



Results from the Field: Highlights from Technology Demonstration Projects

Wednesday, May 11, 2016

3:45-5:00 PM

Agenda

1. The Benefits of Tech Demos: Highlights from the Green Proving Ground
2. HVAC Load Reduction Modules
3. Q-Sync Motors
4. Commercial Advanced Lighting Controls

Open House Poster Session

Today's Presenters

1. Kevin Powell, General Services Administration
2. Michael Wolf, enVerid Systems
3. PJ Piper, QM Power
4. Gabe Arnold, Northeast Energy Efficiency Partnerships and Design Lights Consortium

Highlights from the Green Proving Ground

Kevin Powell, General Services Administration

“The Government’s Landlord”



8,792 assets

- Owned: 1,621 assets
- Assets in all 50 states, 6 U.S. territories, and Washington D.C.

374M square feet

- Owned: 183M square feet

1.1 million federal employees

\$365M annual energy costs



Green Proving Ground leverages GSA's real estate portfolio to evaluate innovative sustainable building technologies.

Federal Leadership by Example

Energy Independence and Security Act, 2007

30% reduction in energy use intensity (EUI) by 2015, over 2003 levels

GSA Response:

-30.0% EUI reduction EOFY2015*

Executive Order 13693, 2015

2.5% annual reduction in EUI through 2025, over 2015 levels

GSA Response:

-3.5% 2016 EUI reduction as of FY2016 Q2*

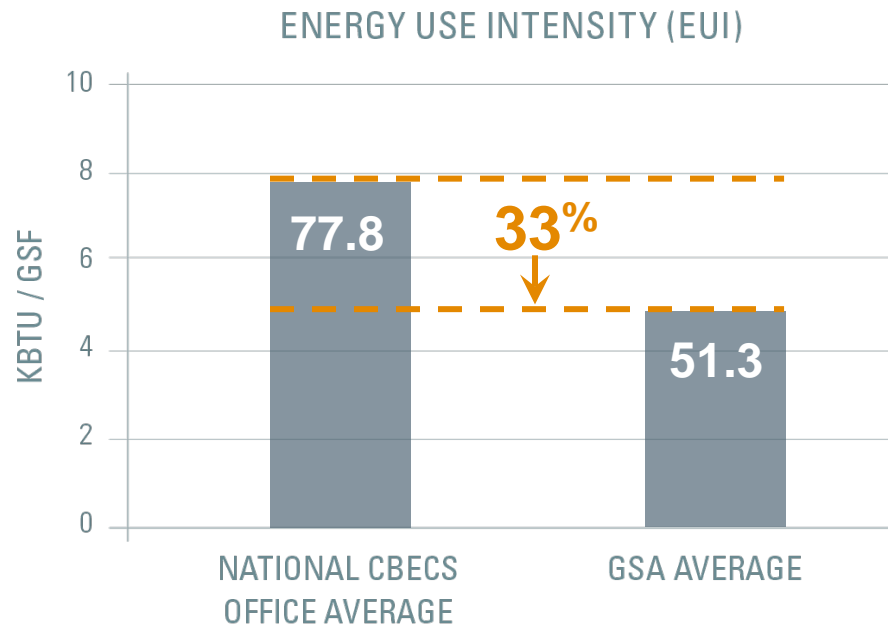
GSA buildings are **33%*** more efficient than typical U.S. office buildings.

* February 2016, GSA Average EUI = 51.3 kBTU/GSF/yr, as reported per legislative mandate;
Commercial office average EUI = 77.8 kBTU/SF/yr, 2012 CBECS, eia.gov

GSA Fosters Outstanding Building Performance

GSA buildings are **33%*** more efficient than typical U.S. commercial buildings.

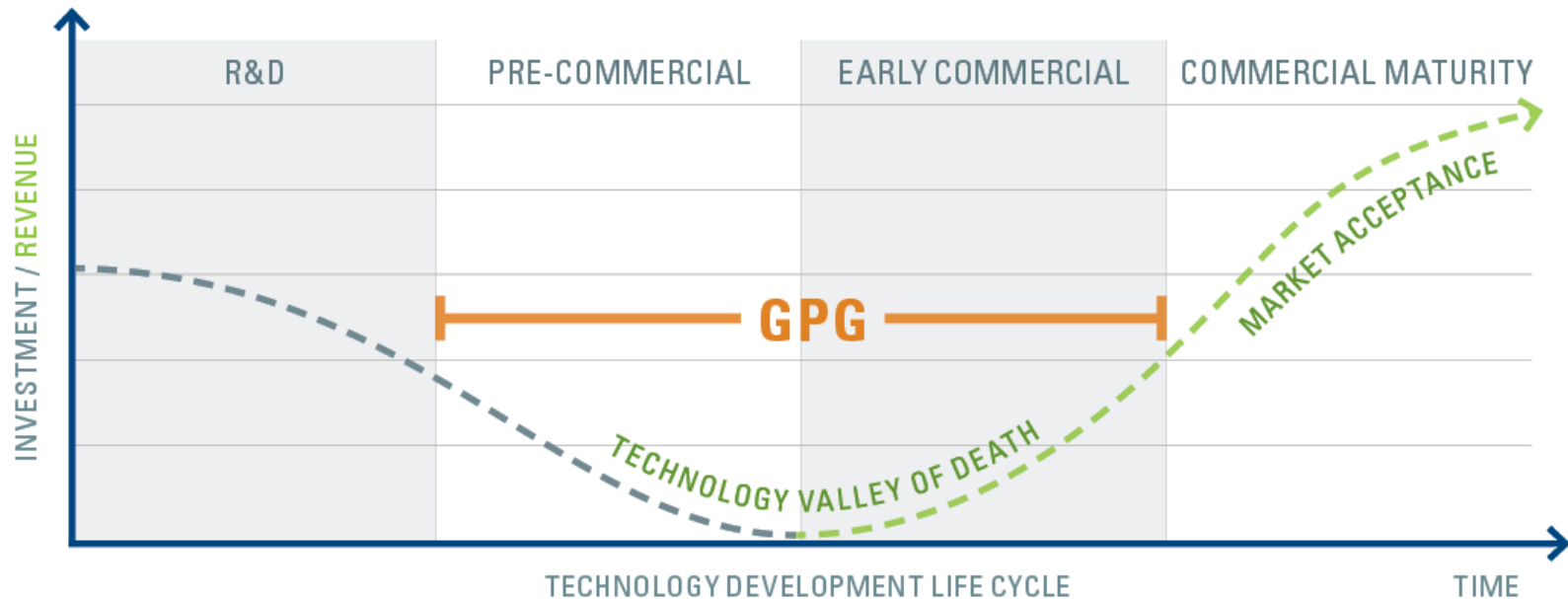
*February 2016, GSA Average EUI = 51.3
kBTU/GSF/yr, as reported per legislative mandate;
2012 CBECS, eia.gov



The Development of Innovative Tech

4 out of 5 technologies fail to cross the Technological Valley of Death because of the financial and operational risks they pose to early adopters.

Tech Demos take on first-use risk to accelerate market acceptance by objectively assessing innovative building technologies in real-world environments.



How Does GPG Work?



Identify promising technologies in pre- or early-commercial phases



Pilot technology installations within GSA's real estate portfolio



Partner with Department of Energy national laboratories to objectively evaluate real-world performance



Recommend technologies with broad deployment potential

Green Proving Ground, 2011-2015

Received	560	technology applications
Selected	48	technologies for M&V
Published	26	DOE laboratory assessments
Identified	17	broad deployment potential

Google Ranking

GPG technology evaluations consistently appear within the top 5 Google search results



Opportunity — 17 Technologies with Broad Deployment Potential

Category	Technology	% Saved at Test Beds	Projected Payback (yrs)
Energy Management	Wireless Sensor Networks	17%	2
	Socially Driven HVAC	20% cooling, 47% heating	NA
	Advanced Power Strips	26 - 48%	2
Lighting	Occupant Responsive Lighting	27 - 63%	6
	LED Downlights Lamps	40%	3
	Integrated Daylighting	27%	6
	LEDs + Wireless ALC	78%	6
	LEDs with Integrated Controls	69%	9
Building Envelope	Hi-R Windows	41%	7
	EC Windows for LPOEs	9%	NA
	Solar Control Film	22%	9
HVAC	Condensing Boilers	14%	7
	Maglev Chiller	42%	5
	Fan Belts	2 - 20%	4
	Wireless Pneumatic Thermostats	20% cooling, 43% heating	6
Water	Weather Station Irrigation	66%	4
	Non-Chemical Water Treatment	NA	2

GPG Technology Deployments 2012-2016

9 Technologies in over 200 Locations within GSA buildings

Wireless Sensor Networks for Data Centers 3 GSA-operated data centers in Chantilly, VA; Fort Worth, TX; and Denver, CO.

