



## October 2018 Development Paper

### MariEMS Learning Material

This is the 26h compilation by Professor Dr Reza Ziarati on the work of the EU funded Erasmus + MariEMS' partners and material extracted from the IMO TTT Course. The material is composed from Chapter 26 of the learning material. Readers are also advised to refer to the papers on IdeaPort and IdealShip projects led by C4FF and published by MariFuture.

#### 26. Ship Energy Efficiency Management Plan (SEEMP) Development

According to MARPOL Annex VI Regulation 22, it is a requirement for ships of more than 400 GT operating internationally, to have a SEEMP on board from 1st January 2013. The SEEMP should be developed taking into account the relevant IMO guidelines. Existing ships will receive an IEE Certificate when the existence of SEEMP on-board is verified. This will happen at the 1st intermediate or renewal survey of the vessel after 1 January 2013, whichever is the first. It is expected that all the existing ships by now have gone through this process and possess an IEE certificate. IMO has adopted guidelines for the development of SEEMP (Resolution MEPC.213 (63)); from which most of the main features of a SEEMP are described in this section. According to IMO guidelines, the SEEMP establishes a mechanism for shipping companies to improve the energy efficiency of their ships operations. The SEEMP also provides an approach for monitoring of a ship efficiency performance over time. The SEEMP urges the ship owner and operator, that at each stage of the operation of the ship, to review and consider operational practices and technology upgrade to optimize the energy efficiency performance of a ship. SEEMP development should follow the IMO guidelines. In this section, the main aspects of a SEEMP are discussed with a view to understand the regulatory requirements and best practice. The content of this section is mainly developed using the IMO guidelines [Resolution MEPC.213 (63)]. The aim of this section is to cover the SEEMP regulatory requirements, practical aspects of SEEMP planning and development.

##### 26.1 SEEMP purposes

The purpose of a SEEMP is to establish a mechanism for a company and/or a ship to improve the energy efficiency of the ship during its operation. Preferably, the ship-specific SEEMP is linked to a broader corporate energy management system of the company that owns, operates or controls the ship. The ship-specific SEEMP is needed since no two shipping companies or ship-owners are the same, and that ships operate under a wide range of different conditions including geographical and commercial. Many companies normally have an environmental management system (EMS) in place under ISO 14001 (*Also companies may have ISO 50001 on "energy management system" that could be directly linked to SEEMP*) which contains procedures for selecting the best measures for particular vessels and then setting objectives for the measurement of relevant parameters, along with relevant control and feedback features. Monitoring of operational environmental efficiency should therefore be treated as an integral element of broader company environmental



management systems. In addition, many companies already develop, implement and maintain a Safety Management System (*"Safety Management System" means a structured and documented system enabling company personnel to implement effectively the company's safety and environmental protection policy, as defined in the International Safety Management Code*). In such cases, the SEEMP may form part of the ship's Safety Management System. The SEEMP is intended to be a management tool to assist a company in managing the on-going environmental performance of its vessels and as such, it is recommended that a company develops procedures for implementing the SEEMP in a manner which limits any on-board administrative burden to the minimum necessary.

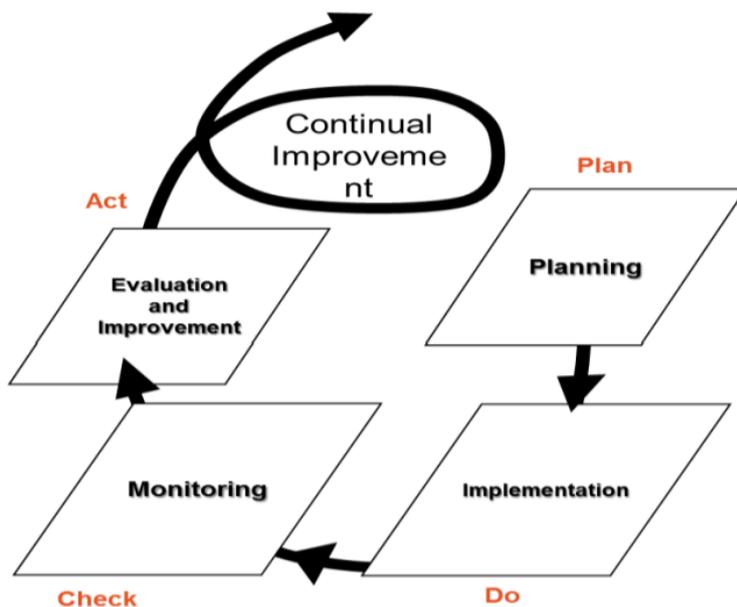
### 26.2 SEEMP framework

The SEEMP should be developed as a ship-specific plan by the ship-owner, operator or any other party concerned, e.g., charterer.

