Superior Energy Performance®
U.S. DEPARTMENT OF ENERGY

SEP Measurement & Verification Case Study Webinar

Cummins-Rocky Mount Engine Plant

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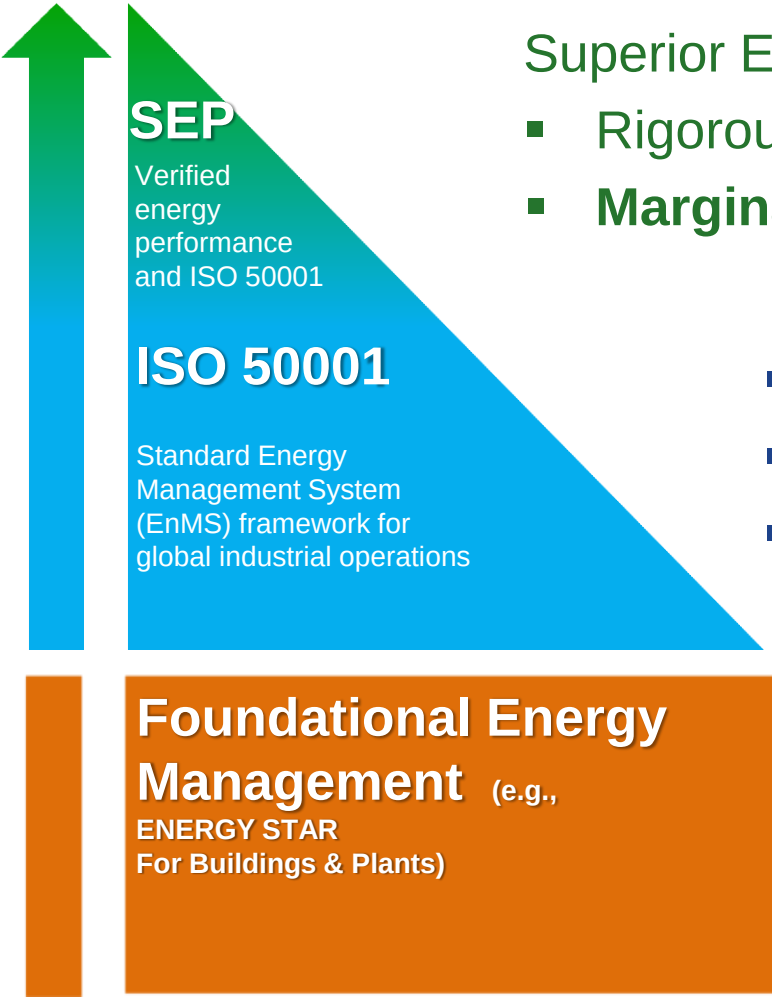
U.S. DEPARTMENT OF ENERGY

Strategic Energy Management Continuum



Superior Energy Performance (SEP):

- Rigorous third-party measurement and verification
- **Marginal effort beyond ISO 50001**

- ISO standard for EnMS
- Similar framework to ISO 9001 & ISO 14001
- Third-party certification

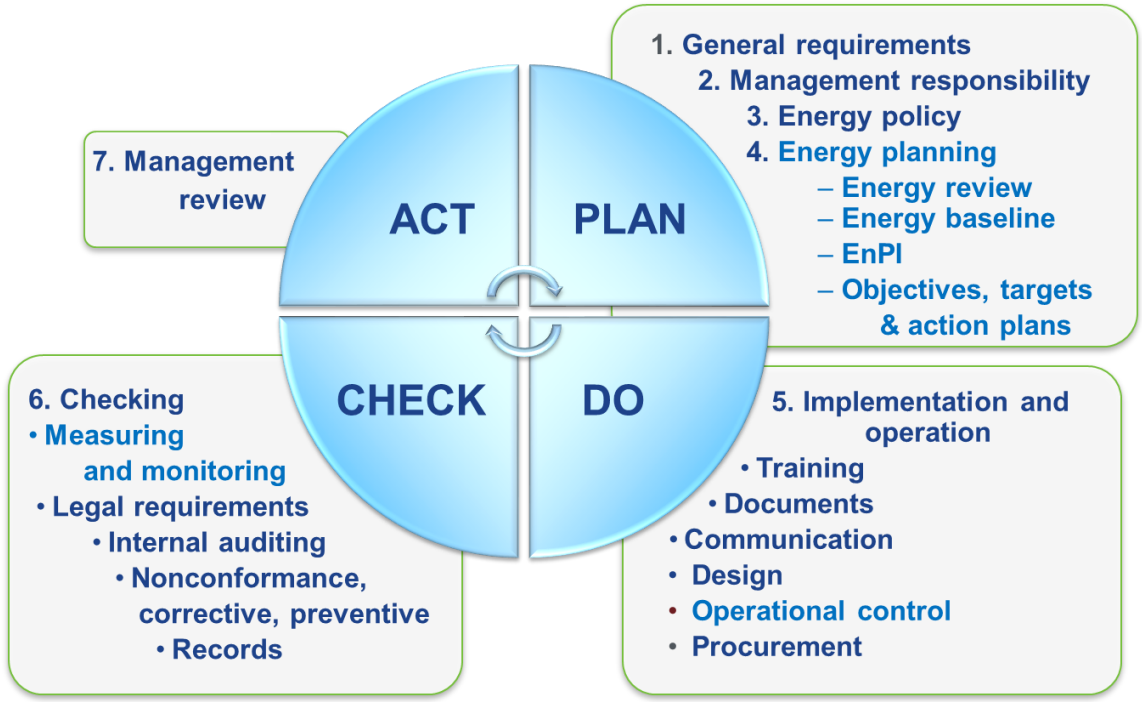
- Systematic approach
- Operation of many utility SEM programs at this level

