



An Introduction to ISO 50001:2011

How to Improve the Energy Performance of Your Organization



Module 2

- **Development and rational of ISO50001**
- **Purpose, scope, and key elements of ISO50001**



ENERGY MANAGEMENT SYSTEMS STANDARDS

ENERGY MANAGEMENT SYSTEM STANDARD – ISO 50001:2011

Realising the importance of energy management, ISO 50001:2011 was developed as the International Standard for energy management by the International Organization for Standardization (ISO) in 2008. The ISO 50001:2011 energy management system standard was published on June 15, 2011. It is anticipated to affect up to 60 percent of the world's energy consumption and has the potential to become a global trade catalyst for industrial energy efficiency in the same way that ISO 9001 has for quality. This standard is expected to achieve major, long-term increases in energy efficiency (20% or more) in industrial, commercial, and institutional facilities and to reduce greenhouse gas (GHG) emissions worldwide.



ENERGY MANAGEMENT SYSTEMS STANDARDS

DEVELOPING ISO 50001:2011

The U.N. Industrial Development Organization (UNIDO) was one of the earliest entities to recognise the industry need to develop an effective response to climate change and to the proliferation of national energy management standards. In March 2007, UNIDO hosted a meeting of experts which led to the submission of a formal request to the ISO Central Secretariat to consider undertaking work on an international energy management standard.

In February 2008, the Technical Management Board of ISO approved the establishment of a new project committee (PC 242 – Energy Management) to develop the new ISO Management System Standard for Energy. The project committee consisted of 35 participating countries and 5 observing countries. The first ISO/PC 242 committee convened in Washington, D.C. in September 2008 and again in Brazil in March 2009.



A MAJOR OPPORTUNITY

- This is the beginning of a new era – the Energy Climate Era. Increased energy efficiency will become the most important ‘momentum’ of the future.
- Low-cost options for reducing actual consumption – many of which are already available – offer the greatest potential for cutting CO2 emissions over the period to 2050.
- Former US Energy Secretary Steven Chu also indicated: ‘In fact energy efficiency is not just low-hanging fruit; it is the fruit that is lying on the ground. And energy efficiency means money back in your pocket because you pay less on your energy bills.’ Energy conservation technology and facilities or equipment are only part of the approach to improve energy efficiency. Most energy efficiency in industry is achieved through changes in how energy is managed in a facility, rather than through the installation of new technologies.



ENERGY MANAGEMENT SYSTEMS STANDARDS

RATIONAL OF ISO 50001:2011

Implementation

Improve energy efficiency

Improvements

Improve energy performance

Periodic review and EnMS evaluation helps:

- Identify opportunities for improvement
- Implementation of identified opportunities
- Improvements in EnMS and energy performance



ENERGY MANAGEMENT SYSTEMS STANDARDS

PURPOSE OF ISO 50001:2011

- Details of the fundamentals of energy management systems are outlined in the Introduction and Scope
- Energy management systems:
 - Establish systems and processes and improve energy performance, including Energy Efficiency, Use and Consumption
 - Lead to reductions in costs and GHG emissions
 - Introduce a continual improvement process
 - Lead to more efficient energy use
 - Create energy measurement plans as well as energy analysis



