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ENERGY MANAGEMENT OF ELECTROMECHANICAL SYSTEMS ON THE BOARD OF A SHIP

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Abstract: *The paper analyzes, starting from the Integrated Management System, the role of automation, the role of the officer and the role of the Energy Management System on board the ship. The implementation of an EnMS establishes the structure and discipline of identifying energy flows, implementing management actions and, finally, applying technical solutions, which significantly reduce energy costs, reduce non-productive time in production, and reduce emissions. of Greenhouse Gases in the environment. The steps to be highlighted in the realization of energy management are analyzed.*

Keywords: energy management, electricity, efficiency, automation, maritime vessel.

1. Introduction

The Egyptians were the first to make evolutions in navigation. The importance of maritime transport dates back to the time of the Cretans, Phoenicians, Greeks and Romans. The development of maritime transport, ships and naval technology has continued to this day. Maritime transport has an essential role to play in the movement of goods from a quantitative, qualitative and operational point of view, as it offers advantages from several perspectives: relatively low costs, in relation to the large volume of goods that can be transported; the complex and diversified character of trade; increasing the number of states and companies at these exchanges.

Maritime transport represents a complex economic activity, having a national and international character, which must be thought and carried out according to needs and to ensure the profitability [1,2].

The main function of maritime transport is to ensure the connection between production and consumption, characterized by two economic features: economic efficiency, in the sense of satisfying defined requirements; profitability, as an essential condition of a broad economic activity, which involves actual transportation costs and costs of related operations. Both economic efficiency and profitability depend on the three essential elements underlying the definition of maritime transport [3,4].

The essential elements underlying the definition of maritime transport are: goods, characterized by a high volume and a high value; ships, as a means of transport incorporating a high level of technicality and investment; ports, as transhipment hubs and operating facilities within them.

Transports are fundamental to the global economy and society. Mobility is vital for the internal and external market, for the quality of citizens' life. Maritime transport

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allows economic growth and job creation; they must be sustainable. Transportation is a worldwide activity, therefore, strong international cooperation is needed in order for the actions taken to be effective. The EU wants to reduce greenhouse gas emissions worldwide, with the aim of limiting climate change to below 2 ° C. Achieving this goal by the EU means reducing emissions by 80-95% by 2050 compared to the 1990 level, in the context of the necessary reductions achieved by the group of developed countries. The Commission's analysis shows that in the transport sector - which is a significant and still growing source of GHG (greenhouse gases) - a reduction of GHG by at least 60% compared to 1990 is required by 2050. By 2030, the target for the transport sector will be to reduce GHG emissions by about 20% from the level recorded in 2008. Until 2050, CO_2 emissions from transport would remain at one-third above 1990 levels [5,6,7,8].

The future development of the association should be based on: improving the performance of ships in terms of energy efficiency for all modes; development and implementation of sustainable fuels and propulsion systems; optimizing the performance of multimodal logistics chains, including by more intensive use of inherently more efficient ways of using resources; more efficient use of transport and infrastructure through the use of improved traffic management and information systems through the use of advanced logistics and the application of market measures - eliminating cabotage restrictions, removing barriers to short sea shipping, etc. [6,9,10,11]. The EU must strive - in cooperation with IMO and other international organizations - to implement and monitor the application of high standards of safety, security, environmental protection and working conditions, as well as the elimination of piracy worldwide. The EU's global approach to policy, legislation and air monitoring and maritime transport security should be further strengthened and strengthened through cooperation with key international partners. SafeSeaNet's traffic monitoring and information system will become the core of all relevant maritime information tools that ensure the safety and security of maritime transport, as well as protecting the environment from pollution caused by ships. Maritime safety agencies play a central role in the three respective fields - maritime surveillance systems (SafeSeaNet), river information services (RIS), intelligent transport systems (ITS), as well as some interoperable interconnected solutions for the next generation of multimodal transport information and management systems. The strategy will also require the development of an investment plan for new navigation, traffic monitoring and communications services. For the years of the 2020s, the degree of electrification, automation and connectivity of the ships is considered. In the field of electrical engineering and related specializations, the main objectives of marine education should be pursued [8,12,13]:

• Training specialists in the field of advanced mobility systems, power electronics and electromechanical systems with applications in the naval industry;
• Increasing the attractiveness of the master's programs for the graduates of the bachelor's degree programs in engineering sciences;
• Elaboration of applicative projects within the internships;
• Development of relevant and high quality professional and transversal skills and competences, with an emphasis on learning outcomes, in order to increase the professional insertion capacity and stimulate innovation.

The energy management activity is a cooperative activity involving an energy team that is responsible for planning, implementing, monitoring and evaluating the energy management program [12,13,14]. The team of energy and technical experts must carry out evaluations at all the ship's facilities to find energy

saving opportunities and to propose a project. The key is the energy manager who has to be passionate about energy management, working with all levels of staff, a leader of the energy team that is empowered by the shipping company.
Funding is a key to the success of the energy management program. Two components are essential to the energy management program: mechanisms for tracking and reporting progress; informal and formal tools for transferring information to managers and crews.

2. Integrated management systems:
The integrated management system (SMI) can be defined as a set of interconnected processes that use the same resources - human, material, infrastructure, financial, information - to meet a set of objectives related to the satisfaction of stakeholders. If properly built, SMI combines all the components of the business into a coherent framework that will allow the fulfillment of the company's mission.
Many organizations have adopted or adopt management system standards and / or specifications, such as ISO 9001, ISO 14001, ISO 45001 (OHSAS 18001), ISO / IEC 27001, ISO 22000 and ISO / IEC 20000, as required or to be aligned. with the trends. Unfortunately, it often results in a set of independent systems with different goals and objectives. These fragmented systems are often documented in uneven styles, are under the control of different people and are heard separately.
However, in all management systems there are certain common elements that can be used in an integrated manner. The common basic principles of these systems can thus be recognized and implemented constructively within the business management system. The Integrated Management System allows the management to establish the directions for the effective and efficient fulfillment of the objectives of the organization. From managing employee needs to studying competitors' performance, encouraging good practices, and minimizing risks and maximizing resource utilization, the integrated management system approach can support the organization to meet its business strategic goals[15].
With the improvements made in the level of regulations and standardization in the field, the marina is today one of the safest means of transport. At the time when technologies evolve and the sector continues to develop, however, there are still aspects to improve, as this year's tragic accidents of Costa Concordia, MV Rabaul Queen and Shariatpur1 have shown.
As maritime transport is one of the most international industries, we must act internationally.
Regarding the integrated management system on board ships, we can talk about the significant impact of management practices on the safe operation of ships. The General Assembly of the International Maritime Organization has asked the Maritime Safety Committee, through Resolution A.596 (15), to develop emergency regulations on management on board ships and onshore organizations and to include in the work program both The Maritime Safety Committee, as well as the Committee for the Protection of the Marine Environment and the International Code of Safety Management (ISM Code).
The ISM Code was developed by the International Maritime Organization to provide the maritime community with an internationally recognized standard for the safe management and operation of ships and for the prevention of pollution, initially adopted as Resolution A. 741 (18), which was subsequently incorporated in the chapter. IX of the SOLAS (Safety Of Life At Sea) Convention and became mandatory for the transportation of petroleum products, chemical tanks, bulk carriers and 500 gross tonnage high speed vessels and for passenger ships, including high speed vessels from 1 July 1998. Other freight vessels and mobile self-propelled marine drilling units with a gross tonnage of 500,

