Lesson 5: energy management system

1. What is an energy management system?

Used by organizations across the world to manage and reduce energy use and costs. An energy management system helps organizations better manage their energy use, thus improving productivity. It involves developing and implementing an energy policy, setting achievable targets for energy use, and designing action plans to reach them and measure progress. This might include implementing new energy-efficient technologies, reducing energy waste or improving current processes to cut energy costs.

The implementation of an effective EMS is guided by standards such as ISO 50001, which provides a framework for establishing, implementing, maintaining, and improving energy management practices. From large retailers to smaller manufacturers and small businesses, the standard offers organizations the opportunity to become more resilient against energy costs and availability. Whether you're interested in certifying to ISO 50001 to reduce costs, comply with legislation or improve your sustainability, implementing the standard provides a systematic approach to achieving all three.

Note:

Energy management system is:

- A systematic approach to the management of energy use
- Not a piece of software nor a technical or equipment solution
- An application of good management practice which combines:
  - Behaviour change among all employees
  - Behaviour change among management
  - Objective use of data to show performance
  - Technical improvement
  - Low cost operation and maintenance of existing equipment

2. Revision of ISO 50001:

The International Organization for Standardization (ISO) officially announced the ISO 50001 management system on 15 June 2011, after numerous meetings and discussions. This standard can be applied to any organization or enterprise in the World. It establishes a standardized document process platform for systematic energy management and for improving energy-use efficiency.

ISO 50001 underwent significant revisions in 2018 to enhance its effectiveness and align with other ISO management system standards. The key differences between the 2011 and 2018 versions include:

- **Adoption of the high-level structure (HLS):** The 2018 version incorporates ISO's HLS, providing a unified framework across various management system standards, such as ISO 9001 and ISO 14001. This alignment facilitates easier integration of multiple management systems within an organization.
- **Enhanced emphasis on leadership:** The revised standard places a stronger focus on the role of top management, requiring them to demonstrate leadership and commitment to the EMS. This includes integrating energy management into the organization's strategic direction and ensuring the necessary resources are available.
- **Context of the organization:** Organizations are now required to understand and consider internal and external issues that can affect their ability to achieve the intended outcomes of the EMS. This involves identifying relevant interested parties and determining their needs and expectations.
- **Risk and opportunity management:** The 2018 version introduces a requirement to identify and address risks and opportunities that can impact the EMS's effectiveness and the achievement of

energy objectives. This proactive approach aims to prevent or reduce undesired effects and promote continual improvement.

- **Energy data collection plan:** The standard now includes detailed requirements for an energy data collection plan, emphasizing the importance of data in monitoring and improving energy performance. This plan replaces the previous "energy measurement plan" and provides a more structured approach to data management.
- **Normalization of energy performance indicators (EnPIs):** The concept of normalization has been introduced to ensure that EnPIs and associated energy baselines (EnBs) accurately reflect energy performance, accounting for relevant variables and static factors.

These updates aim to make ISO 50001:2018 more effective in helping organizations improve their energy performance and integrate energy management into their overall business processes.

3. Benefits of an energy management system:

By offering a systematic methodology for any sizes of organisation, including small and medium enterprises, to establish own energy management system, ISO 50001 can provide organisations with a number of business benefits. These include:

- Helping to achieve energy use reduction and carbon emissions in a systematic way;
- Creating a clear picture of current energy use status, based on which new goals and targets can be set;
- Evaluating and prioritizing the implementation of new energy-efficient technologies and measures;
- Providing a framework to promote energy efficiency throughout supply chain.
- Providing guidance on how to benchmark, measure, document and report corporate energy use.
- Making better use of energy consuming assets, thus identifying potentials to reduce maintenance costs or expand capacity.
- Demonstrating to the stakeholders that corporate commitment to comply with their best practice to protect the environment.
- Fulfilling the associated regulatory requirements and responding with confidence to green trade barriers in global market.
- Organizations that adopt energy management practices can improve their reputation and competitiveness in the marketplace by demonstrating a commitment to sustainability and environmental responsibility.
- Compliance with international standards such as ISO 50001 can facilitate access to new markets and opportunities, as many organizations are now required to meet specific energy management criteria to engage in business partnerships.

