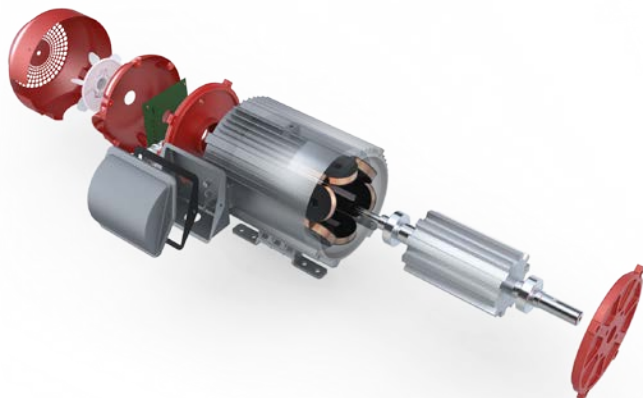


NREL – Systems Technology Research and Development Support



Software Motor Company
High-efficiency smart motors



Dynamic Water Technologies
Chemical free water treatment



Meazon
Low-cost wireless submeter

National Renewable Energy Laboratory
Michael Deru, Senior Engineer
303-384-7503 michael.deru@nrel.gov

Project Summary

Timeline:

Start date: October 2016

Planned end date: December 2018

Key Milestones:

1. Demonstration Project Progress
Snapshot: December 2017
2. Draft Field Validation Report: July 2018

Budget:

Total Project to Date:\$263,000

- DOE: \$153,000
- Cost Share: \$110,000

Total Project: \$430,000

- DOE: \$305,000
- Cost Share: \$125,000

Key Partners:

Software Motor Company	GSA Proving Ground
Dynamic Water Technologies	LA Better Buildings Challenge
Meazon	City of Los Angeles
	Walmart
	Wells Fargo IN ²

Project Outcome:

Test, validate, and document the performance of promising energy and water saving technologies. Results will inform an improved understanding of building systems and optimization complexities to identify additional research needs.

Challenge

Commercial buildings consume nearly **18 Quads** of energy and **360 billion** gallons of water annually in the U.S.

DOE Goal: Reduce energy intensity of buildings by 30% by 2030.

Barriers to reaching this goal:

- Lack of rigorous laboratory and field testing to identify R&D priorities that will produce cost-effective, ultra-low energy commercial buildings
- Lack of credible performance information on new technologies inhibits market uptake and realization of savings from new technologies

Specific Technology Challenges:

Motors: Motors consume 4.2 Quads of energy in commercial buildings and there are limited energy efficient solutions for motors over 1 hp

Cooling Tower Water: Cooling towers are a significant source of water use in commercial buildings and consume large amounts of chemicals

Submetering: Lack of low-cost submetering is a major barrier to reducing energy with energy management systems

Approach

Perform Trusted, Objective Technology Evaluations

- Perform rigorous field performance evaluation of new technologies
- Determine market potential for new technologies
- Inform R&D opportunities for next generation of technologies

Develop Strategic Partnerships

- Form partnerships across technical and market sectors
- Understand technical and market challenges

Disseminate Results

- Input to DOE research planning
- Develop technical reports, journal papers, and webinars
- Distribute results through DOE Better Buildings
- Develop GSA Proving Ground reports and webinars
- Share results with utility programs and CEE

Technology field testing of three technologies

- **Software Motor Company (SMC):** High-efficiency smart motors
 - Refrigeration condenser fans, Walmart in Lakeside CO
- **Dynamic Water Technologies (DWT):** Chemical free cooling tower water treatment system
 - GSA federal building in Savannah GA (GSA funded)
 - City of Los Angeles, City Hall East building
- **Meazon:** Low-cost, wireless submeters
 - GSA federal building in Denver CO