Advanced Power Strips 16,000+ deployed throughout GSA portfolio in 2014

Condensing Boilers 60 locations in GSA's portfolio, many through ESCO-financing

Variable-Speed Maglev Chiller 40 locations in GSA's portfolio, many through ESCO-financing

LEDs with Integrated Controls 23,000 GSF as part of a Total Workplace project in Portland, OR.

Wireless Advanced Lighting Controls 5.5M GSF of workspace in California, through ESPC

Hi-R Windows 3M GSF of workspace in New York, through ESPC

Wireless Pneumatic Thermostats 4M GSF of workspace in New York, through ESPC

Socially Driven HVAC Optimization 230,000 GSF of workspace in California, through ESPC

GSA Portfolio Energy Impact— 9 Deployed Technologies

ANNUAL ENERGY REDUCTION

265,000

MMBtu/yr

EUI REDUCTION

1.5 kBtu/sf/year

2.8% contribution
to EUI Reduction Goal



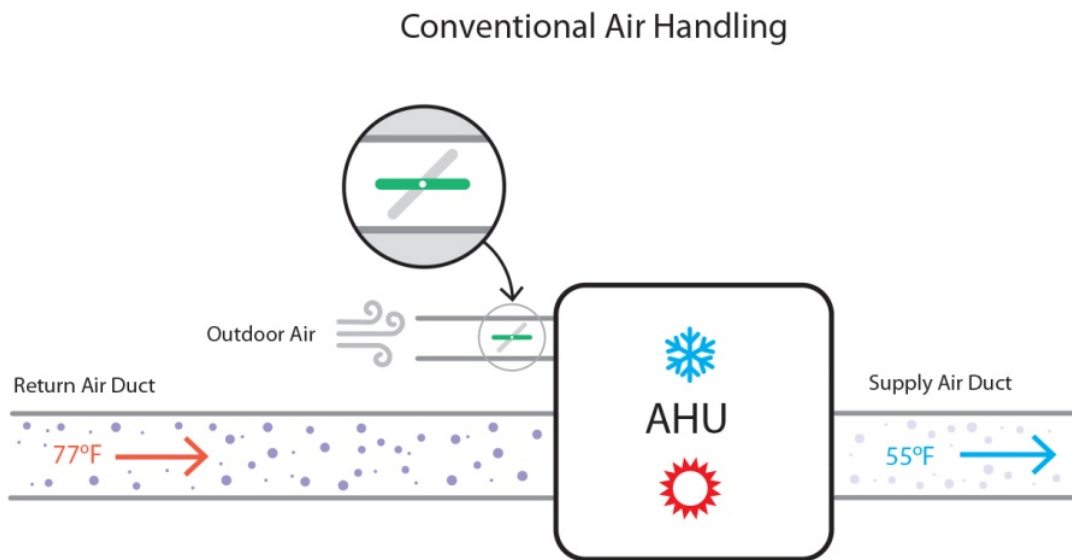
Thank You!

Kevin Powell
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gsa.gov/GPG

HVAC Load Reduction Modules

Michael Wolf, enVerid

Maintaining Indoor Air Quality Today



- Commercial buildings use a lot of outside air
- The reason: ensuring indoor air quality (ASHRAE 62.1)
- A universal, but *inefficient* practice

