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LAWRENCE BERKELEY NATIONAL LABORATORY

U.S. DEPARTMENT OF ENERGY

# ISO 50001 and Superior Energy Performance Program Informational Workshop

*California Air Resources Board*

*Lawrence Berkeley National Laboratory*

*November 10, 2015*

*Sacramento, CA*

# Welcome!

# Introductions

# LBNL Industrial Systems Team

## *Our Mission*

***Empower industry and other large energy users to be globally competitive by obtaining the highest value from available energy and water resources.***

# LBNL Industrial Systems Team

Paul Sheaffer

Dr. Peter Therkelsen

Aimee McKane

Dr. Prakash Rao

Bunmi Adesola

Arian Aghajanzadeh

# Audience Introductions

***Name***

***Organization***

***Why is your organization here?***

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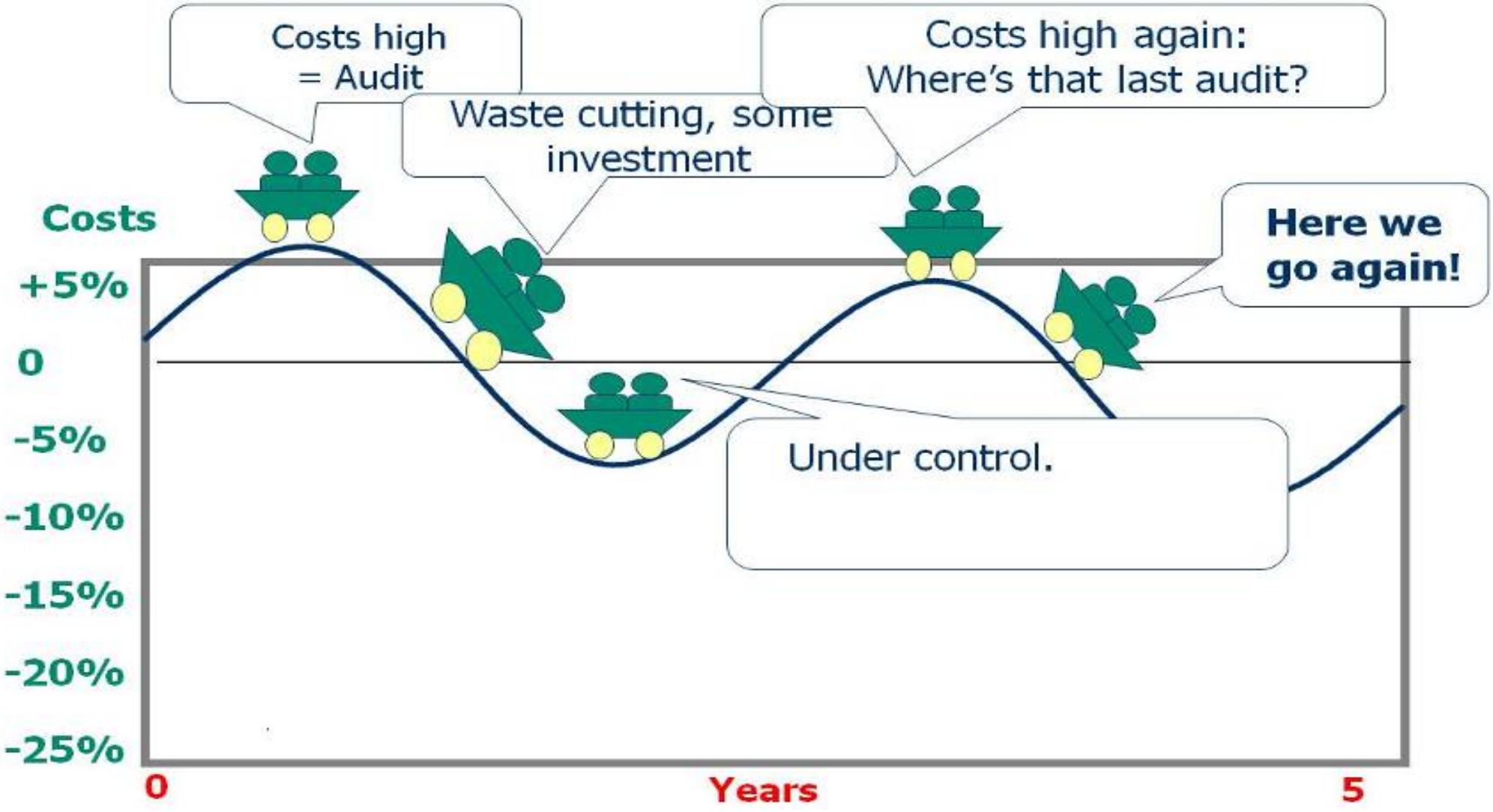
# Core Principles of an Energy Management System

