



# REALIZING IMPROVED INDUSTRIAL ENERGY EFFICIENCY THROUGH IMPLEMENTATION OF ISO 50001

Dubai Solar Show/WETEX  
Dubai, UAE  
23 October 2017

*Ideas to Impacts*  
[www.energetics.com](http://www.energetics.com)

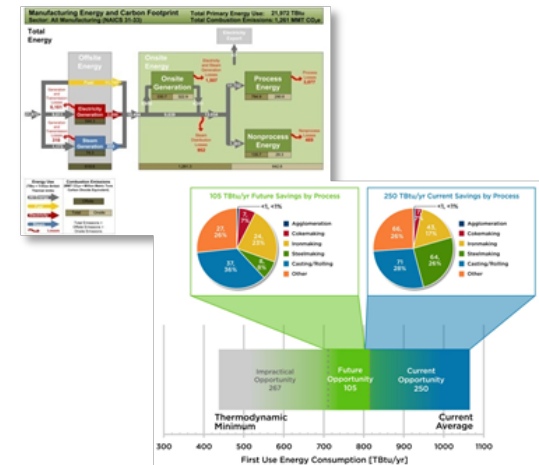
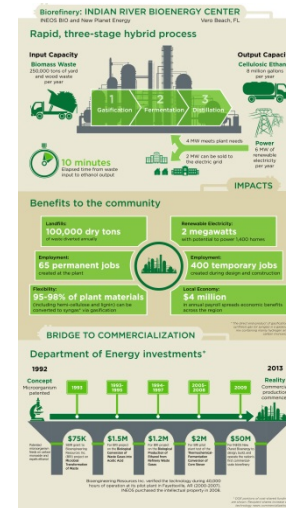
**Eng. Ridah Sabouni,** CEM, PMP, CMVP  
Managing Director, Middle East & North Africa  
Energetics Incorporated



# Energetics at a Glance

## Providing clients with solutions that:

- Increase energy efficiency
- Diversify energy supply
- Measure impacts of new energy technologies
- Benchmark energy and carbon footprints
- Create consensus around strategic priorities
- Modernize infrastructure



## 100+ staff members include engineers, scientists, project managers, and communication specialists

### • 30+ Subject Matter Experts:

*Advanced Manufacturing, Energy Management, Wind, Solar, Bioenergy, Battery Storage, CHP, Fuel-efficient Vehicle Technologies, Green Building Technologies, Smart Grid, Climate Change Adaptation, and Policy/Regulatory Affairs*

### • Over 50% with Advanced Degrees (Ph.D., J.D., M.S.)

### • 55 BS/BA Engineering/Science Degrees

### • Certifications including PMP, PE, CEM, LEED, CMVP

**Integrated delivery of technical, analytical, and communication services for over 35 years**

# ENERGETICS BUSINESS AREAS

CLIMATE CHANGE/  
SUSTAINABILITY

CRITICAL  
INFRASTRUCTURE  
RESILIENCE AND  
CYBERSECURITY

ENERGETICS  
INNOVATION  
PRACTICE

ENERGY  
EFFICIENCY

GRID  
MODERNIZATION

INDUSTRIAL

RENEWABLE  
ENERGY

TRANSPORTATION



# ENERGETICS SERVICE OFFERINGS

**Planning &  
Roadmapping**

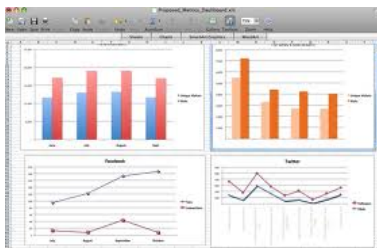
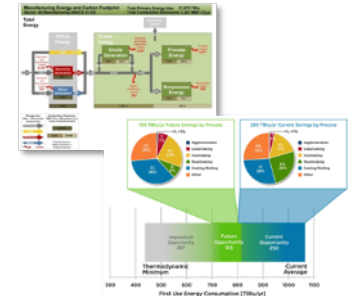
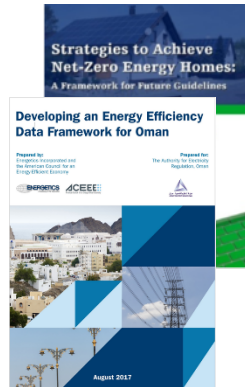
**Analysis &  
Modeling**

**Implementation &  
Deployment**

**Outreach &  
Communications**

**Private Clients**

**Evaluation &  
Metrics**



U.S. DEPARTMENT OF  
**ENERGY**

**NIST**  
National Institute of  
Standards and Technology  
U.S. Department of Commerce

NEW YORK  
STATE OF  
OPPORTUNITY.

NYSERDA



GCC Governments

**FEMP**  
Federal Energy Management Program

**SMARTGRID.GOV**

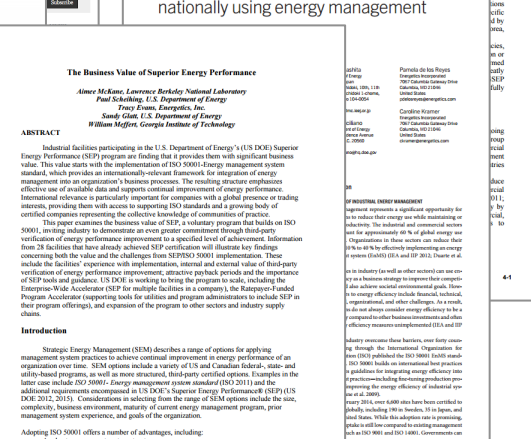
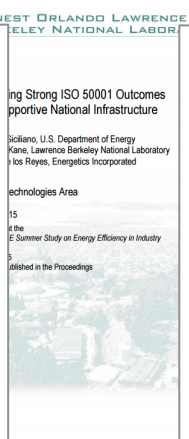
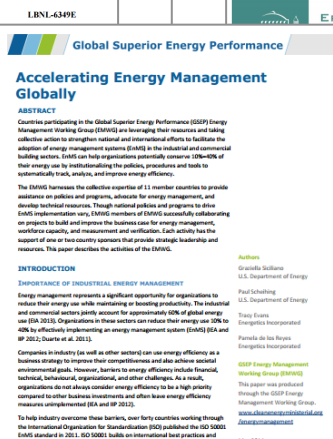
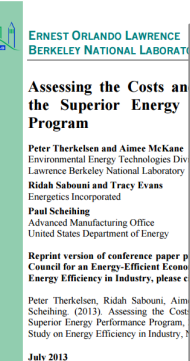
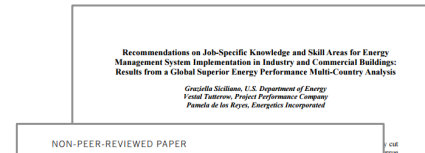
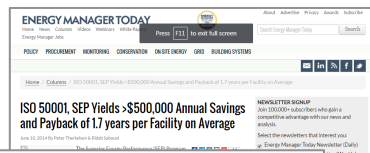
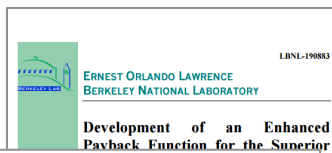


**CLEAN ENERGY  
MINISTERIAL**  
Accelerating the Transition to Clean Energy Technologies



# ENERGETICS ISO 50001 EXPERIENCE ROLE

- Helped to develop and implement U.S. Department of Energy (DOE) national ISO 50001 strategy/program
- Consultant to the Clean Energy Ministerial Energy Management Working Group (Energy Management Leadership Awards, Global Energy Management Campaign)
- Consultant to organizations implementing ISO 50001, including one food manufacturer in Oman (ongoing)





