

SHAPING TRUST IN GLOBAL MARITIME AND ENERGY INDUSTRIES



A LEADER IN SHIP CLASSIFICATION

Our surveyors are on-hand in major ports worldwide to ensure the safety and compliance of all types of vessel and offshore structure.



PARTNERING OFFSHORE ENERGY PROJECTS

We support the world's major energy operators with classification of innovative designs and verification of offshore structures and equipment.



BEYOND COMPLIANCE

Our technical advisory and engineering consultancy services respond to all marine and offshore energy challenges. Its core activities cover engineering & technical advisory, asset management and assurance solutions.

An aerial view of an offshore oil rig in the ocean. The rig is a complex of steel structures, including a tall derrick with red and white stripes. The water is a deep blue, and the sky is light blue with some clouds. A small orange boat is visible in the lower left corner.

EXPERTISE FOR SUSTAINABILITY

A SUITE OF GREEN SERVICES FOR MARINE ENVIRONMENT PROTECTION AND DECARBONIZATION

As a classification society, Bureau Veritas Marine & Offshore works with industry players across the maritime industry, from offshore operators, to ship owners, to port authorities. We are committed to reducing our industry's environmental impact, supporting stakeholders through their unique sustainability journey. We help clients comply with environmental regulations, implement green solutions onboard, measure decarbonization progress, and more.

EXPERTISE FOR SUSTAINABILITY

WHAT IS THE NEXT STEP OF YOUR SUSTAINABILITY JOURNEY ?

Bureau Veritas is committed to embedding sustainability into our strategy and across our businesses. Our BV Green Line of services & solutions empowers organizations to implement, measure and achieve their sustainability objectives.

For the marine and offshore industry, the BV Green Line helps ensure:

- Development and implementation of rules for new fuels
- Sustainable origins of alternative fuels
- LNG expertise and project support
- Electrification of sea-going vessels
- Development of infrastructure for new fuels
- Onshore & offshore wind lifecycle solutions
- Engineering services for sustainability performance
- Green construction at shipyards
- Maritime pollution prevention
- Responsible fishing practices
- Safety of crew and passengers
- Onboard health, safety and hygiene protocols



EXPERTISE FOR SUSTAINABILITY

CARBON INDEXES - ACHIEVING REGULATORY COMPLIANCE TO LIMIT ENVIRONMENTAL IMPACT

Reducing the marine industry's carbon footprint is a top priority for local, national and international organizations, which are developing ever more environmental legislation. To meet existing and upcoming regulatory requirements, such as the EEDI, EEXI and CII, ship owners and managers must meet specific limits for energy consumption and carbon emissions.

Bureau Veritas helps ship owners, managers and operators comply with IMO's Marine Environment Protection regulations and limit their vessels' environmental footprint. Our experts help clients meet EEDI, EEXI and CII requirements, conducting assessments, performing calculations, verifying technical files and identifying technical and operational improvement methods.

KEY BENEFITS

- Comply with upcoming and existing IMO regulations for limiting the marine industry's environmental footprint
- Improve onboard energy efficiency and minimize fuel consumption for newbuilds and in-service vessels
- Identify the carbon intensity of ship emissions and implement operational improvement measures to limit impact
- Benefit from Bureau Veritas' knowledge of the latest regulations under development by the IMO



VERISTAR GREEN

VERISTAR GREEN



Bureau Veritas' VeriSTAR Green guides ship owners through the regulatory requirements of energy efficiency management regulations, IMO DCS and EU MRV, EEXI and CII, eases the path to effective compliance and contributes to emission reductions.

Get ready for EEXI & CII compliance
Available Now

Create your SEEMP Part II & Report fuel consumption data for
IMO DCS & EU MRV
Available Now

EXPERTISE FOR SUSTAINABILITY

MARPOL ANNEX VI – EEDI V/S EEXI

Example:

Ship building contract date: 20/04/2018
 Ship delivery date: 15/05/2020

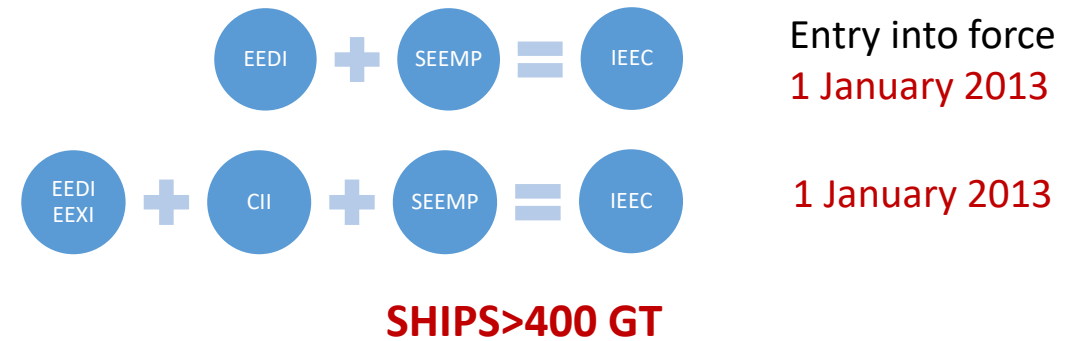
EEDI phase: 1

From 15/05/2020 to 01/01/2023:
 Can navigate with IEEC based on EEDI

From 01/01/2023:
 New IEEC is requested based on EEXI assessment
 (MARPOL regulation2)

Chapter 4

Energy Efficiency Design Index (EEDI) mandatory for new ships
 Carbon Intensity Indicator mandatory for existing ships (CII)
 Ship Energy Efficiency Management Plan (SEEMP) mandatory for all ships.
 International Energy Efficiency Certificate (IEEC)



EEDI vs EEXI			
	EEDI	VERSUS	EEXI
Ship's type, category and size	New Ships Regulation 21	=	Existing Ships Regulation 22
Attained Index Formula	Regulation 22 MEPC 308 (73)	=	Regulation 23 MEPC 333 (76)
Required Index Formula	Regulation 24	=	Regulation 25
Reduce Factor	X= Regulation 24 table 1		Y= Regulation 25 table 3
	Phase 0- 1	<	
	Phase 2 - 3	Adjusted =	
Reference Line Value EEDI/ EEXI	Regulation 24 table 2	=	Regulation 25 table 2

Correspondence table in MEPC 76-J-3

EXPERTISE FOR SUSTAINABILITY

THE ENERGY EFFICIENCY DESIGN INDEX (EEDI)

Energy Efficiency Design Index (EEDI), formulated for new ships, is an index that estimates grams of CO₂ per transport work (g of CO₂ per tonne-mile).