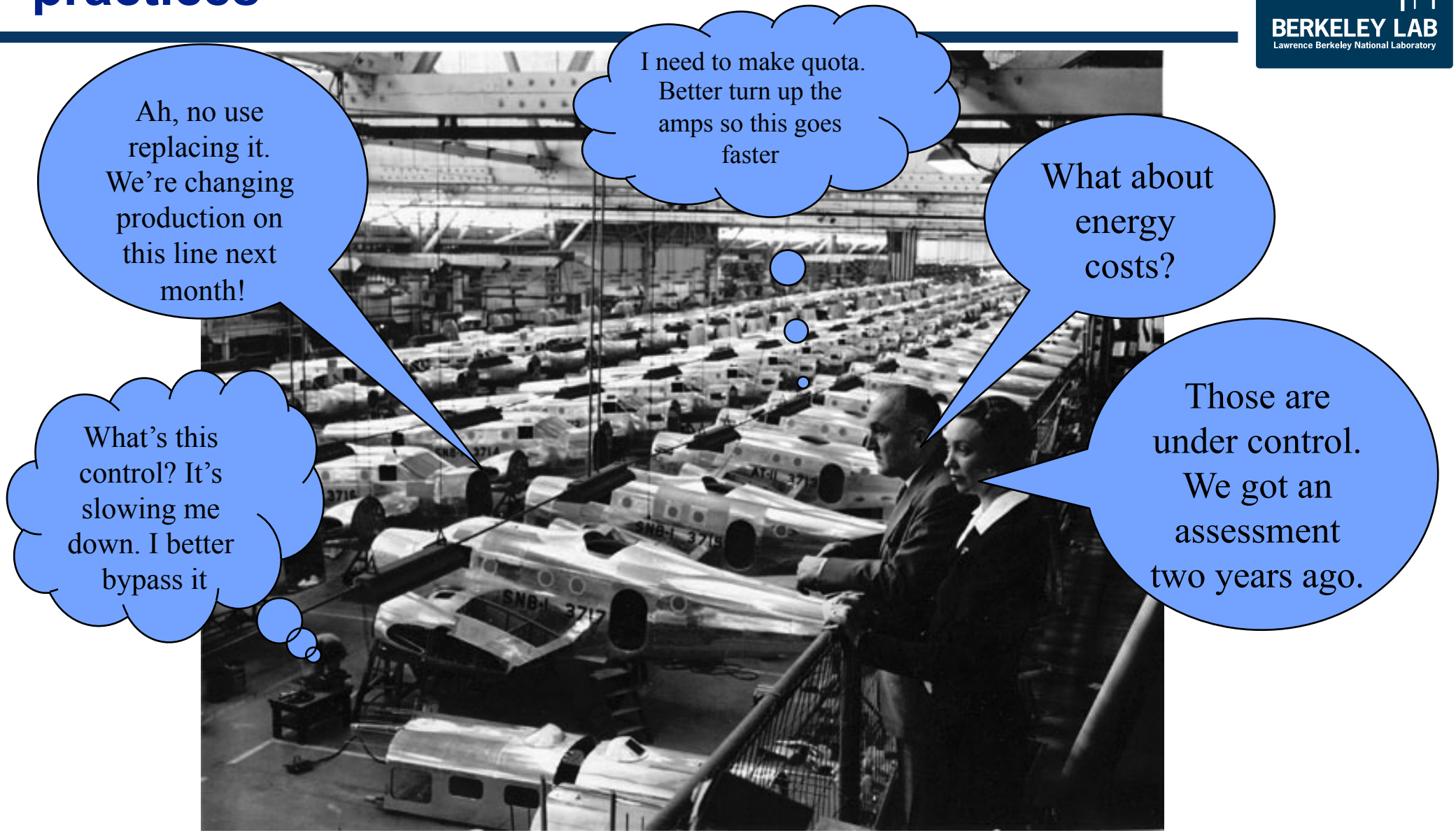
*Prakash Rao, PhD*

# Ad hoc approach to achieving energy savings



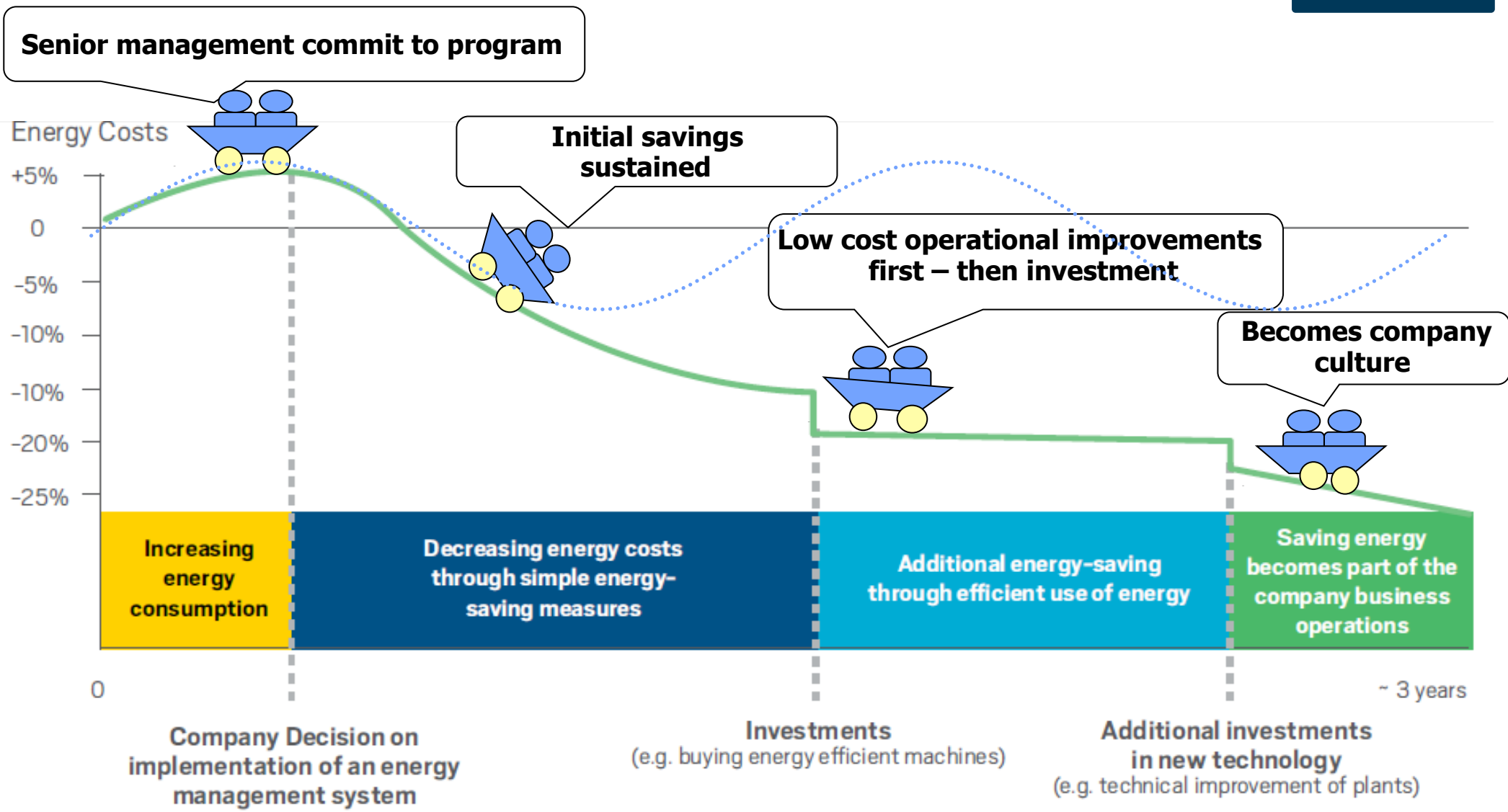

*Source: UNIDO 2010*

# Energy efficiency not integrated in daily practices



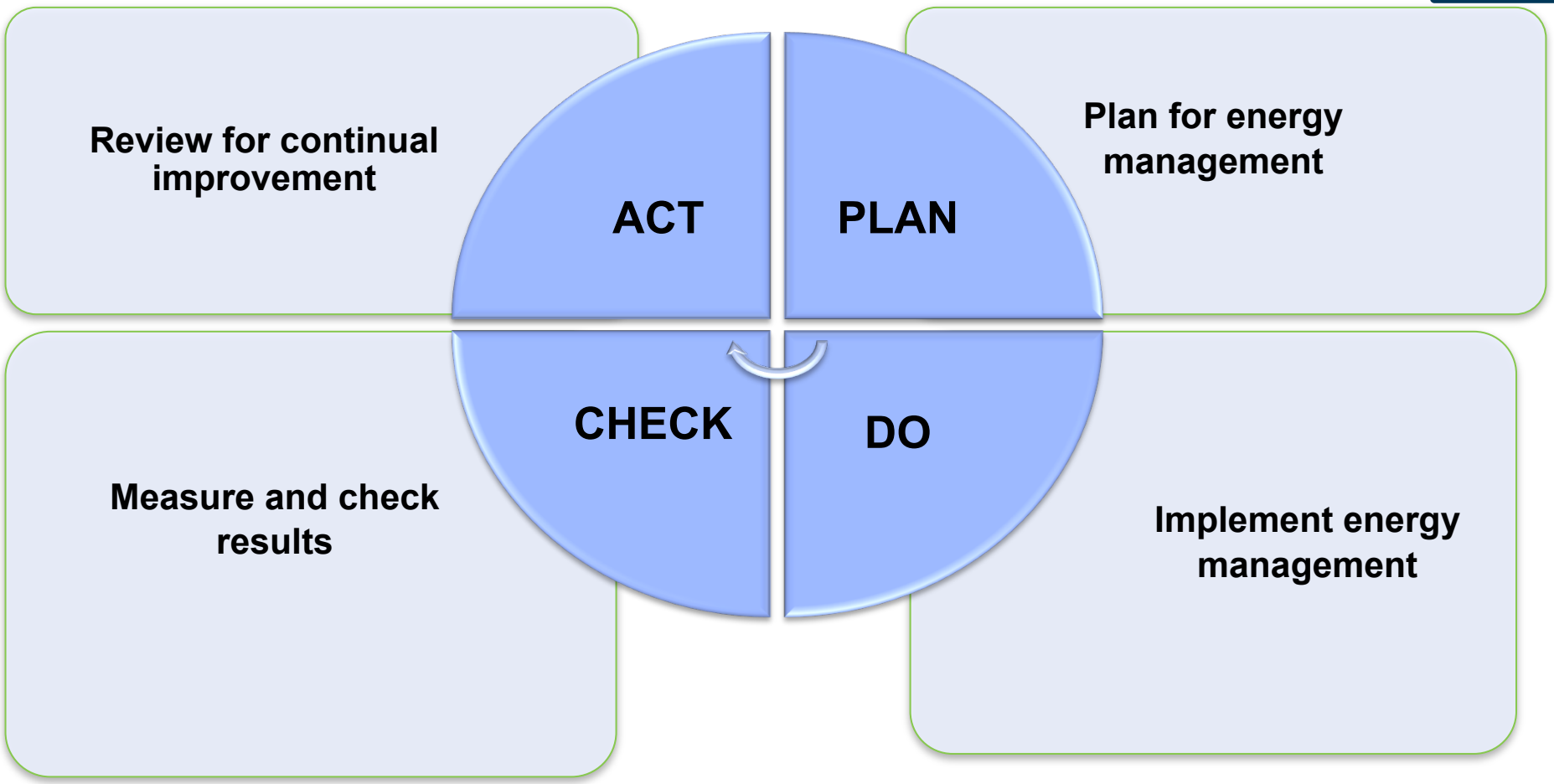

*World War II production at Plant 1 Beech Aircraft Corporation, Wichita, KS, 1942*

# Structured approach to energy management



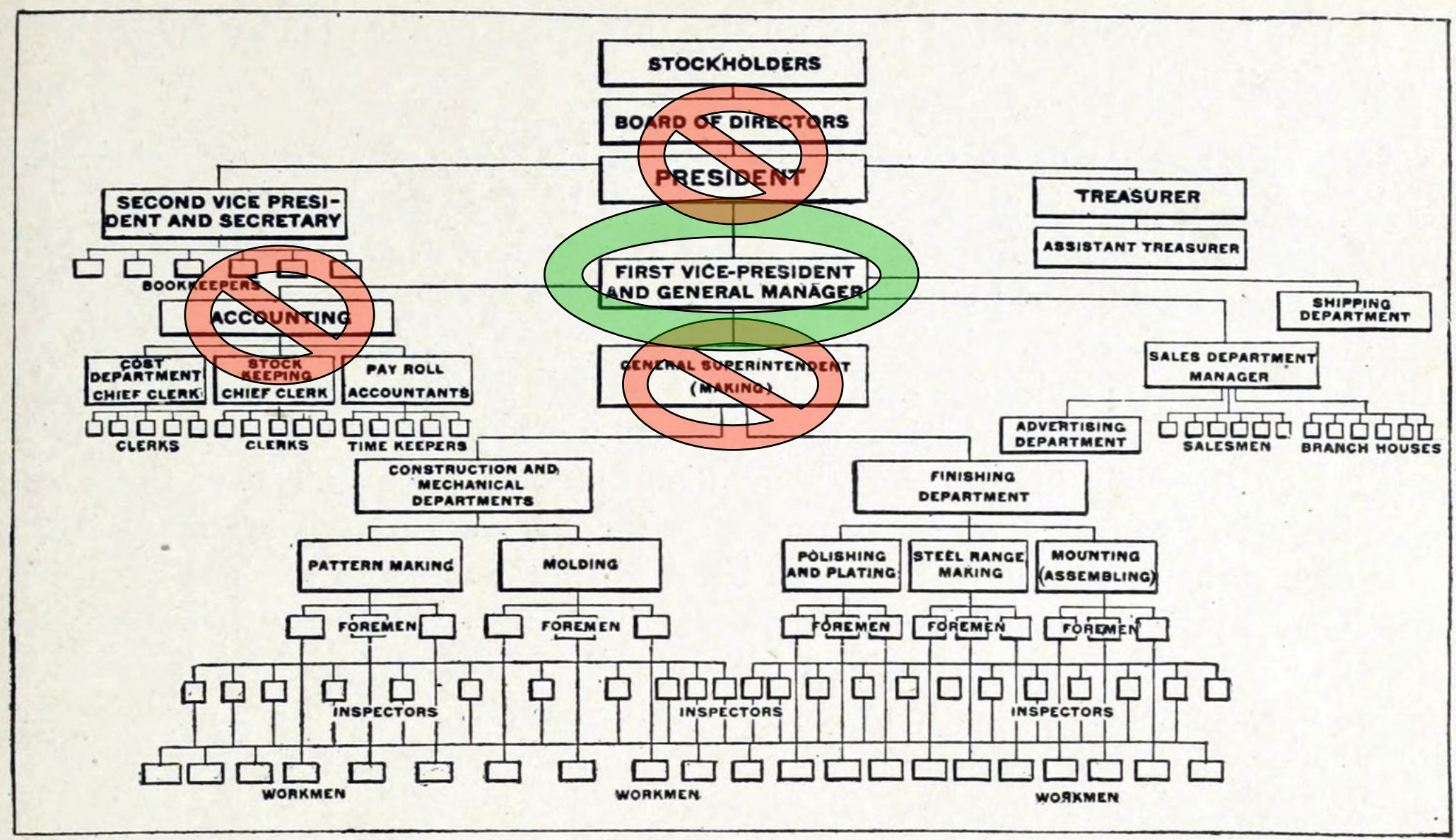

Source: Kahlenborn et al. (2012), based on Lackner & Holanek (2007)

# Continual improvement

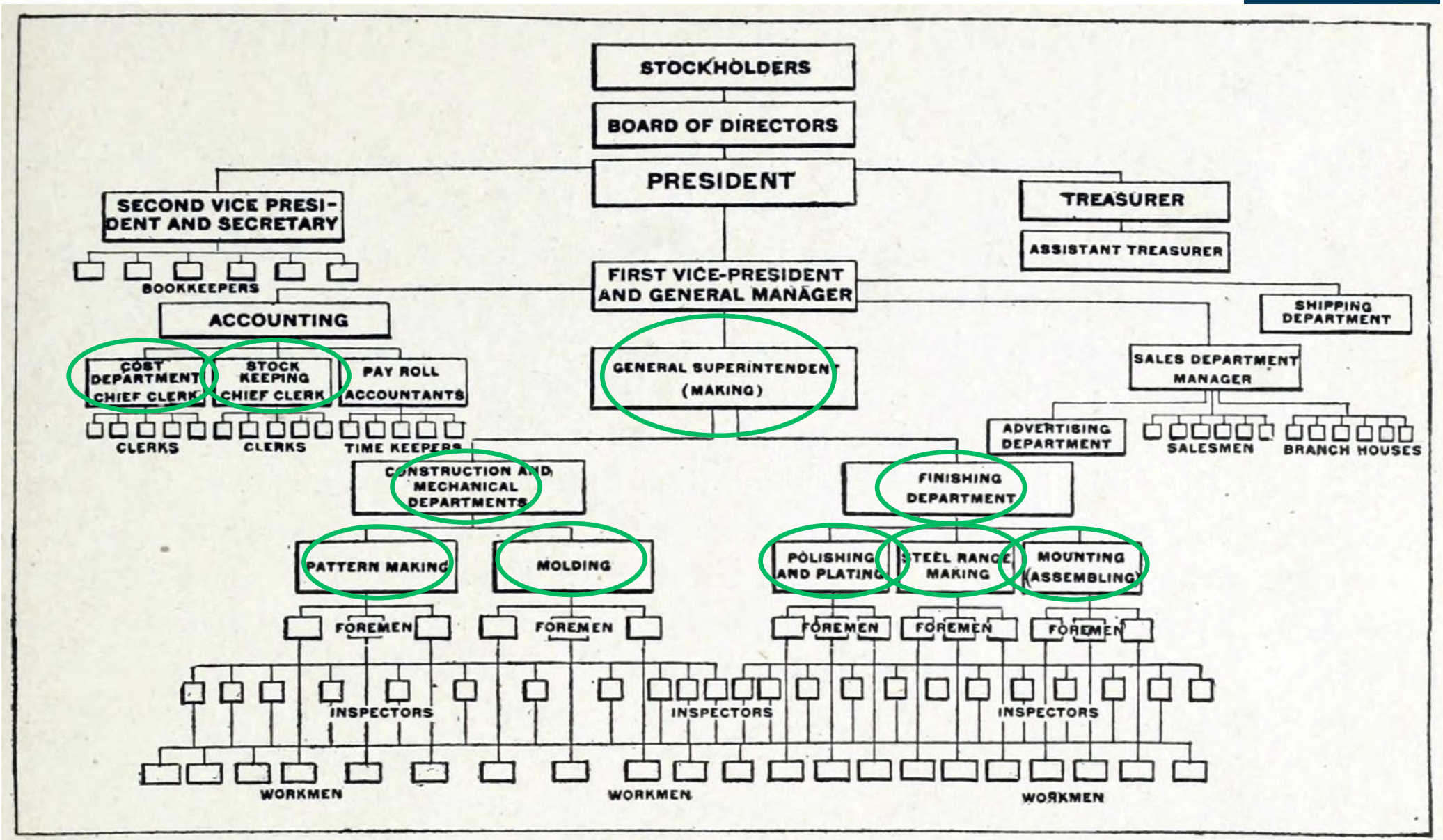



Before entering into the PDCA cycle, ***must*** gain top management commitment and form an energy team!

# First: Top management commitment



# First: An energy team example



# Plan: Energy review

- Understand what, where, how much energy is consumed within the facility
- Understand opportunities for energy savings
- Ask questions such as:
  - —Why is energy used?
  - —Where is it used within the facility?
  - —What type of energy is consumed?
  - —How much energy is consumed? How much does it cost?
  - —What are opportunities to reduce energy consumption and cost?

