Better Plants
U.S. DEPARTMENT OF ENERGY

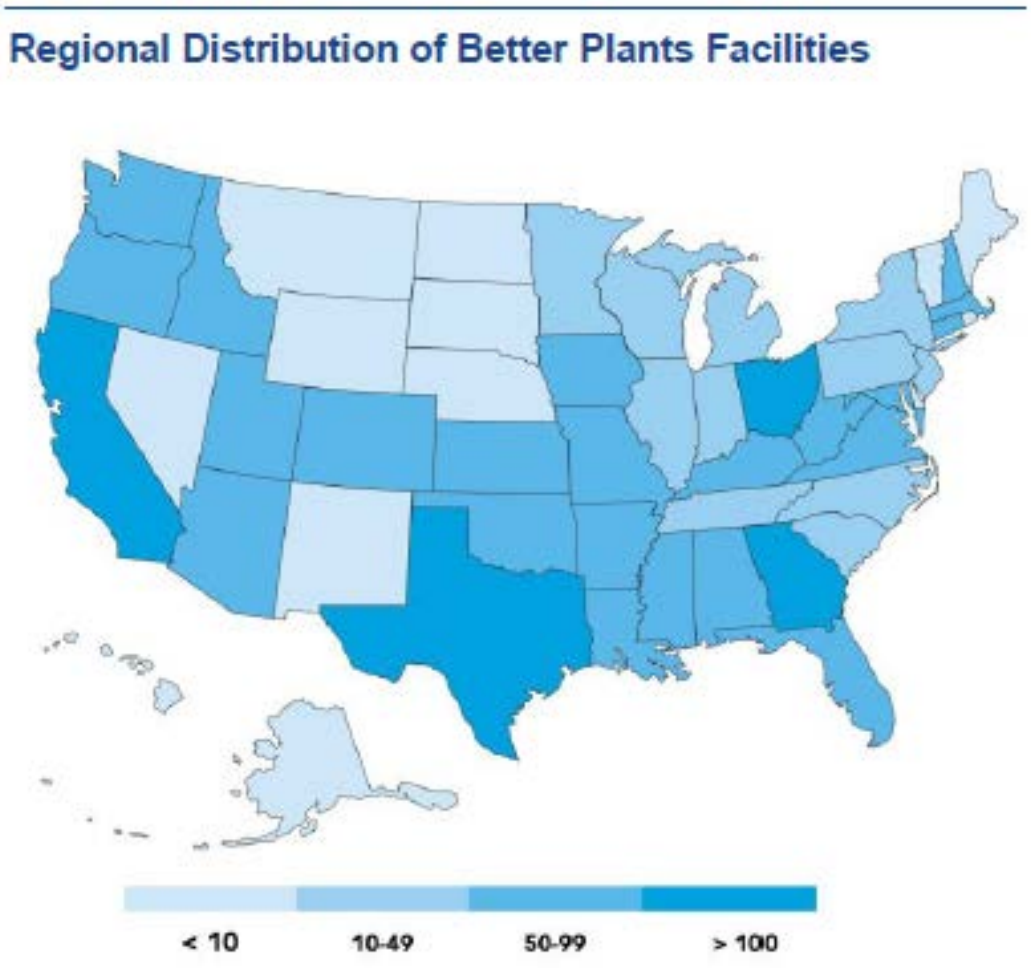
TAPPING INTO DOE'S PORTFOLIO OF MANUFACTURING ENERGY EFFICIENCY RESOURCES

Jay Wrobel – Manager, Technical Assistance
Advanced Manufacturing Office

Better Buildings Summit
May 27, 2015

U.S. DEPARTMENT OF ENERGY

Better Plants Program Overview



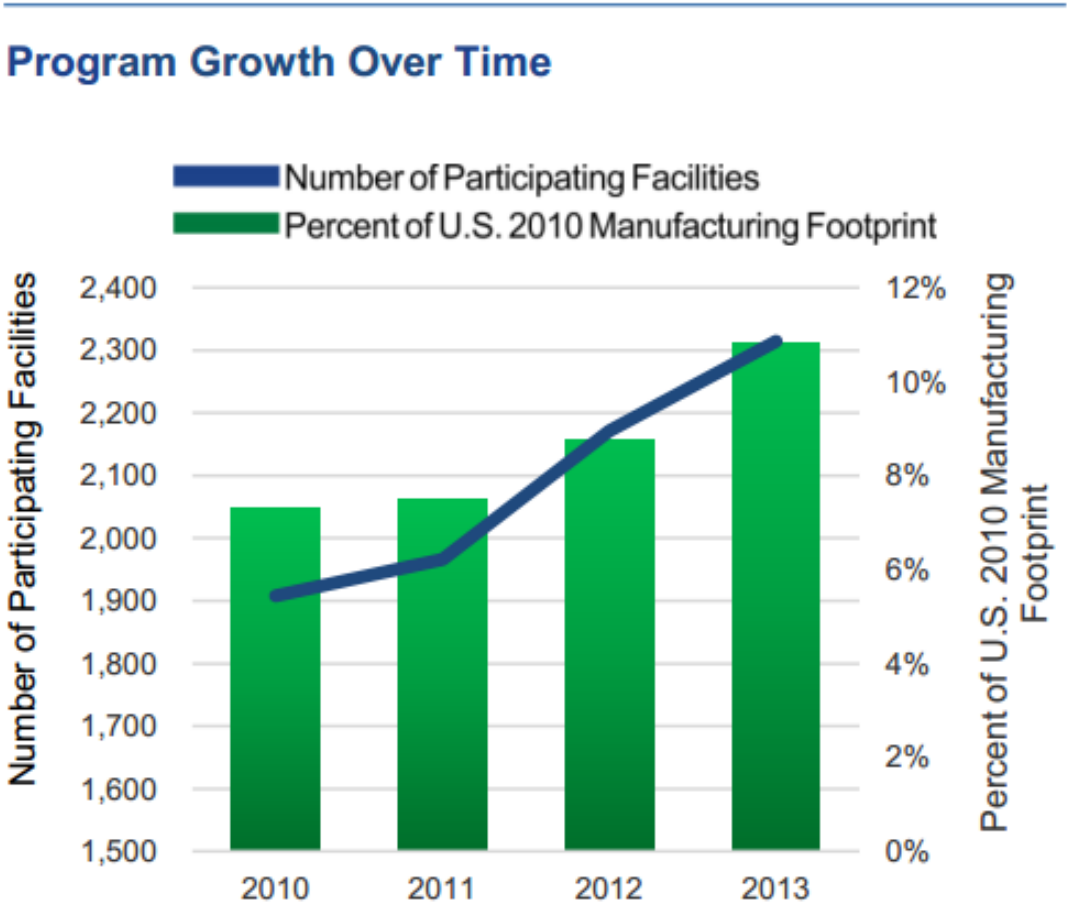
Better Plants consists of close to 160 partners, more than 2,300 facilities

Average energy intensity improvement is about 2.4% per year

Cumulative savings roughly 320 Tbtus and $1.7 billion as of 2014

Better Plants Continues to Grow

- 13 new Program Partners so far this year
- 9 new Challenge Partners
- >11% of the US industrial energy footprint (a doubling since 2010)!



New Better Plants Initiatives

Water Pilot

Water/Wastewater Expansion

Supply Chain Pilot

New Better Plants Program Partners

Industrial

abbvie

BD

Lineage

O'FALLON CASTING
NONFERROUS INVESTMENT CASTINGS

OREGON FREEZE DRY

OSHKOSH

RICHMOND INDUSTRIES INC

Water/Wastewater

ENCINA WASTEWATER AUTHORITY

CITY OF ITHACA, NY
INCORPORATED 1888

environment LA SANITATION
CITY OF LOS ANGELES

The Narragansett Bay Commission

PIMA COUNTY
WASTEWATER RECLAMATION

st.petersburg

New Better Plants Challenge Partners

Industrial

BENTLEY

Celanese
The chemistry inside innovation™

Holcim

LENNOX INTERNATIONAL

TOYOTA

TE connectivity

Water/Wastewater

BCW&SA

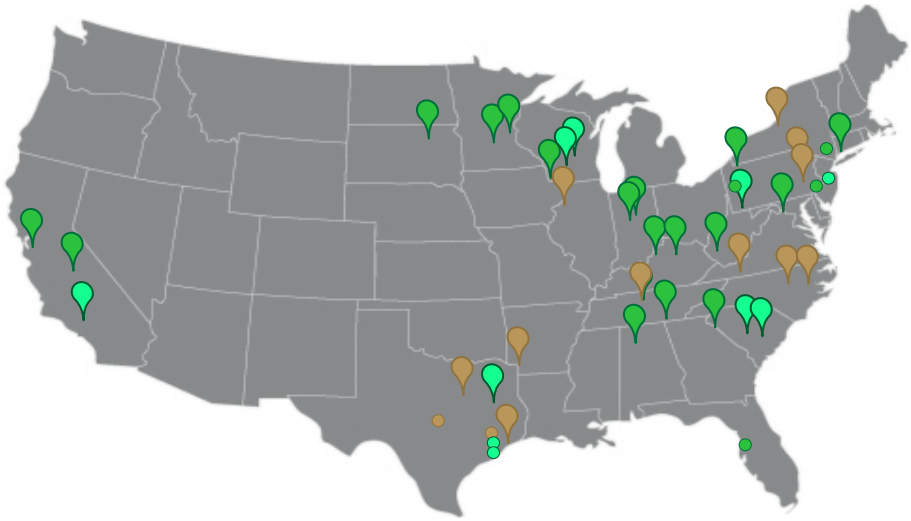
LA DWP Los Angeles Department of Water & Power

SBCSA • Apple Valley • Hesperia • Victorville
VVWRA
Taking the Waste Out of Wastewater