It can be expressed as the ratio of “**environmental cost**” divided by “**Benefit for Society**”

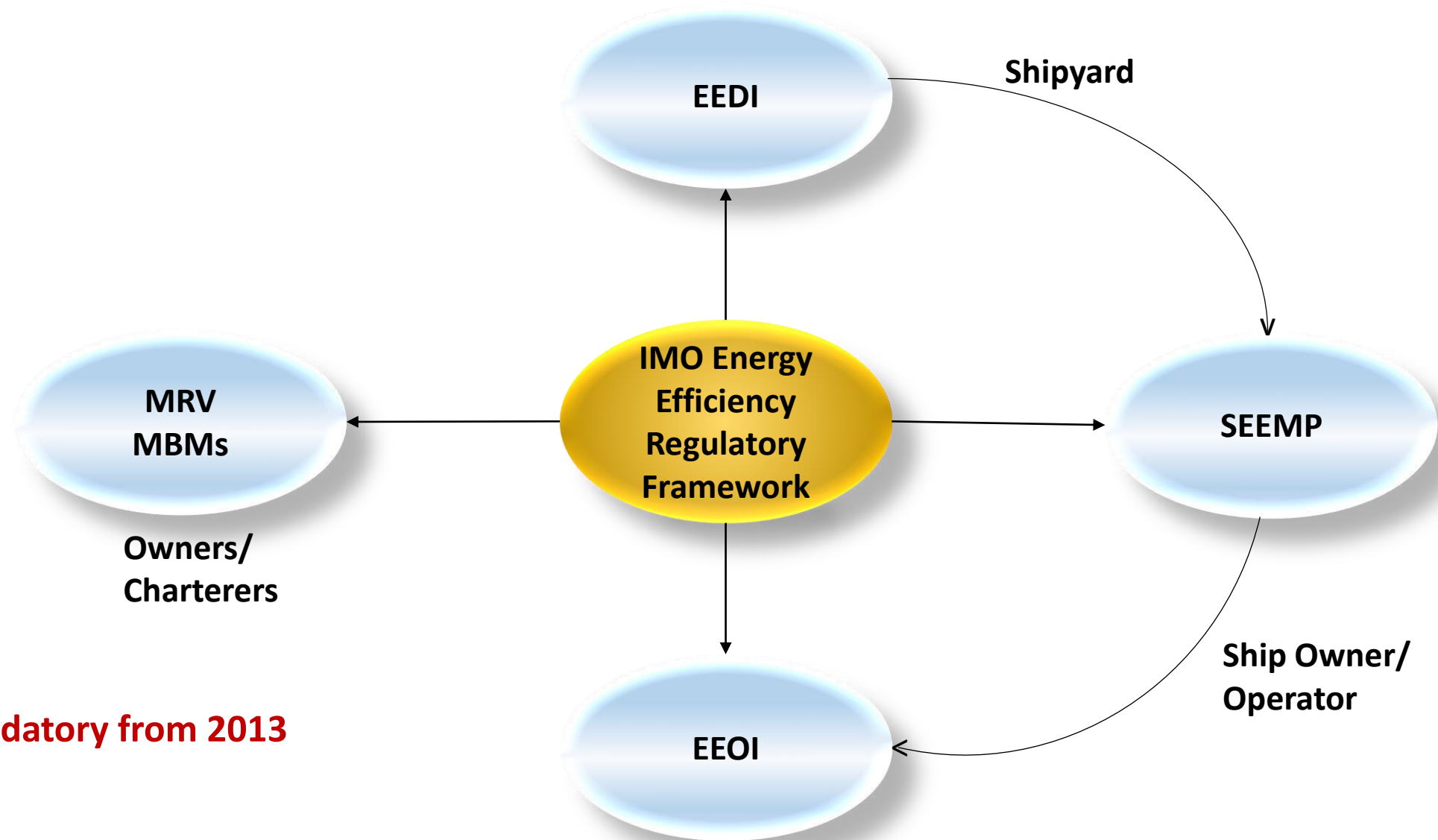
For most newbuilds, the EEDI is mandatory, i.e. they need a class-approved certificate on EEDI

$$\text{EEDI} = \frac{\text{CO}_2 \text{ Emission}}{\text{Transport Work}}$$

It stimulates continued technical development of all the components influencing the fuel efficiency of a ship. It also separates the technical and design-based measures from the operational and commercial ones.

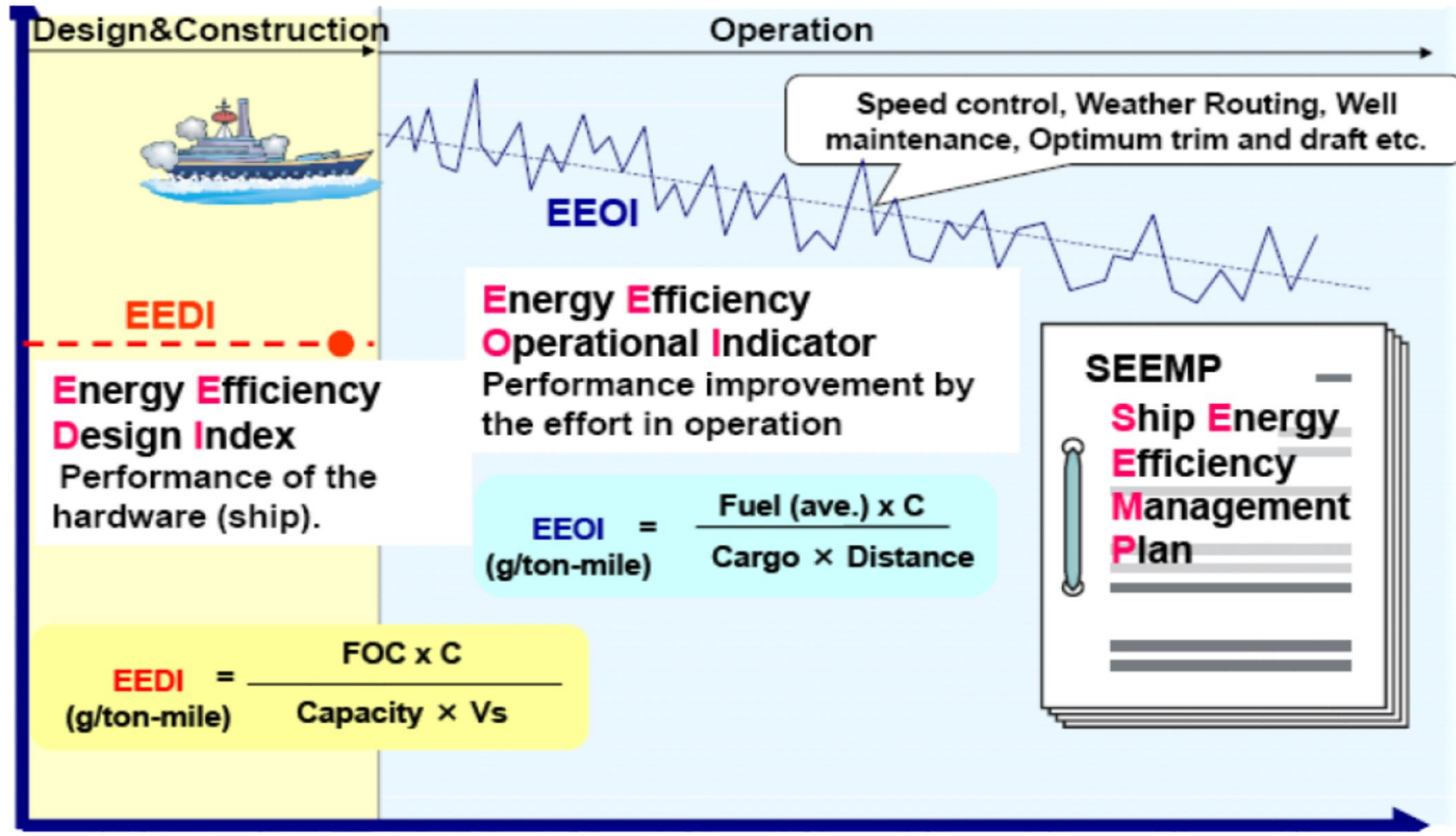


IMO framework for GHG EMISSIONS control from ships



EEDI and SEEMP: Mandatory from 2013
EEOI: Voluntary

EEDI, EEOI and SEEMP links



Applicable Ship types, Required EEDI details Cut-off levels, phases and reduction rates

