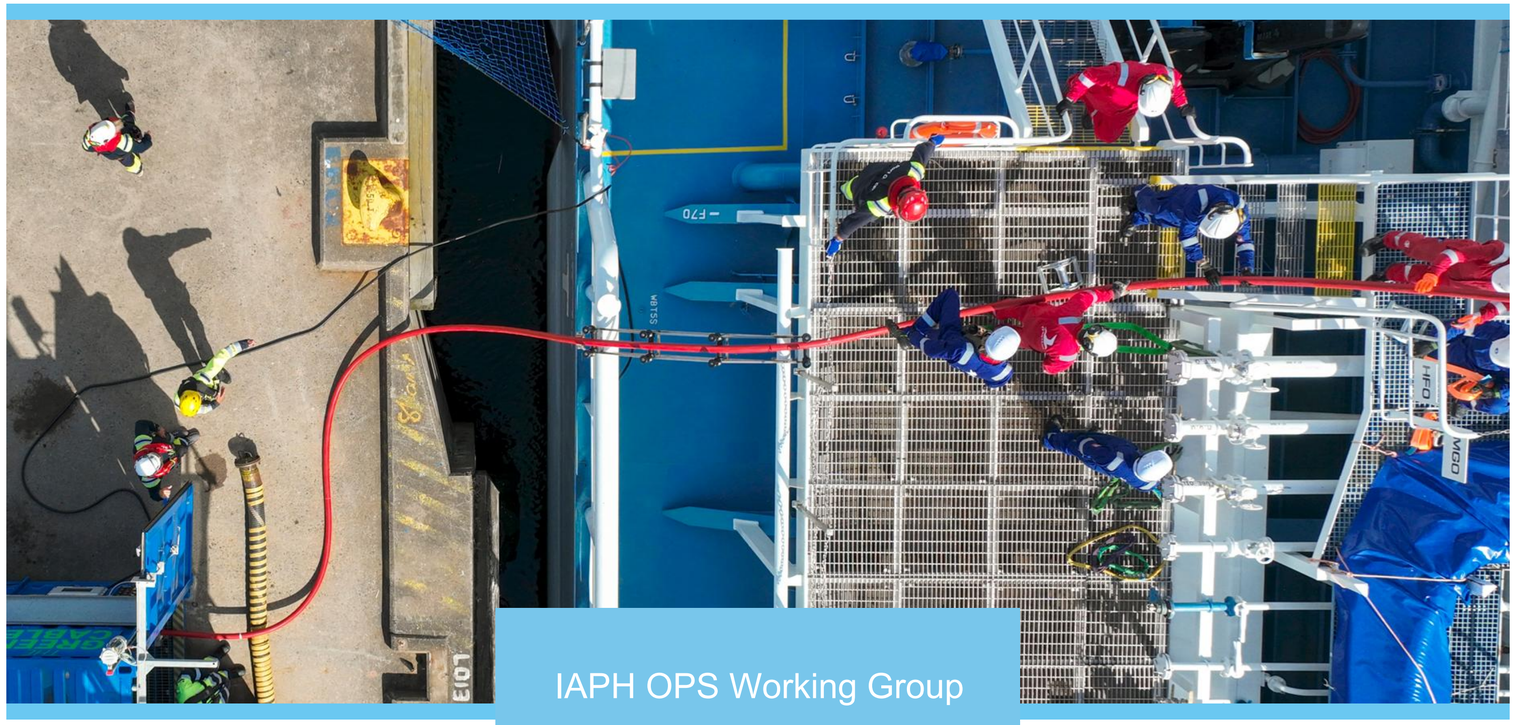
OPS Implementation Levels

Methodology and Guidance



IAPH OPS Working Group

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Developed by:

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2 Executive Summary

This document describes the IAPH methodology to classify Onshore Power Supply (OPS) deployment projects according to their level of development. Created by the IAPH OPS Working Group, this methodology provides a consistent terminology to communicate the planning and progress of shore power infrastructure projects. It also aims to facilitate the development of an accurate and up-to-date overview of OPS infrastructure and facilities worldwide.

