ISO 50001-Energy Management Systems

Building sustainability into energy efficiency

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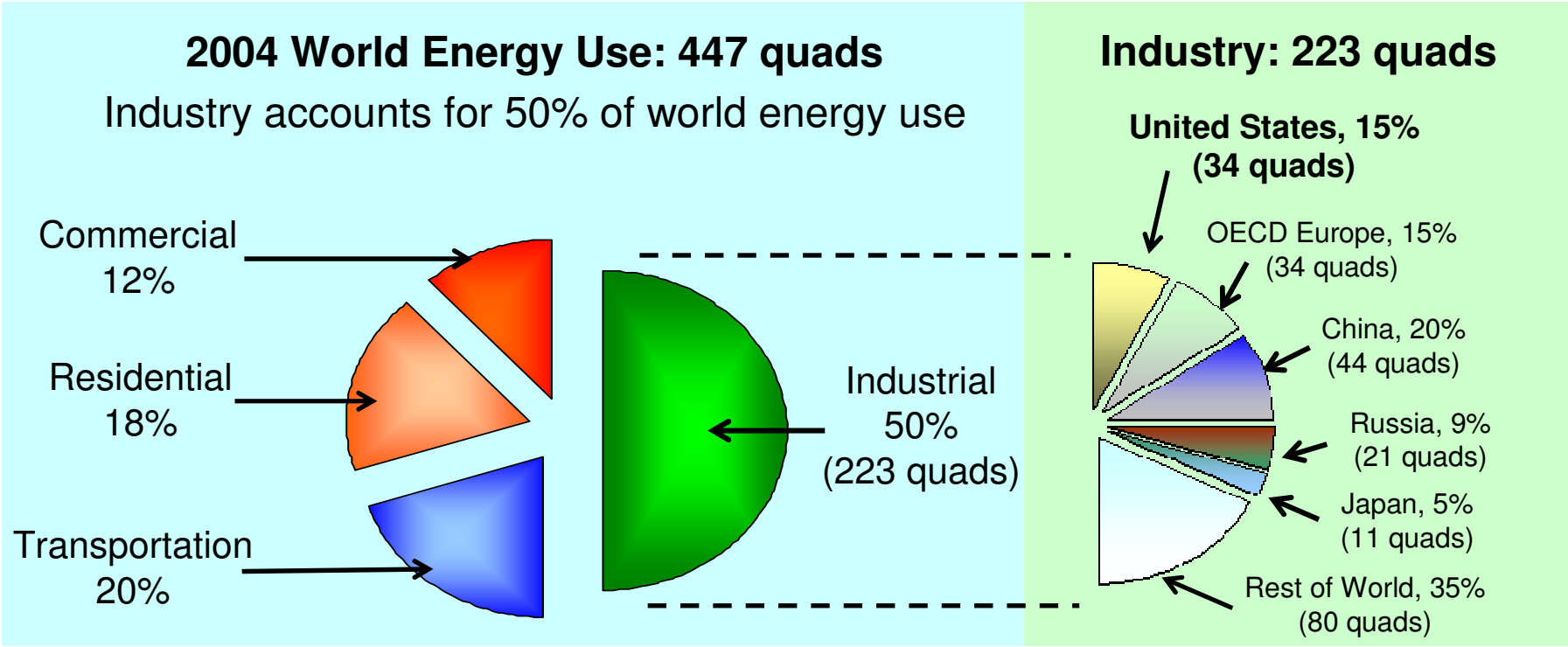
Programa Pais de Eficiencia Energética,
Ministerio de Energía

