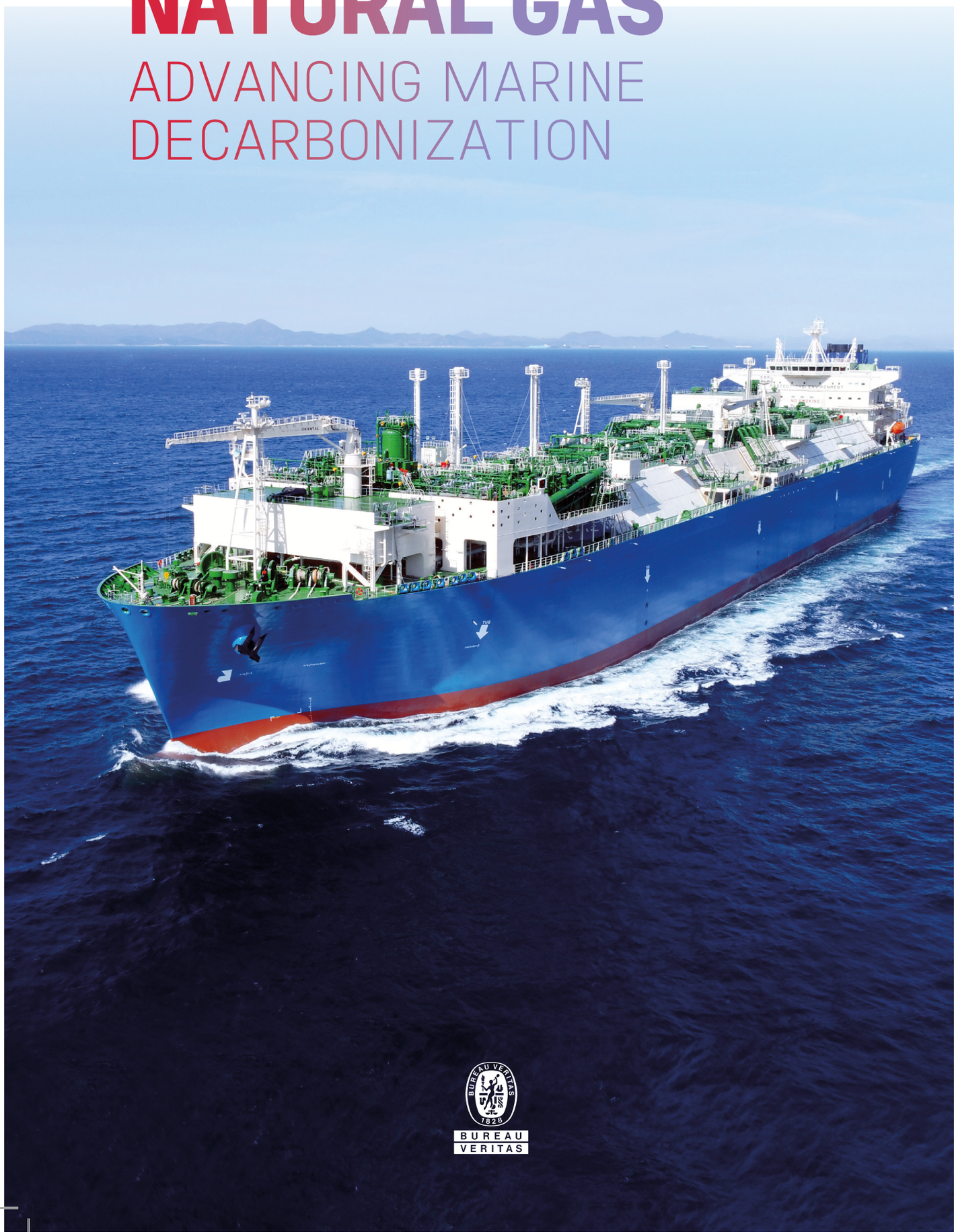
YOUR PARTNER FOR LIQUEFIED NATURAL GAS

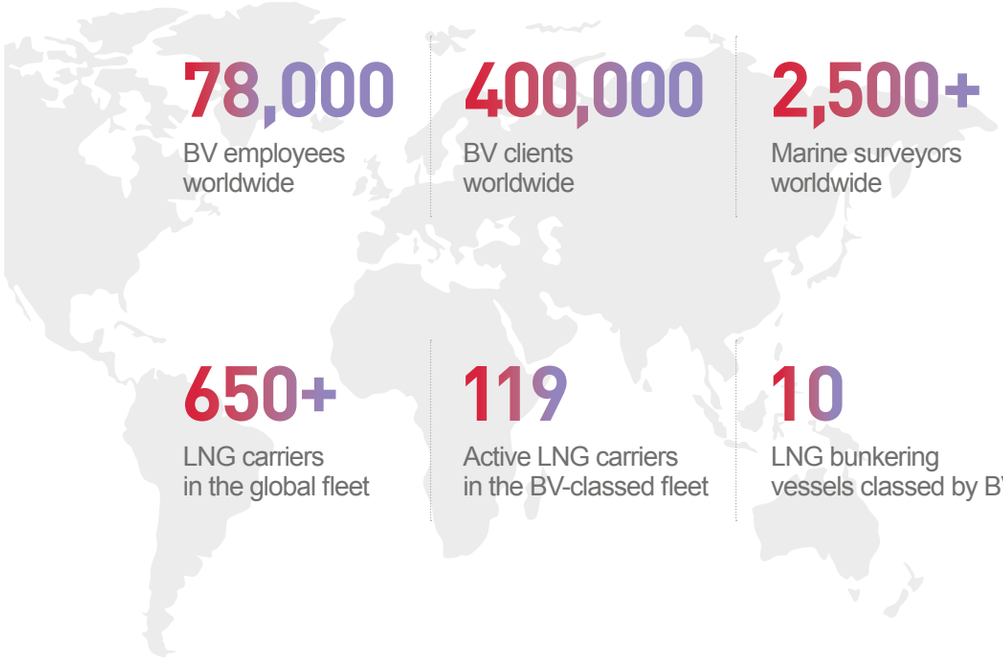
ADVANCING MARINE DECARBONIZATION



BUREAU VERITAS

FROM DE-RISKING THE GAS SUPPLY CHAIN, TO INNOVATING FOR LNG CARRIERS, TO CLASSING LNG-FUELED SHIPS, BUREAU VERITAS HAS DECADES OF EXPERIENCE WITH EVERY ASPECT OF LNG. WE USE THIS CRUCIAL EXPERTISE AND TECHNICAL KNOW-HOW TO SUPPORT RELEVANT STAKEHOLDERS IN USING LNG AS A TRANSITION FUEL AND PREPARING FOR THE NEXT PHASE OF MARINE DECARBONIZATION.

THE SHIPPING INDUSTRY'S LNG EXPERT



78,000
BV employees worldwide

400,000
BV clients worldwide

2,500+
Marine surveyors worldwide

650+
LNG carriers in the global fleet

119
Active LNG carriers in the BV-classed fleet

10
LNG bunkering vessels classed by BV

Sustainability and LNG Key facts

- *IMO has targeted a 40% reduction in CO_2 emissions by 2030*
- *Using LNG as fuel can reduce CO_2 emissions by over 20%(1)*
- *In 2020, nearly 60 new LNG-powered vessels were ordered*

Bureau Veritas Key facts

- *50 years' experience with LNG, biofuels and ammonia*
- *Over 130 dual-fuel vessels(2) in the BV-classed fleet*
- *BV surveyors present in all major LNG bunkering hubs*

(1) Depending on engine type
(2) Vessels that are in-service and on order, excluding gas carriers

A COMPLETE ECOSYSTEM FOR LIQUEFIED NATURAL GAS

Over the past decade, liquefied natural gas (LNG) has come into its own, with major strides in infrastructure development across the gas value chain. Energy providers are producing and exporting LNG worldwide; the LNG carrier fleet continues to grow; and more bunkering facilities and LNG-fueled vessels are being built every day.

