

Energy Management System

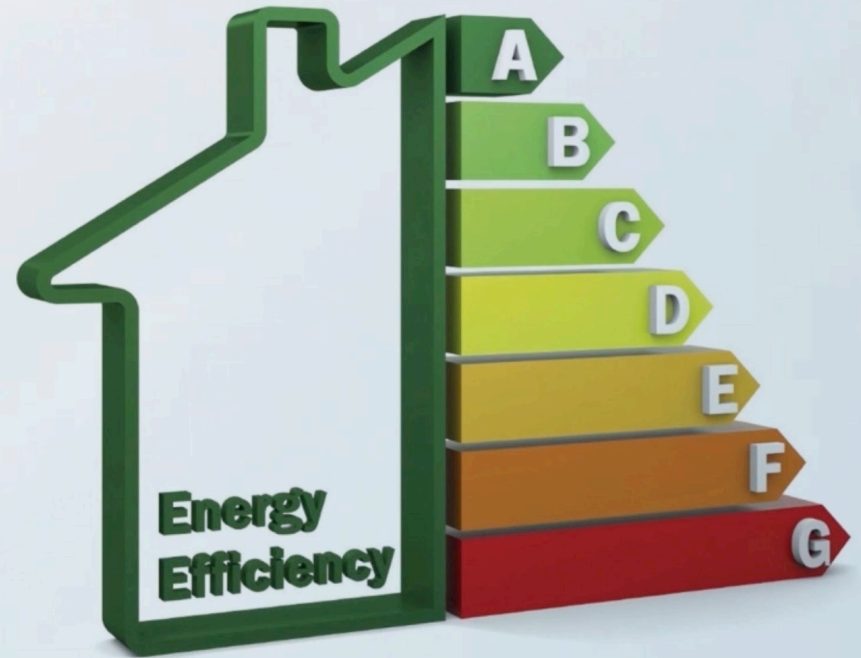
Level: Basic Knowledge

Course Introduction

Energy efficiency simply means using less energy to perform the same output

Energy efficiency brings a variety of benefits: reducing greenhouse gas emissions, reducing demand for energy imports, and lowering our costs on a household and economy-wide level

To be effective, energy efficiency should be included in an energy management system that implements policies, processes and procedures to achieve enhanced/high level of energy performance



Learning objectives



- **Introduction** to SEEC and Energy Management (EM) Program
- **Acknowledge** Energy Management System (EnMS) Terms and Definitions
- **Explore** Main Requirements of ISO 50001:2018
- **Understand** Foundations for the Implementation of an EnMS
- **Discover** Benefits and Feedback from an Effective EnMS

Introduction to SEEC and Energy Management (EM) Program

Introduction to SEEC and EM initiative

Main topics:





Mission & Vision 2010

The Saudi Energy Efficiency Center (SEEC) was established to promote and enhance the energy efficiency in the KSA



H.R.H. Prince Abdulaziz Bin Salman Al Saud

Minister of Energy





المركز السعودي لكفاءة الطاقة
Saudi Energy Efficiency Center



Vision

To be an **international reference** in the **energy efficiency** field, by collaborating with local and international governmental and private sectors stakeholders in order to develop **knowledge** and **experience** in the field of energy efficiency and enable the adoption of best practices inside the Kingdom and abroad



Mission

To **improve efficiency** in the **demand and supply of energy** in order to conserve the natural resources of the Kingdom, and to enhance economic and social well being in the Kingdom

SEEC's main Milestones and Stakeholders



SEEP represents a joint governmental effort involving all relevant stakeholders



SEEC's initiatives, achievement and perspectives

Initiatives and achievements

SEEC has implemented **35 initiatives** to improve and raise the efficiency of energy in **three key sectors**, occupying over **90%** of the **domestic energy consumption**:



Buildings

- Develop and update the **specifications and standards of energy efficiency** of small capacity air conditioners, refrigerators and washing machines
- Prepare **standards** for increasing energy efficiency for lighting, electric heaters, dryers, large-capacity air conditioners, electric motors
- Developed **regulations** for thermal insulation



Transportation

- Apply the **fuel economy card** on light vehicles
- Adopt **fuel economy standard** on light vehicles
- Establish a **standard for tire energy efficiency**



Industry

- Set out **energy intensity targets** on the existing and new steel, cement aluminum and petrochemicals industries and help them to improve their energy efficiency performance in order to achieve the required **energy intensity** targets

Perspectives

SEEC is aiming to **improve energy efficiency** within **medium sized and small manufacturing industries** through the **EM program** to achieve **3 key objectives**



Enable the sector to achieve **energy savings**



Establish an **energy efficiency culture**



Ensure **inclusiveness** of all industrial sectors



What is the EM Program?

The EM program is designed to offer an approach to support the energy efficiency culture of all facilities and ensure the necessary means are in place via the implementation of Energy Management System (EnMS)



EM

Energy Management

EM stands for energy management and the process of tracking and optimizing the energy to improve **energy consumption, energy use and energy efficiency**

EnMS

Energy Management System

EnMS is the abbreviation of energy management system and refers to a set of interacting elements of an organization to establish an **energy policy** and **objectives**, determine energy targets and implement **action plans** to achieve **energy objectives**

EM Program content

The EM Program is based on two high level pillars



EnMS or equivalent

Implementation of **energy management system** via **one of three options** to actively leverage the benefits of EnMS



Capacity building

Aimed at scaling the **energy management** and **energy efficiency awareness** and **understanding** of facilities primarily via awareness campaigns and e-learning content

Energy management system

A facility can opt for one of the three options below to implement an energy management system



ISO 50001

International standard for EnMS to align facilities' EnMS with industry best practice

SEEC 50001 Ready Program

Developed by SEEC to provide a **supported tool** with step-by-step process to evaluate a facility's current EnMS

Internal EnMS

Facilities can opt to plan and implement their **own internal EnMS** (demonstrated as equal to or better than ISO 50001)

Capacity building program

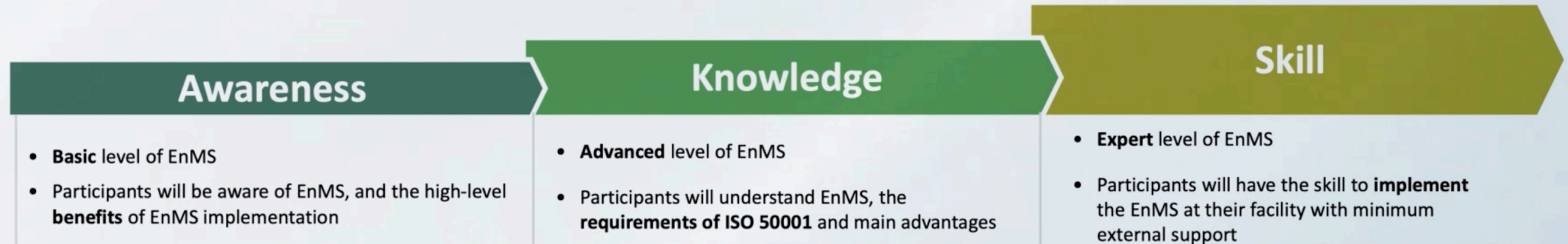


The **Capacity Building Program** is designed to **enhance the energy efficiency culture** of facilities, via a mix of mandatory measures while remaining open to all other facilities as part of the EM program

All facilities have free access to voluntary capacity building

Capacity building

The program will include e-learning modules for **3 competencies levels** of EnMS implementation, and a separate module on **energy efficiency**:



General Energy Efficiency Measures

- Aimed to identify **energy saving opportunities**
- Participants will be able to determine thermal and electrical energy measures

All facilities as part of the EM program will benefit from access to voluntary capacity building

Acknowledge Energy Management System (EnMS) Terms and Definitions

Acknowledge Energy Management System Terms and Definitions

- 1 Terms and definitions related to **energy**
- 2 Terms and definitions related to **energy management system**
- 3 Terms and definitions related to **performance**
- 4 **Quick check**
- 5 **Bonus**



For the purpose of vocabulary alignment, we only refer to the international standard for energy management system in this section.