ENERGY MANAGEMENT SYSTEMS STANDARDS

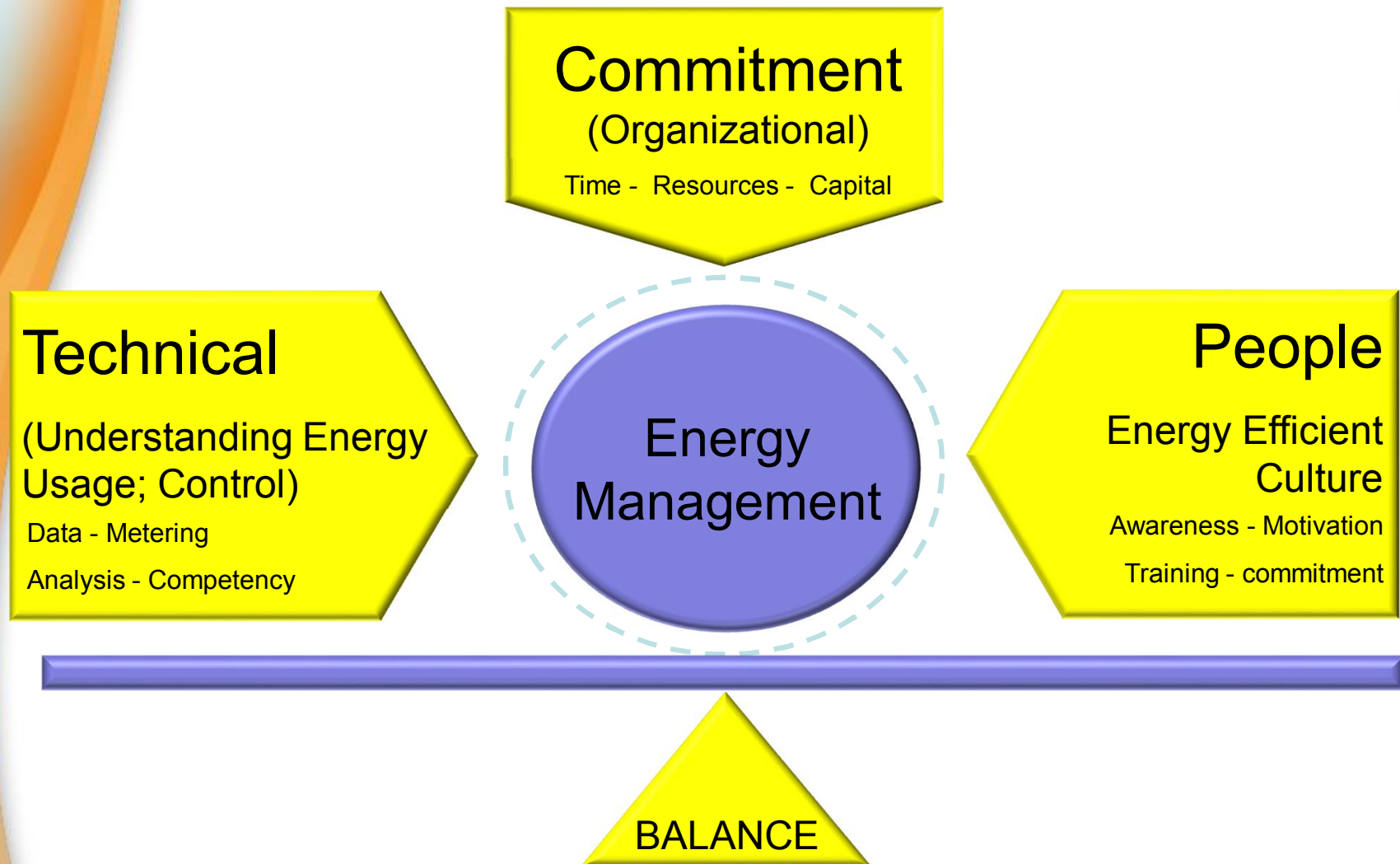
SCOPE OF ISO 50001:2011

- Specifies requirements applicable to energy use and consumption, including measurement, documentation and reporting, design and procurement practices for facilities, equipment, systems, processes and personnel that contribute to energy performance
- Applies to all variables affecting energy performance that can be monitored
- Does not prescribe specific performance criteria with respect to energy
- Can be aligned or integrated with other management systems
- Ensure that it conforms to its stated energy policy and wishing to demonstrate this to others