Superior Energy Performance™

Superior Energy Performance
U.S. DEPARTMENT OF ENERGY

- SEP is a certification program that requires plants to meet the ISO 500 energy management standard and verify the savings they achieve
- 28 plants have been certified so far. Nine improved energy performance an average of 10% and saved over $500,000 per year



ISO 50001 is a foundational tool that any organization can use to manage energy

ISO 50001

Components in place:
- Top Management
- Energy Team
- Policy
- Planning
- Baseline
- Performance Metrics

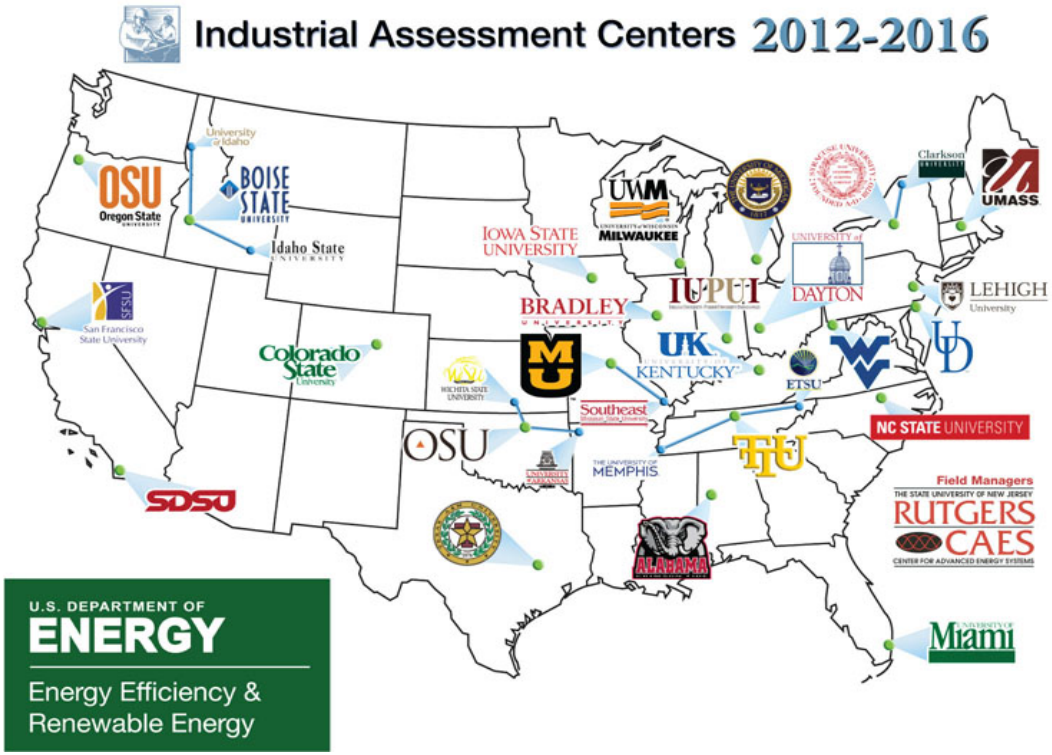
Superior Energy Performance

ISO 50001

Single facility ISO 50001 conformance with verified energy performance improvement

Industrial Assessment Centers (IACs)

- **Free assessments for small/medium sized manufacturers.**
- IACs are university-based centers, led by professors and staffed by engineering students.
- Typical audit uncovers savings equal to about 8% of plant-wide energy consumption

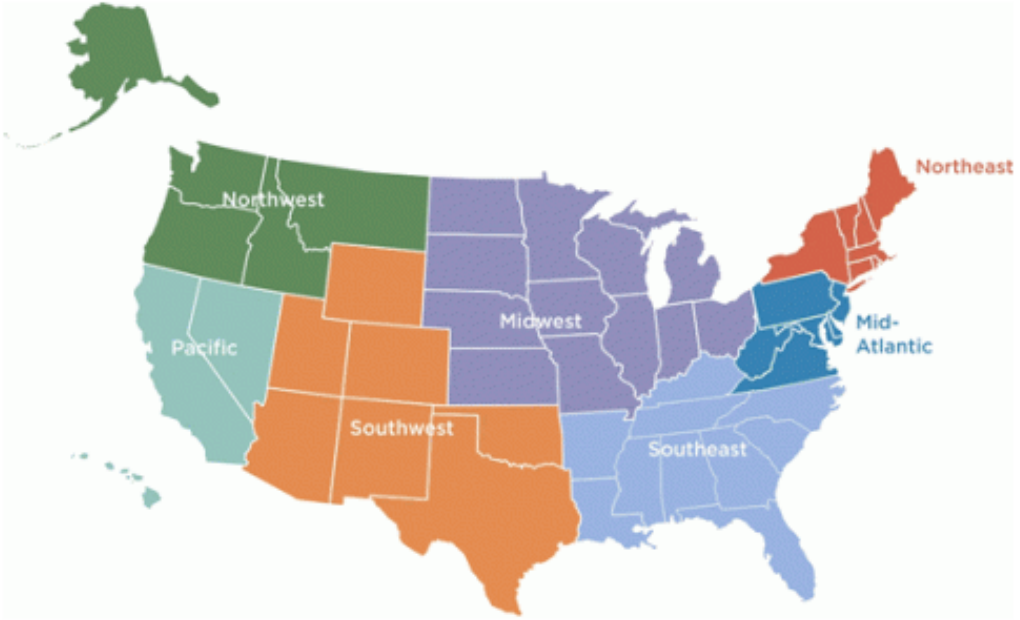


Better Plants Partners receive priority access to IACs

Combined Heat and Power (CHP) Deployment

CHP Technical Assistance Partnerships provide

- Market Opportunity Analysis
- Education and Outreach
- Technical Assistance



Better Plants Partners receive free CHP screenings

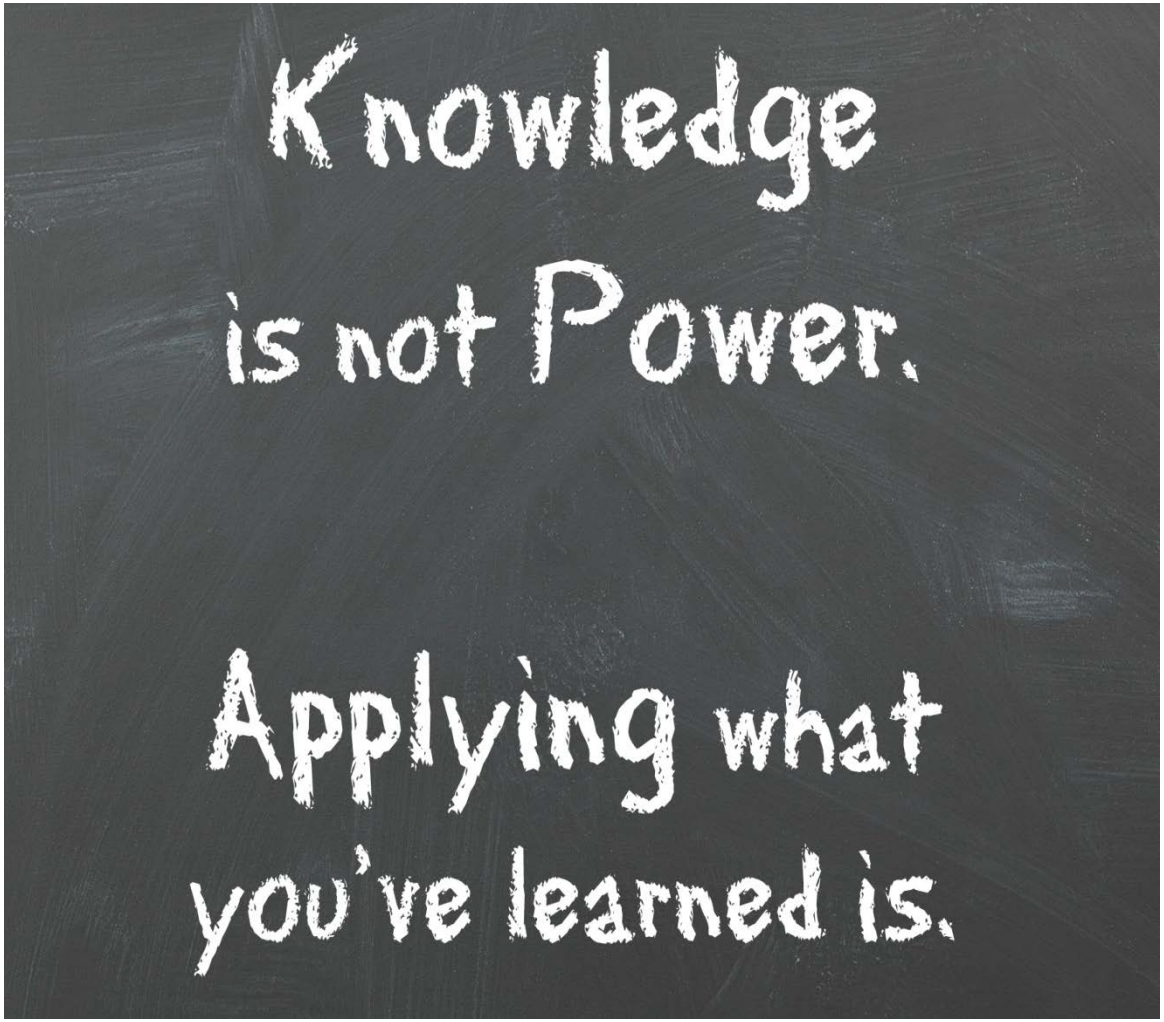
Come to the Better Plants Recognition Event!

Where: Main ballroom (Salons 1 and 2)
When: 5:15-6:00 PM, Thursday evening

- Light snacks and cash bar
- Network with industry peers and Advanced Manufacturing Office (AMO) technology experts
- View posters of ongoing AMO projects

Why are we Here?

