 and energy metering

An aerial view of the New York City skyline, including the Freedom Tower, seen through a dark metal railing. The foreground shows a blurred, dark, curved object, possibly a railing or part of a structure. The city is densely packed with buildings, and the water of the harbor is visible in the distance.

**Questions**

# Thank you!

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[www.johnsoncontrols.com](http://www.johnsoncontrols.com)

 [@johnsoncontrols](https://twitter.com/johnsoncontrols)



# Questions?

- o Fernando Reyes-González, JCI ([fernando.reyes@jci.com](mailto:fernando.reyes@jci.com))
- o Logan Olds, VVWRA ([lolds@vwwra.com](mailto:lolds@vwwra.com))
- o Steve Schultz, 3M ([scschultz@mmm.com](mailto:scschultz@mmm.com))

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Use the Energy Exchange and Better Buildings 2018 mobile app to rate this session and provide feedback