Ship Type	Size	Phase 0 1 Jan 2013 - 31 Dec 2014	Phase 1 1 Jan 2015 – 31 Dec 2019	Phase 2 1 Jan 2020 – 31 Dec 2024	Phase 3 1 Jan 2025 and onwards
Bulk Carrier	20,000 DWT and above	0	10	20	30
	10,000 – 20,000 DWT	n/a	0-10*	0-20*	0-30*
Gas Carrier	10,000 DWT and above	0	10	20	30
	2,000 – 10,000 DWT	n/a	0-10*	0-20*	0-30*
Tanker	20,000 DWT and above	0	10	20	30
	4,000 – 20,000 DWT	n/a	0-10*	0-20*	0-30*
Container Ship	15,000 DWT and above	0	10	20	30
	10,000 – 15,000 DWT	n/a	0-10*	0-20*	0-30*
General Cargo Ship	15,000 DWT and above	0	10	20	30
	3,000 – 15,000 DWT	n/a	0-10*	0-15*	0-30*
Refrigerated Cargo Carrier	5,000 DWT and above	0	10	15	30
	3,000 – 5,000 DWT	n/a	0-10*	0-15*	0-30*
Combination Carrier	20,000 DWT and above	0	10	20	30
	4,000 – 20,000 DWT	n/a	0-10*	0-20*	0-30*
LNG Carrier ***	10,000 DWT and above	n/a	0-10**	0-20*	0-30*
Ro-ro cargo ship (vehicle carrier)***	10,000 DWT and above	n/a	5**	15	30
Ro-ro cargo ship***	2,000 DWT and above	n/a	5**	20	30
	1,000 – 2,000 DWT	n/a	0-5* **	0-20*	0-30*
Ro-ro passenger ship***	4,000 GT and above	n/a	5**	20	30
	1,000 - 4,000 GT	n/a	0-5* **	0-20*	0-30*
Cruise passenger ship*** having non- conventional propulsion	85,000 GT and above	n/a	5**	20	30
	25,000 – 85,000 GT	n/a	0-5* **	0-20*	0-30*

* Reduction factor to be linearly interpolated between the two values depending upon vessel size. The lower value of the reduction factor is to be applied to the smaller size.

** Phase 1 commences for those ships on 1st September 2015

*** Reduction rate applies those ships delivered on or after 1st September 2019.

A ship delivered on or after 1 September 2019 means a ship:

.1 for which the building contract is placed on or after 1 September 2015; or

.2 in the absence of a building contract, the keel of which is laid, or which is at a similar stage of construction, on or after 1 March 2016; or

.3 the delivery of which is on or after 1 September 2019."

n/a means that no "required EEDI" applies.

$$\text{Attained EEDI} \leq \text{Required EEDI} = \left(1 - \frac{X}{100} \right) * \text{Baseline}$$



Reduction rate “X” would be as given in the above table
 Reference line value (baseline) shall be calculated as follows:

$$\text{Reference line value} = a \times b^{-c}$$

where a, b and c are the parameters given below:

Ship Type	a	b	c
Bulk carrier	961.79	DWT of the ship	0.477
Gas carrier	1120.00	DWT of the ship	0.456
Tanker	1218.80	DWT of the ship	0.488
Container ship	174.22	DWT of the ship	0.201
General cargo ship	107.48	DWT of the ship	0.216
Refrigerated cargo carrier	227.01	DWT of the ship	0.244
Combination carrier	1219.00	DWT of the ship	0.488
Ro-ro cargo ship (vehicle carrier)	(DWT/GT)-0.7 * 780.36 where DWT/GT<0.31812.63 where DWT≥0.3	DWT of the ship	0.471
Ro-ro cargo ship	1405.15	DWT of the ship	0.498
Ro-ro passenger ship	752.16	DWT of the ship	0.381
LNG carrier	2253.7	DWT of the ship	0.474
Cruise passenger ship having non-conventional propulsion	170.84	GT of the ship	0.214

CERTIFICATION OF EEDI

DESIGN STAGE

For the preliminary verification at the design stage, a Ship Owner or a Shipbuilder is to submit to a verifier (Administration or its RO) an EEDI Technical File containing the necessary information for the verification and other relevant background documents. EEDI Technical File, which is to be developed by either a Ship Owner or a Shipbuilder, is to include at least but not limited to:

- Dead weight and shaft power of main and aux. Engines;
- Ship speed on deep water in the maximum design loaded conditions at the 75% of the maximum continuous rate (MCR) for the main engine;
- Specific fuel consumption (SFC) of the main engine at 75% MCR and auxiliary engines;
- Principal particulars, overview of propulsion system and electricity supply system on board;
- Estimation process and methodology of the power curves at design stage;
- Description of energy saving equipment; and □
- Calculated value of the Attained EEDI.



The **Bureau Veritas** is to issue the report on the preliminary verification of EEDI after verifying the attained EEDI at design stage.

SEA TRIALS STAGE

Prior to the sea trial, a Ship Owner is to submit the final displacement table and the measured lightweight, or a copy of the survey report of deadweight, as well as a copy of NOx Technical File as necessary.

The verifier is to attend the sea trial and confirm:

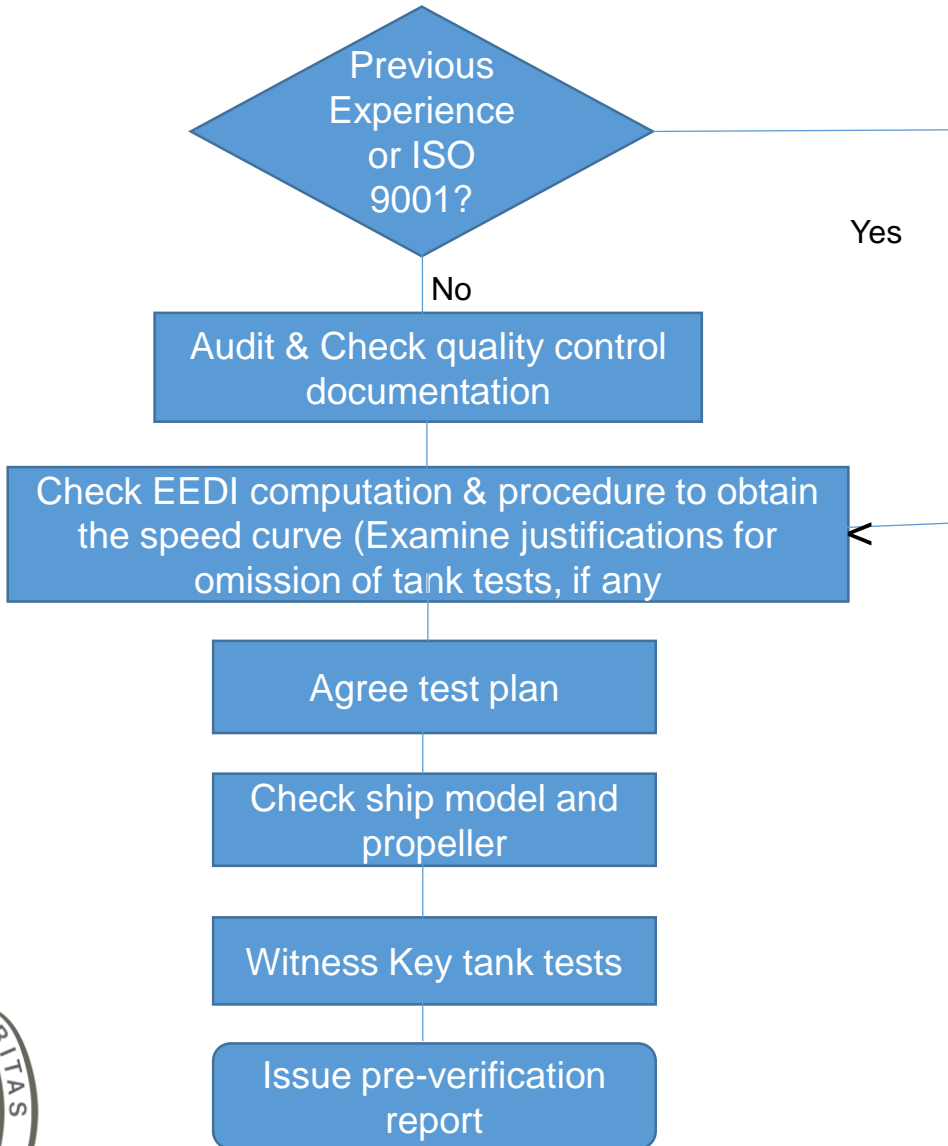
- Propulsion and power supply system;
- Particulars of the engines;
- Other relevant items described in the EEDI Technical File;
- Draft and trim, sea conditions; and
- Ship speed, shaft power of the main engine.

Bureau Veritas is to issue the report on the verification of EEDI after verifying the attained EEDI after the sea trial and it is proposed to issue an International Energy Efficiency (IEE) certificate.

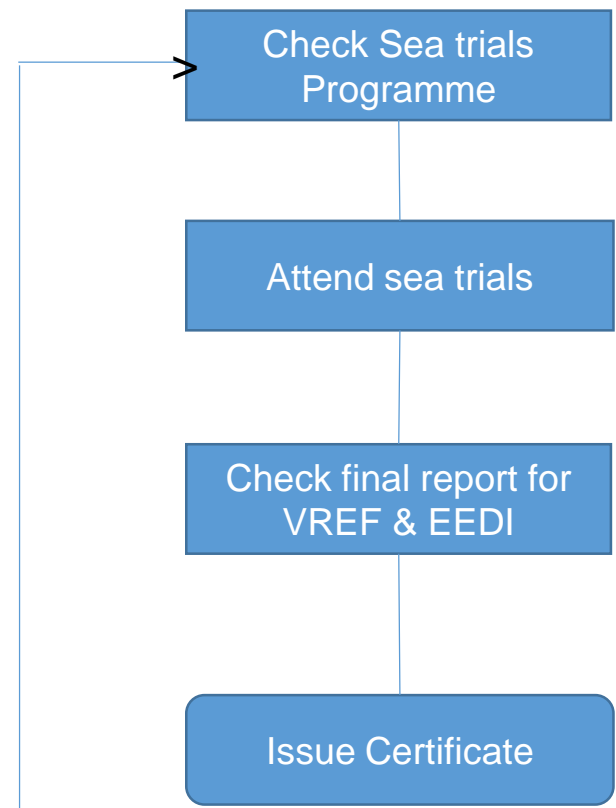


THE FLOW OF THE SURVEY AND CERTIFICATION PROCESS BY BUREAU VERITAS

PRELIMINARY VERIFICATION



FINAL VERIFICATION





IMO2050: A BVS PATH TO ZERO GHG EMISSION

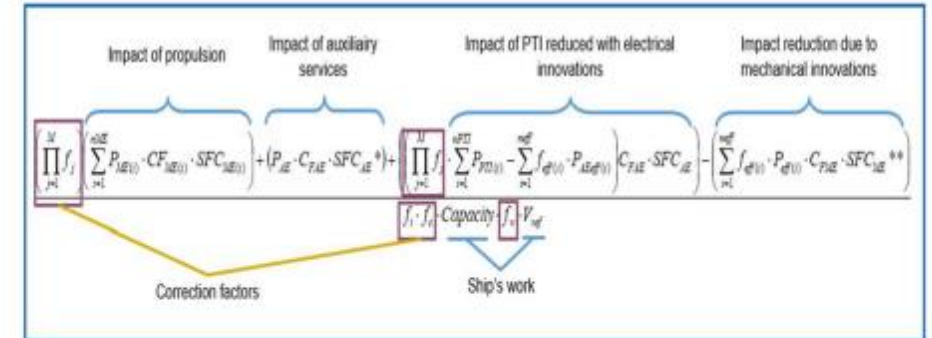


Audit of the fleet GHG baseline



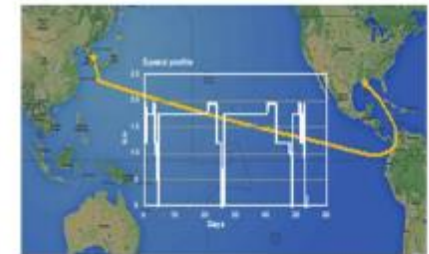
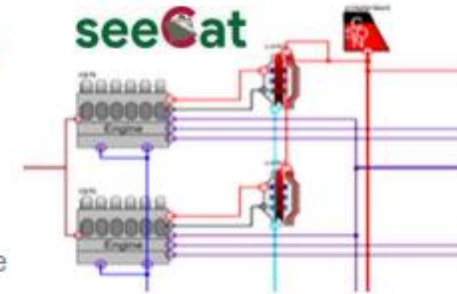
Analysis of vessels energy efficiency Index (EEXI)

