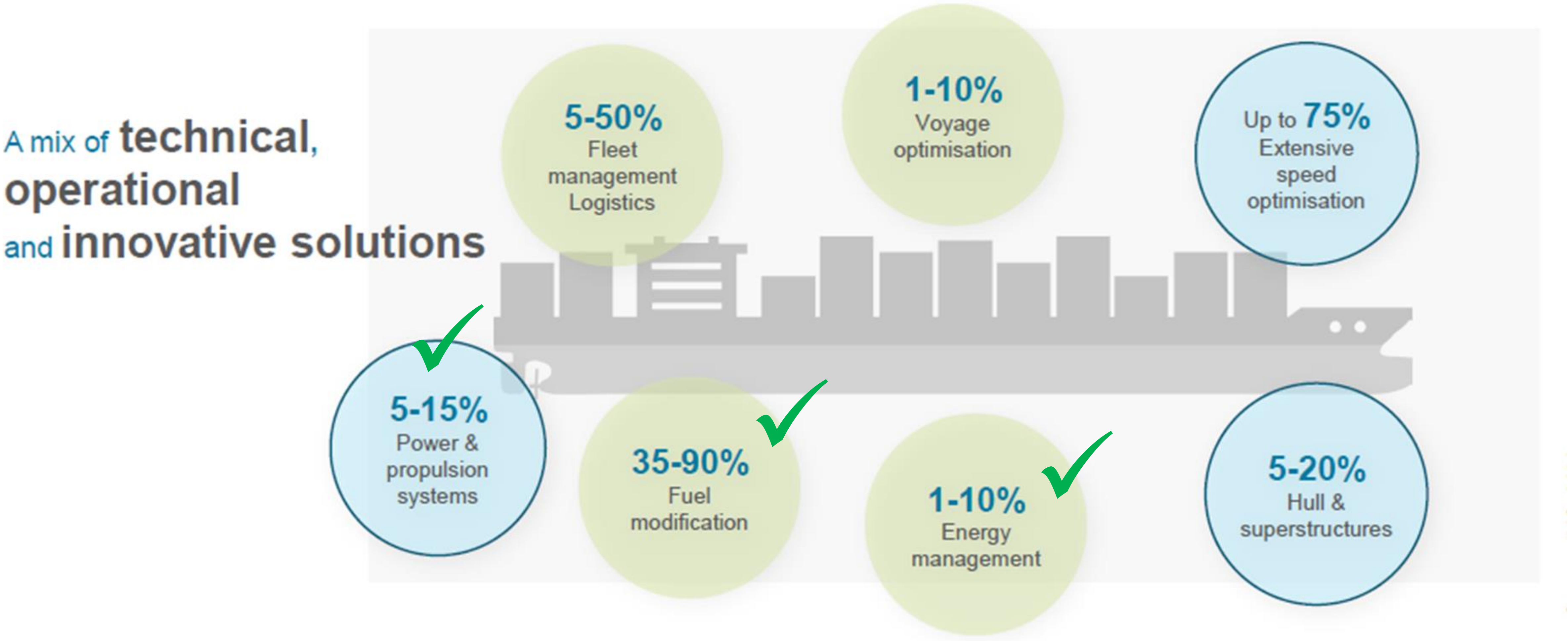
ALTERNATIVE ANTRIEBSLÖSUNGEN IN DER SCHIFFFAHRT

Rolf Stiefel

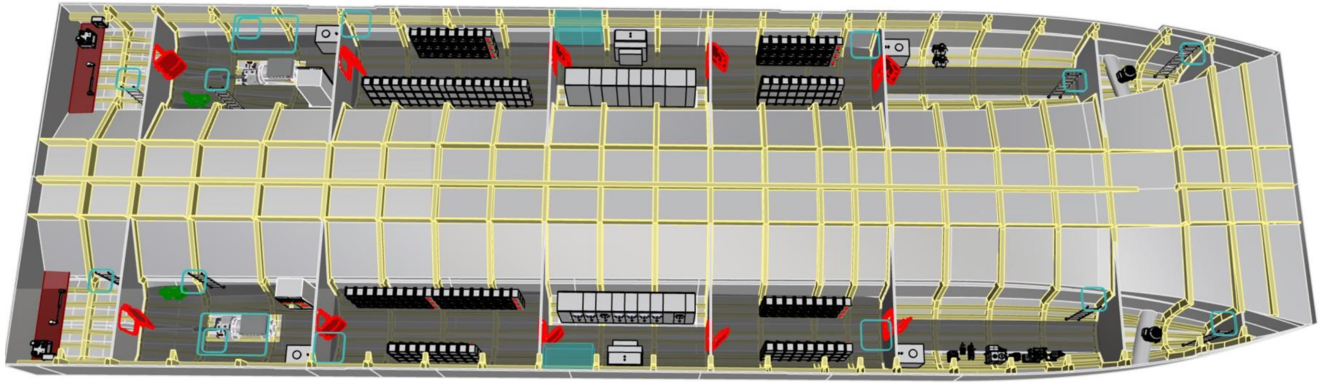
Marine Chief Executive Central Europe and Russia

Rolf.Stiefel@bureauveritas.com

HOW TO ACHIEVE THE AMBITIOUS GHG REDUCTION TARGETS?