# TODAY'S AGENDA

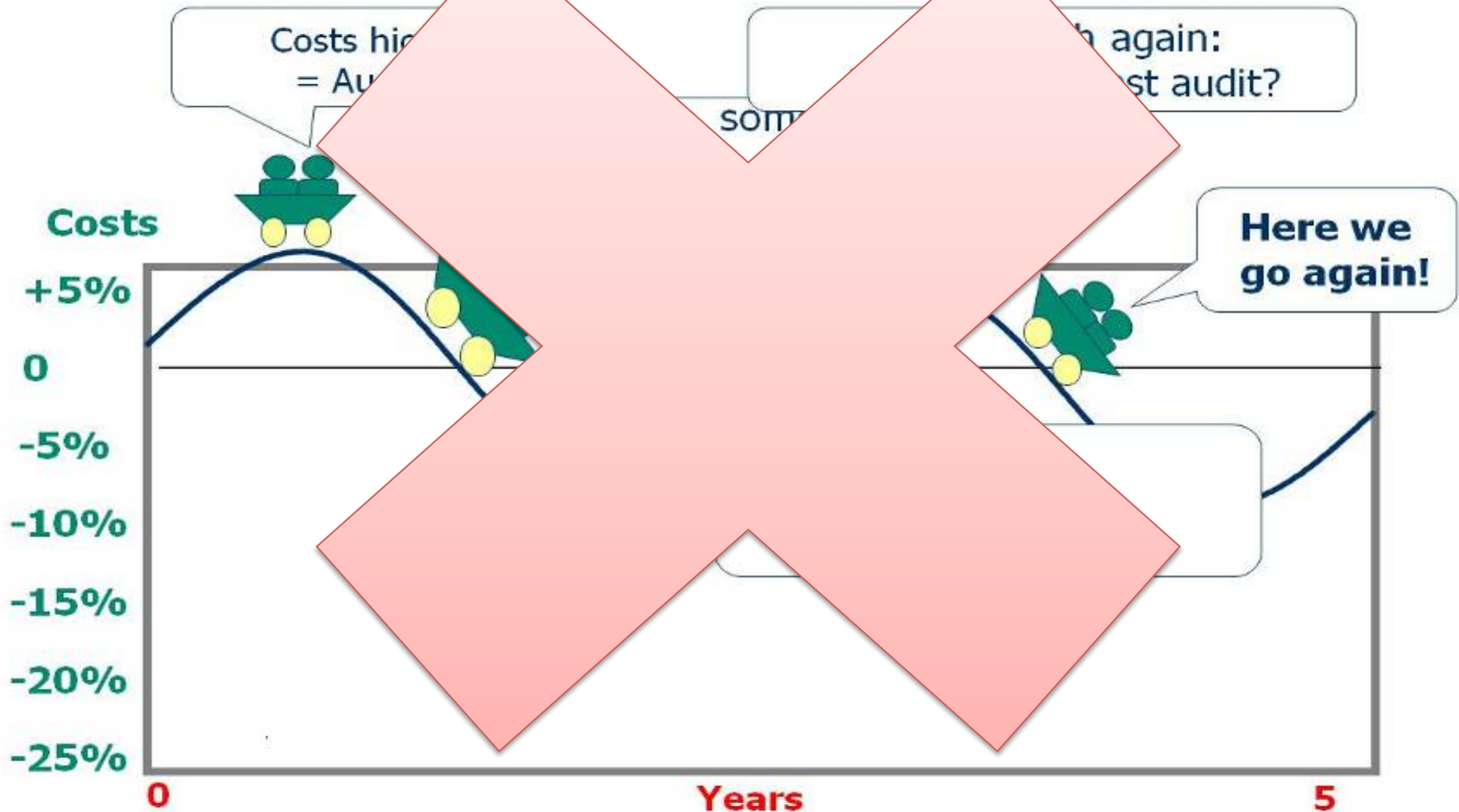
- Introduction to Strategic Energy Management
- What is ISO 50001?
- How Can ISO 50001 Help Cut Energy Costs?
- Getting Started with ISO 50001 Implementation



# TRADITIONAL APPROACH TO ENERGY MANAGEMENT: ENERGY ROLLER COASTER RIDE!



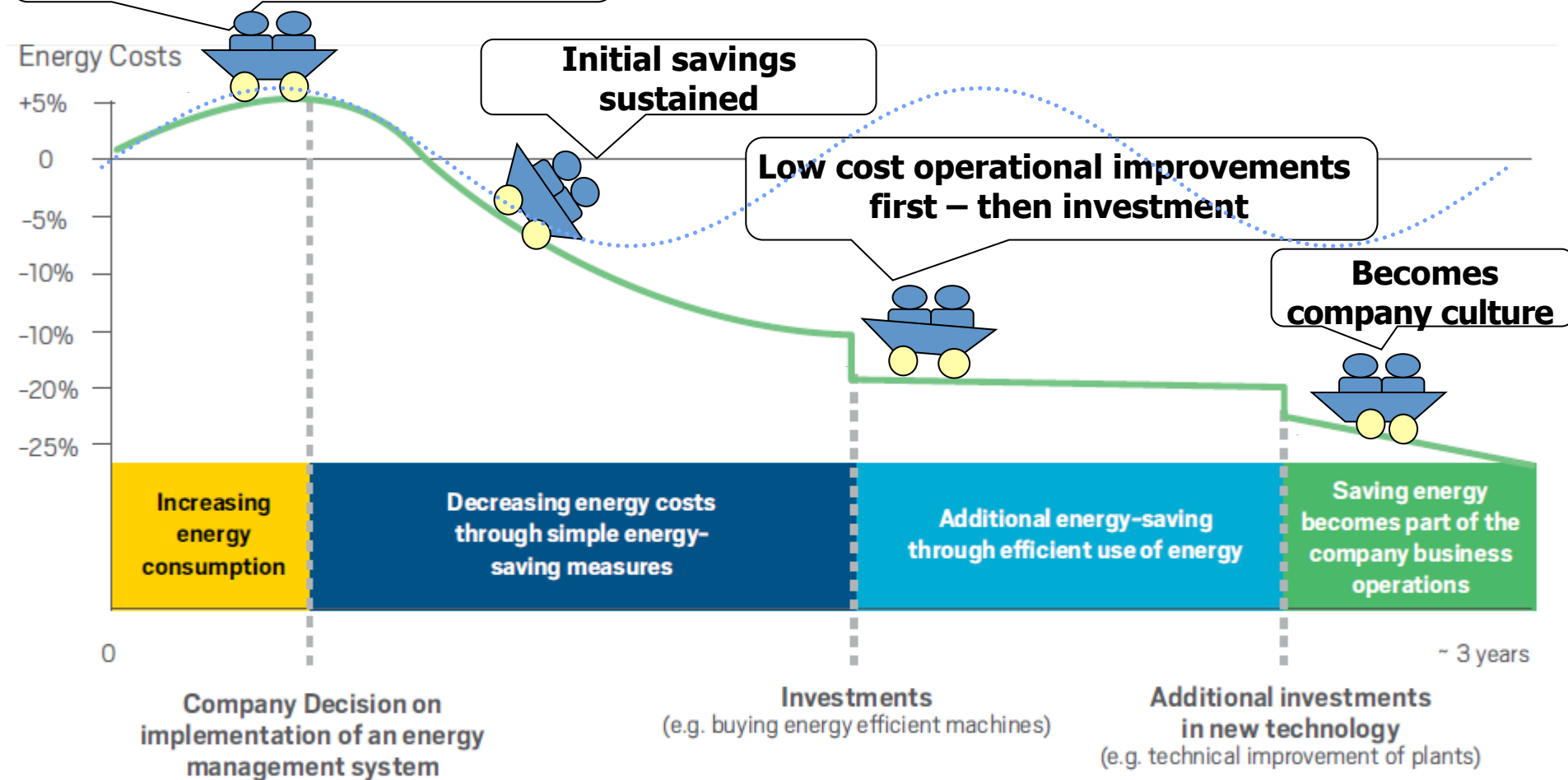
# TRADITIONAL APPROACH TO ENERGY MANAGEMENT: ENERGY ROLLER COASTER RIDE!





# **STRATEGIC APPROACH TO ENERGY MANAGEMENT**

**Senior management commit to program & an energy team is formed**





# WHAT IS STRATEGIC ENERGY MANAGEMENT (SEM)?

- A **structured approach** that elevates + integrates energy management into everyday business practices--as has previously happened for safety & quality

# WHAT IS STRATEGIC ENERGY MANAGEMENT?



Source: <http://www.smithsonianmag.com/history/lunch-atop-a-skyscraper-photograph-the-story-behind-the-famous-shot-439311>





# WHAT IS STRATEGIC ENERGY MANAGEMENT (SEM)?

- A **structured approach** that elevates + integrates energy management into everyday business practices--as has previously happened for safety & quality
- A culture for **continual improvement** of energy performance + efficiency
- Involves all staff (CEO to facility engineers): **Organizational culture change**
- Positions organizations of any size to achieve **credible energy and cost savings** through informed decision making
- Enables implementation of **energy saving practices** for facilities, processes, equipment and operations—helps to improve understanding of processes

## Benefits

- Improved profits!
- Reduced energy costs = lower production costs = more competitive
- More engaged workforce
- Non energy benefits: An additional 2.5X additional benefits