Team

Project lead and M&V



Technology Providers



Building Owner Partners

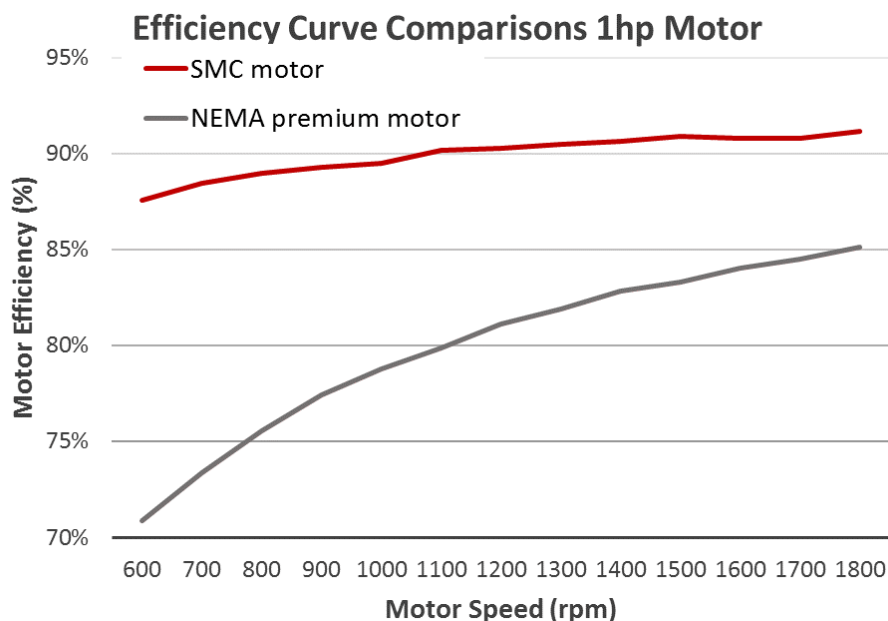
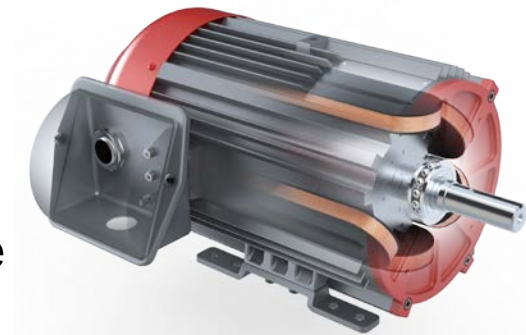