# Plan: Set objectives and targets

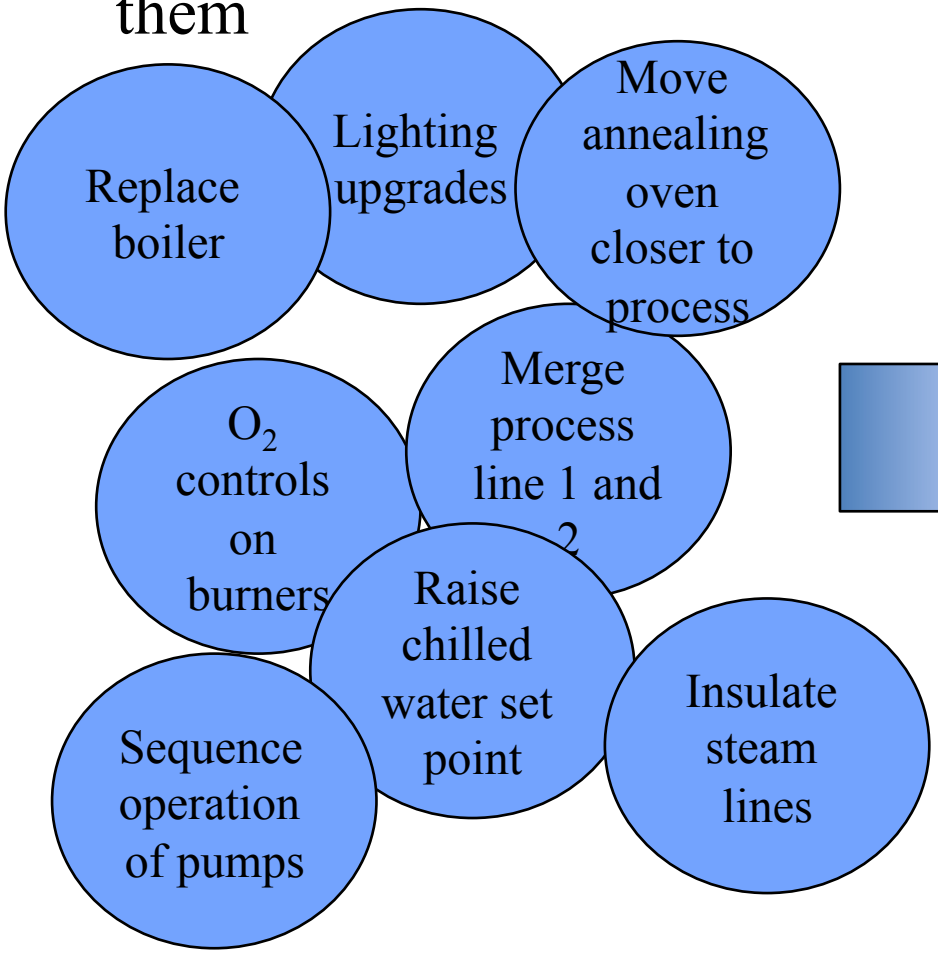
- Energy objectives are high level goals for your organization related to energy consumption
- Energy targets are milestones to work towards to achieve energy objectives
- Establishing baselines and energy performance metrics is essential to setting measurable and trackable objectives and targets

*Objective:*
*Reduce energy intensity by 10% by 2020 against a 2015 baseline*

*Supporting targets:*
*1) Reduce process line 1 energy intensity by 5% by 2020 against a 2015 baseline*
*2) Reduce warehouse energy intensity by 15% by 2020 against a 2015 baseline*
*3) Increase onsite renewable energy consumption to 15% of all electric demand by 2020*

# Do: Implementing identified opportunities

Several opportunities can be identified, but an EnMS facilitates development of mechanisms to vet, prioritize, and implement them




**Prioritized list of actions**

1. Raise chilled water set point
2. Lighting upgrades
3. Sequence operation of pumps
4. Insulate steam lines
5. $O_2$ controls on burners
6. Moving annealing oven closer to process
7. Replace boiler
8. Merge process line 1 and 2

# Do: Operational control

- Equipment and processes have indicators for efficient operation of equipment. Can range from:
  - —Simple…
    - Compressed air set to 100 psi
    - Change air filters when dP is greater than 0.1 psi
    - Automatic shut-off after 5 minutes of idling
  - —…to more complex…
    - <10 MMBtu/lb of product on a process line
    - Price points on natural gas and electricity dictating when to generate electricity using CHP or purchase from the grid
- Developing and operating within these parameters can ensure prolonged and efficient operation

# Check: Monitoring

- For each action, a strategy ('Action Plan') documenting who, what, when and expected results is developed
- After implementation, each action is monitored to ensure it is delivering the expected results
- If results are not what were expected, corrective action is taken

# Act: Review for continual improvement

The management system also needs to be reviewed for effectiveness. Corrective action is taken when/where necessary and successes are recognized

# Takeaways

- A continual improvement based-EnMS transitions a facility from a project-to-project based approach to energy management to one that instills energy considerations into the business practices
- A continual improvement based-EnMS leads to deeper and more sustained energy savings
- There are various EnMS structures based on desired level of rigor
  - —System described here is “core”
  - —Subsequent sections today will focus on more rigorous approaches, specifically ISO 50001 and Superior Energy Performance

# In Their Own Words – Video of MedImmune Pharmaceutical Experience with ISO 50001 and SEP

# MedImmune: Gaithersburg, MD

MedImmune
A member of the AstraZeneca Group

2014–17 | SILVER
Superior Energy Performance®
U.S. DEPARTMENT OF ENERGY

- **SEP Silver Certified**: Gaithersburg, MD headquarters
- First biotech facility to be SEP and ISO 50001 certified
- 8.5% improvement in energy performance over 3 years
- Combination of no-cost projects and capital projects (e.g., CHP)
- DOE Better Plants Partner

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# Fundamentals of ISO 50001 – Energy Management System Standard

*Dr. Peter Therkelsen*

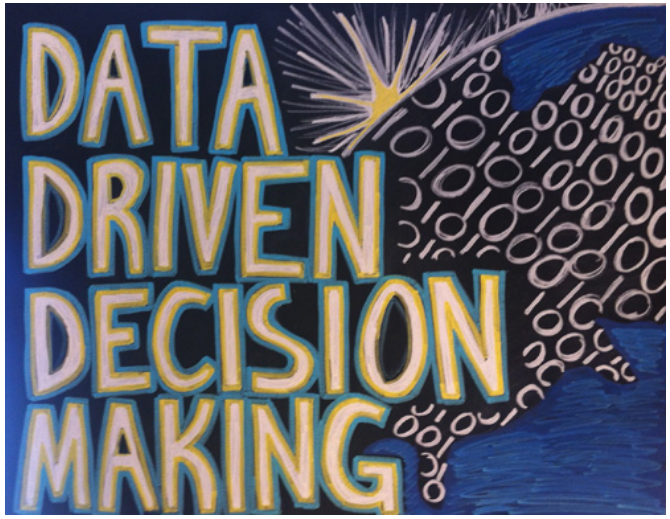
# ISO Harmonizes Standards on a Global Scale

International Organization for Standardization

# ISO 50001 – Not Just Another ~~Paperwork Nightmare~~ Management Standard

ISO50001

ENERGY MANAGEMENT




ENVIRONMENTAL MANAGEMENT SYSTEM

ISO 14001

# Then What is ISO 50001?

# Introduction to ISO 50001 – Energy Management System Standard

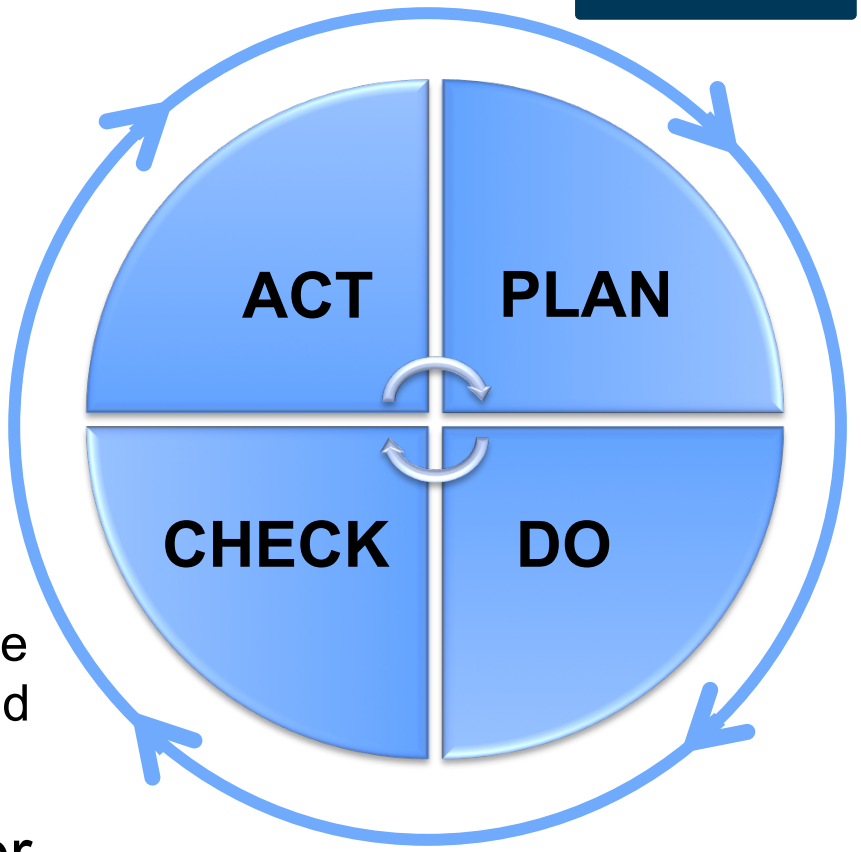
- Requirements for energy management systems (EnMS)
- Applies to any organization
- Uses collection and analysis of *available* energy data to support energy management decision making.
- Improves:
  - Ability to benchmark, measure, and report
  - Transparency and communication to management
  - Operations and capital cost decisions

International Organization for Standardization

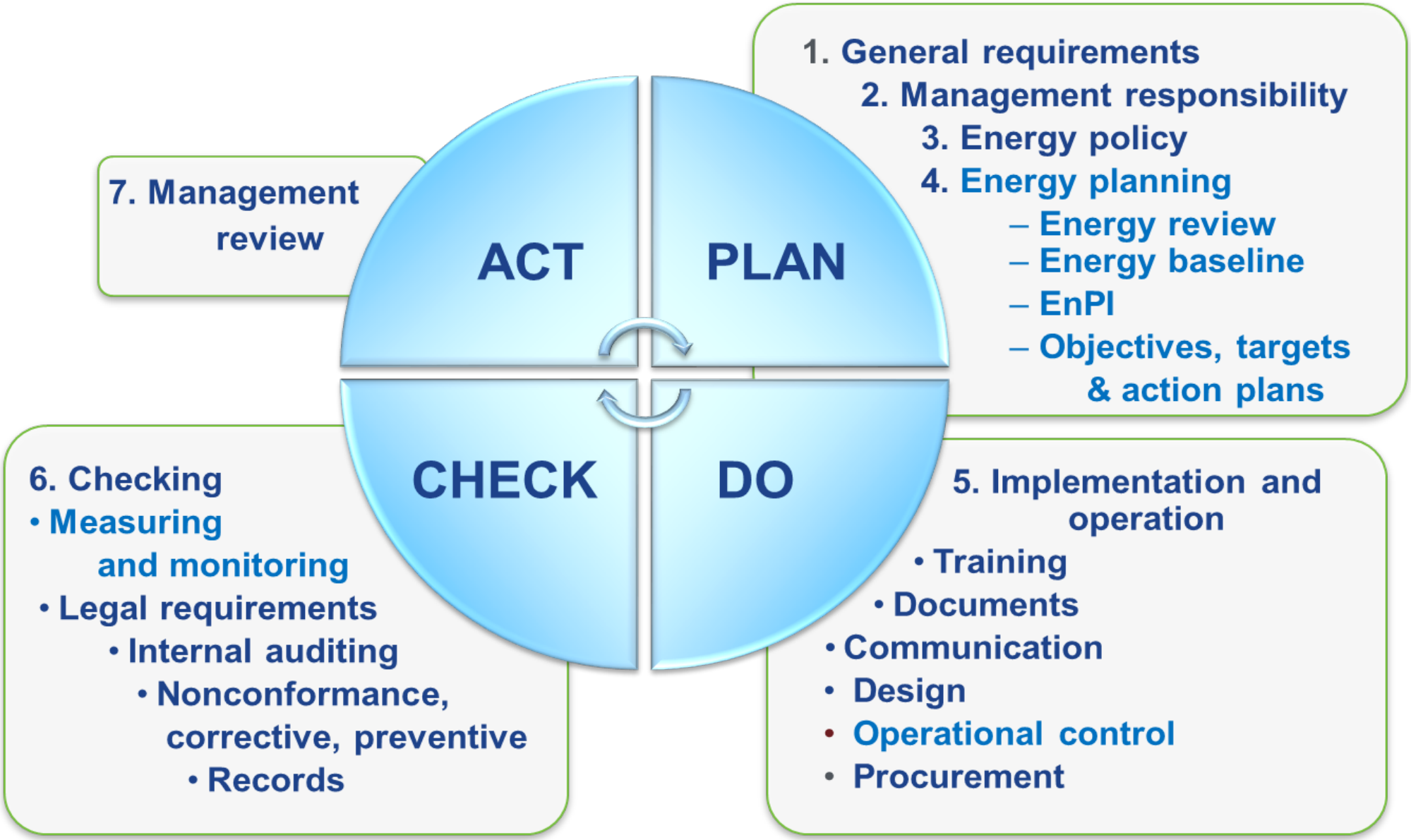
Published June 2011

# Introduction to ISO 50001 – Foundation and Requirements

- Top management commitment
- Energy team
- Energy policy
- Energy planning process
  - Energy review
  - Identification of significant energy uses
  - Establish energy baseline
  - Selection of one or more Energy Performance Indicators to quantify energy performance and measure improvements
- Operating controls and procedures for energy uses
- Documentation of energy performance improvement
- Management review