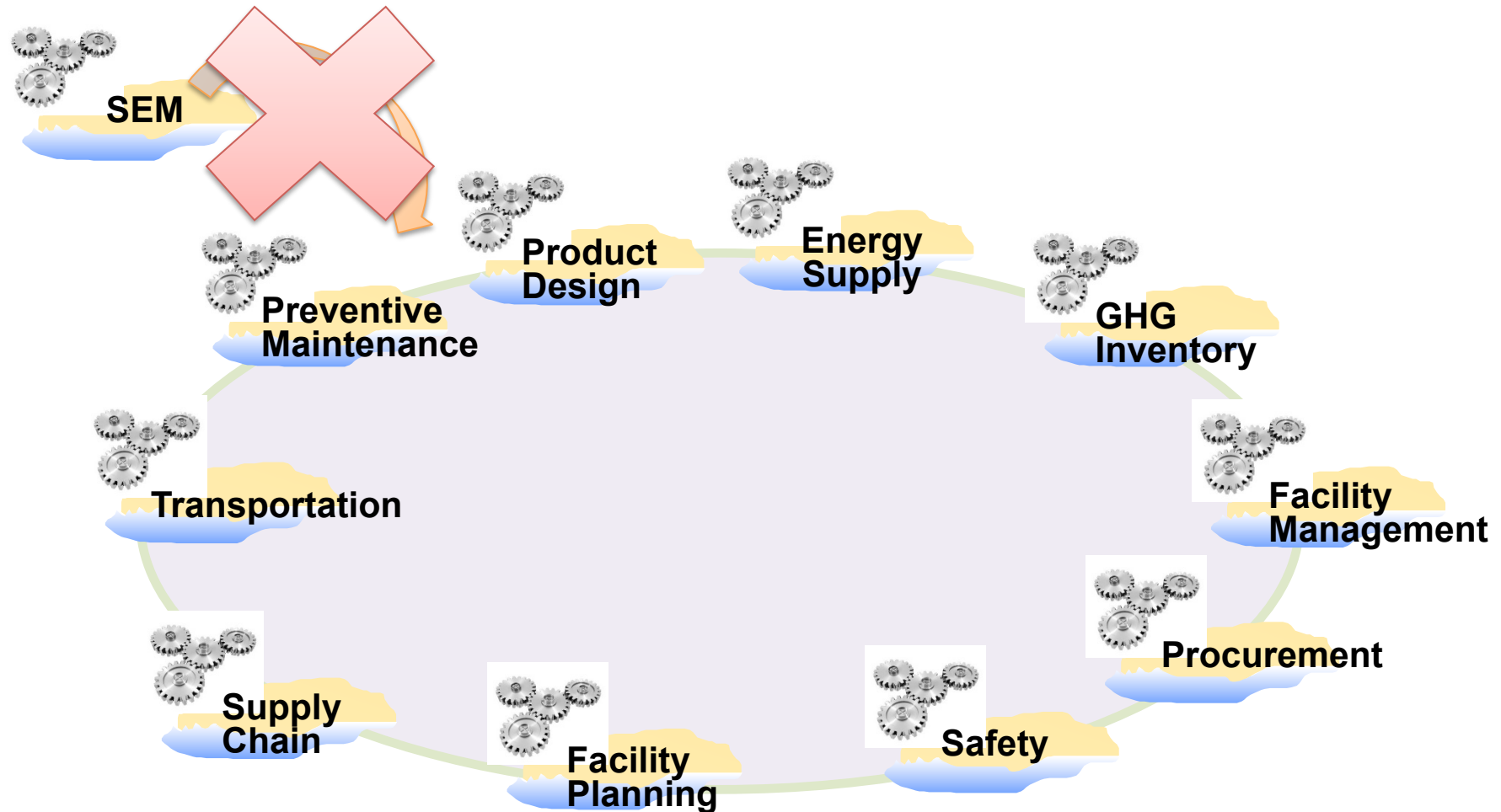


# WHAT IS STRATEGIC ENERGY MANAGEMENT (SEM)?

**Strategic Energy Management should not be considered a cost.**

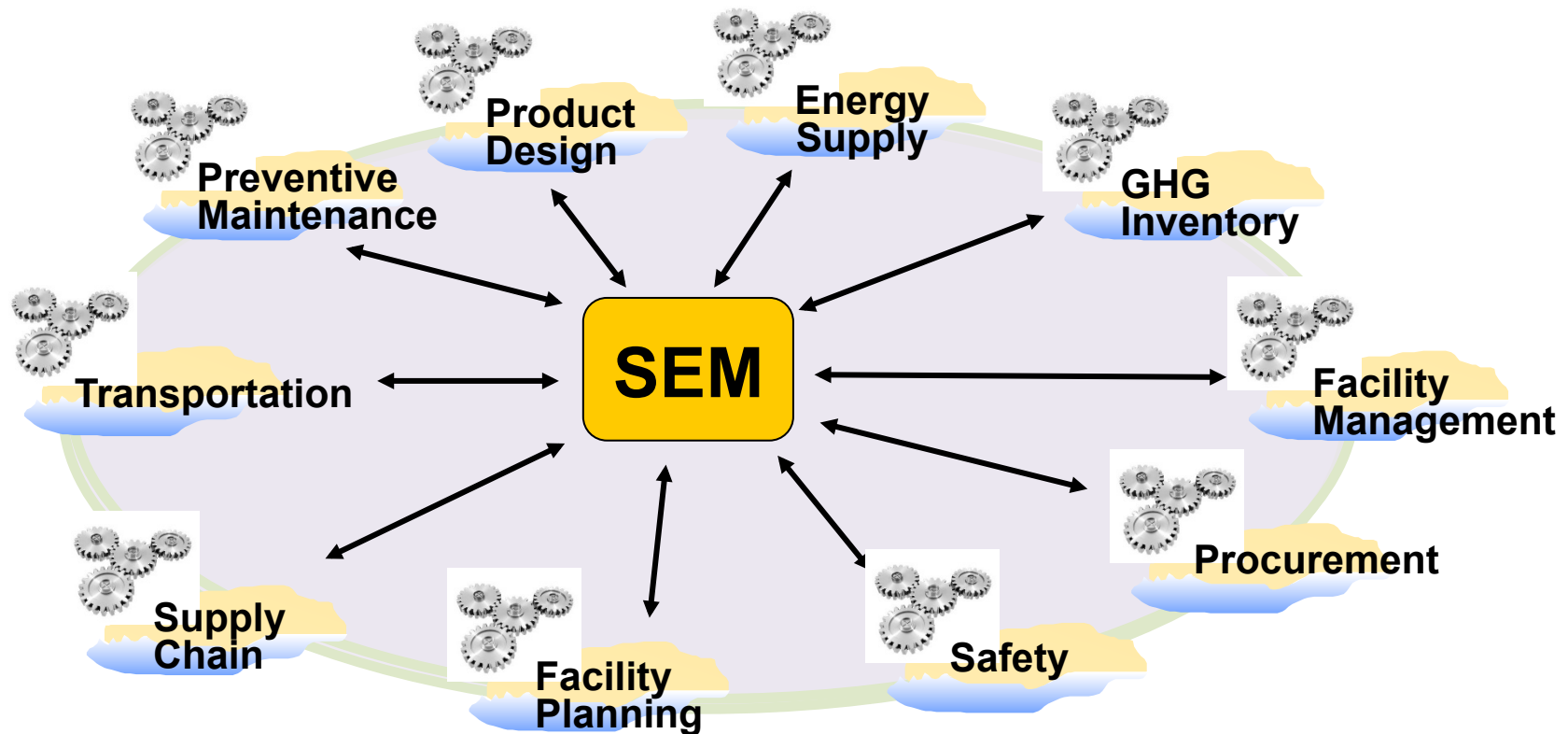
**It's an investment with an attractive ROI!**