The SEEMP seeks to improve a ship's energy efficiency through four steps:

- Planning;
- Implementation;
- Monitoring; and
- Self-evaluation and improvement.

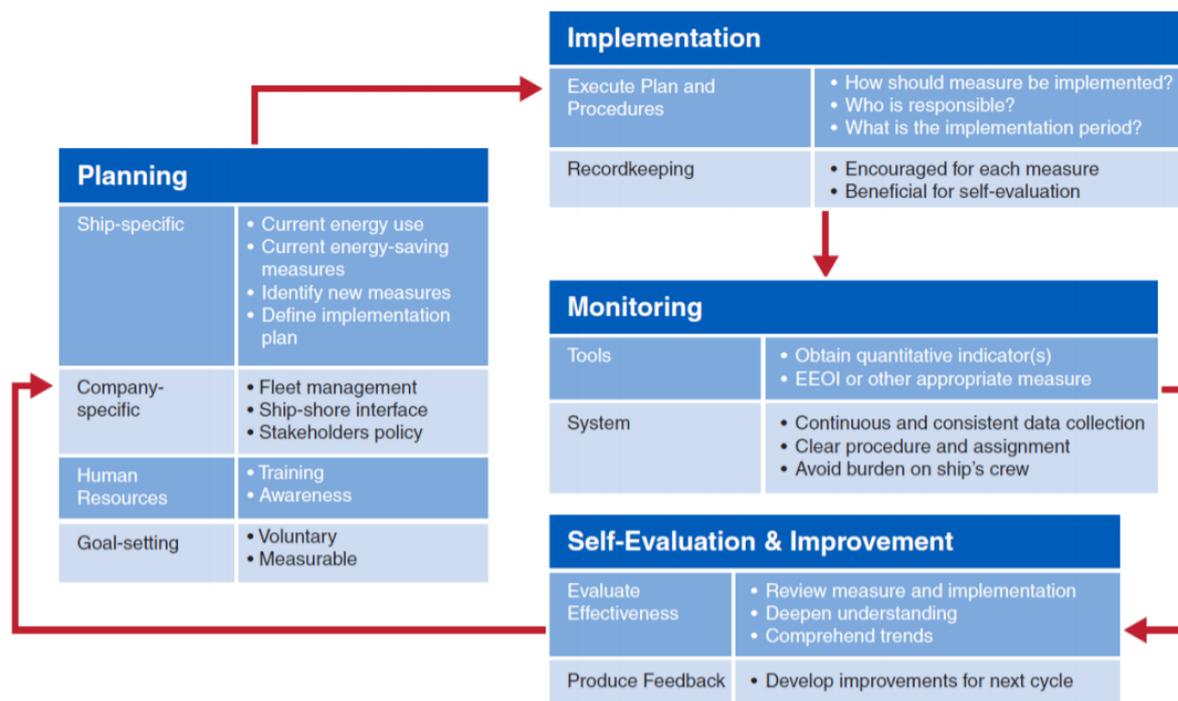
These are shown in Figure 26.2.1. These stages are similar to PDCA (Plan-Do-Check-Act) stages of any other management system and the continuous improvement cycle.



**Figure 26.2.1: SEEMP continuous improvement concept**

The PDCA components play a critical role in the continuous cycle to improve ship energy management. With each iteration of the cycle, some elements of the SEEMP will necessarily change while others may remain as before. The above components are further described in the following sections.

Figure 26.2.2 provides more detailed aspects of each stage of the cycle. Further description of each stage of the SEEMP cycle follows with reference to Figures 26.2.1 and 26.2.2.