ISO 50001–Energy Management Systems (EnMS)

International standard that draws from **best practices around the world**. Developed with input from 56 countries, many countries now adopting it as a national standard.

ISO 50001 specifies requirements for establishing, implementing, maintaining and improving an EnMS.

It does not prescribe specific energy performance improvement criteria.



ISO 50001 & Superior Energy Performance®

ISO 50001

- Proven, **internationally recognized**, best practice in energy management **building upon other ISO standards**
- Requires energy performance improvement with **energy data & metrics**
- **Relevance** for global corporation deploying energy management & sustainability programs

- Builds on ISO 50001 with **specific energy performance improvement criteria**
- National program **accommodating diverse facilities**: sector, size, program maturity, etc.
- **Transparency: Rigorous 3rd party verification** that market can reward: supply chains, utilities, carbon trading

Superior Energy Performance® Certified Facilties
14 companies with 27 certified facilities

MedImmune
A member of the AstraZeneca Group

Schneider Electric

NISSAN

BRIDGESTONE

OLAM

3M

Cummins

VOLVO

HARBEC
Technical Innovation with Environmental Responsibility

CURTISS WRIGHT

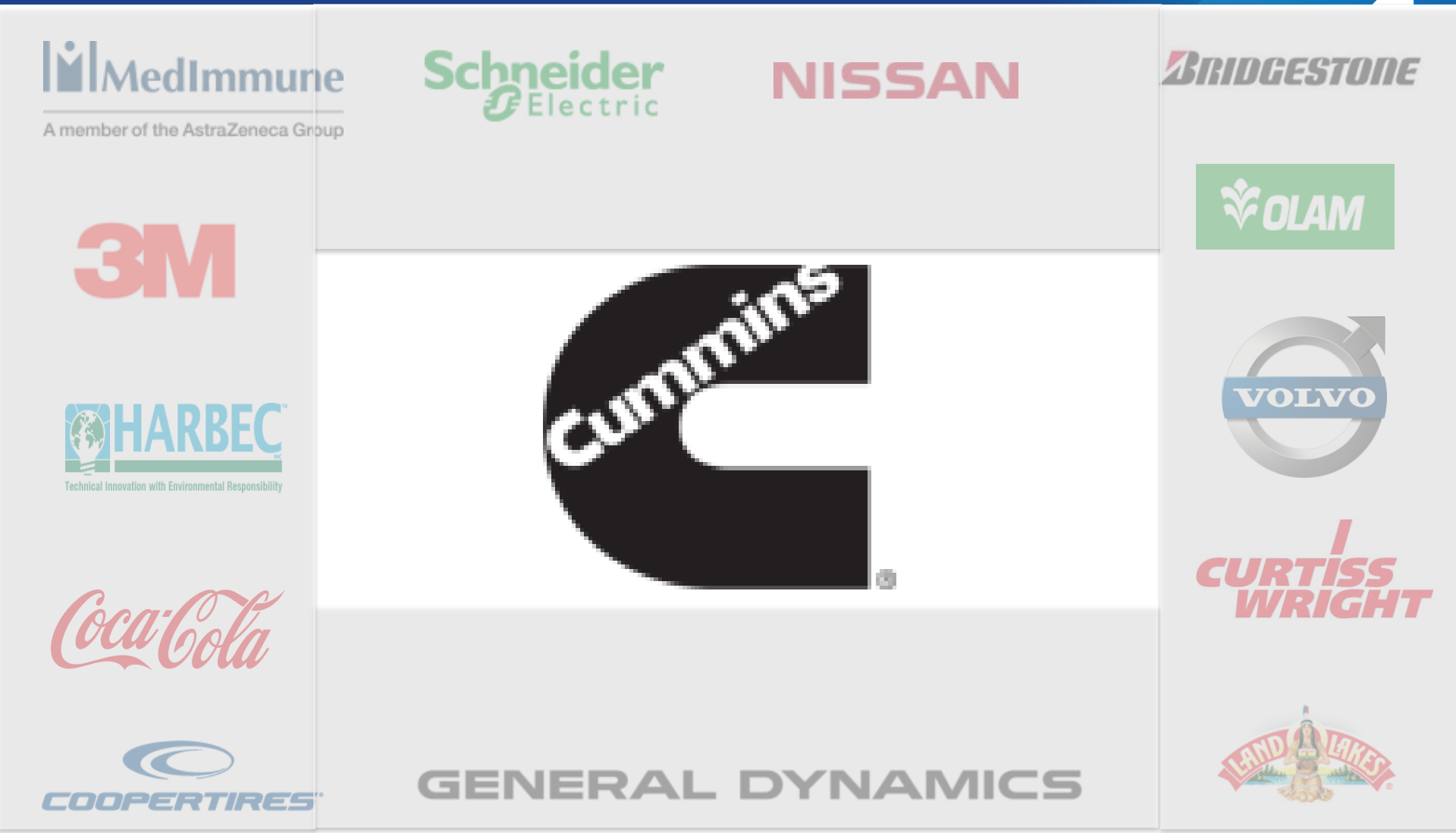
Coca-Cola

COOPERTIRES

GENERAL DYNAMICS

LAND O'LAKES

Superior Energy Performance® Certified Facilities
14 companies with 27 certified facilities



Webinar and Case Study Purpose

- Communicate the business value of SEP
- Share learnings from SEP pilots; especially on measurement & verification (M&V)
- Demonstrate rigor and robustness of SEP verification
- Develop reference case studies
- Hear from SEP community on their M&V experiences

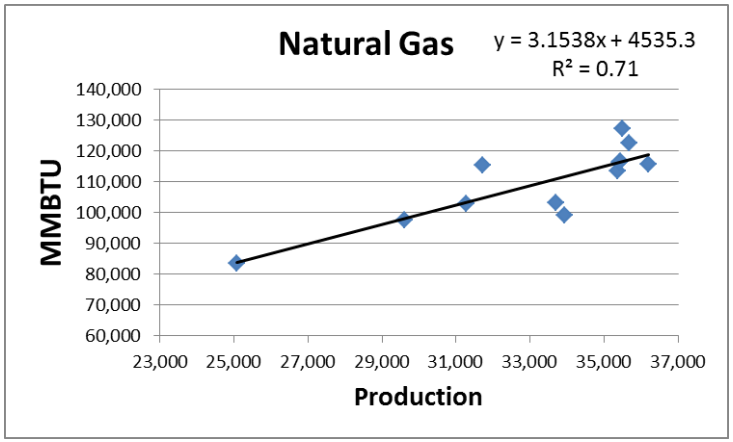
SEP Measurement & Verification

SEP energy performance is demonstrated by,

1. Top-down, whole facility EnPI ("SEnPI")

$$SEnPI = \frac{BTU_{Tot\ actual}}{BTU_{Tot\ predicted}}$$

Where $BTU_{Tot\ predicted} = f(X1, X2, \ldots Xn)$



2. Bottom-up sanity check

   list of projects and their approximate energy savings that reasonably sum up to the calculated savings from the top-down performance improvement

Cummins Sustainability Plan and SEP

PRIORITY AREAS

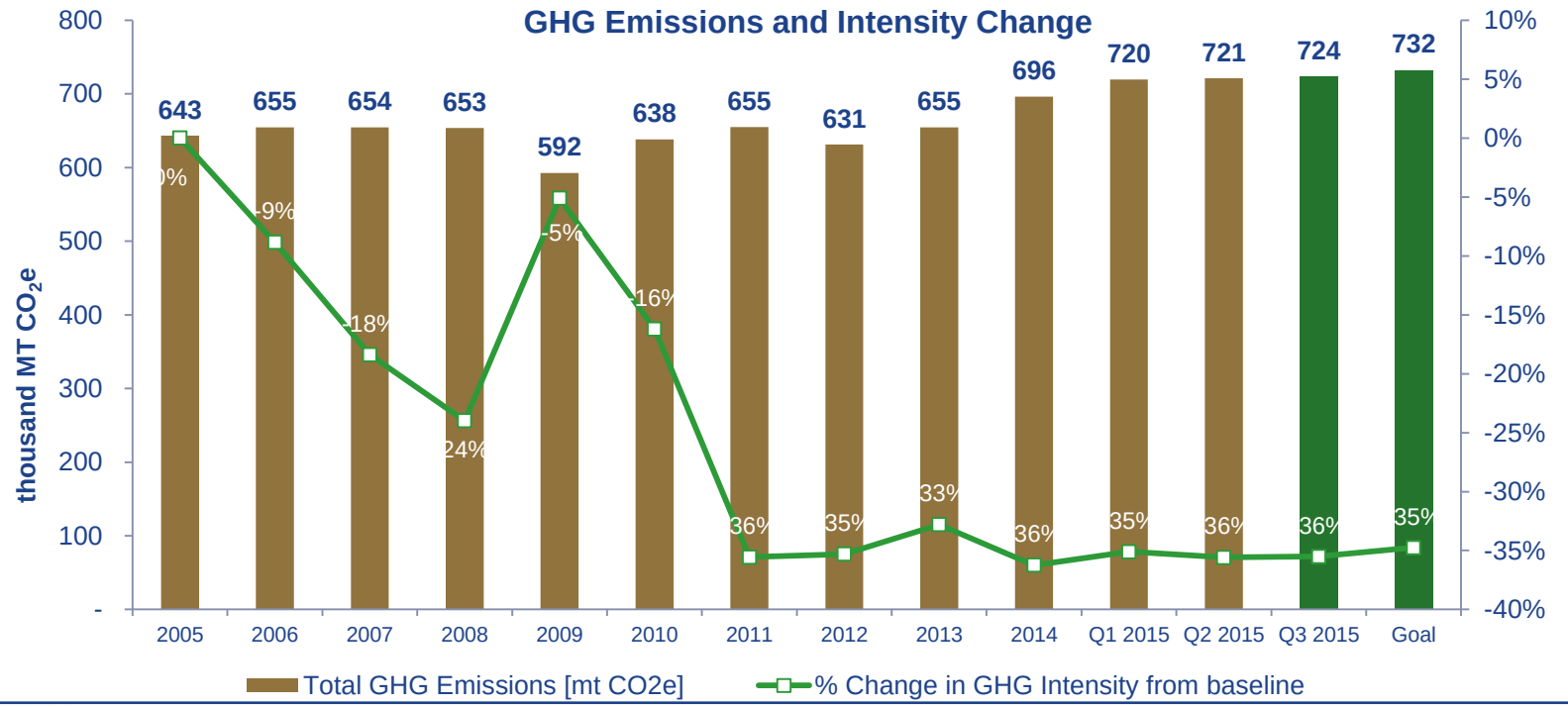
Materials & Fuel Efficiency
Innovative design for efficient use of fuel and raw materials