# SEM PROVIDES A FRAMEWORK TO INTEGRATE INTO EXISTING PROCESSES





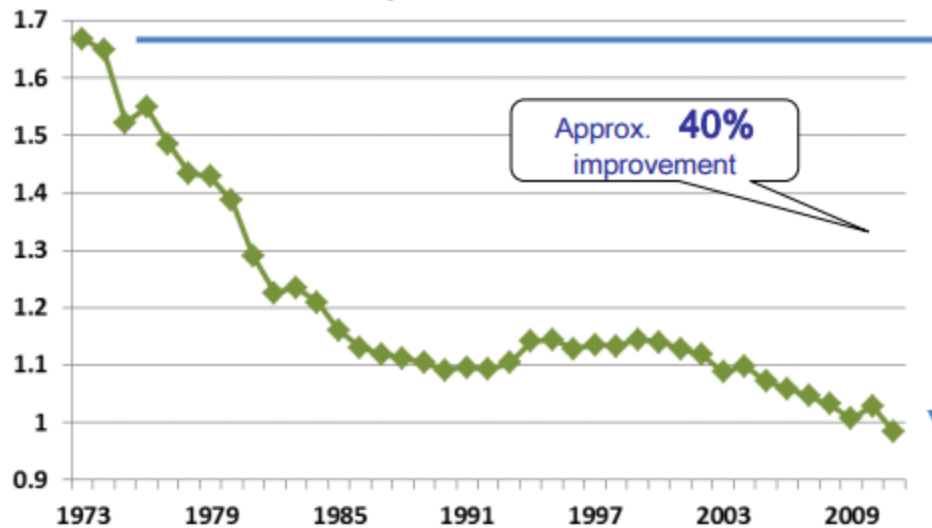
# SEM PROVIDES A FRAMEWORK TO INTEGRATE INTO EXISTING PROCESSES



# CASE STUDY: JAPAN POST 1970S OIL CRISIS

## Primary energy use per real GDP of Japan

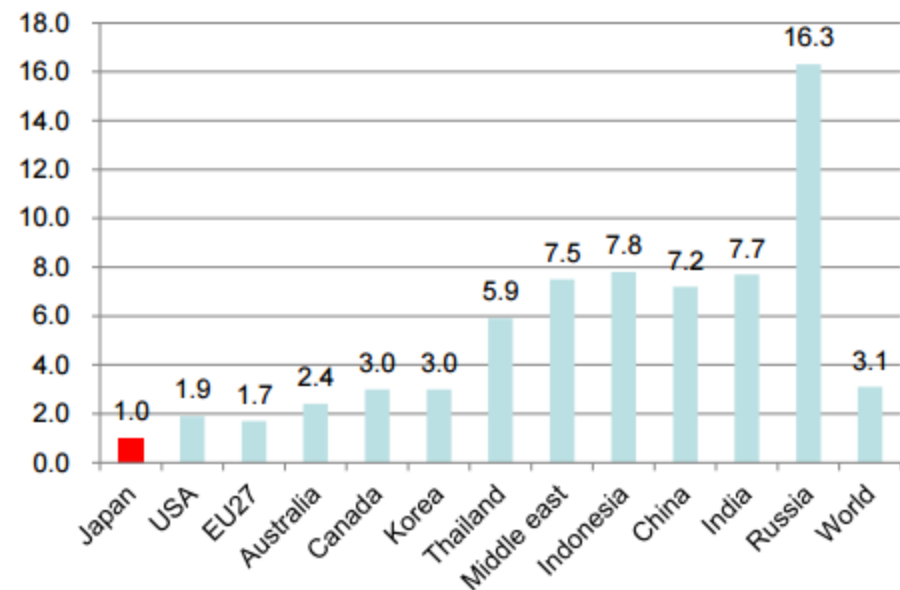
(Oil converted Mt /1 trillion yen)



Source ) Total Energy Statistics by ANRE/METI

## Primary energy supply per GDP unit of each country (2009)

(Index : Japan=1.0)



Calculated according to IEA statistics

Source: Toshiaki Nagata, "Japan's Policy on Energy Conservation".  
[https://unfccc.int/files/bodies/awg/application/pdf/2\\_japan.pdf](https://unfccc.int/files/bodies/awg/application/pdf/2_japan.pdf)



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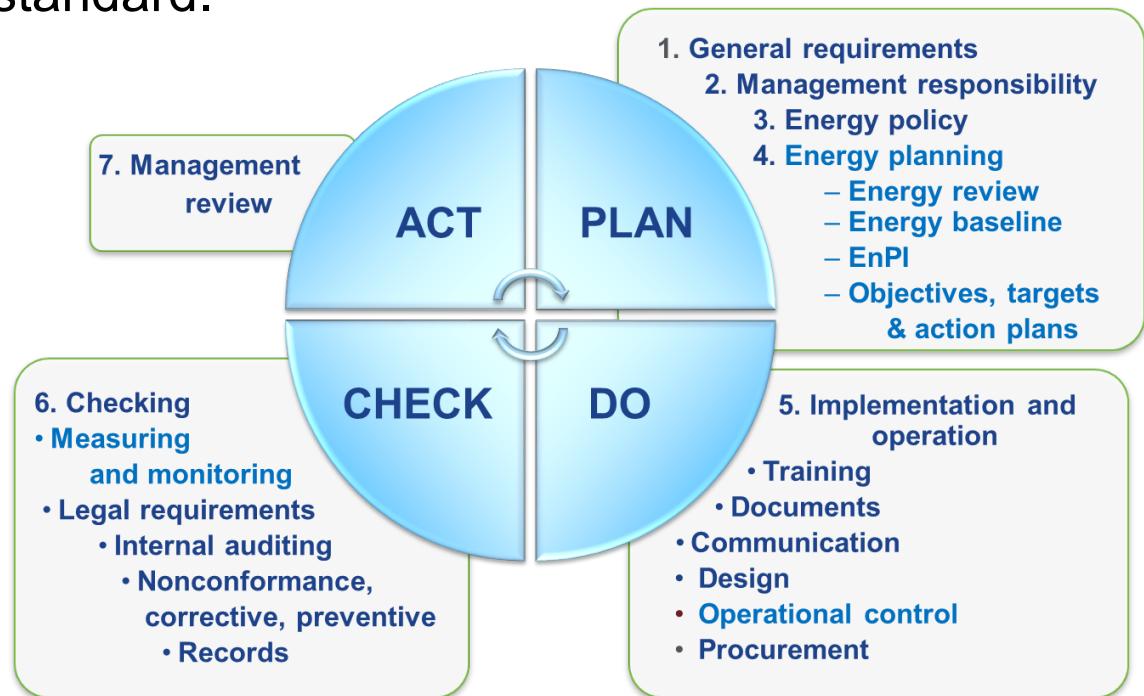
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# ISO 50001–ENERGY MANAGEMENT SYSTEMS (ENMS)

International standard that draws from **best practices around the world**. Developed with in June 2011 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.





# KEY ASPECTS OF ISO 50001

1. **Energy policy**: top management's official statement of the organization's commitment to managing energy
2. **Cross-divisional management team** led by a representative who reports directly to management and is responsible for overseeing the implementation of the energy management system (EnMS)
3. **An energy planning process** to assess energy uses, energy sources, and consumption and identify opportunities for improvement
4. **Baseline** of the organization's energy use
5. **Identification of energy performance indicators** (EnPIs) that are unique to the company and are tracked to measure progress
6. **Energy objectives and targets** for energy performance improvement at relevant functions, levels, processes or facilities within an organization
7. **Action plans** to meet those targets and objectives
8. **Operating controls and procedures** to address all aspects of energy purchase, use, and disposal.
9. **Measurement, management, and documentation** for continuous improvement for energy efficiency
10. **Internal audits and periodic reporting of progress** to management based on these measurements

Source: U.S. DOE Advanced Manufacturing Office

# FULL ISO 50001 IMPLEMENTATION PROCESS

0%

## PLANNING

- Scope and Boundaries
- Energy Policy
- Management Commitment
- Energy Team
- Legal Requirements

0%

## ENERGY REVIEW

- Data Collection
- Data Analysis
- Significant Energy Uses
- Relevant Variables
- Performance Indicators
- Baseline, Objectives and Targets
- Improvement Opportunities
- Improvement Projects
- Monitoring

0%

## CONTINUAL IMPROVEMENT

- Measurement
- Operational Controls
- Corrective Actions
- Energy Consideration in Design

0%

## SYSTEM MANAGEMENT

- Documentation and Records
- Communications
- Training
- Procurement
- Internal Audit
- Calculating Energy Savings
- Management Review



# INTEGRATING ISO 50001 WITH OTHER ISO STANDARDS

## Unique Elements

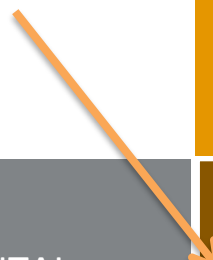
### ISO 50001

#### ENERGY POLICY

Energy review  
Energy performance indicators  
Energy baseline  
Energy Objectives and Targets ( and Action Plans)



## Leverage Common & Similar Elements



### ISO 14001

#### ENVIRONMENTAL POLICY

Environmental aspects  
Emergency preparedness  
Environmental management program