# Outline of ISO 50001



# Connections and Priorities for Energy Performance Improvement are Lacking

Top Management

Maximize Shareholder Value

Stay in Business

Energy = Sunk Cost

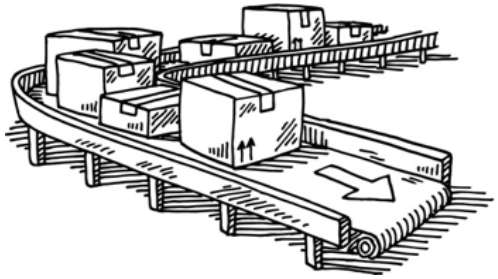
Energy, Environmental, Health, and Safety Managers

Meet Production Demands

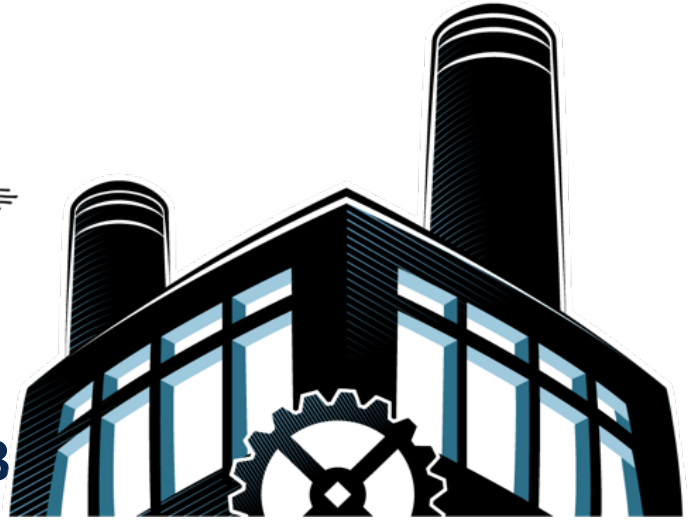
Avoid Violations

Lower Energy Prices

Production Managers and Staff



Produce Product



# Benefits of ISO 50001 Implementation

- Energy consumption savings
- Energy cost savings
- Reduced peak demand
- Improved operations and maintenance
- Decreased environmental impact from waste
- Public credibility for energy consciousness
- An engaged and aware workforce
- Increased organizational communication regarding energy
- Ability to leverage organization to improve energy performance
- Reduced downtime

# SEM Checklist Activity

1. Pick up a participant package with checklist.
2. Review the checklist focusing on the left column and considering the text in the right column. Don't get hung up on unknown terms or ideas.
3. Enjoy lunch!
4. Come back and lets share our results.

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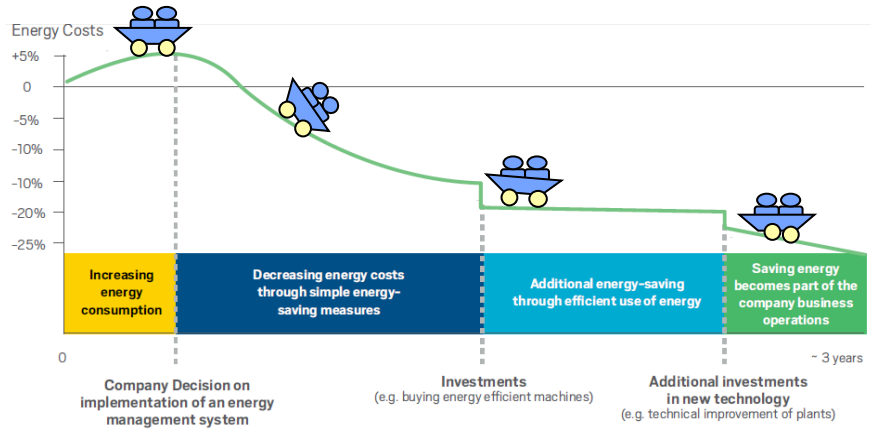
# Fundamentals of the Superior Energy Performance Program

*Dr. Peter Therkelsen*

# What Have We Talked About So Far?




MedImmune

ISO50001

ENERGY MANAGEMENT

# ISO 50001 – Energy Performance Improvement… But How Much?

- ISO 50001 does not:
  - — Specify targets for energy performance improvement
  - — Say how to measure improvement
  - — Provide recognition for achievement of improvement

ISO50001

ENERGY MANAGEMENT

≠

# SEP - An Energy Performance Improvement Program

- A continual energy performance improvement program recognizing excellence in organizational energy management practices.

- SEP Certification based upon third party verification of:
  - — energy management system (ISO 50001) and
  - — energy performance improvement (ANSI/MSE 50021)

Superior Energy Performance®
U.S. DEPARTMENT OF ENERGY

=

ISO International Organization for Standardization

Energy Management System

+

# Commonly Expressed Pros of ISO 50001 and SEP

International Organization for Standardization

Energy Management System

- Framework that the whole organization can make use of.
- Enables internal communication.
- Certification proves strong EnMS.

- Goal to shoot for.
- SEP M&V protocol = transparent determination of energy savings.
- Certification proves savings.

# In Their Own Words: Value of Superior Energy Performance

"SEP adds rigor, analysis, and gives good guidance. It's one thing to have a target and objective, but SEP gives tools that empower you to be more disciplined and prove the impact certain activities have."

-Nissan North America Energy Team

"SEP is the mechanism responsible for driving continuous improvement in energy performance."

- Stephen Cannizzaro, Sustainability Manager, General Dynamics

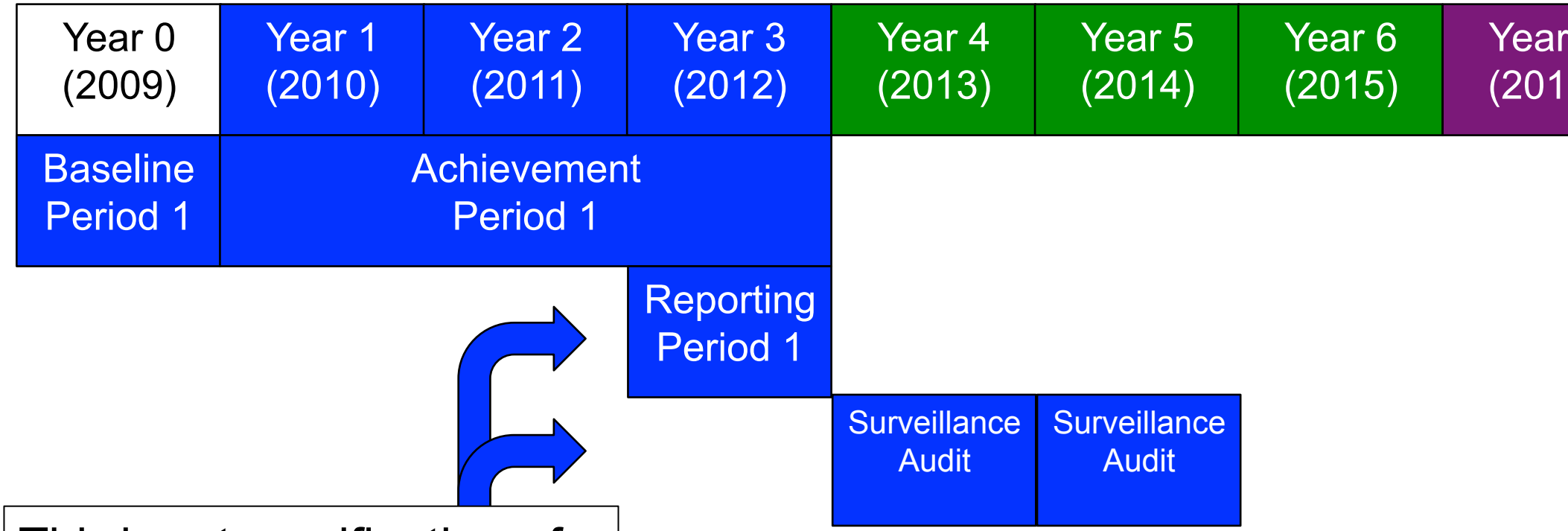
"SEP certification enables us to validate energy savings with actual, verifiable numbers."

-Alan Resnik, Director of Facilities and Operations Environmental Management, Cummins Inc.

"…Without verification, stated savings are just a nice statement."

- Bob Bechtold, President, Harbec Inc.

# Ensuring Savings are Sustained with Third Party Certification

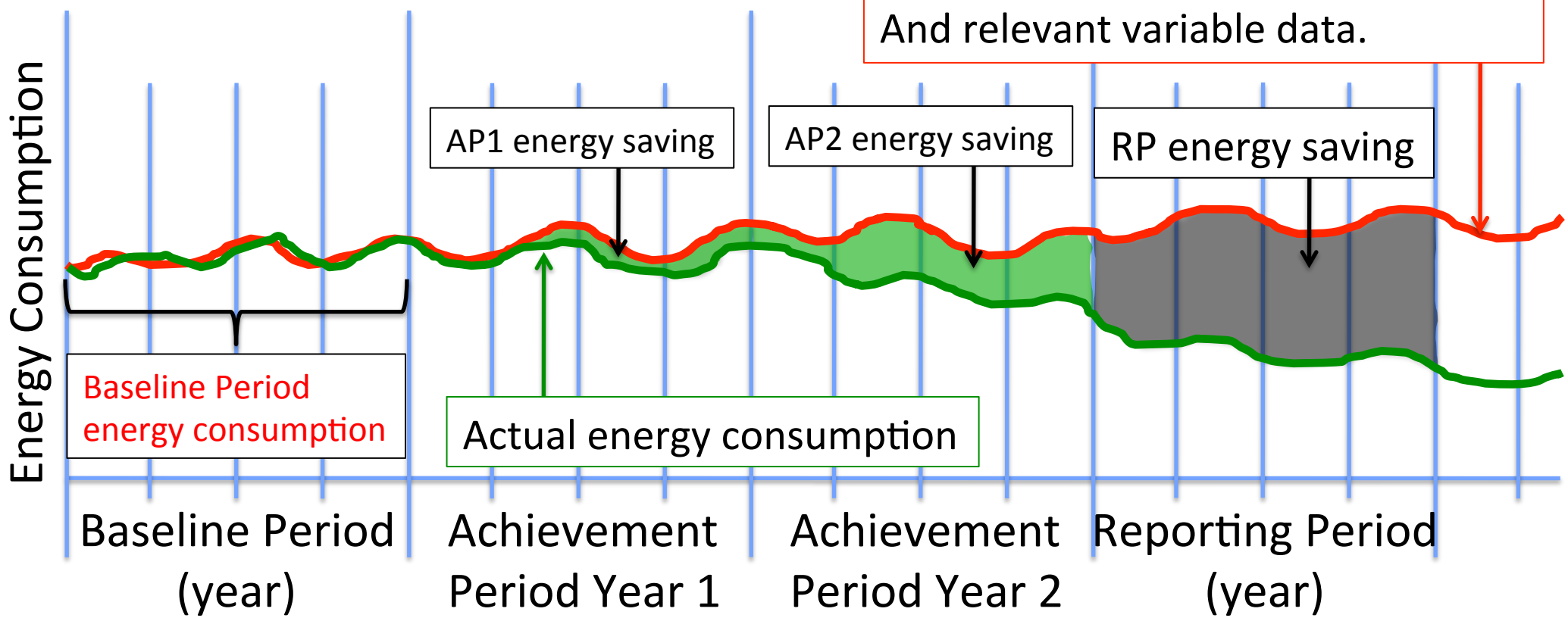



Third party verification of EnMS and energy performance improvement

# Energy Performance Improvement for SEP – How is it Determined?

SEP compares Reporting Period energy energy consumption to Baseline Period energy consumption

Modeled energy consumption Using baseline energy consumption And relevant variable data.