Market and Technical Partners



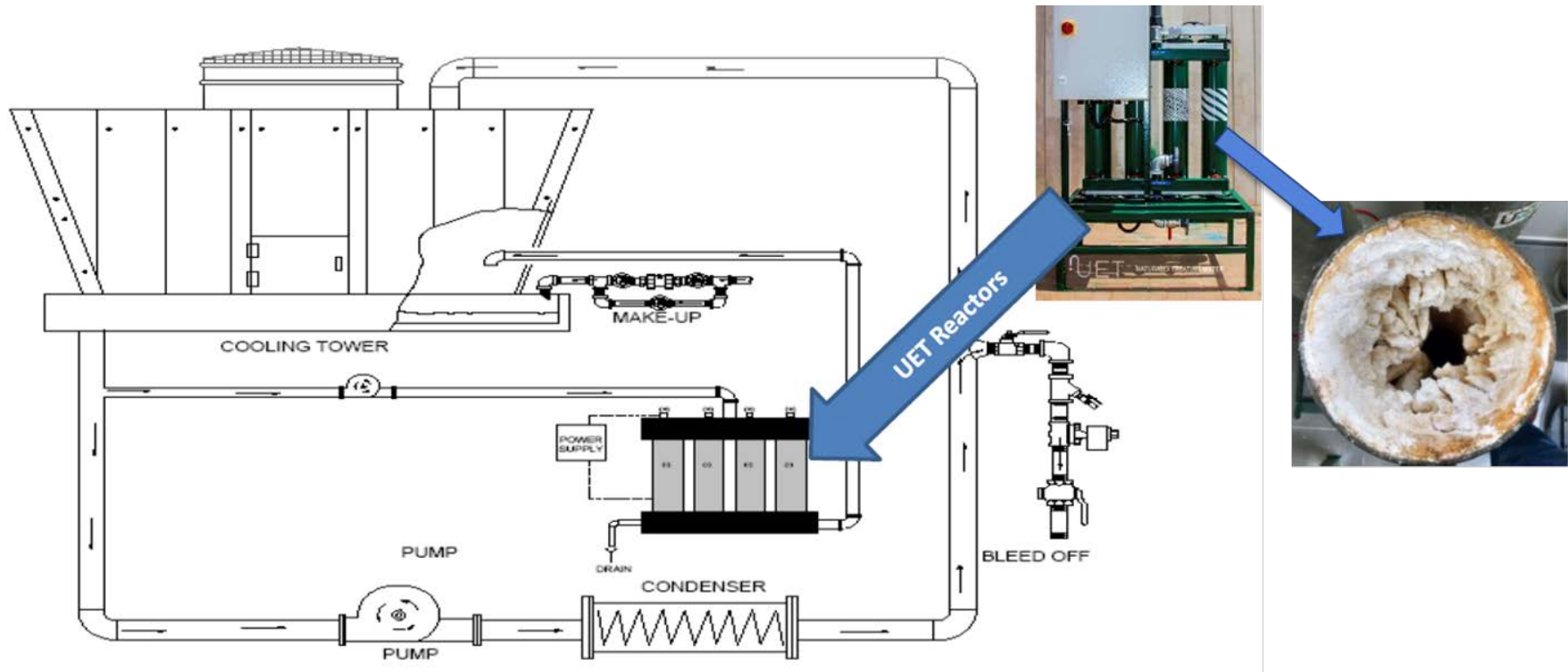
SMC – High-Efficiency Smart Motor

- High Rotor Pole Switched Reluctance Motor with Smart Controller
- Simple, robust, low-cost construction
 - No rotor windings
 - No magnets or rare earth metals
- High efficiency and torque across a wide speed range
- Flexible data and control platform



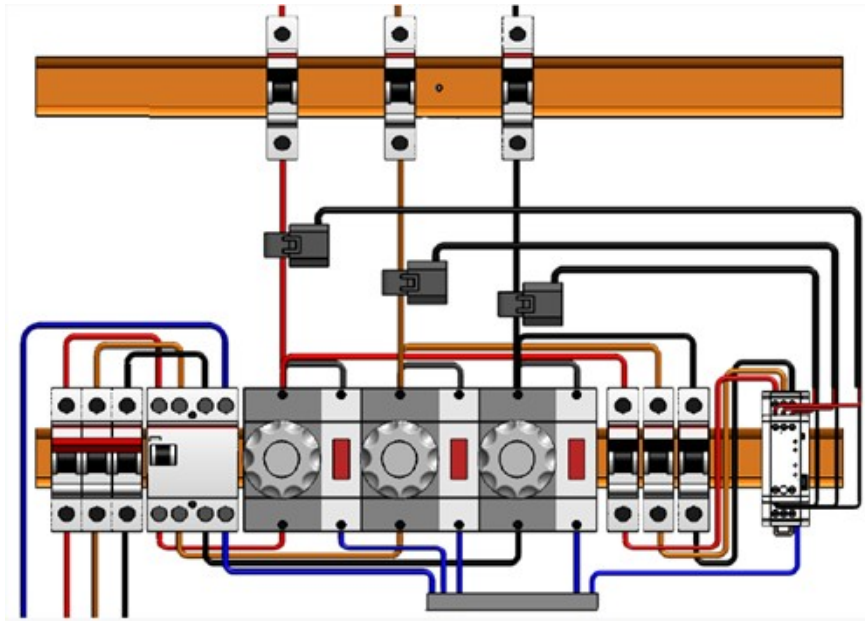
DWT – Chemical Free Water Treatment

- Electro-catalytic process accelerates scale formation in the reactors
- Maintains balanced pH and mineral content to minimize corrosion
- Forms HOCl and Cl ions from the chlorides in the water for biocides
- Blowdown water (and sewer) savings of 25-80% (increase CoC to 30 or more)
- 3%-7% energy savings from cleaner heat transfer surfaces