Why are We Really Here?



Speakers

- Steve Schultz, Corporate Energy Manager, 3M
- Bert Hill, Health, Safety & Environmental Manager, Volvo Group North America
- Muneer Chowdhury, Energy and Environmental Efficiency Manager, Bridgestone Americas

3M Science. Applied to Life.™

Superior Energy Performance – Proven Pathway to Accelerate Improvement

United States Department of Energy Better Buildings Summit

May 27, 2014

Our Vision

3M Technology Advancing Every Company

3M Products Enhancing Every Home

3M Innovation Improving Every Life

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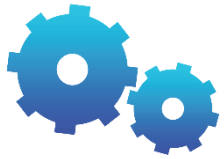
Our fundamental strengths are the foundation of 3M's performance

Leveraging these assets creates value; strengthening them ensures our future

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 cost.

Global capabilities

Subsidiary front- and back-office footprint that allows for effective development, adaptation and commercializa-tion of products.

Brand

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

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3M Has Aggressive Energy-Efficiency Goals

- Challenge ‘95
- Year 2000 Environmental Targets
- Environmental Targets 2005
- Environmental Targets 2010
- 2015 Sustainability Goals
- 2025 Sustainability Goals
  - 30% improvement in energy efficiency
  - 25% more of 3M electricity from renewable sources

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3M Partnership with US Department of Energy

- The partnership between 3M Energy Management and the U.S. Department of Energy goes back to the early 1990's
- The partnership has provided 3M numerous opportunities to be on the cutting edge of programs and resources designed to help industry
- Member of U.S. Council for Energy-Efficient Manufacturing (U.S. CEEM), which collaborated with the U.S. Department of Energy on the development of ISO 50001 and Superior Energy Performance

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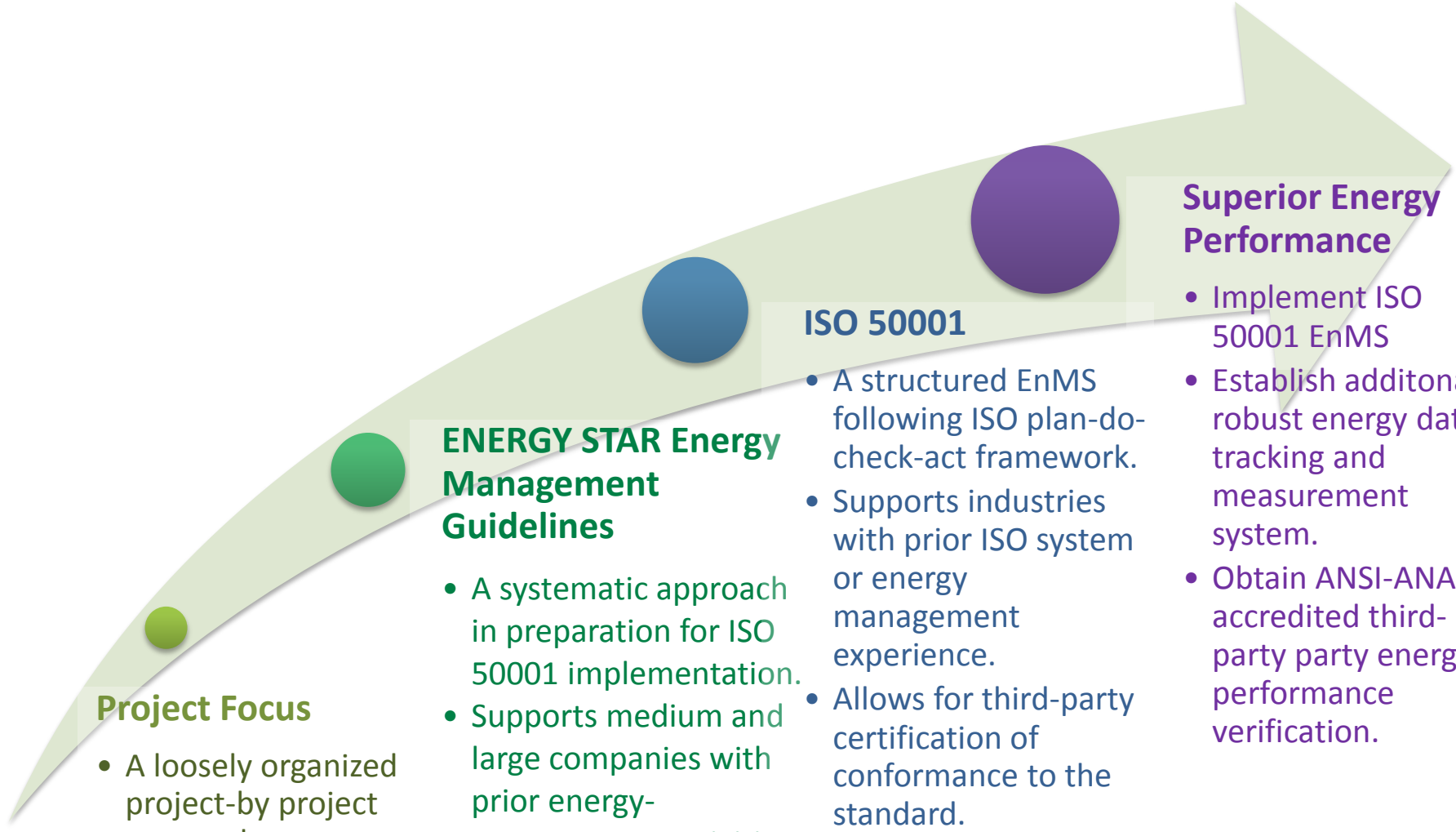
Strategic Energy Management Continuum



Project Focus

- A loosely organized project-by project approach.
- Supports facilities of any size that are beginning to manage their energy.

ENERGY STAR Energy Management Guidelines

- A systematic approach in preparation for ISO 50001 implementation.
- Supports medium and large companies with prior energy-management activities.
- No ISO management system experience is necessary.

ISO 50001

- A structured EnMS following ISO plan-do-check-act framework.
- Supports industries with prior ISO system or energy management experience.
- Allows for third-party certification of conformance to the standard.

Superior Energy Performance

- Implement ISO 50001 EnMS
- Establish additonal robust energy data tracking and measurement system.
- Obtain ANSI-ANAB accredited third-party party energy performance verification.

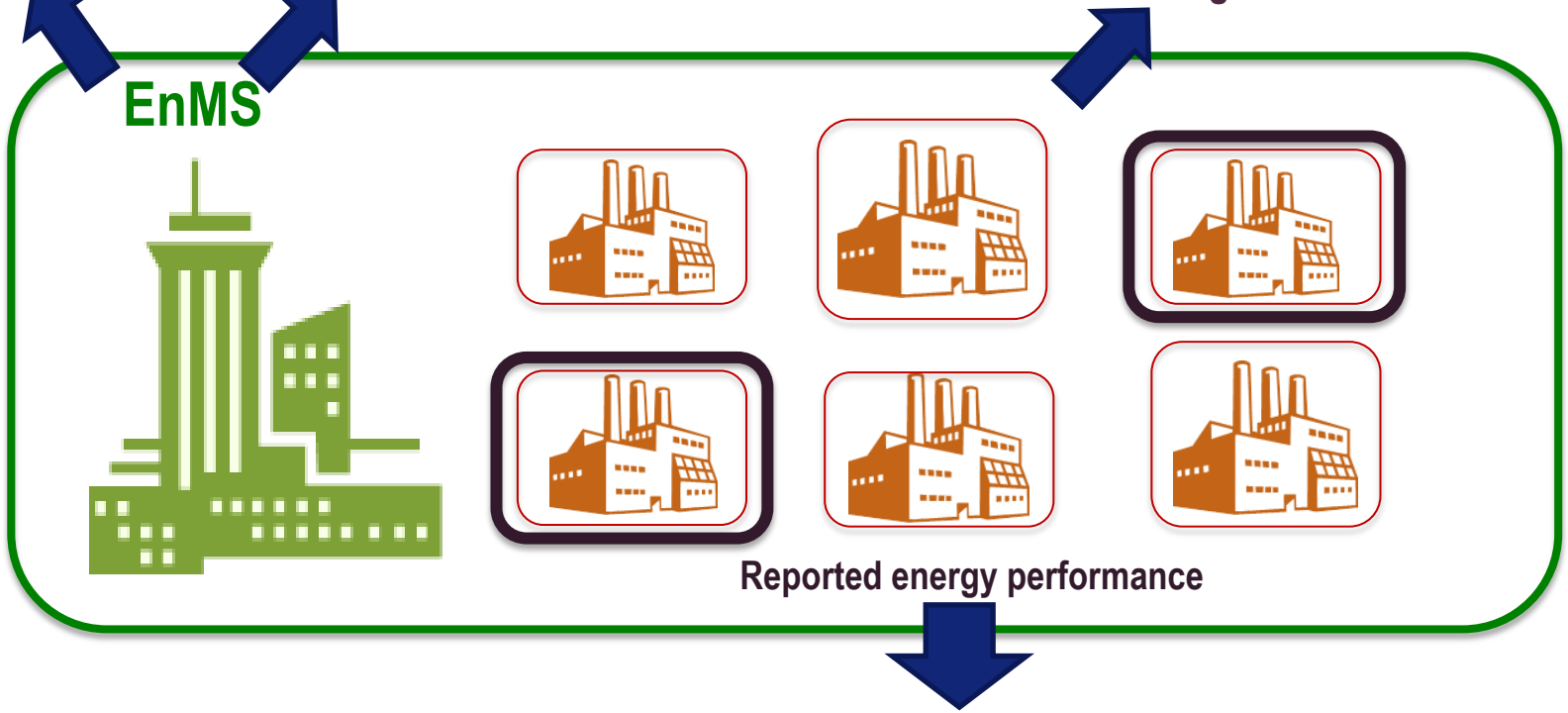
SEP Enterprise Level Implementation Models