Remove molecular contaminants

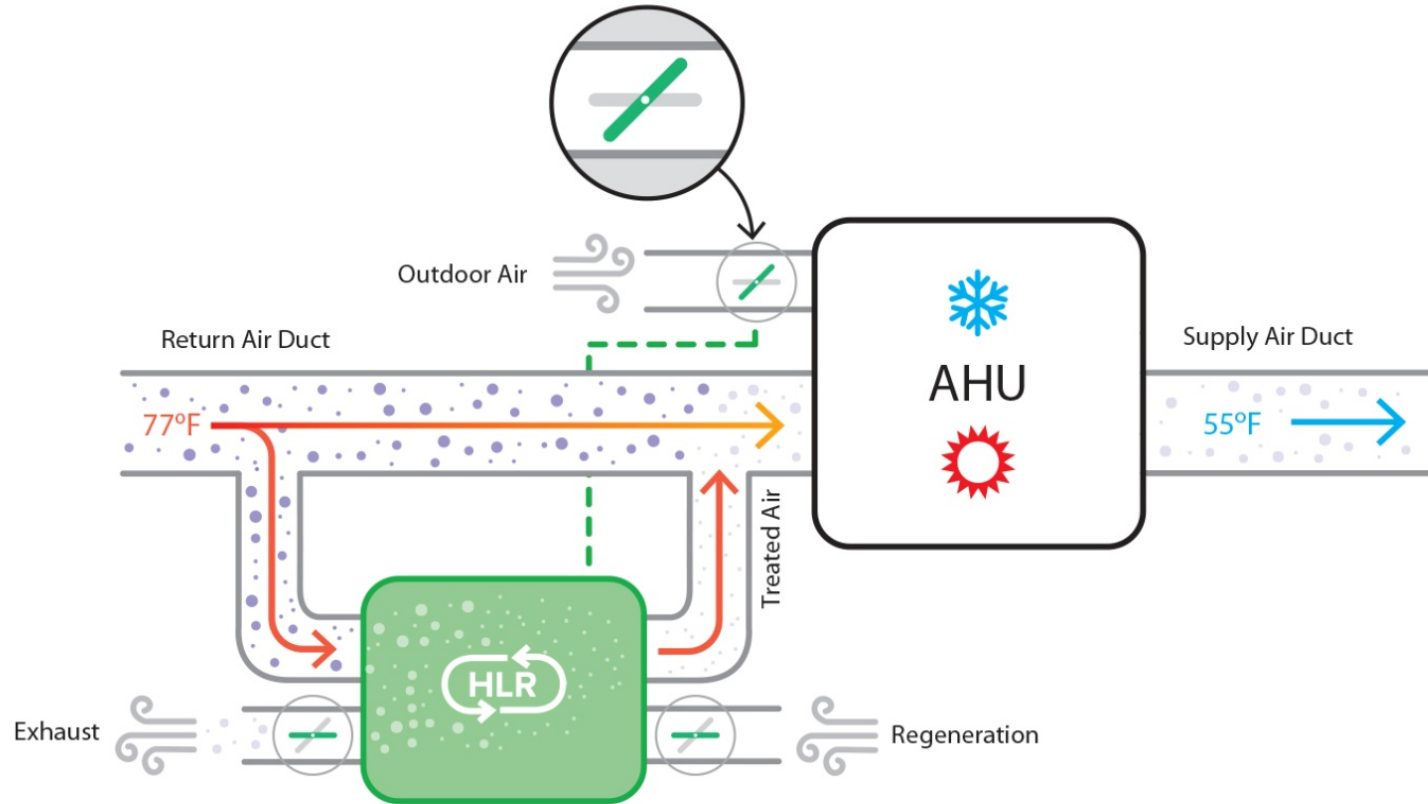


Reduce amount of outside air



Lower energy costs & maintain indoor air quality

HLR System Air Handling



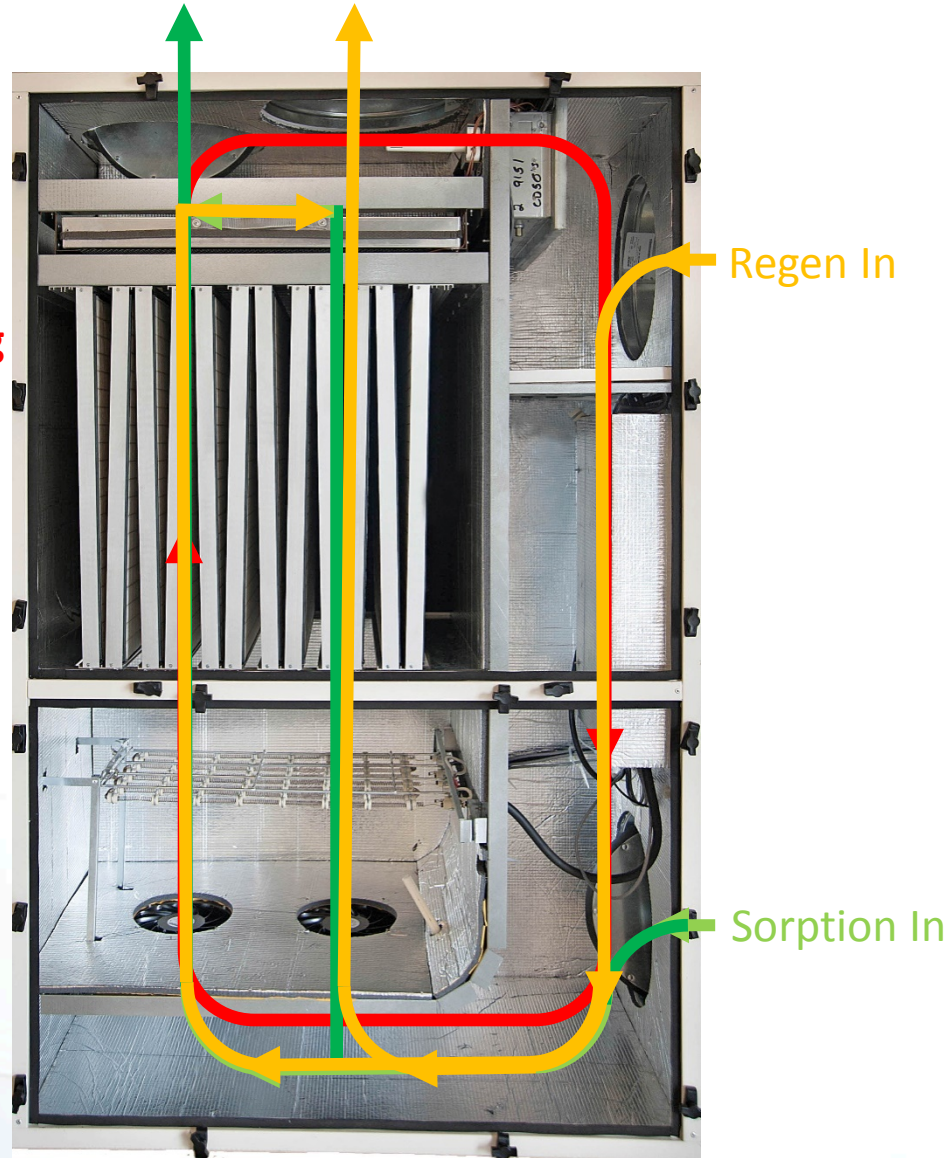
Automated Regeneration In Situ

Sorption Out Regen Out

Adsorption

Closed Loop Heating

Regeneration

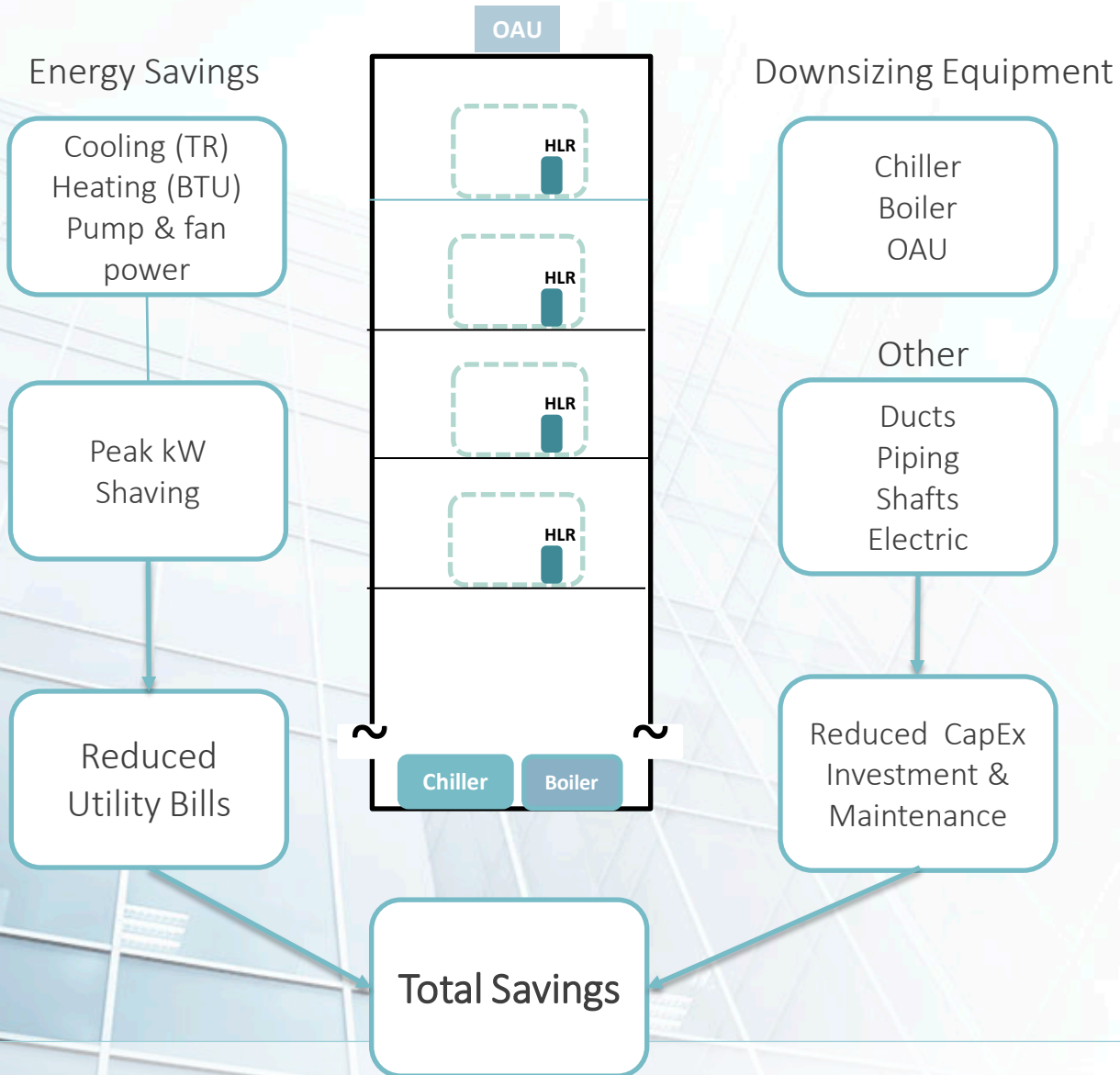


Retrofit Economics



- Typical annual savings **20%**
- Peak load reduction routinely **exceed 40%**
- ROI for retrofit is **2 – 3 years**
- Significant savings on maintenance
- Impact of **financing, rebates, credits**

New Construction Economics

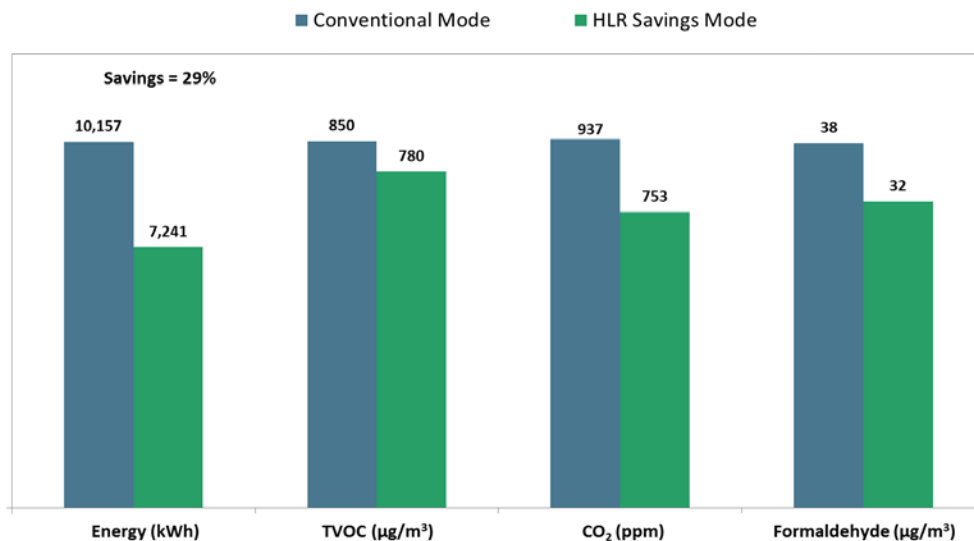


Target Application



- Central HVAC systems in Commercial Buildings of at least 50,000 ft², and zones of at least 10,000 ft²
- Buildings in cities with long summers and/or winters
- Buildings with long hours of operation or high occupancy rates
- Buildings with indoor air quality issues
- Examples : Office buildings, University/campus settings, Government buildings

