CARNIVAL
MARITIME

Experience of LNG Operation & Bunker of AIDAnova

Hamburg, June 6, 2019

Introduction

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Carnival Corporation & plc

- 9 cruise line brands
- 105 ships – 1 LNG powered
- 18 ships on order – 10 LNG powered
- 120,000 employees
- 11.5 Million guests carried per year
- 225,000 daily cruise guests
- 100,000 shipboard employees
- 17.51 Billion USD revenue in 2017
- Bunker 3.3 Million MT fuel / year
- Buy fuel in 175 ports with 120 suppliers in portfolio
- Demand roughly 80% Fuel Oil, 19% distillate & **1% LNG**

AIDA
Carnival
Costa
CUNARD
Holland America Line
P&O AUSTRALIA
P&O CRUISES
PRINCESS CRUISES
SEABOURN

Carnival Corporation New Building

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Delivery Information and Main Data

No.	Project	Yard	Delivery	Lower Berths	No. of Cabins
1	Helios I* (AIDAnova)	Meyer / Papenburg	Fall 2018	5.228	2.626
2	Costa Asia I (Costa Venezia)	Fincantieri / Monfalcone	Spring 2019	4.202	2.104
3	Costa XL I* (Costa Smeralda)	Meyer / Turku	Fall 2019	5.224	2.612
4	P&O Cruises UK I**	Meyer / Papenburg	Spring 2020	5.189	2.605
5	Carnival CL I**	Meyer / Turku	Summer 2020	5.246	2.623
6	Costa Asia II	Fincantieri / Marghera	Fall 2020	4.208	2.104
7	Helios II*	Meyer / Papenburg	Spring 2021	5.406	2.716
8	Costa XL II*	Meyer / Turku	Spring 2021	5.224	2.612
9	Carnival CL II**	Meyer / Turku	Fall 2022	5.246	2.623
10	P&O Cruises UK II**	Meyer / Papenburg	2022	5.276	2.633
11	Helios III*	Meyer / Papenburg	2023	5.406	2.716

* - LNG-Powered XL Platform, Costa Group

** - LNG-Powered XL Platform, other Operating Lines

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The Costa Group fleet

- 70 years of history
- 137 different itineraries,
- 261 destinations
- Italian excellence
- total of 10 ships in service
- First LNG cruise ship for the international market in 2019

- one of the fastest growing and most economically successful tourism companies in Germany
- 12 cruise ships at present
- first LNG cruise ship from Dec 2018

- The first international cruise line to enter China in 2006, now market leader
- In 2015 recognized as “Asia Best Cruise Line”
- 4 cruise ships with unique Italian flavor
- first new build for Asian market

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First Cruise LNG Fueled Vessel

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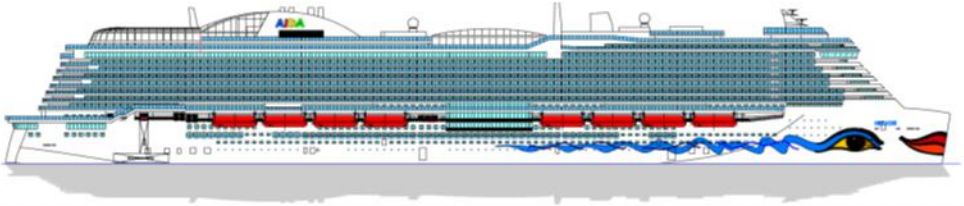
Main Data Sheet Helios



General	
Name:	Helios
Classification / Flag:	RINA / Italian
Hull:	C+ Passenger Ship IWS
Machinery:	AVM IPS, AUT-UMS
Docking Period:	60 months

Main Dimensions	
Length overall (approx.):	337 m
Length pp:	324.95 m
Beam moulded:	42 m
Bulkhead deck:	12.1 m
Draught design (approx.):	8.6 m
Draught max. (approx.):	8.8 m
Deadweight (approx.):	12500 t
Tonnage (approx.):	183,900 GT
Speed (service):	17 kn
Speed (max):	21.5 kn

