

# Port Readiness Level For Marine Fuels (PRL-MF)

## Assessment tool

---

*This assessment tool is developed to:*

- assess the port readiness for a call of vessels sailing on a marine fuel that is still new to the port;*
  - assess the port readiness for the bunkering of a marine fuel that is still new to the port.*
-

## Content

1. The Port Readiness Level assessment tool for marine fuels .....	3
2. The Port Readiness Level framework for Marine Fuels (PRL-MF) .....	4
3. The Port Readiness Level Checklist for marine fuels .....	5
<u>Usage of the PRL checklist for marine fuels:.....</u>	<u>6</u>
Level 1: Fuel relevance assessed .....	8
Level 2 Interest of the bunkering value chain determined.....	11
Level 3 Sufficient information gathered .....	14
Level 4 Policies decided, roadmap and timeline developed.....	17
Level 5 Frameworks designed.....	20
Level 6 Proof of concept.....	25
Level 7 Project based approach .....	29
Level 8 System based approach.....	34
Level 9 Scaling up to going concern.....	38
Attachment: How to use the PRL assessment tool for a Green Corridor program .....	41

## 1. The Port Readiness Level assessment tool for marine fuels

Fighting climate change requires global coordination, with decarbonization actions from all industries and sub sectors. In the maritime world, the decarbonization can largely be divided into two: Energy Efficiency and the use of low and zero carbon fuels. Where the first is likely to have impact on short and mid-term targets, the latter is largely seen as a preferred long-term pathway to helping shipping meet its [IMO mandated GHG emission targets](#) for ships. There is wide consensus that the future will be one with multiple fuels in use.<sup>1</sup> As more ships using new and emerging fuels make their way into the global fleet, ports must prepare to facilitate vessel calls and safe bunkering operations, in a manner that aligns with their strategic objectives, and with a timing which meets the requirements from the vessels.

### **What is the Port Readiness Level for Marine Fuels (PRL-MF)?**

The Port Readiness Level for Marine Fuels (PRL-MF) has been designed by the World Port Climate Action Program (WPCAP - a coalition of front runner ports) in conjunction with IAPH's Clean Marine Fuels (CMF) group. It is a framework to allow port communities to self-assess their preparedness, develop systems to address any gaps and align stakeholder commitments and expectations.

Port communities can use this framework to prepare themselves for infrastructure development and dialogue with:

- a) Port calls of vessels using/or planning to use an new marine fuel for propulsion;
- b) Bunker operations or planned bunker operations of vessels using an new marine fuel;

The checklist and the PRL framework are meant to be used as guidance by stakeholders in the port community to develop the port, ensure that all reasonable measures have been taken to ensure that the port will be on parity with other ports at the same PRL , allocate resources and strategies and have appropriate infrastructure and governance in place. That said, larger ports or those with specific structures may achieve their objectives in different ways, which is why the checklists have adopted a goal based approach to make it as inclusive as possible.

The PRL tool can be used as a profiler tool for green corridor initiatives. You can read more about this in the attachment to this document.

The framework is not meant to be mandatory, as not all strategies, measures and considerations will be applicable for every port. Organizations can use this tool as guidance and take only those steps which are considered appropriate and relevant.

### **Who can use this tool?**

Given the differences in the configuration for various ports and their stakeholders, it is vital to create a framework allowing the port community to prepare themselves, manage customer expectations and meet their strategic and social commitments.

The tool can be used by any relevant member of a port community including the port authority, national maritime authority, ship operating customers, regulators, governments, safety team, regional first responders as well as green Corridor managers and and many more.