The methodology is informed by the IAPH Port Readiness Level (PRL) for Clean Marine Fuels methodology and toolkit, but focuses on planning, investment and realisation of OPS infrastructure. The methodology defines nine implementation levels.

The first three levels comprise the Research and Planning phases, where the necessary studies and assessments are performed, and decisions are made regarding the final investment to be made, the number of systems to be installed and where to install them. Levels four to seven cover the Deployment phase, when the construction and installation works start. Levels eight to nine give an indication of the ratio of Coverage of the OPS systems installed, for each ship type at each specific quay, considering the maximum possible simultaneity of ships berthed at the same quay, and the maximum instant power the OPS system can provide to the quay.

Step-by-step guidance is included, along with a real-life example for reference. The document also proposes a classification for the ships according to type.

This document is the first edition and has been tested by the IAPH OPS Working Group members. Further development of the methodology and documentation is foreseen, based on application by IAPH member ports, OPS investors and developers.

In parallel, the working group foresees the development of a global OPS overview tool based on the implementation levels. This would comprise a database that identifies the OPS infrastructure and technical and operational information.



3 Introduction

Onshore Power Supply (OPS) is seeing increasingly adoption by maritime shipping. Progress differs considerably by ship type, however; a standardized way for ports, terminals and other investors to communicate planning and progress does not exist. The IAPH OPS Working Group developed the OPS Implementation Level methodology to fill that gap. In addition, it aims to encourage the publication of planning, progress and relevant technical and operational aspects of OPS investments in a global OPS overview tool.

The IAPH OPS Working Group originated in the World Port Climate Action Program, operating under the name Power-2-Ship, and has since been integrated into the IAPH organisation, complementing the work that had been carried out previously under the World Ports Sustainability Program.

The objective of this document is to provide a methodology to visualize the degree of implementation of OPS systems at quay level.

The methodology described has two purposes:

1. To provide a common ground to classify the state of development of OPS systems, and
2. To add practical information to the OPS systems visualization map to be developed by the IAPH OPS Working Group.

The first purpose is to provide a commonly agreed standardised indicator for the development and availability for OPS connections worldwide.

When OPS installations are in the planning phase, there might be a wide variety of interpretations and expectations regarding their status. This initiative aims to remedy the situation by creating useful standards. It will enable shipping companies to visualise the roll-out of OPS facilities on their trade routes and will reassure them regarding their investments in OPS equipment for their vessels. It will also enable them to deploy OPS-equipped vessels more quickly on routes where there is ample availability of berthing connections. As a result, OPS facilities in ports are expected to be utilised more frequently.

The second purpose for this indicator is to become a crucial part of the global OPS overview (database and map) that is being developed by the IAPH OPS Working Group. The overview should also contain detailed practical information that ship owners/operators and other stakeholders may find of interest.

The documentation includes a description of the levels and a methodology to perform a self-assessment, including an application example.



4 The Methodology

4.1 Ship types and scope

The following methodology applies to those ship types addressed in the IEC 80005 – Part 1 standard, i.e., **high voltage connection systems for sea-going commercial vessels**. It is anticipated that low voltage connection systems will be addressed in future versions of the methodology.

Regarding the ship types to be used in the methodology, the classification proposed is the one presented in the table below, which follows the classification of ships described in the Annexes of the IEC 80005 – Part 1 standard.

Table 1. Classification of ships proposed.

Ship Type
Ro-ro Cargo ships / Ro-ro Passenger ships
Cruise ships
Container ships
Liquefied Natural Gas Carriers (LNGCs)
Oil and Chemical Tankers
Vehicle Carriers
Bulk Carriers
Other ship types

4.2 OPS implementation levels and granularity

4.2.1 Granularity and aggregation layers

To identify the quays at the port, a **hierarchy of three aggregation layers has been defined: the port; the terminal, and the quays. A port is formed by a group of terminals**, which can be operated by the port authority itself, or by private terminal operators. **A terminal is formed by one or more quays**. A **quay** is, according to the definition given by the Cambridge Dictionary, "a long structure, usually built of stone, where boats can be tied up to take on and off their goods". To clarify this definition, a real example at the Port of Valencia, Spain has been provided. The image displays an aerial view of the port and the CSPV container terminal, enclosed within the red polygon. The CSPV container terminal, operated by the company CSP Iberian Valencia Terminal, is formed by three quays: Príncipe Felipe quay, Este quay and Costa quay. The image displays the quays and their names.