This ecosystem supports the now-mature LNG industry, where demand is expected to grow by 3.4% per year between now and 2035. LNG is also the only fossil fuel expected to see growth beyond 2030, giving it staying power as a transition fuel[(3)]. For the next decade, when shipowners think of low-carbon fuels to reduce their vessels' emissions, LNG will be a top contender.

At Bureau Veritas, we know that no part of the LNG ecosystem stands on its own. This is why we have spent over 60 years developing uncontested technical, environmental, regulatory and classification knowledge for LNG systems for production, transport, bunkering, storage and use. We have developed rules and approved technologies for the entire LNG value chain, helping secure LNG projects from emerging markets in South America to the Arctic.

This longstanding expertise and ongoing engagement with LNG innovation is what gives Bureau Veritas a key role to play in helping clients integrate this low-carbon fuel onboard. With mounting calls for shipping to go green, and the International Maritime Organization (IMO) passing new environmental regulations, shipowners are seeking guidance. Today, the primary solution for minimizing vessels' emissions is using LNG as fuel – an area in which Bureau Veritas is uniquely positioned to guide owners.

At the same time, we are using our expertise in classification and technology approval for LNG technologies as a starting point to de-risk future fuels. We are funneling the knowledge and experience gained from working with low-carbon LNG into the development of zero-carbon alternative fuels. This will be crucial to decarbonizing the shipping industry in the long-term, helping shipowners minimize their environmental footprint and comply with IMO regulations.

NO PART OF THE LNG ECOSYSTEM STANDS ALONE. THIS IS WHY BUREAU VERITAS HAS DEVELOPED TECHNICAL, ENVIRONMENTAL, REGULATORY AND CLASSIFICATION EXPERTISE FOR LNG SYSTEMS FOR PRODUCTION, TRANSPORT, BUNKERING, STORAGE AND UTILIZATION.