---

<sup>1</sup> See publications: MMM, DNV, EMSA, IMO, ABS, LR

## 2. The Port Readiness Level framework for Marine Fuels (PRL-MF)

Port Readiness Level (PRL) for Marine Fuels			
		Call specific fueled vessel	Bunkering specific fuel
PRL 9	Deployment	Calls of specific fueled vessels integrated in regular port operations	Bunkering of specific fuel integrated in regular port operations
PRL 8		System for calls of specific fueled vessels complete and qualified	System for bunkering of specific fuel complete and qualified
PRL 7		Calls of specific fueled vessels established on a project base in an operating environment	Bunkering of specific fuel established on a project base in an operating environment
PRL 6	Development	Framework for call specific fueled vessel demonstrated in a protected environment	Framework for bunkering specific fuel demonstrated in a protected environment
PRL 5		Framework for call specific fueled vessel designed	Framework for bunkering and associated activities of a specific fuel designed
PRL 4		Policy for call specific fueled vessel decided, roadmap developed	Policy for bunkering specific fuel decided, roadmap developed
PRL 3	Research	Sufficient information gathered	
PRL 2		Interest of port stakeholders determined	
PRL 1		Fuel relevance assessed	

### 3. The Port Readiness Level Checklist for marine fuels

WPCAP and CMF have jointly created a checklist to help port communities self assess their readiness across the nine PRLs. The checklist is a goal-based framework to assess the existing level, address any shortcomings within the port community and then communicate this across stakeholders and the wider maritime community. It create a practical roadmap to evaluate the port ambitions over time and make this – and the current level – publicly available, so that stakeholders can make informed decisions when investing in fuel production, ships, equipment, planning, routes, green corridors and more.

The checklist and the PRL framework are meant to be used as guidance by stakeholders in the port community to develop the port, ensure that all reasonable measures have been taken to ensure that the port will be on parity with other ports at the same PRL, allocate resources and strategies and have appropriate infrastructure and governance in place. That said, larger ports or those with specific structures may achieve their objectives in different ways, which is why the checklists have adopted a goal based approach to make it as inclusive as possible.

The checklist is a tool to assess the readiness of a port and the port community. Tasks within the levels can be fulfilled by a port authority, but also by port stakeholders or, for instance, by national authorities. For example, a risk assessment can be performed by a stakeholder in the port, a national authority can develop a safety framework and a port authority can initiate local regulations. Who will perform a certain task can be different in every port.

The framework consists of 9 readiness levels – largely following the systematic of the NASA Technical Readiness Level (TRL). The first three levels concern the research phase (PRLs 1, 2 & 3), the next three levels the development phase (PRLs 4, 5 & 6), and the last three levels the deployment phase (PRLs 7, 8 & 9).

For the above aspects, steps that are to be taken in the research phase can be considered equal, whereas steps for the development and deployment phase will be different for vessels sailing on alternative fuel and vessels bunkering alternative fuel.

In the research phase of the process to prepare the port for additional marine fuels, the relevancy of a fuel for the specific port and its stakeholders is determined, GAPS are identified and pros and cons are , and the interesse of the port.

During the development phase, strategic decisions are made, and a safety framework will be developed based on risk assessments, finally this all will be tested during a pilot.

In the deployment phase the wanted activities in the port will be possible, it will start with a project based approach, grow into a system base approuach after wich the activity will become a regular port operation

The steps taken by individual ports may vary according to the specific operations and structure of the communities (eg: risk assemsnts may be done by the port itself, a specialist organisation or even the national authority).

## Usage of the PRL checklist for marine fuels:

For each new marine fuel, the process of the the nine levels can be followed. Every single level within this process has an objective that can be fulfilled by meeting specific goals across four different domains. It is possible to work in multiple levels at the same time, it is not necessary to wait with the start of a next level till the previous level is completed.

The four domains within every single level are:

- Governance
- Safety
- Infrastructure
- Market and supply/demand

For every domain a goal, strategies, measures and considerations are defined:

### **Strategies and measures**

These are plans and actions to be performed by appropriate stakeholders in a port community to achieve the aim of the objective. The objective of the level can be considered to be achieved if the strategies and measures are fulfilled. However in cases where the strategy or measure will never be feasible in the port, it should be down-graded to a consideration.

**Considerations (optional):** The list of considerations within each domain below every objective is meant to create structures of support for the port community towards reaching its objectives. These are generic suggestions that may not apply in every case – and are not exhaustive (so please see if there are additional considerations that apply to your specific port community).