EXAMPLE ELECTRIC/HYBRID PROPULSION:
A VALID SOLUTION IN SOME AREAS



Flag / Port of Register	PORTUGAL / LISBON
Bureau Veritas Classification and Notations	I ✠ HULL ● MC Passenger Vessel (C) ✠ AUT-UMS Battery System IN (1,2) /(Z) In Water Survey COMF NOISE 3 COMF VIB 3
Length Overall	40,15 m
Length Waterline	39.50 m
Breadth (without fenders)	12,00 m
Depth to Main Deck	3.13 m
Maximum Draft (100% Load)	1,65 m
Passenger Capacity (seats)	540
Disable passengers (Wheelchairs)	4
Bycicles Capacity (outside aft area)	20
Electrical Propulsion Motors	2 x 500 kW at 900 Rpm
Propulsion / Steering Systems	2 propellers / 2 rudders
Contract Speed (100% load of electrical motors)	17 Knots
Service Speed	16 Knots
Range in service speed, with vessel in load operational condition and Energy Storage System (ESS), between 90% and 20%	70 minutes
ESS Batteries – 30 Sets of 62kWh, placed in 10 racks (4 battery rooms)	Corvus Dolphin 2x930kWh
Electrical Power Management System	ABB Ability TM800xA
Electrical Charging System	ZINUS SWC100 2 x 2200 A
Electrical Bowthrusters	2 x 75 kW– 1000 Kg Thrust

BV Involvement in electric-hybrid ships

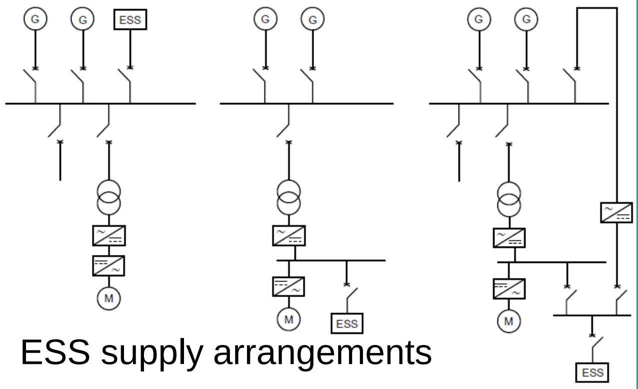
building on return of experience

→ On-board energy storage systems (ESS)

BV class notations:

- **BATTERY SYSTEM**
  NR467, Pt F, Ch 11, Sec 21
- **ELECTRIC HYBRID ()**
  - **-PM** (power management)
  - **-PB** (power backup)
  - **-ZE** (zero emission)

  NR467, Pt F, Ch 11, Sec 22

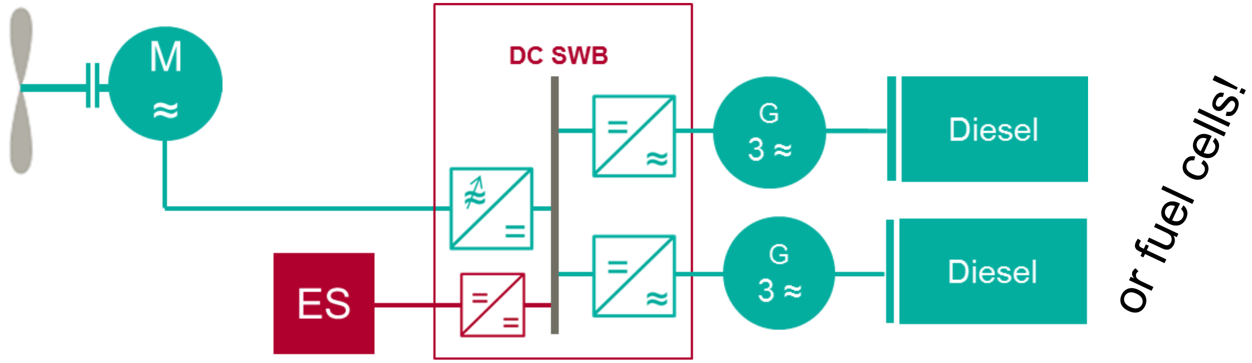


Hybrid electric ships

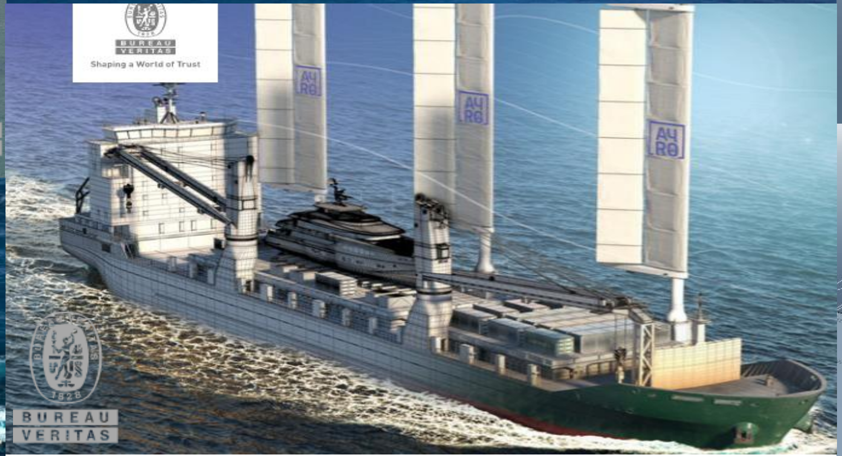
Energy storage systems (ESS) key to success