ISO 50001:2018

Energy Management Terms and Definitions

Table of definitions

Terms related to energy

Energy

Energy consumption

Energy efficiency

Energy review

Energy use

Terms related to energy management system

Energy management system

Energy policy

Energy management team

Terms related to performance

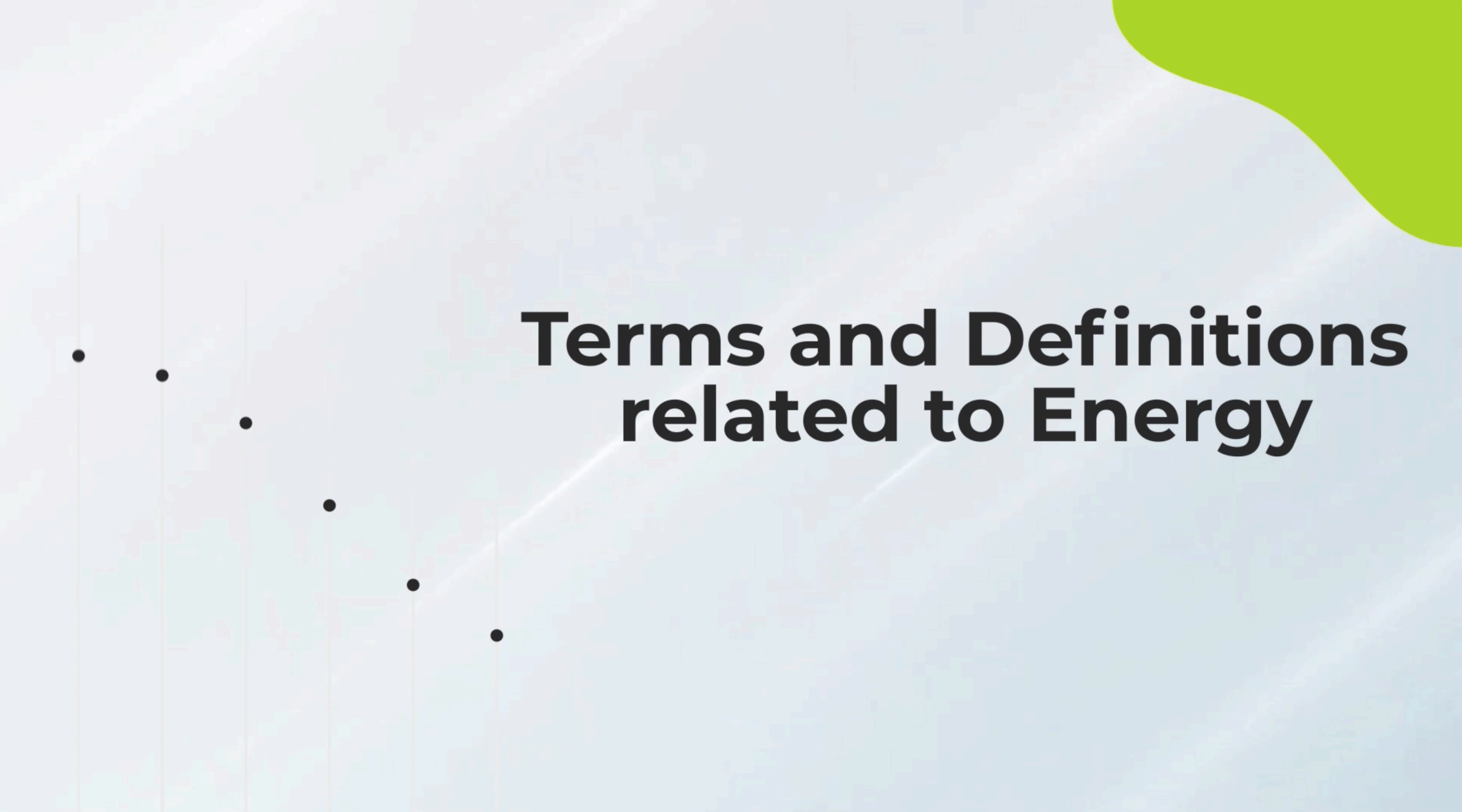
Energy performance

Energy baseline

Relevant variable

Energy objective

Energy target



Terms and Definitions related to Energy

Terms and Definitions related to **Energy**

ENERGY

Electricity, fuels, steam, heat, compressed air and other similar media

Source: ISO 50001:2018 clause 3.5.1

**ENERGY
CONSUMPTION**

=

**Quantity of
energy applied**

Terms and Definitions related to **Energy**

ENERGY EFFICIENCY

Ratio or other **quantitative relationship** between an output of performance, service, goods, commodities, or energy, and an input of energy.

Source ISO 50001:2018 clause 3.5.3

In other words:

When people try to limit the amount of energy that they use, it is called energy efficiency. It's a way of conserving, or saving, energy by using it more wisely.

Terms and Definitions related to **Energy**

ENERGY REVIEW

Analysis of energy efficiency, energy use and energy consumption

based on data and other information, leading to identification of significant energy uses and opportunities for energy performance improvement

Source ISO 50001:2018 clause 3.5.5



Energy Use
Is the application
of energy



Terms and Definition related to Energy management system



Terms and Definition related to Energy management system

ENERGY MANAGEMENT SYSTEM

Management system to establish an **energy policy, objectives, energy targets, action plans and process(es)** to achieve the objectives and energy targets

Source ISO 50001:2018 clause 3.2.2

Terms and Definition related to Energy management system

ENERGY POLICY

Statement by the organization of its overall intention(s), direction(s), and **commitment(s) related to its energy performance, as formally expressed by top management**

Source ISO 50001:2018 clause 3.2.4

Terms and Definition related to Energy management system

ENERGY MANAGEMENT TEAM

Person(s) with **responsibility and authority** for effective implementation of an energy management system and for delivering energy performance improvement.