NOTE: Not all domains or objectives may apply to all ports, so there is the expectation that port communities will identify all objectives that are applicable and work towards achieving them – and ensure that there are clear reasons and documentation as to why selected goals are not suitable for action.

# Port Readiness Level Checklist for Marine Fuels

---

*This assessment checklist is developed to:*

- assess the port readiness for a call of vessels sailing on a marine fuel that is still new to the port;
- assess the port readiness for the bunkering of a marine fuel that is still new to the port.

---

Port:
Marine Fuel:
<input type="checkbox"/> Swapping MECS <input type="checkbox"/> Bunkering from a shore based bunker facility <input type="checkbox"/> Bunkering from trucks (TTS) <input type="checkbox"/> Bunkering from a bunker vessel (STS) <input type="checkbox"/> Other.....

## Level 1: Fuel relevance assessed

**Objective level 1:** to gather information about industry fuel trends and consider whether a new marine fuel should be seen as relevant for your port

**- Domain: Governance:**

**Goal:** To gather information about specific marine fuel(s) and energy transition within shipping.

This includes:

- industry fuel trends;
- appetite within the port community for energy transition within shipping;
- upcoming regulations and regulatory trends;
- environmental benefits to support the port environmental goals;
- maturity of technical readiness of the use of the specific energy carrier as a marine fuel.

Strategies and measures:

- The PRL and assessments tool should be used as the guiding framework for the port.
- Research should be conducted to gain insight on:
  - present and upcoming regulations for the energy transition within shipping;
  - the influence of the port's policy and other stakeholder policies on energy transition within shipping;
  - the maturity of technical readiness for the use of a specific fuel on board of a vessel;
- Stakeholder opinions, support and initiatives should be assessed for the energy transition within shipping
- Relevant industry stakeholders must be identified
- The general public must be regularly informed about energy transition of shipping

Considerations:

- (Port-wide) emission targets are assessed (i.e. carbon footprint) to include the effect of energy transition within shipping;
- Stakeholder analysis in the governance domain (city, government, local and governmental authorities, safety agencies, environmental agencies and organizations) is performed;
- Public perception on the individual fuels being considered by the port community is assessed;



**- Domain: Safety:**

**Goal:** To assess specific marine fuels to identify aspects that might be related to safety related showstoppers

Strategies and measures:

- An analysis is made on the aspects that should be introduced in the safety framework for specific low- and zero-carbon marine fuel(s)
- It seems feasible to establish enough distance to vulnerable areas for specific fuels
- Present national / international safety regulations are known
- Regulatory authorities, competent authorities and their focus areas are known

Considerations:

- It has been investigated how the regulatory process can be influenced
- It seems feasible to establish a sufficient incident response capability in the port

**- Domain: Infrastructure:**

**Goal:** The basic potential to become a port of call of alternative fuelled vessels and bunker port for the specific low- and zero-carbon marine fuel;

Strategies and measures:

- It seems feasible to facilitate vessels sailing on the respective alternative fuel in the port
- All the new fuel-related activities seem to fit (with some adaptations) in the port

Considerations:

- It seems feasible to arrange a spatial planning for activities with low- and zero-carbon marine fuel with enough safety distance to vulnerable areas
- It seems feasible to have sufficient infrastructure in place to support initiatives on new fuels
- It seems feasible to develop physical bunkering infrastructure and facilities in the port for specific alternative fuel

**- Domain: Market, supply/demand (if applicable)**

**Goal:** The port has a basic commercial potential to become a bunker port for the respective fuel and/or vessels on low- and zero-carbon fuels likely to utilize port in the future as part of service string;

Strategies and measures:

- It seems feasible to enter the market for port's stakeholder
- It seems feasible to have the infrastructure in place for specific new fuels available in the port in the quantities needed for the commercial use

- Threats or opportunities for the bunker market in the port due to changing bunker patterns are assessed
- The interest of stakeholders to invest in specific fuels is assessed

Considerations:

- It seems feasible to add specific fuels to the bunkering fuels portfolio
- Information on the competitive position of the bunker port is available
- Sufficient knowledge on fuel trends in the shipping industry is available
- Basic knowledge on future demand and supply of low- and zero-carbon marine fuel is available

**Objective level 1 is achieved:**

**Confirmed**

**Sufficient information about industry fuel trends is gathered, relevance for the port of specific fuels is considered**

The strategies and measures of the domains within level 2 are being prepared

## Level 2

### Interest of the bunkering value chain determined

**Objective level 2:** to gather information of the bunkering value chain stakeholders about their plans for future fuels.