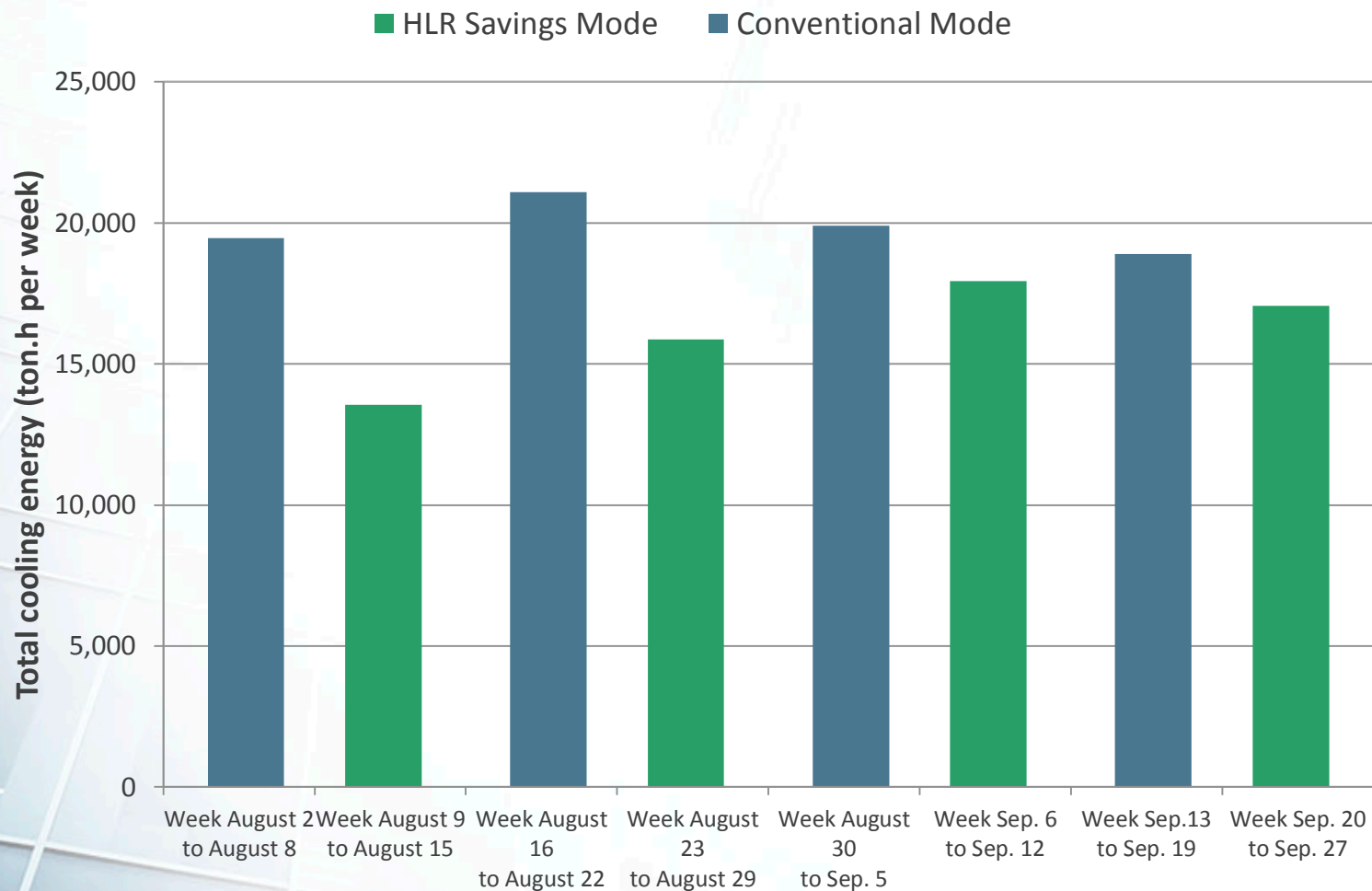
Project: University of Miami Wellness Center June 2015



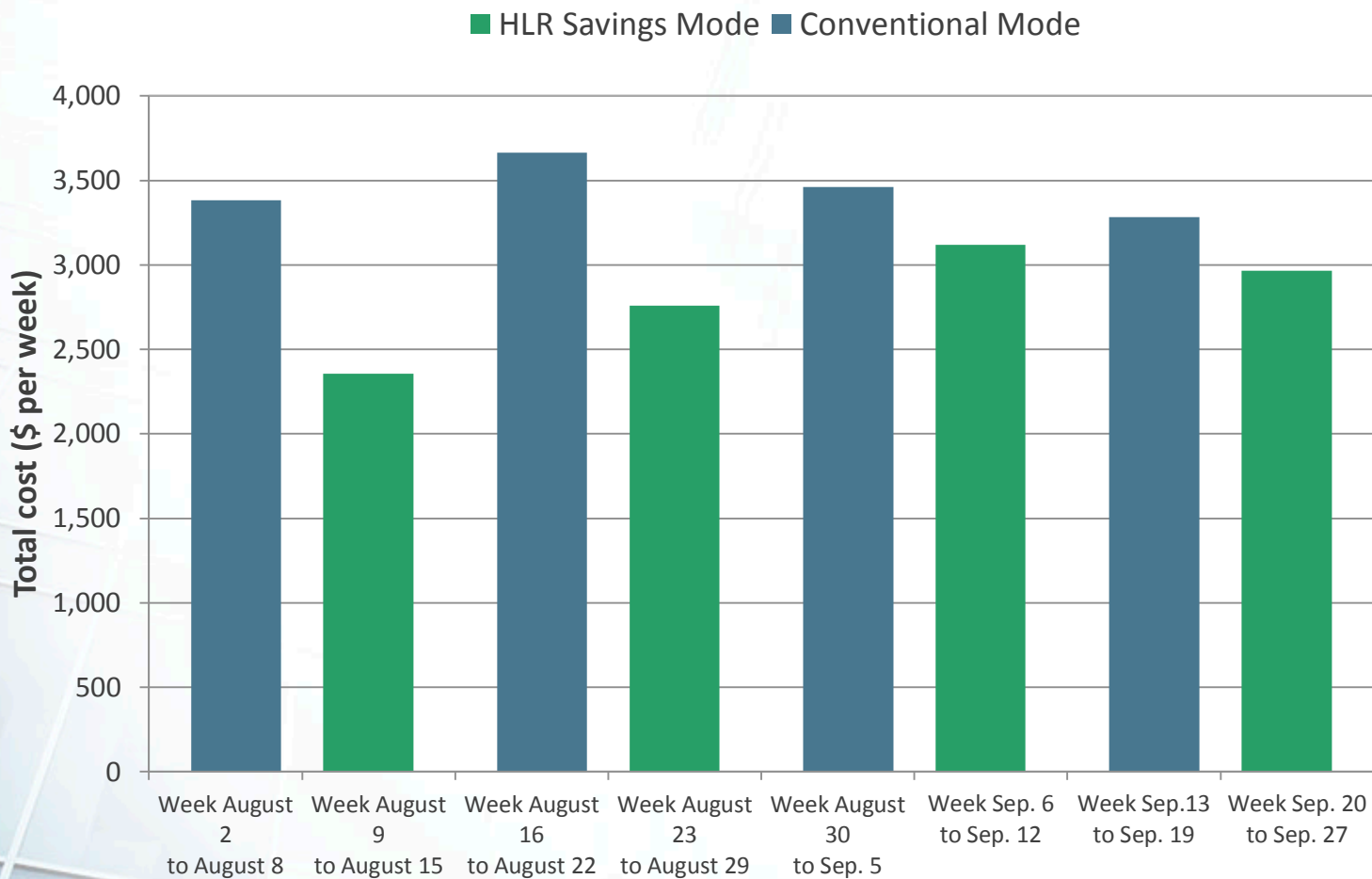
In HLR Savings Mode:

- 29% reduction in energy consumption
- All three IAQ measurements improved

Project: University of Miami Wellness Center June 2015 – Cooling Energy Savings



Project: University of Miami Wellness Center June 2015 – Energy Savings



Summary

- Substantial energy savings
- Excellent indoor air quality
- Retrofit or new construction projects

Change is in the air.

Works anywhere. Changes everything.

Q-Sync Motors

PJ Piper, QM Power

QM POWER

Q-SYNC™

Reinventing the High-Efficiency Motor

April 2016



Q-Sync is a Department of Energy High Impact Technology

Q-Sync launched at the 2015 FMI Energy Conference in San Francisco

Q-Sync Motors in Commercial Refrigeration: Preliminary Test Results and Projected Benefits



ORNL/TM-2015/466

Brian A. Fricke
Bryan R. Becker
September 2015

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE US DEPARTMENT OF ENERGY



ENERGY SAVINGS OF PERMANENT MAGNET SYNCHRONOUS MOTORS IN REFRIGERATED CASES

San Diego Gas & Electric
Emerging Technologies Program
Technology Assessment Report
Project ID ET15SDG1061



Prepared for:
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March 2016

What's the Big Deal With Motor Efficiency?

- Over 50% of all electricity used in buildings is consumed by motors

Source: Department of Energy

- Up to 98% of the total cost of an electric motor is in the energy it consumes
- Most motors in operation today are based on Tesla's design from the late 1800s



"QM Power's technologies are THE biggest leap in electric motor design logic in more than a hundred years."

- Jamie Childress, Boeing Research and Technology

THE MOST EFFICIENT COMMERCIAL REFRIGERATION MOTOR IN HISTORY

INTRODUCING THE NEXT BIG LEAP IN EFFICIENCY

Q-Sync in HVACR fan applications "could reduce source energy consumption by as much as **one quad or more [annually]**, with proportional environmental benefits."