Facilities / Operations
Reduce energy, water, and waste footprint

Transportation
Use most efficient method and mode to move goods across Cummins network

Products In-Use
Partner with customers to improve fuel efficiency of our products in use

Facilities / Operations
Reduce energy, water, and waste footprint



Cummins Rocky Mount Engine Plant (RMEP) Background

Project Summary	
Industry	Diesel Engines & Components
Facility location	Whitakers, NC, USA
Operations	Cast Iron Machining, Assembly, Paint, Test, Upfit
Employment	1,800
Production Schedule	3 shifts, 5 to 7 days per week
SEP certification level	Gold – 12.6%
Energy management system	ISO 50001

2013–16 | GOLD
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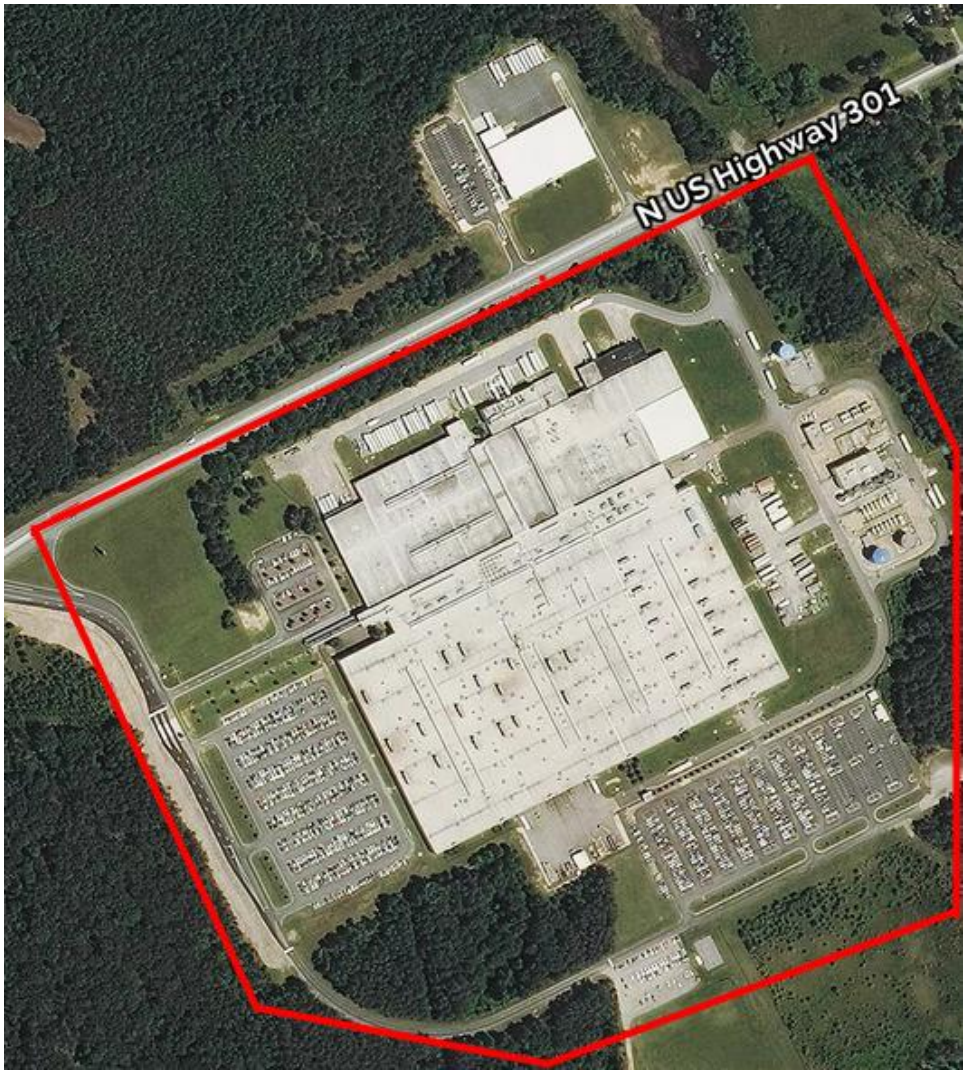
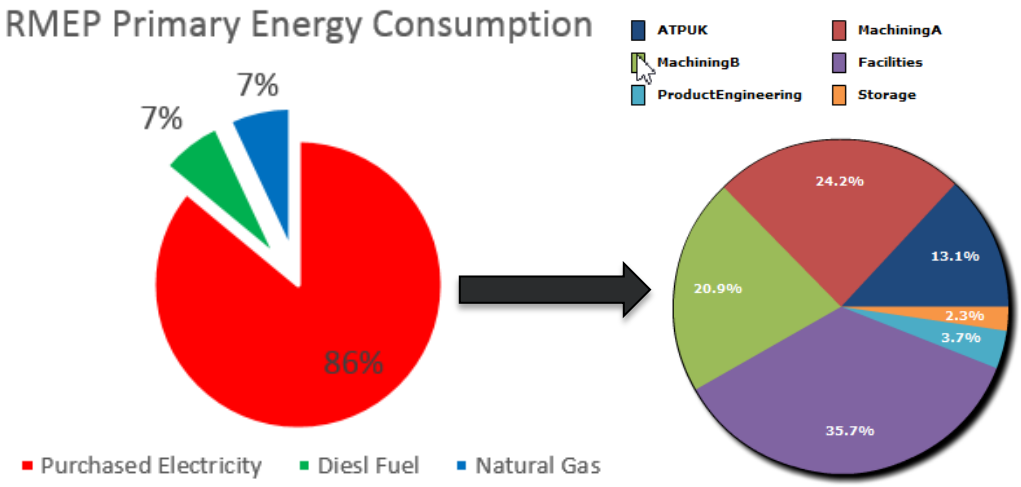
EnMS Scope and Boundary



