



DESMI OptiSave™

Optimizing Pump and Fan Speed to Current Conditions and Saving Fuel

OptiSave™

OptiSave™ is designed to be integrated in new-build vessels as well as in vessels already in operation and can be fully integrated into the vessels' IAS/AMS/CAMS/ICAMS system.

OptiSave™ is installed onboard +575 vessels around the world, saving more than +16.8 million USD in fuel every year.

DESMI

Customer Says:

Andreas Asimakopoulos dep. tech.manager at Minerva Marine:
"We selected OptiSave™ on several projects both as retrofits and as new-builds on the basis of sound engineering approach compared to competitive products and rigid support through execution stages. Performance of delivered systems have been evaluated as satisfactory, proving that intended savings have been well met. It goes without saying that OptiSave™ is an added value to company's energy efficiency drive."

DESMI

Customer Says:

Lars Voss, Senior Superintendent, Hapag-Lloyd AG:
"The job was well done, and co-operation was very good."

DESMI

Customer Says:

Chief Engineer Dieter Nühse, Ernst Jacob (GmbH & Co KG):
"The OptiSave™ was installed on May 22. 2015 and already, after only two weeks we can see big savings. We save about 250-350 liters fuel a day (about 1 m³ in 3 days), and with today's fuel prices the savings are about 350 USD in 3 days, 42,583 USD a year."

DESMI

Customer Says:

Dorian Kukuljan, Marine Electrical Consultant, CB Maritime d.o.o., Croatia
"We are very satisfied with functioning of the system indeed and as far as I know, crew did not experience any particular problem with operation of the Condenser. Testing showed correct operation with the system pressure reduced to 1,3 bar. That is an excellent result because initial minimum speed of 80% has been reduced to 65% requiring motor power of 12 kW only. Further observation and testing in different circumstances is of course still required."

OptiSave™ helps ship owners and designers to meet the requirement for reduction of CO₂ stipulated in IMO MEPC 62 rules.

OptiSave™ is designed to be integrated in new-build and retrofit applications and can be fully integrated into the overall Control System.

Energy Efficiency Design Index (EEDI)

The EEDI for new ships aims at promoting the use of more energy efficient (less polluting) equipment and engines. The level is to be lowered every five years, and so the EEDI is expected to stimulate continued innovation and technical development of all the components influencing the fuel efficiency of a ship right from its design phase.

The EEDI requires a minimum energy efficiency level of CO₂ emissions per capacity mile for different ship types and size segments. Divided into four phases, the level will be lowered over time. Emission reduction factors are set until 2025 when a 30% reduction is mandated over the average efficiency for ships built between 1999 and 2009.

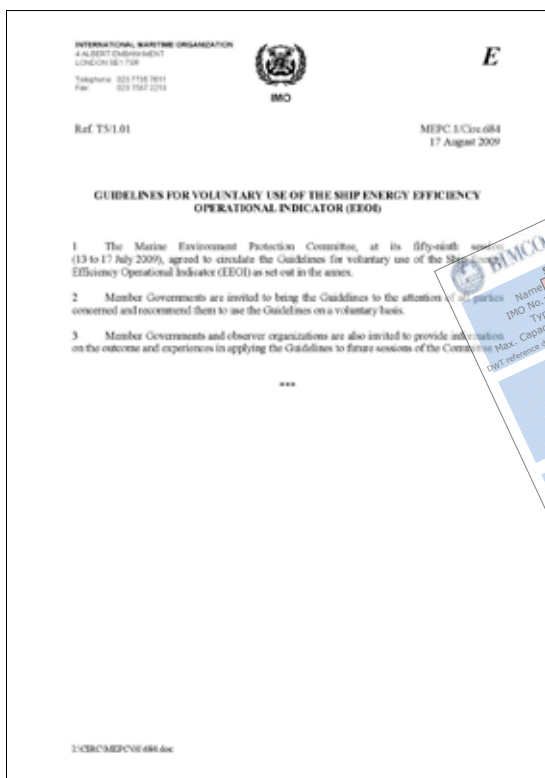
The EEDI has been developed for the largest and most energy intensive segments of the world's merchant fleet and will cover 72% of emissions from new oil and gas tankers, bulk carriers, general cargo, refrigerated cargo and container ships.

Ship Energy Efficiency Management Plan (SEEMP)

The Ship Energy Efficiency Management Plan (SEEMP) is an operational measure that improves the energy efficiency of a ship in a cost-effective manner.

From 2013 onwards the SEEMP urges owners and operators of existing ships to review and consider operational practices and technology upgrades at each stage of the operation of a ship to optimise the energy efficiency performance.

EEDI technical measures will have a significant long-term effect while SEEMP operational measures will have an effect mostly medium term.



