

## Cruise Liner driven by LNG: Operational Experience

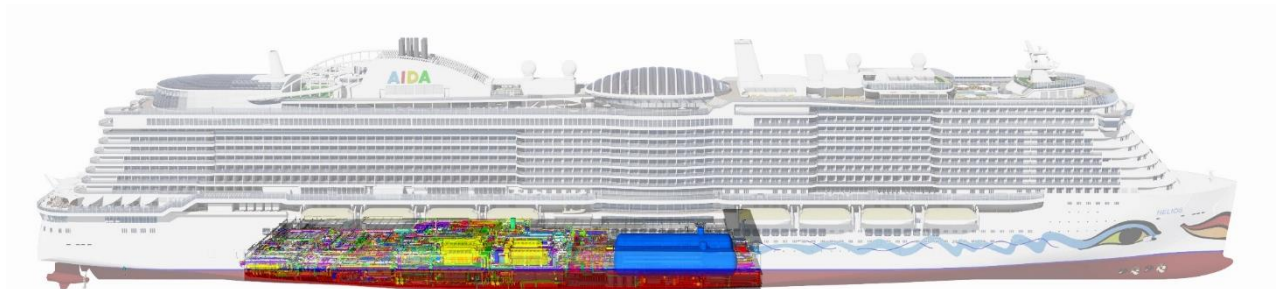
AIDA Cruises has been working intensively for more than ten years on the benefits of using low-emission natural gas (LNG) in shipping. In 2011, AIDAprima and AIDAprera were the first cruise vessels ordered with a system to use LNG in port. In 2015, AIDAsol was supplied with electricity from natural gas in Hamburg for the first time by the LNG hybrid barge "Hummel". In the summer of 2016, AIDAprima was the first cruise ship in the world to be provided with LNG while lying in the harbour, followed shortly by further ports in Europe. Also the sister vessel AIDAprera started to use LNG in Mediterranean ports a year later.

During this first test phase of LNG introduction, a high number of suppliers and partners, but also public and port authorities, police and fire services as well as politicians were involved. This provided an opportunity for all involved to familiarise with the technology, define processes and gain experience on the matter.

With the commissioning of AIDAnova, another technological leap was made. In December 2018, the world's first cruise ship was put into service, which can operate entirely on LNG, in port and at sea. Within Carnival Corporation plc., where AIDA is one of ten cruise brands, ten more LNG cruise ships will be delivered between 2019 and 2025.

AIDAnova has an overall length of 337 m and a tonnage of 183 900 GT. In 2 600 cabins, a maximum number of passengers of around 6 500 can be accommodated. The four dual fuel gensets can deliver a total output of 61 760 kW, the design speed of the vessel is 17 kn.

The LNG systems is based on three cylindrical tanks with a total volume of 3 600 m<sup>3</sup>. The capacity is sufficient to power all ships systems for a minimum of two weeks. In accordance with the safety concept "safe return to port" a MGO fuel system can act as a secondary fuel system. The image highlights the engine spaces with LNG tanks, supply system and engines on AIDAnova.



The selection of the right technology and the implementation in the construction of the ship are only part of the necessary preparations for LNG operation. Many different scenarios were developed and evaluated during the design and approval process. The scenarios were analysed in HAZIDs (Hazard Identification Study), followed by FMECAs (Failure Mode and

Effects Analysis) which fed back to the system design. Also several HAZOPs (Hazard and operability study) were concluded, e.g. on the bunker procedure and emergency set ups.

Training of the ship's crew began well ahead. In CSMART Almere (Netherlands), Carnival's Center for Simulator Maritime Training, dedicated lectures were developed to familiarize with the system handling. Safe operation is the main focus throughout all related activities. To gain also practical experience, the key technical staff also joined LNG tankers for a number of weeks and took part in LNG operations on board.

The management of LNG passenger ships also requires far-reaching adjustments to the processes and regulations. These start at regular operations like the bunker process and lead to the planning of any necessary short-notice docking at the shipyard.

And, ultimately, the introduction of a new technology into a market can only be done with strong partners. The partners are required to set up an infrastructure and provide a full supply of LNG in the area of sailing.

In September 2019, AIDA Cruises looks back on ten months of operation of the first LNG cruise ship with plenty of experience and lessons learned. AIDAnova is operating almost 100 % on LNG and is considered a great success as the first cruise ship specially designed to use this clean fuel.