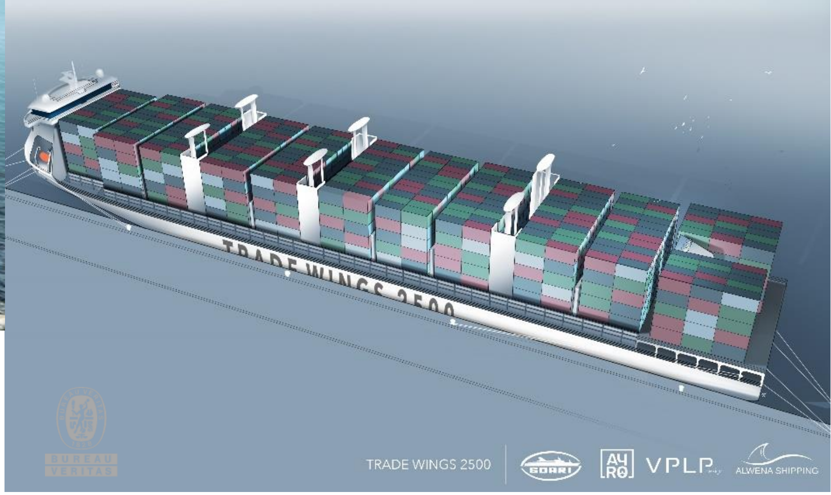
→ Electric-hybrid ships with batteries

- Minimize fuel consumption/emissions over operating range
  - Efficient for ships with high load variations (e.g. OSV, tug)
  - Suitable for “plug-in” additional power sources (e.g. wind, solar, **fuel cells**)
- Operational modes:
  - Power back-up (PB mode)
  - Zero-emission (ZE mode)
  - Power management (PM mode), e.g. peak shaving
- BV class notations **ELECTRIC HYBRID()** & **BATTERY SYSTEM**



REDUCING EMISSIONS THROUGH WIND ASSISTED PROPULSION





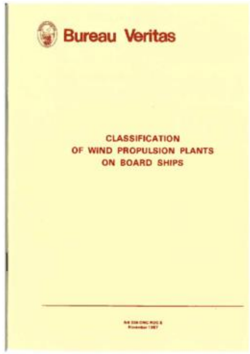
BV supported projects:

WIND PROPULSION:
A LONG STORY IN BV

BV classes the very first tanker

Survey and classification of the **“Glückauf”:**

- first steel ship to **carry Oil in bulk**,
- built in 1886



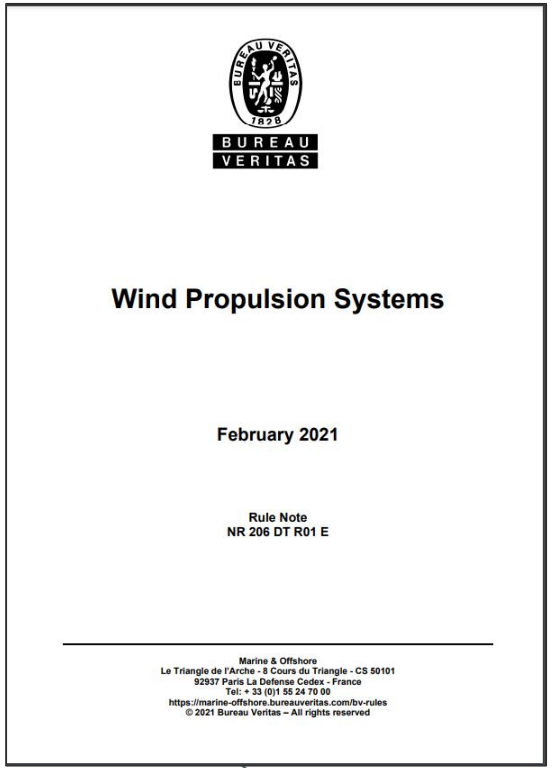
NR206

Classification of wind propulsion plants onboard ships

Additional service features notations:

WAP – Wind assisted propulsion

EAWP – engine assisted wind propulsion



Current rules on 2021

NR206 rev.1 - Feb 2021

Wind Propulsion Systems (WPS)

Additional class notations :

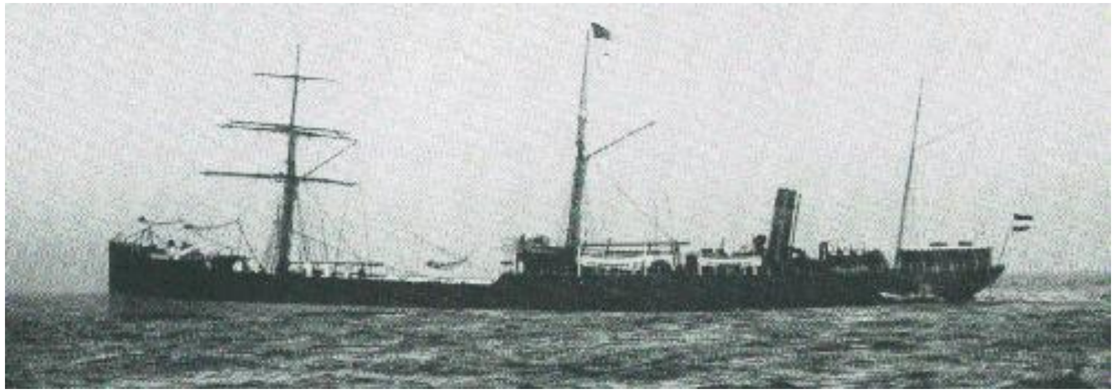
WPS1 – Standing rigging

WPS2 – Standing and running rigging

1886: 1st BV class

1987 : 1ST BV NOTE

2021: New release of modern rules



Glückauf”, the first steel ship to **carry Oil in bulk** with steam propulsion assisted by wind propulsion