ENERGY MANAGEMENT SYSTEMS STANDARDS

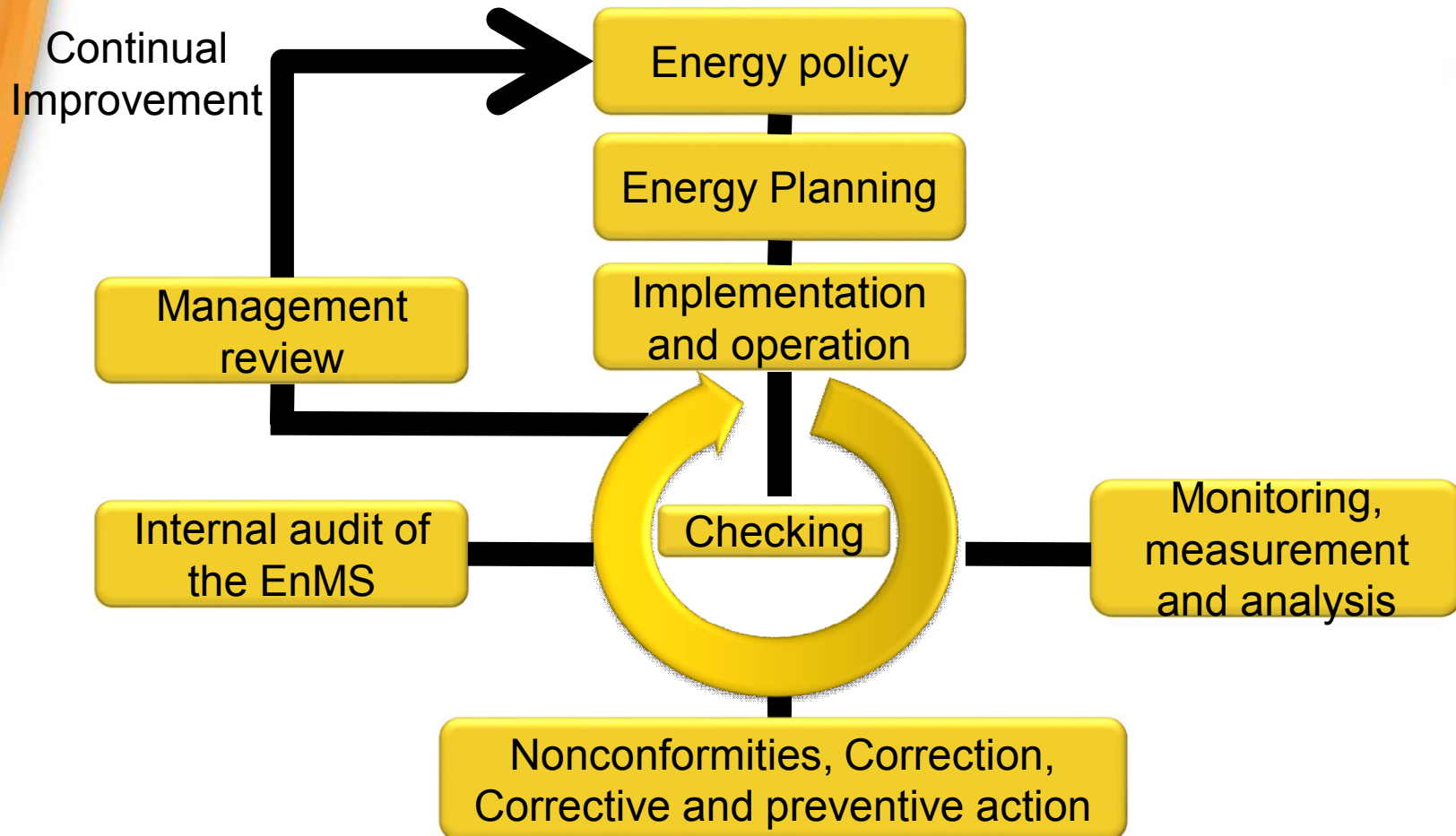
KEY ELEMENTS





ENERGY MANAGEMENT SYSTEMS STANDARDS

THE MODEL





Solutions?

- Rationing of fossil fuels
- Increase prices
- Slow down global developments
- Bring down rate of growth
- Change present lifestyles
 - Shun all power consuming devices: no air conditioners, mobiles, ovens, heaters, cars/ buses
- Explore new sources of fossil fuels
- Explore alternate sources of energy



Accepting the Challenge

- Use energy wisely (use only when required; do not use more than what is required)
- Operate and manage energy efficiently (Residential, Transport, Industrial etc.,)
- Adopt energy efficient technologies (Availability ? Cost ?)
- Use products which consume the least amount of energy and /or are carbon neutral



Benefits

An energy management system (EnMS):

- Allows for systems and processes to be established to improve energy performance, energy use and energy consumption
- Introduces a continual improvement process
- Creates energy monitoring plans as well as energy analysis activities
- Formalizes energy policy and objectives
- Improved drive toward innovation



Benefits (...cont.)

Within your organization, you can see benefits such as:

- Reduction in energy costs
- More efficient use of available energy sources
- Improved business performance
- Increased productivity and competitiveness
- Reduction in GHG emissions and other legislative requirements





Purpose of ISO 50001

Implementation

Help and enable organizations to establish the systems and processes necessary to improve