The strategies and measures of the domains in level 1 have been evaluated and lessons learned are implemented.

#### - Domain: Governance:

**Goal:** The port has sufficient insight in the bunker value chain stakeholder strategies for specific fuels;

Strategies and measures:

- An initial stakeholder analyses is performed
- A SWOT analysis for calls of alternative fueled vessels and bunkering of low- and zero-carbon marine fuel is conducted
- An engagement & communication plan for stakeholders and public is developed
- An initial/qualitative PRL schedule with present situation and indicative ambition for general or specific low- and zero-carbon marine fuel(s) within the port is created

Considerations:

- The network within the port community is expanded with key players within the scope of specific fuels. For green corridors, this includes the full value chain.
- A discussion platform is developed with primary stakeholders
- Tools are available to support communication to stakeholders

#### - Domain: Safety:

**Goal:** The port has sufficient insight in the opportunities within the port to develop a safety framework for specific low- and zero-carbon marine fuel;

Strategies and measures:

- Resources and budget can be allocated for all activities that should be performed to contribute to the safety of new activities and to establish a safety framework for bunkering

Considerations and action points:

- A network is available to involve all authorities and key players in the development of a safety framework

**- Domain: Infrastructure:**

**Goal:** The port has sufficient insight in the present infrastructure to know if it can facilitate calls of new marine fuel fuelled vessels and bunkering of new marine fuels;

Strategies and measures:

- The possibilities to achieve a relevant spatial area for bunkering of specific fuels are identified
- Future bunker scenarios, and future bunker infrastructure needs are examined

Considerations:

- It seems feasible to incorporate necessary infrastructure in the port for bunkering of specific fuels
- Currently available infrastructure in the port is assessed for suitability to facilitate initiatives of early movers
- Required future services for alternative fuelled vessels and bunkering of specific fuels is explored.

**- Domain: Market, supply/demand (If applicable)**

**Goal:** The port is acquainted with the opportunities for port's stakeholders to enter the new market;

Strategies and measures:

- A benchmark on fuel availability is developed
- The interest of relevant stakeholders in the port to use low- and zero-carbon marine fuel is assessed

Considerations

- Relevant port stakeholders are acquainted with the value chain of low- and zero-carbon marine fuel for from fuel projects to vessels
- The feasibility of a coalition of stakeholders to form a value chain for bunkering of specific fuels is assessed
- The interest of relevant stakeholders in the port for Green Corridor projects is assessed
- The bunker market is equipped to keep itself informed on the future market conditions of specific fuels
- The stakeholders within the value chain for bunkering are aware they have to keep a balance between demand and supply

Objective level 2 is achieved:

Confirmed

**There is sufficient insight available in the opportunities within the present infrastructure to facilitate calls of vessels sailing on new marine fuels and the bunkering of specific low- and zero-carbon marine fuel**

The strategies and measures of the domains within level 3 are being prepared

## Level 3 Sufficient information gathered

**Objective of level 3:** to ensure sufficient information is gathered about all aspects needed to make a decision about whether vessels can call the port using this specific fuel and can bunker the specific fuel.

The strategies and measures of the domains in level 2 have been evaluated and lessons learned are implemented.