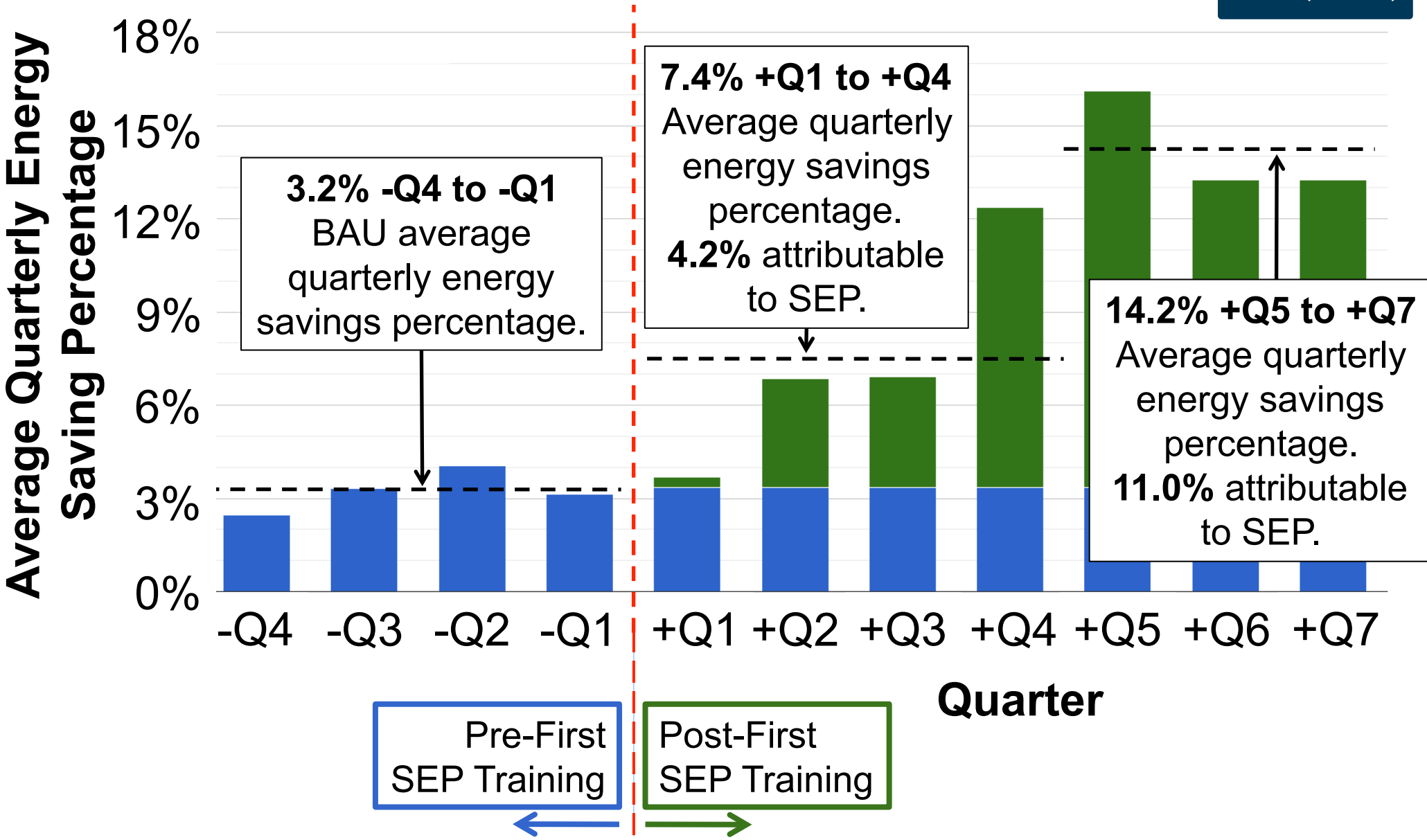
# SEP Certified Facilities and Verified Energy Performance Improvements

| | | |
|---|---|---|
| Schneider Electric | Saanichton, BC Canada | 30.6% |
| | **Smyrna, TN - Recertified** | **23.1%** |
| | Clovis, CA | 16.7% |
| | Seneca, SC | 15.6% |
| | Hopkins, SC | 10.2% |
| | Tijuana, Mexico | 10.2% |
| | Peru, IN | 24.9%<br>10 yr RP |
| | Cedar Rapids, IA | 8.8% |
| | Lexington, KY | 6.9% |
| | Lincoln, NE | 6.5% |
| | Rojo Gomez, Mexico | 5.9% |
| VOLVO | Mack Trucks, Macungie, PA | 41.9%<br>10 yr RP |
| | **Dublin, VA - Recertified** | **28.4%<br>10 yr RP** |
| | Hagerstown, MD | 20.9% |

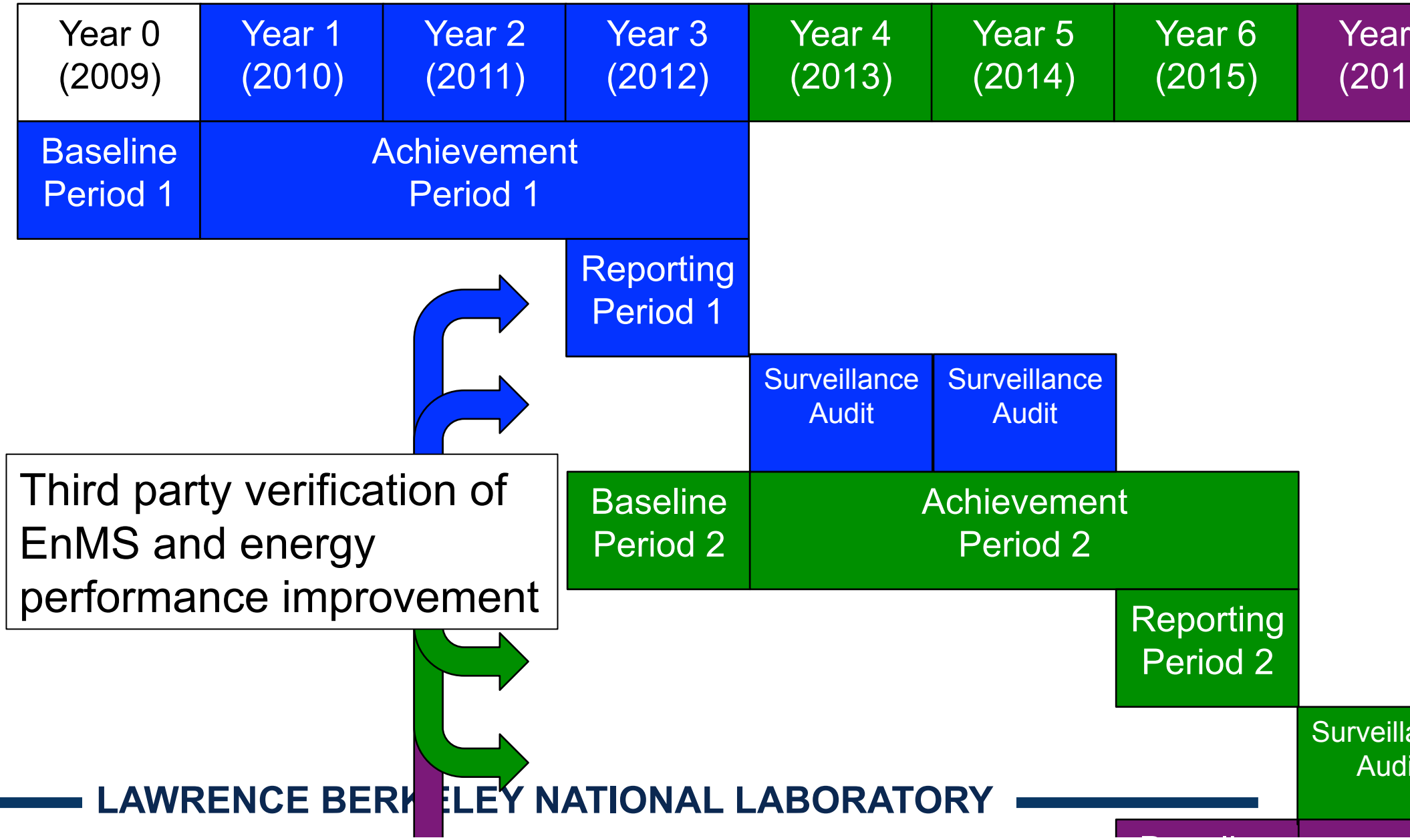
| | | |
|---|---|---|
| 3M | **Brockville, Ontario Canada - Recertified** | **21.4%<br>7 yr RP** |
| | Cordova, IL | 5.6% |
| NISSAN | **Smyrna, TN - Recertified** | **17.7%** |
| HARBEC | Ontario, NY | 16.5% |
| Cummins | Whitakers, NC | 12.6% |
| Coca-Cola | Dunedin, FL | 12.2% |
| GENERAL DYNAMICS | Scranton, PA | 11.9% |
| COOPERTIRES | Texarkana, AR | 10.1% |
| BRIDGESTONE | Wilson, NC | 16.8%<br>10 yr RP |
| OLAM | Gilroy, CA | 9.8% |
| MedImmune | Gaithersburg, MD | 8.5% |
| CURTISS WRIGHT | Cheswick, PA | 7.6% |
| LAND O' LAKES | Carlisle, PA | 5.7% |

Improvement with 3 year RP unless stated otherwise - Last updated: September 1, 2015

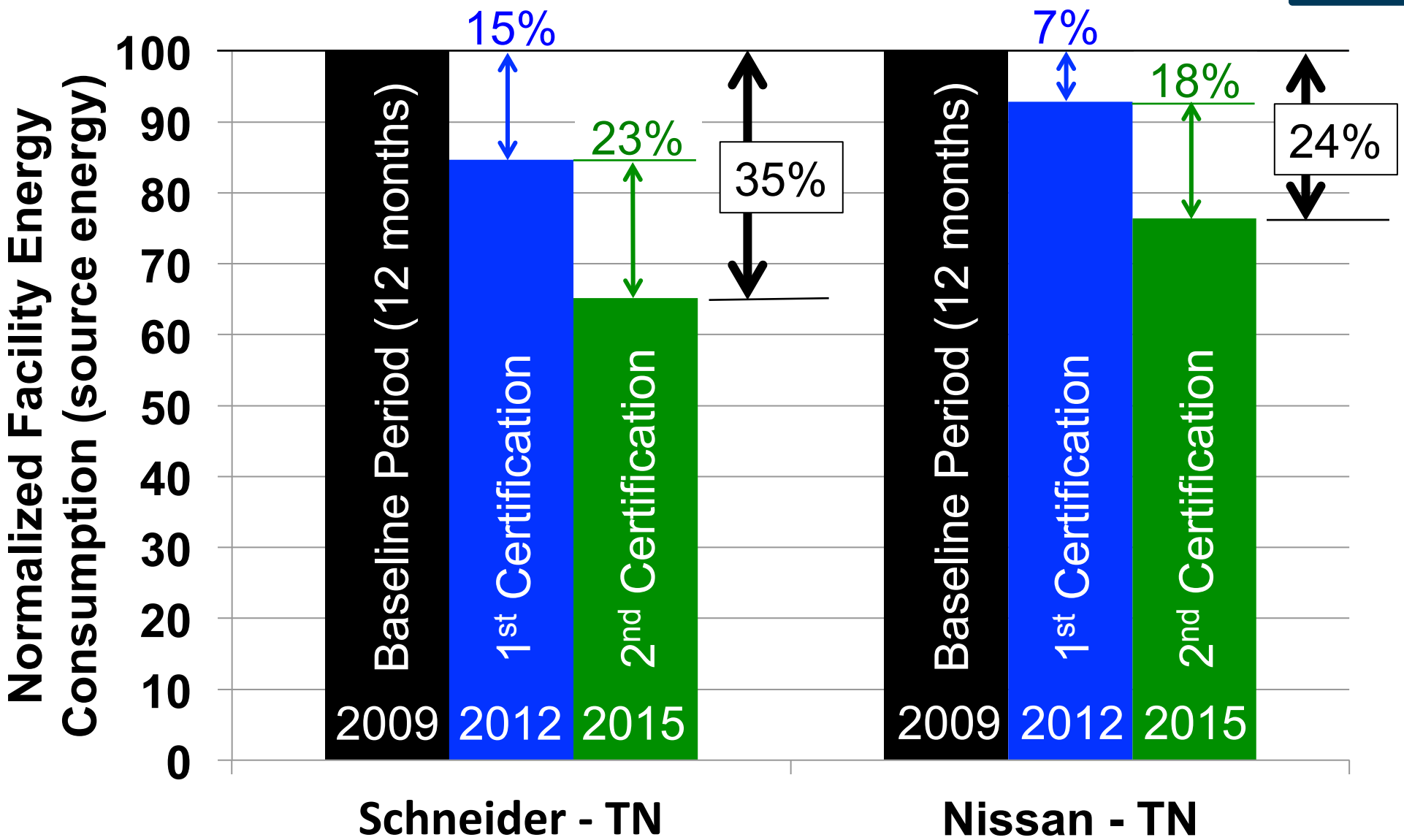
# Verified Facility Wide Energy Savings Attributable to SEP