- Energy performance
- Energy use
- Energy consumption

World wide application will contribute to

- More efficient use of energy sources
- Enhanced competitiveness

Leading to reduction in

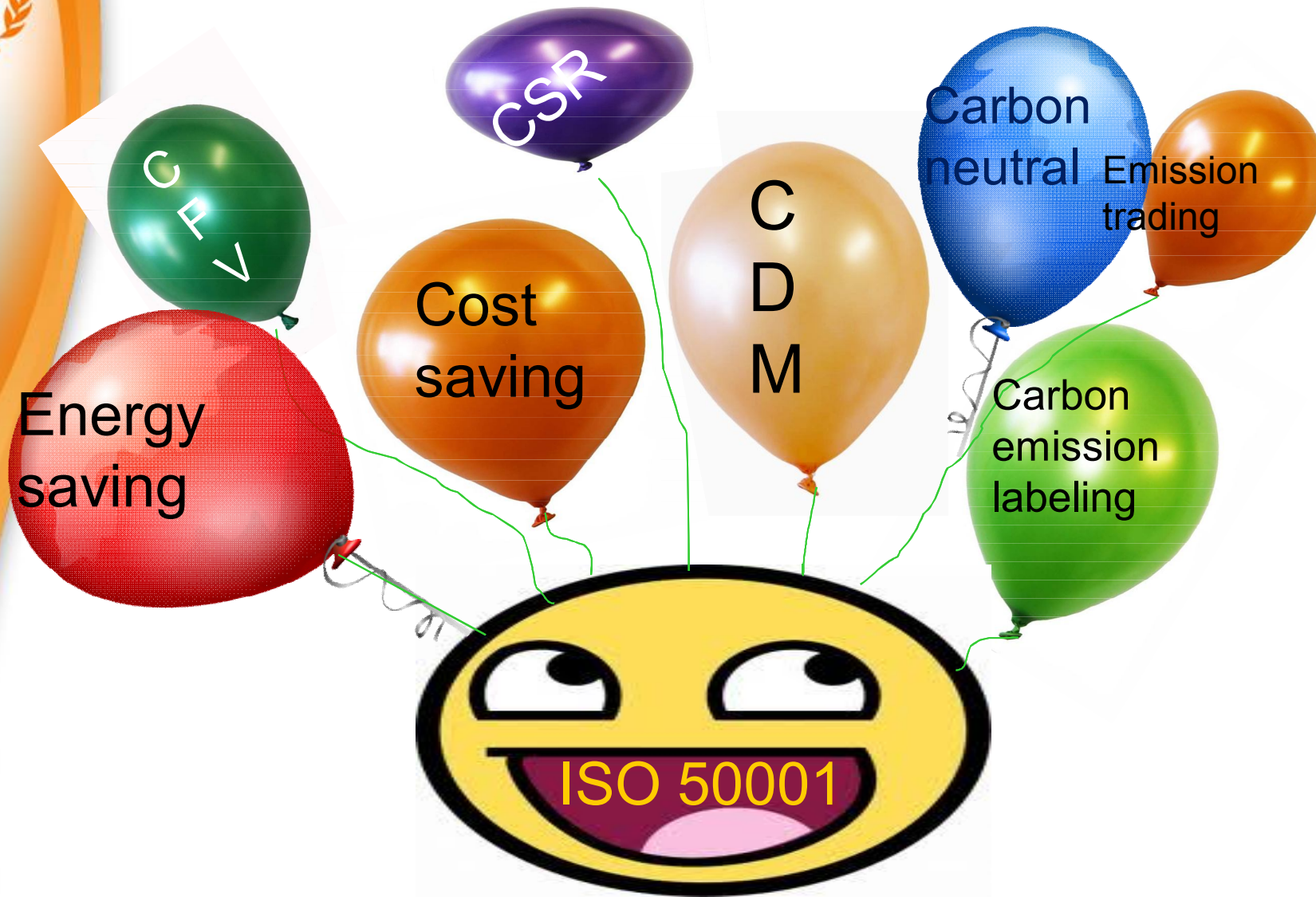
- GHG emissions
- Energy cost
- Other Env. Impacts

Through systematic management of energy



ISO 50001 with Other Initiatives

Energy saving	CFV (ISO 14064-1 / PAS 2050)	Cost saving
Carbon emission labeling	ISO 50001	CSR
Emission trading	Carbon neutral (PAS 2060)	CDM (ISO 14064-2)





Integrating ISO 50001 with Other Management Systems

- ISO 50001 can be used independently or integrated with other management systems
- The MS model is in line with ISO 14001
- Common or integrated policies (environment and energy policy) may be developed
- Documentation such as procedures, work instructions, and formats can be integrated as appropriate
- Operational controls can be integrated with an existing QMS/EMS
- Internal audits and management reviews can be integrated



Exercise 1

UNDERSTANDING ENERGY CASE STUDY



Module 4

- **Intent and interpretation of the requirement**
- **Ways to meet requirements**



Energy Planning (4.4)

- 4.4.1 General
- 4.4.2 Legal Requirements and other requirements
- 4.4.3 Energy review
- 4.4.4 Energy baseline
- 4.4.5 Energy performance indicators
- 4.4.6 Energy objectives, energy targets, and energy management action plans



Energy Planning Process

Planning Inputs

Past & present energy use

Relevant variables affecting significant energy use

Performance

Energy Review

1. Analyze energy use and consumption
2. Identify areas of significant energy use and consumption
3. Identify opportunities for improving energy performance

Planning Outputs

- Energy Baseline
- EnPI (s)
- Objectives
- Targets
- Action Plans



WHAT IS THE NEED?

- Identify the processes, break them into segments with it's battery limits
- List the energy use (equipment) attached to these processes
- Document the connected load of the process / use
- Identify the variables / concerns attached to these processes / equipment
- What is the metering system / accounting system
- % of the total energy of the process or the plant
- What are the existing controls present
- Flow diagrams with controls
- Track the service providers



Legal and Other Requirements (4.4.2)

- Planning Input
- Organizations are responsible for:
 - Knowing applicable energy use, consumption, and efficiency legal requirements applicable to their organization
 - Determining how these requirements impact their energy use
 - Ensuring they comply with these legal requirements
 - What is the method of updating the changes when these happen
 - Reviewing legal requirements at defined intervals



Energy Management Legislation

Most countries have evolved their energy policies, regulations and guidelines.