Life Saving	
Max. persons on board:	8,200
Max. passengers on board:	6,654
Number of tender boats:	-
Capacity of tender boat:	-
Number of life boats:	16
Capacity of life boat:	440

Call Sign:	IBUK
MMSI	247 389 200
IMO	9781865

GAP Revision	N / January 2018

Passenger Accomodation	
Suite	31
Balcony Cabin	1,384
Balcony Cabin Single	12
XL / XL Aft Cabin	110
Wintergarden Cabin	106
Balcony Family Cabin	12
Window / Porthole Cabin	180
Inside Cabin	779
Inside Cabin Single	12
Total Pax Cabins	2,626
Total Lower Berths	5,228
Max Load Factor	127%
Balcony Cabin Ratio:	63%
Outside Cabin Ratio:	70%

Crew Accomodation	
Captains Class	4
Senior Officer	42
Junior Officer, window	30
Single Crew	44
Crew Double	714
Total Crew Cabins	834
Crew Berth	1,548

Machinery	
No. of main engines:	4 pcs
Type:	16 V
Output (each):	15440 KW
Total installed power:	61760 KW
No. of main generators:	4 pcs
Propulsion concept:	Pod
Shaft Propulsion motors:	-
Pod Propulsion motors:	2 pcs
Pod Propulsion power	37 MW
Propeller Type:	FPP
Propeller diam. abt:	5.8 m
Stern thrusters:	-
Output (each):	-
Bow thrusters:	4 pcs
Output (each):	3500 KW
Stabilisers:	1 pair

Tank Capacities	
LNG	3535 m³
Heavy Fuel Oil	0 m³
Gas oil:	2205 m³
Lub oil:	300 m³
Grey Water	4200 m³
Heeling water:	1650 m³
Potable Water:	4570 m³

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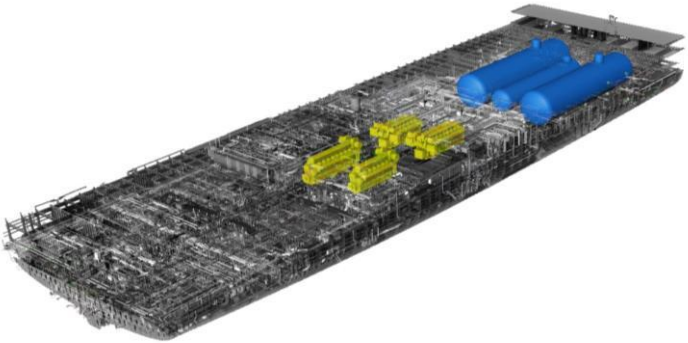
LNG On-board Arrangement

- 4 x 16 cyl 46 DF MaK
- 3600m3 LNG in 3 type ‘C’ tanks
- Operates at 0.7 bar
- Max pressure 4.5 bar
- Transatlantic range
- Safe return to port via MGO (2200m3)