EnMS resides at the corporate, business unit or enterprise level

Third-party validation of enterprise level EnMS Processes

Facility owns:

- Data
- Objectives, targets and action plans
- Monitoring and measurement



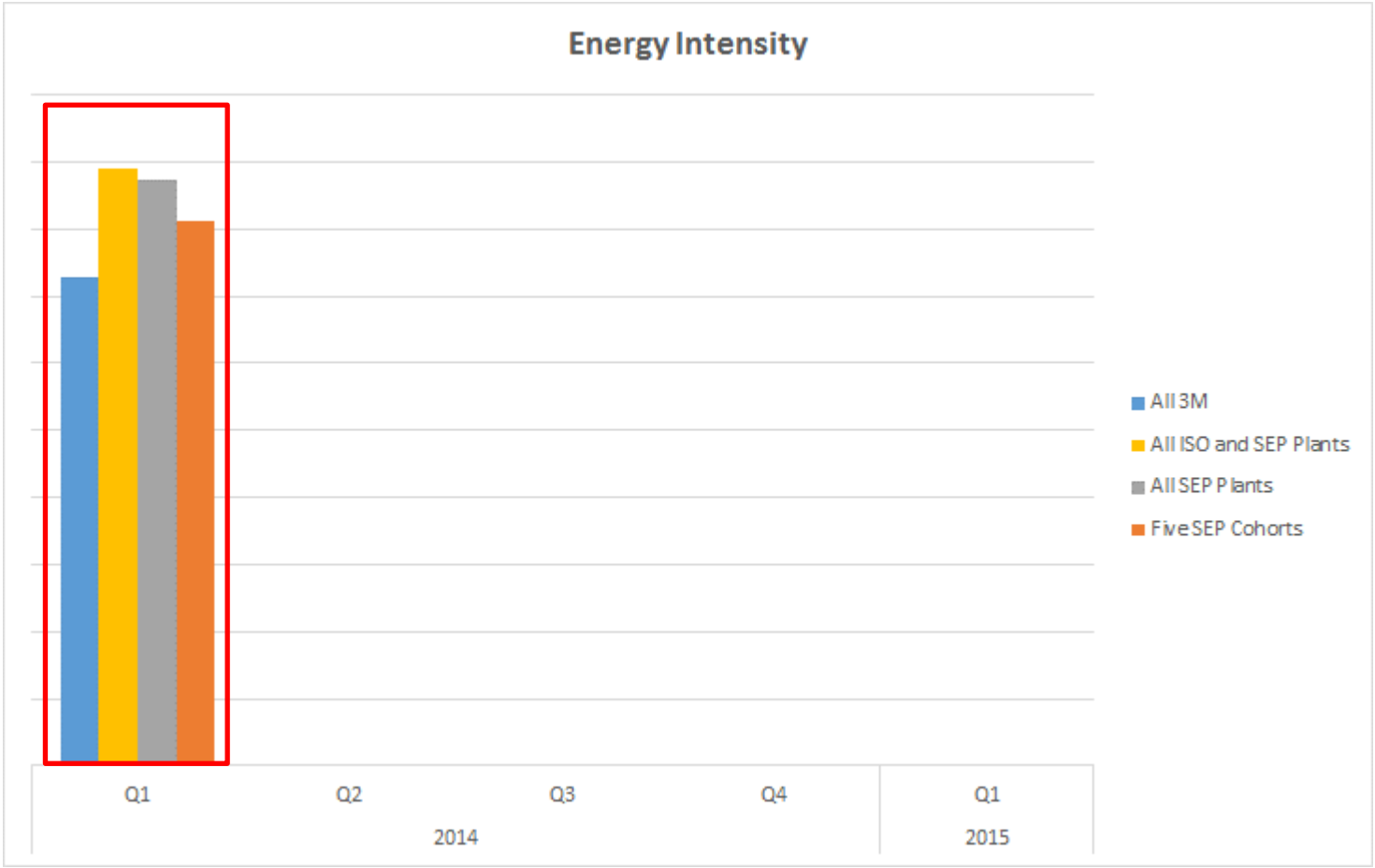
Level 1: Third-party verification of energy performance at each facility

Level 2: Third-party verification of energy performance with sampling onsite of similar facilities

Level 3: Third-party validation of enterprise energy *performance verification methodology with some sampling onsite*

3M Locations Certified or Pursuing Certification

Country	Site	Latest Action	SEP Certified
Canada	Brockville 501 (Tape)	ISO 50001 Certified	Plantinum
Canada	London	ISO 50001 Certified	No
Canada	Perth 301	Awaiting Stage 1 Audit	No
Canada	Perth 302	Awaiting Stage 1 Audit	No
France	Tilloy	ISO 50001 Certified	No
Germany	Kempten (Ceradyne)	ISO 50001 Certified	No
Germany	Neuss	ISO 50001 Certified	No
Germany	Hilden	ISO 50001 Certified	No
Germany	Kamen	ISO 50001 Certified	No
Germany	Seefeld & Landsberg	ISO 50001 Certified	No
Germany	Jüchen	ISO 50001 Certified	No
Korea	Naju		
Poland	Wroclaw PSD	ISO 50001 Certified	No
Poland	Wroclaw Automotive	December 2014	
U.K.	Gorseinon	On-hold	
U.S.	Cordova	ISO 50001 Certified	Silver
U.S.	Aberdeen	Working as a group of co-horts	Enterprise-wide ISO 50001 and individual Superior Energy Performance certificates
U.S.	Cynthiana		
U.S.	Decatur		
U.S.	Hutchinson		
U.S.	Prairie du Chien		
U.S.	3M Center		



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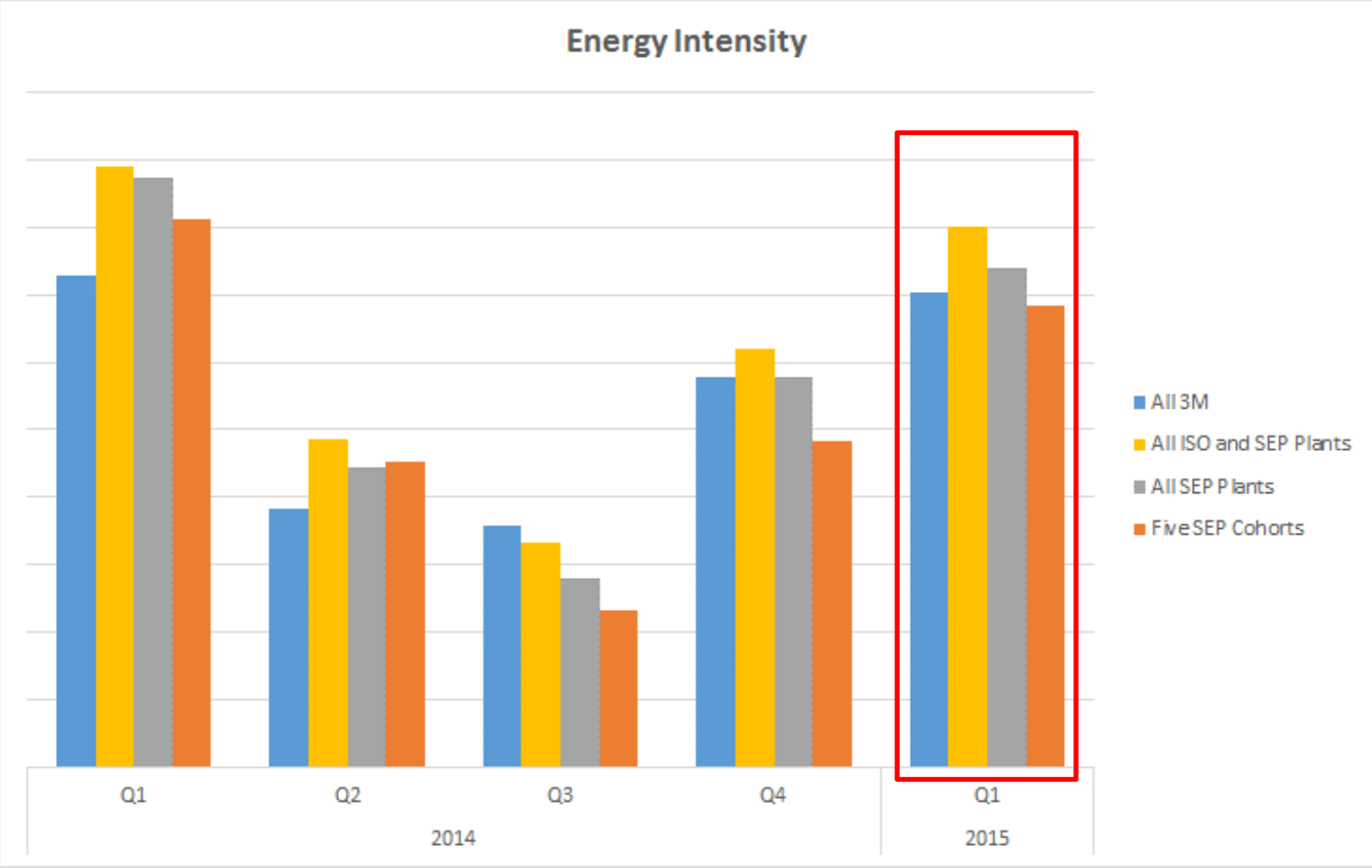
Results



- 1Q 2015 vs 1Q 2014
  - 3M global improvement of 1.7%
  - 3M ISO 50001 facilities improved 5.3%
  - 3M Superior Energy Performance facilities improved 7.8%
  - Five SEP cohort plants in Enterprise-wide certification improved 8.1%

— All data based on BTU's per pound of product

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Challenges

- Realizing the significance of the undertaking
- Enterprise-level ISO certification in a matrix organization
- Maintaining support and momentum

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Thank you!