- ▶ Attained EEXI for each concerned vessel
- ▶ Comparison to required EEXI



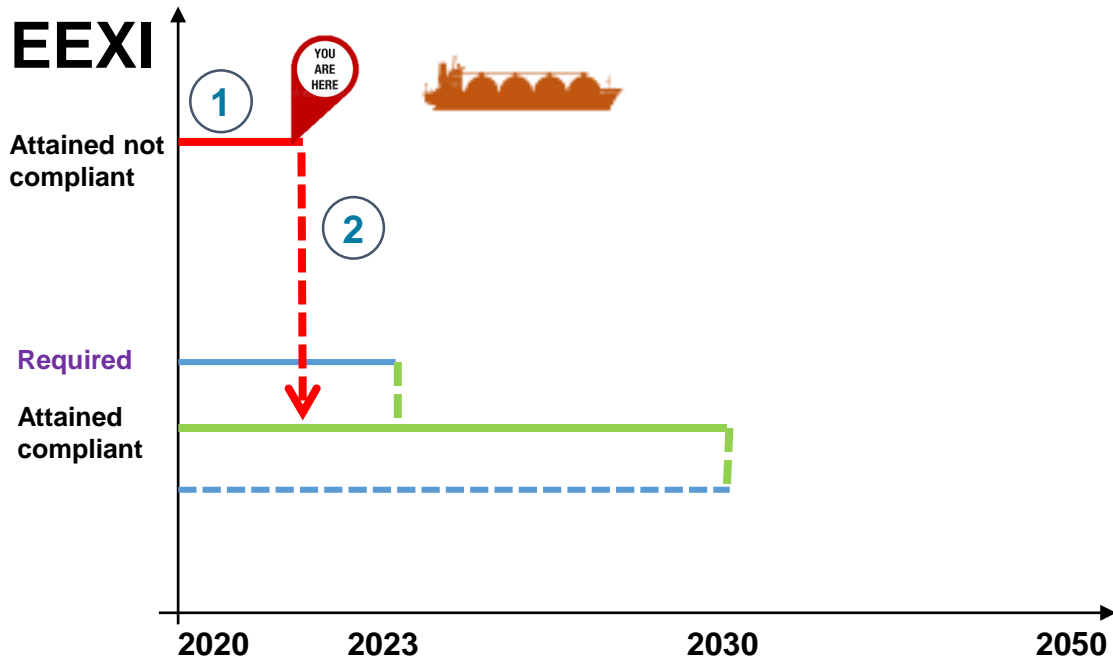
Evaluation of the vessels energy footprint (CII)

- ▶ **COMPUTATION** of the operational carbon intensity indexes (AER, EEOI, etc.) based on collected data
- ▶ **UNDERSTANDING** of the past and current performance of fleet and ships

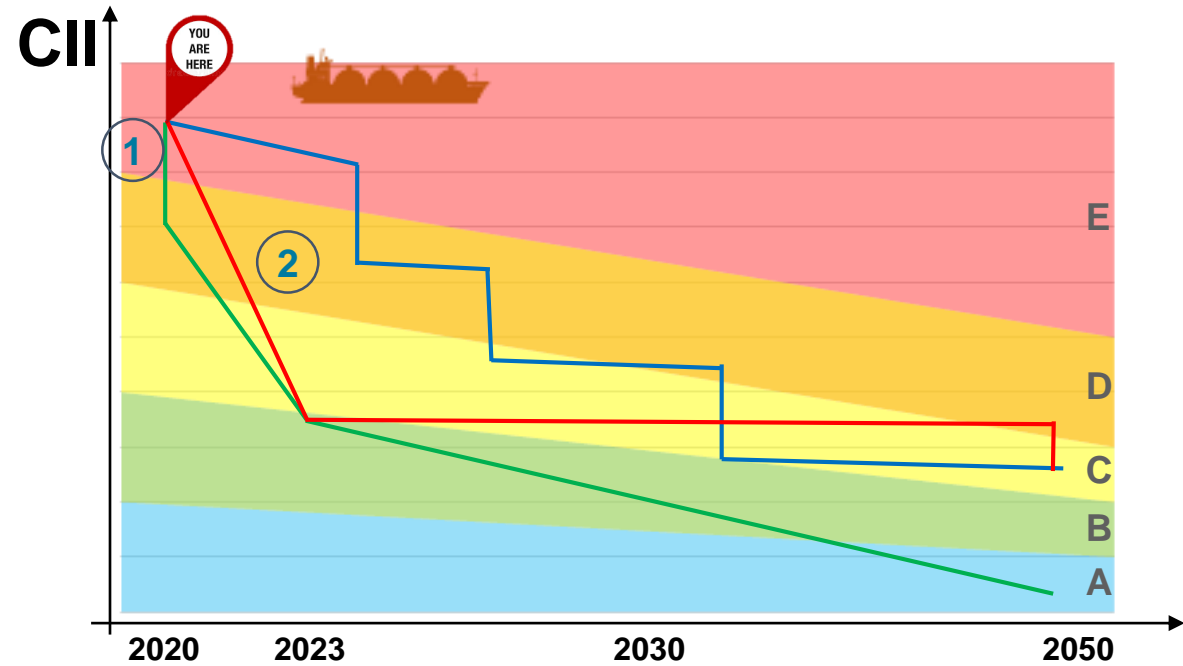
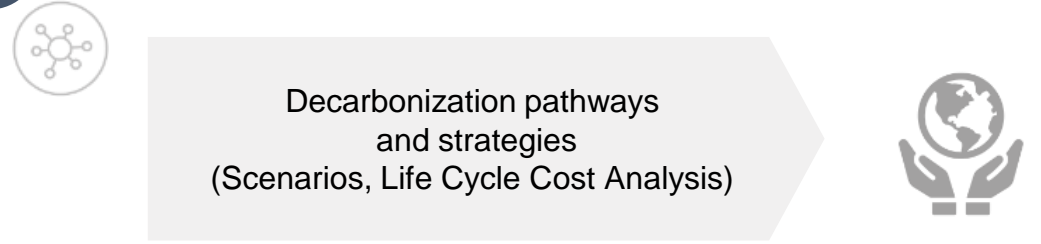