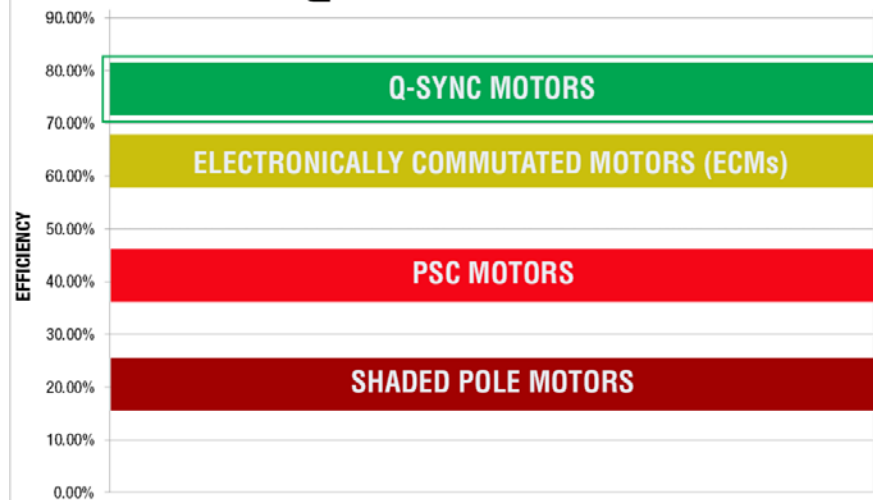


*-Dr. Brian Fricke
Former ASHRAE Technical Committee
Chairman, Commercial Refrigeration and
R&D Staff member in the Building
Equipment Research Group at
Oak Ridge National Laboratory*

Source: See page 13 of "Q-Sync Motors in Commercial Refrigeration: Preliminary Test Results and Projected Benefits" published by Oak Ridge National Laboratory, September 2015, authors Brian A. Fricke & Bryan R. Becker.

<http://info.ornl.gov/sites/publications/Files/Pub58600.pdf>

QM POWER

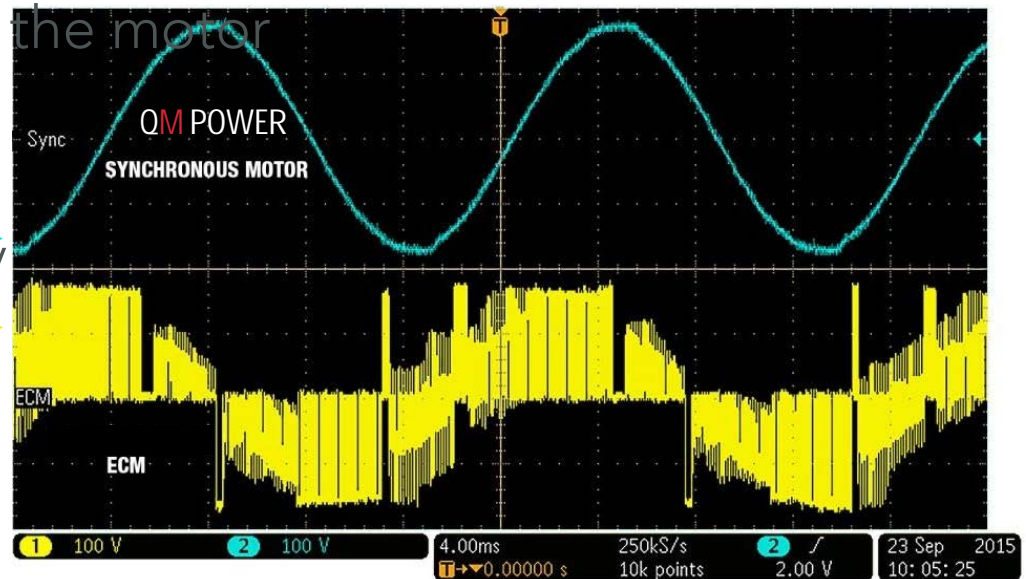


QM POWER

Q-Sync Technology Explained:

Why is Q-Sync Superior to an ECM?

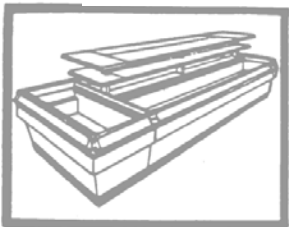
- Get the advantage of permanent magnets without the losses associated with continual power conversions found in ECM designs
- ECMs consume more electricity because they must convert AC to DC and synthetically “chop it up” to artificially create an AC waveform to run the motor
- QM Power’s motor is perfectly synced to the 60Hz AC line frequency
- The yellow lines in the diagram on the right show the power losses and wasted energy inherent in an ECM design



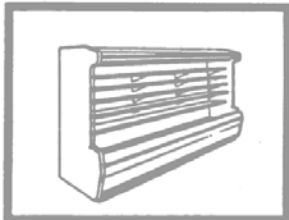
Types of Refrigeration Fan Motors in a Supermarket

Average Number of Refrigeration Fan Motors Per Store	Coffin 4-8W	Case 9-12W	Walk Ins 38-50W	Total All Wattages
	100	300	70	470

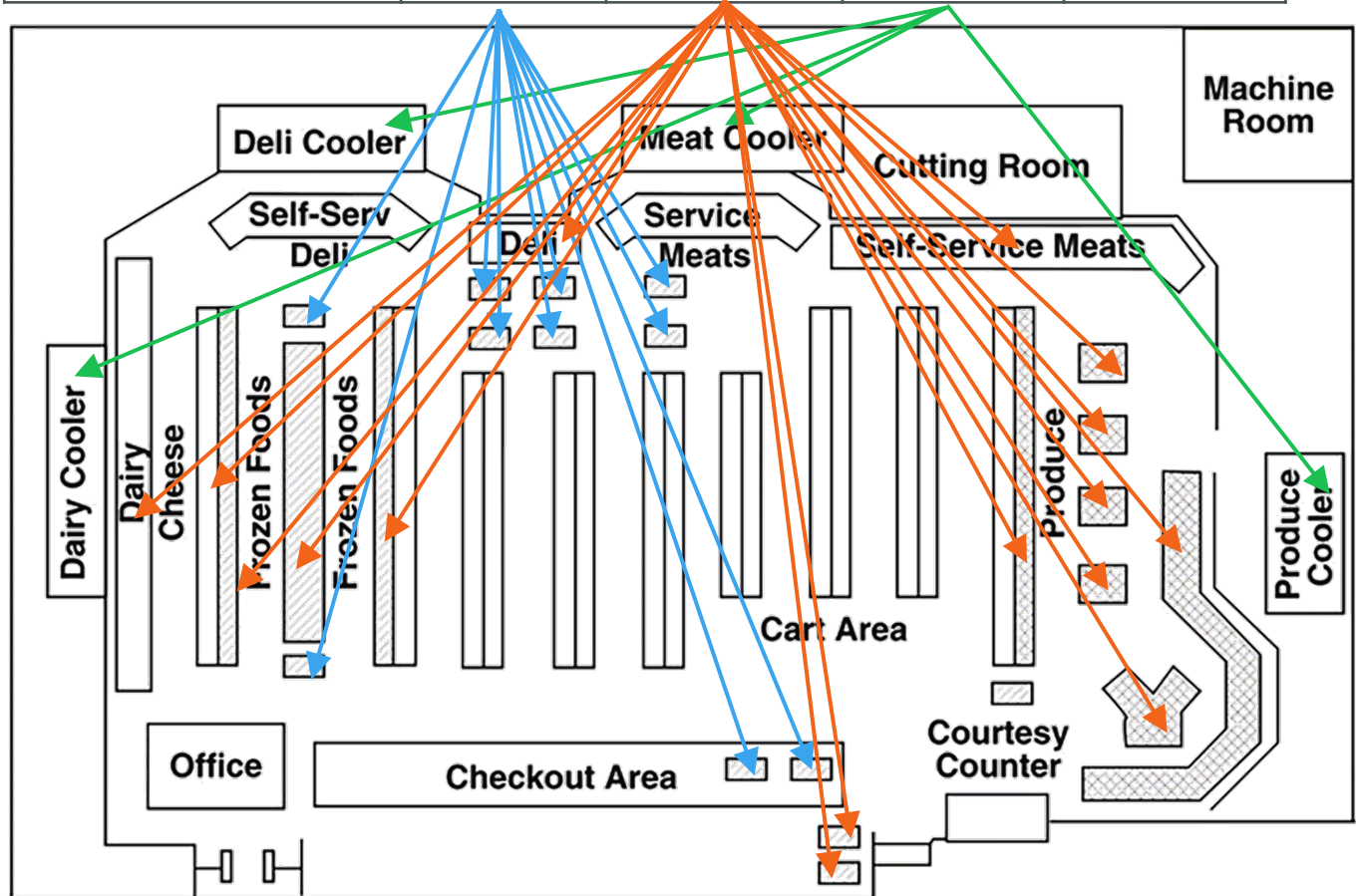
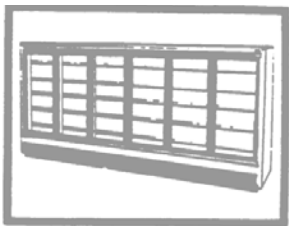
Coffin