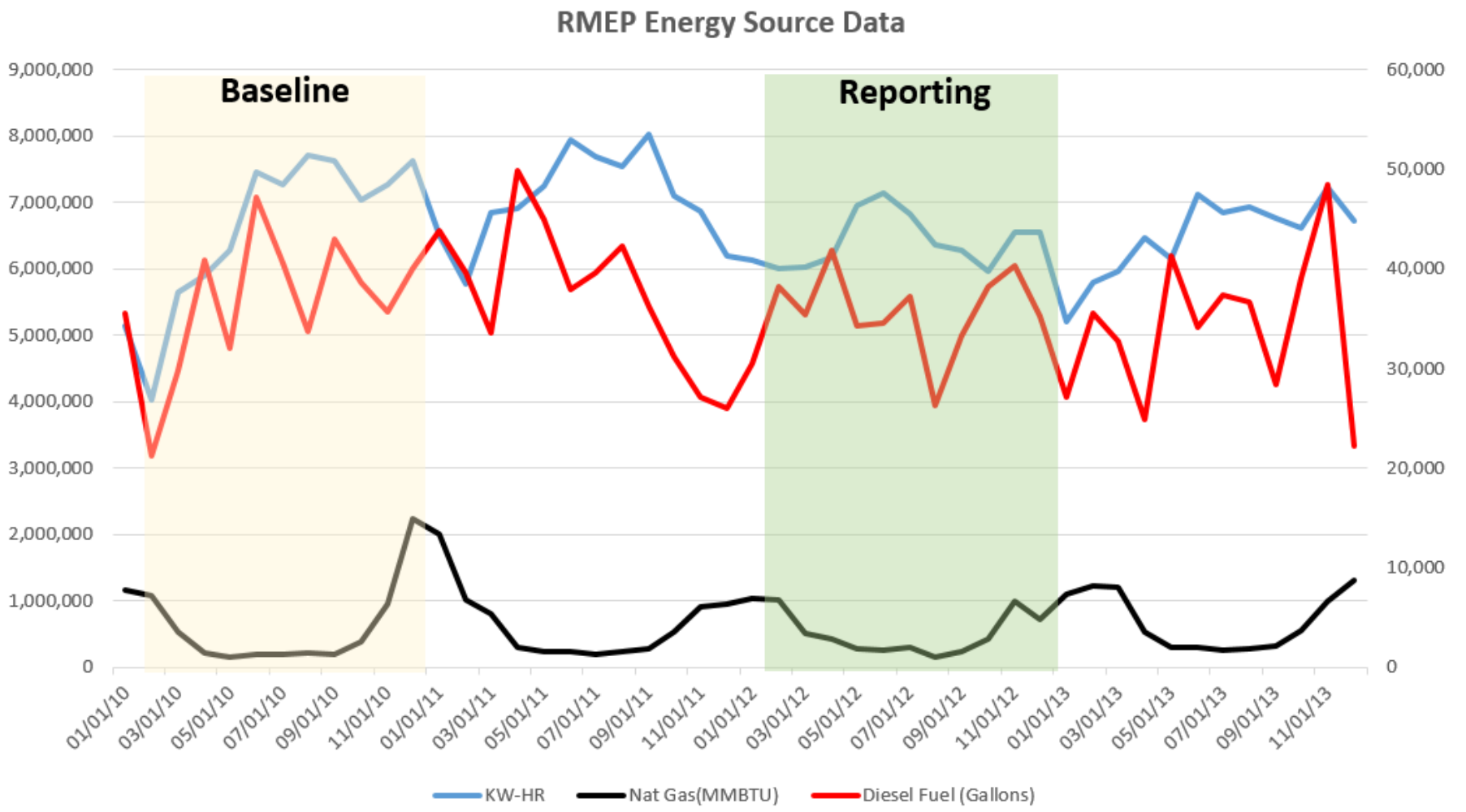
- Cummins RMEP is a 1.2M Sq Ft Facility
- Scope includes all the operations located at 9377 US 301 N. Excluded is the Training Center across Hwy 301
- Boundary includes all of the property, buildings, grounds, parking areas