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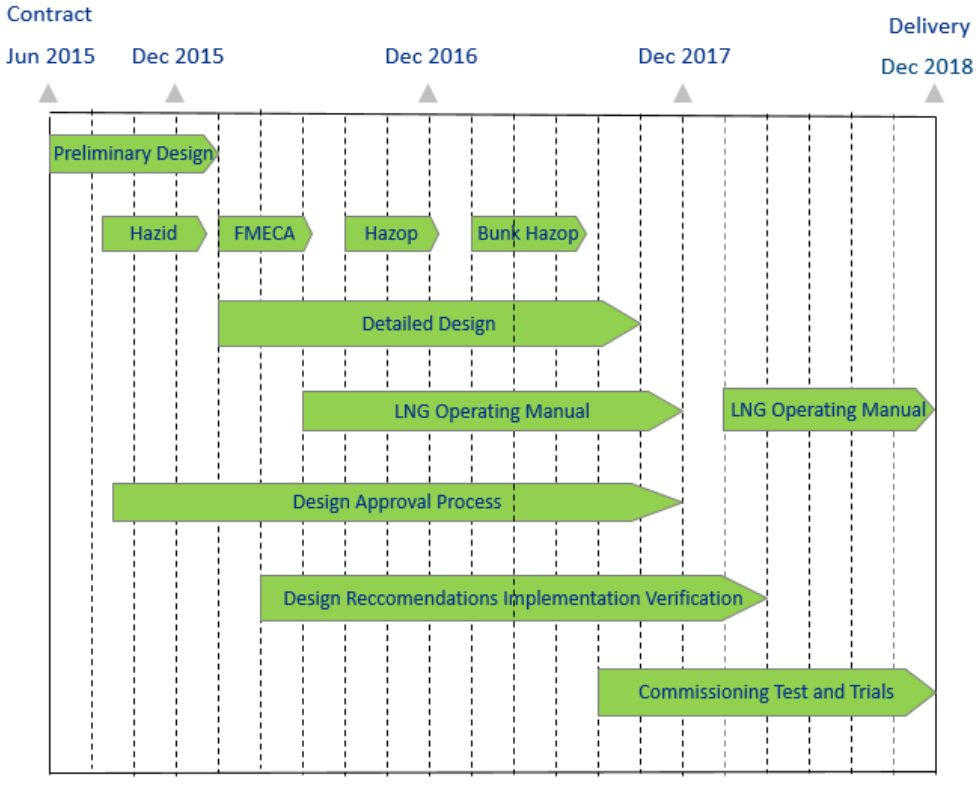
Risk Assessment Process and LNG System Design



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ECR

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AIDAnova – 1st LNG Bunkering – Cardissa - Tenerife

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AIDAnova – 3rd LNG Bunkering – Coral Methane - Tenerife

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Compatibility

- Study
  - Mooring
  - Manifolds
  - Transfer System
- Procedures
  - Communication
  - Hose Handling

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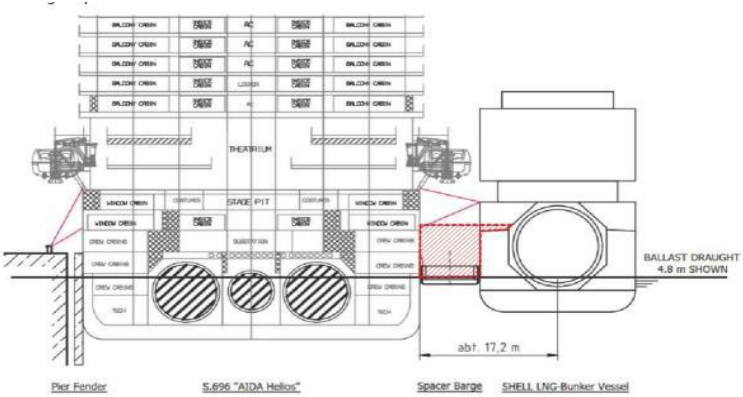
Bunkering Safety Zone