BV NR206: key classification framework for wind assisted propulsion

provides requirements for all types of wind propulsion technologies

- Traditional and modern rig, free standing (rotating) rig, wing sail, kite rig, rotor sail, suction wings, …
- Telescopic, tilting technology
- Material in steel, aluminium, composite

Wind propulsion system

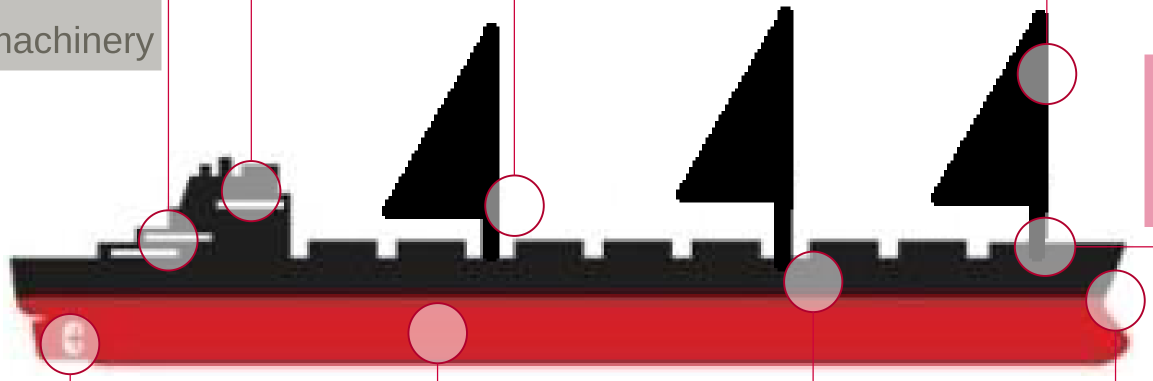
Impact of wind propulsion system on ship

Electrical installation& machinery

Control

Arrangement
Fire safety

Material
Load cases
Structural design
Foundation design
Lightning protection



Drive unit
Automation
Safety release system

Rudder & steering gear
Manoeuvrability

Ship stability

Hull structure

Equipment in chain and anchors

Survey, testing

Construction inspection (quality) and certification

Sea trials and final testing

In service surveys

REDUCING FRICTION TO REDUCE PROPULSION POWER

Example for increasing innovation

GILLS On Filia Ariea – 10% Fuel Savings

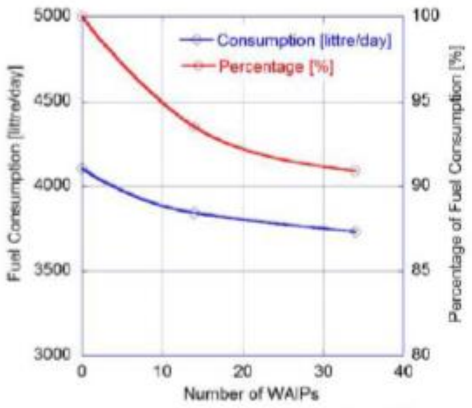


Fig. 12. Fuel consumption as a function of the number of WAIPs.

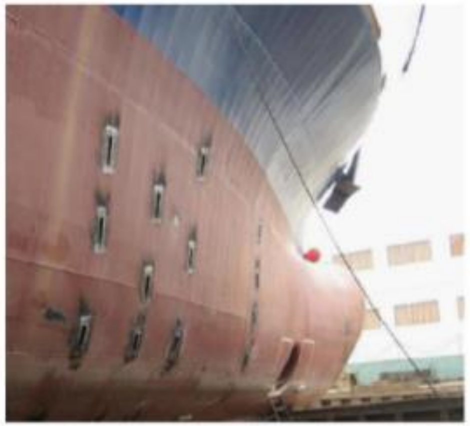
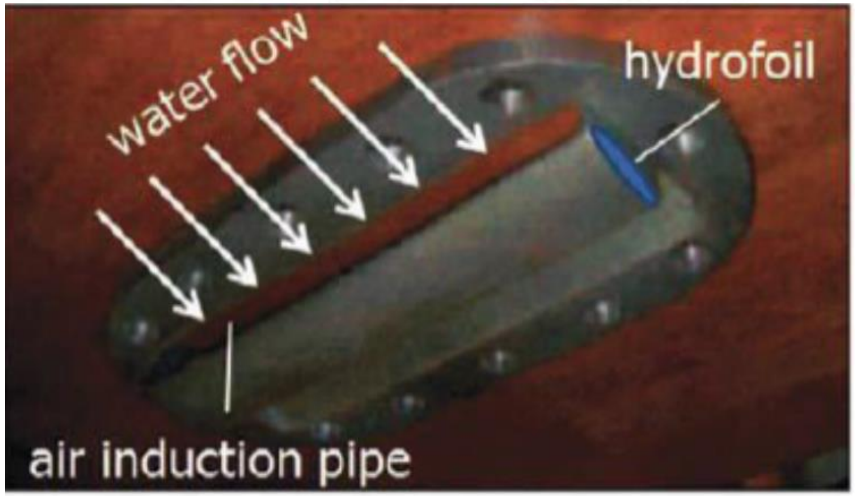


Fig. 13. Side view of the Filia Ariea (84.95 m (Lpp), 13.73 m (Bmd), 5.55 m (Dmd), 1440 kW (power)). WAIPs were installed on the ship as shown. (From Murai et al., 2010).