Tapping into DOE's Portfolio of Manufacturing Energy Efficiency Resources – Industrial Assessment Centers

Bert Hill
Manager, Health Safety and Environment
Volvo Group North America

Better Buildings Summit
June 2015

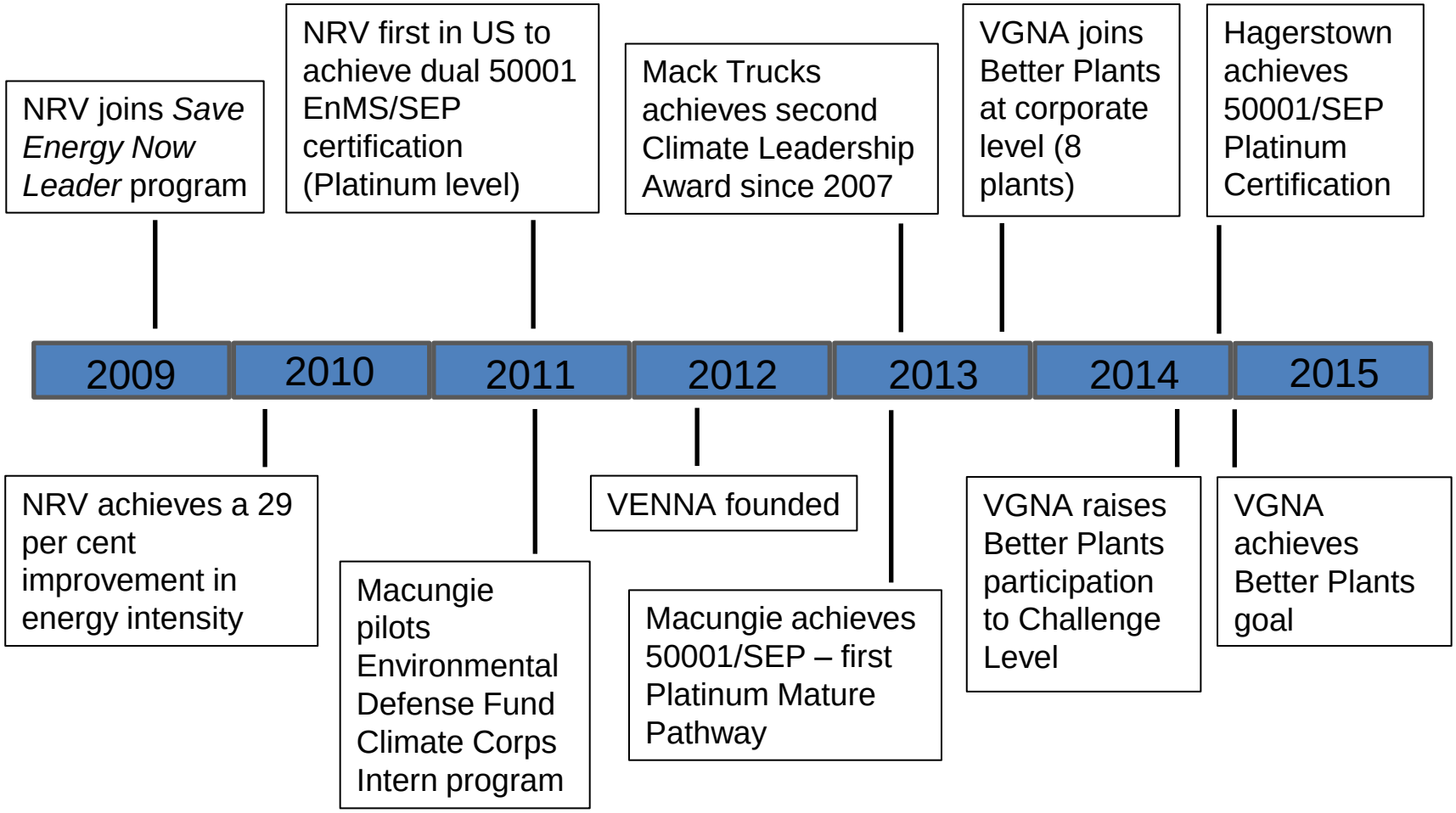
The Volvo Group is one of the world's leading manufacturers of trucks, buses, construction equipment and marine and industrial engines. The Volvo Group also provides complete solutions for financing and service.

The Volvo Group's vision is to become the world leader in sustainable transport solutions by

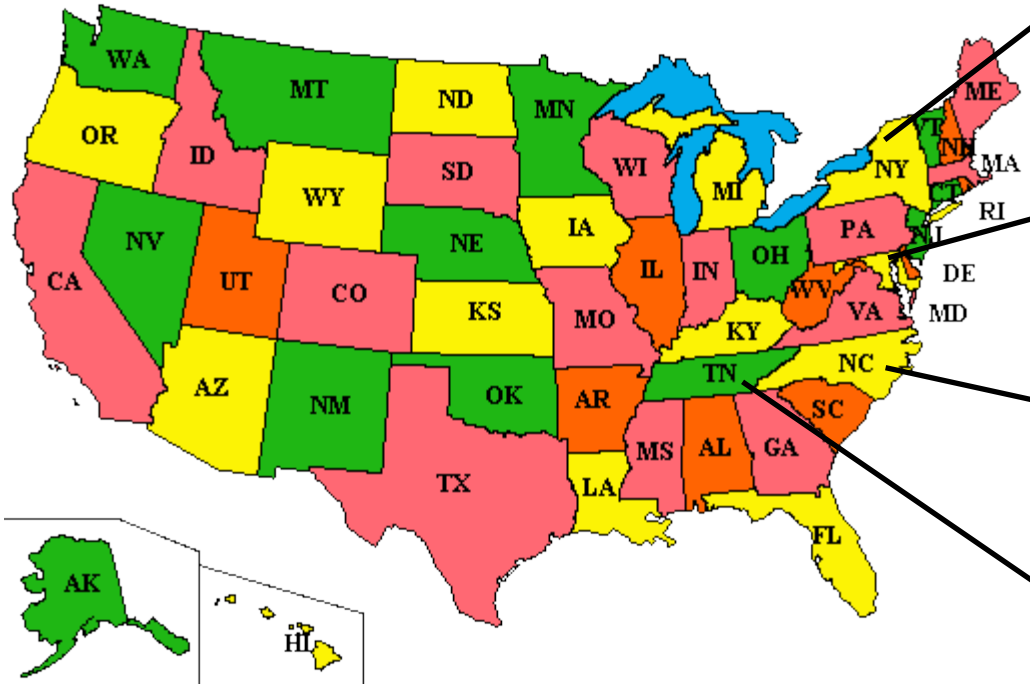
- creating value for customers in selected segments
- pioneering products and services for the transport and infra-structure industries
- driving quality, safety and environmental care
- working with energy, passion and respect for the individual

Corporate core values

Volvo Group North America Energy Milestones



Completed IAC Assessments



Nova Bus
Plattsburgh, NY

Powertrain Production
Hagerstown, MD

Remanufacturing
Charlotte, NC

Volvo Penta
Lexington, TN

IAC Assessment summary

Facility	Scope	Potential savings identified	Average simple payback	Example Energy Saving Recommendations
Nova Bus Plattsburgh	Production of complete buses	$41,223 (assessment just completed)	18 months	• Destratification fans • Rainfall harvesting • Wood pallet grinder
Powertrain Hagerstown	Engine and transmission production	$173,614	15 months	• Self-recuperative burners • Heat recovery • Vibration analysis
Powertrain Remanufacturing Charlotte	Truck engine and part reconditioning	$17,556 (15% implemented)	17 months	• Re-use dynamometer cooling water • Convert electric parts washer to NG • Replace flexible air hoses and reduce pressure
Volvo Penta Lexington	Assembly of marine engines and drives	$56,911 (30% implemented)	6 months	• Pressure pad controllers • Replace CA blowers with air knives • Part sensors to lower paint oven temp when not in use

Example Assessment Recommendation (AR)

AR No. 4: Install Secondary Receiver Tank and Improve Performance of VSD

ARC# 2.4224	Annual Savings			Project Cost	Simple Payback
Resource	Amount	CO_2 (lbs)	Dollars		
Electricity	684 MMBtu (200,329 kWh)	438,721	$10,990	-	-
Capital	-	-	-	$7,000	-
Labor	-	-	-	$560	-
Total	-	438,721	$10,990	$7,560	9 months

*1 kWh = 2.19 lbs of CO_2

Recommended Action

Install a secondary compressed air receiver tank for improving the performance of VSD.

Best Practices Tool

The BestPractices software tool (MotorMaster+4.0) was used during the development of this assessment recommendation. The facility is encouraged to utilize these tools as part of its continuous improvement process.

Background

Presently, the facility has one 346-hp main air compressor and one 337-hp back up air compressor. The main compressor has a VSD control on-it. This compressor operates at a set pressure of 99 psig. Currently the compressor motor is loading and unloading frequently in a band of 50 amps for every 4 minutes to meet the compressed air demand as shown in Figure 4.4.1. This frequent loading and unloading indicates that there is no enough compressed air storage and hence this can be reduced by installing a secondary storage tank near the area where more compressed air is used. A typical VSD motor should unload to around 20% of the compressor motor load, whereas existing VSD motor is unloading to around 60% load. Installation of secondary receiver tank will reduce the frequent fluctuation of compressor motor and also improves the performance of VSD by unloading the motor to a lower load. Based on the VSD performance studies on compressor motors in various plants, it is estimated that the performance of VSD will improve by 25% after installation of secondary storage tank. Receivers are especially effective for systems with widely varying compressed air demand.

Purpose of receiver

1) Reduces compressor cycling.
2) Stores air for periods of high demand.
3) Facilitates air/liquid separation.
4) Prevent oil and water migration down-stream.

