ENERGY MANAGEMENT PLANS AND SYSTEMS

POCA Cycle
Plan-Do-Check-Act refers to the continuous improvement cycle. PDCA is the most basic framework for any management system.
- **Plan:** Develop an action plan of the activities that need to be done together with all relevant implementation details.
- **Do:** Implement the action plan and the selected efficiency measures.
- **Check:** Monitor the results of the implementation via effective data analysis and assessments.
- **Act:** Review the effectiveness of the plan and set new targets.

Management commitment is the cornerstone of implementation of any management system including energy management plans and systems

Company Energy Policy
A "company energy policy" sets the agenda for the corporate-wide energy saving and reduction of GHG emissions. Based on ISO 50001, it needs to be developed and endorsed by top management. The energy policy would deal, inter alia, with the following topics:
- **Aims:** objectives and targets
- **A commitment to continual improvement**
- **A commitment to the availability of resources to achieve objectives and targets**
- **A commitment to comply with applicable legal and other requirements**
- **A framework for setting and reviewing energy objectives and targets**
- **A commitment to training staff and engaging major external stakeholders**
- **Support for purchase of energy-efficient products/services**

Commitment from the management at the highest level should be demonstrated via energy policy endorsement and its wide communication to staff at all levels.

Data Collection and Reporting
IMO data collection system is currently under development and advocates the collection of ships' fuel consumption and some other parameters.

The system aims to have three main elements:
1. **Data collection by ships**
2. **Flag State functions of data verification**
3. **Establishment of a centralised database at the IMO**

Although not final yet, some general agreement has been reached in areas of:
- **Applicable to ships greater than 5000 GT**
- **IMO reporting**
- **Use of the IMO number for ship identification**
- **Registered owner will be responsible for submission of data**
- **Flag Administration will be responsible for data verification**

**Engine Performance / Condition Monitoring**
These systems are primarily based on analysis of cylinder pressure data. Cylinder pressure is measured and processed for:
- **Maximum cylinder pressure**
- **Angle of this maximum**
- **Cylinder compression pressure**
- **Ignition angle** – The angle at which combustion starts
- **Indicated power as measured on top of the piston**

In addition, current day systems collect other data such as engine brake power, scavenger pressure, turbocharger speed, fuel injection pressure diagram, etc. in support of the analysis.

Commonalities of Management Systems
It can be demonstrated that all the management standards have common features in areas of:
- **Need for defining objectives and policies**
- **Need for top management engagement and commitment**
- **PDCA cycle approach for continuous improvement**
- **Need for training of human resources**
- **Need for monitoring and inspection**

**PE MEO Framework**
The SEEMP works through four steps:
- **Planning**
- **Implementation**
- **Monitoring**
- **Self-evaluation**

**Ship Energy Audit/Review**
Development of a SEEMP based on IMO guidelines or a CEnMS based on ISO 50001 will involve planning activities. An energy audit or review is best for this purpose. Also, audits could be used for monitoring of SEEMP or CEnMS effectiveness. Depending on the area of application, the energy audit scope and objectives may be different.

A ship energy audit normally aims to identify a set of EEMs for implementation purposes. As part of the audit/review, all aspects of the ship including hull, propeller, engines, auxiliary machinery, voyage, route, trim, training, etc. will be assessed.

A ship energy audit/review may involve a number of phases:
- **Phase I – Pre-survey activities such as preliminary data gathering and data reviews**
- **Phase II – Ship survey: The ship visit is planned and carried out by the auditor, facilitated by ship personnel**
- **Phase III – Analysis of data for the identified measures and reporting**

A shipping company energy review or audit will follow the same format but areas to be investigated will be different and the concentration will be on common high-level issues of the fleet.

**Marginal Abatement Cost Curves (MACC)**
A simple and effective way of presenting the EEMs for a ship or a fleet is by plotting a MACC. A MACC can be developed through the following steps:
- **Step 1 – Identify EEMs and their energy saving levels.**
- **Step 2 – Calculate the cost implementation of the EEMs.**
- **Step 3 – From fuel consumption, estimate annual CO2 reductions (Y-axis).**
- **Step 4 – From steps 2 and 3 calculate, the cost-effectiveness (Scost per tonne CO2 reduced (Y-axis).**
- **Step 5 – Rank the EEMs from the lowest MAC to highest MAC.**
- **Step 6 – Plot the MACC using the measures according to their rank.**