Derived from OrtoPNOA 2024, CC BY 4.0, scne.es

Figure 1. Quays at the CSPV container terminal.

As can be seen, **a quay is a longitudinal structure, which can have multiple berthing positions and may have one or more OPS supply points**. Having the information gathered by quay detail and ship type allows for later aggregation of the information in the upper levels, from bottom to top: quay, terminal and port. **A terminal will aggregate the information from one or more quays, and a port will aggregate the information from a group of terminals**.

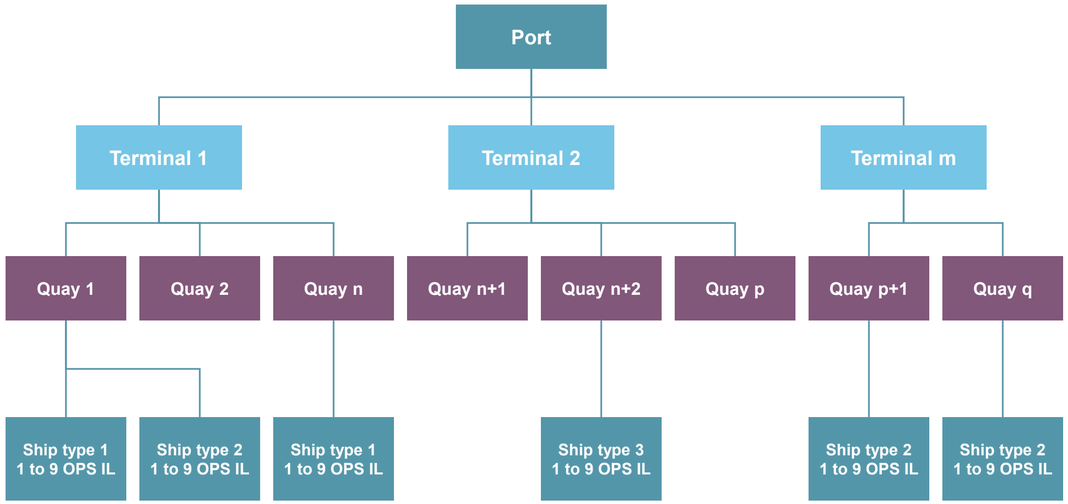


Figure 2. Schematic of port hierarchy and OPS implementation levels.

The information on OPS implementation levels should be given at **quay level**. This means that, if the level is provided as a table, the information of the OPS implementation level at each quay is provided as a new row in the table, recording, **at minimum information about the port, the ship type, the terminal and the quay**, as can be seen in the following template:

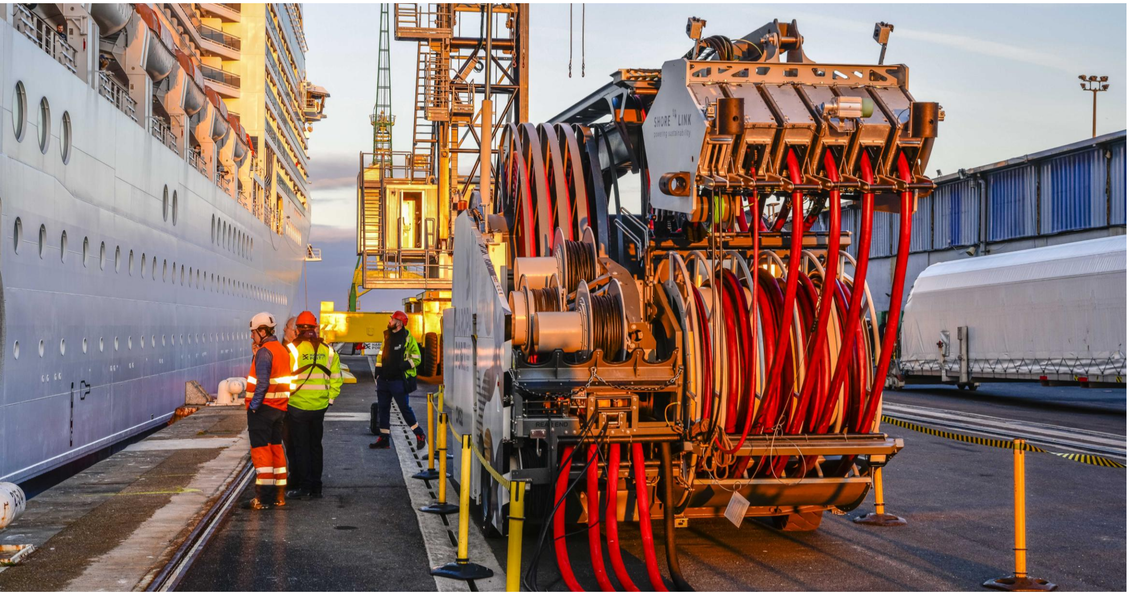
Table 2. Table template for the OPS implementation levels by quay.