Cummins RMEP Energy Profile

- SEU selected was **Air Compressors**
- ISO 50001 and SEP Certified "**Gold**" with 12.6% improvement
- Baseline Period is Feb 2010 to Jan 2011
- Reporting Period is Feb 2012 to Jan 2013
- Certification date: October 2013
- SEP Verification Body is DEKRA



RMEP Energy Data



RMEP Model Challenges

3 Energy Sources – Electricity, Natural Gas, Diesel Fuel
Variables selected – ***Weather*** and ***Equivalent Engines***

Electricity

Electricity (MMBtu)	X1 Equivalent Engines	X2 Temperature
P-Values	0.00085	0.00450
F-Test	0.00201	
r^2	0.83	

and Natural Gas

Natural Gas (MMBtu)	X1 Temperature
P-Values	0.00058
F-Test	0.00185
r^2	0.75

models meet SEP M&V statistical tests easily

Diesel Fuel Use Failed the Model Initially vs Equivalent Engines

Diesel (MMBTU)	X1 Equivalent Engines
P-Values	0.57518
F-Test	0.57518
r^2	0.03

Other Variables to evaluate Diesel Fuel such as engines processed or number of engines tested failed as well.

RMEP Model Challenges

Further investigation:

There are three separate consumers of Diesel Fuel at RMEP.

1. Generator Sets – We were able to discount because they total less than 5% of total
2. Production Test – High volume, automated test process running production validation testing typically for 2 minutes.
3. Product Engineering Test Operations Lab – Long and short term testing for Performance, Emissions, Endurance and Structural Analysis testing of current and future product.

Challenge: Both test areas consume nearly equal amounts of fuel. How do we normalize 2 significantly different users of the same energy source and pass the model?

RMEP Model Challenges

- Both consumers of diesel fuel have time component
  - Production Test Records Minutes/Test
  - Product Engineering Records shaft hours

- Conversions / Calculations entered to apply “Test Hours” as a variable to normalize diesel fuel usage.

	X1
Diesel (MMBTU)	Engine Test Hours
P-Values	0.00070
F-Test	0.00070
r^2	0.70

RMEP Model Challenges

- Diesel Fuel use continues to be a challenge.
- RMEP produces engines of varying sizes to over 350 different customers.
- Without being able to accurately account for fuel rates in Production test and Product Engineering, accounting for “mix” or applying a weighting factor has proven unrealistic.
- Diesel fuel flow meters are planned to be installed that should give a more accurate depiction of use by area than current estimates.