The OptiSave™ Concept

All implemented DESMI OptiSave™ solutions have shown that the relatively inexpensive installations have an average payback time of less than a year. The fact that the installed components have an expected lifetime of ten years or more means that you will see a multiple return of your investment.

With OptiSave™ we guarantee the most efficient solution, where energy efficiency and fuel savings are key benefits.

The systems directly applicable with DESMI OptiSave™ are:

- Seawater cooling systems
- Steam condenser cooling system
- Fresh water cooling systems
- Engine room ventilation
- Cargo hold ventilation
- Pump monitoring
- Online vessels monitoring
- Customized solutions

or any combinations of the above.

Today, the OptiSave™ concept is more than an energy efficiency system to install onboard ships.

This also includes:

- Design and engineering
- Installation onboard, either with DESMI installation teams or in co-operation with ship's crew

Service and after sales

Cash flow neutral investment, also called "Pumps-for-Free". (Pay with the savings)

The next generation of OptiSave™ is a modular system, allowing a flexible solution and cost efficiency installation. The solution also offers the flexibility of extending the system over time.

Modular system

The new generation of OptiSave™ is designed as a modular system with a common control platform, which can be used for both new building vessels and onboard vessels already in operation. The concept has a basic control platform and can be customized from project to project.

Depending on the application chosen, a system consists of basic components, as OptiSave™ Master Control panel, frequency converters and a numbers of field sensors, as pressure and temperature sensors.

With OptiSave™ product range DESMI offer solutions from the less complex standalone solutions to full redundant concept.

**Yearly savings on +575 installed OptiSave™
systems around the world:**



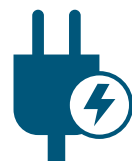
180,000 tons of CO₂



67,000 tons of fuel



16.8 million USD



345,000 MWh

Highest possible flexibility during the design and installation phase

The OptiSave™ Master Control panel has a modular design offering one common control platform for all the different applications and the possibility of combining more applications into the same system. This ensures the highest possible flexibility during the design and installation phase for both new building vessels and retrofitting of existing vessels.

The common control platform is also offering the flexibility to upgrade the OptiSave™ systems to include more application over time.

The OptiSave™ Master Control panel is a central control unit, which can be installed, where-ever possible on the vessels. Field sensors, such as temperature, pressure or other sensors are integrated into the OptiSave™ Master Control panel via local placed I/O stations.

The I/O stations can be installed where it is most advantageous, ensuring a min. of cable installation and thereby the lowest possible installation cost.

Special features of OptiSave™ Master Control panel:

- Design temperature up to 50°C
- IP54 designed for installation in engine room
- Standard design for wall mounting
- TCP/IP communication for integration with the vessel's IAS/AMS/CAMS/ICAMS system
- Customized solution

The operation of the OptiSave™ is fully automated and only adjustment of operation parameters is needed.

These operation parameters can be adjusted on the OptiSave™ Touch Screen, supplied with the OptiSave™ system.

The benefits of DESMI OptiSave™

- ✓ Energy saving up to 90%
- ✓ Short return on investment
- ✓ Prolonged lifetime of pumps due to less wear and tear
- ✓ Minimum changes in existing electrical installations
- ✓ Proven technology
- ✓ Proven savings from +575 systems in operation
- ✓ Reduced OPEX
- ✓ Worldwide service support



OptiSave™ Frequency Converters

The OptiSave™ Frequency Converters are designed for marine application with focus on installation in engine room as close to the pump or fan as possible, to lower installation cost and EMI (Electromagnetic interference).

OptiSave™ Frequency Converters offer the following special features:

- Designed for harsh marine environment
- Design temperature up to 50°C without de-rating
- Marine coating of circuit boards (3C3)
- Internal components are ruggedized
- RFI filters suitable IT-net, with insulations resistance
- Two inbuilt DC chocks for reduction of harmonic distortion
- IP54/55 drives designed for installation in engine room
- Type approval from the nine (9) leading class Authorities (DNV-GL, RINA, BV, RMRS, ABS, LR, CCS, Class NK and KR)



For the OptiSave™ frequency converter solution DESMI offers four standard solutions, which are designed for interface with OptiSave™ Master Control Panel:

- ✓ OptiSave™ Frequency Converters
- ✓ OptiSave™ Frequency Converters with integrated electro mechanic by-pass
- ✓ OptiSave™ Frequency Converters with integrated softstarter by-pass
- ✓ OptiSave™ Frequency Converters with full redundant motor starter

Higher Operation Safety

OptiSave™ Frequency Converters with integrated electro mechanic by-pass

Special features:

- Same features as OptiSave™ Frequency Converters
- Automatic or remote control of by-pass function
- Test of function VSD in by-pass mode allowing programming of VSD during by-pass operation
- For pumps / fans from 11kW to 90kW, the by-pass function integrated solution in frequency. - Only for DOL starters
- For pumps / fans over 90kW the by-pass function integrated solution in mounting cabinet.
- Customized solution with soft starter or auto-transformer starter as alternative to the DOL starter

The OptiSave™ Frequency Converters with integrated electro mechanic by-pass offer a higher operation safety than the standard OptiSave™ Frequency Converters. With this solution, DESMI offers a full by-pass of the frequency converter.