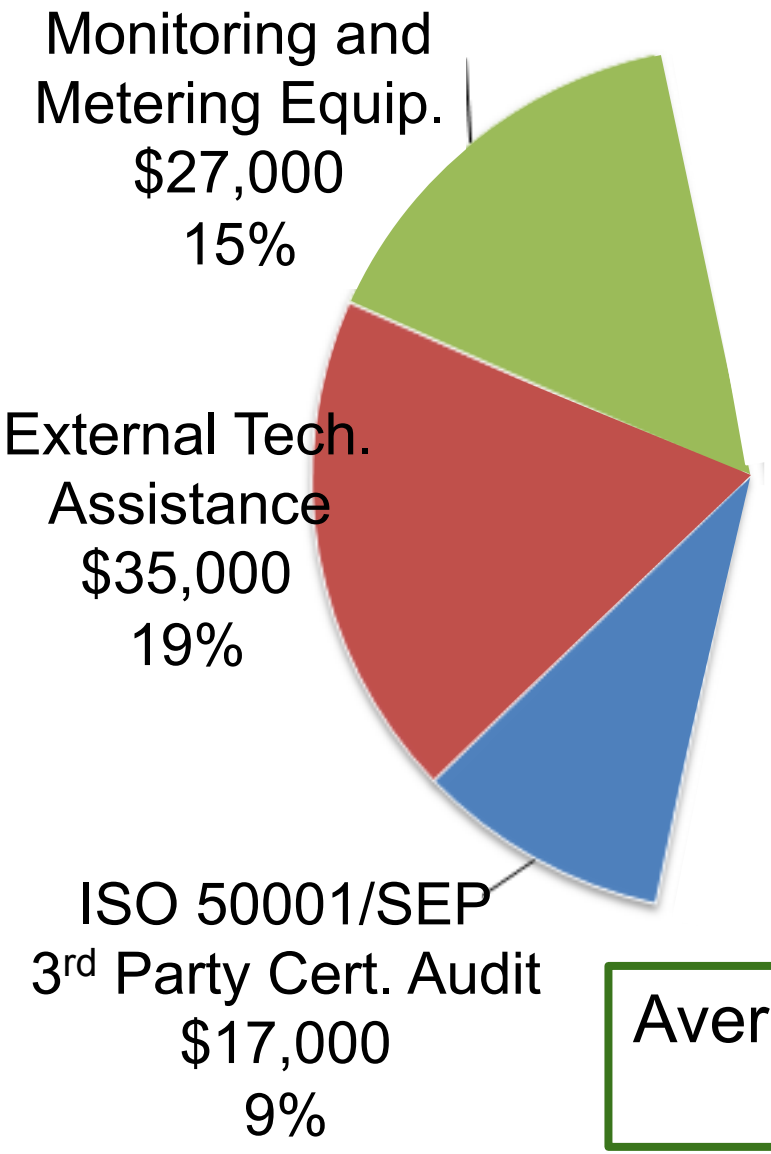
# Ensuring Savings are Sustained with Third Party Certification



# Recertified Facilities Show Continual Energy Performance Improvement

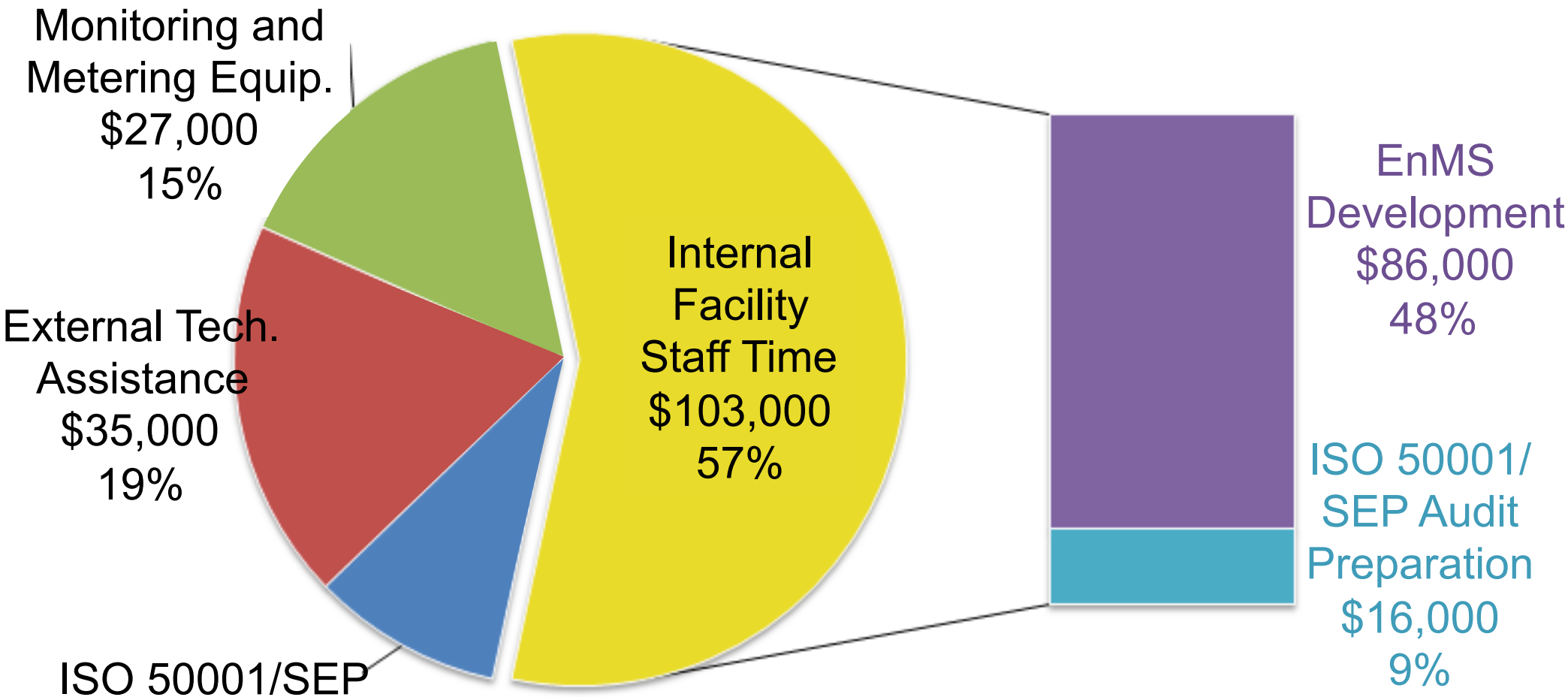


# Costs of Implementing and Certifying to Superior Energy Performance




Average SEP Implementation Costs
$77,000

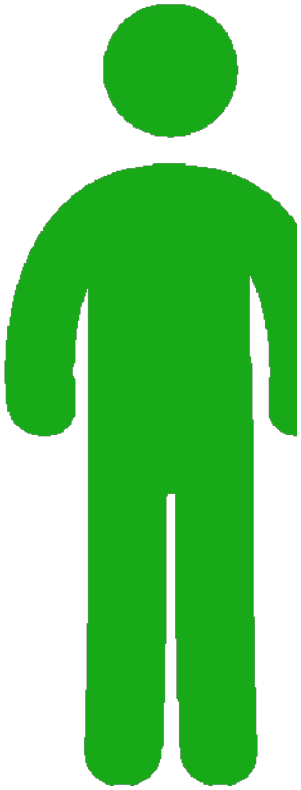
# Costs of Implementing and Certifying to Superior Energy Performance