IMO2050: A PATH TO ZERO GHG EMISSION

1 AUDIT OF THE FLEET GHG BASELINE

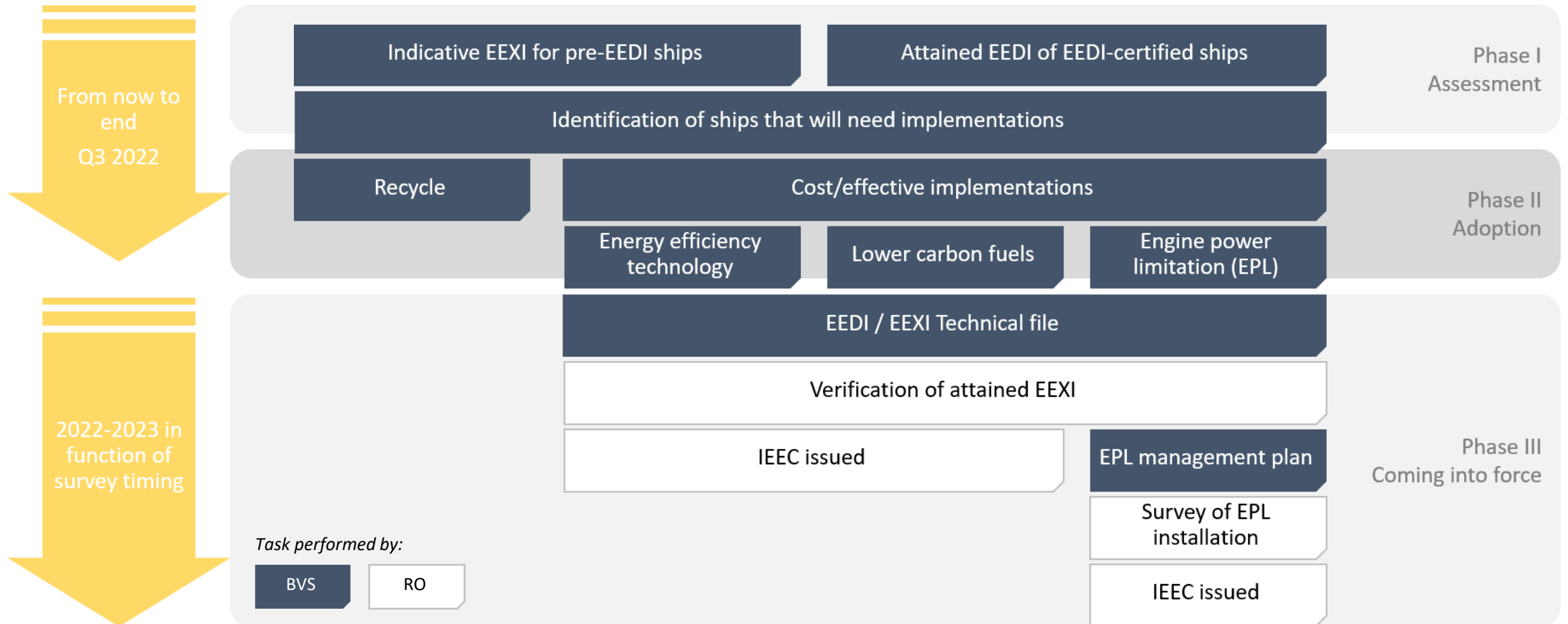


2 DECARBONIZATION STRATEGY



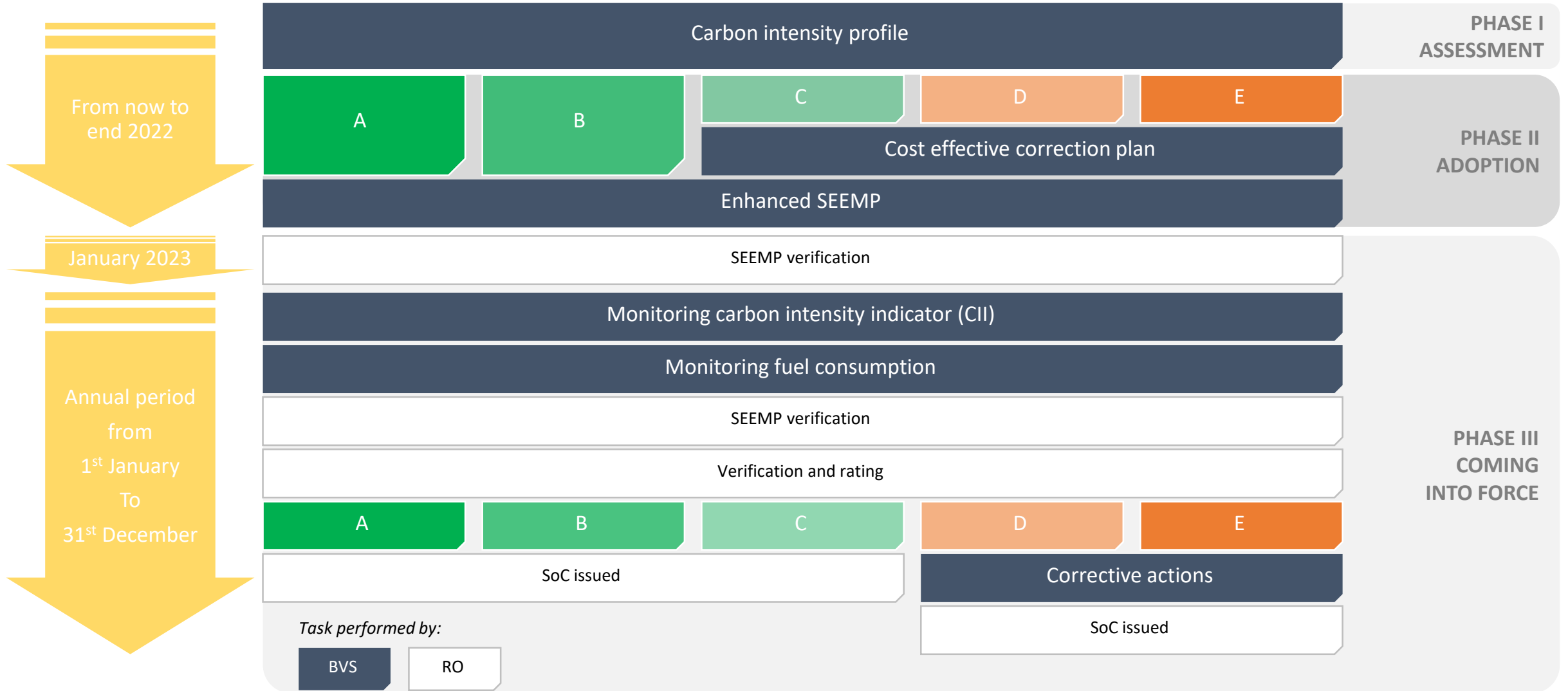
EEXI PHASES

HOW WE CAN SUPPORT YOU



CARBON INTENSITY REDUCTION

HOW WE CAN SUPPORT YOU



CARBON INTENSITY REDUCTION

Close follow-up of actions taken

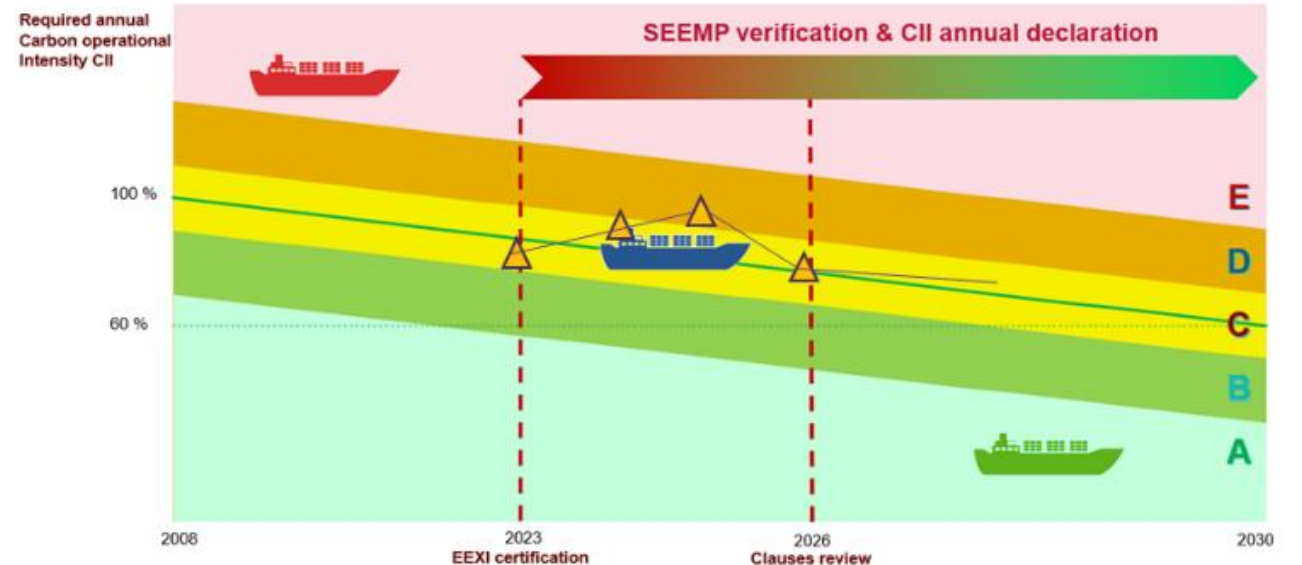
The carbon intensity of a ship will have to be monitored quantitatively, in application of the CII guideline currently under development

Ships rated D (or E) for 3 consecutive years shall develop a plan of corrective actions to achieve the required annual operational CII.