**Figure 26.2.2: SEEMP as a 4-step ship energy management [ABS]**

### 26.3 Planning

Planning is the most crucial stage of a SEEMP development. It involves activities such as determination of both:

- The current status of ship energy usage; and
- The expected improvements.

Based on the above and via using further energy reviews or audits, a set of Energy Efficiency Measures (EEMs) are identified and documented as part of the planning phase. The SEEMP planning activities do not stop at identification of EEMs but includes dealing with all aspects of planning for implementation, monitoring and self-assessment of the identified EEMs. Therefore, planning part for ship energy management and SEEMP is crucial and it is essential to devote sufficient time to planning.

#### 26.3.1 Identification of ship's EEM

The first step in energy management planning is to identify the EEMs for improving the energy efficiency of a ship. It is important to note that there are a variety of options to improve a ship's efficiency; that the best EEMs for a ship to improve efficiency differs to a great extent for various ship types, cargoes, routes and other factors, As such, it is recommended that the specific EEMs for each ship needs to be defined.

To do this, there will be a need for carrying out activities such as energy audits or energy reviews (*For energy audit and review techniques, refer to IMO Module 5 of Train the Trainers*

<http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Documents/Air%20pollution/M5%20ship-port%20interface%20final.pdf>) for the corresponding ship.



SEEMP should be adjusted to the characteristics and needs of individual companies and ships, thus each ship will have its own ship-specific plan.

### **26.3.2 Goal Setting**

According to IMO guidelines, goal setting for SEEMP is voluntary and there is no need for announcement to public nor are they subject to external inspection. Purpose of goal setting is to increase commitment to improving energy efficiency; thus the IMO guidelines encourage companies to set goals. The goal should be measurable and easy to understand. It can take any form such as "annual fuel consumption", "EEOI targets" or other items.

On importance of goal setting, the following may be mentioned:

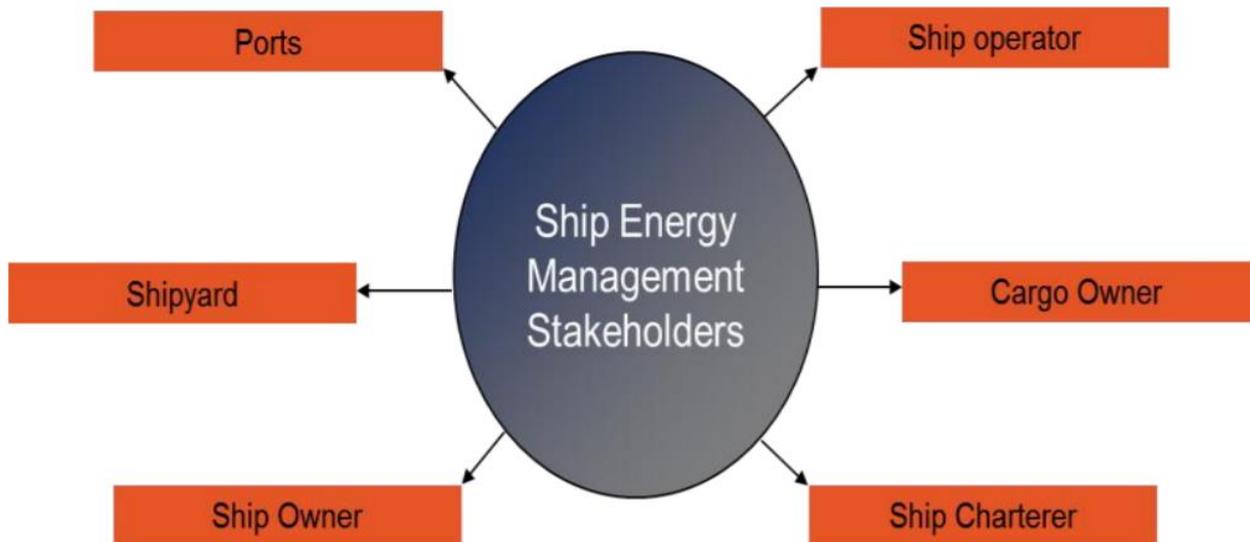
- Although IMO has made goal setting voluntary, a company with quantitative goals for their ship's energy efficiency would show more determination in this area.
- A goal will be a measurable indicator and will be used to evaluate if the set objectives are met.
- Many good quality companies already have quantitative goals for their ship energy management; primarily at corporate levels.
- Despite difficulty of goal setting at ship level, it is important that ways for making sure that the continuous improvement is actually taking place could be evaluated.
- Current IMO debates on data collection for ships and future likely MRV is likely to deal with these aspects in the future. As such, SEEMP related regulatory framework is likely to be enhanced in the future.