Carlos Guerrero
Global Market Leader
for Gas Carriers and Oil Tankers
Bureau Veritas Marine & Offshore

(3) https://www.mckinsey.com/industries/oil-and-gas/our-insights/global-gas-outlook-to-2050#

60 YEARS
PIONEERING

BUREAU VERITAS HAS PLAYED A KEY ROLE IN EVERY MAJOR INNOVATION IN LNG SINCE THE BIRTH OF THE INDUSTRY. WE HAVE ACTIVELY CONTRIBUTED TO THE SAFE AND SUCCESSFUL DEVELOPMENT OF LNG EXTRACTION, PROCESSING AND TRANSPORTATION SINCE THE 1960S. THE RESULT IS UNPARALLELED KNOWLEDGE AND EXPERIENCE OF THE LNG INDUSTRY, WHICH WE SHARE – AND CONTINUE TO DEVELOP – WITH OUR CLIENTS.

1962 1971

Bureau Veritas' relationship with LNG began with one of the industry's very first vessels. In 1962, we assessed the ***Beauvais*** *[above]*, the first experimental LNG carrier in France, and published our first dedicated classification Rules for LNG carriers. Over the decade, we developed a solid reputation for LNG carrier classification, with three more carriers joining the classed fleet: the ***Jules Verne, Descartes*** and ***Hassi R'Mel.***

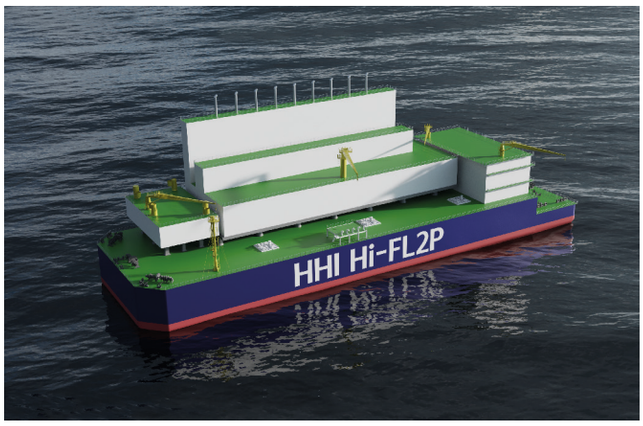
1972 1995

Our expertise in cargo containment systems began to be recognized from the early 1970s. Bureau Veritas classed the first membrane LNG carrier, the ***Ben Franklin*** *[left]*. At 125,000 m^3, it was also the world's largest LNG carrier, leveraging Bureau Veritas' expertise in hydrodynamics and structural integrity. Over the next two decades, we partnered with owners and shipyards around the world, leading to our classification in 1995 of the first membrane LNG carrier built in Korea, the ***Hanjin Pyeong Taek.***

2000 2010

The first part of the 21st century saw multiple innovations in performance and sustainability throughout the LNG value chain. Bureau Veritas classed the first two LNG regasification vessels, the ***Excellence*** and the ***Excelsior*** in 2005. The following year saw our classification of the first ever LNG carrier with a dual-fuel diesel electric propulsion system, ***GDF Suez Global Energy*** (now ***Global Energy***). And in 2009, we classed the first multipurpose gas carrier, the ***Coral Methane*** *[above]*, capable of carrying LNG, LPG and LEG.

LNG



Hyundai gained an AIP for its LNG-to-power solution

2010 2014

We began the decade with publication of dedicated classification rules for Offshore Floating Gas Units. Bureau Veritas played an instrumental role in the development of the first FLNGs. In 2014, we were selected to class the world's largest FSRU, a 263,000 m^3 vessel for MOL.

2014 2017

Innovation in LNG carriers dominated the middle part of the decade. New projects in the Arctic created demand for icebreaking carriers, resulting in our classification of the first icebreaking LNG carrier for SCF *[below]*. Bureau Veritas classed the first LNG carriers equipped with WinGD dual-fuel engines and supported the rise of LNG as fuel with classification of the first LNG bunkering ship for NYK, and publication of a dedicated notation. We also classed the first LNG power barge.

2017 2019

As owners and energy majors recognized the flexibility and efficiency of floating units, Bureau Veritas published several notations to support growth in FSRUs and FSUs. We published notations for specific FSU requirements, and guidelines for the conversion of LNG carriers into floating units. In 2019, Bureau Veritas was selected to class the first FSRU for an LNG-to-floating power project.

2020 2021

As the new decade began, Bureau Veritas remained at the forefront of innovative LNG projects. The first ever Babcock LGE ecoSMRT® compact reliquefaction systems[4] began operations on BV-class LNG carriers ***SCF La Pérouse*** *[above]* and ***La Seine.***

The ***CMA CGM Jacques Saadé*** delivered in 2020 marked the coming of age for LNG as fuel: the first of a series of 23,000 teu dual-fuel containerships, the order contributed to a surge in the development of LNG bunkering ships.

Meanwhile, new orders in 2021 are looking to improve LNG carrier efficiency and performance. Four new 200,000 m^3 LNG carriers, which will feature an optimized BOR with Mark III Flex+ cargo containment system and lower CAPEX, will have Man Energy Solution's low-pressure, ME-GA, two-stroke dual-fuel engines installed onboard. Part of a six ship order, all vessels will be classed by Bureau Veritas.

[4] Many BV-classed ships that have been delivered or are on order have or will have Babcock LGE, ALAT TBF, DSME FRS-SUNBO or PRS-SAMWOO reliquefaction or subcooling systems, the leading technologies for LNG carriers.

