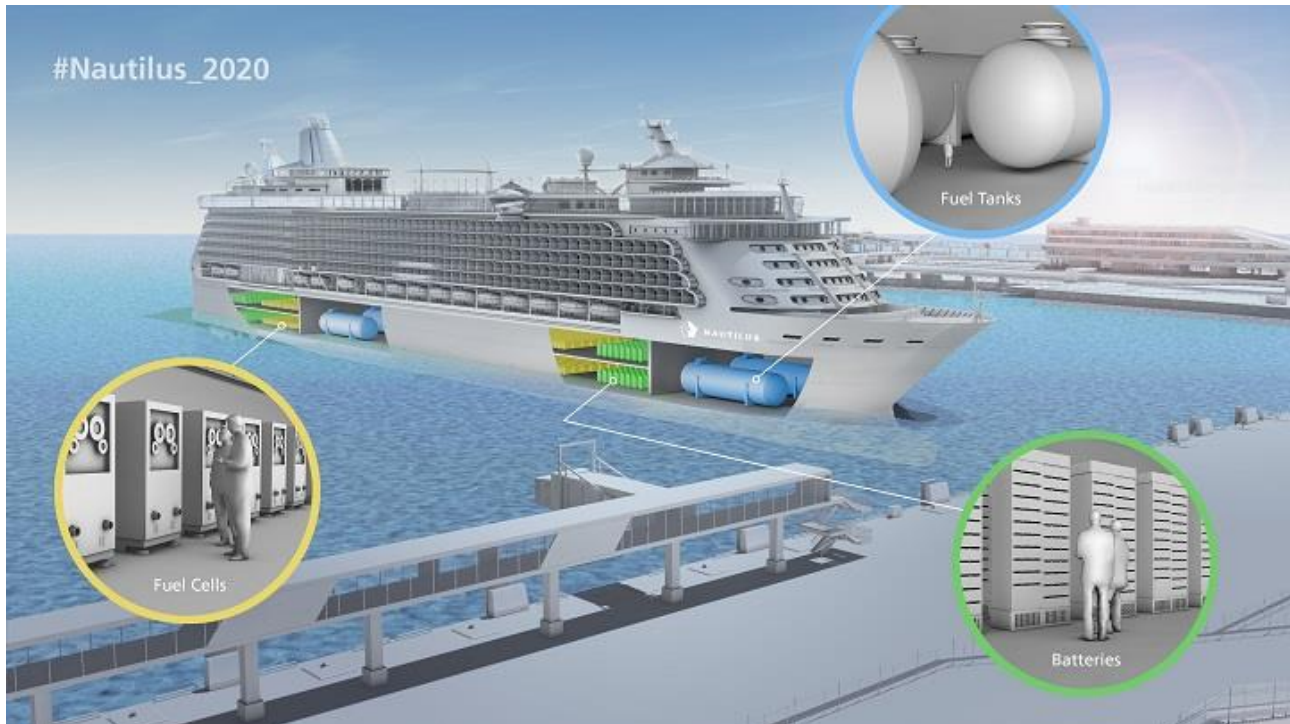


## Fuel cells reduce ship emissions



*Climate-friendly energy supply for ships*

*Note for editor:*

- GRANT Garant is working with [partners](#) from research and industry sectors to develop a climate-friendly energy supply system for ships to cut carbon dioxide and soot emissions.
- The fuel cells are fuel flexible. The new supply system can therefore operate with conventional ship generators as well as with alternative fuels.
- The [NAUTILUS](#) Project, funded by the European Union, is creating a demonstrator of a propulsion system – fuel cell coupled with battery, suitable for large passenger ships.
- **Focus: #Energy, #transport, #climatechange, #hydrogen #NAUTILUS\_2020**

## Modular energy system for cruise ships

**A consortium of technology developers, shipyards and shipowners is developing a hybrid solid oxide fuel cell (SOFC) and battery genset under the NAUTILUS project. The NAUTILUS engineers and researchers are developing a novel propulsion system which will be hybridized with currently used**