### **26.3.3 Managing the stakeholders**

The improvement of energy efficiency of a ship does not necessarily depend on ship operator/owner only. A number of stakeholders are involved as shown in Figure 26.3.3.

These are:

- Port authorities who are in charge of port management and thus ships' use of ports and related delays and so on.
- Cargo owner and charterer that have ultimate authority for ship itinerary and commercial activities of the ship.
- Ship owner could be different from operator/manager and thus will impact ship operational efficiency via decision making on ship technical improvements and relevant investments.



**Figure 26.3.3: Ship energy management stakeholders**

More coordination between stakeholders is more rewarding and to do this, the company should do the coordination rather than the ship. Therefore, IMO recommends that a company should also establish a “company energy management plan” to manage its fleet and ensures stakeholders’ coordination. This will also reduce the work burden on ship-board staff.

On importance of company-level energy management plan/system, the following may be mentioned:

- The overall ship energy efficiency is highly impacted by many industry stakeholders who have influence on the way the ship is commercially operated.
- Main stakeholders are ship owner, ship operator/manager/ports, regulatory authorities, charterer, cargo owner and so on.
- Management of the above stakeholder to ensure good ship operation and loading profile is essential.
- Without effective stakeholders’ management, most of potential energy saving opportunities will not be realised.
- The above could be realised as part of a “company energy management plan” as advocated by the IMO or a “company energy management system” as advocated by ISO 50001.

#### **26.3.4 Human resources development**

According to IMO guidelines, raising awareness and providing necessary training for personnel both on shore and on board are an important element. Such human resource development is encouraged and should be considered as an important component of planning as well as a critical element of implementation.

Additionally, the company should implement procedures, which limit any onboard administrative burden. The company management should define and communicate the companies’ values and aspirations and detail how the company intends to achieve the



objectives of their energy policy including the identification of roles and responsibilities, the setting of targets and monitoring performance.

## 26.4 Implementation

Two areas are of importance as far as planning for implementation is concerned:

- Establishment of an implementation system; and
- Record keeping.

**Establishment of implementation system:** A system for implementation of the selected EEMs needs to be defined via developing the procedures, tasks and assigning roles and responsibilities. The SEEMP should describe how each measure should be implemented and who the responsible person(s) is. The implementation period (start and end dates) of each selected measure should be indicated. The development of such a system can be considered as a part of planning, and therefore may be completed at the planning stage.

**Record keeping:** According to IMO guidelines, the planned EEMs should be carried out in accordance with the predetermined implementation system. Record-keeping for the implementation of each EEM is beneficial for self-evaluation and should be encouraged.

On the importance of implementation system and record keeping, it can be mentioned that:

- Without proper implementation of EEMs, the energy management objectives could not be completed.
- Assignment of responsibilities for various EEMs together with implementation process and schedules are important indicators that EEMs implementation is managed properly.
- Record keeping is important for not only monitoring purposes but also for use during self-assessment and the next planning phase of continuous improvement cycle.

## 26.5 Monitoring

In a SEEMP, the monitoring aspects also need to be clarified at the planning phase. Consistent data collection is the foundation for monitoring. To allow for meaningful and consistent monitoring, the monitoring system, including the procedures for collecting data and the assignment of responsible personnel, should be developed. The development of such a system can be considered as a part of planning, and therefore should be completed at the planning stage.

To avoid unnecessary administrative burdens on ships' staff, monitoring should be carried out as far as possible by shore staff, utilizing data obtained from existing ship-board log books and data systems. In this monitoring context, the ship's EEOI that is introduced in Section 6 may be advocated as the primary monitoring tool to ensure that the energy management cycle provides expected outcomes.