ACTIVE THROUGHOUT
THE GAS VALUE CHAIN

Exmar

PRODUCTION >

Bureau Veritas' services lower risk and ensure compliance of onshore production plants and offshore floating production units.

We supported safe construction of the world's first Floating Liquefied Natural Gas projects. Bureau Veritas classed Exmar's ***TANGO FLNG,*** the first ever FLNG to reach completion, and BV Solutions M&O, the technical advisory component of Bureau Veritas Group, provided engineering and third party services to Shell for the construction of ***Prelude,*** the world's largest FLNG. Today MatthewsDaniel, a BV company and a global leader in pre and post risk services, risk assessment and loss adjusting, is providing Eni with marine warranty services for the ***Coral Sul FLNG,*** to be used for production offshore Mozambique from 2022.

RULES AND GUIDANCE NOTES

NR 542 – Classification of floating gas units[5]

—

NI 554 – Design sloshing loads for LNG membrane tanks[5]

—

NI 546 – Strength assessment of LNG membrane tanks[5]

SK Shipping

TRANSPORTATION >

Bureau Veritas is a classification partner of choice for owners of innovative gas carriers and their charterers, with over 30% of the world's orderbook[6].

We classed a number of industry firsts, including the first LNG carriers to run on dual-fuel diesel-electric propulsion, the first ships propelled by WinGD engines, the first icebreaking gas carriers, and ships that set new records in cargo capacity. These carriers today serve flagship energy projects, from Yamal LNG in Russia's far north to Icthys in offshore Australia.

Bureau Veritas also classed two 180,000 m^3 LNG carriers, the ***SK AUDACE*** and ***SK RESOLUTE,*** for the Sabine Pass project, the first LNG export terminal in the United States.

RULES AND GUIDANCE NOTES

BOG-reliquefaction

—

LNG-subcooling

—

NR 467 – Classification of Steel Ships – Liquefied Gas Carriers[7]

—

NR 517 – Compressed natural gas carriers

—

NI 623 – Condition assessment program for LNG carriers

200+

OFFSHORE FLOATING UNITS USING BUREAU VERITAS SERVICES

1 in 3

LNG CARRIERS ARE ORDERED TO BV CLASS

(5) These guidance notes apply to multiple vessel and unit types

(6) As of December 2020, including gas carriers for the Arctic LNG-2 project

(7) Part D, Chapter 9

BUREAU VERITAS WORKS WITH THE WORLD'S LEADING ENERGY COMPANIES THROUGHOUT THE GAS VALUE CHAIN TO PRODUCE AND DISTRIBUTE GAS WORLDWIDE. WE SUPPORT ONSHORE AND OFFSHORE GAS PRODUCERS, LNG CARRIER OWNERS AND CHARTERERS, AND TERMINAL OPERATORS IN CONDUCTING THE SAFE EXPLORATION, EXTRACTION, LIQUEFACTION, TRANSPORTATION AND DELIVERY OF NATURAL GAS.

MOL

Excelerate Energy

KARMOL

BUNKERING >

Bureau Veritas' experience with LNG bunkering vessels (LNG BV) enables us to provide guidance for cargo handling, reliquefaction and cooling systems, and propulsion.

We classed the first ever LNG BV, ***Green Zeebrugge*** (previously the ***Engie Zeebrugge***), along with the ***Coralius,*** the second LNG BV to enter service. Since then, we have been involved in most bunkering vessel projects. The latest, ***Gas Agility,*** is currently the world's largest bunker vessel in operation, and is chartered by Total to supply gas to a fleet of LNG-fueled CMA CGM containerships, also built to BV class.

RULES AND GUIDANCE NOTES

NR 620 – LNG bunkering ship
—
NI 618 – Guidelines on LNG bunkering

STORAGE >

Bureau Veritas has supported the fast-growing market for Floating Storage and Regasification Units (FSRUs) and Floating Storage Units (FSUs) with dedicated rules and services for both newbuildings and LNG carrier conversions.

Long-term partner to FSRU market leader Excelerate Energy, we classed the ***Excelerate Sequoia,*** owned by Maran Gas Maritime Inc. under a bareboat charter to Excelerate, in 2020. Our Rules and expertise enable us to class units of all sizes, from the ***MOL FSRU Challenger,*** still the largest FSRU in operation today at 263,000 m^3, to the latest FRU and FSU for Gasfin Development.

RULES AND GUIDANCE NOTES

NR 645 – Classification of FSRUs and FSUs
—
NI 655 – LNG carrier conversion to FSRU or FSU

POWER >

Bureau Veritas is at the forefront of power unit development, working on both classic gas-to-power and LNG-to-power projects. We provide approvals in principle (AiP) for innovative designs, and classification services for gas and LNG power barges.

In the past two years alone, Bureau Veritas has provided AiPs for Hyundai Heavy Industries' Hyundai Innovative Floating LNG to Power and Technip's ***iLNGP Barge,*** two innovative LNG-to-power concepts. We provided classification for the world's first barge-based FSRU for Exmar, and are now working with Wison Nantong Heavy Industry on China's first floating gas power plant.