USA

- The Energy Policy Act 2005
- Regional Greenhouse Gas Initiative (RGGI)



UK

- Climate Change Levy (CCL) and Climate Change Agreement (CCA)
- EU Emission Trading Scheme (EU ETS)
- ISO 50001:2011

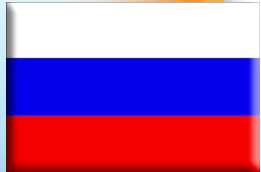


Australia

- The National Framework for Energy Efficiency (NFEE)
- The National Greenhouse and Energy Reporting Act (NGER)



Energy Management Legislation



Russia

- Energy Conservation Law 1996
- Energy Conservation and Increase in Energy Efficiency Law
- The National Energy Strategy 2020 (ES 2020)



China

- Energy Conservation Law (October 2007)



Japan

- Energy Conservation Law (1979)



India

- Energy Conservation Act 2001



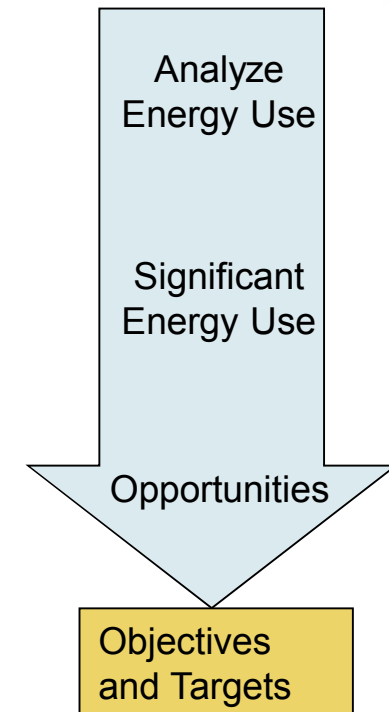
Standards Relating to Energy Management

ANSI/MSE 2000:2008	A Management System for Energy (American National Standards Institute)
I.S. 393:2005 Energy Management Systems	Requirements with Guidance for Use (NSAI, National Standards Authority of Ireland)
DS 2403:2001 Energy Management	Specification (Danish Standards Association)
Energy Management System	Specification with Guidance for Use (2004, Senter Novem, the Netherlands)
ISO 50001: 2011 Energy Management Systems	Requirements with guidance for use



Energy Review (4.4.3)

- Determine where you are before you determine where you want to be:
 - What is the methodology & Criteria for conducting a energy review
 - Analyze your past and present energy use and sources
 - Determine current energy performance(EnPI; Baseline)
 - Identify significant energy use areas
 - Estimate future energy use
 - Record opportunities for improving energy performance
 - Prioritize to take actions on areas identified as having the greatest potential in improving energy performance
 - Update the review at defined intervals and in response to major changes





WHAT IS DESIRED?

Based on the Initial Data that is available or has been captured:

- Capture / Segregate each energy source, and do a Pareto analysis to identify the equipment's and consumption (FESPP)
- Conduct a review or an energy audit to find the actual performance against the baseline and identify the significant equipment that is consuming more than the norms or desired value.
- Once the significant equipment are identified, understand the reason why it is significant. What caused it? List the variables or the concerns and how many.
- Based on the significance, list all the opportunities for improvement (LOOP).
- Based on the available resources or the importance categorize these on priority and make a schedule to address them.
- Attack the low hanging opportunities which can be done free of cost or with low investments.
- Draw a plan how and when these will be addressed.



WHAT IS DESIRED?.....Cont.....

- Convert these opportunities into objectives & targets and plan the action plans for achievement.
- Update the review process regularly.



Energy Baseline (4.4.4)

- Establish an energy baseline(s)
 - Using information in the initial energy review
 - Considering a suitable data period
- Measure changes in energy performance against the energy baseline(s)
- Make adjustments to baseline(s) when:
 - EnPI no longer reflects the organization's energy use and consumption
 - Major changes to the processes, energy systems, operations
 - According to a pre-determined method (based on production level, supply quality, seasons etc.,)
- Maintain and record energy baseline(s)





WHAT TO DO?

- Collect the data for the last 12 months if available. If not available then start today and create a baseline for every source / process / equipment.
- Collect both output of a process and the absolute energy consumed.
- Calculate the Specific consumption that you want to maintain.
- Check for the stability of the process in terms of output and see the energy consumed.
- See for reasons where the variations have taken place and why?
- Baseline is not a static document; it is a dynamic document and should be reviewed and updated on a regular basis.



Energy Performance Indicators (4.4.5)

- EnPIs must be:
 - Appropriate for monitoring and measuring energy performance
 - Reviewed with the baseline as appropriate
- Methodology for determining EnPIs must be recorded and regularly reviewed



HOW TO APPLY?

- What are the performance indicators attached to the process or the equipment, needs to be identified and ascertained.
- Are the macro level indicators linked to the processes and equipment that gives a common understanding.
- Do I need to monitor all the EnPIs all the time? Is it giving me a meaningful input? When do I change the EnPIs?