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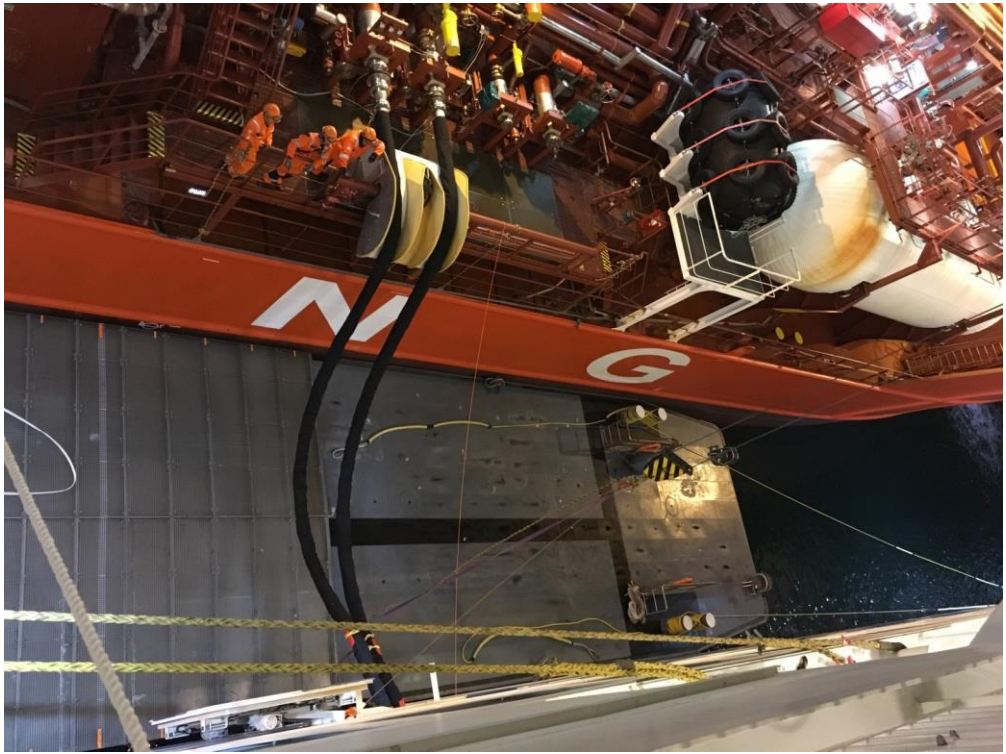
Connected hoses



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Bunkering Station

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SIMOPS Activities - Quayside

- Passenger and crew movements
- Shore side labour movements
- Loading of stores
- Unloading and Loading of luggage
- Discharge of waste material (solid and liquid)
- Loading of spares and unloading of unused materials
- Loading of lubricants and other consumable liquids
- Loading of fuels via truck or pipeline
- Movements of gangways and air bridges
- Mooring line operations
- Loading of potable water
- Parking of tour busses
- Hull cleaning (water washing, painting etc)
- Unloading and loading of tour equipment including bicycles, segways, gazebos, security booths etc
- Connection and disconnection of shore power cables
- Diving operations – hull/propeller cleaning, Thruster Entablature
- Pier Based Events including fireworks

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SIMOPS Activities - outboard side operations

- Lifeboat & rescue boat maneuvering (not possible due to position of bunker vessel)
- MES operation (not possible due to position of bunker vessel)
- Opening of shipside doors (limited to outside of safety zone)
- HFO/MGO bunker operations (not possible due to position of bunker vessel)
- Garbage transfer
- Lowering of crew boats (limited to outside of safety zone)
- Painting of hull and superstructure (limited to outside of safety zone)
- Window washing (limited to outside of safety zone and not above safety zone)
- Window washing via gondola (limited to outside of safety zone and not above safety zone)
- Window replacements (limited to outside of safety zone and not above safety zone)
- Fire and boat drills resulting in displacement of personnel
- Passing traffic
- Berthing of adjacent ships
- Diving operations (Divers in Water) – hull/propeller cleaning (not during bunkering)

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SIMOPS - Onboard

- Testing of machinery
  - Main Engine
  - EDG Testing
- On boarding maintenance
  - Thrusters
  - Pod Testing
  - Stabilisers
- Maintenance and hot work, internal and external
- Drills
- Passenger and Guest access to open decks

LNG Project – Global HESS Procedure

- Creation of a Carnival Inter brand 'LNG working group' including Crew and Shore representatives from following Carnival brands: CMG, CUK, CCL, CCS and Csmart
- The LNG working group has been tasked to review Global HESS procedures to include LNG related matters, covering all the topics: TEC,MAR,OHS,EMR,ENV,SEC… more than 100 procedures are discussed
- The LNG working group principle is based on the exchange of experience between Cruise Ships experts and LNG experts
- The missions of the LNG working group:
  - Analyze the LNG system set up on board of the new LNG fueled ships and make sure that all new operational requirements are included in the Global HESS
  - Understand the LNG safety related concerns and make sure that a LNG Safety culture is implemented into the Global HESS
  - Ensure that the new working principles are shared and applied by all the Carnival brands