Bureau Veritas is also providing classification for the conversion of two MOSS Type LNG carriers into FSRUs. This Karadeniz and MOL joint venture will deliver LNG to Senegal and Mozambique.

RULES AND GUIDANCE NOTES

NR 656 – Power generation units

50%

OF LNG VESSELS IN OPERATION ARE BV-CLASSED

37%

OF FSRUS ARE BV-CLASSED

50%

OF POWER BARGES ARE BV-CLASSED

FUTURE-PROOFING THE WORLD'S GAS FLEET

WITH THE ENERGY TRANSITION ACCELERATING, LNG IS A PROVEN ALTERNATIVE FUEL FOR SHIPOWNERS WORLDWIDE. FOR GAS PRODUCERS AND DISTRIBUTORS, BUREAU VERITAS' EXPERIENCE WITH LNG TECHNOLOGY IS KEY TO BUILDING THE INNOVATIVE AND EFFICIENT GAS CARRIER FLEET OF TOMORROW.

MEETING DEMAND FOR LNG AS AN ENERGY SOURCE

The use of LNG as a cleaner, alternative energy source is growing worldwide, spurring the development of gas carriers. Industry players in recognized hubs for gas development and transportation need cutting-edge expertise to take advantage of the expanding LNG landscape.

Thanks to our extensive expertise with gas carriers of all kinds, Bureau Veritas is uniquely positioned to support shipowners, shipyards and equipment manufacturers in the classification of new-generation LNG carriers.

OPTIMIZING GAS CARRIER CARGO CONTAINMENT SYSTEMS

Constructing safe and fuel-efficient LNG carriers is a high-stakes balancing act for shipyards and designers. To achieve optimal performance, gas carriers must seamlessly match state-of-the-art cargo containment systems (CCS) with reliquefaction and subcooling technology, and the right propulsion system.

Bureau Veritas' long collaboration with leading LNG carrier owners, shipyards and equipment manufacturers has helped us master this balance. BV Solutions – M&O has extensive knowledge of CCS' technical challenges, and has learned how to choose the right propulsion and boil-off gas handling systems. It has applied these skills to LNG carriers of many types, designs and sizes, taking a flexible, yet robust approach to gas carrier development and construction.

EXPERTISE IN ALL LNG TANK TYPES

Bureau Veritas has classed large-scale gas carriers with every type of tank currently available, and can fully support companies in their choice of technology. For Type B tanks, fitted with partial secondary barriers, we have worked with spherical and prismatic shaped tanks. For newer membrane tanks, we have firsthand experience with onboard tank integration and membrane and insulation technology. Bureau Veritas also offers a comprehensive understanding of Type A and Type C tanks for other gas carriers.

© Dynagas

DELIVERING MAXIMUM LNG WITH ADVANCED RELIQUEFACTION

LNG carriers currently rely on advanced subcooling and reliquefaction systems to manage boil-off gas (BOG), maintain optimal temperature and pressure inside the CCS, and reduce BOG waste. This enables ship operators to deliver maximal LNG during discharge without compromising safety.

BV Solutions - M&O has acquired technical expertise with subcooling and reliquefaction systems for gas carriers and bunkering vessels. By leveraging our know-how, clients can maximize efficiency by balancing LNG vaporization and regasification, while remaining safe and compliant with regulations[8].

TARGETING OPTIMUM EFFICIENCY FOR PROPULSION SYSTEMS

LNG carriers need to maintain a delicate balance between their propulsion system and CCS to ensure that boilers, propulsion engines and auxiliary engines use the right amount of BOG and have a minimum reliance on GCUs. To achieve peak efficiency, and shipyards must be flexible, matching the right reliquefaction or subcooling system with evolving propulsion and CCS.

323

BV-classed gas carriers

80+

Gas carriers ordered in 2019-2020

35%

Market share in small-scale lng carriers

(8) E.g., The International Code of the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk

"Ship owners face a great challenge in choosing the best way forward when considering the range of design options in development. Our long-time collaboration with leading LNG carrier owners, shipyards and equipment makers, combined with our always being involved in the leading LNG projects, have enabled us to acquire practical knowledge of currently available propulsion and containment technologies. This means we can readily help clients make the right choice for their projects – to reduce risk and drive performance."

Paillette Palaiologou
VP Hellenic, Black Sea and Adriatic Zone
Bureau Veritas Marine & Offshore

EXPERTISE FOR ALL TYPES OF LNG-POWERED VESSELS

THE BENEFICIARIES OF A WELL-DEVELOPED LNG SUPPLY CHAIN ARE SHIPOWNERS WORLDWIDE AND ACROSS SEGMENTS. FROM CONTAINERSHIPS, TO TANKERS, TO CRUISE SHIPS, VESSEL OWNERS ARE INTEGRATING LNG AS FUEL ONBOARD TO LIMIT THEIR ENVIRONMENTAL IMPACT.