Compressed current profile was measured during the time of energy assessment and is shown in Figure 4.4.1.

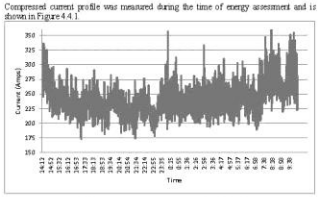


Figure 4.4.1 Current Profile of 346 hp Air Compressor

Estimated Savings

The total annual energy savings, ES, can be estimated from the following relationship:

ES = N x PI x HP x LF x UF x C x OH / EFF

Where,

N	=	number of air compressors
PI	=	VSD performance improvement factor, 25%, no units
HP	=	horsepower rating of the compressor, hp
LF	=	load factor, no units
UF	=	utilization factor, percent of time the compressor is working
C	=	conversion constant, kW/hp (0.746)
OH	=	annual hours of operation
EFF	=	compressor motor efficiency, no units

The energy savings for the 346-hp compressor can be given as,

ES = 1 x 0.25 x 346 x 0.7 x 1 x 0.746 x 4,160/ 0.938
= 200,329 kWh/yr
= 684 MMBtu/yr (Note: 1 MMBtu = 293 kWh)

The annual energy cost savings, ECS, can be calculated as:

ECS = ES x (unit cost of electricity)
= 200,329 kWh/yr x $0.05486/kWh
= $10,990/yr

Implementation Cost

A compressed air receiver tank of capacity 1,500 gallons is recommended to be installed and is estimated to cost around $5,000. A detailed engineering study needs to be conducted to implement this recommendation. For installation of the tank, it is estimated that 8 hrs of labor is necessary. This implementation cost is only to provide a rough estimation.

Implementation Cost = Engineering Cost + Cost of Tank + Cost of Labor
= $2,000 + $5,000 + 8 hrs x $70/hr
= $7,560

Payback period = (Implementation Cost / Annual Savings) x 12 months/yr
= ($7,560/$10,990) x 12
= 8.25 months
= 9 months

The cost savings of $10,990 will pay off the implementation cost of $7,560 in 9 months.

Experience with IAC Assessments

- Timely scheduling and completion
- Enthusiastic students
- Thorough technical detail
- Outside the box thinking

Thank you!

One Team, One Planet.

BRIDGESTONE

Bridgestone Americas' commitment to
helping ensure a healthy environment for current
and future generations to enjoy

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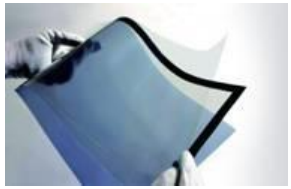
Bridgestone Corporation

- Founded in Japan in 1931, headquartered in Tokyo
- The world's largest tire and rubber company
- Manufactures tires and a broad range of diversified products, which includes Industrial Products, Building Products, Chemical Products and Sporting Goods.
- Products sold in more than 150 nations and territories around the world

Conveyer Belts

Seismic Isolation Rubber

Sporting Goods



High Performance film

Bicycles

Seat pads for automobiles (Polyurethane foam)

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Brief Background of Bridgestone Americas (BSAM)

- Nashville, Tennessee-based BSAM is the largest subsidiary of Bridgestone Corporation with 50,000 teammates in North and South America.
- BSAM and its subsidiaries develop, manufacture and market a wide range of Bridgestone, Firestone and associate brand tires to address the needs of a broad range of customers, including consumers, automotive and commercial vehicle original equipment manufacturers, and those in the agricultural, forestry and mining industries.
- The company is also engaged in retreading operations throughout the Western Hemisphere and produces air springs, roofing materials, and industrial fibers and textiles.
- BSAM also operates the world's largest chain of automotive tire and service centers.

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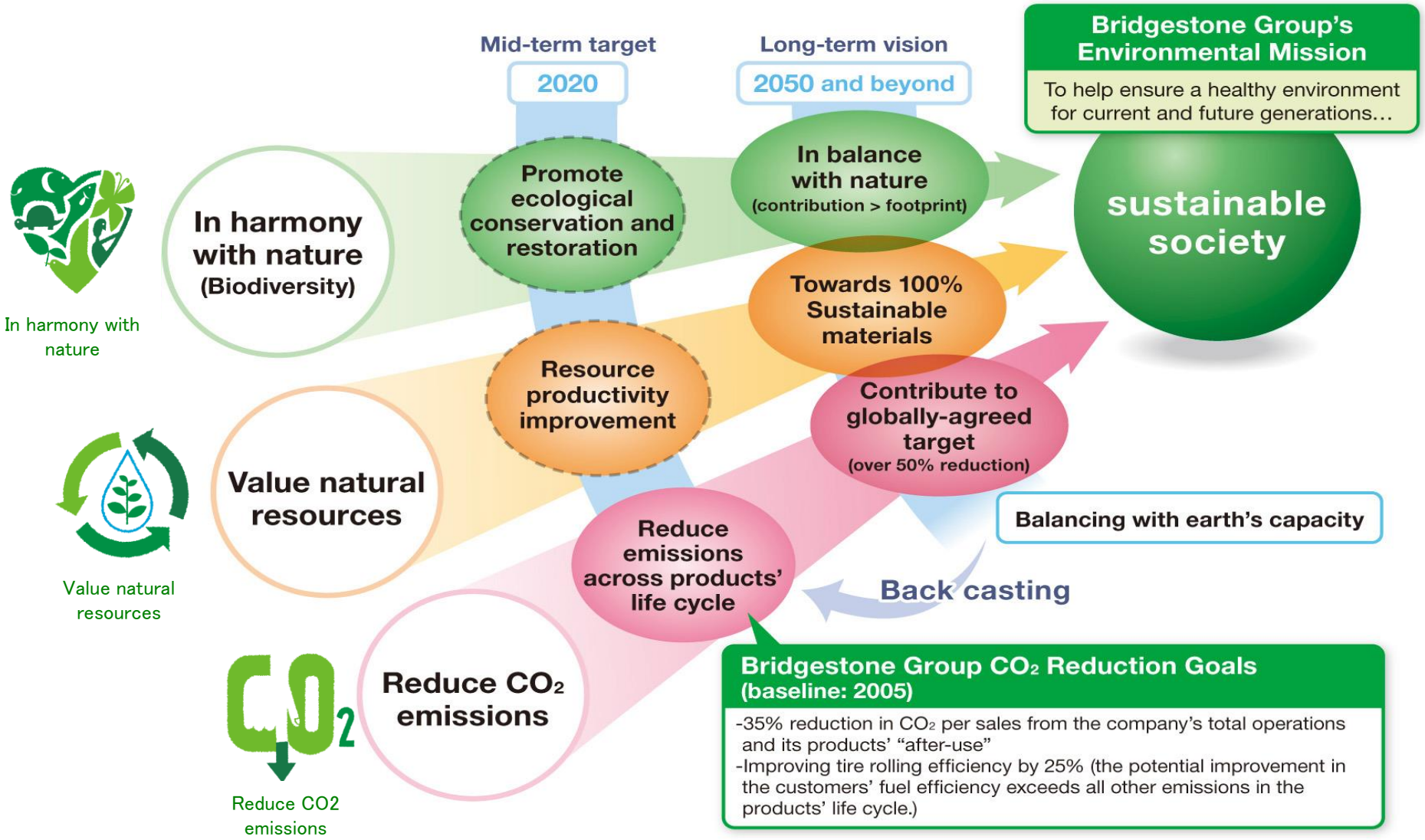
Long-term Vision



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Environmental Mission | Reducing C02 Emissions

Global goals to:

- **Reduce** CO2 from entire products lifecycle by **35%** per sales
- **Improve** tire rolling efficiency by **25%**, resulting in less fuel use and CO2 emissions while driving

(By the year 2020, based on a 2005 benchmark.)

ECOPIA™ FUELTECH

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Operations | Embracing New Technologies

- Clean, efficient hydrogen fuel cells power material movers at our tire plants in Warren County, Tenn., and Aiken County, S.C.

- We reduce our energy consumption by using low energy lighting and high efficiency fans in our plants

- Through energy savings measures in our plants, the company saved **Millions** and continues to reduce greenhouse gasses on our way to achieving 25% reduction by 2020

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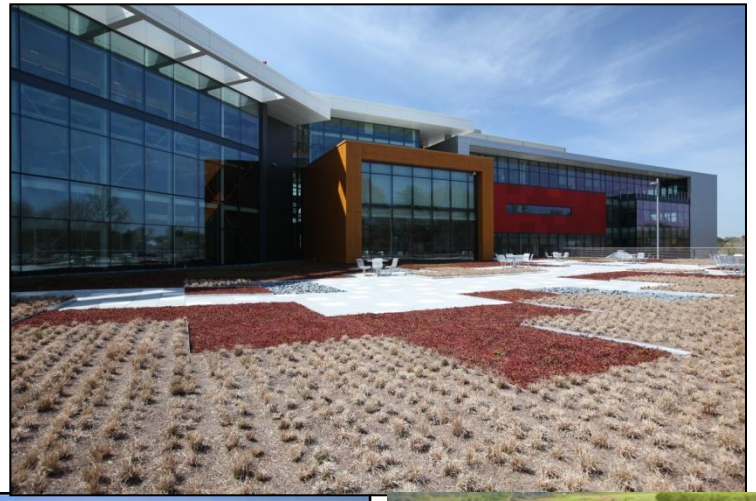
Operations | Leadership in Energy and Environmental Design

- Two Bridgestone Americas tire plants, the new Americas Technical Center in Akron, Ohio and a retail store in Tennessee are all LEED certified
- New Aiken OTR manufacturing facility is also being built to LEED specifications
- First tire plants ***in the world*** to earn certification
- All Bridgestone Americas manufacturing facilities are ISO 14001 certified, even those that are not required to be