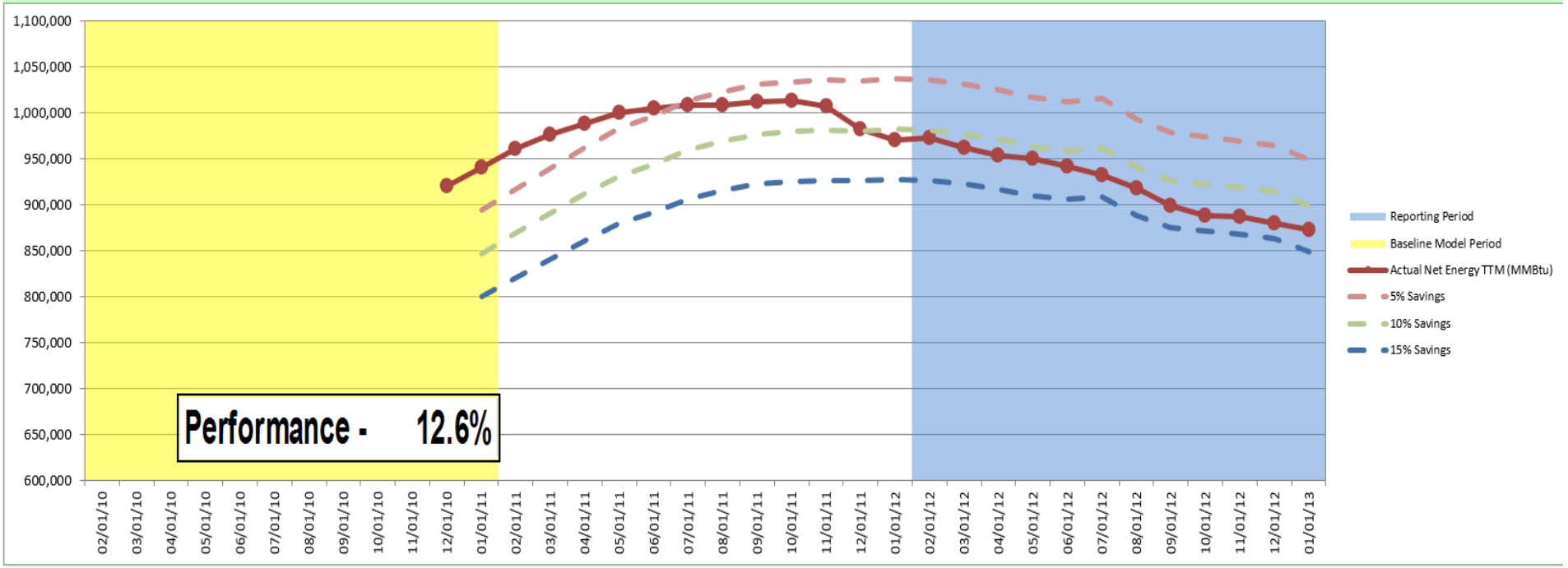
Model Results

Graph Range

Start Date	02/01/10
End Date	01/01/13
Min MMBtu	600,000

Update Graph

TTM MMBtu Consumption vs. TTM Model - Forecast Method
(TTM = Sum of the Trailing Twelve Months)



Other Performance considerations

Bottom-up sanity check showed 12.6% improvement

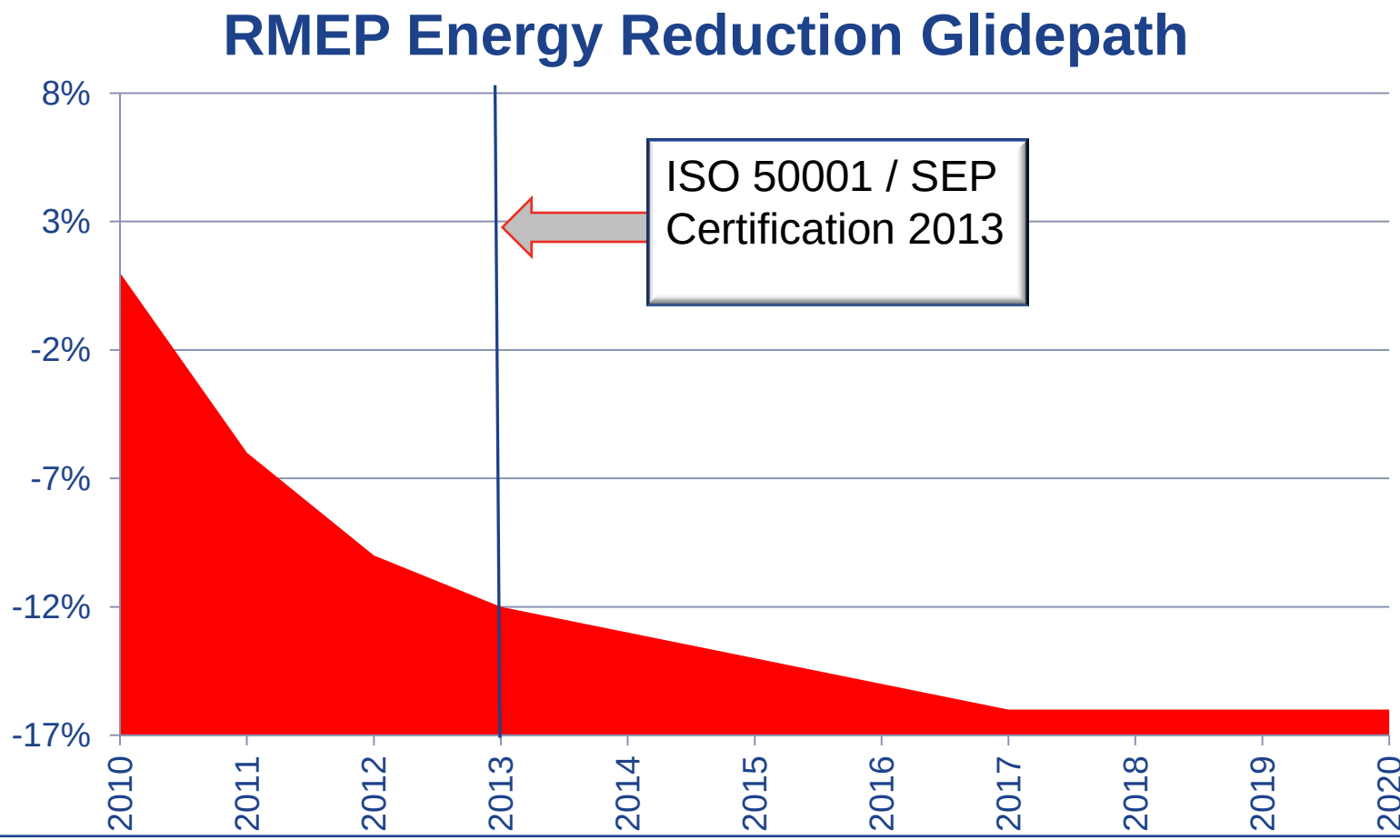
Projects Implemented at the Rocky Mount Engine Plant