Objectives and Targets (4.4.6)

The output of the energy review. These are the goals for the EnMS and need to:

- Match the energy policy
- Be documented
- Be relevantly placed within the organization
- Contain time frames
- Account for legal requirements, significant energy uses, and opportunities for improvement, as well as business conditions





Action Plans (4.4.6)

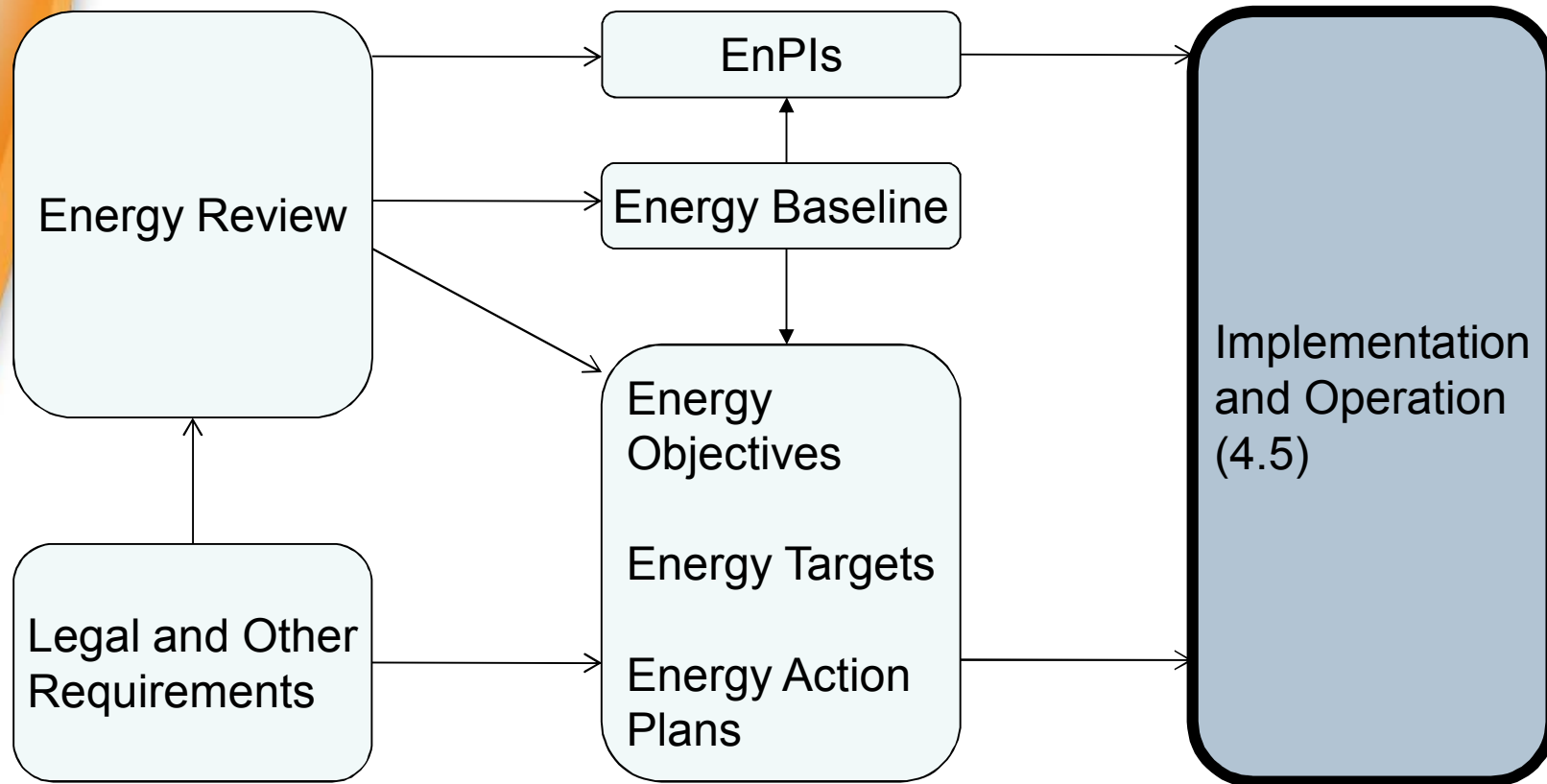
If objectives describe *what* you need to do, action plans describe *how* you will do it.

- Who is responsible for the objective or target
- When should it be met
- How will it be met
- How will you show that energy performance is improving
- How will you verify those results

Action plans must be documented and updated



Planning Summary





Exercise 1

UNDERSTANDING ENERGY CASE STUDY



Exercise 2

ENERGY PLANNING PROCESS



Module 6

- **Intent and interpretation of the requirement**
- **Ways to meet requirements**



Checking (4.6)

- 4.6.1 Monitoring, measurement and analysis
- 4.6.2 Evaluation of legal requirements and other requirements
- 4.6.3 Internal audit of the EnMS
- 4.6.4 Nonconformities, correction, corrective and preventive action
- 4.6.5 Control of records





Monitoring, Measurement, and Analysis (4.6.1)

- Key characteristics to monitor, measure, and analyze at determined intervals:
 - Significant energy uses and other energy review outputs
 - Relevant variables related to significant energy use
 - Energy Performance Indicators
 - Effectiveness of action plan(s) in achieving objectives and targets
 - Evaluation of actual versus expected energy consumption
- Record monitoring and measurement results
- Define and implement an energy measurement plan



Monitoring, Measurement, and Analysis (4.6.1) (cont.)