LNG Project - Training

- Creation of the Carnival Corporation LNG Competency framework:
  - Identify the new LNG specific tasks on board of the Helios/XL ships (operation and maintenance)
  - Describe the task related LNG competency requirements
  - Develop an assessment guideline
  - Assign LNG specific training requirements per function on board
  - Link the requirements with knowledge source and Procedures
  - Analyze the gap between the IGF STCW training and Carnival LNG competency requirements
  - Develop LNG Training and Familiarization matrix in coordination with CMG Training department
  - Develop LNG Experience matrix
  - Develop concept to assist LNG operation: ship and shore organization (LNG Engineer- LNG SME)
  - Assist and assess the crew once the ship is delivered

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Risk Mitigation - Training

CSMART
Center for Simulator Maritime Training
Part of the Carnival Corporation & plc Group

Development of

- Type specific simulator models
- Type specific LNG training courses
- Type specific Training Rigs

Goal:

Ensure ships staff familiar and confident with their ships design and operation before using vessel for the first time

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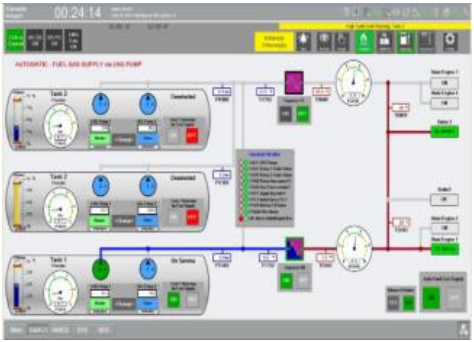
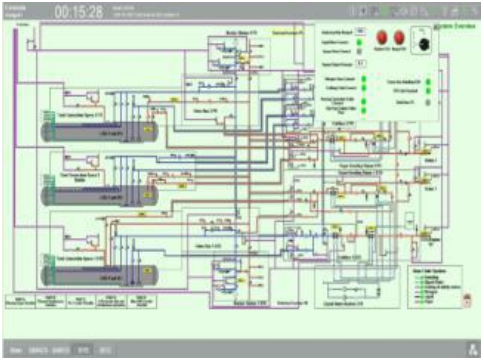
LNG XL Simulator





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LNG Bunker Training Rig - Full size

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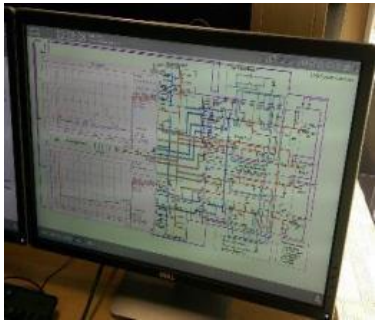
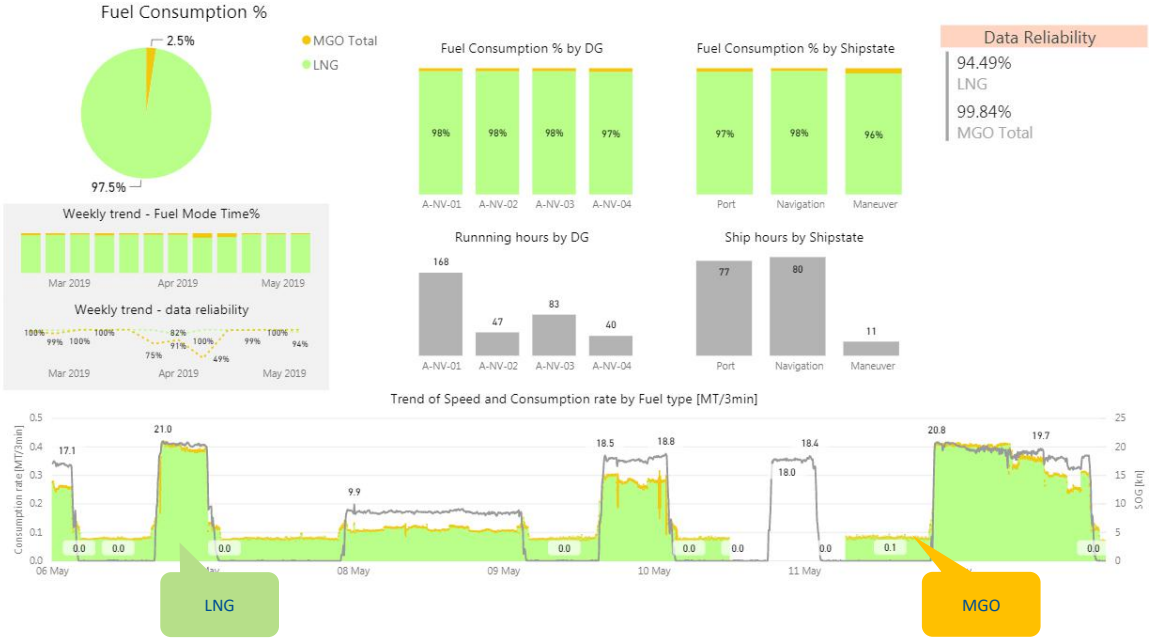
LNG-XL Training Courses