Project Description	Annual Site Energy Savings		Annual Energy Cost Savings ($)
	kWh	MMBtu	
Replaced open blow offs with engineered nozzles	5,300,000	18,070	$339,000
Upgraded lighting systems	1,500,000	5,114	$96,000
Reduced leaks in 2VH compressed air lines	567,210	1,934	$36,000
Compressed air leak reduction project for the B Blockline	668,448	2,279	$43,000

- Total Annual Project Savings Listed = 27,397 MMBtu which equals 11% improvement and Gold certification of greater than 10%.
- Additional, smaller projects totaled 12.6%

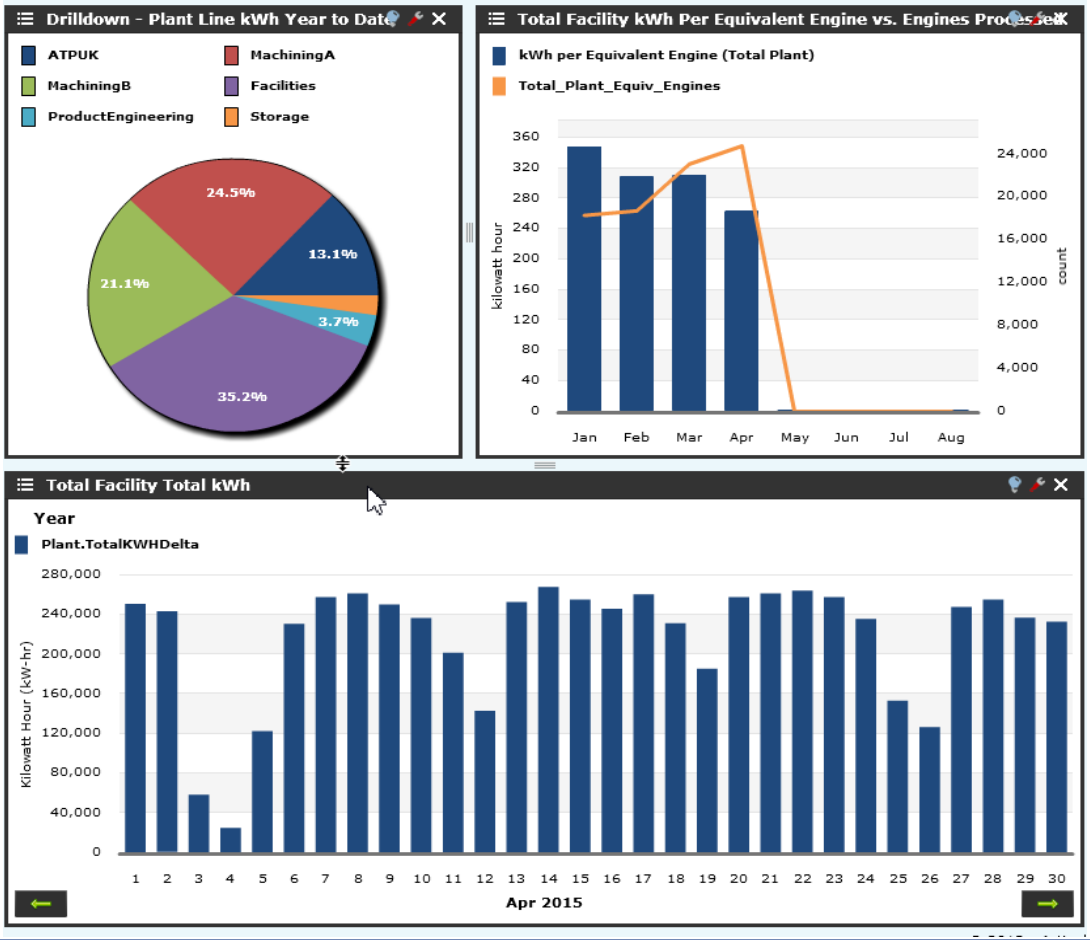
Benefits of SEP Implementation

Provides a tool for communication to Upper Management, customers and employees. SEP makes energy use visible.



Benefits of SEP Implementation

Provides a pathway to quantify savings and secure future funding for metering and equipment.



Closing Comments

Observations

- RMEP was greatly aided by Cummins' commitment to energy / ghg reduction and the establishment of a dedicated corporate capital fund.
- Energy Leader program also very beneficial.
- Expertise in both Energy Systems and Management systems a must.
- SEP drives everyone to be energy conscious from planning to maintenance.

Next Steps

- Certify internal auditors
- Assist other facilities within Cummins attempting certification
- Challenges associated with expansion / increase in consumption
- Future Certification Level / Mature Pathway

SEP info

- Next webinar in two months
- Further training on SEP M&V is included in CP EnMS and SEP PV Training

  http://energy.gov/eere/amo/become-energy-management-professional

energy.gov/isosep

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