Aimee McKane
Lawrence Berkeley National Laboratory
atmckane@lbl.gov

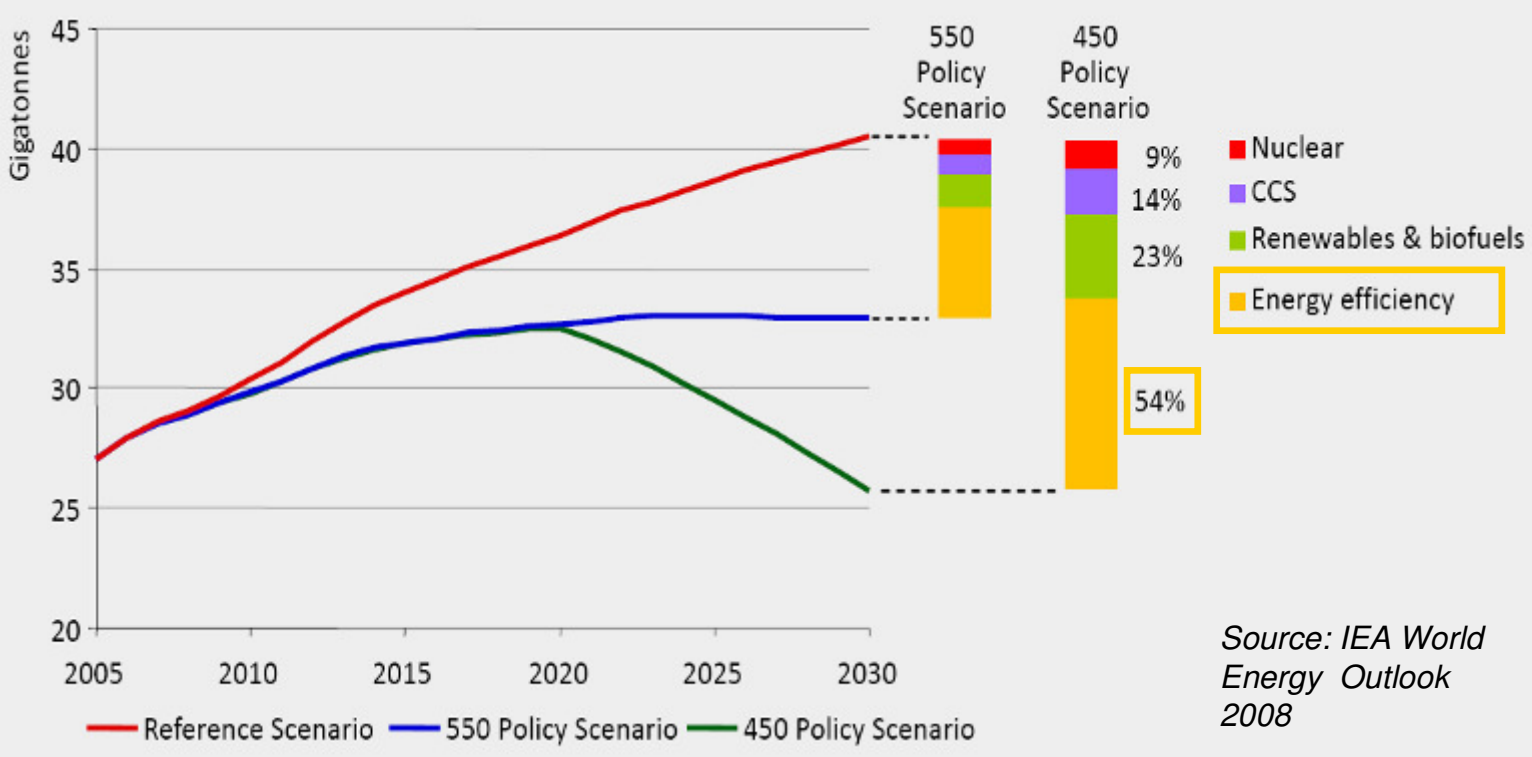
World Industrial Energy Use



Source: EIA/International Energy Outlook 2007

Climate Change - What needs to be done

Reduction in energy-related CO_2 emissions in the climate-policy scenarios



While technological progress is needed to achieve some emissions reductions, efficiency gains and deployment of existing low-carbon energy account for most of the savings

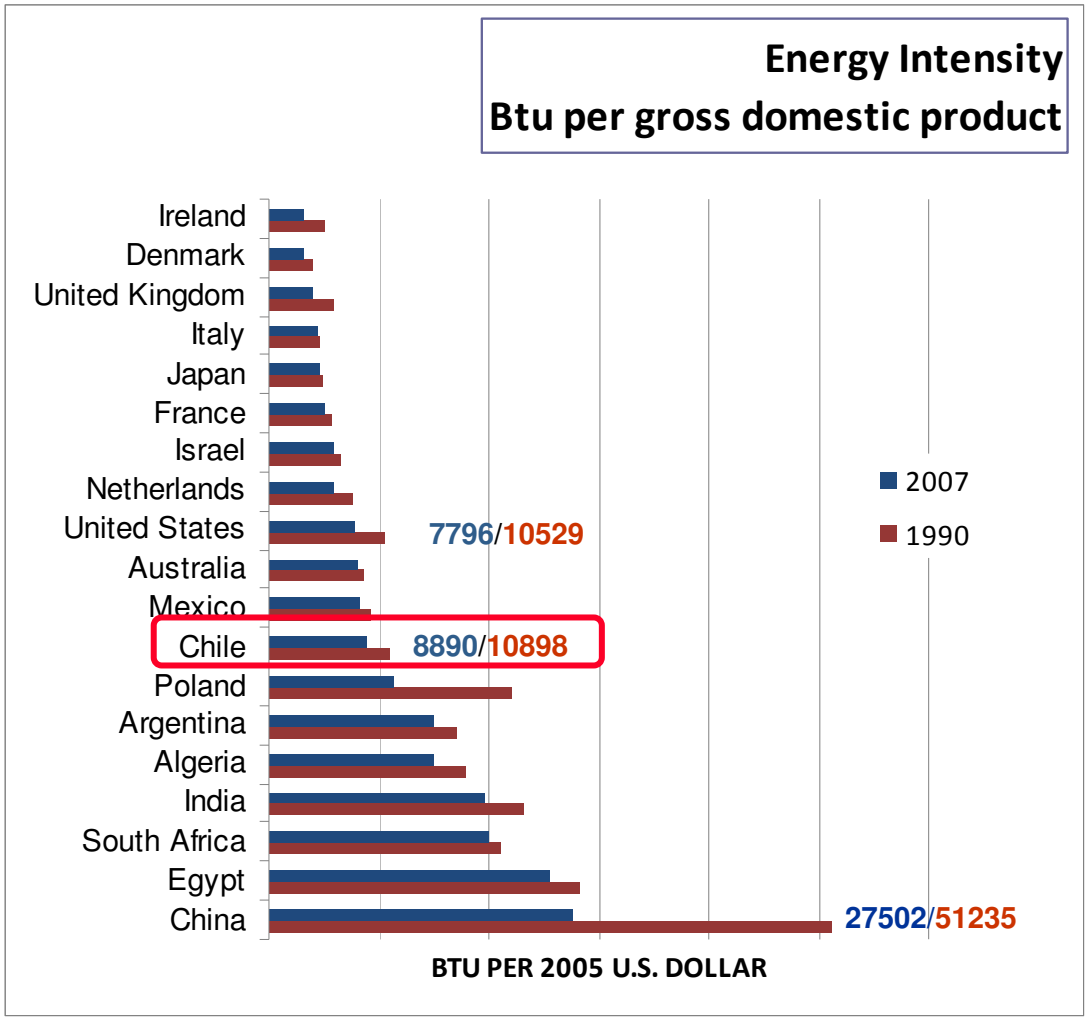
For Developing Countries and Emerging Economies, Timing is Critical

- For developing countries and emerging economies, industrial energy can be in excess of 50% of the total and can produce supply problems[1]
- *Non-OECD countries will continue to lead global growth of energy demand* (87% until 2030) with industry being the biggest user
- Industrial sector growth requires many new facilities, rapidly built and expanded; including substantial growth in energy intensive sectors
- It is much more cost-effective to build in energy efficiency the first time than retrofit it later
- *In industry, a missed opportunity for energy efficiency may not reoccur-* for decades or at all until the original installation fails or becomes obsolete

1 McKane, et al 2007 Policies for Promoting Industrial Energy Efficiency in Developing Countries and Transition Economies

2 International Energy Agency, 2008

Energy Intensity Around the World



Source: U.S. Energy Information Administration, EIA, International Energy Statistics (http://tonto.eia.doe.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=92&pid=46&aid=2)

Energy Efficiency a Major Opportunity

•Existing technologies *with an attractive internal rate of return* can cut the growth in global energy demand by half or more within 15 years.

-- *Curbing Global Energy Demand Growth*, McKinsey & Co., May 2007

•Industries around the globe can cut CO_2 emissions 19 to 31% using *proven* technologies and practices.

-- International Energy Agency, 2007

•"Energy Efficiency is the most promising means to reduce greenhouse gases in the short term."

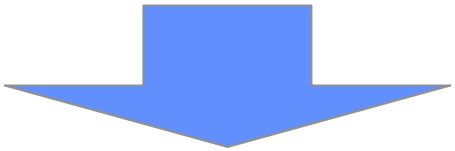
—*Yvo de Boer, Exec. Secretary UNFCC*

Industrial Energy Efficiency Benefits

Energy efficiency has demonstrated, time and again, that

- ✓ It saves industrial firms money
- ✓ It increase reliability of operations
- ✓ It has a positive effect on productivity and competitiveness
- ✓ It can offer attractive financial and economic returns
- ✓ Reduces exposure to rising energy prices
- ✓ Increases security of supply
- ✓ ….

then



Why it is not happening?