Source ISO 50001:2018 clause 3.2.5

Terms and Definition
related to
Performance



Terms and Definition related to performance

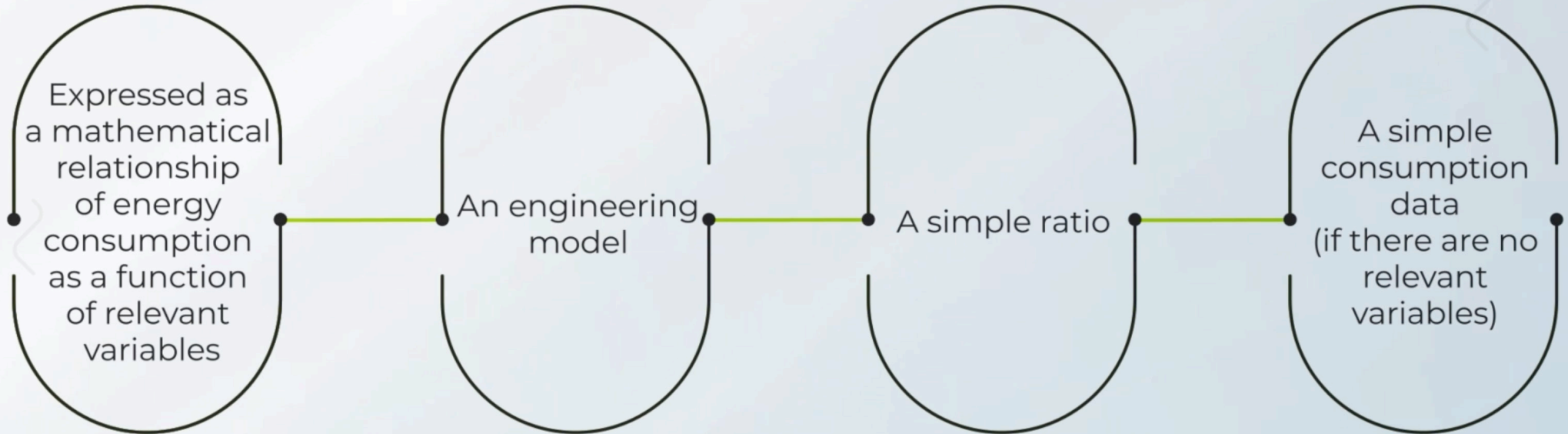
ENERGY PERFORMANCE

Measurable result(s) related to energy efficiency,
energy use and energy consumption

Source ISO 50001:2018 clause 3.4.3

ENERGY BASELINE (EnB)

Quantitative reference(s) providing a basis for comparison of energy performance. EnB may be:



RELEVANT VARIABLE



**Quantifiable factor
that significantly
impacts energy
performance and
routinely changes**

Terms and Definition related to performance

ENERGY OBJECTIVE

Source ISO 50001:2018 clause 3.4.13

Results to be achieved

Ex: reduce electricity
consumption

ENERGY TARGET

Source ISO 50001:2018 clause 3.4.15

Quantifiable objective of energy
performance improvement

Ex: 2% reduction of energy consumption
compared to previous year

Explore Main Requirements of ISO 50001:2018

Explore main requirements of ISO 50001:2018

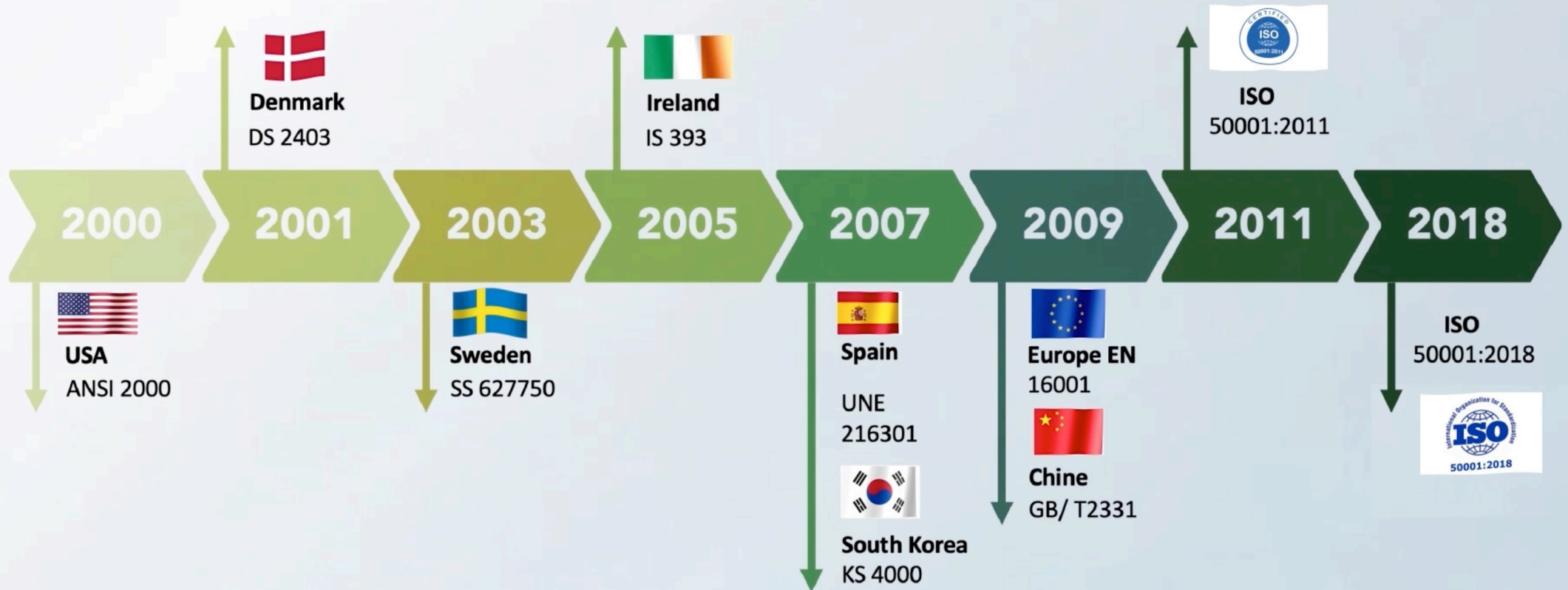
- 1 **Evolution** of energy management
- 2 **Types** of energy management
- 3 Key elements of **SEEC 50001 ready program**
- 4 **Energy management** associated standards
- 5 Purpose of **ISO 50001:2018**
- 6 **Energy management system** and legal obligations
- 7 **Structure** of ISO 50001:2018
- 8 **PCDA** and **continual improvement principles** in the context of EnMS
- 9 **Quick check**
- 10 **Bonus**

Evolution of Energy Management: from energy Conservation to Energy Management

The term energy management started to replace energy conservation during the period 1981-1993. Several models of effective energy management were developed and widely implemented. A consensus on what energy management started to emerge.



Evolution of energy management: from energy conservation to energy management



Types of Energy Management

EnMS can be implemented through three options

Reference



ISO 50001:2018

Overview

International standard that specifies the energy management system (EnMS) requirements for an organization



**SEEC 50001
Ready program**

Free tool developed by SEEC



Internal EnMS

Facilities' own EnMS

Types of energy management: ISO 50001: 2018



ISO 50001:2018, Energy management systems – Requirements with guidance for use. ISO 50001 is a strategic tool that helps organizations **put in place an energy management system** and use their energy more efficiently and effectively. ISO 50001:2018 is used for third party certification purpose.