The SEEMP shall be reviewed to include the plan of corrective actions accordingly, and reviewed by duly authorized organisation (RO)

Ship rated D (or E) for 3 consecutive years shall duly undertake the planned corrective actions in accordance with the updated SEEMP.

Administrations, port authorities and other stakeholders as appropriate, are encouraged to **provide incentives to ships rated A or B.**



A BVS PATH TO SUSTAINABLE SHIPPING

- BVS **empowers** you with a set of **decision aids** based on:
 - A detailed insight on the baselines
 - Consolidation of scenarios to reach the objectives
 - Engineering expertise to quantify performance, CAPEX and OPEX

1



Audit of the fleet baseline

2



Engineering services supporting Sustainable shipping strategies

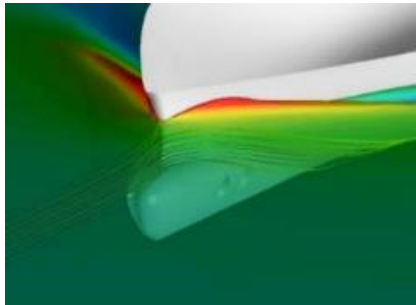


DECISION AID TOWARDS
SUSTAINABLE SHIPPING



SOLUTIONS BY DESIGN

EXPERTISE TO IMPROVE SHIP DESIGN



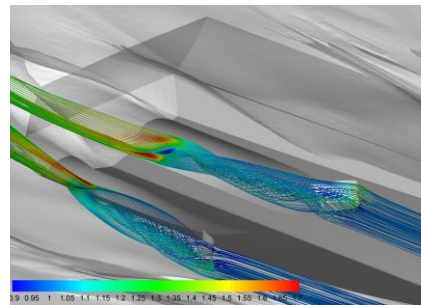
• HULL FORM OPTIMISATION

- Hull performance audit
- Improve design to meet operating profile
- Resistance, speed and fuel consumption prediction
- Self-propulsion calculations
- Added resistance in waves



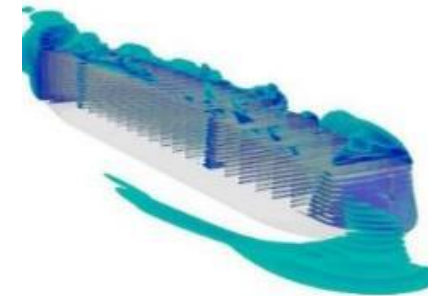
• ENERGY SAVING DEVICES

- Full integration study & optimisation
- Performance validation



• PROPELLER & APPENDAGES

- Self-propulsion calculations
- Rotating propeller calculations
- Cavitation evaluation
- Hull interaction



• AERODYNAMIC OPTIMIZATION

- Superstructures optimisation
- Appendage design
- Wind assisting equipment evaluation
- Based on vessel operating profile



• NEW FUELS & INNOVATIVE DESIGNS

- LNG as fuel
- H2 and Ammonia
- Risk based approach
- Feasibility studies
- Integration studies

CFD PATH: HULL FORM OPTIMISATION

Agile AND INTEGRATED within design process

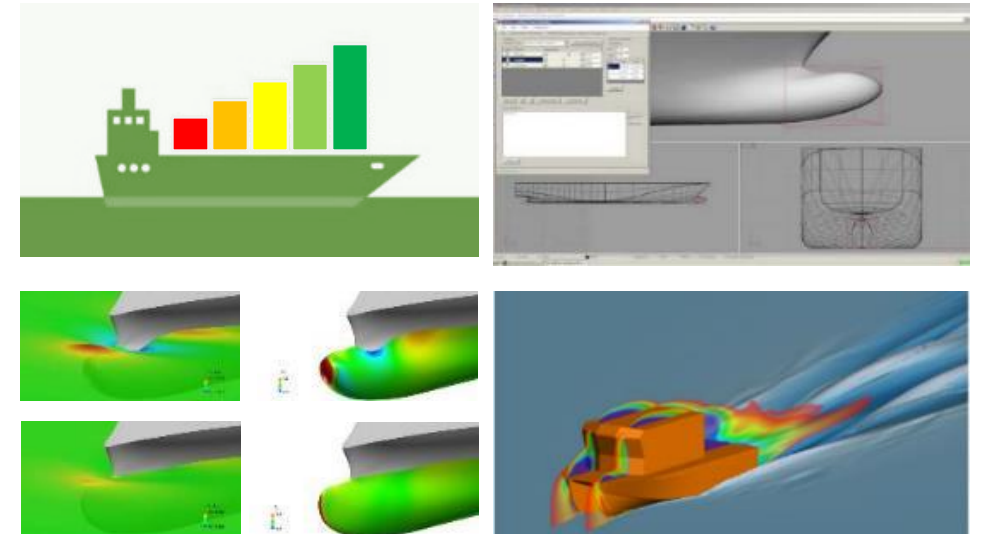
BVS is able to evaluate a lot of designs in a very short duration, and can easily be integrated within design process and phases of the ship yard or design office

Immediate savings

No additional construction cost and each % gain will reduce fuel consumption for the whole life of the ship.

Higher ship value beyond Indexes compliance

Better ship designs with low consumption have higher value for chartering and on the second hand market.

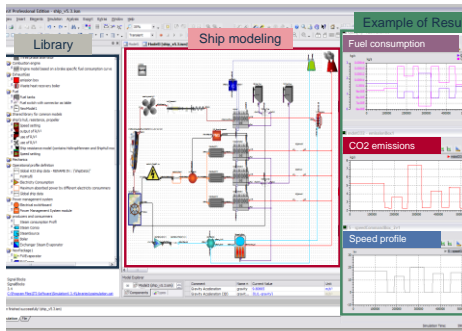


- **AVERAGE GAINS EXPECTED OVER 100+ PROJECTS:**
- **Retrofit**
 - ▶ 5 to 17 % gains
 - ▶ Increase with operational profile changes
- **New build**
 - ▶ 2 to 8% gains
 - ▶ Depending on initial design & constraints

SOLUTIONS BY OPERATIONS



Expertise to support better operations



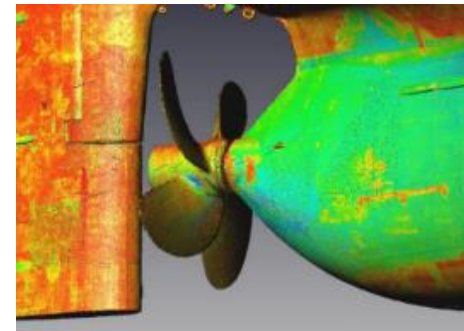
• SHIP ENERGY MODELLING

- Energy models using SEECAT BV software
- Based on actual operating profile
- Energy and machinery architectures benchmarks
- Energy efficiency and GHG emissions simulations



