



Digital Performance Monitoring of Vessels Enables a Visible Increase in Eco-efficiency in Shipping

Improving eco-efficiency on existing fleet in focus

Enhancing eco-efficiency in shipping is commonly connected to building new, more economic and more eco-friendly ships. However, this takes time and money and thus is out of reach in many sub-sectors of shipping. With monitoring digital performance, it is possible to make both new and existing older vessels eco-efficient saving both environment and money. With relatively simple and inexpensive digital solutions, shipowners can reach significant results quickly, even in cases where there is no need or economic possibility to replace old vessels with new ones.

Key findings

Many factors can affect a vessel's operational efficiency. Monitoring vessel performance in real time makes it easier to identify potential inefficiencies. With the help of digital technologies, solutions and models, it is possible to capture and analyse real-time operational data from vessels.



The data gained from **digital performance monitoring enables the personnel to make informed decisions** and adjust operations and activities accordingly.



Digital performance monitoring can help to **reduce a vessel's fuel consumption and emissions by up to 20%, prevent breakdowns and reduce repair and maintenance costs.**



Digital performance monitoring system can be **installed on existing, even old vessels** and provides **significant and quick potential for promoting eco-efficiency in the shipping business** by reducing vessels' fuel consumption and emissions.



Investments in research and development of suitable technology and solutions is needed on both national and EU levels.



Technology is not enough; it is equally **important to focus on training crews and onshore personnel** to use the systems properly to fully utilise system's potential.



Cooperation between shipowners, researchers and system providers is crucial.



Great potential for reducing fuel consumption and emissions

The results obtained in the project indicate differences in the level of digitalisation and eco-efficiency depending on which segment, ship or route is in question. A great potential exists for reducing fuel consumption and emissions, preventing engine breakdowns and reducing maintenance and repair costs. These effects can be obtained by using digital technologies and models created for improving and predicting operations of the ship and its various components. In addition, continuous improvement and changes to work play essential roles. All these factors aid personnel in adjusting work tasks and making improved data-based decisions.

Fuel consumption and emissions can potentially be reduced by up to 20% according to data and analysis from distinct ship segments, routes and their baseline situations. In addition, digital performance monitoring can prevent breakdowns and reduce repair and maintenance costs.

It should be highlighted that this reduction can be achieved in existing ships through retrofitting, and not only by newbuildings, as is generally assumed.

Digital end-to-end solutions must perform steadily on ocean-going vessels operating all over the world on a 24/7 basis. This means that Internet of Things (IoT) solutions have to be technically advanced and robust with reliable connections via satellite or 4G networks to onshore cloud-based storage of data. Artificial intelligence (AI) models must support crew onboard and technical managers onshore, and the performance of AI models needs development. The importance of training modules for training crews onboard was also recognised as a crucial factor in supporting the operations.

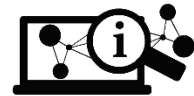


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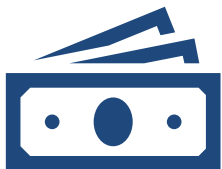
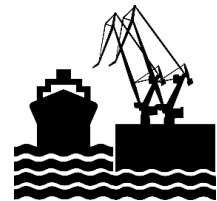
Implications and recommendations

It is clear that the technology used in digital monitoring needs further development. At least equally important is investment in developing **AI models** of high accuracy and quality. The AI models and scripts have to be developed so that they perform well on set criteria for larger groups of vessels, on voyages with variable data sets and for longer periods.



However, sophisticated technology and software are not enough. The data provided by the new technology must be understood and applied to everyday operations. **Training** users both onshore and onboard in the discipline of digital vessel performance monitoring is crucial to utilise all the potential it offers.

With the evidence based on the results of the ECOPRODIGI project, it is recommended that more emphasis be placed on **transforming the existing vessels** to be more eco-efficient using different digital performance monitoring solutions depending on the vessel's type and operational circumstances.



It is recommended that policymakers decide to invest in financing of **research and development** of needed technology and software on both national and EU levels. Shipowners should be encouraged to retrofit their existing vessels with new or better digital vessel performance monitoring devices and software. **Investment aid** through reductions in some dues or taxes could be used as encouragement. EU and the International Maritime Organization (IMO) should promote the use of **international standards** for data exchange and performance monitoring.



Different types of vessels studied in the ECOPRODIGI project

The first case of digital performance monitoring involved the Island Ferries connecting the Danish mainland and small islands. In this case, a team of researchers and students from Aalborg University and the University of Southern Denmark and experts from Danish Maritime completed visits and case studies of four selected ferry routes. They investigated the current state of operational modes, processes, systems and eco-efficiency performance and were actively engaged in developing and implementing the solutions. The improvement potential from implementing digital performance solutions for the ferries was estimated. A team of researchers developed a methodological framework that guided the gathering of additional data from sample voyages. It included definitions of operational modes, identification of machinery and equipment for energy provision and consumption and estimation of time and energy consumption and production per operational mode.

The second case concentrated on gas carriers of the shipping company J. Lauritzen and involved the above-mentioned team of researchers. It focused on the options for digitalising data capture, performance monitoring and decision support for the engines of the gas carriers. Solutions were co-developed, implemented and tested to reduce fuel consumption and emissions and improve the maintenance cycles of engines with better predictions, thus reducing costly and dangerous engine breakdowns. On top of this, the company Vessel Performance Solutions contributed to further development of AI models for monitoring vessel, hull and propeller performance using state of art weather and AIS data.

A third small case study was done for Ardea Shipping's bitumen tankers where the Swedish RISE research institute identified similar eco-efficiency benefit potential using digital performance monitoring data to optimise ballast and trim for voyages.



Further reading

Maritime industry processes in the Baltic Sea Region. Synthesis of eco-inefficiencies and the potential of digital technologies for solving them. ECOPRODIGI RESEARCH REPORT 2020.

Elisa Aro, Niels Gorm Malý Rytter, Teemu Itälänna.

<https://ecoprodig.eu/wp-content/uploads/2020/02/ECOPRODIGI-Research-Report-1-2020-final.pdf>

A more specific policy agenda and the results on the pilotings conducted in the project will be released in December 2020.

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