Average SEP Implementation Costs
$180,000

# An Improved Methodology to Determine Internal Staff Costs

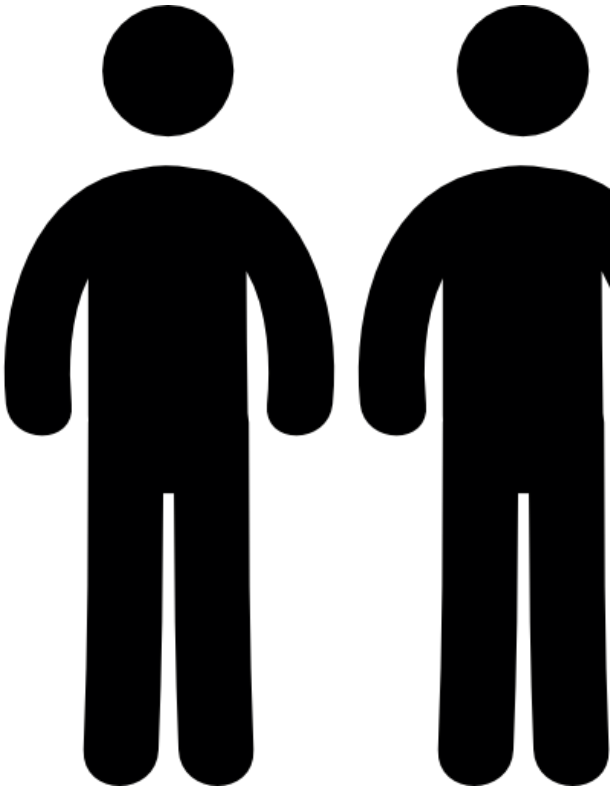
**Labor costs attributable to SEP**



**0.8 person/yr**
**$103,000**

=

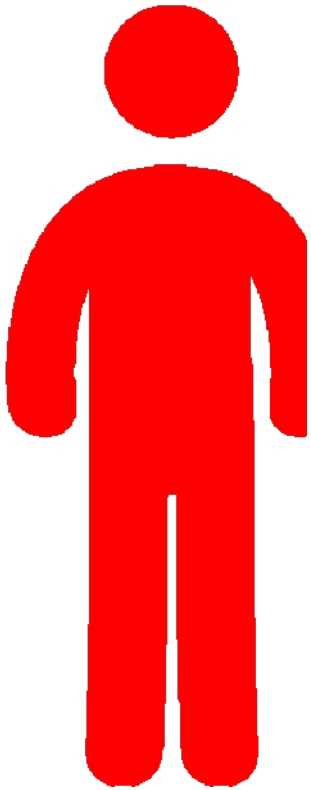
Total internal labor costs



1.7 person/yr
$217,000

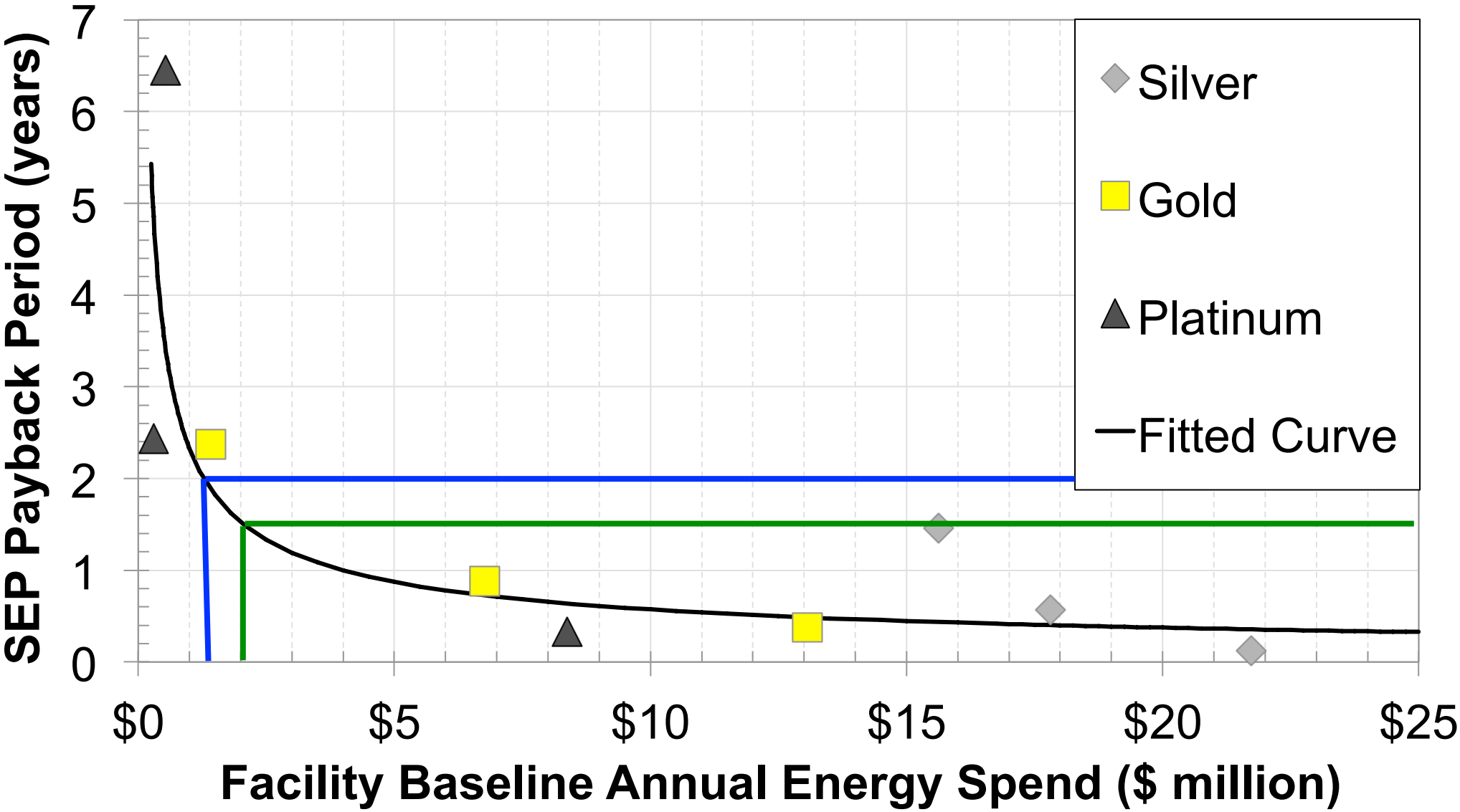
-

Sunk EnMS labor costs



0.9 person/yr
$114,000

# A Representative Payback Function



# M&V Protocol

- Clear methodology for determining energy performance improvement
  - Energy accounting
  - Energy savings
  - Criteria needed to be SEP certified

## 1. Introduction

This Measurement and Verification Protocol for Industry defines the procedures that will be used to confirm conformance with the energy performance level requirements of the Superior Energy Performance (SEP) Program. The Program has two paths. This document is structured to reflect those different paths.

**Requirements**
The SEP program criteria for all levels require a facility to:

A. Have an energy management system that conforms to the ISO 50001: *Energy management systems-Requirements with guidance for use* (referred to as ISO 50001 in the remainder of the document), and
B. Have met program performance levels for the selected application category.
   1. For the Energy Performance Pathway, meeting the program performance level means achieving an energy performance improvement of a designated percentage (varying with the program level) over the past 3 years.
   2. For the Mature Energy Pathway, meeting the performance level means achieving designated energy performance improvements over a required period of time and demonstrating preferred practices in accordance with the SEP Industrial Facility Best Practice Scorecard.

Google these terms together to find the M&V protocol online:

- DOE
- AMO
- SEP
- M&V Protocol

# EnPI Tool

- Free Excel based regression analysis tool
  - Track energy consumption and relevant variables
  - Build energy consumption models
    - Enables apples to apples comparison
  - Output directly translates to reporting forms

| | A | B | C |
|---|---|---|---|
| 1 | General Energy Performance Results | | |
| 2 | | | |
| 3 | | FY1 | FY2 |
| 4 | Electricity (MMBTU) | 15,865 | 14,875 |
| 5 | Natural Gas (MMBTU) | 463 | 358 |
| 6 | TOTAL (MMBtu) | 16,328 | 15,233 |
| 7 | Electricity (MMBTU) Annual Savings | 0 | 990 |
| 8 | Electricity (MMBTU) Estimated Cost Savings | $ - | $ 7,740.35 |
| 9 | Natural Gas (MMBTU) Annual Savings | 0 | 105 |
| 10 | Natural Gas (MMBTU) Estimated Cost Savings | $ - | $ 747.56 |

Google these terms together to find the scorecard online:

- DOE
- AMO
- SEP
- EnPI Tool

# SEP Scorecard

- Catalog of points useful towards certification
  - Rewards above and beyond EnMS
  - Credit for innovation in energy efficiency
  - Recognizes contribution of on-site renewables

Superior Energy Performance[CM]

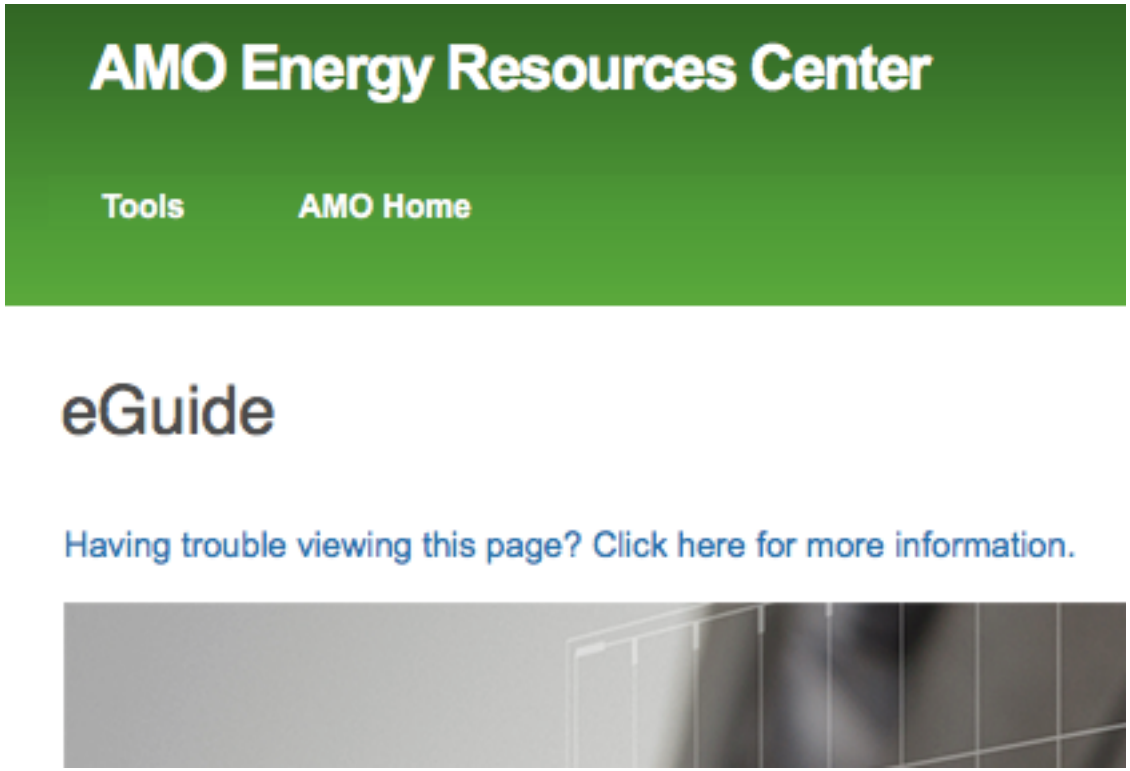
**Industrial Facility Best Practice Scorecard**

Google these terms together to find the scorecard online:

- DOE
- AMO
- SEP
- Scorecard

# eGuide

- In depth resource to understand
  - — Strategic energy management
  - — ISO 50001
  - — Superior Energy Performance




Google these terms together to find the scorecard online:

- DOE
- AMO
- eGuide

# Land O'Lakes: Carlisle, PA

- **SEP Silver Certified**: Carlisle, PA facility
- First dairy manufacturer to be SEP and ISO 50001 certified
- 5.7% improvement in energy performance over 3 years
- DOE Better Plants Partner

# Nissan: Smyrna, TN

2015–18 | PLATINUM
Superior Energy Performance®
U.S. DEPARTMENT OF ENERGY

"SEP adds rigor, analysis, and gives good guidance. It's one thing to have a target and objective, but SEP gives tools that empower you to be more disciplined and prove the impact certain activities have."

-Nissan North America Energy Team

- **SEP Platinum Certified**: Smyrna, TN vehicle assembly plant
- **Sustained achievement**:
  - 2015 Recertified SEP Platinum
    - 17.7% improvement in energy performance over 3 years
    - **6 week payback**
  - 2012 Certified SEP Silver
    - **$938,000 total annual energy savings**; 7.2% improvement over 3 years
    - **4 month payback**
- **Used DOE EnPI Tool** to measure & track improvements

# Cummins: Rocky Mount Engine Plant

2014–17 | GOLD
Superior Energy Performance®
U.S. DEPARTMENT OF ENERGY

- **SEP Gold Certified**: Rocky Mount Engine Plant, Whitakers, NC facility
- 12.6% energy performance improvement over 3 years
- **$716,000 annual energy savings**
- **11-month payback** from low- or no-cost operational changes
- DOE Better Plants Partner

# Bridgestone: Wilson, NC

BRIDGESTONE

2012–15 | SILVER
Superior Energy Performance®
U.S. DEPARTMENT OF ENERGY

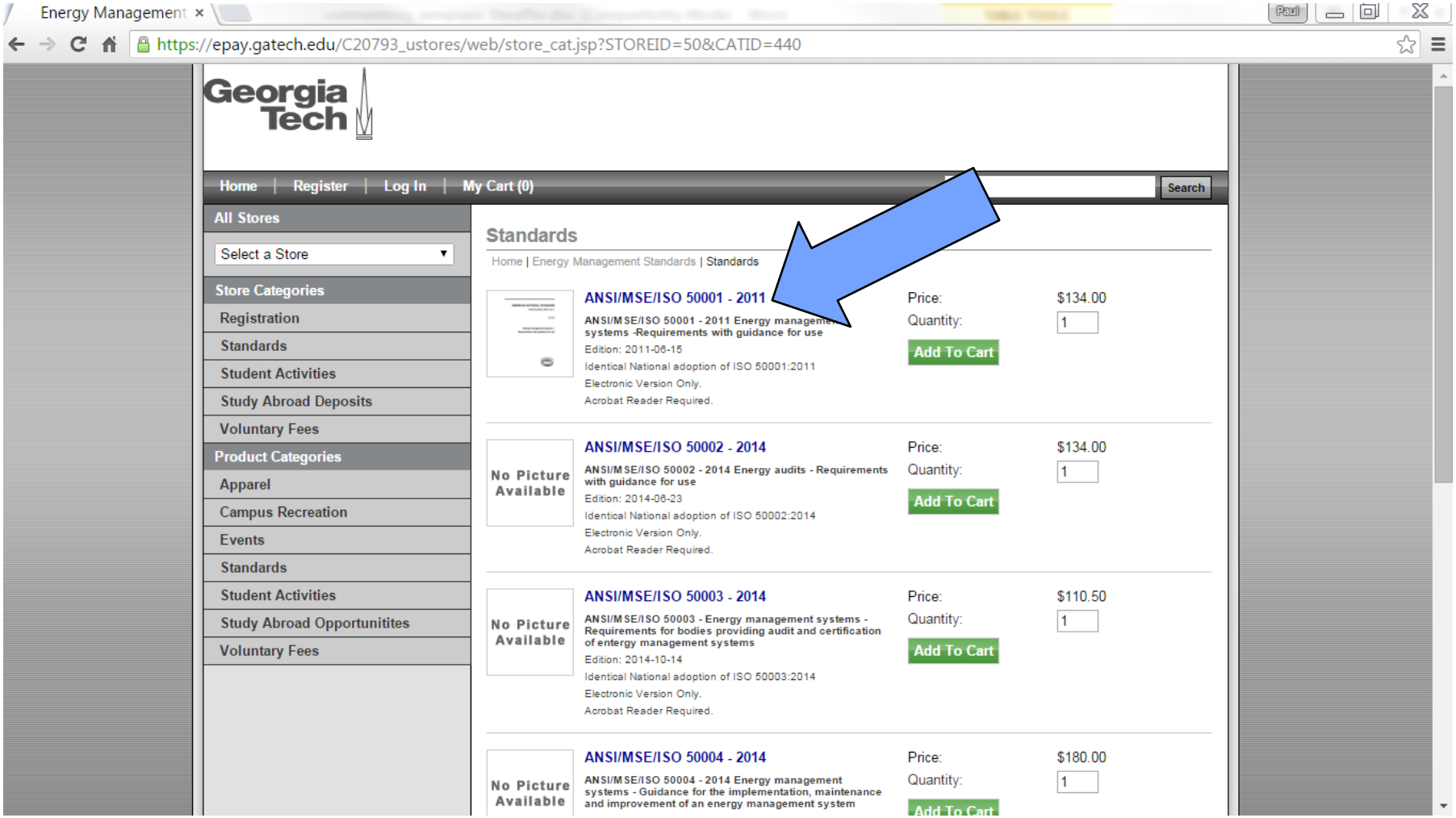
- **SEP Silver Certified**: Wilson, NC facility
- 16.8% improvement in energy performance over 10 years
- Recognized by Honda with an energy reduction award, as a result
- Best practices identified in SEP implementation will continue to be spread across operations facilities, increasing the impact
- Prior certification to ISO 140001 helped, team modified existing documentation and practices
- DOE Better Plants Partner