Case



Enclosed Case



Total Energy Savings from Q-Sync Motor in Supermarkets

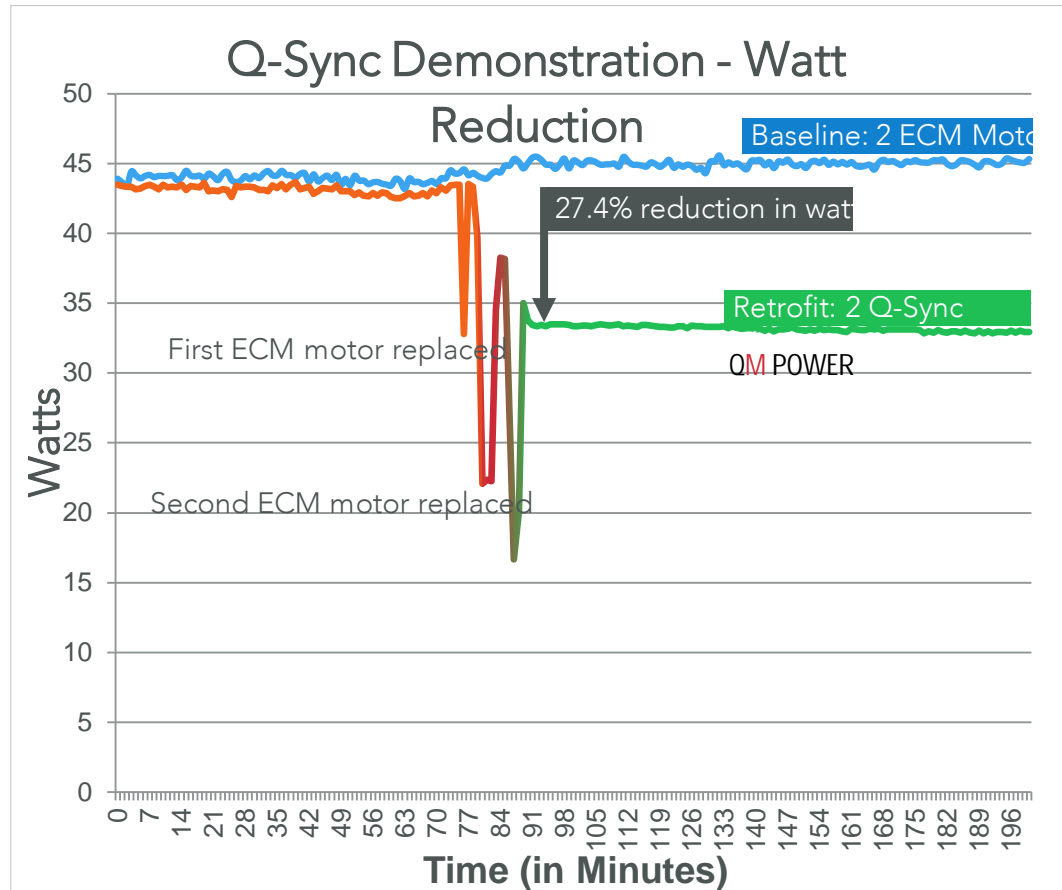
Over 353 Million kWh saved every year for 15 years

Q-Sync Fan Motor	Coffin 4-8W	Case 9-12W	Walk-Ins 38-50W	Combined Year One Savings*	Combined Savings Over 15 Years*		
					\$	kWh	CO ² Emissions (lbs)
Annual Cost Savings Per Motor:							
vs ECM Motor	\$4.83	\$8.18	\$18.67				
vs PSC Motor	\$6.10	\$15.30	\$84.11				
vs Shaded Pole Motor	\$34.77	\$57.26	\$218.47				
Per Store Cost Savings From Retrofitting with Q-Sync Motors (By Type):							
Average Motors Per Store	100	300	70				
Upgrading from all ECM	\$483	\$2,454	\$1,307	\$4,244	\$63,653	581,837	913,485
Upgrading from all PSC	\$610	\$4,589	\$5,888	\$11,087	\$166,300	1,520,112	2,386,576
Upgrading from all Shaded Pole	\$3,477	\$17,177	\$15,293	\$35,947	\$539,205	4,928,750	7,738,138
Chain-Wide Cost Savings From Retrofitting by Scenario:							
Store Count	1,000	1,000	1,000				
Assumed % of Stores With ECM	10%	35%	20%				
Assumed % of Stores With PSC	0%	0%	20%				
Assumed % of Stores With Shaded Pole	90%	65%	60%				
Savings Upgrading All Stores to Q-Sync	\$3,178,005	\$12,023,808	\$10,614,460	\$25,816,273	\$387,244,099	3,539,708,403	5,557,342,193

* Data provided in this chart is for example only. All competing motor data and efficiency levels used in calculating cost and energy savings were verified in the field by third parties. Sources include NCI and PNLL, 2011; ORNL, 2015; and SDGE, 2016.

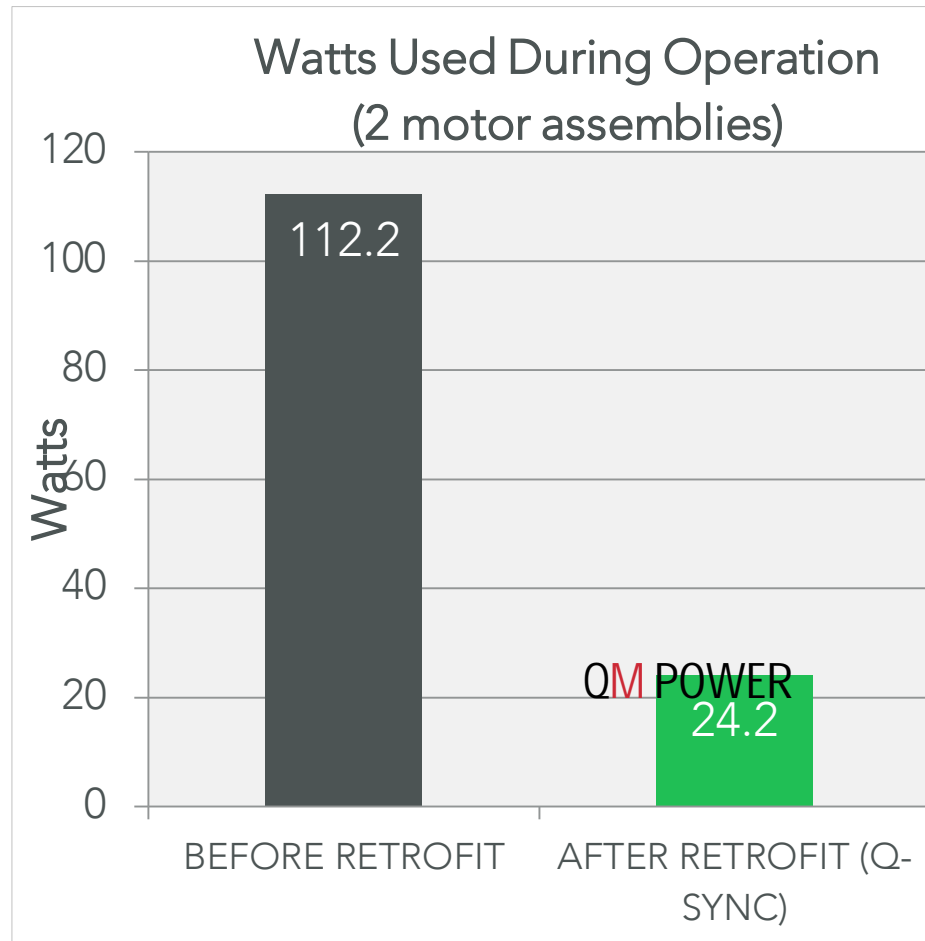
Real Results: Hy-Vee Retrofit Demonstration