4. Objectives of an energy management system:

The primary objective of an EMS is to improve energy performance, which encompasses energy efficiency, energy use, and energy consumption. By adopting an EMS, organizations can consciously monitor their energy aspects, leading to significant improvements in energy performance and reductions in operational costs. For instance, research indicates that companies implementing an EMS can achieve substantial energy savings and cost reductions by optimizing their energy consumption patterns. Furthermore, the integration of energy management practices into existing management systems can enhance overall operational efficiency across various sectors, making it a versatile solution for organizations of all sizes.

5. How ISO 50001 works:

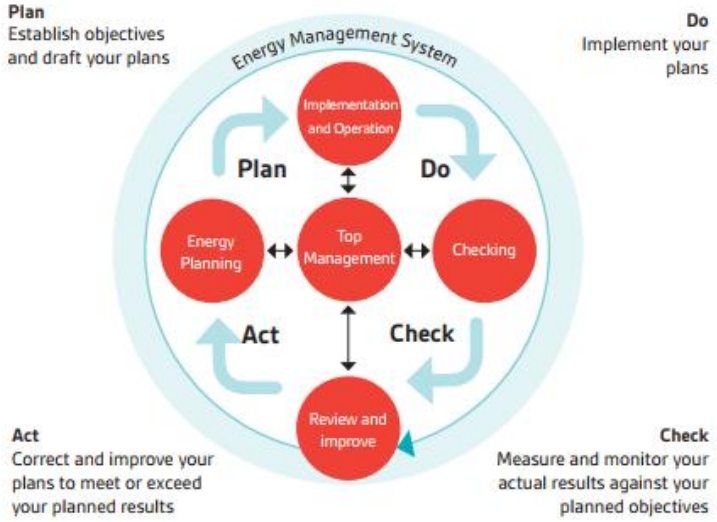
ISO 50001 is based on the management system model of continual improvement. The standard provides a framework of requirements for organizations to:

- Develop a policy for more efficient use of energy.
- Fix targets and objectives to meet the policy.
- Use data to better understand and make decisions about energy use.
- Measure the results.
- Review how well the energy policy is working.

The Plan-Do-Check-Act (PDCA) cycle is the operating principle of ISO management standards. By following this cycle, you can effectively manage -and continually improve- your organization's effectiveness.

PDCA and continuous improvement

- PDCA is the most basic framework for any management system.
- **Plan:** An action plan of the activities that need to be done together with all relevant implementation details.
- **Do:** The implementation of the selected improvement measures.
- **Check:** Monitor the results of the implementation via effective data analysis and assessments.
- **Act:** The effectiveness of the plan is reviewed and new targets are set for next PDCA cycle.



6. Requirements of an energy management system:

The main requirements of an EMS based on ISO 50001 include the following components, structured around the Plan-Do-Check-Act (PDCA) cycle:

- **Plan:**
  - **Energy policy:** Establish a policy for efficient energy use. This policy serves as the organization's commitment to energy management and provides the foundation for setting energy performance objectives.
  - **Energy planning:** Identify and evaluate energy use, consumption, and opportunities for improvement. This includes setting an energy baseline, determining energy performance indicators, and establishing objectives and targets.
- **Do:**
  - **Implementation and operation:** Put into practice the strategies and processes outlined in the energy plan. This involves operational controls, design, and procurement, ensuring that energy-efficient choices are made in purchasing and daily operations.
- **Check:**
  - **Monitoring, measurement, and analysis:** Continuously track energy performance and assess against objectives. This step ensures the EMS is functioning as planned, with data collected for evaluation.
  - **Non-conformities, correction, corrective action and prevention:** Any deviations or issues in achieving energy objectives are identified and addressed with corrective measures to prevent future issues.
  - **Internal audit:** Conduct regular audits to verify the effectiveness and compliance of the EMS with ISO 50001 requirements.
- **Act:**
  - **Management review:** Senior management reviews the EMS to ensure it is adequate, effective, and aligned with the organization's strategic goals. This step includes addressing identified non-conformities and implementing corrective actions as necessary.