**internal combustion engines that are used to fill the power and hotel needs of cruise ships. The novel fuel cells work with hydrogen, natural gas, methanol or synthetic fuels. This makes the gradual conversion of existing energy systems possible.**

Currently, cruise ships are propelled with heavy marine diesel oil, in the NAUTILUS project, this heavy marine diesel oil will be changed for **natural gas**. This change alongside with replacement of some gas engines with the fuel cell system will stop the production of nearly all soot particles. "The new fuel cell system and original generator sets with a gas engine will then be in operation at the same time during a transition period," explains Syed Asif Ansar, coordinator of the NAUTILUS consortium. "The fuel cell system can use the same fuel as the gas engines. As a result, **numerous components of existing energy systems can still be used. In many cases this is more cost-effective, and conversion is technically easier.**"

The fuel cell concept can also be **transferred to merchant ships and stationary industry**. The NAUTILUS project is one step along the road to the **emission-free shipping**.

## Reducing emissions

The NAUTILUS demonstrator is designed to produce 90 kilowatts of electrical power. In comparison with conventional ship generator sets, the fuel cell system will emit around **50 percent less carbon dioxide and up to 99 percent less soot**.

In order to make this system efficient in terms of energy and space, the fuel cells will be coupled with batteries, which will be used to provide a buffer to cope with peak loads of electrical power and dynamic load changes.

The DLR Institute of Engineering Thermodynamics is developing new concepts for coupling power circuits to one another for this purpose. The aim is to make the system as efficient as possible in terms of energy and space. "We can achieve electrical efficiencies of 65 percent with the high-performance fuel-flexible cells. The waste heat produced in this process will be fed back elsewhere in the energy system. In this way we can utilise more than 85 percent of the energy input," Ansar stresses.

GRANT Garant is a member of the NAUTILUS consortium in charge of informing the public about the project and publicizing its outputs. The company has a long-term history of cooperation with foreign partners in the field of establishment of the scientific consortia and the implementation of projects financed from various grant mechanisms. The company has an experience in the field of innovation management and technology transfer, including market evaluation, an evaluation of the potential of new technologies and a development of patent strategies. Among other things, GRANT Garant is responsible for defining the strategy for disseminating and exploiting the results of the NAUTILUS project.

## Simulation of energy system requirements and functional demonstrator

The researchers aim to test the NAUTILUS demonstrator under realistic conditions. To achieve this, voyages, manoeuvres, load variations and the 'hotel operation' of a cruise ship will be simulated.

The consortium targets to validate the generator system as if it was actually integrated on the board of a ship. It will cover the entire process chain, from fuel tank to power consumer. This will also allow us to evaluate the supply system in terms of maritime safety, future regulations and expected service life," says Ansar.

To do this, the NAUTILUS team is creating a 'digital twin' of the generator system. This computational model should make it possible to simulate fully integrated ship energy systems with outputs between 5 and 60 megawatts, which correspond to the output requirement of ships with 1000 to 5000 passengers. Systems already installed can be evaluated and structured more efficiently with computer simulations of this kind.

The next step after the initial trial runs of the NAUTILUS demonstrator is already planned. In a second project phase, the DLR Institute of Engineering Thermodynamics and the DLR Institute of Maritime Energy Systems will test the NAUTILUS system under real-world conditions.

## The impact of the NAUTILUS project

The suggested technology will offer lower emissions, higher efficiency, improved dynamic capability, fuel flexibility and modularity.

The future system has potential to cut greenhouse gas (GHG) emissions by 50% and all other diesel engine exhaust gas emission components (soot) almost entirely.

The NAUTILUS energy system will make cruising more sustainable and compliant with IMO 2030.

### Follow us at

 <https://nautilus-project.eu/>

 [info@nautilus-project.eu](mailto:info@nautilus-project.eu)

 [linkedin.com/company/NautilusEU](https://www.linkedin.com/company/NautilusEU)

 [twitter.com/NautilusEU](https://twitter.com/NautilusEU)

 #NAUTILUS\_2020

### Project consortium:

<https://nautilus-project.eu/about-us>