Q-Sync motors consumed 27.4% less electricity than incumbent ECMs



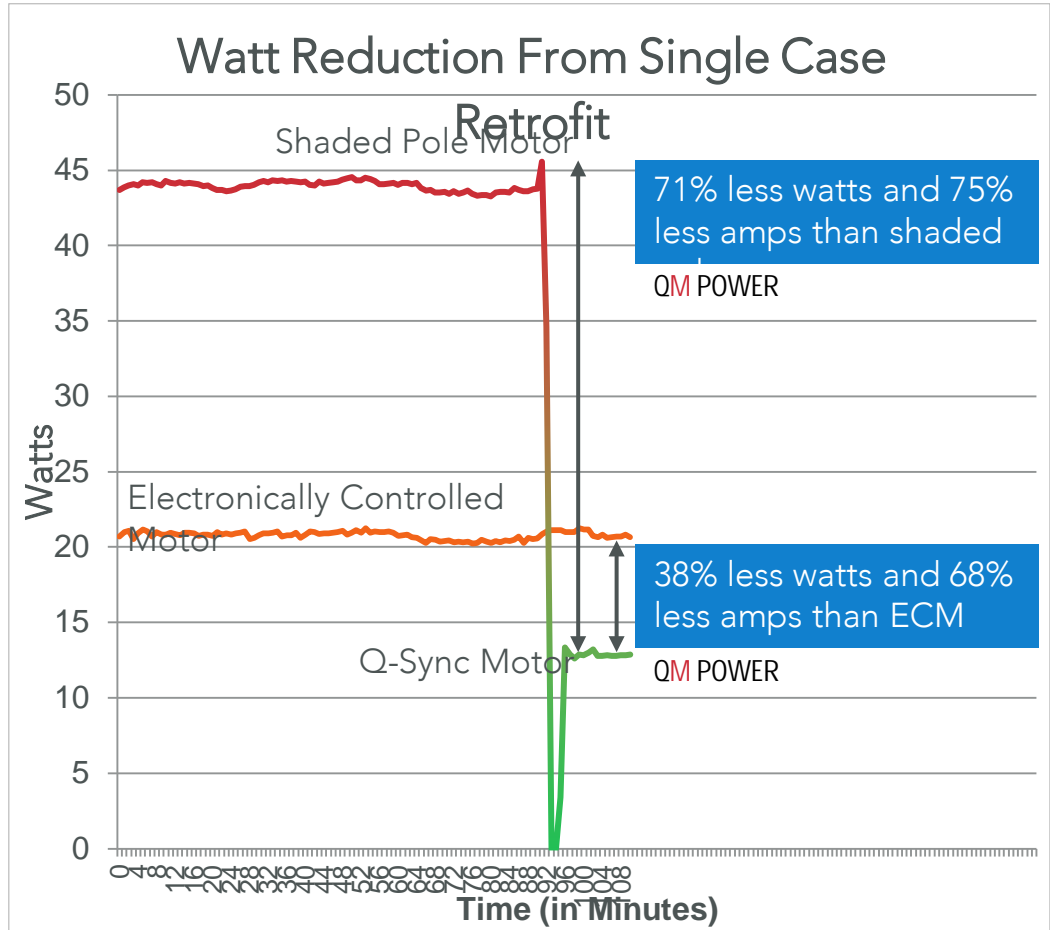
Real Results: Price Chopper Demonstration

Q-Sync motors consumed 78.4% less electricity than shaded pole motors



Real Results: Vons (Safeway-Albertsons)

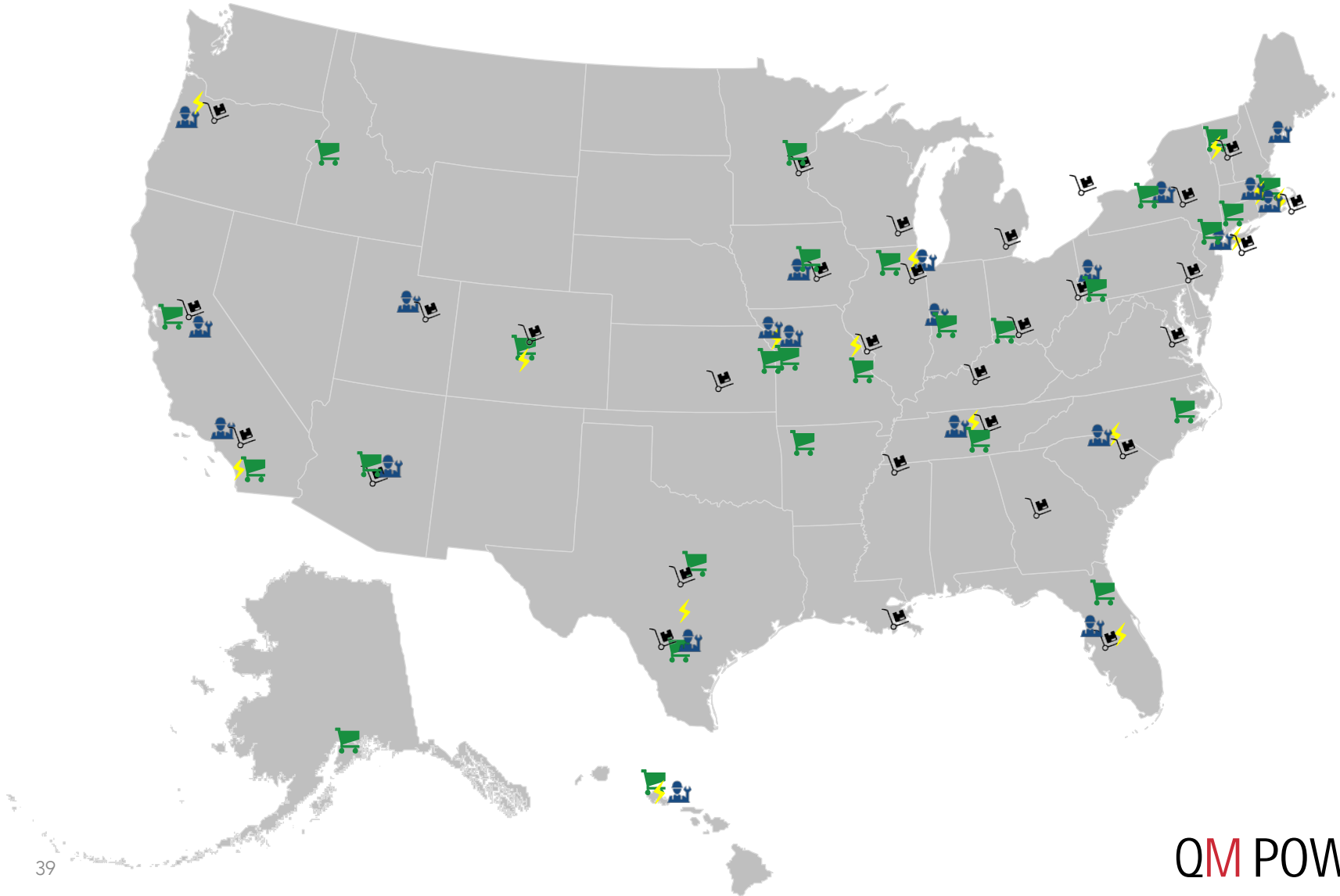
Q-Sync motors consumed 71% less electricity than incumbent motors



SAFeway VONS

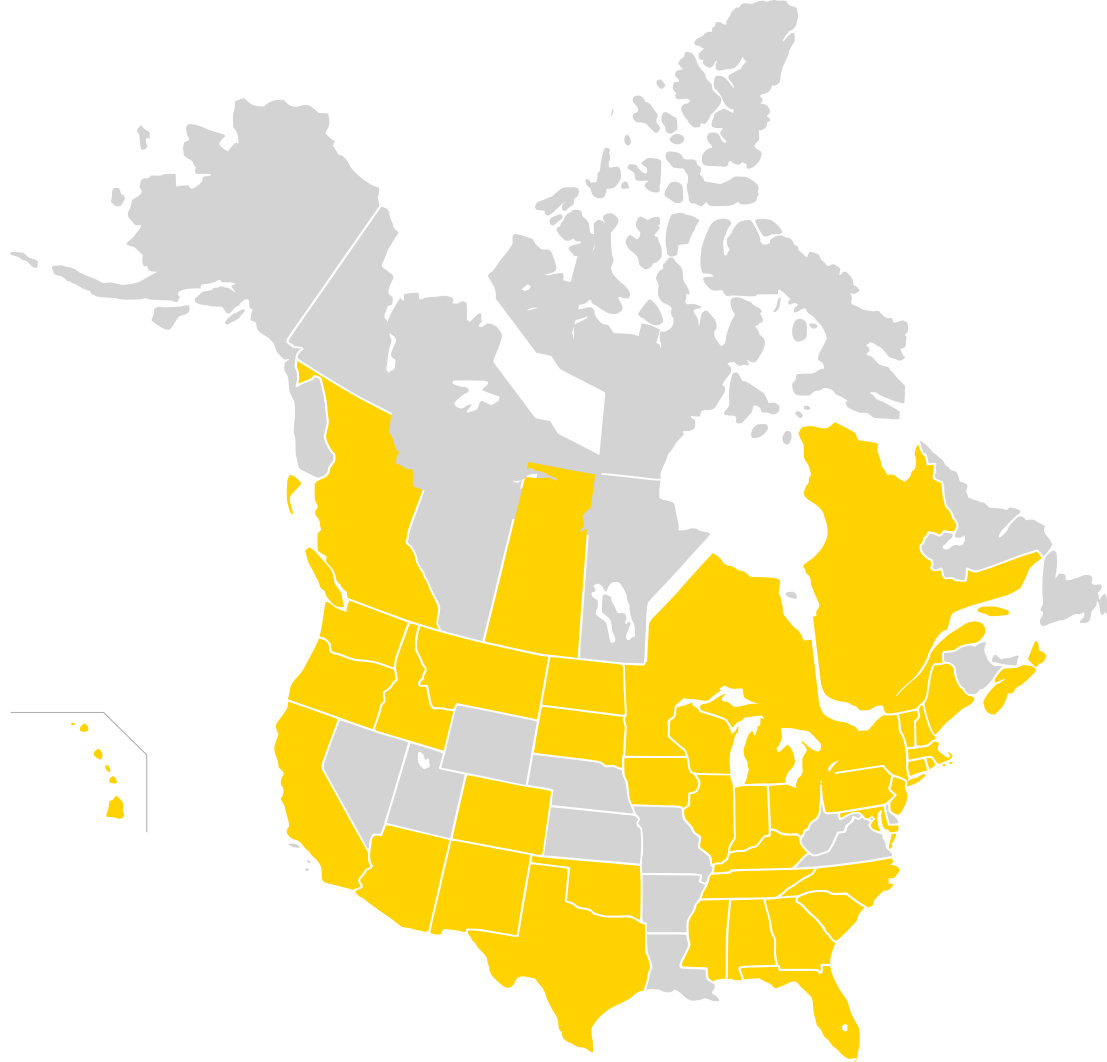


Q-Sync Roll Out: Sep 2015-Sep 2016



Advanced Lighting Controls

Gabe Arnold, Northeast Energy Efficiency Partnerships and Design Lights Consortium