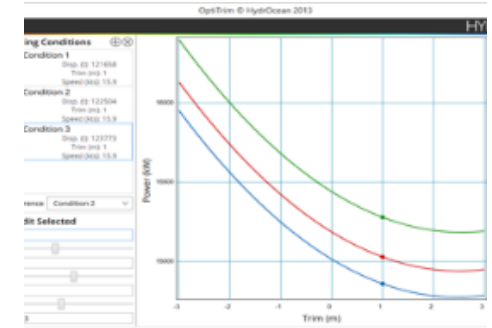
• VOYAGE OPTIMISATION

- Ocean & Coastal routing
- Based on accurate ship model
- Accounting for real metocean conditions
- Just in time with homogeneous sailing



• HULL SURFACE CONDITION

- Fouling effect evaluation
- Hull cleaning strategy
- Anti-fouling optimization
- Air lubrication system



• TRIM OPTIMISATION

- Determine the optimal trim at given speed and ship displacement
- Accounting for loading manual constraints



ONE OPERATIONAL PATH: TRIM OPTIMISATION



Advanced engineering

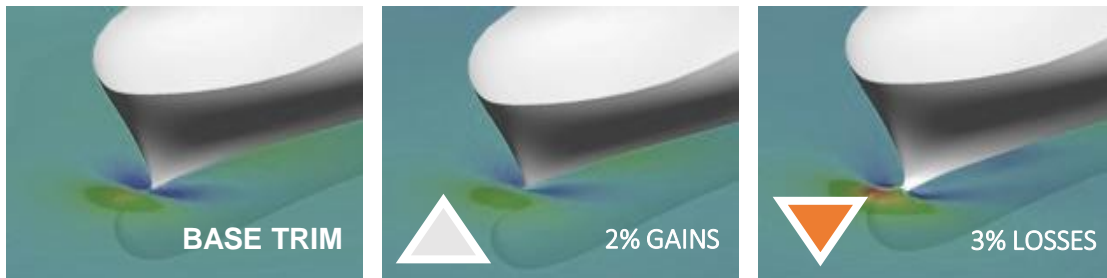
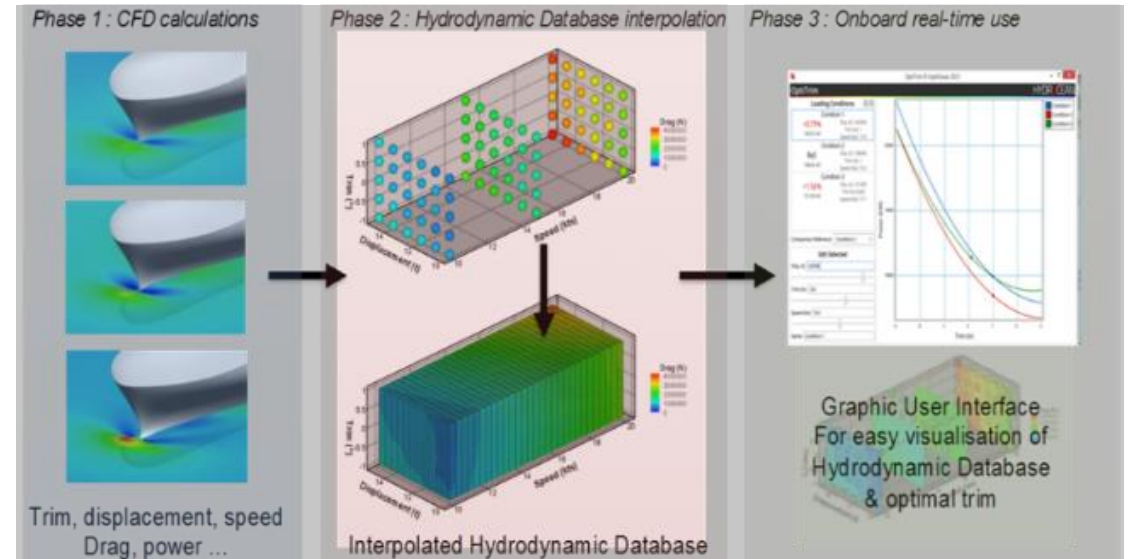
Based on a hydrodynamic database of ship performances, generated by a trim, speed and displacement systematic study of a given hull form. All computations are performed by the most advanced and accurate Computational Fluid Dynamic (CFD) software available.

Real time optimization & savings

BVS has developed and distributes a dedicated Trim Optimisation Software (**OPTITRIM**) that enables ship's crew and operators to determine the optimal trim at given displacements and speeds.

Beyond Operational Indexes compliance

Reach and maintain the objectives. Enable from single ship management a better fit to operational profiles of a whole fleet.



CASE STUDY ON A CONTAINER SHIP

Avg. consumption/ship

25,000 T/Year/vessel

Trim Optimisation

-1% in HFO Consumption

Savings

500 T/Year/vessel

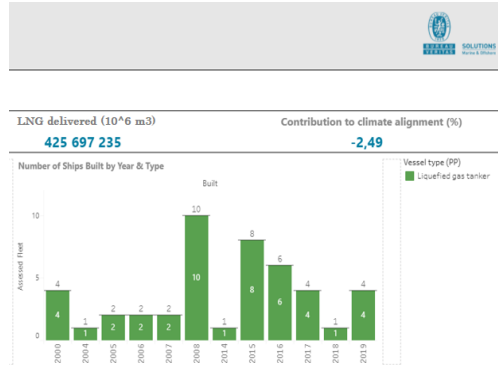
ROI

2 months

PERFORMANCE SOLUTIONS FROM ASSETS TO FLEET



Global support to improve fleet insight & performance



• OPERATING CONDITIONS

- Reverse engineering
- Adapt operations to actual hull design
- Following operating constraints

• FLEET PERFORMANCE

- GHG emissions prediction tool at fleet level
- Support to decision making: impact of slow steaming, newbuild vs. retrofit...

• FLEET AUDIT & COMPLIANCE

- Energy index (EVDI, EEI, CII...)
- Poseidon Principles
- Calculation of ship portfolio alignment
- Detailed analysis of vessel contribution
- Support to improvement strategy

• SEA DATA ANALYSIS ONBOARD SURVEYS

- Noise (radiated in air and underwater)
- Ship energy audits
- Correlate predictions with in-situ information



ADVISORY SERVICES

FULL TECHNICAL SUPPORT FOR ENERGY TRANSITION



**BUREAU
VERITAS**

SOLUTIONS
Marine & Offshore

ENGINEERING & RISK

ASSURANCE

PROJECT MANAGEMENT CONSULTANCY

SMART ASSETS & DIGITAL SERVICES

MatthewsDaniel
a Bureau Veritas Group Company

LOSS ADJUSTING

RISK MANAGEMENT

MARINE WARRANTY SERVICES



YOUR JOURNEY WITH BUREAU VERITAS

Shaping a world of trust

- A service provider in certification of EEDI both at the design stage and sea trials stage in professional manner acting as an independent entity or as RO on behalf of flag administration
- As an institute for management of ship data for the benefit of the ship owners in ascertaining the EEDI values of their current fleet for comparison with the IMO baseline and provide professional advise as and when required, to the owners in choosing the best technical options available to improve the energy efficiency of their fleet
- Our subsidiary, [BV Solution M&O](#) also offers technical advisory and engineering consultancy services respond to all marine and offshore energy challenges. Its core activities cover engineering & technical advisory, asset management and assurance solutions.





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