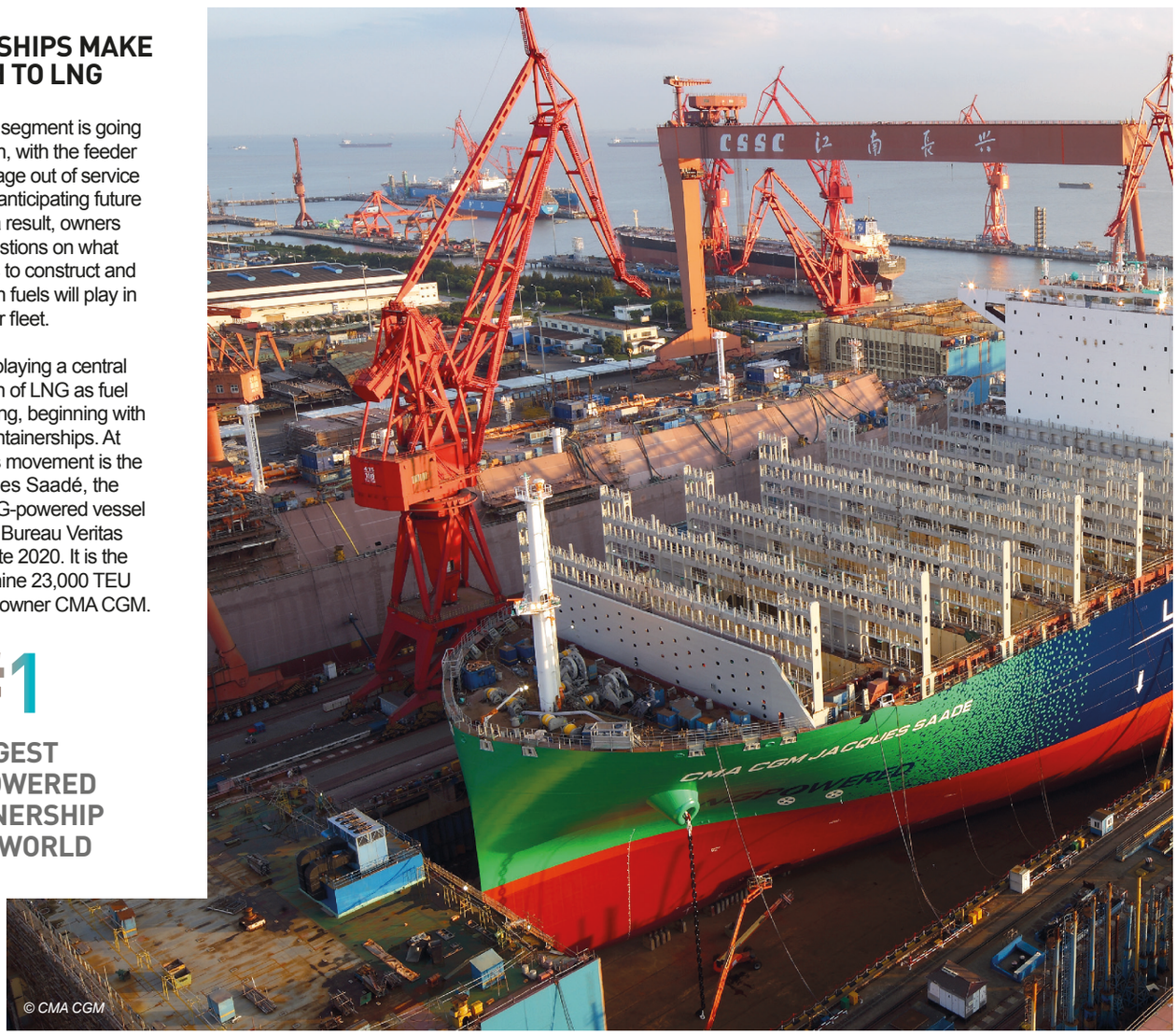
HELPING CONTAINERSHIPS MAKE THE SWITCH TO LNG

The containership segment is going through a transition, with the feeder fleet beginning to age out of service and large carriers anticipating future carbon taxes. As a result, owners are facing key questions on what kinds of newbuilds to construct and the role low-carbon fuels will play in decarbonizing their fleet.

Bureau Veritas is playing a central role in the adoption of LNG as fuel in container shipping, beginning with large, dual-fuel containerships. At the forefront of this movement is the CMA CGM Jacques Saadé, the world's largest LNG-powered vessel (right), classed by Bureau Veritas and delivered in late 2020. It is the first in a series of nine 23,000 TEU containerships for owner CMA CGM.

#1

LARGEST LNG-POWERED CONTAINERSHIP IN THE WORLD



© CMA CGM

HOW PASSENGER SHIPS USE LNG TO LOWER EMISSIONS

As public opinion and legislation change, cruise ships and ferries are increasingly subject to local, national and international sustainability regulations. To continue sailing in emissions protected areas, including islands around the Caribbean, South Pacific and Mediterranean, passenger ships are integrating LNG onboard.

Bureau Veritas is supporting cruise ship and ferry owners in reducing their environmental footprint by using LNG as fuel. In 2020, we delivered class certificates to an LNG-powered Vista Class cruise ship for MSC Cruises, and we are currently classing their World Class series of LNG-powered cruise ship. Among our LNG projects for ferries, we recently classed an LNG-fueled ro-ro passenger ship for Tallink, built by Rauma Marine Construction in Finland.