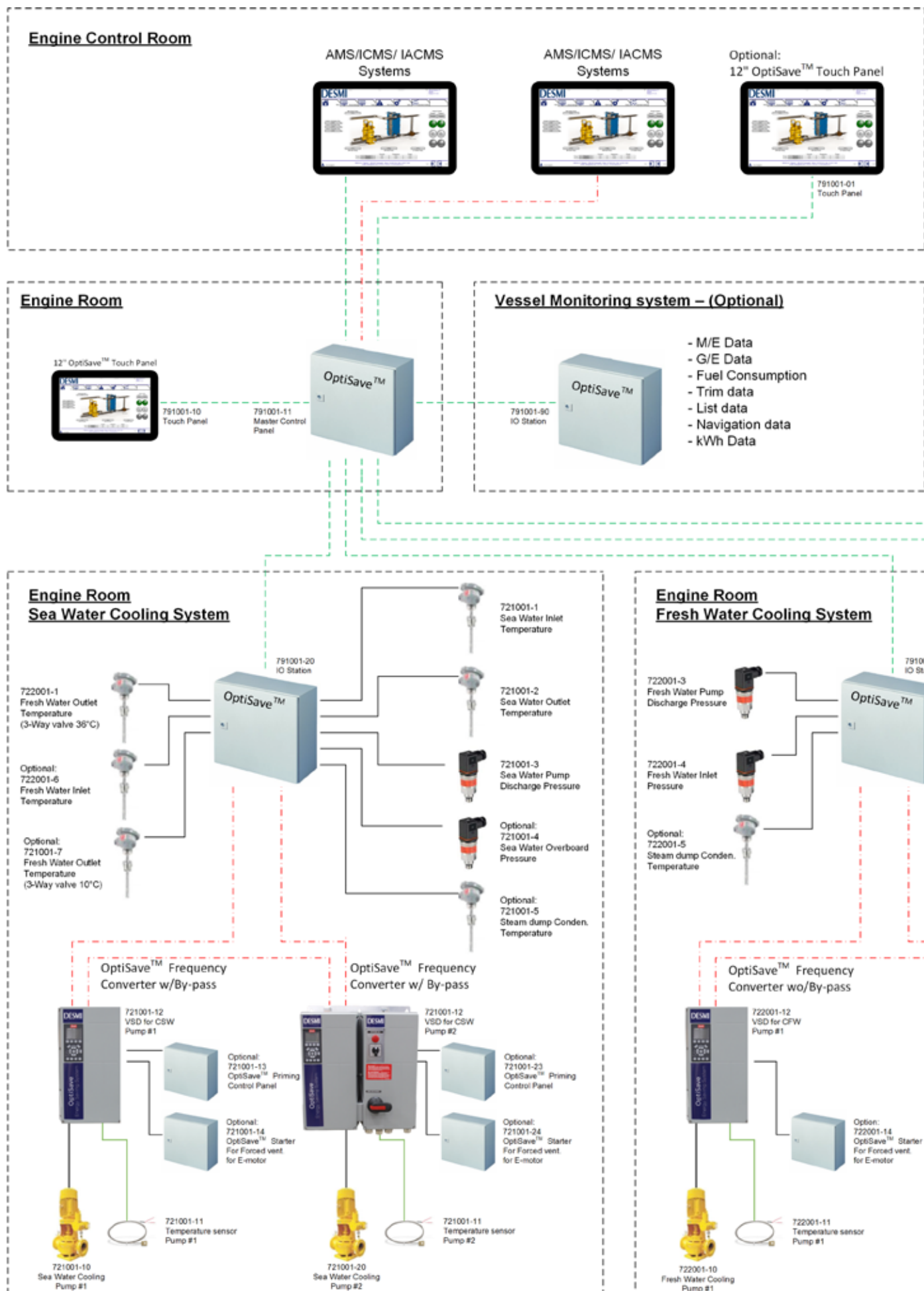


OptiSave™ Frequency Converters with full redundant motor starter

Special features:

- Same features as OptiSave™ Frequency Converters with all safety functions included
- Automatic switch over to motor starter mode upon frequency converter failure with all safety functions included
- Sensors for safety control are redundant
- For pumps / fans, designed as fully redundant systems, frequency converter and motor starter are integrated in a common cabinet
- DOL starter, Y/D starter, softstarter or autotransformer starter depending on application.