Firestone Complete Auto Care
Smyrna, Tenn.
Gold LEED Certified



Americas Technical Center
Akron, Ohio
Silver LEED Certified

Passenger Tire Manufacturing Facility
Aiken, SC
Silver LEED Certified

Commercial Tire Manufacturing Facility
Warren County, TN
Silver LEED Certified

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Combined Heat and Power
Qualification Screening Results for

Bridgestone Americas Tire Operations
Wilson, NC

Isaac Panzarella, Christina Kopitopoulou
DOE Southeast CHP TAP
North Carolina Clean Energy Technology Center
North Carolina State University
October 15, 2014

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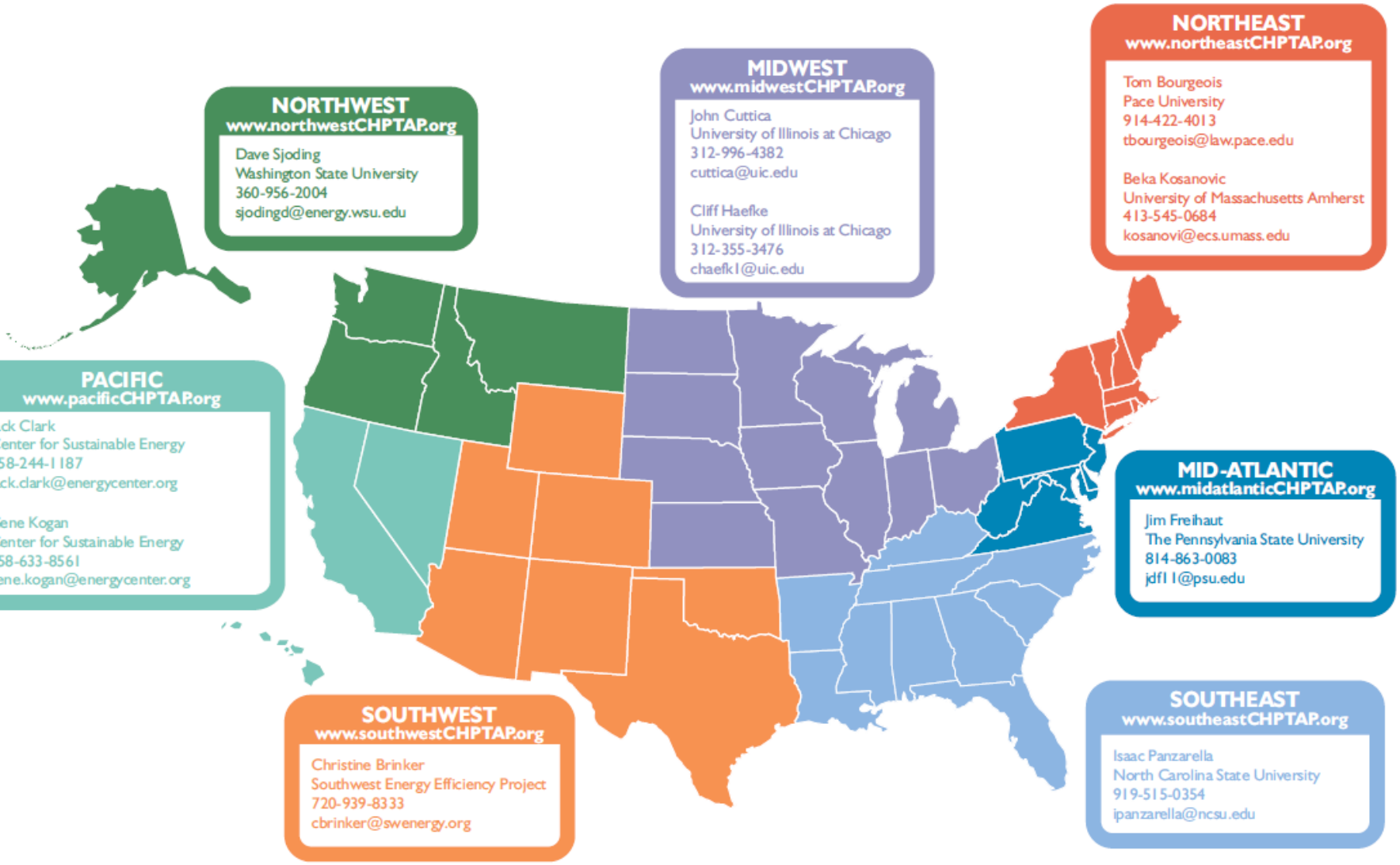
DOE CHP Technical Assistance Partnerships (CHP TAPs)



DOE CHP Technical Assistance Partnerships (TAPs): Program Contacts

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CHP Technical Assistance Partnerships

Key Activities

Market Opportunity Analysis.

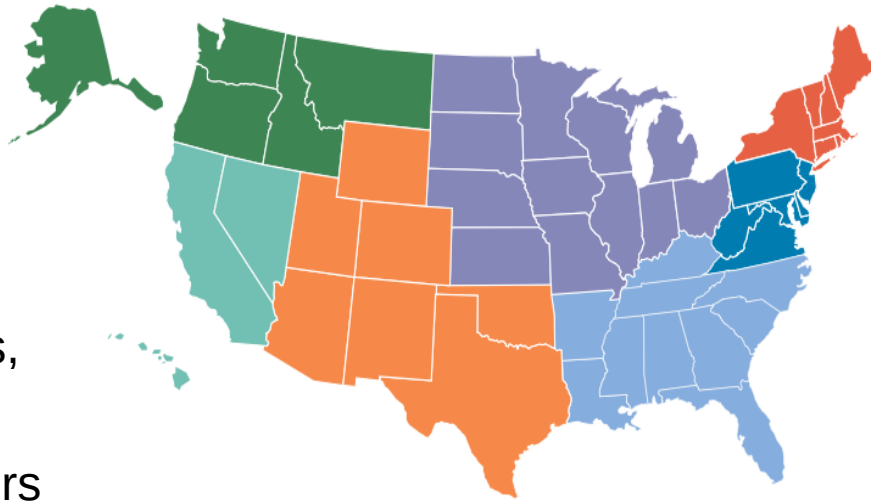
Supporting analyses of CHP market opportunities in diverse markets including industrial, federal, institutional, and commercial sectors

- Education and Outreach.

  Providing information on the energy and non-energy benefits and applications of CHP to state and local policy makers, regulators, end users, trade associations, and others.

Technical Assistance.

Providing technical assistance to end-users and stakeholders to help them consider CHP, waste heat to power, and/or district energy with CHP in their facility and to help them through the development process from initial CHP screening to installation.



http://eere.energy.gov/manufacturing/distributedenergy/chptaps.html

BRIDGESTONE
Your Journey, Our Passion

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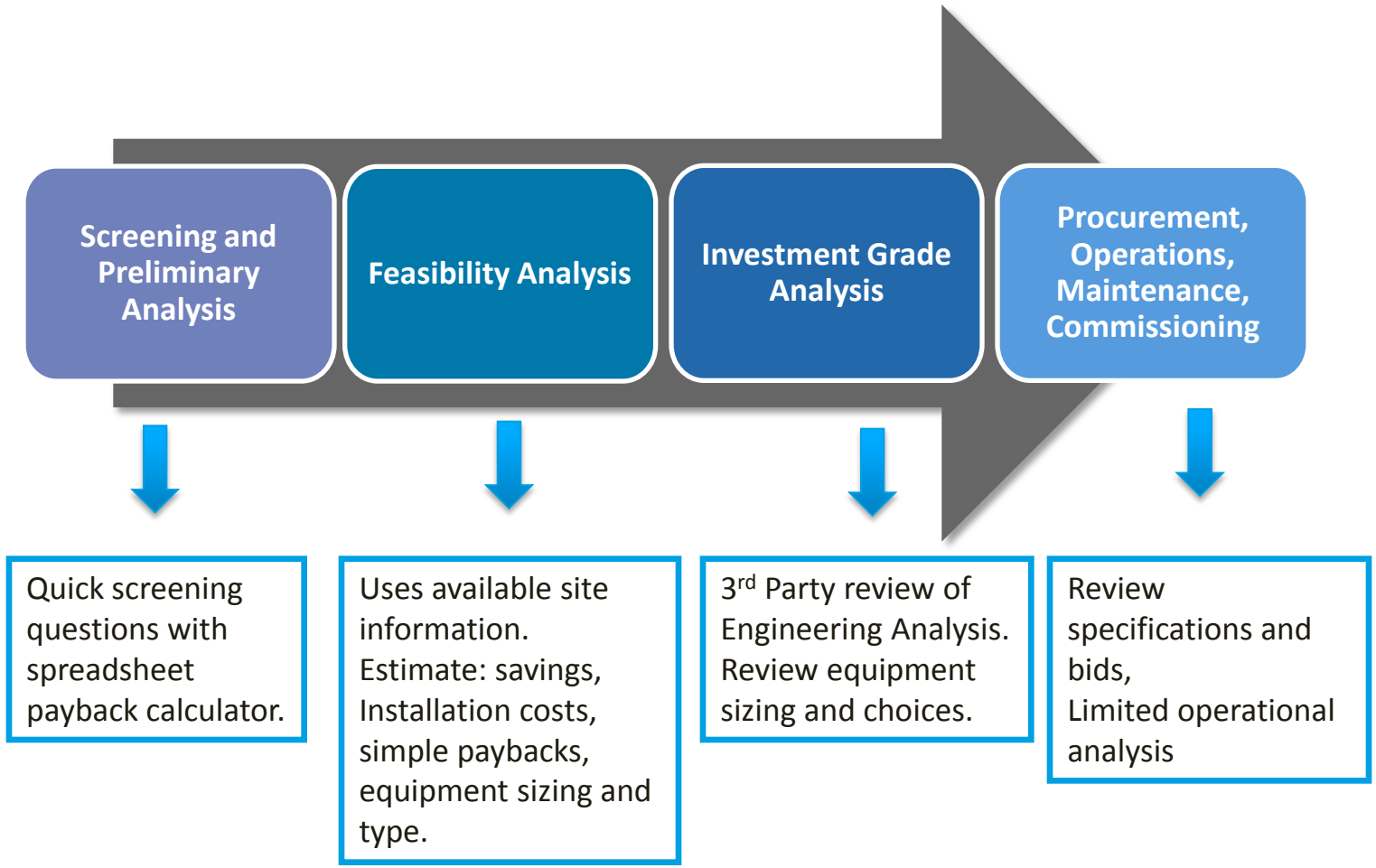
DOE CHP TAP
Technical Assistance Process