Types of energy management: SEEC 50001 ready program



A self-based approach for any facility to **implement an energy management system.**



Guidance to **identify** and **analyze** facility-wide **energy use** and to **develop action plans** around energy performance improvements.

Types of energy management: organizations' internal EnMS



- Set of **internal requirements** to plan and implement an EnMS
- Can be **based on ISO 50001 and / or other best practices and guidelines** that may improve energy performance and provide a framework for identifying energy savings opportunities

The key elements of SEEC 50001 ready program

Context of the organization



01.

An EnMS and your
organization

02.

People and legal
requirements affecting the
EnMS

03.

Scope and
boundaries

The key elements of SEEC 50001 ready program

Leadership



04.

Management
commitment

05.

Energy policy

06.

Energy team and
resources

The key elements of SEEC 50001 ready program

Planning



07.

Risks to EnMS success

08.

Energy data collection and
analysis

09.

Significant energy
uses (SEUs)

The key elements of SEEC 50001 ready program

Planning



10.

Improvement
Opportunities

11.

Energy performance
indicators and energy
baselines

12.

Objectives and
targets

13.

Action plans for
continual
improvement

The key elements of SEEC 50001 ready program

Support



14.

Competence and training

15.

Awareness and
communication

16.

Documenting the
EnMS

The key elements of SEEC 50001 ready program

Operation



17.

Operational Controls

18.

Energy Considerations in
Design

19.

Energy
Considerations in
Procurement

The key elements of SEEC 50001 ready program

Performance evaluation



20.

Monitoring and
Measurement of the
EnMS

21.

Monitoring and Measurement
of Energy Performance
Improvement

22.

Internal audit

23.

Management review

The key elements of SEEC 50001 ready program

Improvement



24.

Corrective actions

25.

Continual improvement

Purpose of ISO 50001



To provide a **framework** for a complete, strategic approach to an organization's energy **policy, plans and actions** .

To encourage any organization to strive for the **continual improvement of energy performance** and **EnMS** .

To enhance **top management's commitment** toward the need to integrate energy performance into core business .

Energy management associated standards



- ISO 50002: Energy audits, requirements and guidelines
- ISO 50003: Energy management system, requirements for bodies conducting certification and audits
- ISO 50004: Guidelines including recommendations for the implementation of an EnMS
- ISO 50006: General principles and guidelines for measuring energy performance using energy baselines (EnB) and energy performance indicators (EnPI)
- ISO 50015: General principles and guidelines for measurement and verification of energy performance of organizations

Energy management associated standards

**ISO
50002**

Used to support energy review and facilitate monitoring, measurement and analysis as described in ISO 50001

**ISO
50003**

Used by certification bodies to ensure the effectiveness of the audit and certification

**ISO
50004**

Used for the implementation of ISO 50001

**ISO
50006**

Used to determine a methodology of energy performance indicators and energy baselines



**Used as audit criteria for
third party certification**

**ISO
50015**

Used to quantify and verify the effectiveness of energy performance improvement projects against its intended (or planned) outcome

Energy management associated standards



- **ISO 50002 : Energy audits, requirements and guidelines**

Specifies the process requirements for carrying out an **energy audit in relation to energy performance .**

It is applicable to all types of establishments and organizations, and all forms of energy and energy use .

Energy management system, requirements for
bodies conducting certification and audits
ISO 50003

Energy management associated standards



- **ISO 50003 : Energy management system, requirements for bodies conducting certification and audits**

Specifies requirements for competence, consistency and impartiality in the auditing and certification of ISO 50001 energy management systems (EnMS) for bodies providing these services.

Guidelines including recommendations for the
implementation of an EnMS

ISO 50004

Energy management associated standards



- **ISO 50004 : Guidelines including recommendations for the implementation of an EnMS**

Gives practical guidelines and examples for establishing, implementing, maintaining and improving an energy management system (EnMS) in accordance with the systematic approach of ISO 50001:2018. The guidance in this document is applicable to any organization .

General principles and guidelines for measuring energy
performance using energy baselines (EnB) and
energy performance indicators (EnPI)

ISO 50006

Energy management associated standards



- **ISO 50006: General principles and guidelines for Measuring energy performance using energy baselines (EnB) and energy performance indicators (EnPI)**

Provides guidance to organizations on how to establish, use and maintain energy performance indicators (EnPIs) and energy baselines (EnBs) as part of the process of measuring energy performance.

General principles and guidelines for measurement
and verification of energy performance of organizations

ISO 50015

Energy management associated standards



- **ISO 50015: General principles and guidelines for Measurement and verification of energy performance of organizations**

Establishes general principles and guidelines for the process of measurement and verification (M&V) of energy performance of an organization or its components

M&V is the process of planning, measuring, collecting data, analyzing, verifying, and reporting energy performance or energy performance improvement for defined M&V boundaries

ISO 50006 clause 3.13

Energy management system and legal obligations:

Legal survey general approach

ISO 50001 recognizes that energy- related obligations, both legal and voluntary, are an important component of a comprehensive and systematic method to energy management. 4 main steps are included in the legal survey approach:

1. Identify



2. Access

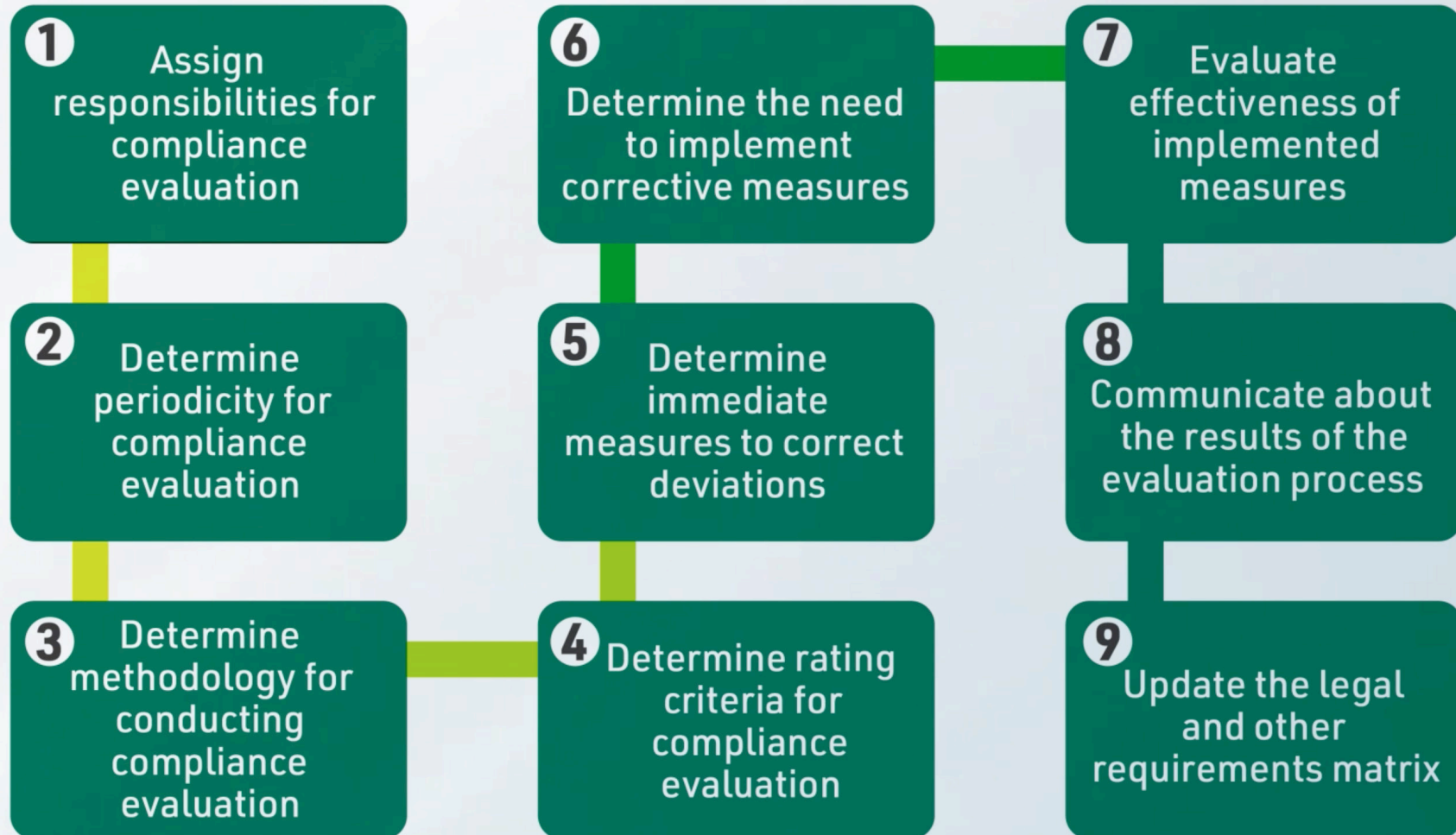


3. Evaluate



4. Update

Energy management system and legal obligations: Main sequence for the evaluation and update of legal & other requirements process



Energy management system and legal obligations:

Identify and access applicable legal and other requirements

To get started, gather information that answers the following questions :

1 What is your organization's existing process for identifying the applicable legal requirements related to energy uses?

2 Who in your organization has information on the applicable legal and regulatory requirements related to your energy uses?

3 How is this information maintained? Is there a list of these applicable legal and regulatory requirements?



4 Who is responsible for ensuring access to the applicable laws and regulations and their requirements? How is this accomplished?

Structure of ISO 50001:2018

High Level Structure:

- 1 Scope
- 2 Normative references
- 3 Terms and definitions
- 4 Context of the organization
- 5 Leadership
- 6 Planning
- 7 Support
- 8 Operation
- 9 Performance evaluation
- 10 Improvement

Structure of ISO 50001:2018

ISO 50001:2018 has been prepared with the aid of the basic structure for management system standards (" High Level Structure ", HLS) introduced by ISO, with the below structure:

1

Scope

2

Normative References

3

Terms and Definitions

4

Context of the Organization

5

Leadership

6

Planning

7

Support

8

Operation

9

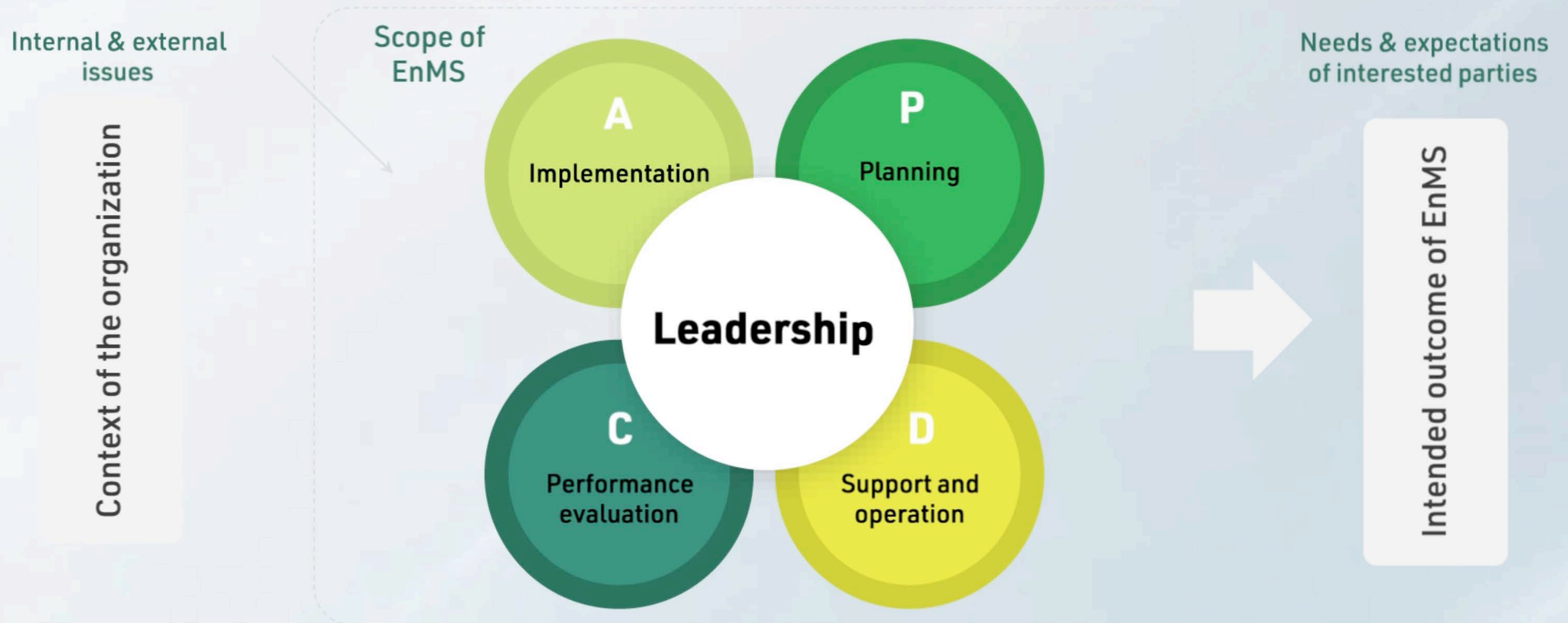
Performance Evaluation

10

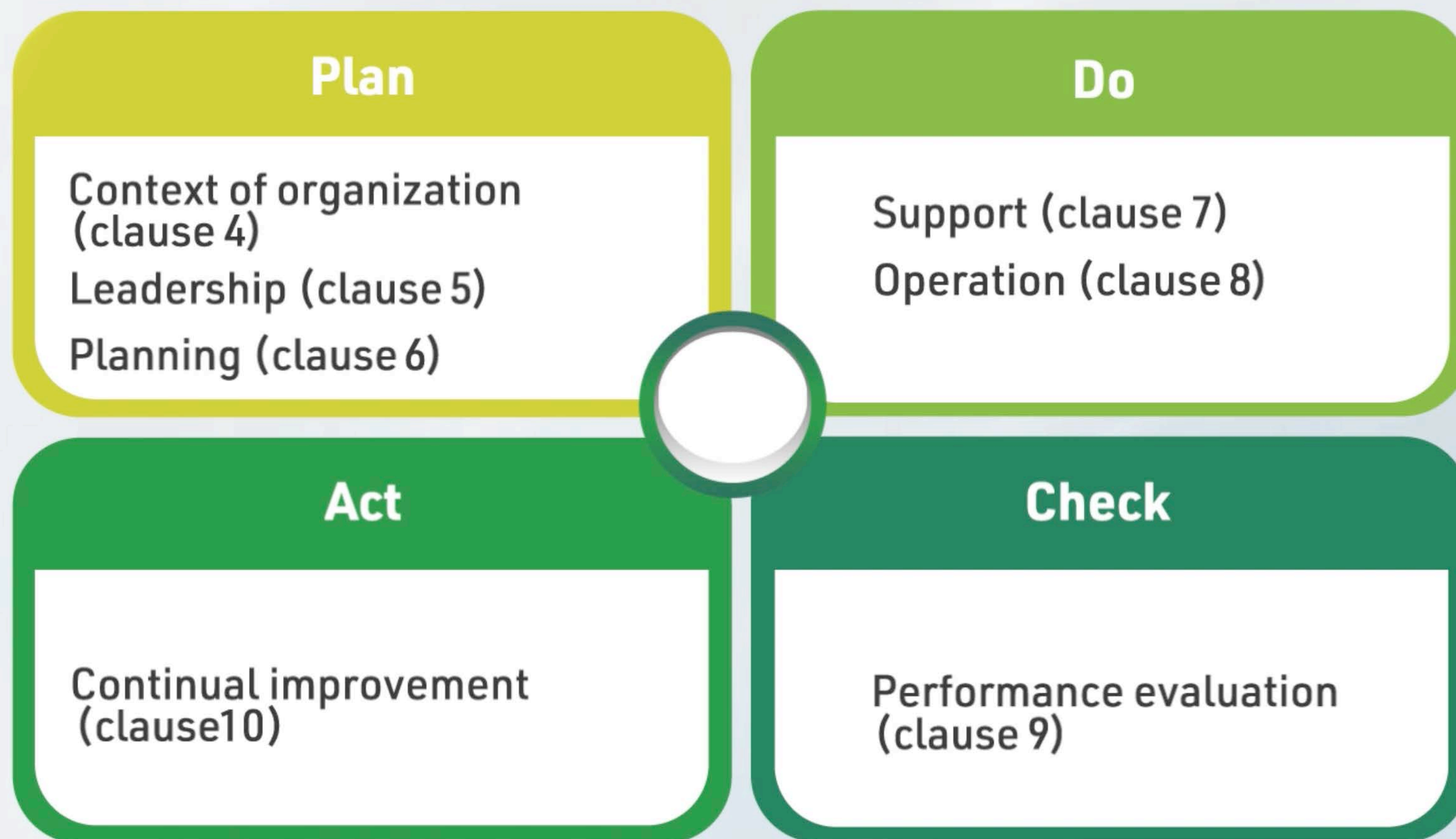
Improvement

PDCA and continual improvement principles in the context of EnMS

The EnMS described in ISO 50001 : 2018 is based on the **Plan - Do - Check - Act (PDCA)** continual improvement framework and incorporates energy management into existing organizational practices



PDCA and continual improvement principles in the context of EnMS



PDCA and continual improvement principles in the context of EnMS

Plan

Context of organization
(clause 4)

Leadership (clause 5)

Planning (clause 6)

PDCA and continual improvement principles in the context of EnMS

Do

Support (clause 7)
Operation (clause 8)

PDCA and continual improvement principles in the context of EnMS

Check

Performance evaluation
(clause 9)

PDCA and continual improvement principles in the context of EnMS



- **Monitoring, measurement, analysis and evaluation .**



- **Internal audit.**



- **Management review.**

PDCA and continual improvement principles in the context of EnMS

Act

Continual improvement
(clause 10)

PDCA and continual improvement principles in the context of EnMS



**Non conformity &
corrective actions**



**Continual
improvement**



PDCA and continual improvement principles in the context of EnMS

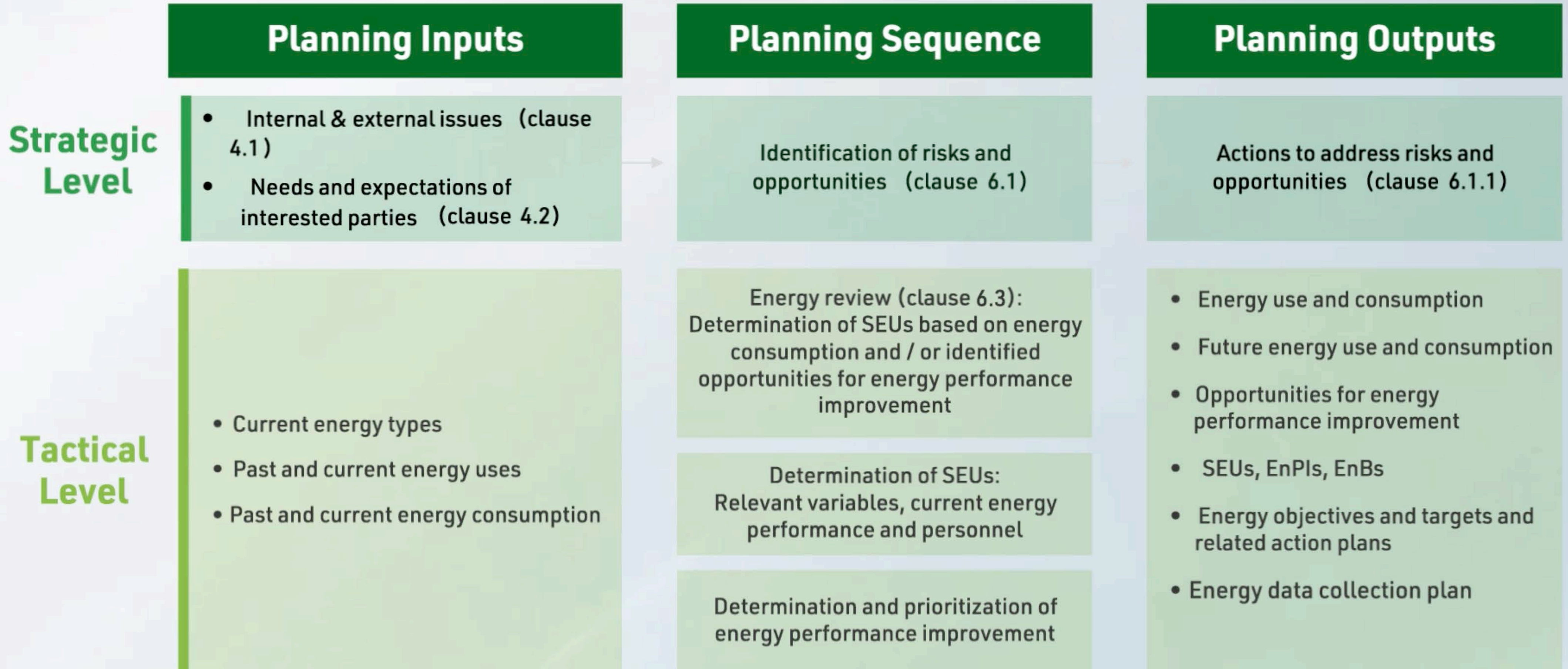
Plan

Context of organization
(clause 4)