### - Domain: Governance:

**Goal:** The port has sufficient information to develop a policy and roadmap for the new fuels;

Strategies and measures:

- Arguments and reasons to support (or not to support) the use of specific fuels are recorded in Management of Change
- Internal and external position papers for the use of low- and zero-carbon marine fuel in the ports are drafted
- National and international incentives are explored, and key findings documented

Considerations:

- Research reports and scientific papers are consulted to gather relevant information
- Sufficient support for the changes is established within the port community
- The potential impact of the use of the new fuels on the port's footprint (e.g.: CO<sub>2</sub> levels, air quality in the port, etc) is assessed
- A gap study on missing policy areas is conducted, and a sequencing of the mitigations is established
- Relevant port stakeholders participate in research programs, consortiums, partnerships to gather knowledge
- Port stakeholders are aware of the impact of the decision to support specific fuels in the port on their internal organisation
- Public and stakeholder perceptions and impact on reputation are considered

### - Domain: Safety:

**Goal:** The port has enough information to establish a sufficient safety level for new fuels;

Strategies and measures:

- Safety issues and risks of specific fuels are identified

- Possible risk mitigation measures are identified, and mitigations are sequenced
- The present incident response preparedness for incidents related to activities with the specific new marine fuel is assessed.

#### Considerations

- A gap study is performed to identify all gaps in regulations for the use of low- and zero-carbon marine fuel by shipping
- Incident response and health organizations are aware that they need to prepare for the new fuels
- Relevant technical and nautical institutes are aware of the future need for knowledge and training as a consequence of the changes in the port
- Relevant safety standards, regulations and industry best practice is known
- GAPS in requirements for protecting vulnerable areas, local populations, etc, are identified
- Relevant safety- and environmental authorities are acquainted with market trends and aware of growing use of this specific fuels in the shipping sector

#### - Domain: Infrastructure:

**Goal:** The port has sufficient information on the necessary infrastructure and space for the new fuels used by vessels

#### Strategies and measures:

- The required additional space for calls of alternative fuelled vessels and bunkering of low- and zero-carbon marine fuel is identified Gaps are identified and demonstrators described for making fuel available and perform bunker operation

#### Considerations

- Future required services for vessels sailing on low- and zero-carbon marine fuel are identified
- Future required auxiliary products for vessels sailing on low- and zero-carbon marine fuel are identified

#### - Domain: Market, supply/demand (If applicable)

**Goal:** The port has a sufficient insight about predicted fuel demand and supply chain

#### Strategies and measures:

- Key stakeholders of the supply chain have confirmed their interest and support, and participation in joined projects established
- The incremental cost for calling and bunkering operations (including CAPEX) is assessed

#### Considerations:

- The commercial impact of the decision to accommodate new fuels on the present fuels supply sector and local business is assessed
- Commercial partnerships are considered in the region
- Green Corridors are moved into Feasibility Phase
- Potential future demand and supply is considered
- Initial options for attracting vessels/operators on low- and zero-carbon fuels are considered: reduced port fee, priority berthing etc.

**Objective level 3 is achieved:**

**Confirmed**

**Sufficient information is gathered about all aspects needed to make a decision about whether vessels can call the port using this specific fuel or bunker the specific fuel.**

The strategies and measures of the domains within level 4 are being prepared



## Level 4 Policies decided, roadmap and timeline developed

**Objective of level 4:** A decision should be made whether to proceed with a plan to facilitate bunkering of the specific fuel or to halt progress for this specific fuel

The strategies and measures of the domains in level 3 have been evaluated and lessons learned are implemented.

### - Domain: Governance:

**Goal:** The port established a governance policy that reflect the decision to proceed or not proceed with the specific fuel in the port

### Strategies and measures:

- A position or policy paper is created to explain port's choice to proceed or halt with a specific fuel.
- A firm PRL schedule with present situation and ambition for specific low- and zero-carbon marine fuel(s) within the port is created and communicated publicly
- A communication policy is established