7. Challenges of an energy management system:

Implementing and maintaining an effective energy management system presents several challenges:

- **Data management and cybersecurity:** EMSs rely on extensive data collection and analysis. Ensuring the security of this data against cyber threats is crucial, as breaches can lead to operational disruptions and financial losses.
- **Integration of renewable energy sources:** Incorporating renewable energy into existing systems can cause bidirectional power flows, complicating protection coordination and voltage control. This integration requires advanced control strategies to maintain grid stability.
- **Technological complexity:** Modern EMSs often involve sophisticated technologies like IoT devices and machine learning algorithms. Managing these technologies demands specialized expertise and can be resource-intensive.
- **Regulatory compliance:** Organizations must navigate complex and evolving energy regulations, which can vary by region. Ensuring compliance requires continuous monitoring and adaptation of the EMS.
- **Financial constraints:** The initial investment for EMS implementation, including hardware, software, and training, can be substantial. Organizations may face challenges in securing funding and demonstrating a clear return on investment.
- **Human resources and organizational culture:** Effective EMS operation depends on skilled personnel and a culture that prioritizes energy efficiency. Resistance to change and lack of awareness can hinder EMS adoption and effectiveness.

Addressing these challenges requires a comprehensive approach, including investing in technology, training, and fostering a culture of continuous improvement in energy management practices.

8. The difference between EMS and EMP:

while an Energy Management System is the structured framework that facilitates the systematic management of energy, the Energy Management Program is the overarching initiative that defines the organization's energy objectives and strategies. The EMS serves as a component within the broader program, providing the mechanisms to implement and sustain energy management practices. Here's a comparative table highlighting the distinctions between them.

Aspect	Energy Management System	Energy Management Program
Definition	A structured framework comprising policies, procedures, and tools designed to monitor, control, and optimize an organization's energy consumption.	A broader organizational initiative aimed at enhancing energy efficiency and reducing energy costs through strategic planning and implementation.
Scope	Focuses on the systematic processes and methodologies for managing energy usage within an organization.	Encompasses the overall strategy, objectives, and initiatives related to energy efficiency and conservation across the organization.
Components	- Energy policy - Energy performance indicators (EnPIs) - Objectives and targets - Action plans - Monitoring and measurement systems	- Strategic energy goals - Energy audits - Employee training and engagement - Investment in energy-efficient technologies - Continuous improvement initiatives
Standards Alignment	Often aligns with international standards such as ISO 50001, which specifies requirements for establishing, implementing, maintaining, and improving an EMS.	May incorporate elements of various standards but is not necessarily aligned with a specific one; focuses on broader energy management objectives.

Implementation Focus	Emphasizes the development of a systematic approach to energy management, including documentation, procedures, and regular reviews.	Concentrates on setting strategic energy objectives, allocating resources, and implementing initiatives to achieve energy efficiency goals.
Duration	Designed for continuous operation with ongoing monitoring, evaluation, and improvement cycles.	Can be time-bound, focusing on specific projects or initiatives, but often includes plans for long-term sustainability.
Responsibility	Typically managed by a dedicated energy manager or team responsible for the EMS's operation and maintenance.	Involves cross-departmental collaboration, with leadership from senior management and participation from various organizational levels.
Outcome Measurement	Utilizes specific energy performance indicators (EnPIs) to assess the effectiveness of energy management activities.	Measures success through the achievement of strategic energy goals, cost savings, and overall improvement in energy efficiency metrics.