OptiSave™ System Layout



OptiSave™ Online Monitoring (Option)



Satellite / Internet

Owner Office



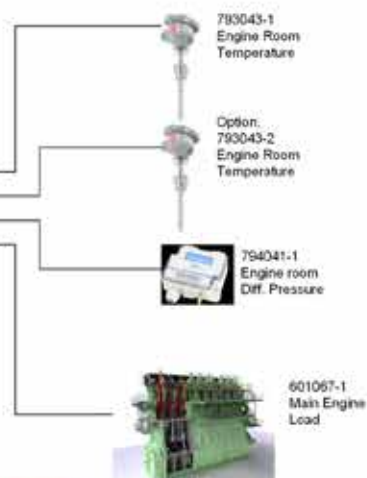
- Online support
- Adjustment of control parameters
- Performance data

DESMI Service Center



- Online support (PLC, HMI and VSD level)
- Adjustment of control parameters
- Trouble shooting

Engine Room Ventilation



OptiSave™ Frequency Converter w/By-pass



OptiSave™ Frequency Converter wo/By-pass



OptiSave™ Frequency Converter w/By-pass



OptiSave™ Frequency Converter w/By-pass



OptiSave™ for Sea water cooling systems

The purpose of the system is to control the seawater cooling pumps to the actual cooling demand at any time by reducing/increasing pump(s)' speed/flow according to the actual needed cooling capacity.

OptiSave™ is an intelligent system, which operates the speed/flow of the pumps, taking the following conditions into consideration:

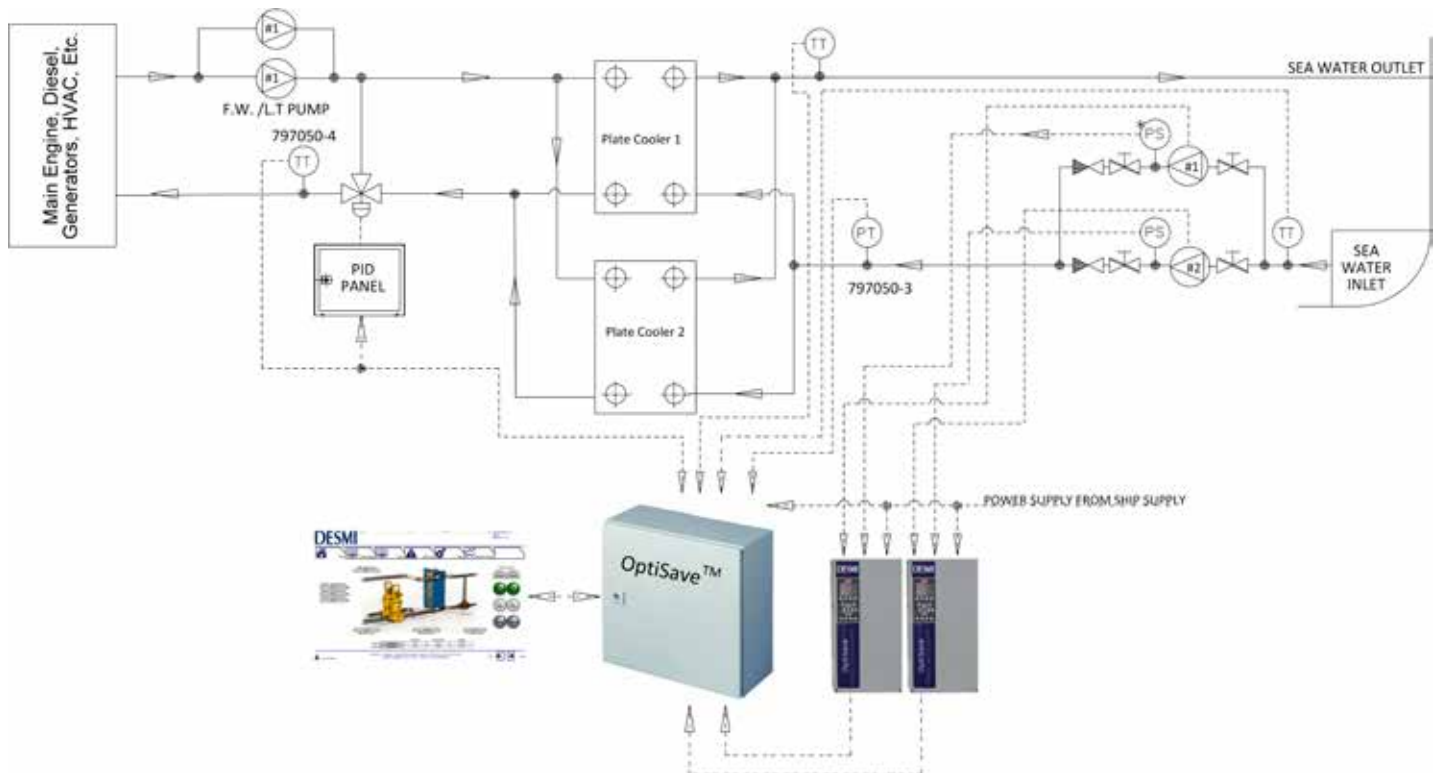
- Fresh water temperature (LT)
- Sea water outlet temperature (it's kept under scaling temperature for central coolers)
- Temperature of electric motors on sea water cooling pumps are monitored
- Monitoring of discharge pressure for pumps to ensure water filled central coolers

The OptiSave™ system for sea water cooling systems also includes a number for control functions, which enhance the preformation and increases the safety functionality.