Barriers to greater energy efficiency

- Management focus is on production and not on energy efficiency
- Lack of information and understanding of financial and qualitative benefits
- First costs are more important than recurring costs → disconnection between capital and operating budgets
- Lack of technical training on *systems* energy efficiency (energy and management)
- Technical knowledge exists resides with individuals rather than with the organization → sustainability risk
- Poor monitoring system and data for overall operations

Industry and Energy Management

- Most energy efficiency in industry is achieved through changes in *how energy is managed* in an industrial facility, rather than through installation of new technologies;
- Actively managing energy requires an *organizational change in culture*
- *Top management needs to be engaged* in the management of energy on an ongoing basis.
- At its core, energy management requires a group of people to ***change their behavior*** and ***sustain the change***

Scope of energy management

Business Benefits

Implementation of an energy management plan assists a company to:

- Actively managing energy use and costs, reducing exposure to rising energy costs
- Reduce emissions without negative effect on operations
- Continual improvement of energy intensity (energy use/product)
- Document savings for internal and external use (e.g. emission credits)
- Utilize company personnel and resources wisely

Energy Management Results

- Companies who have used energy management to achieve major energy intensity improvements[1] include:
  - Dow Chemical achieved 22% improvement ($4B savings) between 1994 and 2005, and is now seeking another 25% from 2005 to 2015
  - United Technologies Corp reduced global GHG emissions by 46% per dollar of revenue from 2001 to 2006, and is now seeking an additional 12% reduction from 2006 to 2010
  - Toyota's North American (NA) Energy Management Organization has reduced energy use per unit by 23% since 2002; company-wide energy-saving efforts have saved $9.2 million in NA since 1999.

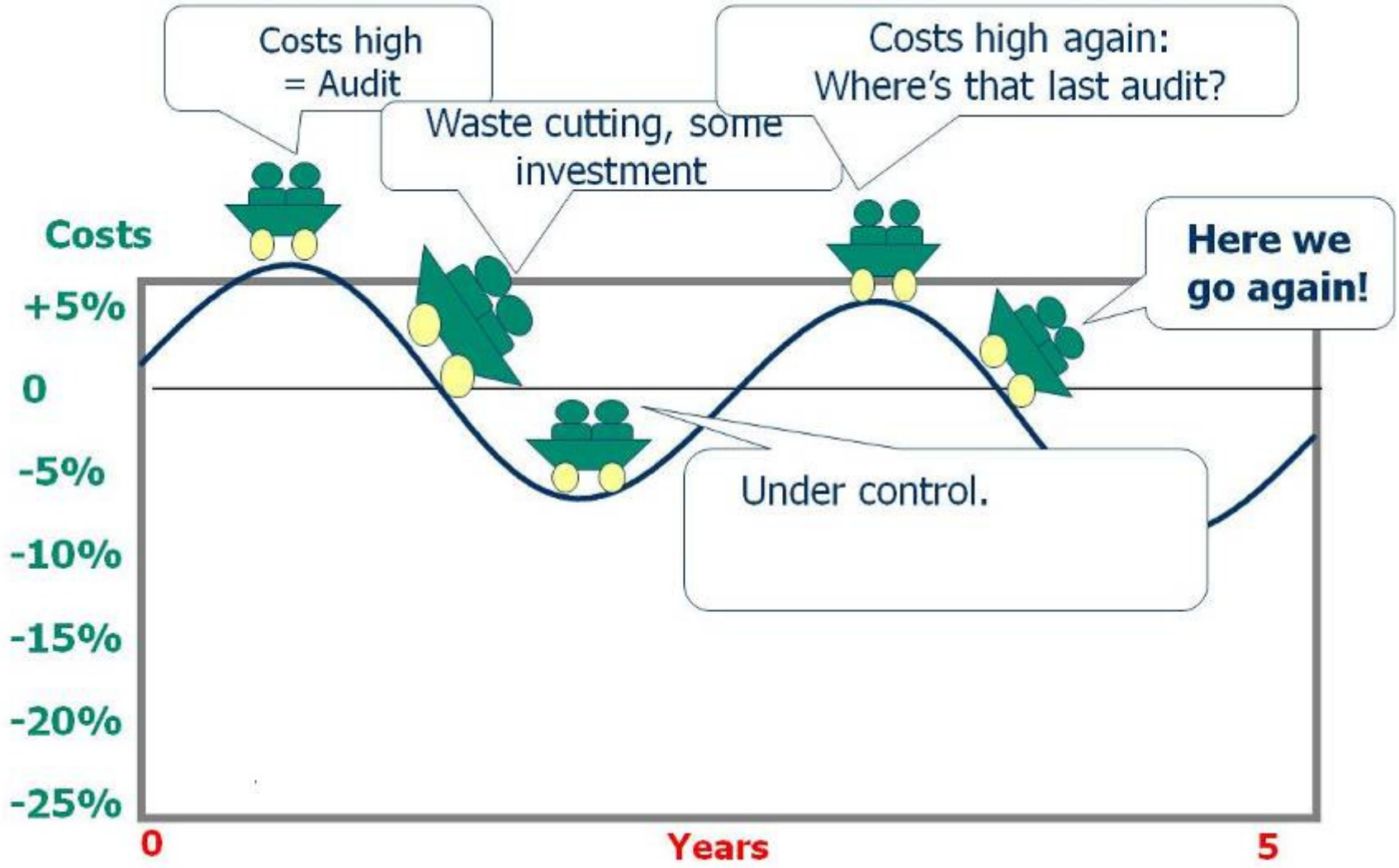
1 Btu/lb of product

Why an Energy Management Standard?