LNG System Measured Results week 2019/20



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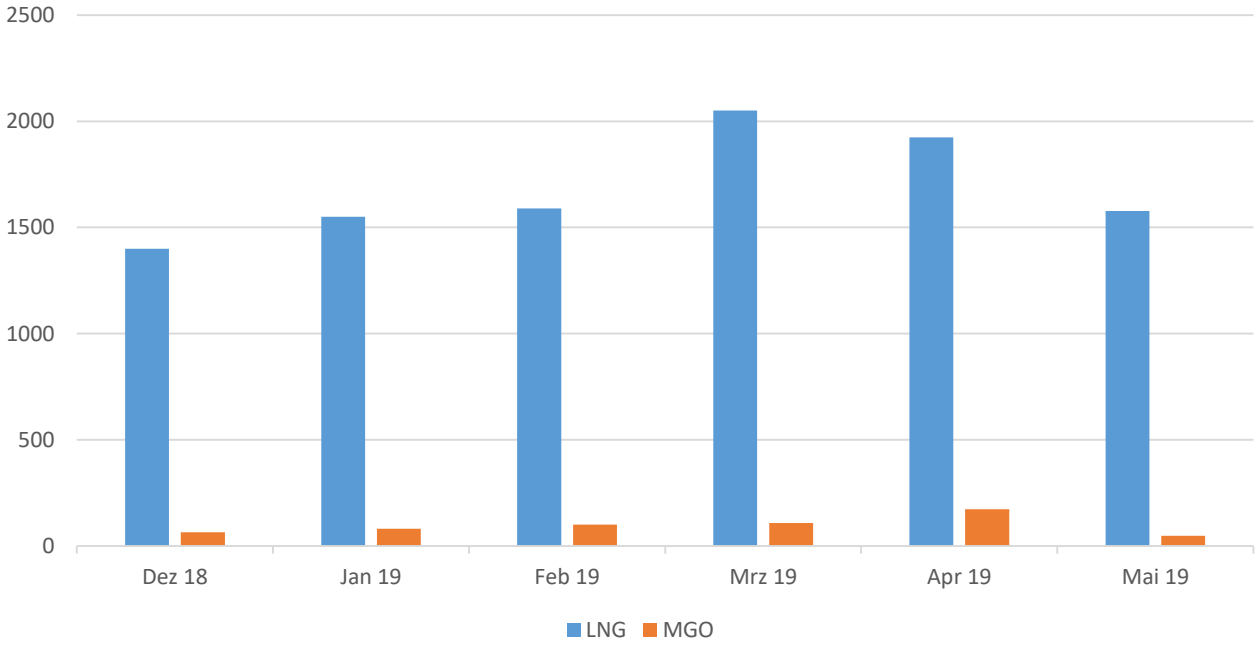
LNG / MGO Actual Consumption (MT)