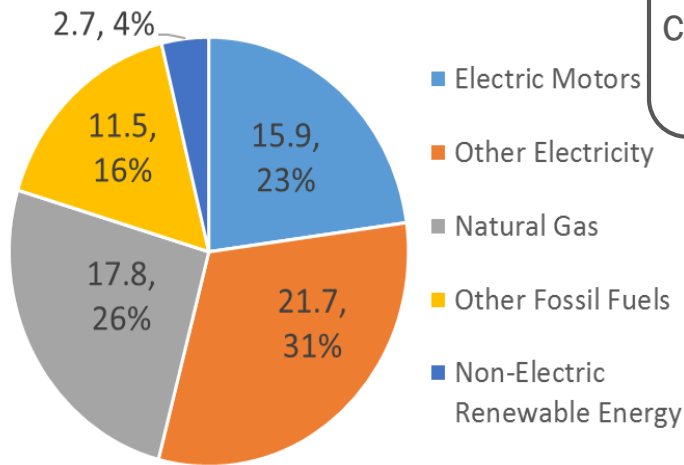
Meazon – Low-Cost Wireless Submetering

- Winner of the DOE wireless submetering challenge
- Self-contained and self-powered
- 1% of reading accuracy
- Under \$100 per monitoring point
- Secure 128-bit encrypted data transfer