- Timer controlled automatic flushing through central coolers
- Idle stop of pumps at low cooling demands
- Automation restart after blackout
- Intelligent parallel pump operation
- Energy savings up to 90%
- Built-in stand-by functionality in each frequency converter

The system layout corresponds to minimum class requirements, and therefore OptiSave™ is designed for basic systems.





Special features for New Building or options:

- ✓ Controlling of priming ejectors in case one of the seawater cooling pumps is used as emergency bilge pump.
- ✓ Dynamic pressure drop monitoring cross coolers and condition controlled flushing
- ✓ Standby function of pumps
- ✓ Integrated sequential start
- ✓ Frequency converters on all pumps

OptiSave™ for fresh water cooling systems

The purpose of the system is to control the LT/FW Cooling water pumps to the actual cooling demand at any time by reducing/increasing pump(s)' speed/flow/pressure according to the actually needed cooling capacity on the fresh water system.

OptiSave™ is an intelligent system, which operates the speed/flow/pressure of the pumps, taking the following conditions into consideration:

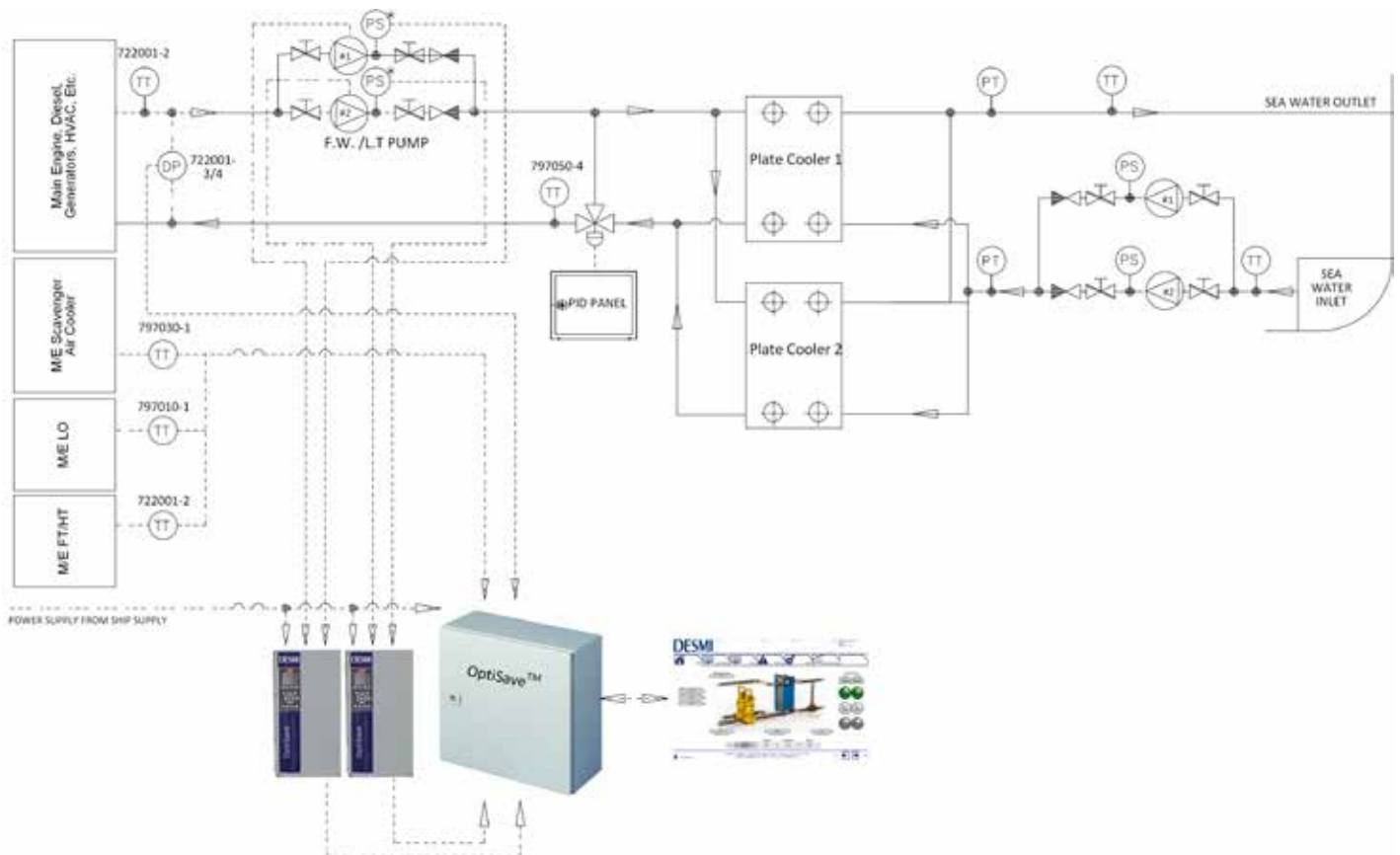
- Fresh water temperature
- Fresh water pressure
- Main engine load
- Scavenge Air temperature
- Main engine lub oil temperature
- Shaft bearing temperature
- HT/FW temperature
- Control of valves
- Temperature of electric motors on sea water cooling pumps is monitored