# What to do Next

*Paul Sheaffer, CP EnMS – Industrial, SEP PV*

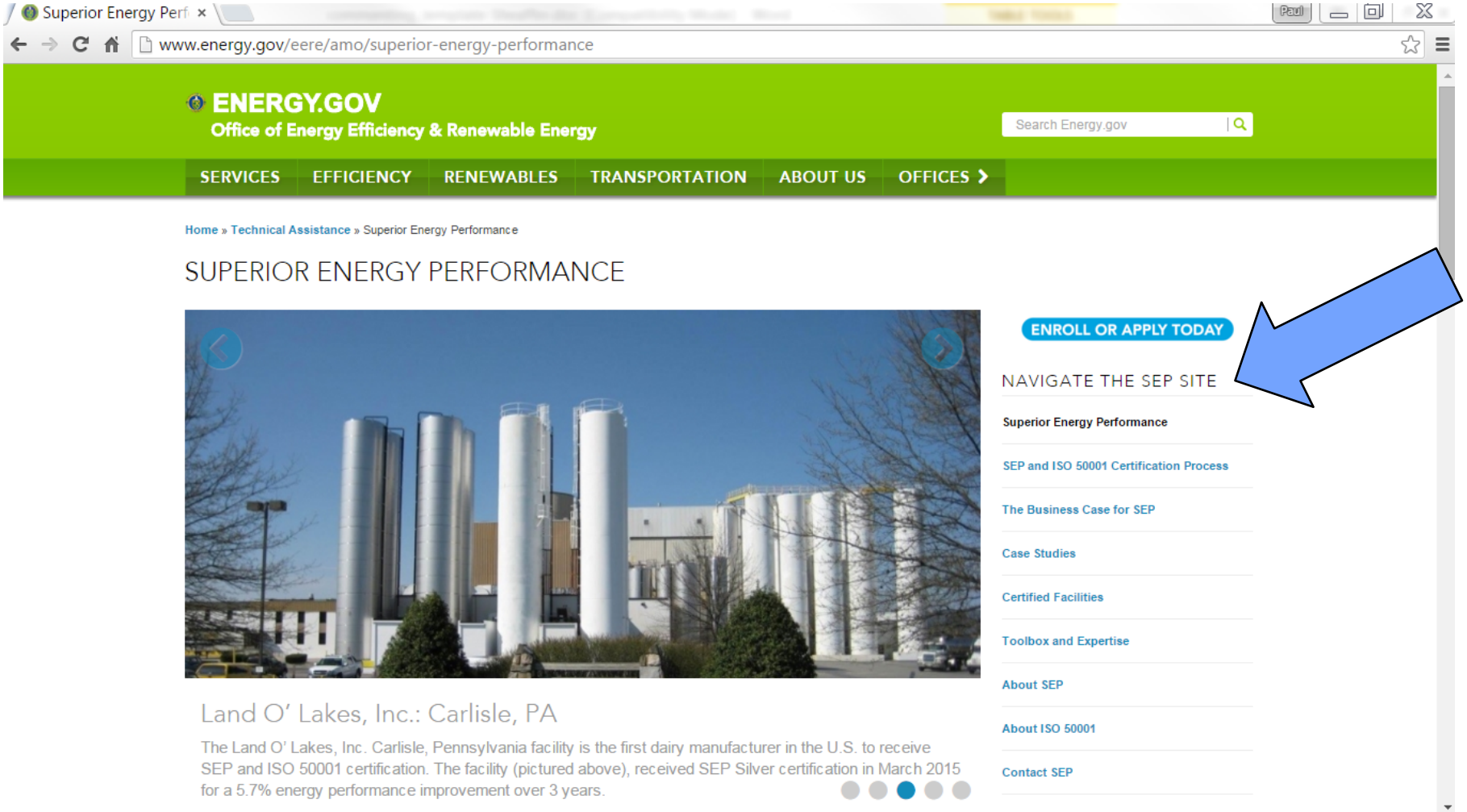
# Get a copy of ISO 50001

- Available in the US from Georgia Tech https://epay.gatech.edu/C20793_ustores/web/store_main.jsp?STOREID=50



# Review Information on SEP

- USDOE's Advanced Manufacturing Office (AMO) http://www.energy.gov/eere/amo/superior-energy-performance

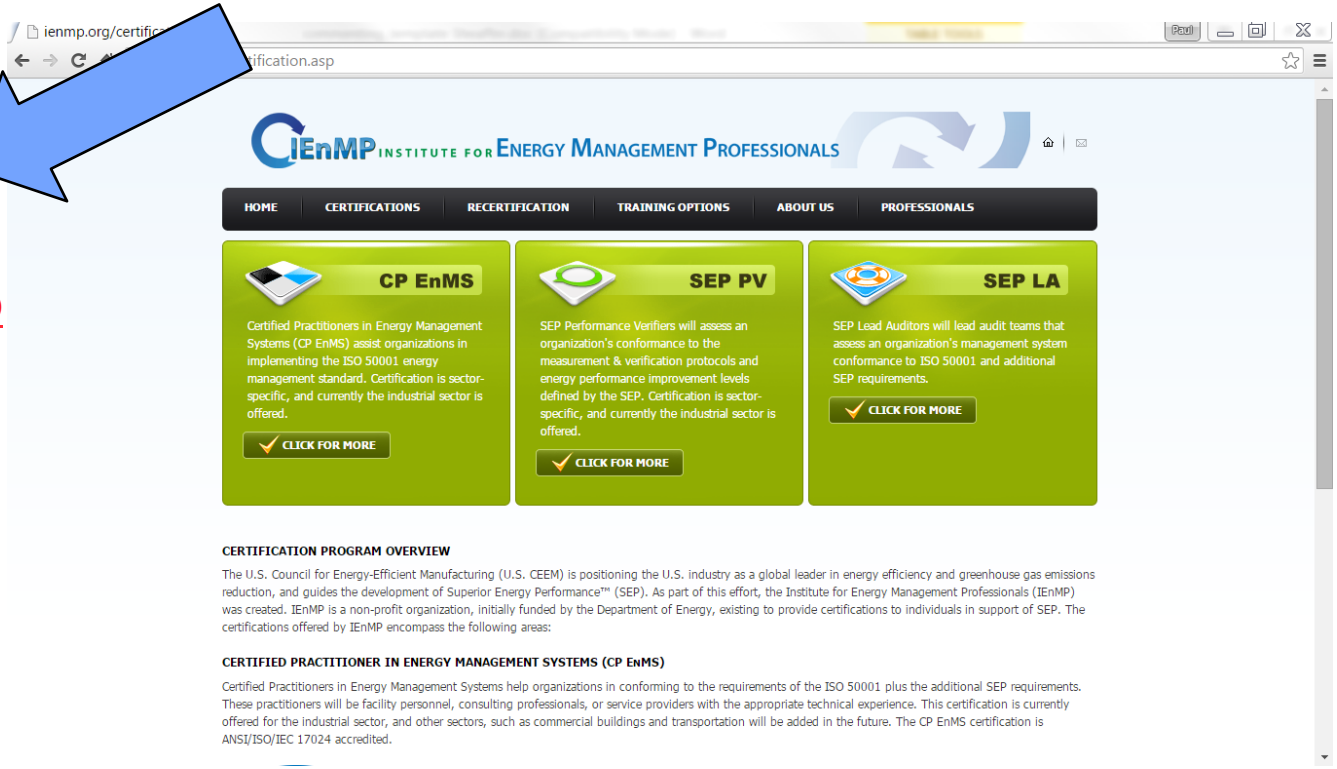


# Build your Workforce

- 4 professional credentials (with training programs)
- Certified Practitioner in Energy Management Systems – Industrial (CP EnMS – Industrial)
- ISO 50001 Lead Auditor
- SEP Lead Auditor
- SEP Performance Verifier

http://ienmp.org/certification.asp

— Train your internal staff
— Hire a consultant
— Get a third-party audit



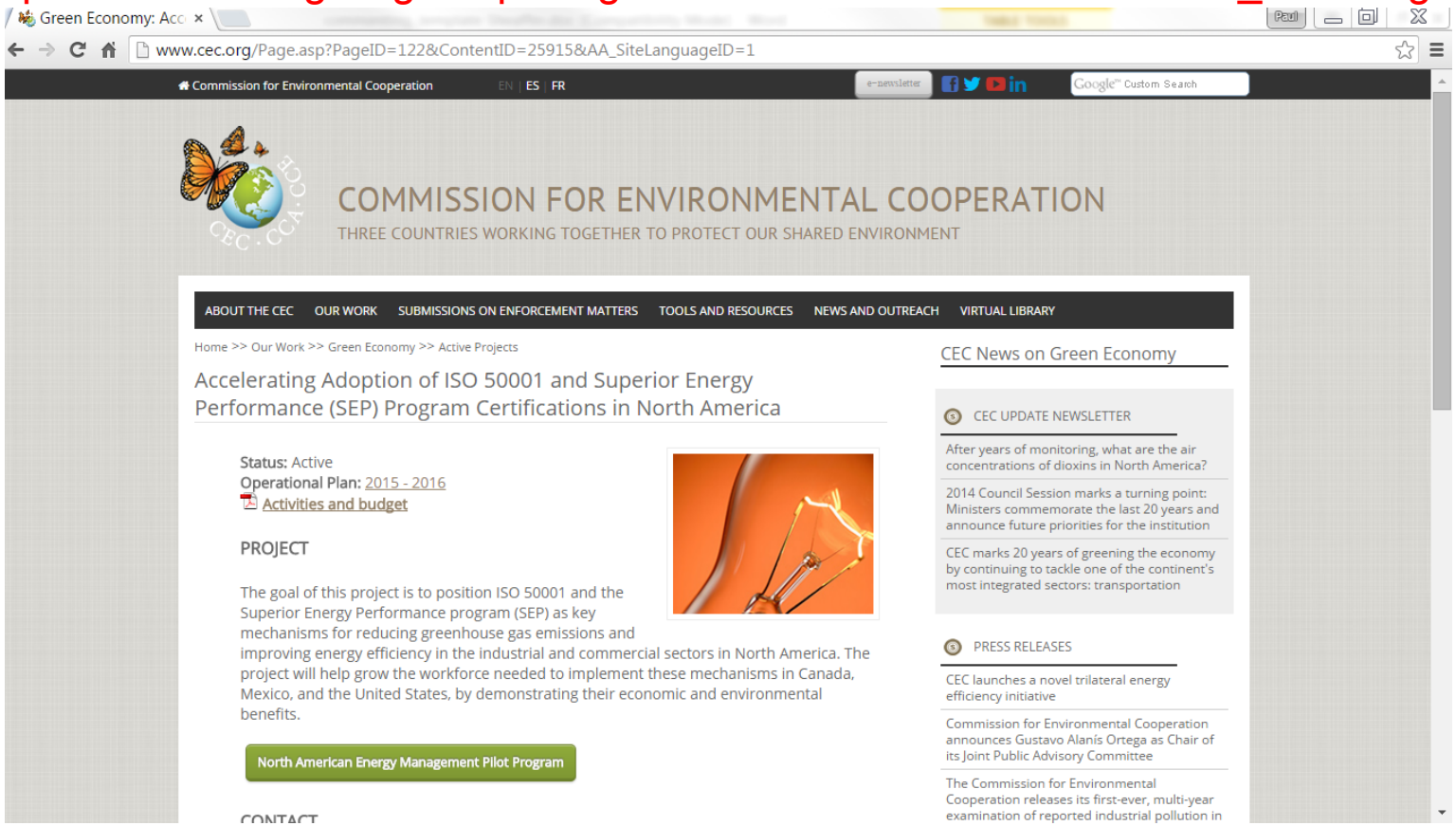
# Use the Infrastructure that has Been Developed

- Tools
- Qualified workforce
- Training for internal staff
- Business cases showing the value
- Verification bodies for certification
- Recognition

"Because of SEP, management has higher confidence levels for future investments in terms of the expected savings and return on investment."

— 3M Company
Cordova, IL

# Participate in the North American Energy Management System Pilot Program

- Selected participants will receive cost-shared, tailored training and personalized coaching to implement ISO 50001 and SEP® and identify energy cost-saving opportunities

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