Port	Ship Type	Terminal	Quay	OPS Implementation Level

4.2.2 The OPS implementation levels

Regarding the OPS implementation levels, **nine OPS implementation levels have been defined. The nine OPS implementation levels are classified in three groups**:

- **Research and Planning**. Classification levels 1 to 3. These are the initial phases of performance of feasibility and viability studies for OPS implementation and the approval of OPS investment.
- **Deployment**. Classification levels 4 to 7. In this phase, the OPS systems are projected and tendered, and the installation work is performed.
- **Coverage**. The last levels of the classification (8 and 9) indicate the level of coverage of annual calls of each specific ship type for each specific quay where the OPS infrastructure has been deployed.



The different levels are described in more detail:

Levels 1 to 3: Research and Planning.

Level 1 is the first step of the planning phase. The OPS demand is assessed and characterized in future scenarios, in terms of annual energy and the daily variation in aggregated power demand from ships at berth. This study is the basis to perform the subsequent assessment of the power grid and the actuations needed to guarantee the future supply of power for shore side electricity at the quays, terminals, and port.

In classification **Level 2**, basic engineering projects are prepared to obtain an accurate estimate of the investments – capital expenditure (CAPEX) and operational expenditures (OPEX) – needed for the deployment and operation of the OPS systems.

In classification **Level 3**, the port authority or terminal operator have performed the feasibility studies and financial assessment of the OPS installation. Different options for the OPS exploitation model are evaluated. Based on the results of the studies, a decision is made regarding the final investment to be made, the number of systems to be installed, where to install them and the exploitation model.

Levels 4 to 7: Deployment.

In classification **Level 4** all the necessary permits for the installation works are processed and obtained. This level includes guaranteeing all the necessary permits, if any, for the concession and/or operation of the OPS system and energy supply to vessels, and all the procedures and permits to guarantee the availability of enough power for the future demand by the operator of the external power grid that supplies energy to the port or terminal, and/or from the energy provider or utility.

In classification **Level 5**, the company or companies that will execute the installation works of the OPS system, including the deployment of the Cable Management System, have been selected.

In classification **Level 6**, once all the permits are clear, the civil works for the deployment of the OPS system have already started.

In classification **Level 7**, the electrical works have already started. More complementary permits may be needed to be granted during this phase.

Levels 8 and 9: operation of the infrastructure and coverage ratio.

The objective of these last levels is to provide an indication on how ready the quay is to cover the supply of electricity from the shore to the usual annual traffic of sea-going commercial vessels at the specific quay, considering all its berthing positions. In **Level 8**, the quay has at least one OPS supply point in operation at the quay. **Level 9**, the highest level, indicates that the OPS infrastructure can provide supply to at least 90% of the annual calls of sea-going commercial vessels at the quay. The value of 90% has been chosen as a realistic figure, due to possible breakdowns, maintenance events and exceptional circumstances.