* Test results in Table 4 Sea Trials, I. Kumagaietal./OceanEngineering95(2015)183–194

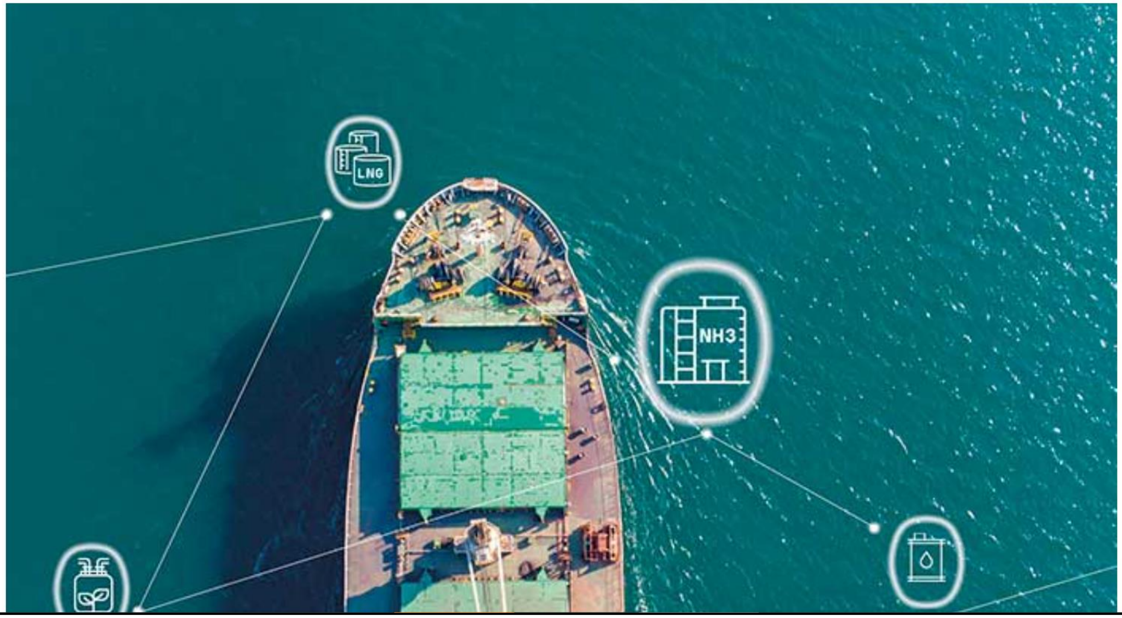


SHIPBUILDING ▾ INLAND/COASTAL ▾ PASSENGER ▾ OFFSHORE ▾ LEGAL/SAFETY ▾ PERSPECTIVES ▾ CONFERENC

May 04, 2021 | Environment, News, Shipping, Technology

BV releases "Ammonia-Prepared" class notation

Written by Nick Blenkey



SECTION 35 AMMONIA-PREPARED SHIPS

1 General

1.1 Application

1.1.1 The additional class notation **AMMONIA-PREPARED** is granted to new ships that are designed with specific arrangements to accommodate future installation of an ammonia fuel system, in accordance with the requirements of this Section. The following cases are considered:

a) The ship is designed for:

- original operation on oil fuel and
- future conversion to dual fuel operation, i.e. on oil fuel and ammonia fuel.

b) The ship is designed for:

- original dual fuel operation on oil fuel and methane fuel and
- future conversion to dual fuel operation with oil fuel and ammonia fuel, i.e. methane fuel is not used anymore.

c) The ship is designed for:

- original dual fuel operation with oil fuel and methane fuel and
- future conversion to tri-fuel operation, i.e. on oil fuel or methane fuel or ammonia fuel. Methane fuel and ammonia fuel can be used alternately or simultaneously.

d) The ship is designed for:

- original dual fuel operation on oil fuel and LPG fuel and
- future conversion to dual fuel operation with oil fuel and ammonia fuel, i.e. LPG fuel is not used anymore.

e) The ship is designed for:

- original dual fuel operation with oil fuel and LPG fuel and
- future conversion to tri-fuel operation, i.e. on oil fuel or LPG fuel or ammonia fuel. LPG fuel and ammonia fuel can be used alternately or simultaneously.

1.1.2 The additional class notation **AMMONIA-PREPARED** may be completed between brackets with one or a combination of the following notations **S**, **T**, **H**, **P** and **B**:

- **S** when specific arrangements are implemented for the ship structure at the original design stage with the aim of preventing the need for specific structural modifications at the conversion stage (see Article [3])
- When the ship is originally designed to use LNG or LPG as fuel:
  - **T** when at least one original LNG or LPG fuel storage tank can also be used with ammonia fuel, possibly with modifications of the operational conditions of the tank at the ship conversion stage (see Article [4])
  - **H** when the original LNG or LPG fuel handling equipment (pumps, heat exchangers, compressors) can also be used with ammonia (see Article [5])
  - **P** when the original LNG or LPG piping system can also be used with ammonia (see Article [6])
  - **B** when the original LNG or LPG boil-off gas management method (other than pressure accumulation, i.e. combustion unit, boiler or refrigerating system) can also be used with ammonia (see Article [7]).

Examples:

AMMONIA-PREPARED

AMMONIA-PREPARED (T)

AMMONIA-PREPARED (S,T,H)

1.1.3 When the ship is effectively converted to operate on ammonia fuel, the additional class notation **AMMONIA-PREPARED** may be replaced by the additional service feature **ammoniafuel dualfuel**, provided that all the applicable requirements, in particular those of Rule Note NR671, are complied with.