subject to the SOLAS reserve, were to comply by July 1, 2002.
We can list below some ideas regarding the complete automation of the ship. Automation plays an increasingly important role on board ships. This automation has developed a lot and has evolved very quickly in the naval field. They are now developed and delivered on board ships, the sixth generation of the alarm system for the engine room, the development since the first version designed in 1970. This was the first step towards complete ship automation [9,10,16].
Automated integrated management systems have been developed and multiplied both on board and on land. The automation of the storage terminals, the fixed point approach (SPM - Single Point Mooring) were created and developed. An SPM terminal is intended to prevent the failure of a large port (VLCC) carrier to load or unload cargo. The loading and unloading monitoring and control is also performed automatically at the SPM terminals.
On board ships we can talk about the energy management system that is part of the operating system and the control system of generators and automatic switches, the final aim of which is the efficiency of energy consumption on board a ship. A latest generation of this energy management system can also be used in combination with the control of the main motor power or the adjustable pitch propeller. In this way, the energy management of the propulsion can be optimized, finally obtaining a fuel economy which generates much lower operating costs [8,10]. Also here we can talk about the automatic ballast control system on board the ship [6]. The main function of the BCS (Ballast Control System) operates valves and pumps to make ballast as efficient and safe as possible. Using a graphical interface, the system ensures a friendly operation - the speed of the system ensuring real-time operation and feedback. The system is suitable for complete integration with tank level measurement systems and ship loading and unloading programs.
Energy management has evolved over time- [17,18] The implementation of the Energy Management System (EnMS) allows a record and analysis of energy consumption, - which allows companies a substantial improvement in their ability to monitor, to regulate energy consumption, to evaluate production costs and at the same time reduce CO2 emissions. It is possible to evaluate the impact of the measures and to intervene. The benefits of implementing an energy management system include: reducing and controlling energy costs; improving the management of energy assets and the efficiency of materials; increasing productivity; reducing greenhouse gas emissions; meeting the legal requirements of energy, environment and energy security; strengthening corporate social responsibility. The implementation of an Energy Management System (EnMS) is a systematic and methodological process of continuous improvement of energy performance as a result of the implementation of energy efficiency initiatives in order to maximize energy savings and increase productivity. By implementing an EnMS system, companies obtain the optimization of industrial systems and obtain a general monitoring of CO2 emissions in production.
The key factor and the success of the EnMS implementation is the involvement of the company personnel through individual commitments towards a continuous improvement of the energy efficiency measures [3]. Continuous commitment and leadership role of Management are critical in ensuring an efficiently functioning EnMS. The top employees and managers are involved at the appropriate level in the company through continuous individual commitments of energy efficiency. The motivation and the action procedures for the employees will ensure the continuity of the actions of the Energy Efficiency. The reduction of energy consumption is combined with the CO2 monitoring

systems, - which gives the system additional value so that the specific impact can be well understood at the ship and shipping company level [5,18,19,20].

3. Conclusions

The implementation of the Energy Efficiency measures leads to energy performance values of 2-3 times higher. At the current level of implementation, for an Energy Management System, there are six steps to be highlighted:

a. The Management commitment, which involves the elaboration of a long-term energy policy, which sets objectives with a well-defined purpose and the employees will be mobilized for quality actions and performance;

b. Significant energy users, which provides for the identification of significant energy users, provides an analysis of the energy flow and consumption (> 80%) on each process with the priority of energy conservation actions;

c. Energy Performance Indicators, which inform the energy performance of processes to track the evolution of energy consumption and to avoid inefficient consumption;

d. Opportunities for energy performance, which establish measures for structured energy consumption efficiency such as: value of investment, calculated energy savings, duration of investment recovery, priorities implemented, preventive planning of the implementation period and possibly the source of financing;

e. Operational control, which provides a plan to identify the maintenance activity related to significant energy users and which derives from the energy policy, objectives, purpose and action plan;

f. Verification of the progress, which includes evaluating the degree of achievement of the objectives established with the identification of the operating barriers by carrying out an internal audit or an external audit, in case an objectivity of the verification of the functioning process is desired.

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