Leadership (clause 5)

Planning (clause 6)

PDCA and continual improvement principles in the context of EnMS: The energy planning process



PDCA and continual improvement principles in the context of EnMS

Do

Support (clause 7)
Operation (clause 8)

PDCA and continual improvement principles in the context of EnMS

• Support

- Resources
- Competence
- Awareness
- Communication
- Documented information



• Operation

- Operational planning & control
- Design
- Procurement

PDCA and continual improvement principles in the context of EnMS



- **Monitoring, measurement, analysis and evaluation .**
- Evaluation of **compliance** with legal requirements and other requirements .



- **Internal audit:** systematic process of collecting and **evaluating** objective evidence against the requirements of ISO 50001:2018, internal EnMS and legal and other requirements .



- **Management review:** periodical evaluation of the suitability , adequacy and effectiveness of the energy management system .

Understand foundations for the implementation of an EnMS

1

Approach for the **implementation** of an energy management system

2

Basics for the **certification of an EnMS** as per ISO 50001:2018

3

Quick check

4

Bonus

Approach for the implementation of an energy management system

7 steps to start with your energy management system:

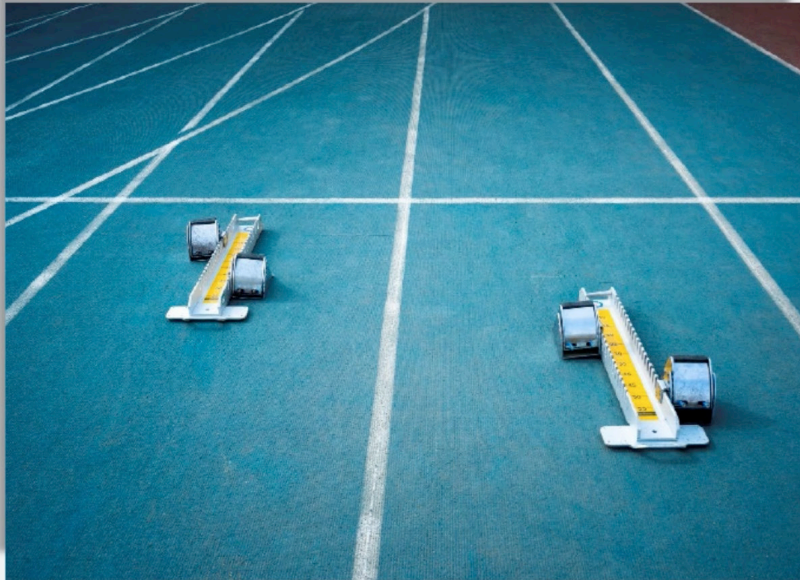
- 1 Self - assessment .
- 2 Securing top management commitment .
- 3 Defining roles and responsibilities .
- 4 Establishing a project plan .
- 5 Organizing energy data collection .
- 6 Establishing a documentation system .
- 7 Establishing a monitoring and measurement process .



Approach for the implementation of an energy management system

1

Self assessment



One of the first activities to be undertaken when implementing an energy management system within an organization is to **check the existing level of energy management** in the company. The purpose of such self - assessment is to identify the main priorities for our organization regarding the implementation process

Approach for the implementation of an energy management system

2

Securing top management commitment



It is crucial that any effective energy management system has the **full commitment** of top management of the organization. This commitment can be demonstrated by signing the energy policy but in general more is needed from top management to make successful energy management possible .

Approach for the implementation of an energy management system

3 Defining roles and responsibilities



Top management shall determine **key roles** of the energy management implementation team with significant responsibilities and authorities

Approach for the implementation of an energy management system

4 Establishing a project plan



Project planning is necessary to determine all relevant **sequences**, **delays**, **responsibilities** and **resources** for an effective implementation

Approach for the implementation of an energy management system

5 Organizing energy data collection



Approach for the implementation of an energy management system

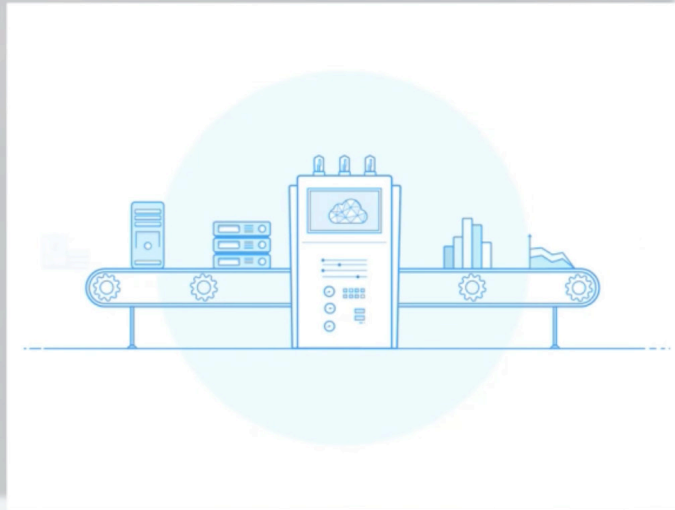
6 Establishing a documentation system



A solid documentation process ensures information **traceability** and **availability** at all levels of the organization

Approach for the implementation of an energy management system

7 Establishing a monitoring & measurement process



Monitoring & measurement of what?