In cases where the quay has multiple berthing positions, and coincident stays of vessels at the quay, such as the case of a container terminal, having one OPS connection point would lead to an OPS Implementation Level of 8, since not all the berthing positions in the quay would be covered by a single OPS connection point. In the case of a cruise terminal with only one berthing position at the quay, installing a single OPS system that covers the berth would lead to an OPS Implementation Level of 9.

The decision of having a level 8 or 9 is affected by the simultaneous berths that may be found at a quay (such as in the case of a container terminal) and by the total power available to supply to the quay, to cover an aggregated demand of OPS systems. This aggregated demand will vary during the day and will be directly related to the profile of ship types and sizes, duration and frequency of calls during the year.

A summary table of all nine levels is provided overleaf.

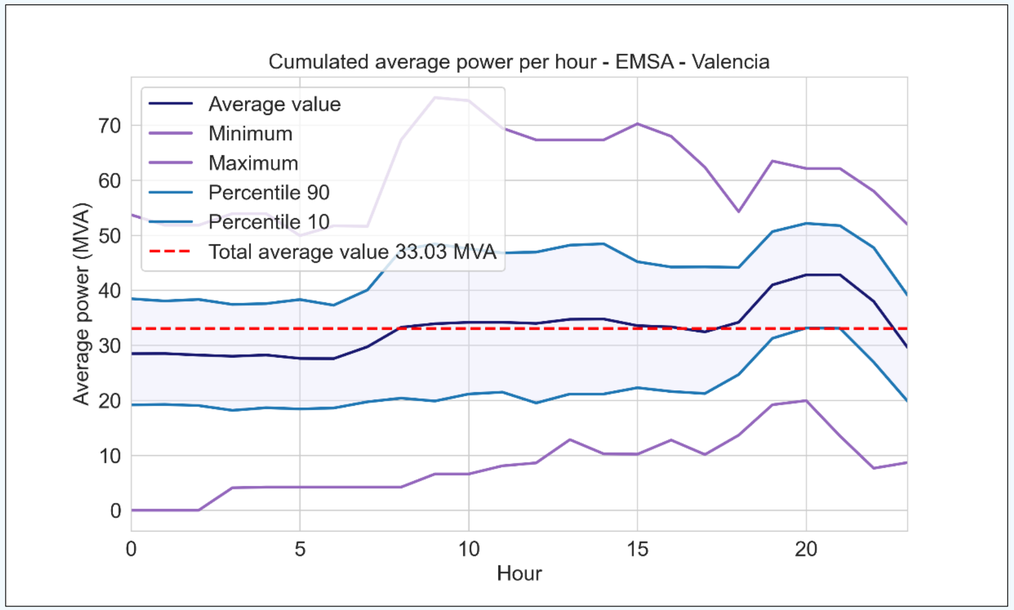


Figure 3. Port of Valencia. Study of simultaneity of ships and estimated average OPS power demand based on calls from year 2024. Source: Fundación Valenciaport – BREEZE Project.

Table 3. Onshore Power Supply (OPS) implementation levels.

Phase	RESEARCH & PLANNING			DEPLOYMENT				COVERAGE	
Level	1	2	3	4	5	6	7	8	9
	OPS energy demand study performed, and grid capacity analysed.	**FEED or Basic Engineering Project performed, estimation of CAPEX and OPEX for OPS deployment and operation performed.**	**OPS feasibility study performed and investment accepted. Decision on the business and exploitation model made.**	**All the necessary permits are in place. Access to external power grid granted.**	**Call for tenders for the installation of OPS system published and awarded.**	**Civil works have started.**	**Electrical works have started.**	**At least one supply point deployed, commissioned and in operation.**	**At least 90% of coverage achieved.**
	The Port Authority or Terminal Operator performs a study of OPS future needs and characterization of the demand in terms of power and energy in future scenarios. The Port Authority or Terminal Operator performs an assessment of the availability of power and energy from the external grid, studying where to take the supply of electricity needed and how. An assessment on the situation on the internal power grid is also done, to evaluate the necessity of upgrades or renovation.	Basic engineering projects are performed to assess the infrastructure needed at the quay and obtain an estimation of CAPEX. Further studies are made to estimate OPEX of the infrastructure.	Financial analyses are performed, including the possibilities of applying for funds to deploy the OPS systems. The exploitation model is decided. The investment is approved.	The necessary permits are obtained, and the prescriptive environmental proof studies are performed. The power needed by an external grid is guaranteed by the Distribution System Operator (DSO), Transmission System Operator (TSO) or electricity provider. This level includes also guaranteeing all the necessary permits, if any, for the concession and/or operation of the OPS system and energy supply to vessels, and all the procedures and permits to guarantee the availability of enough power for the future demand by the operator of the external power grid that supplies energy to the port or terminal, and/or from the energy provider or utility.	The Port Authority, Terminal Operator or third party in charge of the future OPS system publishes one or more calls for tender that at least include the execution of the necessary civil and electrical works to deploy the OPS. Installation and the Cable Management System (CMS) at the quay.	Once all the permissions are obtained and the detailed engineering project is agreed, civil works to deploy the OPS system have started. Some complementary permits may be needed in this phase.	Electrical works from the distribution substation to the quay have started. Some complementary permits may be needed in this phase.	One supply point is deployed and in operation at the quay.	Operation has started. The quay is ready to grant OPS to at least 90% of annual calls of sea-going commercial vessels at the quay for the targeted ship type.