### Considerations:

- Responsibilities are clearly addressed in the policy paper
- For the specific fuels with a decision to proceed, a roadmap should be created including:
  - o clearly addressed responsibilities
  - o a plan to allocate human resources, work hours and budget
  - o mapping out the cultural changes that needs to emerge to support new fuels
  - o identifying the need for new policies for safety and infrastructure investment
  - o early limits to the exploration of the fuel operations (e.g.: boundary conditions)
  - o possible ways to facilitate and support the use of the fuel (e.g.: policies, incentives, etc)
  - o a communication plan with:
    - the message that should be brought to the public and stakeholders
    - outreach to the press and media
    - outreach to industrial, commercial and social stakeholders
    - outreach to political partners
    - outreach to other authorities such as environmental protection agencies and governmental authorities
    - outreach to general public

- The roadmap conceptualises how to:
  - monitor the environmental impact of using alternative fuel and technology on the CO2 footprint and air quality in the port.
  - map out the likely socio-economic benefits of bunkering this new fuel at your port
  - adapt the internal organization of relevant port stakeholders to the coming multi fuel future

**- Domain: Safety:**

**Goal:** The port developed a safety policy and roadmap for the call of vessels sailing on the specific marine fuel and/or bunkering of the specific marine fuel

Strategies and measures:

- A safety policy is developed including boundary conditions for bunkering of specific fuels in the port.

Considerations:

- A safety roadmap is developed to establish a safety framework and regulatory framework including:
  - spatial planning or allocation for vessels sailing on alternative fuel or bunkering of low- and zero-carbon marine fuel;
  - planning of port specific risk assessments
  - licensing or approval of operations
  - enforcement management for relevant safety regulations
  - options for “Port of Refuge” for alternative fuelled vessels in distress (even if the port decided not to accommodate a specific fuel)
- A roadmap is developed to establish incident response management:
  - incident response scenario’s
  - training of incident responders
  - proper incident response equipment.
  - trained and prepared ports health organization;
- A roadmap is prepared to initiate training and knowledge institutes to include schooling and training for low- and zero-carbon marine fuel in their portfolio
- A roadmap is prepared for adapting the internal organisation of the competent authority to be ready for the multi fuel future

**- Domain: Infrastructure:**

**Goal:** The port established an infrastructure policy and roadmap to develop sufficient infrastructure for the specific new marine fuel

Strategies and measures:

- Admission policies for specific alternative fuelled vessels are developed

Considerations:

- An infrastructure roadmap is established to:
  - o implement the admissions policies
  - o develop adequate Vessel Traffic Services (VTS) and Vessel Traffic Management (VTM)
  - o establish infrastructure such as quays to host vessels and operations
  - o establish a proper bunker infrastructure
  - o establish an infrastructure for delivering and collection of auxiliary products
  - o establish an IT and digitalisation support of the process including digital twin
  - o establish a sustainable collection of alternative fuel associated waste
  - o establish a proper service level (maintenance, cleaning and gas freeing facilities)

**- Domain: Market, supply/demand (if applicable)**

**Goal:** The port developed a commercial policy and strategy, and a roadmap for the specific low- and zero-carbon marine fuel

Strategies and measures:

- A commercial policy and strategy are developed for the complete supply and value chain

Considerations:

- A commercial roadmap is developed which includes plans for:
  - o port incentives for supporting the use of new fuels
  - o supporting innovations and start-ups in energy transition
  - o setting up green corridors and other coalitions which include the whole supply chain
  - o market licensing schemes
  - o exploring niches and market opportunities
  - o marketing, acquisition and market communication

**Objective level 4 is achieved:**

**Confirmed**

**A decision is made whether to proceed with a plan to facilitate bunkering of a specific marine fuel or to halt progress for this specific marine fuel, roadmaps are developed**

The strategies and measures of the domains within level 5 are being prepared

## Level 5 Frameworks designed.

**Objective of level 5:** The roadmaps from PRL 4 should be executed to create a practical framework to facilitate calls of vessels sailing on alternative fuel or bunkering of specific fuels

The strategies and measures of the domains in level 4 have been evaluated and lessons learned are implemented.