The OptiSave™ system for fresh water cooling systems also includes a number of control functions, which enhance the performance and increase the safety functions.

- Timer controlled automatic flushing through central coolers
- Idle stop of pumps at low cooling demands
- Automation restart after blackout
- Intelligent parallel pump operation
- Energy savings up to 75%

The system layout corresponds to minimum class requirements, and therefore OptiSave™ is designed for basic systems.

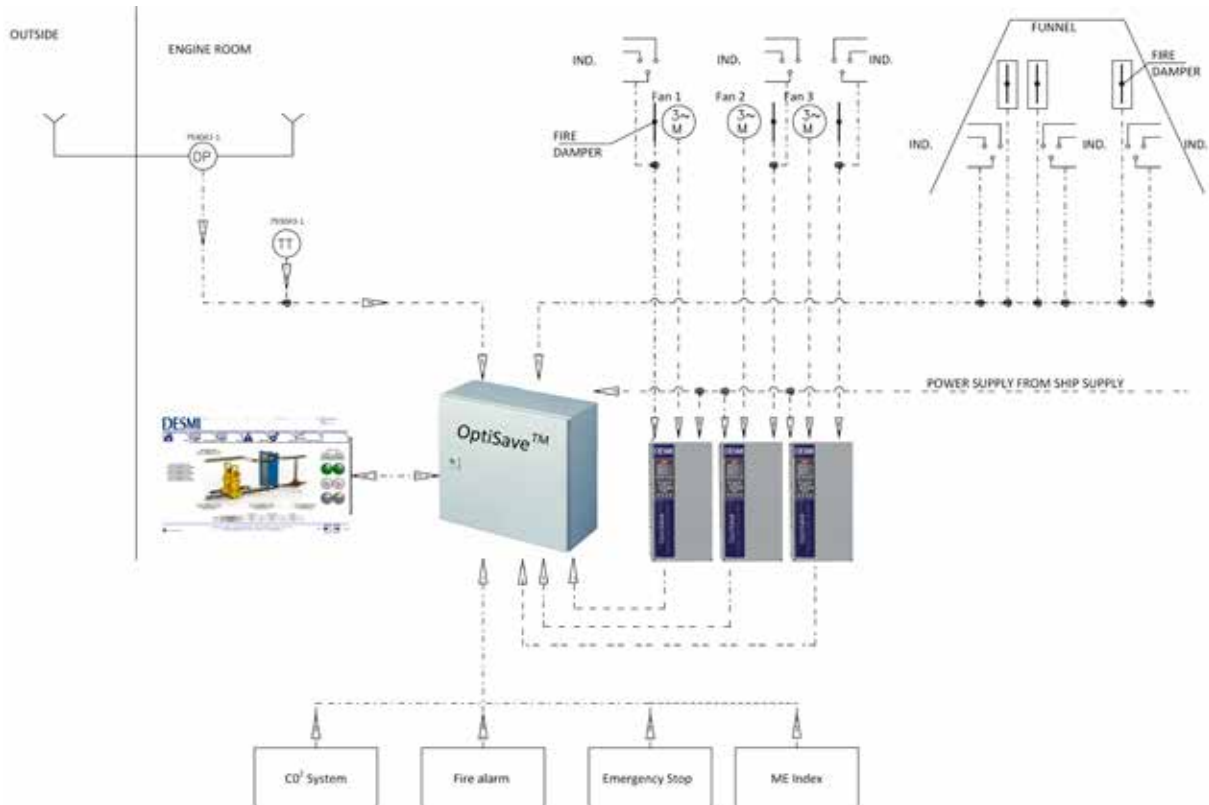




Special features for New Building or options:

- ✓ On/Off valves for fresh water consumers
- ✓ Operation condition of compressor
- ✓ Standby function of pumps
- ✓ Integrated sequential start
- ✓ Frequency converters on all pumps

OptiSave™ for Engine room ventilation



The purpose of the system is to control E/R fans to the actual conditions by reducing/increasing fan speed according to the actually needed airflow.