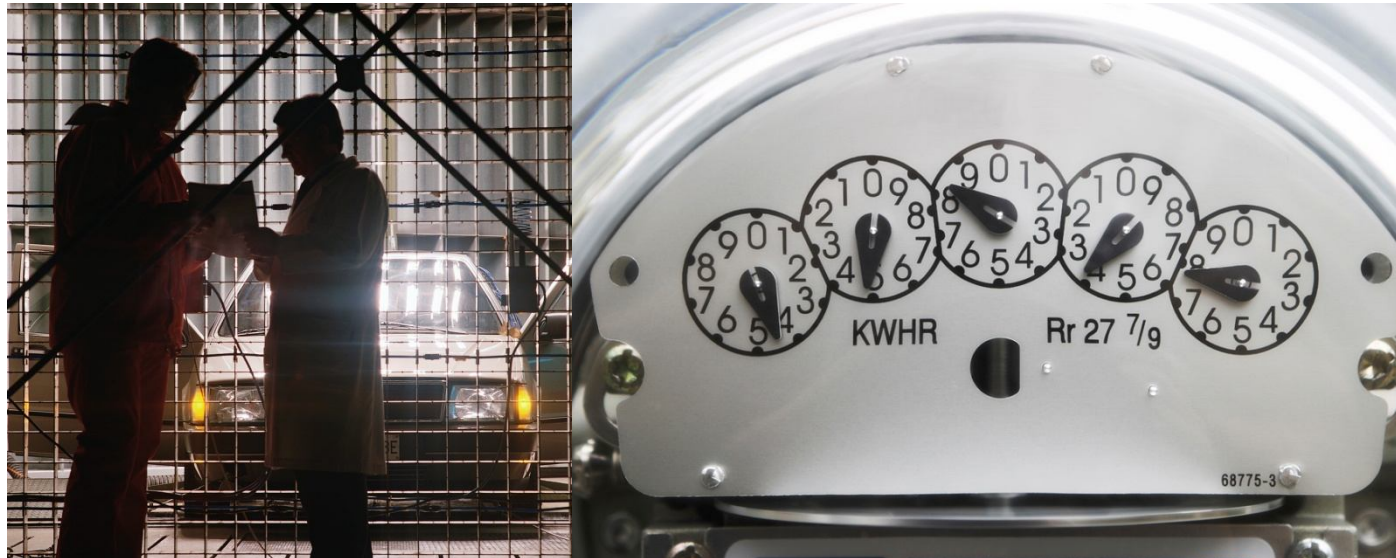
- Define and Review measurement needs periodically
- Ensure that the equipment used to monitor and measure is accurate and repeatable
- Maintain records of calibration or other means to establish the accuracy and repeatability of the measuring and monitoring equipment
- Investigate and respond to significant deviations in energy performance
- Maintain the results of activities



Evaluation of Legal Requirements and Other Requirements (4.6.2)

Evaluate compliance to legal and other requirements at planned intervals

Maintain the results of evaluations





Internal Audit of the EnMS (4.6.3)

- To ensure the EnMS is meeting objectives and targets, organizations must perform internal audits at planned intervals
- Audit plans and schedules must take into account:
 - The status and importance of the processes
 - Results of previous audits
- Ensure objectivity and impartiality for the audit process (selection of auditors, conducting the audit)
- Maintain records of results of the audit
- Report the results of the audit to top management



What to do?

- Internal audits are a requirement of ISO 50001
- Internal audits help:
 - Maintain systems
 - Create awareness
 - Identify the gaps in planning and implementation
- Results in continual improvements if performed regularly
- Can not be carried out the by the person responsible for the same activities
- Competent people can perform the internal audit
- Can be performed by external competent persons



Nonconformities, Correction, CAPA (4.6.4)

- Any deviations from the criteria set by the organizations (operating parameters, performance criteria etc.,) will be a nonconformity
- If the internal audit finds you are not compliant with the requirements of ISO 50001, you have a nonconformity, which should be addressed with a corrective action
- Potential nonconformities should be addressed with preventive actions to prevent nonconformities from occurring



Addressing Nonconformities

- Review nonconformities
- Determine the causes
- Evaluate the need for action
- Determine and implement the appropriate action needed
- Maintain records of CAPA
- Review the effectiveness of CAPA
- Ensure that CAPA is appropriate to the magnitude of the problem and effect on energy performance
- Ensure that necessary changes are made to the EnMS



Control of Records (4.6.5)

- Establish and maintain records necessary to demonstrate conformity to EnMS and ISO 50001
- Define and implement controls for identification, retrieval and retention of records
- Ensure records remain legible, identifiable and traceable



What Records are required?