### MANAGEMENT COMMITMENT

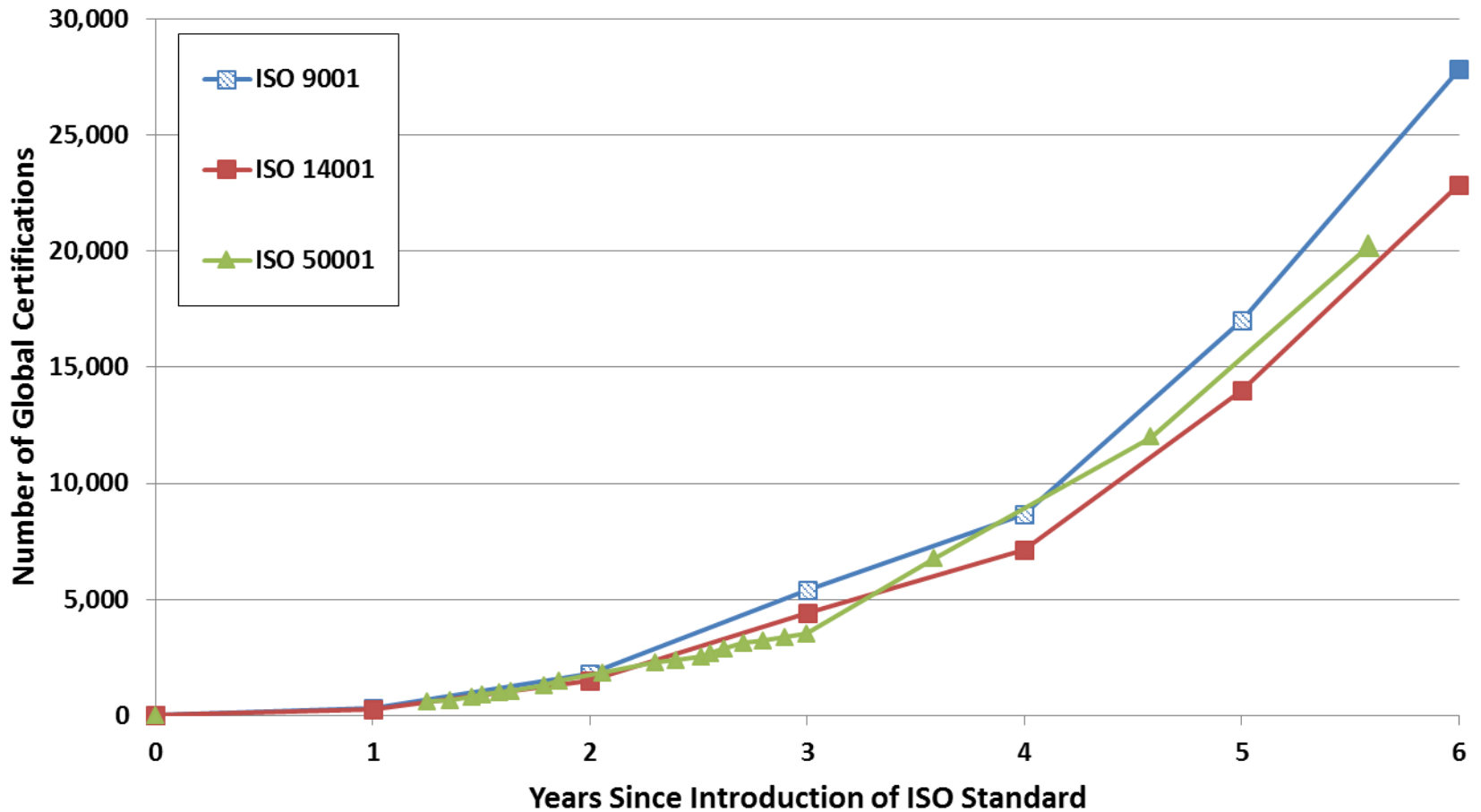
LEGAL AND OTHER REQUIREMENTS  
ROLES, RESPONSIBILITY & AUTHORITY  
COMPETENCE, TRAINING & AWARENESS  
COMMUNICATION  
OPERATIONAL CONTROL  
MONITORING & MEASUREMENT  
DOCUMENTATION  
INTERNAL AUDIT  
CORRECTIVE & PREVENTATIVE ACTION  
MANAGEMENT REVIEW  
DESIGN  
PROCUREMENT

### ISO 9001

#### QUALITY POLICY

Customer focus  
Planning of product realization  
Customer-related processes  
Control of nonconforming

# GLOBAL GROWTH OF ISO 50001





# ISO 50001 GROWTH IN THE MENA REGION

Year	2011	2012	2013	2014	2015	2016
Bahrain					2	2
Egypt		6	7	8	23	33
Jordan			1	1	1	2
Kuwait			1	1	1	1
Lebanon			1	1	1	1
Iran		1	14	29	48	65
Oman						0
Qatar				2	2	2
Saudi Arabia		2	3	3	6	2
United Arab Emirates	4	6	25	33	47	48

# ISO 50001 IN THE UAE

At least 48 ISO 50001 certifications in the UAE



هيئة كهرباء ومياه دبي  
Dubai Electricity & Water Authority

**DAMAC**  
LIVE THE LUXURY

(seeking certification)



**DP WORLD**



هيئة كهرباء ومياه الشارقة  
Sharjah Electricity & Water Authority

“**ADNOC** saved US \$150 million in energy costs through its corporate EnMS since 2014”

“Energy efficiency and savings are one of **ENOC's** core values, integrated into business process and operations since 2008”

“**SEWA** achieved 7.1% savings within one year of implementation”

“ISO 50001 helped **DAMAC** achieve savings in utility bills and service charges, and also a reduction in CO<sub>2</sub> emissions”

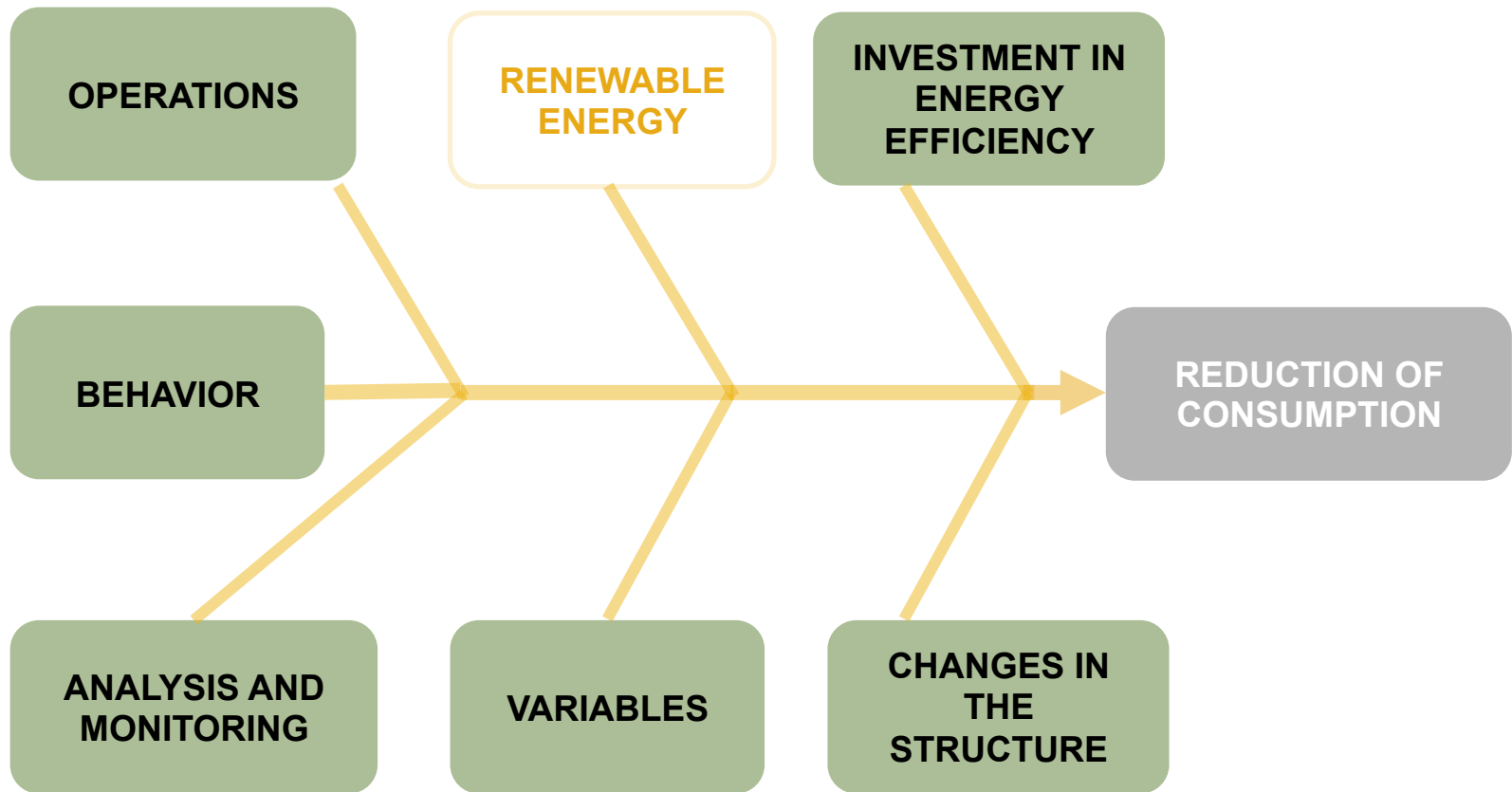




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- Introduction to Strategic Energy Management
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- **How Can ISO 50001 Help Cut Energy Costs?**
- Getting Started with ISO 50001 Implementation

# WHAT FACTORS IMPACT ENERGY CONSUMPTION?



# SELECT ISO 50001 CERTIFIED FACILITIES IN THE USA: VERIFIED ENERGY PERFORMANCE IMPROVEMENT











Saanichton, BC Canada	30.6%
★ Smyrna, TN	23.1%
★ Clovis, CA	16.7%
★ Seneca, SC	15.6%
★ Costa Mesa, CA	23.4% / 15 mo's
★ West Kingston, RI	20.0%
★ Apodaca, Mexico (Monterrey 4)	15.0%
★ Peru, IN	24.9% / 10 yrs
★ Lincoln, NE	22.0% / 10 years
★ El Paso, TX	14.8%
★ Greensboro, NC	13.7% / 16 mo's
★ Columbia, MO	13.3% / 1 yr
★ Apodaca, Mexico (Monterrey 2)	11.3%
★ Hopkins, SC	10.2%
★ Tijuana, Mexico	10.2%
★ Cedar Rapids, IA	8.8%
★ Apodaca, Mexico (Monterrey 3)	7.8%
★ Foxboro, MA	6.7%
★ Lexington, KY	5.9%
★ Rojo Gomez, Mexico	5.9%