© MSC Cruises

ADOPTING LNG AS FUEL FOR LARGE TANKERS

For tanker owners, LNG is a strong option for cleaner fuel, as evidenced by the recent rise in orders for Aframax and VLCC tankers. The adoption of LNG is also being spurred by the discussion of a carbon tax for transportation across the European Union.

Bureau Veritas is bringing its technical expertise for LNG as fuel to large tanker owners, helping ensure structural safety and compliance. In 2020, we were awarded classification of a dual-fuel, LNG-powered VLCC tanker for owner AET, the first of its size in South Korea to be BV-classed. Our experts also classed 15,000 DWT chemical tankers for Terntank that uses LNG and liquid biogas as fuel, in addition to having hybrid-electric power.

2/3 OF IN-SERVICE LNG-FUELED TANKERS ARE BV-CLASSED

TUGS, DREDGERS AND OSVS MOVE TOWARD LNG

Other segments are looking to LNG as a way to lower their emissions and environmental impact in the short-term. Tugboats and dredgers often work in or around populated areas, and can be subject to harsher environmental restrictions than sea-going vessels. Offshore wind service and supply vessels face similar pressure, as part of the supply chain for the production and delivery of renewable electricity.

Bureau Veritas provides classification and sustainability expertise for tugs, dredgers and offshore service vessels, helping owners move toward LNG and dual-fuel power. We have notably classed three dual-fuel escort tugs – Dux, Pax, Audax – for Ostensjo Rederi AS, designed by Robert Allan Design and built at Gondan Shipyard.

TRANSITIONING TO A ZERO-CARBON MARINE INDUSTR

WHILE LNG IS THE MOST WIDELY USED ALTERNATIVE FUEL, THE SHIPPING WORLD IS ALSO DEVELOPING OTHER OPTIONS. BUREAU VERITAS IS ACTIVELY WORKING TO CERTIFY TECHNOLOGIES AND DEVELOP RULES FOR ZERO-CARBON FUELS AND WIND PROPULSION SYSTEMS, WHILE HELPING CLIENTS MEET IMO SUSTAINABILITY REGULATIONS.

COMPLYING WITH CARBON INDEXES

Reducing the environmental impact of the shipping industry is a top priority. To help shipowners limit emissions from their vessels, IMO has introduced two new environmental regulations.
The Energy Efficiency Existing Index (EEXI) is a technical, design-based carbon index, and the Carbon Intensity Indicator (CII) is an operating index.

We help owners verify compliance with carbon indexes with tools including our VeriSTAR Green application.

JANUARY 1, 2023

EEXI AND CII COME INTO FORCE

IMPROVING FUEL EFFICIENCY

While LNG carriers are designed to minimize gas waste, ships can produce excess or insufficient boil-off gas (BOG). Selecting the right cargo containment system (CCS), reliquefaction or subcooling technology, and propulsion systems is crucial to optimizing fuel efficiency.

Bureau Veritas has worked closely with GTT to properly assess optimized cargo containment systems[9] and BOG handling systems, managing LNG vapors through subcooling and reliquefaction. We have experience balancing propulsion and cargo systems performance, ensuring that boilers, gas combustion units and engines use the right amount of BOG. Our expertise in improving fuel efficiency applies across the LNG value chain[10].

In addition to improving operational performance, fuel efficiency can help shipowners comply with upcoming IMO MARPOL regulations for limiting CO_2 emissions.

0.07%

MINIMUM BOG RATE FOR FUEL EFFICIENCY FOR STANDARD 174,000 M^3 LNG CARRIER

(9) For more information, see our report, Modern LNG Carrier Technology

(10) For more information, see our report, Bunkering for a More Sustainable Future

© AIRSEAS

MINIMIZING EMISSIONS WITH ALTERNATIVE FUELS

To meet key IMO targets for limiting emissions and environmental impact, many shipowners are turning to alternative fuels. In addition to LNG, industry stakeholders have begun incorporating other low-carbon fuels onboard, including methanol, ethanol, and biofuels, and are looking into zero-carbon fuels like ammonia and hydrogen.

Bureau Veritas supports ship operators and shipyards in preparing vessels to safely use low- and zero-carbon fuels onboard. We have or are developing rules and notations for methanol, ammonia and hydrogen, and are participating in several major projects to develop marine technologies for alternative fuels.

5

CLASS NOTATIONS (AMMONIA-PREPARED, AMMONIA FUEL METHANOL FUEL SUSTAINABLE SHIP -1 AND -2)

DEVELOPING WIND-ASSISTED PROPULSION

As the marine industry searches for new ways to reduce its environmental footprint, wind-assisted propulsion is emerging as a powerful contender. Wind-assisted technologies, such as rotating sails, kite sails and rigid sails, can be installed onboard vessels, enabling them to sail using freely available renewable energy.

To help shipowners move forward with wind-assisted propulsion, Bureau Veritas has released updated classification rules that provide a framework for using wind propulsion systems. These rules are complemented by two class notations: WPS-1 for wind-powered ships with standing rigging and WPS-2 for vessels with both standing and running rigging.