An energy management system (EnMS):

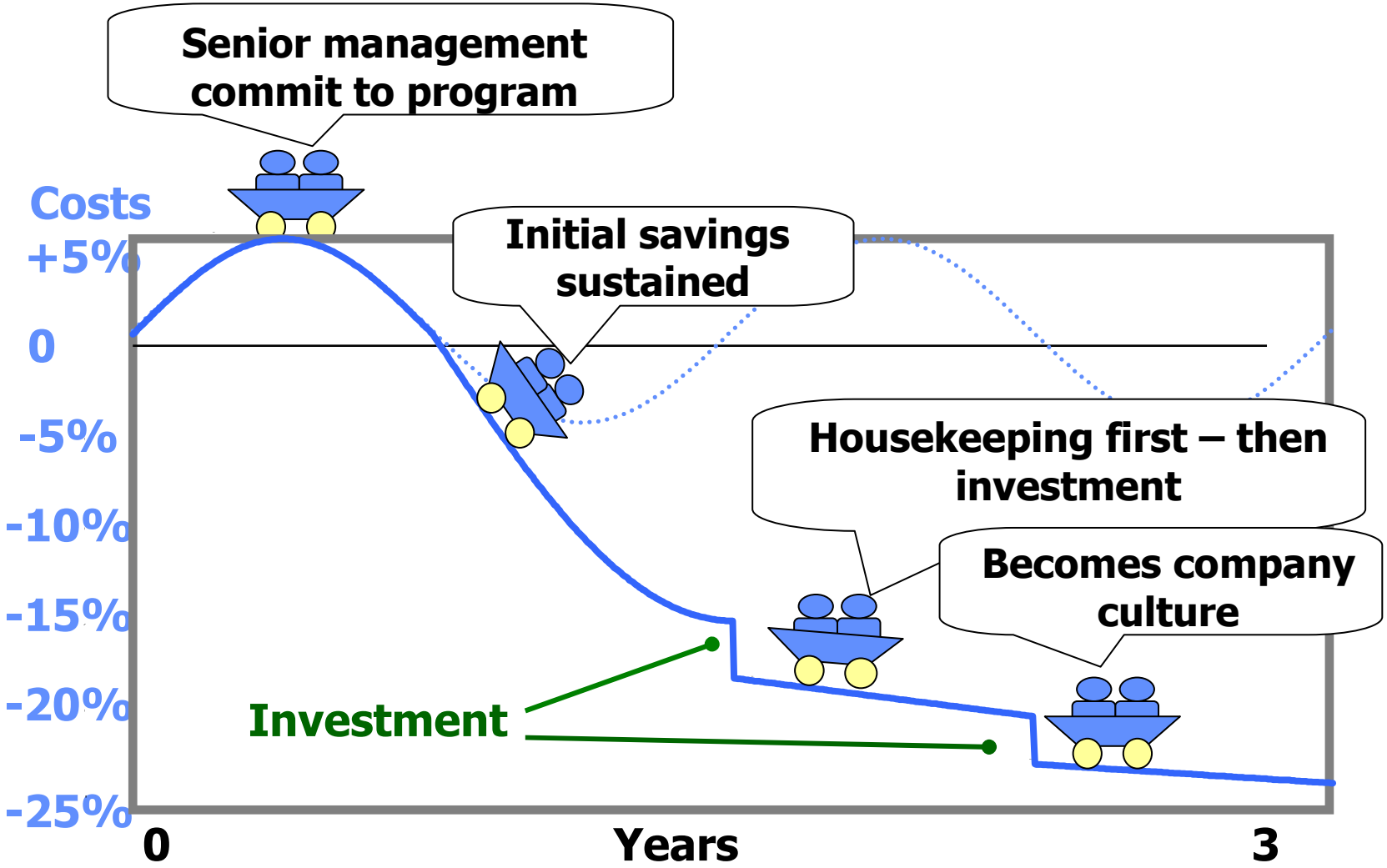
- *Strengthens* management focus on energy
- *Creates awareness* /encourages commitment across a company/organization
- Introduces and *sustains* a systematic approach to efficiency
- Requires management *commitment of resources* appropriate to the goals of the EnMS
- Is based on *measurement*
- Provides *continuity* through changes in personnel

Ad hoc approach to energy management…



Source: UNIDO 2010

Structured Approach



Source: UNIDO 2010

What can an EnMS achieve?

- Most industrial enterprises that have implemented EnMS achieved average ***annual energy intensity reductions of 2.0-3.0%*** against the 1.0% reduction of business as usual (Ireland, Netherlands, Denmark, USA)
- However, for companies new to energy management, savings during the first 2 years are **10-20%**
- EnMS accelerate adoption of energy efficient best-practices and technology upgrades, enhancing productivity and competitiveness

An EnMS improves a company's bottom line

ISO 50001 – Energy Management System Standard

ISO 50001 Energy management system standard will establish a framework for industrial plants, facilities, and organizations to manage energy.

Potential impacts:

- Applicable to commercial, institutional, and transportation sectors
- Could influence up to 60% of the world's energy use

Uptake of ISO 50001 will be driven by companies seeking an internationally recognized response to:

- Corporate sustainability programs
- Energy cost reduction initiatives
- Demand created along the manufacturing supply chain
- Future national cap and trade programs; carbon or energy taxes; increasing market value of "green manufacturing" / reduced carbon footprint
- International climate agreements

International Organization for Standardization

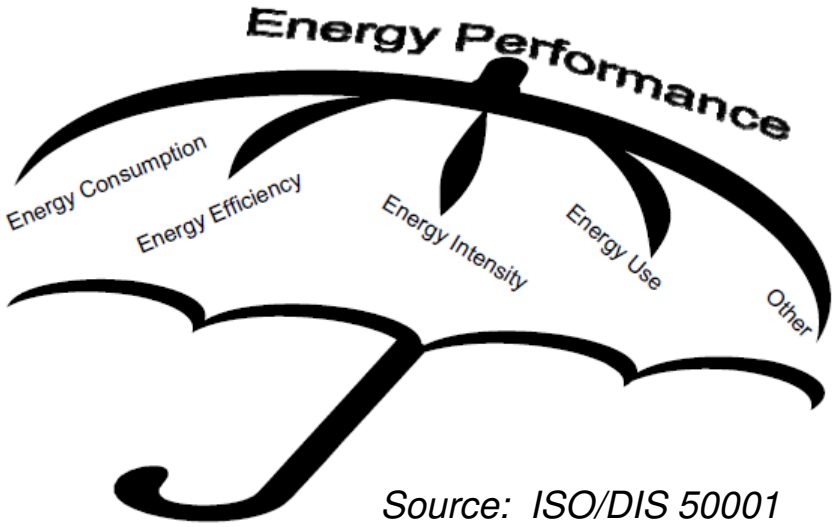
Status of ISO 50001

- Under development by ISO Project Committee 242; United States and Brazil lead effort with the United Kingdom and China
- 42 countries participating
- Draft International Standard released April 2010
- FDIS anticipated by March 2011
- Ready for publication by July 2011

ISO 50001 Energy Management System

Purpose of ISO 50001

"..enable organizations to establish the systems and processes necessary *to improve energy performance* .."