5 How to perform the self-assessment of OPS implementation levels

The methodology has been designed as a voluntary self-assessment tool and, at present, no verification process is considered as it is assumed that accuracy of information is in the best interest of the information provider.

An Excel template is provided to allow each interested stakeholder to fulfil the information on the OPS implementation level at their port or terminal. The procedure prioritises simplicity, and follows two main steps:

- **First step:** list your OPS projects per ship type and quay.
- **Second step:** assign a level to each OPS project per ship type and quay.

The formal start of activities defined as an implementation level determines the status, even when activities in the previous levels have not been finalised. For instance, if electrical works (level 7) have started while civil works have not been finalised. In future editions, the intention is to present the multi-annual planning by forecasting how the project is expected to develop through the implementation levels, eventually reaching level 9.

As an example, a real study by the Port of Valencia representing the status by mid-July 2026 has been included.

5.1 Example: Port of Valencia

The Port Authority of Valencia is planning to deploy OPS in the following terminals to meet Alternative Fuels Infrastructure Regulation (AFIR) requirements:

- TRASMED passenger terminal, for Ro-Pax vessels and cruise ships.
- MSCTV container terminal.
- CSPV container terminal.
- APMTV container terminal.
- VNT container terminal.

Applying the methodology described, the following OPS implementation levels would be obtained for each quay:

Table 4. Port of Valencia, OPS implementation level by quay.

Port	Ship type	Terminal	Quay	OPS IL
Valencia	Cruise ships	TRASMED	Poniente	7
Valencia	Ro-Pax vessels	TRASMED	Poniente	7
Valencia	Cruise ships	TRASMED	Transversales	7
Valencia	Ro-Pax vessels	TRASMED	Transversales	7
Valencia	Container vessels	MSCTV	Transversal de Costa	7
Valencia	Container vessels	CSPV	Príncipe Felipe	2
Valencia	Container vessels	CSPV	Este	2
Valencia	Container vessels	CSPV	Costa	2
Valencia	Container vessels	APMTV	Llovera	2
Valencia	Container vessels	APMTV	Levante	2
Valencia	Container vessels	VNT	-	1

6 Conclusion

The methodology presented allows a quick classification of the OPS implementation level for each OPS system planned and deployed at quays. As the IEC standard evolves, the methodology will be reviewed periodically to consider other ship types and technologies, such as shore charging for electric or hybrid vessels. The working group plans to further enrich the methodology in future editions – for instance, by presenting more detailed progress in the deployment phase, and identifying how to communicate progress in an aggregated manner at the terminal or port level. Lessons learned while using this first edition will inform this process.