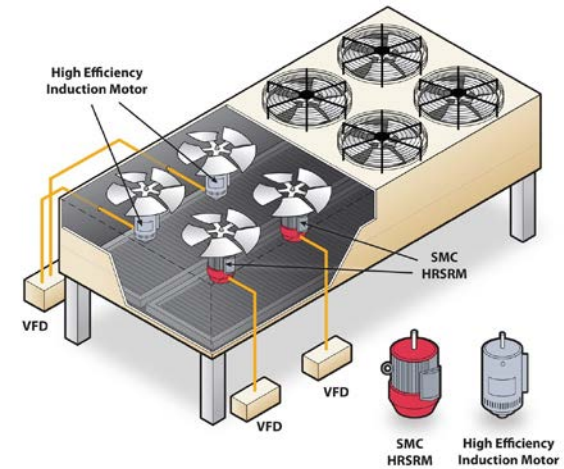
Impact – High-Efficiency Smart Motors

Industry and Buildings 70 Quads

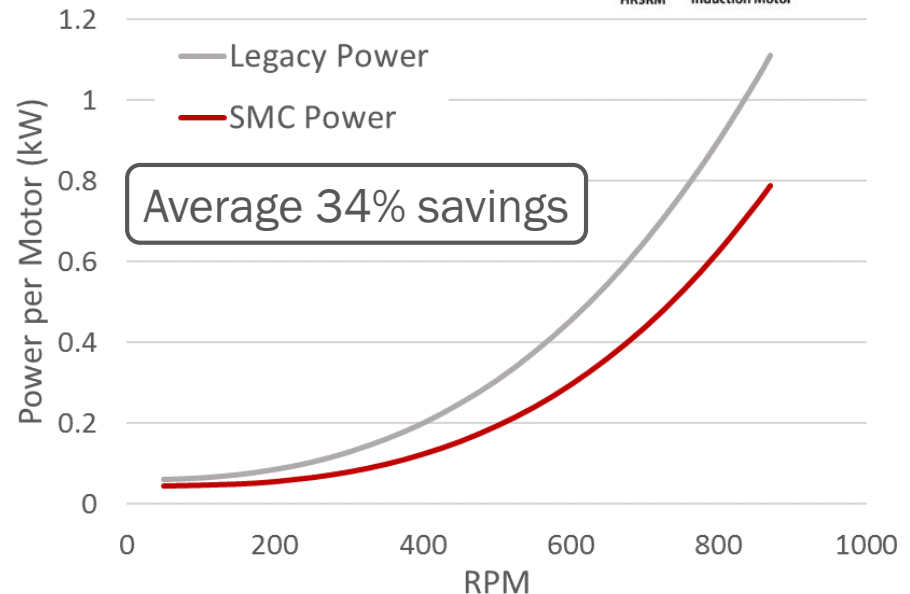


Electric motors consume 42% of the electricity!

Refrigeration Condenser Motors



Assuming half of the electric motors in buildings can be replaced by this motor, an average savings of 30% will provide 1.5 quads of energy savings.



Impact – Chemical Free Water Treatment

Tests at a GSA Federal Building in Savannah, Georgia

Water Use reduction 33 %

Water saved 1,170,190 gallons

\$ Savings \$7,770

Reduced scale and bio-films on condenser tubes and cooling can provide 3%-7% chiller energy savings



Impact – Low-cost Submeters

Low cost panel-level wireless submeters provide key data to support analytics with potential 8-10% whole building energy savings

- Near Term – validate technical performance
- Intermediate – share outcomes with large, demanding community
- Long Term – provide cost-effective means for small & medium sized buildings to measure and manage energy use

Preliminary testing in GSA headquarters proved installation and communications capabilities of the Meazon product



Progress

Software Motor Corporation:

- Completed refrigeration motor condenser testing in February 2018 – 34% energy savings
- draft report completed April 2018

Dynamic Water Technologies:

- Completed GSA testing in November 2017 – 33% water savings
- Draft report April 2018
- Started LA City Hall testing in March 2018

Meazon:

- Installation in April 2018

Stakeholder Engagement

Key Stakeholders and Partners:



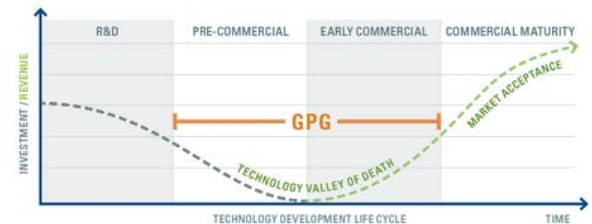
Outreach:

- GSA Proving Ground reports
- DOE Reports
- Webinars
- Journal articles
- Utility resources



Leading by example

GPG accelerates market acceptance by assessing innovative building technologies in real world environments and deploying those that deliver



GPG helps technology bridge the valley of death
and accelerates market acceptance by:



Selecting promising technologies at the edge of commercialization



Piloting technology installations within GSA's real estate portfolio



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



Identifying technologies with broad deployment potential for GSA

GPG results provide actionable data

to enable GSA to make sound investment decisions

32

PUBLISHED
REPORTS

20

IDENTIFIED
TECHNOLOGIES

9

DEPLOYED
TECHNOLOGIES

\$7.8M

ANNUAL COST
AVOIDANCE

Remaining Project Work

Software Motor Corporation:

- Final report (July 2018)

Dynamic Water Technologies:

- GSA GPG final report (July 2018);
- Complete data collection at LA city hall (June 2018)
- Finalize analysis and reporting (September 2018)

Meazon:

- Complete data collection (May-July 2018)
- Finalize analysis and reporting (September 2018)

Thank You

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REFERENCE SLIDES

Project Budget

Project Budget: \$430,000

Variances: None

Cost to Date: \$263,000

Additional Funding: \$125,000

Budget History

FY 2017 (past)		FY 2018 (current)		FY 2019 (planned)	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
\$40K	\$80K	\$240K	\$45K	\$25K	\$0