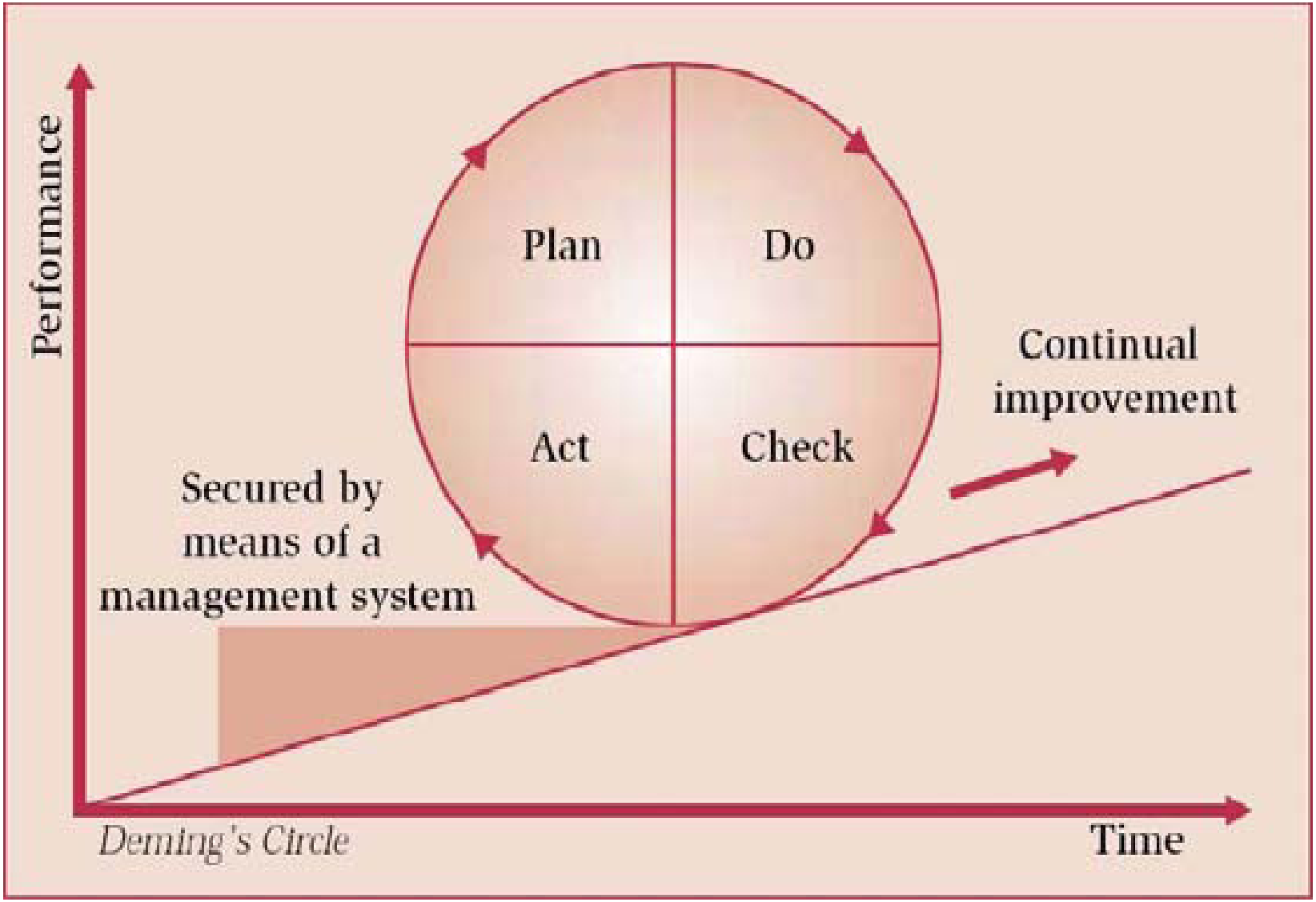
Source: ISO/DIS 50001

Scope of ISO 50001

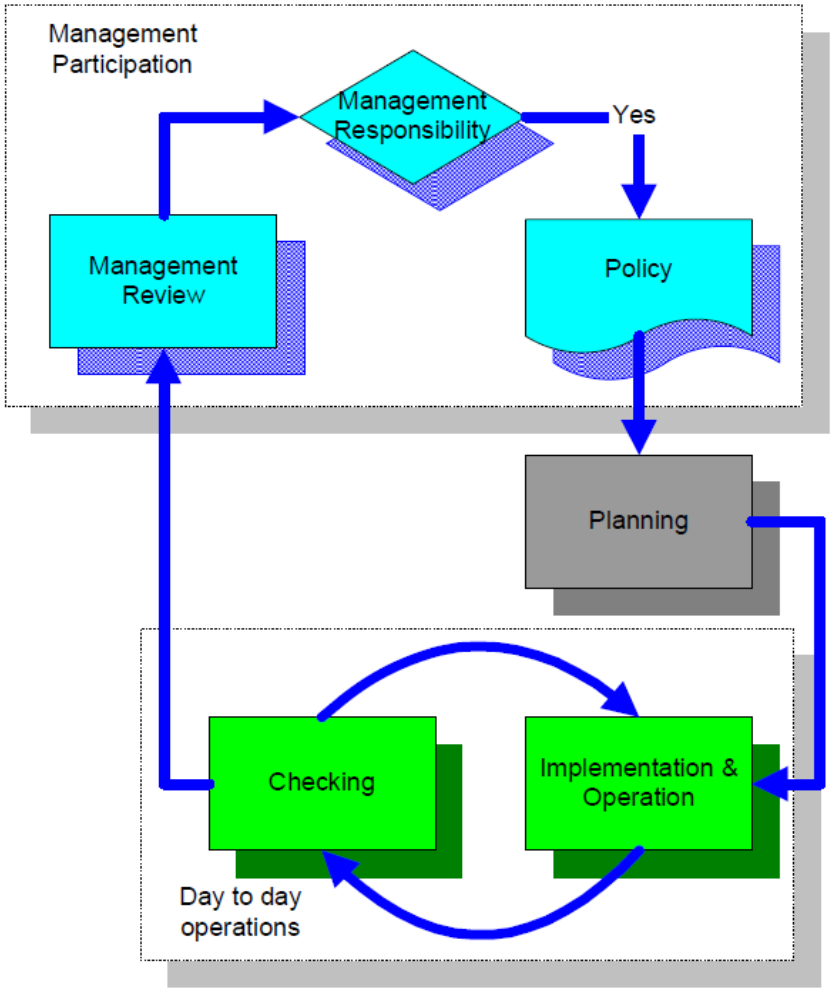
".. specifies requirements applicable to energy supply and energy uses and consumption, including *measurement,* documentation and reporting, *design and procurement practices for energy using equipment, systems, processes, and personnel"*

"It is applicable to all organizations"

Plan-Do-Check-Act



ISO 50001- Energy Management System



Source: UNIDO Practical Guide 2010

Based on the concept of:

- **Plan**
- **Do**
- **Check**
- **Act**

ISO/DIS 50001- Key Elements

Key Elements include:

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.
3. *Energy review* to assess current and planned energy use, energy sources and consumption and identify opportunities for improvement
4. *Baseline(s)* of the organization's energy use.
5. *Energy performance indicators* (EnPIs) that are unique to the company and are tracked against the baseline to measure progress.