1.2 Documents and information to be submitted

1.2.1 The plans and documents to be submitted are listed in Tab 1.

1.3 Definitions

1.3.1 "Ammonia fuel handling system" means the equipment necessary for pumping, vaporizing, heating or compressing the ammonia fuel.

1.3.2 "Ammonia valve unit" means a set of shut-off valves, venting valves, pressure control valve, flow meter, filter and pressure / temperature transmitters and gauges, located on the ammonia fuel supply to each consumer.

1.3.3 "Ammonia combustion unit" means a system intended for the combustion of boil-off ammonia vapour in excess or ammonia vapours from piping safety valve discharges, venting systems, etc.

1.3.4 "Ammonia dissolution system" means a system where ammonia vapours are dissolved in a water tank.

Bureau Veritas Rules for Classification alternative fuels

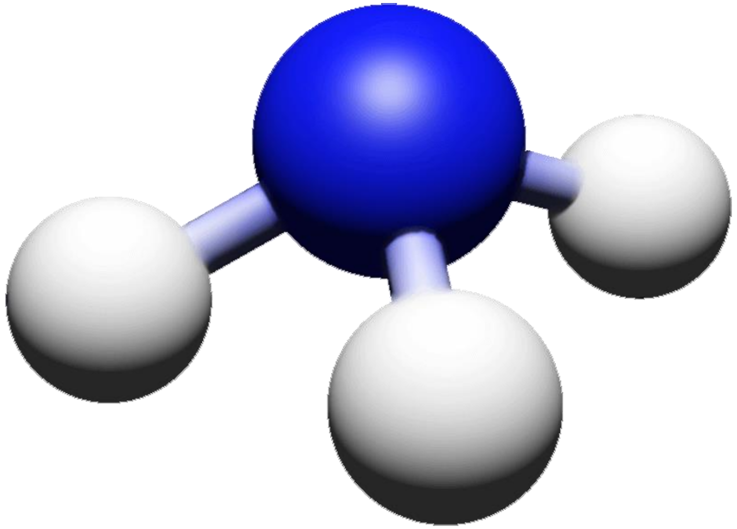
	LNG / CNG	Fuel Cells	Methanol	LPG	Ammonia	Hydrogen
General principles	BV NR529 General part – Requirement for a risk assessment					
Detailed requirements related to Ship design and construction	**BV NR529** Revised January 2020	**BV NI547** Issued in 2009 Revision under progress – Target draft 2021	**BV NR670** Target publication S1 2021 Based on IMO MSC.1/Circ.1621	**BV NI647** Issued in 2018	**BV NI671** Issued 05/2021	**BV NI547** Includes requirements for compressed hydrogen storage
Gas-fuelled gas carriers	BV NR467 Pt D, Ch 9, sec 16					