Improvement over 3 years unless stated otherwise

	★ Aberdeen, SD	11.0%
	★ Hutchinson, MN	10.7%
	★ Cynthiana, KY	6.9%
	★ Cordova, IL	5.7%
	★ Decatur, AL	5.2%
	★ Prairie du Chien, WI	5.2%
	★ San Diego, CA	22.7%
	★ La Quinta, CA	17.6%
	★ Washington, DC	15.9%
	★ Waikoloa, HI	13.5%
	★ Honolulu, HI	8.4%
	★ San Francisco, CA	6.3%

# SELECT ISO 50001 CERTIFIED FACILITIES IN THE USA: VERIFIED ENERGY PERFORMANCE IMPROVEMENT

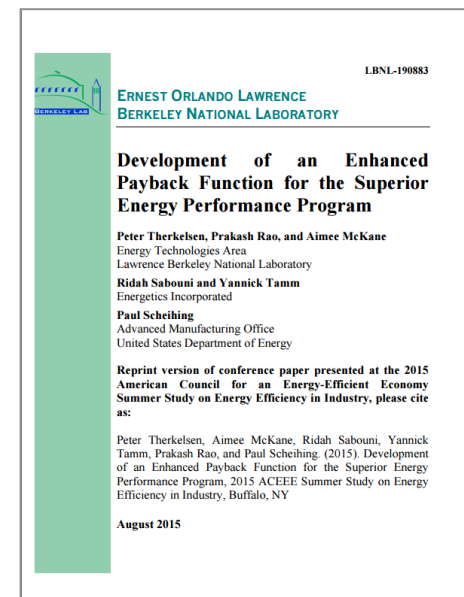
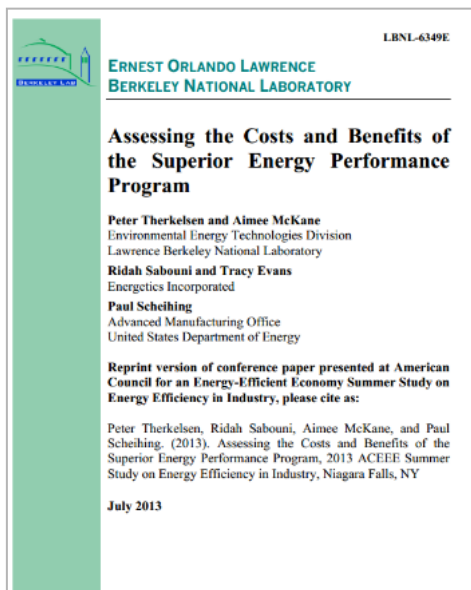
	★ Mack Trucks, Macungie, PA	31.6% / 10 yrs
	★ Dublin, VA	28.4% / 10 yrs
	★ Hagerstown, MD	20.9%
	★ Canton, MS	20.9%
	★ Smyrna, TN	17.7%
	★ Decherd, TN	8.0%
	★ Columbus, IN	16.8%
	★ Whitakers, NC	15.5% / 7 yrs
	★ Detroit, MI	32.5% / 10 yrs
	★ Ontario, NY	25.7% / 5 yrs
	★ Bethlehem, PA	17.0%
	★ Washington, DC	16.5%
	★ Dunedin, FL	12.2% / 2 yrs
	★ Wilson, NC	15.1% / 10 yrs
	★ Gaithersburg, MD	8.5%
	★ Cheswick, PA	7.6%
	★ Carlisle, PA	5.7%

Improvement over 3 years unless stated otherwise

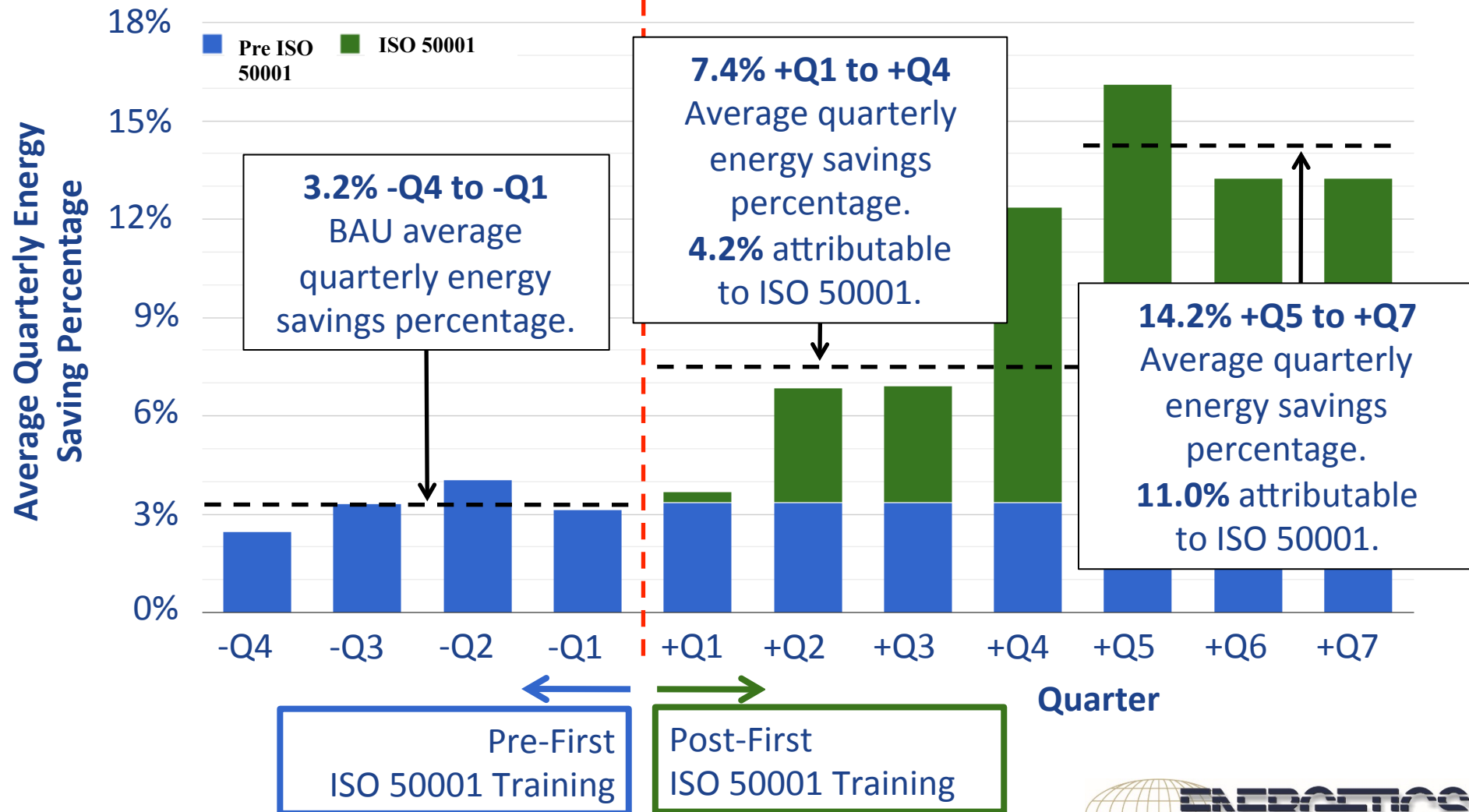


# ROI (PAYBACK) OF U.S. ISO 50001 FACILITIES

- USA ISO 50001 certified facilities:
  - 12% reduction in energy costs within 15 months of starting ISO 50001 implementation
  - Over \$500,000/year on average from low/no cost operational improvements
  - Paybacks of less than 2 years for most facilities
  - Many already had mature energy management programs!