ISO/DIS 50001- Key Elements

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* for significant energy uses
9. *Measurement, management, and documentation* for continuous improvement for energy efficiency .
10. *Periodic reporting of progress* to management based on these measurements.

4.4 Energy Planning

Energy planning

- Shall lead to activities to improve *energy performance*
- Involves review of the organization's activities which can affect *energy use and consumption*
  - Reduced energy consumption captures two related concepts- *energy efficiency and energy conservation*
- Establishes "significant energy uses"
- Identifies energy performance improvement opportunities
- Sets the *expectation for performance improvement* through objectives, targets, and action plans
- Presents a "data driven" approach
  - Actions to improve energy performance are developed and prioritized based on analysis of *measured and other data*

Energy Planning and the EnMS

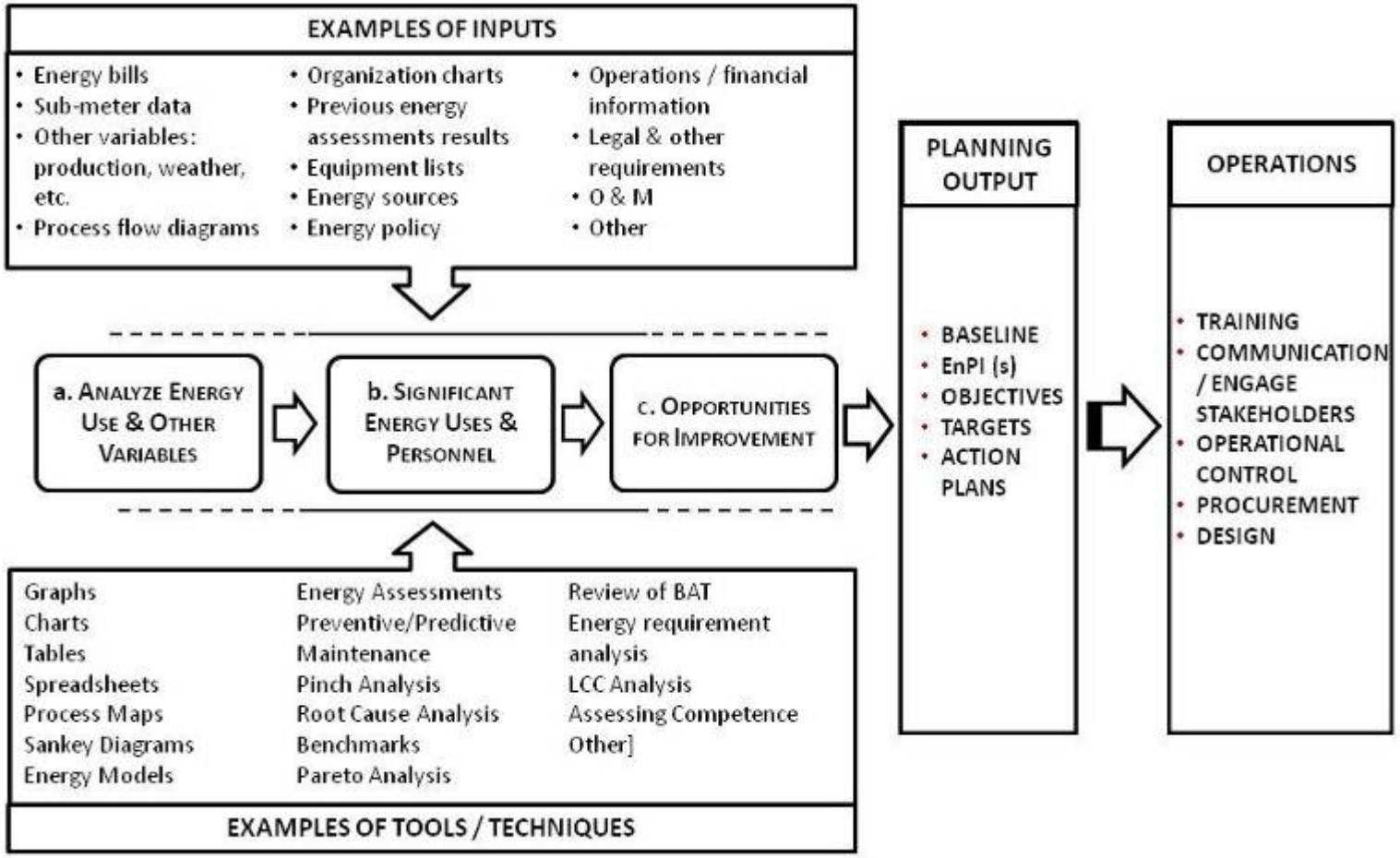


Figure A.2 — Energy Planning Process Concept Diagram

Applying ISO 50001

- Applies to all factors that can be monitored and influenced by the organization to affect energy use.
- Designed to be used independently, yet can be aligned or integrated with other management systems (e.g., ISO 9001 and ISO 14001). Applicable to all organizations that use energy.
- *Does not prescribe specific performance criteria or results* with respect to energy.
- Needs *enabling policies* to realize its global potential for GHG emissions reductions

What is Superior Energy Performance?

➢Market-based, US program developed w/support from the US Department of Energy

➢ANSI-accredited facility certification program that provides industrial and commercial facilities with a roadmap for achieving continual improvement in energy efficiency

Goals:

- Drive continual improvement in energy intensity
- Develop a transparent system to validate energy intensity improvements and management practices
- Encourage broad participation throughout industry
- Support and build the industrial efficiency market and workforce

Superior Energy Performance will be launched nationwide in 2011.

Superior Energy Performance

Superior Energy Performance Certification Requirements:

1. Energy Management System Conformance to ISO 50001 Energy Management Standard
2. Energy Performance Improvement

An ANSI-accredited Verification Body will conduct a third-party audit to verify that the SEP requirements are met.