- 1 EnMS
- 2 Energy consumption
- 3 Energy efficiency
- 4 Energy use

Basics for the certification of an EnMS as per ISO 50001:2018

third party certification process

1- Pre audit (option)

2- Certification audit (2 stages)

3- Annual surveillance audit

4- Recertification audit

Basics for the certification of an EnMS as per ISO 50001:2018

third party certification process

1. Pre audit (option)

- 1 Pre assessment of EnMS conformity
- 2 Evaluation of EnMS readiness
- 3 Identification of deviations affecting EnMS certification process



Basics for the certification of an EnMS as per ISO 50001:2018

third party certification process

2. Certification aud



Certification is awarded
following successful stage
1 & 2 audit results



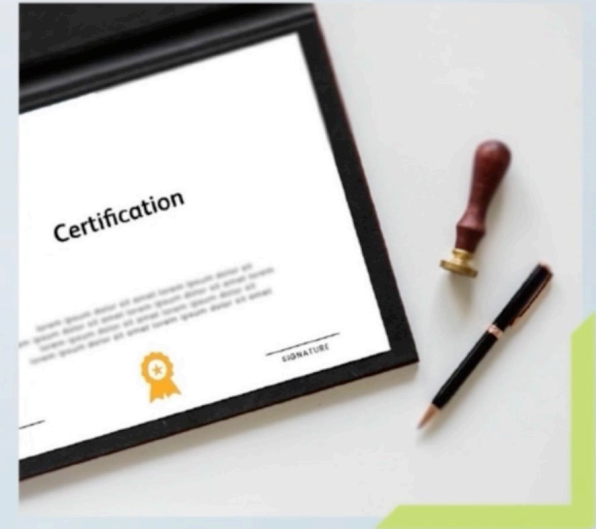
Stage 1:

Determine the organization's readiness



Stage 2 :

Evaluate the implementation and effectiveness
of the organization's EnMS



Basics for the certification of an EnMS as per ISO 50001:2018

third party certification process

3. Annual surveillance audit

Ensure the organization is continuing to conform with **the requirements of its EnMS, ISO 50001 and legal requirements**



Basics for the certification of an EnMS as per ISO 50001:2018

third party certification process

4. Recertification audit



3 Years



**Discover benefits and feedback from
an effective EnMS**

Discover benefits and feedback from an effective EnMS

1 **Advantages of EnMS** on organization's performance

2 **Feedback** and **lessons** learned from EnMS users

3 ISO 50001 **certifications** and **top sectors**

4 **Quick check**

Advantages of EnMS on organization's performance

- 1 **Reduction of energy consumption**
- 2 **Reduction of operational costs**
- 3 **Improvement of energy efficiency** of significant energy uses
- 4 Core part of an organization's **business improvement**
- 5 Enhancement of **employees' competence** and **organizational know-how**
- 6 **Reduction of environmental impacts**
- 7 Development of a **framework** for the implementation of suggestions for **energy saving ideas**

Feedback and lessons learned from EnMS users

ISO 50001 helps **reduce carbon emissions** and **limit global temperature warming** by 2°C

9 standard users out of 10 **recommend** to adopt ISO 50001



95% of the users of ISO 50001 confirm that EnMS helped in **identifying potential improvement areas** of energy performance

89% of organizations that have implemented an energy management system and obtained certification are **very satisfied** for achieving EnMS improvement

ISO 50001 certifications and top sectors



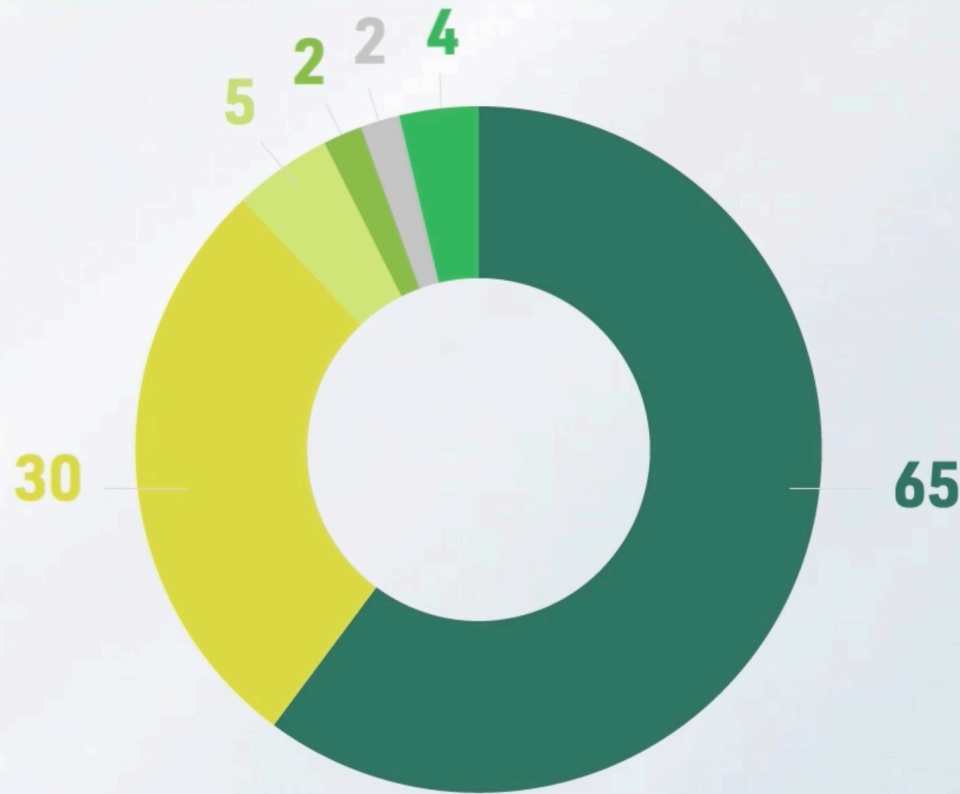
19,731 certificates awarded worldwide

45,092 certified sites

40 sectors are covered by ISO 50001 certification

ISO 50001 certifications and top sectors:

Valid ISO 50001 certificates in GCC countries



■ United Arab Emirates ■ Kingdom of Saudi Arabia
■ Qatar ■ Kuwait
■ Oman ■ Bahrain

108 ISO 50001 valid certificates are awarded in 2020 in the GCC countries

TOP 3 countries:

1. United Arab Emirates
2. Kingdom of Saudi Arabia
3. QATAR

ISO 50001 certifications and top sectors:

Valid ISO 50001 certificates in G20 countries

Represents **77%** of total
ISO 50001 valid certificates

A total of **15,202**
ISO 50001 valid certificates



ISO 50001 certifications and top sectors



Top 5 certified sectors

01



Transportation
and
communication

02



Basic metal &
fabricated metal

03



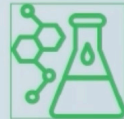
Rubber and
plastic products

04



Food industry

05



Chemicals,
chemical
products & fibers

Conclusion

Takeaways:

- 1 **Energy management system** is useful to demonstrate long term improvement of energy performance
- 2 **SEEC supports organizations** in implementing an **EnMS** and adhering to the **EM program** in order to improve energy efficiency and provide a framework to achieve energy savings
- 3 **3 options** are available for companies willing to **implement an EnMS** (ISO 50001, SEEC 50001 Ready, internal EnMS)
- 4 **ISO 50001** is a certifiable international standard for energy management systems
- 5 **Top management's ultimate commitment** is vital to implement an effective energy management system
- 6 **Compliance with legal requirements** is an undeniable condition to achieve energy management system's performance
- 7 **Continual improvement** must be demonstrated for energy performance and EnMS

Conclusion

Introduction to examination:

- The exam has been designed to assess participants' understanding of the basic elements related to energy management systems. The knowledge assessment is based on the MCQ « multiple choice question » approach. Documents are allowed.
- Only one correct answer per question is accepted.

Conclusion

Next level:

Energy management system for **Advanced**

Main learning objective:

To learn the requirements of the international standard ISO 50001:2018