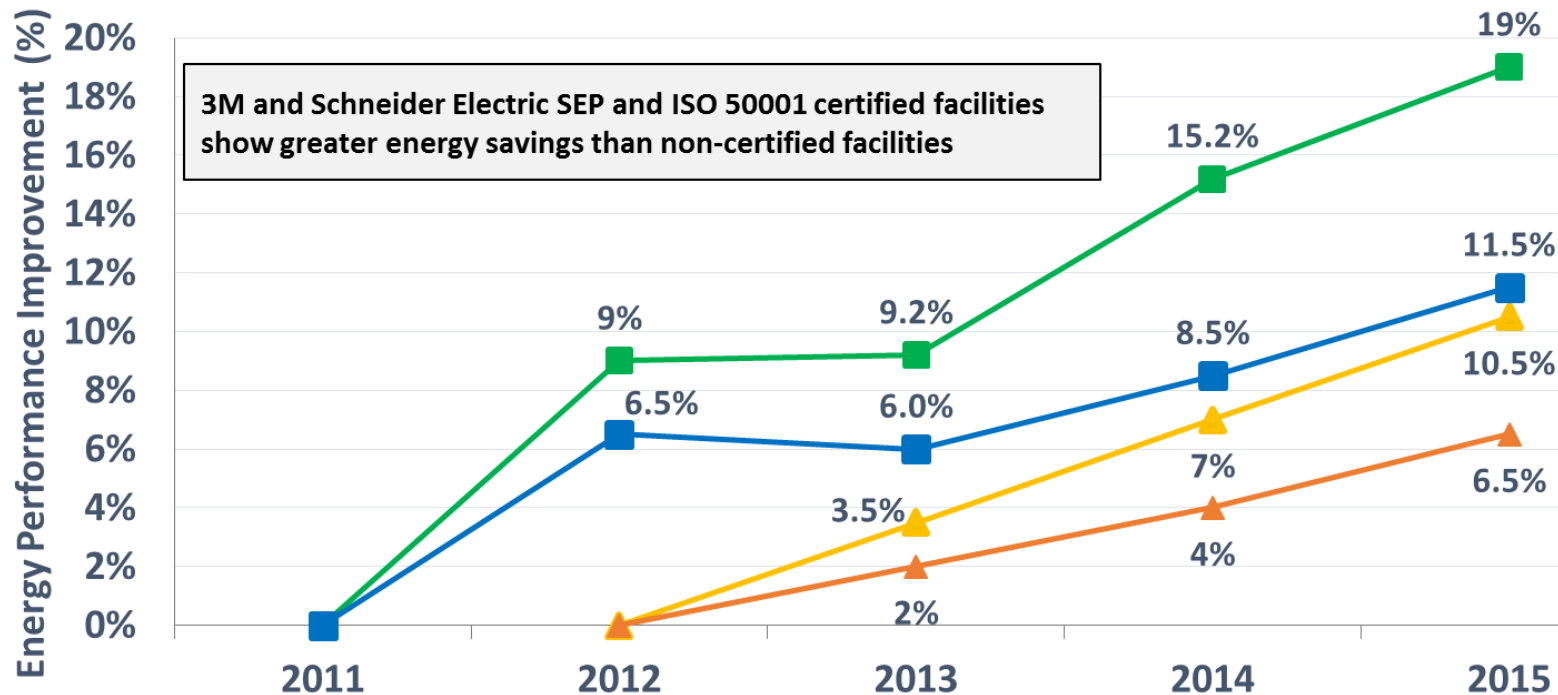
# OPERATIONAL ENERGY PERFORMANCE IMPROVEMENT OF 11%



# ISO 50001 CERTIFIED PLANTS OUTPERFORM PEERS AT 3M AND SCHNEIDER ELECTRIC

Savings at certified facilities greater on average compared to non-certified facilities:

- **3M: 62% greater over 3 years:** 18 ISO 50001 certified sites across 7 countries; 2 US SEP, 1 Korea SEP certified; 257 non-ISO 50001
- **Schneider Electric: 65% greater over 4 years:** 20 ISO 50001 certified in North America; 16 US SEP certified; 30 non-ISO 50001



Data analysis conducted by  
3M and Schneider Electric.

■ Schneider Electric: ISO 50001 and SEP Certified  
■ Schneider Electric: Not ISO 50001 or SEP Certified  
▲ 3M: ISO 50001 and SEP Certified  
▲ 3M: Not ISO 50001 or SEP Certified

# CASE STUDY: NISSAN SAVES \$1M ANNUALLY VIA NO-COST/LOW-COST ACTIONS ONLY

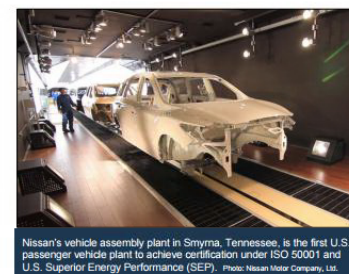
- Nissan automobile manufacturing facility implements rigorous ISO 50001 compliant energy management system
- Energy cost savings of nearly \$1M per year
  - Equivalent of 7.2% improvement in energy performance over 3 years
- No capital project investment needed
  - Costs consisted mostly of energy management system implementation (over a ~ 1 year period), training, and related labor costs
  - **~4 month payback on those costs**

## Global Energy Management System Implementation: Case Study

USA, Superior Energy Performance

### Nissan

Automaker improves energy performance 7.2% with a four-month payback using Superior Energy Performance



Nissan's vehicle assembly plant in Smyrna, Tennessee, is the first U.S. passenger vehicle plant to achieve certification under ISO 50001 and U.S. Superior Energy Performance (SEP). Photo: Nissan North America, Inc.

#### Case Study Snapshot

Industry: Automotive  
Energy Management System (EnMS) guidance/standard: ISO 50001  
Key driver for EnMS: Environmental stewardship and cost reduction  
Improvement focus: Paint operations and central utilities plant  
Location: Smyrna, Tennessee, USA  
Product(s): Passenger cars and SUVs  
Cost to implement: \$331,000  
Annual energy cost savings: \$938,000  
Payback period: ~4 months  
Energy sources: Electricity, natural gas, and coal (coal displaced by gas-fired boilers as of March 2013)  
Energy reduction goal: The Nissan plant established its own plant energy and global corporate CO<sub>2</sub> reduction policies.

#### Business Benefits Achieved

Nissan worked with the U.S. Energy Department's Advanced Manufacturing Office (AMO) to implement an energy management system (EnMS) that meets all requirements of Superior Energy Performance (SEP) and ISO 50001. At its vehicle assembly plant in Smyrna, Tennessee, the company established an energy baseline and assessed opportunities to save energy within its major energy-using systems. Implementing the recommended projects and EnMS improved the facility's energy performance by about 7.2%.

Nissan's Smyrna vehicle assembly plant is now certified by SEP at the silver level. By installing a rigorous business system that proactively manages its energy resources, the plant will sustain these improvements and continue to strengthen its energy performance in the future.

Collectively, the capital and operations projects implemented at the plant are saving Nissan \$1.2 million and 250 billion Btu (264,000 GJ) per year. Annual cost savings attributable solely to implementing SEP (annual savings minus those persisting from pre-SEP actions) total \$938,000. Nissan invested \$331,000 to implement SEP (including internal staff time), resulting in a payback period of just four months.

#### About Superior Energy Performance (SEP)

SEP is a market-based plant certification program that provides industrial facilities with a clear path to achieve continual improvement in energy performance while also boosting competitiveness.

To be certified under SEP, an industrial plant must implement an energy management system (EnMS) in conformance with ISO 50001 and make verified improvements in energy performance. SEP is accredited by the American National Standards Institute (ANSI).

1

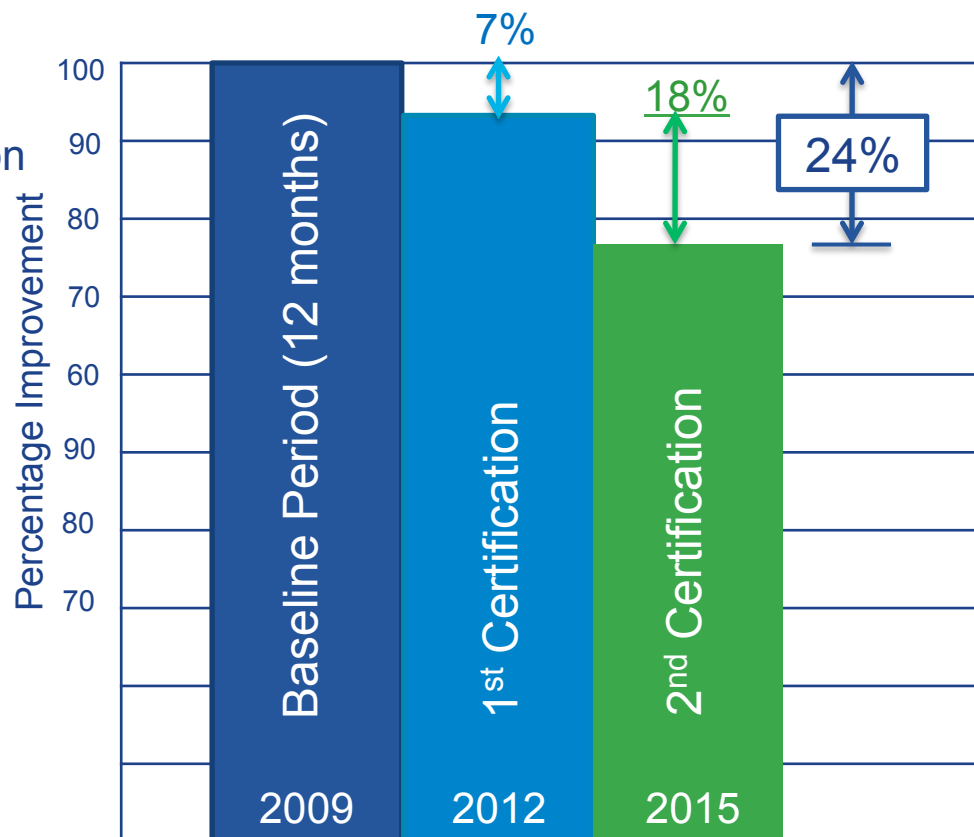
Details here:

<http://energy.gov/eere/amo/downloads/nissan-case-study-superior-energy-performance>



# RECERTIFIED NISSAN FACILITY: CONTINUAL ENERGY PERFORMANCE IMPROVEMENT

Normalized  
Facility  
Energy  
Consumption  
(source  
energy)



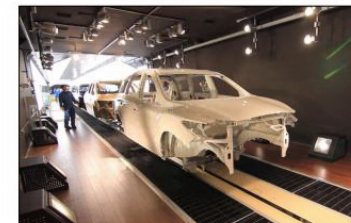
Nissan – Smyrna, TN, USA  
facility

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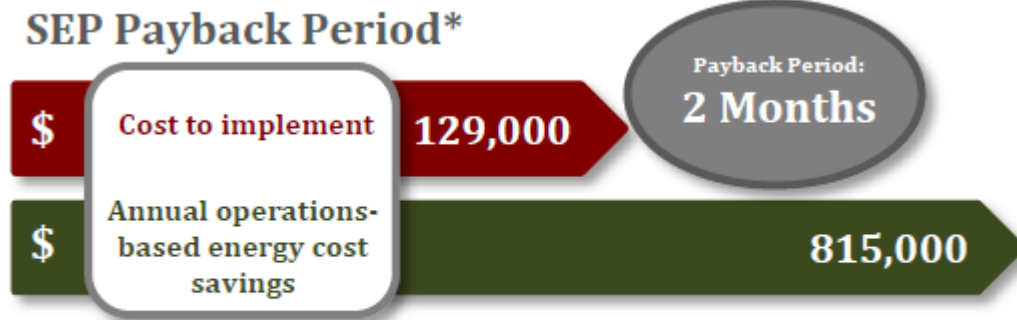
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Details here:

<http://energy.gov/eere/amo/downloads/nissan-case-study-superior-energy-performance>

# CASE STUDY: DETROIT DIESEL SAVES \$37M OVER 10 YEARS

- Improved energy performance by nearly 33% over 10 years



\* SEP marginal payback is based on operational energy cost savings attributable to ISO 50001 and SEP.



Case Study  
February 2017

## Detroit Diesel Saves \$37 Million over 10 Years

Daimler's Detroit Diesel Corporation facility in Detroit, Michigan earned Platinum certification to the U.S. Department of Energy's (DOE's) Superior Energy Performance® (SEP™) program. The facility used a rigorous energy management system (EnMS) to meet the requirements of the ISO 50001 standard and saved \$37 million over 10 years. Using SEP's robust Measurement and Verification (M&V) protocol to verify its energy performance improvement, the facility improved its energy performance by nearly 33% over 10 years, even as production increased by 93% over the same time span.<sup>1</sup>

### Business Benefits Achieved

During the 12 month period following ISO 50001 certification, Detroit Diesel saved \$815,000 in annual energy costs, yielding a two-month payback—based solely on operational savings. SEP cost-benefit analyses focused exclusively on savings from changes in operating procedures because those savings can be directly linked to the EnMS implementation investment (mostly staff time and training). While an EnMS will help to identify capital investments that can further improve energy performance, those capital projects have unique scopes and paybacks.

Independent, third-party verification provided corporate management greater confidence in the financial numbers, leading to additional capital funding for future energy projects at the facility and relaxation of the payback period requirements.

### Facility Profile

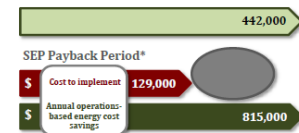
Detroit Diesel's Detroit facility is 3.2 million square feet and employs 3,000 staff to manufacture and assemble diesel engines, axles, transmissions, and



Detroit Diesel was the first U.S.-based Daimler subsidiary to implement ISO 50001 and achieve SEP certification.

"Investments in energy projects are typically expected to have a payback of 1–2 years. Using SEP to validate what we've saved over the past 10 years [\$37 million] gave us credibility. Our management is now much more receptive to investing in 3–5 year payback projects across the facility."

—Del Spooner  
Detroit Diesel Technical Services Director



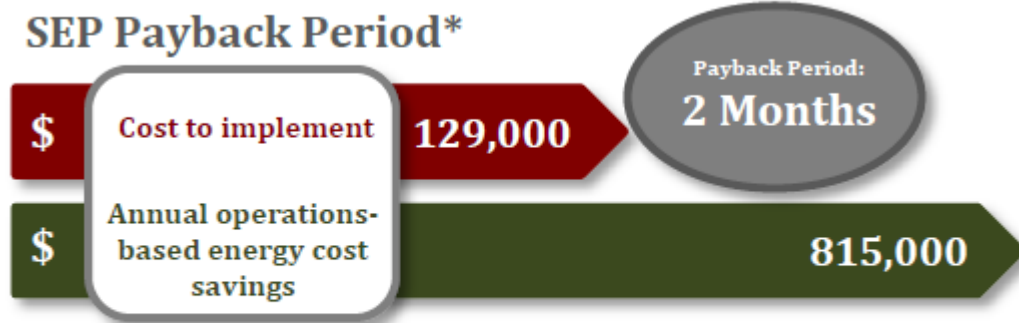
\* SEP marginal payback is based on operational energy cost savings attributable to ISO 50001 and SEP.

Details here:

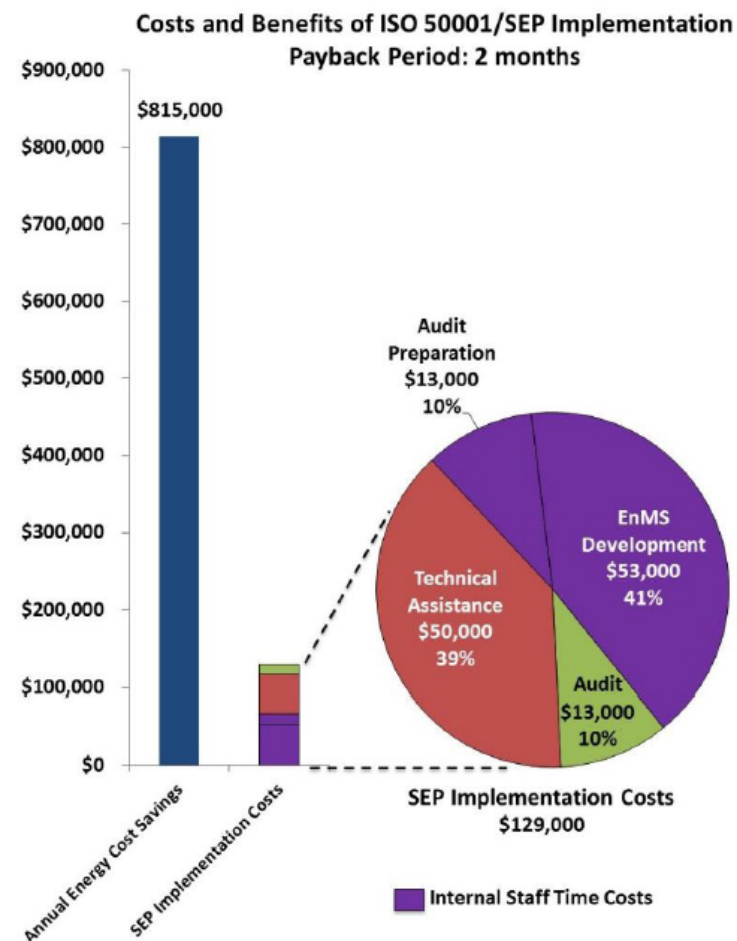
<https://www.energy.gov/eere/amo/downloads/detroit-diesel-case-study-superior-energy-performance>

# CASE STUDY: DETROIT DIESEL SAVES \$37M OVER 10 YEARS

- Improved energy performance by nearly 33% over 10 years



\* SEP marginal payback is based on operational energy cost savings attributable to ISO 50001 and SEP.



Details here:

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# GETTING STARTED WITH ISO 50001 CERTIFICATION...

- Learn more about ISO 50001 (talk to me or google search)
- Implementation process typically takes ~1 year
- Technical assistance to implement and perform energy modeling is highly recommended (Energetics can help!)
- Energy audit should happen early on in the process
- Submetering should be considered if your organization desires more granularity in evaluating energy consumption
- Real-time energy monitoring should be also considered
- Get certified! (you should be able to use the same certification body that does your ISO 14001 and/or ISO 9001 audit)





# THANK YOU

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## IDEAS TO IMPACTS

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