U.S. Council for Energy-Efficient Manufacturing

- Acts as champion of U.S. industry in pursuing national energy efficiency goals.
- Seeks to improve the energy intensity of U.S. manufacturing through a series of initiatives.
- Guides development of **Superior Energy Performance.**

Texas Industries of the Future

Superior Energy Performance Program Design

The program accommodates:

- Maturity of plant's energy management program
- Level of external validation desired
- Business climate/cycle

Two Program Tiers:

Partner	Certified Partner
Self-declaration	*ANSI-accredited certification*

Performance Levels

Certified Partners can qualify for Silver, Gold, and Platinum based on:

- Validated energy intensity improvements
- Superior Energy Performance Best Practices Scorecard

SILVER

GOLD

PLATINUM

Certified Partner
ANSI-accredited certification

Performance Level Criteria

Performance Characteristics		Silver	Gold	Platinum
EI Pathway	**Energy Intensity Improvement**	Meets **5%** energy intensity improvement threshold over the last 3 years.	Meets **10%** energy intensity improvement threshold over the last 3 years.	Meets **15%** energy intensity improvement threshold over the last 3 years.
Mature Energy Pathway	**Energy Intensity Improvement**	Demonstrates an energy intensity improvement of **15%** or more over the last **10** years.	Demonstrates an energy intensity improvement of **15%** or more over the last **10** years.	Demonstrates an energy intensity improvement of **15%** or more over the last **10** years.
	Score on Best Practices Scorecard *Includes credits for energy management best practices and energy performance beyond the 15% EI improvement over the last 10 years.*	• Meets a score of **at least 35 and up to 60** out of 100 total points for Best Practices Scorecard • Minimum of 25 points required for the energy management best practices.	• Meets a score of **at least 61 and up to 80** out of 100 total points for Best Practices Scorecard • Minimum of 25 points required for the energy management best practices and 10 for energy performance.	• Meets a score of **at least 81** out of 100 total points for Best Practices Scorecard • Minimum of 25 points required for the energy management best practices and 10 for energy performance.

Partner Plants that self-declare results are not eligible for silver, gold, or platinum designation

System Assessment Standards

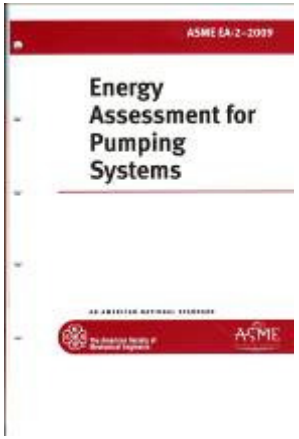
US Department of Energy and the American Society of Mechanical Engineers (ASME) have developed 4 standards to provide guidance on conducting an energy-efficiency system assessments and to help plants define a pathway for achieving energy savings.

Initial Four Standards:

- Pumping
- Compressed Air
- Steam
- Process Heating

Standards address:

- Organizing an assessment
- Conducting an assessment
- Analyzing the data collected and developing efficiency recommendations
- Reporting and documentation



Visit ASME website to purchase standards (print or digital) for $35:

- http://catalog.asme.org/home.cfm?CATEGORY=CS&TaxonomyItemID=3191
- **Corresponding guidance documents will be available in Fall 2010.**

Measurement and Verification Protocol

The Superior Energy Performance Measurement and Verification (M&V) Protocol is a methodology to:

1. Verify results and impact from implementing the energy management standard.
2. Track energy intensity changes over time for the overall manufacturing facility.
3. Documents energy performance normalized to production.

Program Certification Structure- Personnel

- Personnel (4 Types)
  1. **Certified Practitioner in Energy Management Systems:** Help plants implement the ISO 50001 energy management standard
  2. **SEP Lead Auditor:** conducts third-party audit of plants seeking to become SEP Certified Partners; verifies conformance to ISO 50001 and SEP Additional Requirements
  3. **SEP Validator**: Audit team member qualified to verify the energy performance improvement of plants seeking to become SEP Certified Partners
  4. **Certified Practitioner in [Type] Systems:** Perform compressed air, process heating, pumping, or steam system assessments using ASME standards to help plants meet the SEP energy performance improvement criteria

Program Certification Structure- Facilities

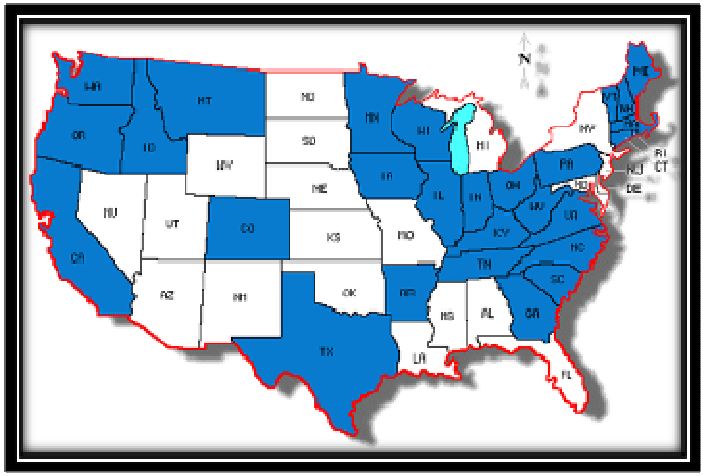
- Verification Bodies
  1. Perform third-party audit for plants applying to become Certified Partners
  2. Audits led by SEP Lead Auditor and SEP Validator
  3. Audits based on M&V Protocol

Energy Management Demonstration Projects

ITP is conducting State/Regional Energy Management Demonstration Projects in support of its *Save Energy Now* LEADER initiativ Superior Energy Performance.

Energy Management Demonstration Goals:

- **Provide *Save Energy Now* LEADER Companies with a roadmap** to achieve ambitious goals to reduce industrial energy intensity.
- **Test the elements of Superior Energy Performance**.
- **Build energy management expertise** at the regional, state, and plant level by showcasing lessons learned and best practices.
- **Broaden energy savings** throughout the nation.