On the importance of monitoring, the following may be mentioned:

- Monitoring is an essential element of any management cycle. It is well known that "if one cannot measure, one cannot manage". This applies to energy management system as well.



- Monitoring to a large extent relies on data collection and data analysis over long term. Thus establishment of a data collection and analysis system is an essential part of any monitoring system.
- To effectively analyse and make conclusions, a set of Key Performance Indicators (KPIs) need to be defined for quantitative assessment of the gathered data. As indicated, the KPIs could relate to overall ship performance (such as EEOI) or developed for each EEM.
- Data collection and analysis, performing internal audits, energy reviews, benchmarking, etc. and so on forms the backbone of any good monitoring system.

### **26.6 Self-evaluation and Improvement**

Self-evaluation and improvement is the final phase of the management cycle (see Figures 26.2.1 and 26.2.2). It should produce meaningful feedback for planning stage of the next improvement cycle.

The purpose of self-evaluation is to evaluate the effectiveness of the planned measures and of their implementation. For this process, procedures for self-evaluation of ship energy management should be developed. Furthermore, self-evaluation should be implemented periodically by using data collected through monitoring.

On importance of self-evaluation and target setting for future improvements, the following may be mentioned:

- Self-evaluation and improvement is the responsibility of the management team.
- The closer this "management team" is to top management of the company, the more effective will be their decisions; thus is indicative of more corporate management engagement.
- Developing an energy policy, setting quantitative goals and committing investment in energy efficiency technologies and operations are main indications of the top management commitment.
- Results of the self-evaluation form the basis for planning of the next improvement cycle.
- Self-evaluation is normally done periodically for example annually or bi-annually.

### **26.7 SEEMP format**

IMO guidelines [Resolution MEPC.213 (63)] provide a sample template for development of the SEEMP as shown in Figure 26.7.1.



A SAMPLE FORM OF A SHIP EFFICIENCY ENERGY MANAGEMENT PLAN			
Name of Vessel:		GT:	
Vessel Type:		Capacity:	
Date of Development:		Developed by:	
Implementation Period:	From: Until:	Implemented by:	
Planned Date of Next Evaluation:			
<b>1 MEASURES</b>			
Energy Efficiency Measures	Implementation (including the starting date)	Responsible Personnel	
Weather Routeing	<Example> Contracted with [Service providers] to use their weather routeing system and start using on-trial basis as of 1 July 2012.	<Example> The master is responsible for selecting the optimum route based on the information provided by [Service providers].	
Speed Optimization	While the design speed (85% MCR) is 19.0 kt, the maximum speed is set at 17.0 kt as of 1 July 2012.	The master is responsible for keeping the ship's speed. The log-book entry should be checked every day.	
<b>2 MONITORING</b>			
Description of monitoring tools			
<b>3 GOAL</b>			
Measurable goals			
<b>4 EVALUATION</b>			
Procedures of evaluation			

**Figure 26.7.1: Sample SEEMP template from IMO guidelines**

Accordingly, the SEEMP will, as a minimum, include the following elements:

- Ship identification details
- Energy Efficiency Measures and how they should be implemented, responsible persons and timeline
- Monitoring aspects
- Goals (optional)
- Evaluation aspects.

There are already typically developed SEEMPs in public domain. An example is given in Reference [OCIMF 2011] for a tanker.

### 26.8 References and further Readings

1. 1. IMO Train the Trainer (TTT) Course on Energy Efficient Ship Operation. <http://www.imo.org/en/ourwork/environment/pollutionprevention/airpollution/pages/imo-train-the-trainer-course.aspx> viewed Dec 2016.
2. Resolution MEPC.231 (65): 2013 Guidelines for calculation of reference lines for use with the energy efficiency design index (EEDI), adopted in 2013.
3. Resolution MEPC.213 (63), "2012 Guidelines for the development of a ship energy efficiency management plan (SEEMP)" IMO MEPC, Adopted on 2 March 2012.



4. ABS "Ship Energy Efficiency Measures, Status and Guidance",  
<http://ww2.eagle.org/content/dam/eagle/publications/2013/Energy%20Efficiency.pdf>  
, viewed Dec 2016.