OptiSave™ is an intelligent system, which operates the speed of the fans, taking the following conditions into consideration:

- Engine room temperature
- Engine room static over-pressure
- Main engine load

The OptiSave™ system for engine room ventilation systems also includes a number for control functions, which enhance the preformation and increases the safety functionality.

- Integration with ship's CO₂ release system
- Integration with ship's fire alarm system
- Integration with emergency stop systems for fans
- Intelligent parallel fan operation
- Energy savings up to 60%

Special features for New Building or options:

- ✓ Control of all E/R fans and exhaust dampers to increase energy savings
- ✓ Purifier room temperature
- ✓ Integration of load signals from GEN-SET

OptiSave™ Pump monitoring

The purpose of the system is to monitor the performance of the individual pump.

OptiSave™ is an intelligent system, which is capable of monitoring both pump and the electrical motor with the following add on:

- Runout protection (non-overload load)
- Dry running protection
- Bearing temperature monitoring
- Vibration monitoring
- Differential pressure monitoring (duty point)

- Power consumption (Amps)
- Flow
- Shaft deflection monitoring
- Shaft seal monitoring (leakage)

The OptiSave™ system is capable of being fully integrated in to vessel's IAS/AMS/CAMS/ICAMS system and is therefore easy to integrated in to vessels or fleets pre maintenance program.



OptiSave™ Online Vessels monitoring

The purpose of the system is to forward performance monitoring data to ship owners office.

OptiSave™ is an intelligent system, which is capable of monitoring both pumps and fans and at the same time collect data regarding vessels performance as follows:

- M/E Shaft power
- M/E Index
- M/E RPM (shaft)
- M/E T/C RPM
- M/E Scavenge air pressure

- M/E FO Consumption
- G/E FO Consumption
- Boiler FO consumption
- Other performance parameters on customer request



OptiSave™

Pumps for free

With the Pumps For Free concept, DESMI offers a unique financing package for ships owners who want to energy optimize their vessels, where the savings are used to pay for the investment. Short pay-back time, typically between 14-18 months.

DESMI offers a wide range of energy-savings products under the Pumps For Free concept, such as:

- Replacement of old low efficiency pump with DESMI highly energy-efficient pumps

- Energy-saving system, also called OptiSave™ for pump applications
- Energy-saving system, also called OptiSave™ for ventilation applications
- OptiSave™ Online vessels monitoring

The financing schedule is directly linked to the return on investment time / pay-back period, with quarterly payments.



Project timeline (Weeks)





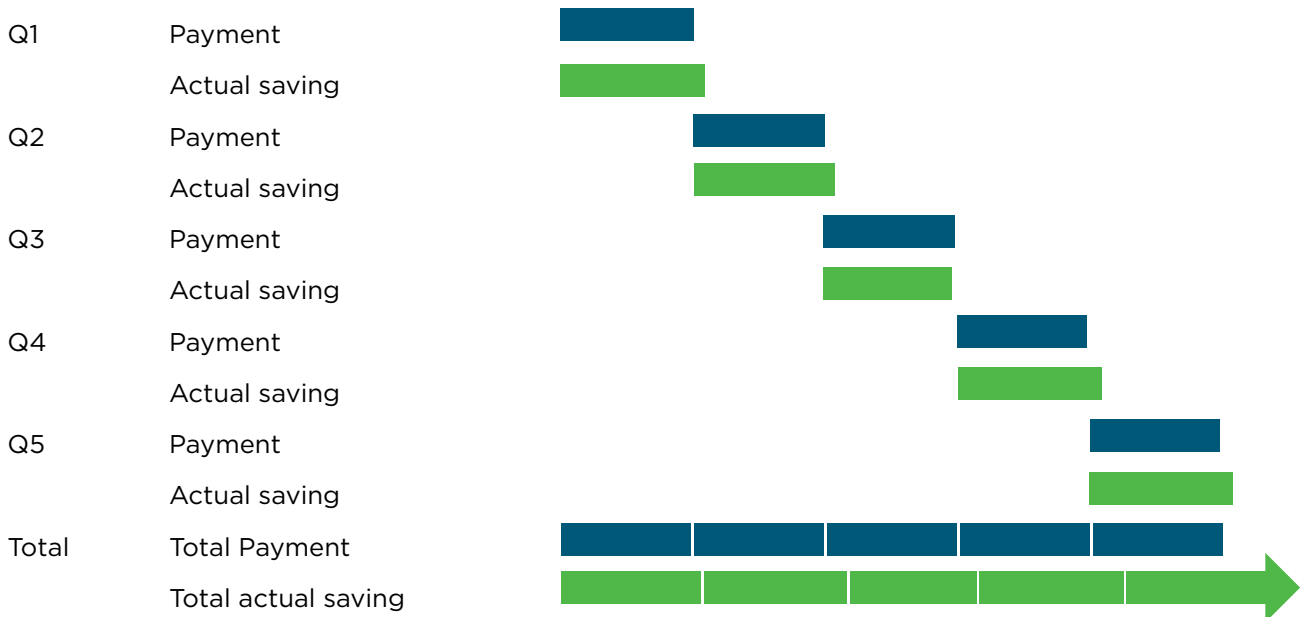
Savings with the EnergyCheck Report

The quarterly payments to DESMI will be based on the report from EnergyCheck on board the vessel. This report will include the following:

- ✓ Pre-inspection report
- ✓ Operation pattern of vessel (basis for calculation) such as:
 - Fuel type and fuel cost
 - Operational hours sea-going / harbour
 - Operational pattern of existing equipment (pumps, fans etc.)

Payments

The payment schedule is fixed before the project starts. Every quarter a performance report is made based on data readout from the installed equipment.



The Pumps For Free concept offers these benefits:

- ✓ Cash flow neutral investment in Green Technology
- ✓ The easy way to get your vessels in accordance with IMO's SEEMP rules
- ✓ Low interest rates and administration costs
- ✓ Proven technology with more than +575 OptiSave™ systems on the reference list





Lighthouse Shipping

CEO, Frode Bjørklund: *"I joined the company in January 2015. The shipbuilding contract for our five new vessels had been inked in 2013, and OptiSave™ wasn't in the Scope of Supply. Fleet Management in Hong Kong were doing the supervision for us and for Spar Shipping, and they mentioned the solution to us as one of three alternatives for improving the vessels' spec beyond the original agreement".*

Fleet Management had performed early tests of OptiSave™ on one of the Spar Shipping vessels and made a more solid recommendation to Lighthouse Shipholding.

"Like any financially driven shipowning company, we needed a strong business case with a horizon well within the lifespan of the vessel. Pumps For Free seemed to be a very compelling case, so we started talking to DESMI about payback time, looked at oil price trends, and worked out the likely ROI for our vessels.

In general, the financing aspect of the deal – its cash neutrality – got our investors on board and we decided to include OptiSave™ on the four vessels remaining to be built. For the first vessel we will consider a retrofit as it is only marginally more expensive. In fact, going



for the concept was almost a 'no-brainer'!" Frode Bjørklund is highly positive about his experience with both DESMI and OptiSave™.

"We met with DESMI in Shanghai at the yard and have been working closely both in Scandinavia and at the local level. I've found the company to be open-minded and easy to talk to. And they have good shipowner customers on their reference list, too, including one widely considered to be the industry's technology leader."

"DESMI has cut no corners on building a great system. Even though we have been running the vessels mostly in warmer water temperatures, which means we would have expected lower savings, it has still delivered according to schedule. And in a trans-Atlantic scenario, we would see even more savings" concludes Frode Bjørklund.



Grindrod Shipping - Owner and manager of IVS and Unicorn Tankers has installed OptiSave™ onboard 9 vessels; 7 bulk carriers and 2 tankers and more will follow

The co-operation with IVS goes back to 2009 and the first OptiSave™ system was installed on board one of the bulk carriers soon after.

Technical Project Manager, Grindrod Shipping, Per Fabricius says: *"We have a great co-operation with DESMI and their automation team. We always look at how much fuel can be saved and where we can improve the efficiency - and more ideas are coming all the time for improvements".*

OptiSave™ is installed for seawater, freshwater, ventilation and air conditioning and the surveillance is online 24/7, which makes it easy for Per Fabricius to follow how much fuel is saved, how the vessels performs and how we can help the vessels to perform better.

Per Fabricius continues: *"I believe we are first movers on the system. This is a great surveillance system, we are online all the time so to me this makes performance management easy".*

So far, OptiSave™ saves a total of 125 tons fuel per month in average and Per Fabricius keeps track of the



fuel index from year to year so that he always knows how well each tanker and Bulk Carrier performs.

"All vessels travel world wide and report the numbers of CO₂, NO_x and SO_x monthly to the main offices in Singapore and South Africa. With the OptiSave™ system this is an easy task to complete".

At the moment Per Fabricius and DESMI are developing a training simulator for easy education of the crew to handle the system and improve efficiency.

"It is fantastic to have workshops with DESMI, brainstorm on new ideas and develop the system and efficiencies for our vessels - the mutual co-operation is very beneficial for both of our businesses - a win-win situation" concludes Per Fabricius.

Savings and highlights from January 1st 2016 to July 31st 2016:



Savings in USD:
179,470



Average SW temperature - 9 vessels:
22,8°C

A number of OptiSave™ references:



J. Lauritzen
Shipowners



Need more information or specifications? Contact us at desmi@desmi.com or read more about DESMI and DESMI's other products and solutions at www.desmi.com