1. Energy review (clause 4.4.3)
2. Opportunities for improving energy performance (clause 4.4.3 c)
3. Energy baselines (clause 4.4.4)
4. Records of competence, education, training, skills and experience (clause 4.5.2)
5. Trainings provided and other actions taken to meet the needs of competence (clause 4.5.2)
6. External communication (decision) (clause 4.5.3)
7. Results of the design activities (clause 4.5.6)
8. Results from monitoring and measurements of key characteristics (clause 4.6.1)
9. Records of calibration and other means of establishing accuracy and repeatability of equipments used for monitoring and measuring key characteristics of its operation (clause 4.6.1)
10. Records of activities carried out when “significant deviations in energy performance” encountered. (clause 4.6.1)



Exercise 3

UNDERSTANDING CLAUSE 4.6 OF ISO 50001



Module 9

- **The Certification Process**
- **The Accreditation Process**



Certification Requirement

1. Gain Top management commitment for EnMS
2. Appoint Energy management team/ MR
3. Promote awareness of EnMS
4. Finalize organ gram & Job descriptions
5. Develop Metering Plan / Review Instrumentation process
6. Develop Legal Compliance Management System
7. Develop understanding of Procurement team
8. Develop Service QM on EnMS for Service Providers
9. HRD to understand role and comply
10. Energy Review Process and Gap Assessment



Certification Requirement

11. Baseline, EnPI and Improvement Opportunities
12. Apex Level Documentation, Energy Policy
13. System Procedures as per EnMS
14. Develop Implementation plan at Departmental Levels
15. Section Specific Documentation
16. Identification of Internal Auditors
17. Joint Internal Audit with consultants
18. Operate and assess EnMS / Closure of IA Findings
19. Management Review
20. System offered for Certification



Accreditation Requirement

CBs for all types of management systems conform to the most recent versions of ISO 17021:2011, Conformity assessment - Requirements for bodies providing audit and certification of management systems

1. Requirement Documents (current versions)

- 1.1 ISO 50001, Energy Management Systems – Requirements with guidance for use
- 1.2 MSE 50028, Superior Energy Performance – Requirements for verification bodies for use in accreditation
- 1.3 ISO/IEC 17021, Conformity assessment – Requirements for bodies providing audit and accreditation of management systems
- 1.4 MA 6000, ANAB Accreditation Manual, and applicable ANAB Accreditation Rules
- 1.5 IAF Mandatory Documents as applicable



Accreditation Requirement

2. Application Process

2.1 EnMS applicant CBs can obtain an application for informational use at www.anab.org.

2.2 The application process outlined at <http://www.anab.org/certification-bodies/become-acertification-body.aspx> must be completed via ANAB's Enterprise Quality Manager (EQM) database when the CB is ready to apply for EnMS accreditation.

2.3 The application fee includes the cost of one assessor day for the off-site documentation review.



Accreditation Requirement

3. Initial Assessment and Accreditation

- 3.1 An ANAB accreditation assessor shall conduct a full documentation review.
- 3.2 After the documents are found acceptable, ANAB shall conduct an office assessment and required witnessed audits.
 - 3.2.1 The office assessment normally shall be conducted on site and is conducted to ensure the CB's certification process for EnMS conforms with ISO/IEC 17021 for ISO 50001.
 - 3.2.2 ANAB shall witness the CB conducting a two-stage audit process (stages 1 and 2).
 - 3.2.2.1 The stage 2 ISO 50001 audit shall be conducted by a team of at least two auditors of the CB.



Accreditation Requirement

The terms and definitions as specified within ISO 50001:2011 apply. The scope of accreditation is referenced to the definition stipulated from the ANAB document “Accreditation Rule 44 – Accreditation Program for ISO 50001 Energy Management Systems”. There are seven scopes of accreditation, including six categories referred to in MSE 50028 plus a category encompassing all other activities. They are:-

- Commercial Buildings
- Light to Medium Industry
- Heavy Industrial
- Transportation
- Building Complex Energy Use
- Energy Supply
- Other



Requirements for Verification Bodies: MSE 50028

Verification Bodies for Superior Energy Performance will be required to conform to the MSE 50028 standard, once released. MSE 50028 will specify the principles and requirements for bodies that undertake verification of energy performance and energy management systems. ANSI/ANAB will use MSE 50028 to accredit Verification Bodies for Superior Energy Performance. Until MSE 50028 is available, ANSI will use ISO 17021 to accredit Verification Bodies for Superior Energy Performance. MSE 50028 is based on ISO 17021 and is under development by the Georgia Tech Energy & Environmental Center (GTEEMC), an ANSI-accredited standards development organization. Upon completion of the due process requirements for American National Standards, MSE 50028 will be submitted to ANSI for adoption as an American National Standard.



Thank you

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