2

CLASS NOTATIONS FOR WIND PROPULSION SYSTEMS

BUREAU VERITAS **SOLUTIONS** Marine & Offshore

OPTIMIZING VESSELS TO USE LNG

Bureau Veritas Solutions – Marine & Offshore offers a complete portfolio of services to help ships improve sustainability by integrating LNG as fuel onboard.

Our experts can notably perform **vessel performance optimization** and **LNG tank size optimization** to determine the right equipment and systems for storing and burning LNG.

To help clients comply with EEXI and CCI requirements, BV Solutions M&O also offers a pre-assessment, **calculating EEXI and CII** and reviewing available technical information. We then identify **technical and operational improvement** methods, and support owners in implementing innovative technologies onboard.

BV Solutions M&O is the BV Group dedicated company providing independent support for Marine & Offshore non-classification activities to clients via its core services, including risk assessment, project management, technical consulting, digital solutions and environmental development.

ADVANCING MARITIME DIGITALIZATION

SHIPS ARE INCREASINGLY CONNECTED TO ONSHORE AND OFFSHORE NETWORKS AND FITTED WITH DATA COLLECTION SENSORS. BUREAU VERITAS PROVIDES SERVICES TO HELP CLIENTS PROTECT THEIR SHIPS AND REAP THE BENEFITS OF DIGITALIZATION.

ACHIEVING COMPLIANCE WITH CYBER SECURITY REGULATIONS

Cyber protection is a growing concern for the marine industry, with organizations like IMO passing regulations to mandate the inclusion of cyber risk management onboard. For LNG-powered ships, these measures are vital, as the advanced, interconnected systems onboard can leave them vulnerable to cybercrime.

With 360° knowledge of the industry's available solutions, Bureau Veritas can create a comprehensive cyber security ecosystem for low- and zero-carbon-fueled ships. We help clients integrate cyber risk into their safety management systems and earn our CYBER MANAGED and CYBER SECURE notations for in-service vessels and newbuilds.

LEVERAGING DIGITAL FOR MORE EFFICIENT SURVEYS

Remote inspections are growing in popularity and scope, offering shipowners a variety of benefits. Bureau Veritas' industry leadership in remote inspections enables our clients to take full advantage of cutting-edge technology and our experts' unrivalled know-how.

Our trained inspectors use remotely controlled drones and robots, live-streaming solutions and augmented reality to conduct partly or fully offsite remote inspections. This can improve survey efficiency and facilitate maintenance, providing faster decision-making and shorter response times, and helping companies meet regulatory, health, safety and quality needs.

SEEING THE FUTURE WITH PREDICTIVE MAINTENANCE

Increased digitalization brings with it the possibility of predictive maintenance, which offers shipowners more accurate information about their assets, and the ability to anticipate and resolve problems.

Bureau Veritas is developing optimized and predictive surveys, which use a risk and condition-based approach that accounts for maintenance history to evaluate when ships should undergo survey.

Our experts have already begun laying the groundwork for optimized and predictive surveys, developing digital tools like remote inspection and 3D Classification.

A CLASSIFICATION PARTNER OF CHOICE

WE KNOW
LNG

Bureau Veritas provides a wealth of expertise in the safe handling, use and bunkering of LNG. We have contributed to the development of gas extraction, processing, liquefaction and LNG transportation for over 60 years, bringing LNG projects to safe, successful conclusions. We provide key support for overcoming the safety challenges of LNG-powered vessels, helping construct newbuilds and retrofit in-service vessels to use LNG as fuel.

WE KNOW
THE GAS VALUE CHAIN

Bureau Veritas is active throughout the gas value chain, and we remain pioneers in the qualification of new LNG technologies. Shipowners, shipyards, equipment manufacturers and energy providers trust us with the classification of their LNG-powered vessels and the certification of LNG technologies. From production, to transportation, to use, we help ensure the safety and efficiency of LNG operations worldwide.

WE KNOW
ALTERNATIVE FUELS

Bureau Veritas is on the front lines of innovation for existing and alternative fuels, helping stakeholders across the maritime industry safely develop the low- and zero-carbon fuels of tomorrow. Building on our classification experience with LNG, we are actively working on JIPs and AiPs for projects using ammonia, hydrogen, fuel cells, wind propulsion and carbon capture and storage.

WE KNOW
DIGITALIZATION

Bureau Veritas anticipates clients' needs as we enter the next age of maritime digitalization. We are committed to ensuring the safety of connected ships and offshore units, and help clients leverage their data to optimize asset use and operational efficiency. We are industry leaders in the field of cyber security, early adopters of remote inspection techniques, and pioneers in predictive maintenance.

WE KNOW
SUSTAINABILITY

Bureau Veritas helps shipowners minimize the environmental impact of their assets and advance the energy transition by moving first to low-carbon, then to zero-carbon fuels. Our solutions are designed to help optimize fuel efficiency, limit GHG emissions, and decarbonize the maritime sector. This is supported by our BV Green Line of services, which helps shipowners implement, measure and achieve their sustainability objectives.

BV GREEN LINE

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BUREAU VERITAS

Shaping a World of Trust

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