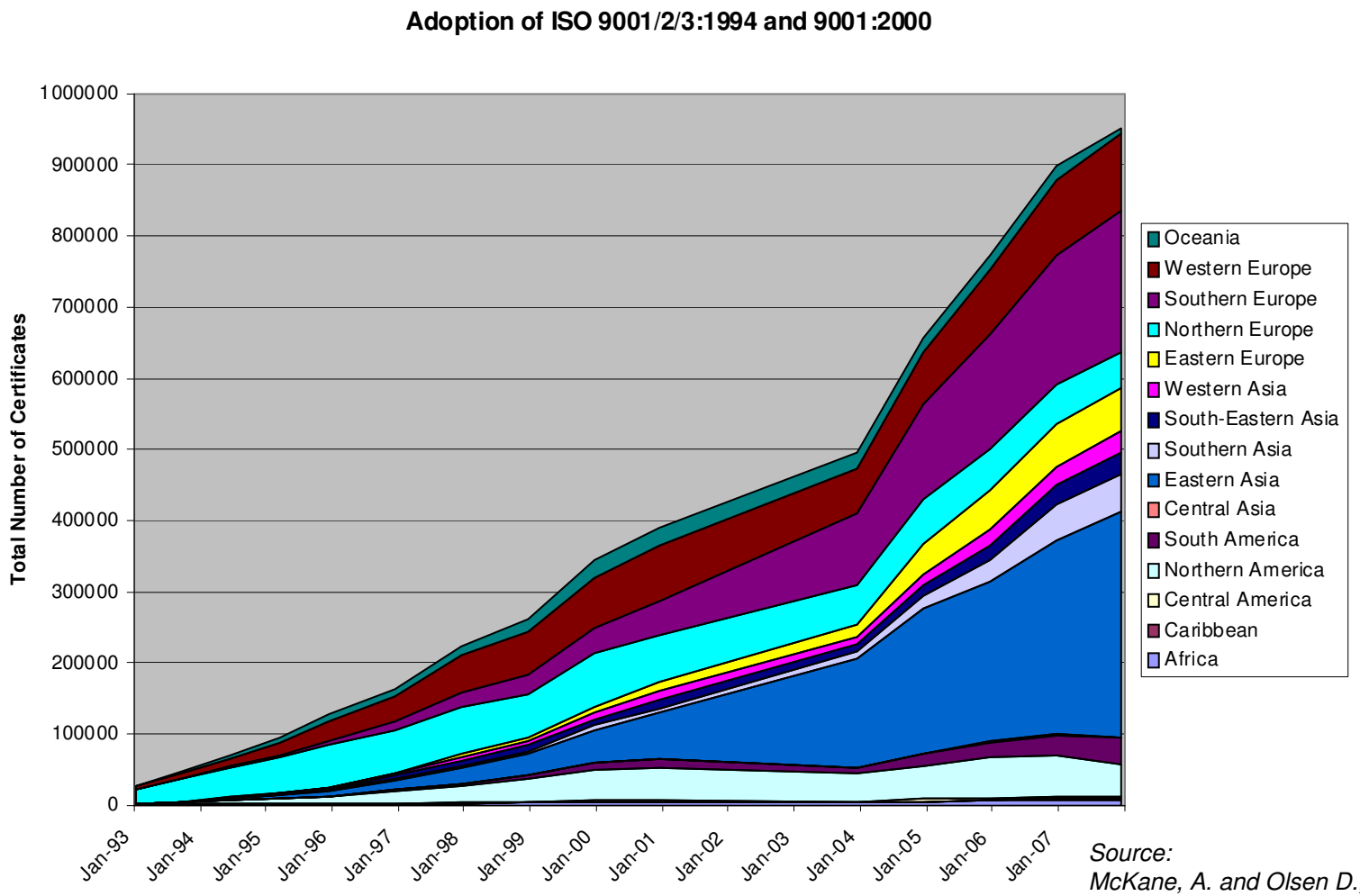
- **2008-2010**:Texas Pilot
  - the first plants certified by SEP
  - first SEP certification body receives ANSI-accreditation
- **2009:** Northwest region initiated demonstration projects
- **Summer 2010:** Southeast, Midwest, Mid-Atlantic, Northeast regions
- **Fall 2010:** California, Colorado
- **Fall 2011:** Texas (2nd round)

http://www.eere.energy.gov/industry/energymanagementdemonstrations/

Global Superior Energy Performance: GSEP

- GSEP is conceived as an international network of national government agencies, national-level certification programs, and other public/private sector organizations that will catalyze continuous energy performance improvements in **commercial buildings and industrial facilities** of all performance levels.
- The GSEP partnership includes Canada, the European Commission, France, India, Japan, Korea, Mexico, Russia, South Africa, Sweden, and the United States.
- GSEP was announced in July 2010 at the Clean Energy Ministerial, which convened 25 energy ministers from 20 countries and the European Commission.
- Clean Energy Ministerial provided a forum for like-minded countries to take specific steps forward to promote clean energy technologies.
- See www.cleanenergyministerial.org/gsep

Global impact of ISO 9001



Source:
McKane, A. and Olsen D., LBNL 2009
based on ISO Survey data

ISO 50001 and Trade

- All indications are that ISO 50001 will have an even greater impact on international trade than ISO 9001
  - —Companies will demand participation by their suppliers- this is already happening for environmental and lean manufacturing (i.e.--Wal-Mart, Toyota)
  - —Uptake of ISO 9001 in the supply chain was driven largely by Western European countries and Japan
  - —Uptake of ISO 50001 will be driven the US, Canada, the expanded EU, Japan, Korea, China, Brazil, and India
  - —Exporters that position themselves now will be at a competitive advantage

Early Corporate Response to ISO 50001

Anglo American has a global initiative to reduce energy consumption (against business as usual) by 15% by 2014, off a 2003 baseline. … the company was currently reviewing that target with the intention of raising it.

In time, **companies would have no choice but to get on the ISO 50001 'bandwagon' because the products that they sell would need it**, as customers would call for decarbonising of a company's products. Langridge anticipated that this would likely only be the case after about five years.

He emphasised that **the standard would force the management of a company to place a value on energy**, which would ultimately benefit an organisation, as it could ensure a competitive advantage.

ISO 50001 would enable businesses to systematically set and reach energy-use goals, **and realise energy cost savings.** An ISO 50001 management system for energy was said to be on track to become the universally accepted standard, and **many organisations were already working with it, so that they could be certified as soon as the document is released**.

*Ian Langridge, Anglo American principal electrical engineer, as quoted in an interview by Engineering News, August 25, 2010 (**bold** added)*

For additional information about Anglo-American's energy management initiatives, see http://www.angloamerican.com/aal/siteware/optima/optima-volume-53-4.pdf

References

ISO 50001

- http://www.iso.org/iso/pressrelease.htm?refid=Ref1337
- http://www.iso.org/iso/pinero_focus_sept09.pdf
- http://www.unido.org/index.php?id=o86084

Superior Energy Performance

- www.superiorenergyperformance.net

Global Superior Energy Performance

- www.cleanenergyministerial.org/GSEP/

Energy Management Standards and System Standards

- http://industrial-energy.lbl.gov/node/94

Industrial Energy Policy

- http://www.unido.org/index.php?id=1000596