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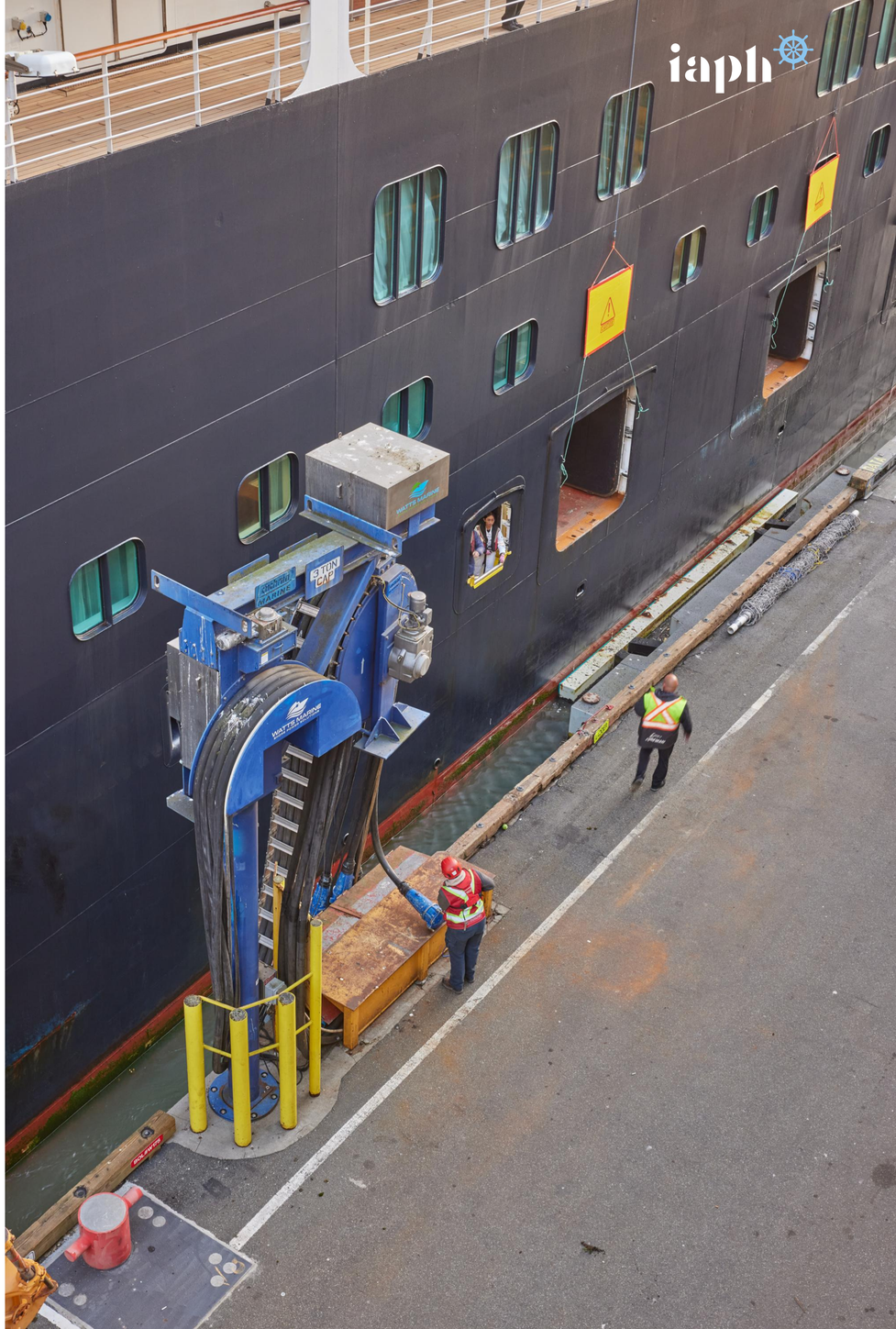
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7 About IAPH

Founded in 1955, the International Association of Ports and Harbors (IAPH) is a global alliance of port authorities and port-related businesses. Comprised of over 100 different nationalities across the world's continents, member ports handle over one third of the world's sea-borne trade and well over 60% of the world container traffic. IAPH leads global port industry initiatives on decarbonisation and energy transition, risk and resilience management, and accelerating digitalisation in the maritime transport chain. The IAPH's **World Ports Sustainability Program** has grown into the reference database of best practices of ports applying the UN Sustainable Development Goals and integrating them into their businesses - **iaphworldports.org.**



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