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Preliminary Assessment

SBU	PLANT	Generator	Investment	ROI, years, Range, simple with CHP only (2)	CO2 reduction		Cost saving/yr including
		MW	M$		TM-Co2/Y	Comments	M$/Yr
Tire Plants	A	10	22	7.10	(21,000.)	Study by DOE screening 1/30/15	2.50
	B	8	16	12.90	(17,500.)	Delayed for longer payback	1.50
	C	10	22	16.90	(21,000.)	Study by DOE screening 1/30/15	1.10
	D	14	25-30	5.90	(25,000.)	Phase 2 Study underway	7.00

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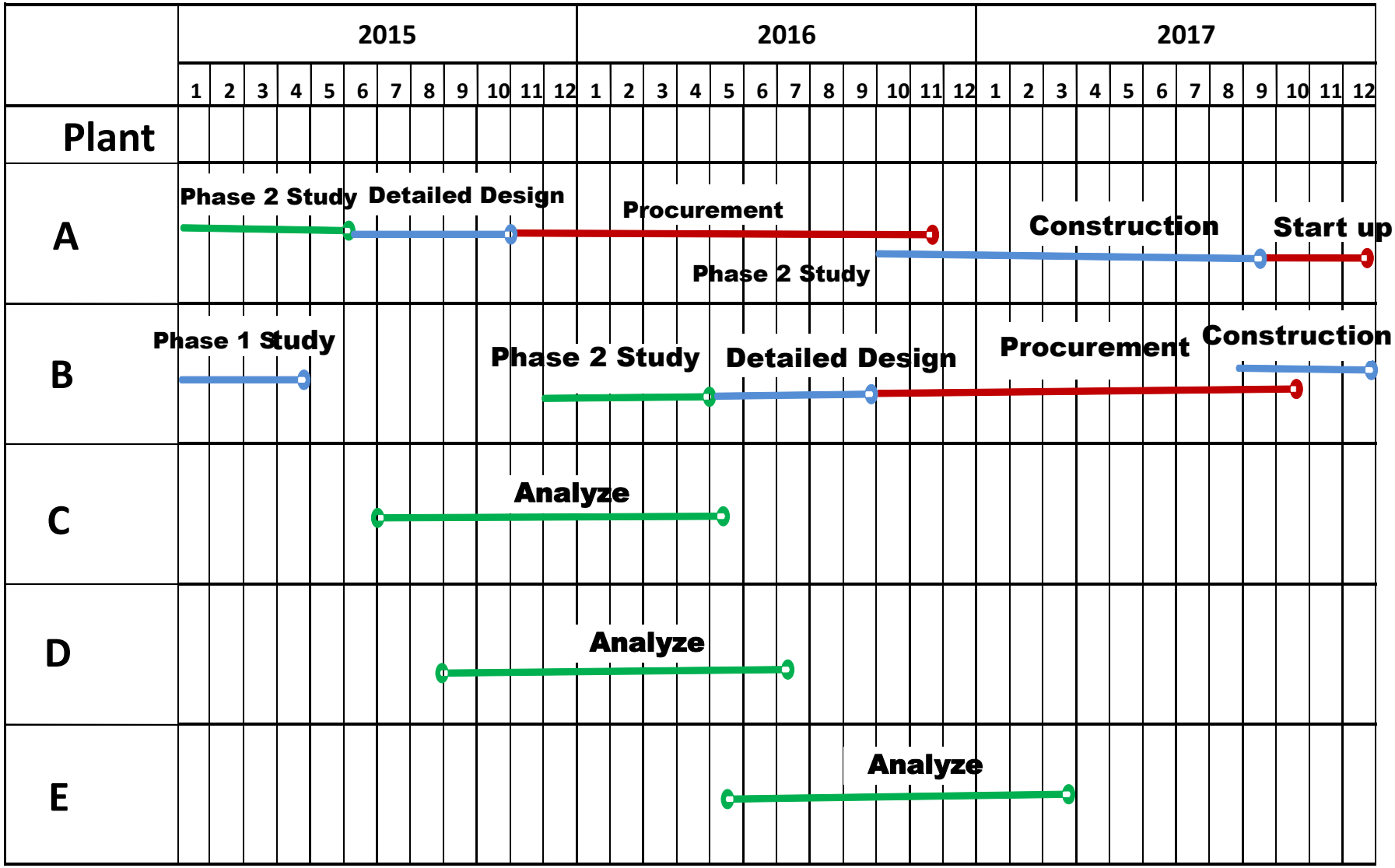
CHP Project Schedule



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Initial Objectives

1. Reduce impact of unplanned electricity outages
2. Achieve related energy savings
3. Meet BSI Corporate carbon emissions reduction target
4. Benefit from NC State Tax Credit and Federal Tax Credit incentives

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CHP Screening: 18.2 MW Gas Turbine

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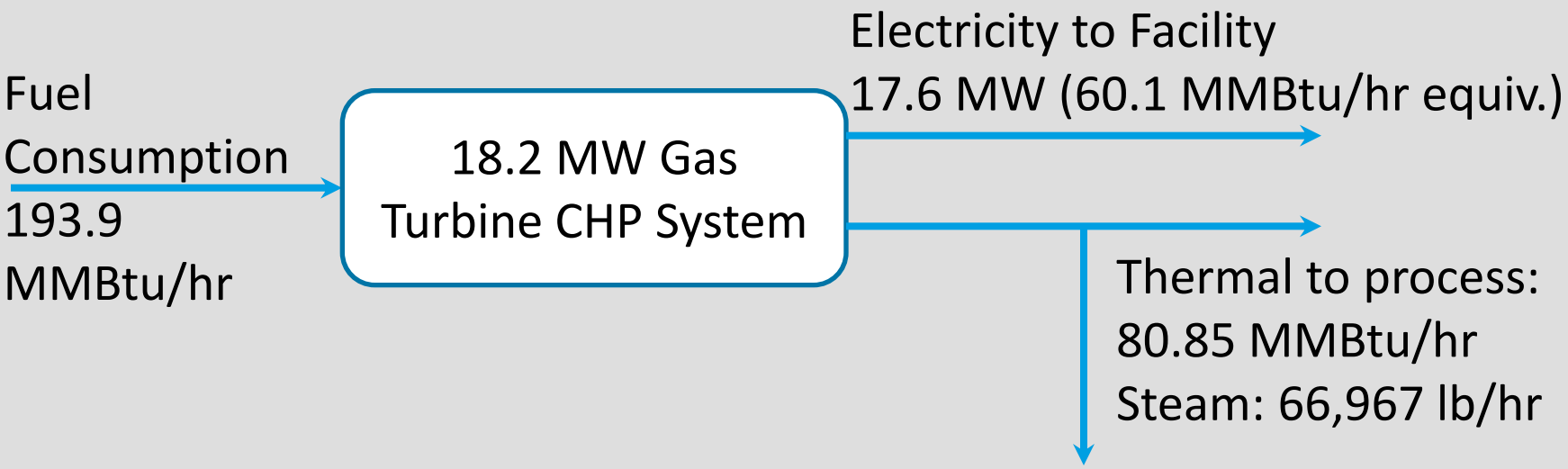

CHP Performance Summary

Fuel Consumption	Electricity to Facility	Thermal to Facility	Annual Efficiency
1,698,394 MMBtu/year	154,315 MWh/year 526,524 MMBtu/year	708,307 MMBtu/year	72.7 %

Business Energy Investment Tax Credits for CHP

Federal: Credit is equal to 10% of expenditures, with no maximum limit stated. Eligible CHP property generally includes systems up to 50 MW in capacity that exceed 60% energy efficiency, subject to certain limitations and reductions for large systems. This credit applies to eligible property placed in service after October 3, 2008.

State: Tax credit equal to 35% of expenditures with a maximum of $2.5 million per installation. The allowable credit may not exceed 50% of a taxpayer's state tax liability for the year, reduced by the sum of all other state tax credits. The credit is taken in five equal installments beginning with the year in which the property is placed in service. If the credit is not used entirely during these five years, the remaining amount may be carried over for the next five years.

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Depreciation: Under the federal Modified Accelerated Cost-Recovery System (MACRS), businesses may recover investments in certain property through depreciation deductions. CHP technologies are classified as five-year property. The depreciation schedule used is: 20%, 32%, 19.2%, 11.52%, 11.52%, 5.76% in years 1 - 6 respectively.*

Visit DSIRE – The database of policies and incentives for renewable energy and energy efficiency at www.dsireusa.org for details and references.

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Findings and recommendations

Findings:

- Installing a Gas Turbine CHP system can produce nearly all the electricity and thermal needed for facility.
- Simple paybacks range from 5.9 years w/out incentives to 3.7 years w/ incentives.
- Significant reduction of carbon emissions of 53% associated with site electric and boiler fuel consumption.

Recommend feasibility analysis to:

- Refine inputs and operating conditions.
- Better evaluate current and new utility rates, including natural gas infrastructure upgrades if required.
- Accurately model economic performance.

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Real pleasure for the opportunity

THANK YOU

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