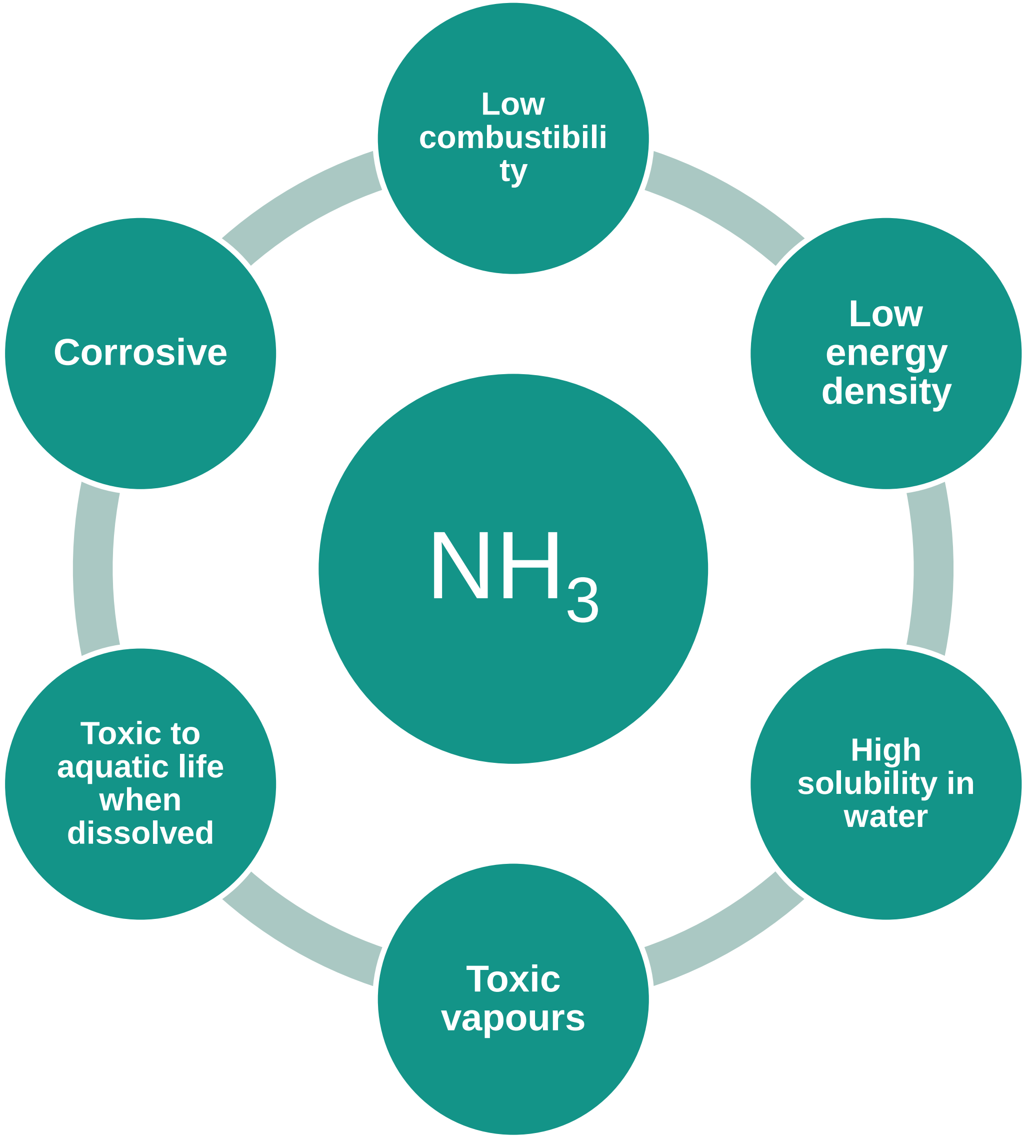
Bonus

BV NR620 – LNG bunkering ships

BV NI618 – Guidelines on LNG bunkering

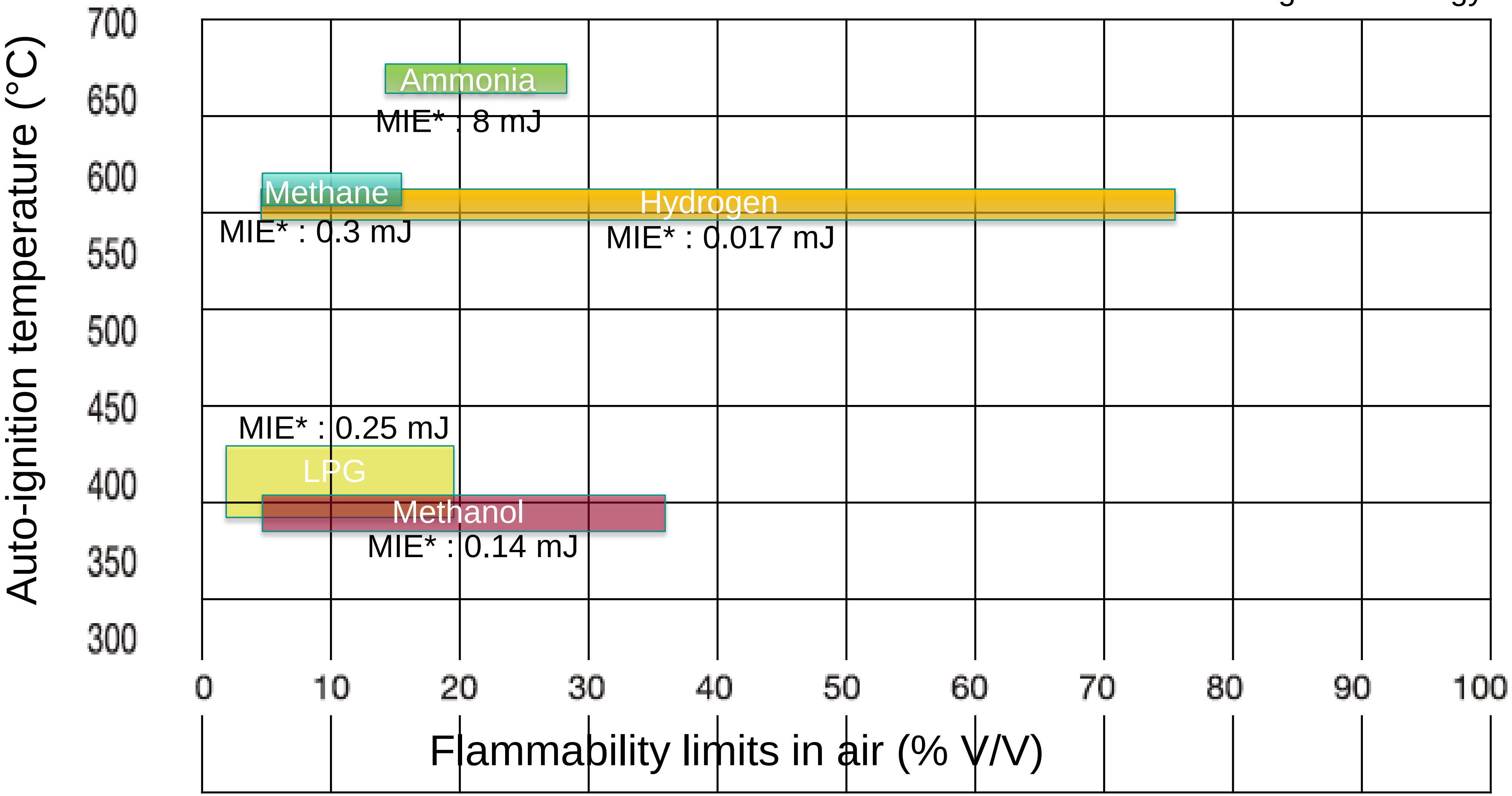
NI671 – NH_3 Characteristics





The flammability characteristics of alternative fuels

*MIE : Minimum Ignition Energy



Toxicity, global warming and pollution challenge with Ammonia

	Characteristics	Toxicity	Pollution
NH_3	Gaseous: - Lighter than air - High humidity: heavier than air Highly soluble in water	≥5 ppm: can be smelled ≥30 ppm: dangerous ≥100-200 ppm: irreversible health effect (depending on exposure time)	Sea water poisoning by dissolved ammonia
	By-products of ammonia combustion		
N_2O	« Laughing gas » Gaseous	Non-toxic	GHG, ~300 times worse than CO_2 (on 100 y timescale)
NO_x	NO and NO_2 Gaseous	≥0.5ppm: dangerous ≥10-20ppm: irreversible health effect (depending on exposure time)	Atmospheric pollutant, responsible for acidic rains