No emissions

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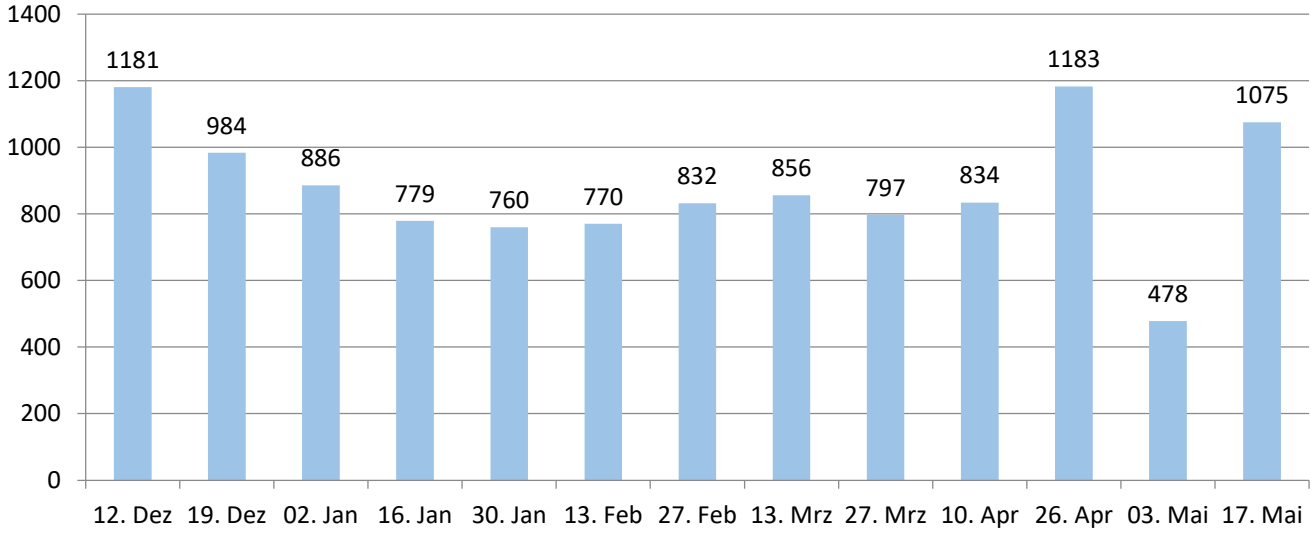
Delivered volumes



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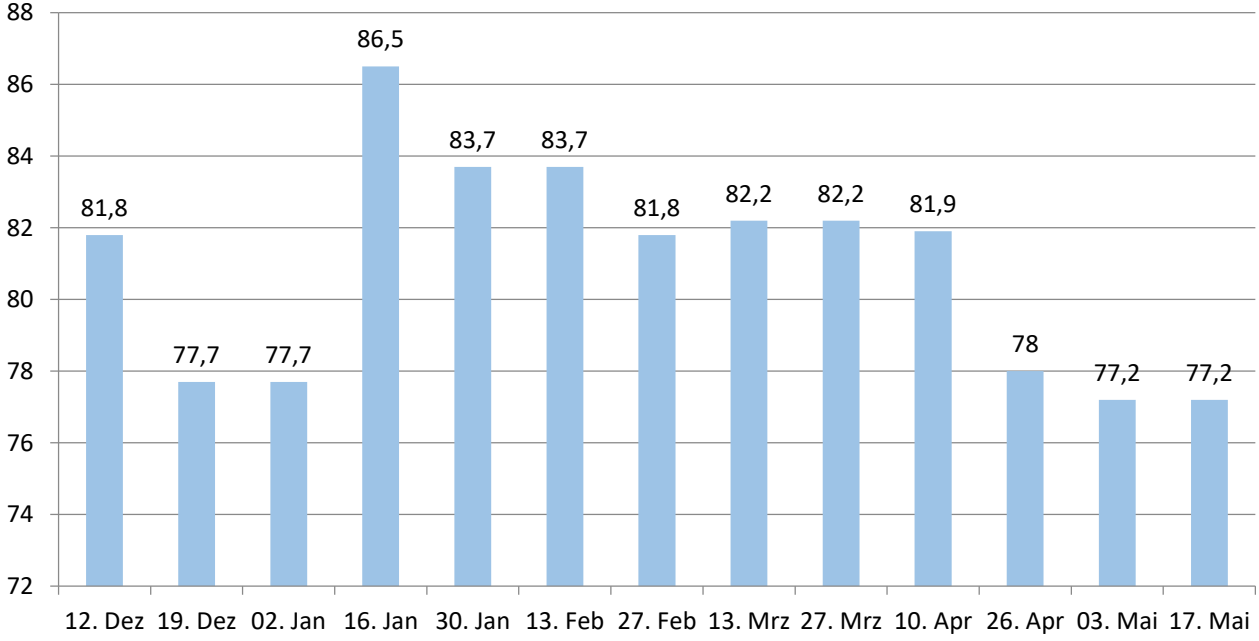
Methane Number