DesignLights Consortium drives efficient lighting forward by defining quality and delivering tools and resources to the lighting market through open dialogue and collaboration



Delivering more than power.™



Commercial Advanced Lighting Control Project



Demonstration Projects in Partnership with US DOE



Performance Spec and Qualified Products List



Training Programs for Designers and Installers



Advanced Control Savings Calculator



Support for Industry Standards



New Nationally Adopted EE Program Offerings



Demonstration Projects

-  **Enlighted**
-  **Daintree ControlScope**
-  **Philips Connected PoE**
-  **Digital Lumens**
-  **Cree SmartCast**
-  **Philips SpaceWise**
-  **Lutron Vive Energi Tri-pak**
-  **OSRAM Encelium**
-  **Eaton DLVP**

- Selected Technologies by RFQ
- Scoring Criteria heavily weighted to products that used innovative approaches to overcome technology adoption barriers

Features that were scored highly

- Simple to Install, Commission, and Use
- “Embedded” or “Integrated” Sensors
- Wireless
- Open-standards based or as interoperable as possible
- Distributed Intelligence
- Embedded energy meter
- Auto-Commissioning
- Well-executed programming interface or GUI



First Five Projects



Two Roads Brewing Company – Stratford, CT

- Install Complete
- Status: Analyzing Metering Results



Rhode Island Public Utilities – Warwick, RI

- Install Complete
- Status: Post-Metering



Multi-Tenant Medical Office Building – Avon, CT

- Install Complete
- Status: Post Metering



University of Vermont PFG Sports Complex – Burlington, VT

- Status: Finalizing Scope/Budget
- Install over Summer



Super Stop & Shop – New Bedford, MA

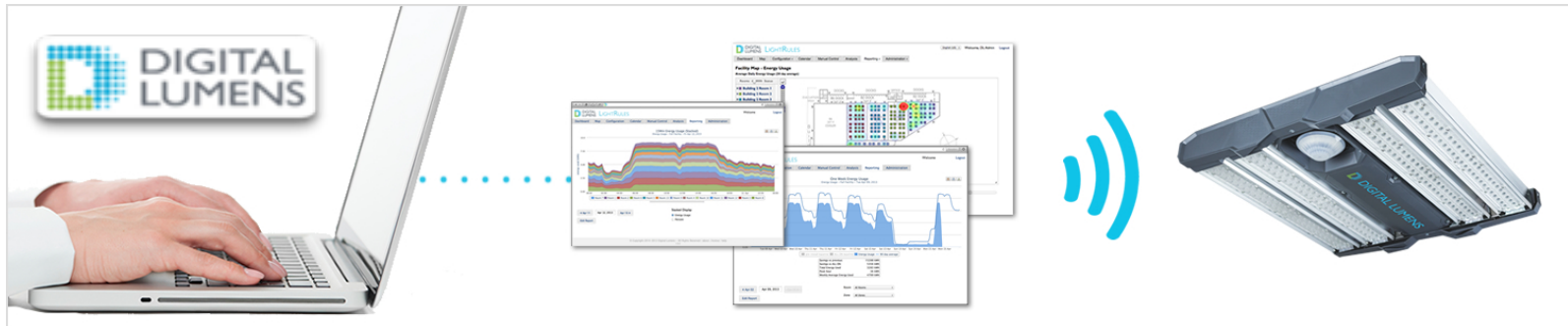
- Status: Scope Budget Complete, Developing M&V Plan
- Install begins July 8



Two Roads Brewing Company



Technology: Digital Lumens Intelligent Lighting System



Low-Bay Areas

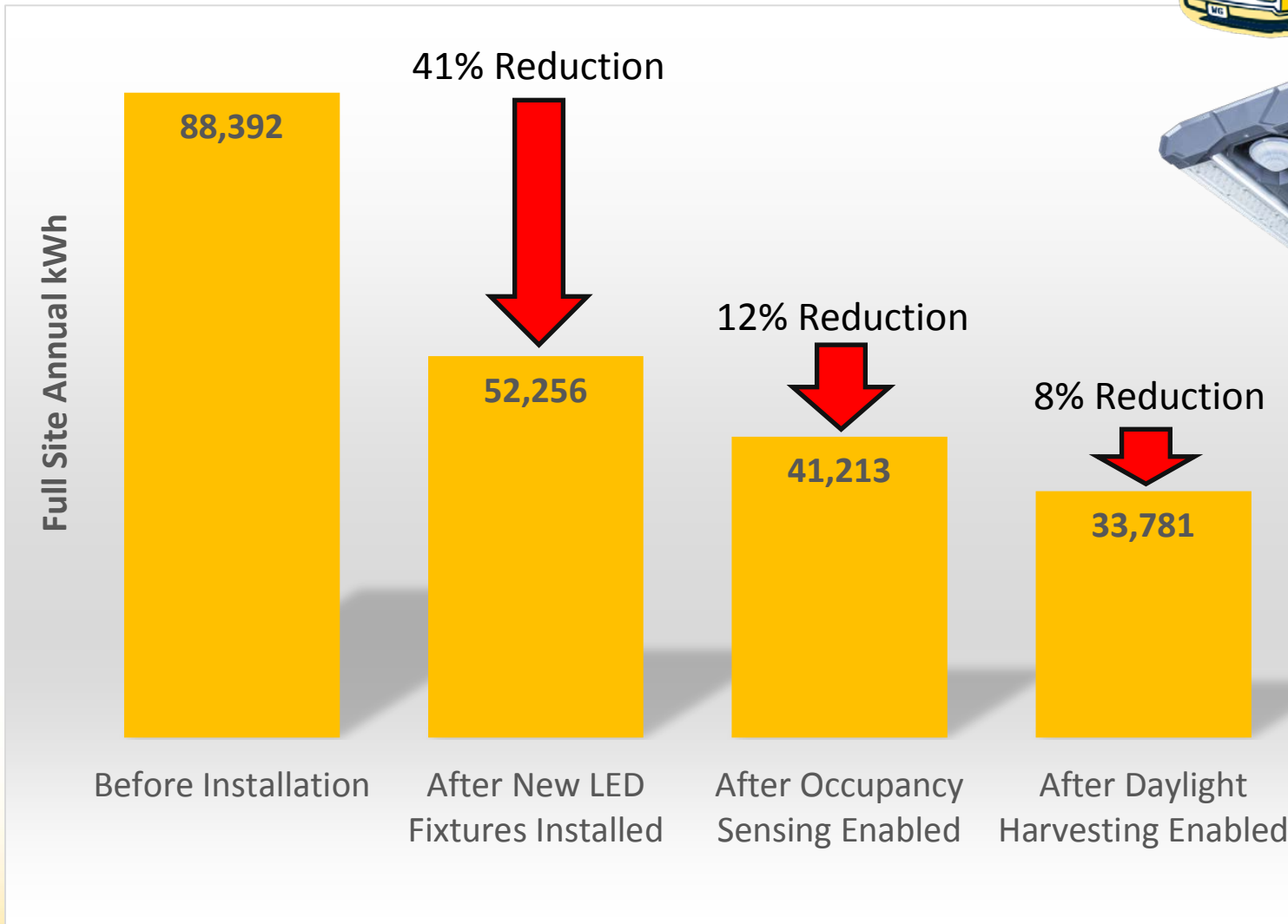


Office Areas
(Integrated into
Philips Evokit
Troffer)



High-Bay Areas

Preliminary Results – Digital Lumens at Two Roads Brewing



62% Energy Savings

7 yr Payback before utility incentives

3.5 yr Payback after utility incentives

Demonstration Projects – Next Five

 Philips Connected POE

 Lutron Energi Tri-pak

 OSRAM Encelium

 Eaton DLVP

 TBD

- Site Recruitment Underway

Thank You!

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Thank you!

Please join us for open discussion and posters.