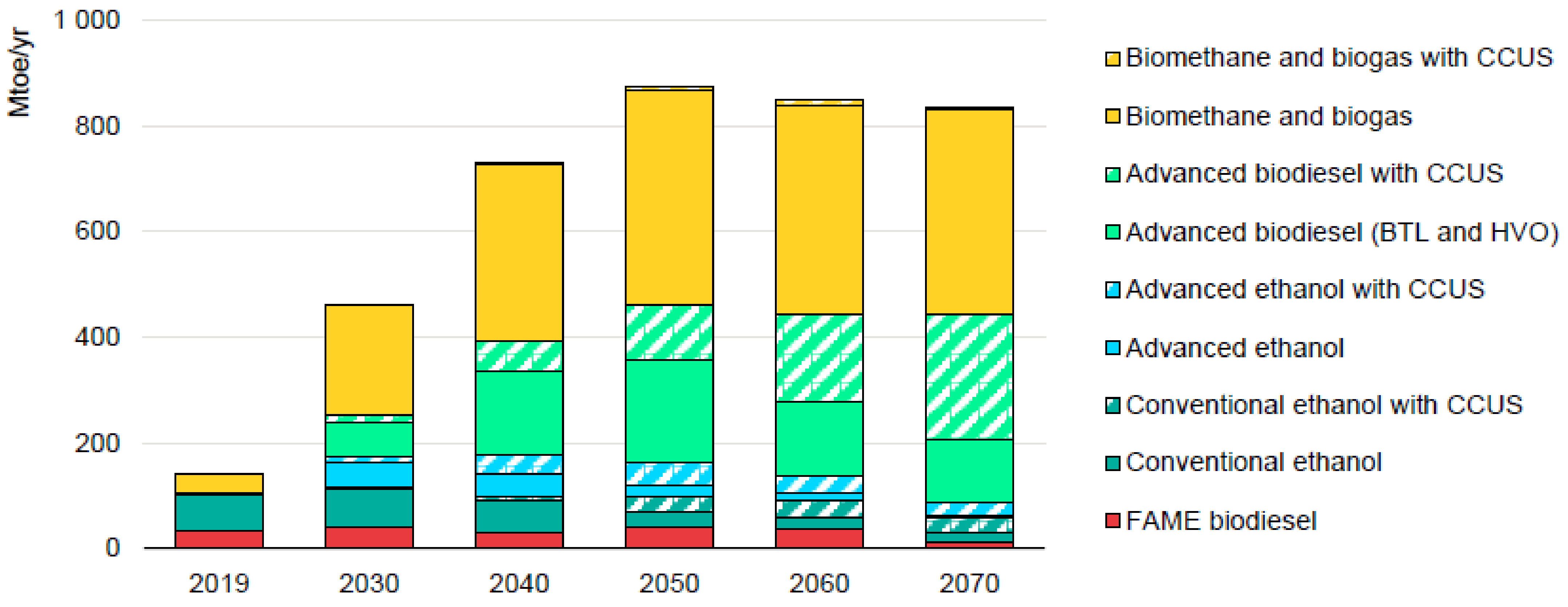
BIOFUELS GENERATIONS

1st GEN	2nd GEN	3rd GEN	4th GEN
Made from the sugars and vegetable oils found in food crops using standard processing technologies	Production of biofuels manufactured from agricultural and forest residues and from non-food crop feedstocks	Specially engineered crops such as algae as the energy source.	Uses genetically modified (GM) algae to enhance biofuel production
Ethanol Based Sugar Starch Oil Based Corn Rapeseed Soybean Palm	Agriculture/food processing waste grasses and trees	Transgenic Materials, Low Lignin Eucalyptus, Poplar Trees and Sorghum e.g. higher yield feedstocks and algae	NOTE: Take into account the carbon capture and storage potential on the crops used to produce the required biomass, as well as the energy efficiency of the processing technology that generates the resulting fuel.
Fermentation (bioalcohol) Transesterification (biodiesel)	Fischer Tropsch Biomass-To-Liquid (BTL) Fermentation Gasification	Fischer Tropsch Biomass-To-Liquid (BTL) Fermentation Gasification Algae Processing	*Not available yet!*
Bio Alcohols Ethanol Biodiesel Fatty Acid Methyl Esther (FAME) Unprocessed Vegetable Oil as fuel	Cellulosic Ethanol Biogas Biohydrogen Fischer Tropsch Diesel	Cellulosic Ethanol Biogas Biohydrogen Fischer Tropsch Diesel Algae Oil	*SOURCE: LEAF LQM www.lqm.com/leaf/*

Availability of projected global quantity of biofuels by 2030?

Highest growth predicted for Biomethane by IEA

Global Biofuels production (worldwide all sectors) by technology in the Sustainable Development Scenario, 2019-2070



THE PATH FROM THE FOSSIL AGE TO A GHG NEUTRAL PROPULSION WILL BE COLOURFUL AND EXITING….

WE ARE HERE TO SUPPORT!

Rolf Stiefel

Marine Chief Executive Central Europe and Russia

Rolf.Stiefel@bureauveritas.com