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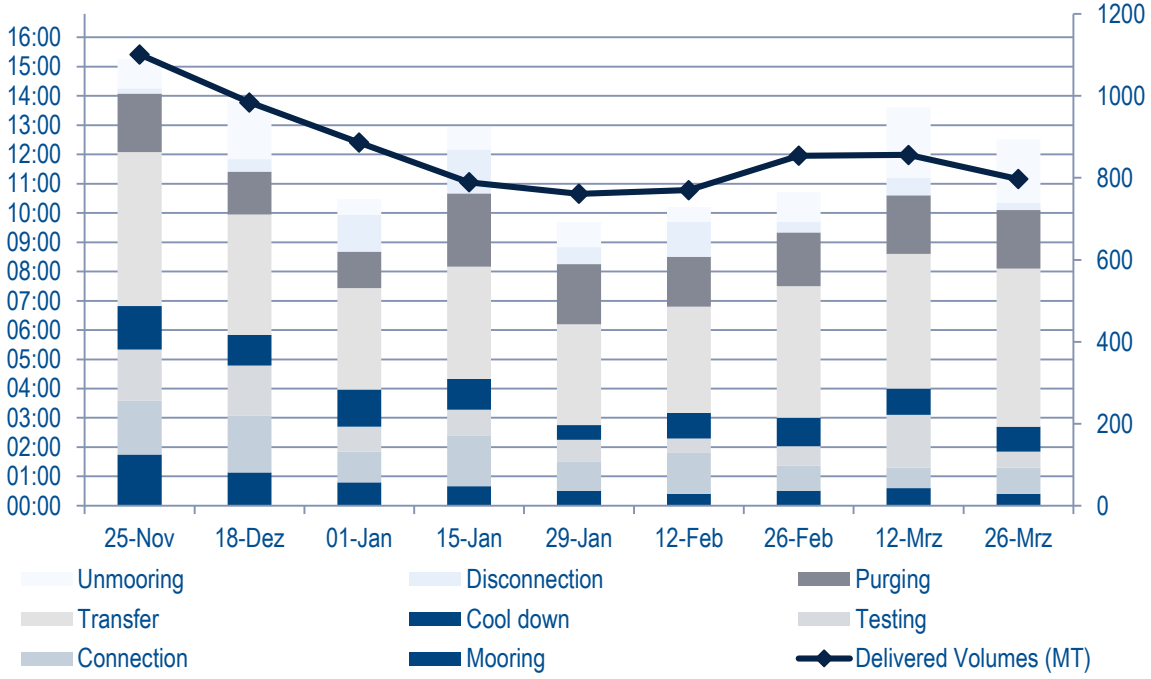
Bunkering Times



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LNG System Lessons Learnt and Future Improvements

Improve the Bunker Station Layout

Improve LNG control system

Improve the Safety System (venting, ventilation, etc.)

LNG Planned Maintenance follow up

A joint activity with all the Operating Lines has been launched in order to identify possible improvements on the current plant such as:

Improve LNG Operation procedures using feed back experience

Improve Nitrogen System

Follow up and control of the Methane Number

Costa Group LNG Activities

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Next Steps - 2019

- 17 October 2019 Delivery Costa Smeralda
- 22 October LNG bunkering in Rotterdam
- 30 October 2019 Arrival of Costa Smerelda in Barcelona