### - Domain: Governance:

**Goal:** The port implemented the governance roadmap of level 4 and created proper governance for calls of vessels sailing on-, or bunkering the specific marine fuel

### Strategies and measures:

- A "Management of Change" program for energy transition shipping is established
- A PRL schedule based on self-assessment with a timeline for every relevant new marine fuel is developed
- A (port) emergency response and contingency plan is in place
- A resiliency procedure is in place to accommodate vessels with fuels not normally accommodated
- The Port Information Guide is updated with knowledge established in level 5

### Considerations:

- A by external party validated PRL schedule with a timeline for every relevant new marine fuel is developed
- A program is in place which identifies new opportunities and supports the uptake of new fuels and technologies by:
  - o funding and support for demo projects;
  - o short term or long-term funding on Capex or Opex
  - o pricing strategy (incentives or port dues) for vessels sailing on low- and zero-carbon marine fuel and bunker vessels for low- and zero-carbon marine fuel
  - o pricing strategy for non-sustainable fuels
- A program is in place to meet the need for competent human resources by communication with industry, schools and training institutes.
  - o training courses are available to ensure appropriately trained staff to handle the fuel
  - o a vetting system is in place for training courses for specific fuels to ensure that they meet sufficient standards;
- The effect of the use of low- and zero-carbon marine fuel and technology on the CO2 footprint of-, and air quality in the port can be monitored

- Due diligence is performed by validating essential part off ports safety management by experts such as technical consultants or class
- Planning and procedures can be tested in a simulated environment using CFD and digital twinning (IT supported)
- The communication plan is implemented:
  - o expectations of the stakeholders are managed
  - o information, transparent on pros and cons, is reach out to stakeholders and the general public
  - o a Q&A list and easy access feedback management is developed
  - o where necessary stakeholders and/or public are consulted
  - o the public is acquainted with the multi fuel port
  - o involved stakeholders can reach the key players within the bunker value chain
  - o involved stakeholders are familiar with boundary conditions, requirements and procedures
  - o communication and publication tools, such as a website, flyers, one pagers etc are developed

#### - Domain: Safety:

**Goal:** The port implemented the safety roadmap of level 4 and developed a safety framework, regulatory framework and spatial planning for calls of vessels sailing on the specific marine fuel and bunkering of this specific marine fuel

#### Strategies and measures:

- Spatial planning and a regulatory framework for the call of vessels using a specific fuel, or the bunkering of specific fuels in the port is developed

#### Considerations:

- Spatial planning is based on:
  - o port specific risk assessments to develop spatial planning and allocation of bunkering are performed
  - o quantitative external risk assessments to ensure enough safety distance between alternative fuel activities and vulnerable- or populated areas is performed
  - o
- An allocation of bunkering of specific fuels is established based on external safety studies (see above) and nautical safety studies (see the item in domain infrastructure)
  - o a “bunker map for specific fuels” is developed to define and communicate where a bunkering can take place.
- Safety management is established, and safety studies are performed:
  - o credible spill scenarios are defined and gas dispersion studies are performed to define control-, safety-, and exclusion zones
  - o HAZID and HAZOP studies are performed to define proper risk mitigation measures and safety procedures
- A regulatory framework is established which includes:
  - o Port Bye Laws or other relevant local regulations
  - o port safety procedures for bunkering
  - o environmental legislation
  - o water quality and water pollution prevention regulations

- regional and national legislations
  - international legislation for vessels (IMO)
  - ISO standards
- The safety- and regulatory framework is developed for vessels sailing on alternative fuel and all relevant bunker scenarios:
- land installation to ship
  - truck to ship;
  - ship to ship bunkering;
  - transfer of modular energy containment systems
  - .....
- The safety- and regulatory framework contains requirements and conditions for:
- reporting the kind of fuel a vessel is using for propulsion or auxiliary equipment;
  - the stakeholders involved in the bunkering
  - the site or terminal operator where a bunkering will take place
  - reporting of activities and operations;
  - interaction with other port stakeholders not involved in low- and zero-carbon marine fuel operations;
  - internal and external responsibilities;
  - control and exclusion zones;
  - safety distances for passing vessels;
  - terminals and other port users;
  - simultaneous Operations (SIMOPS);
  - signalling or marking of vessels bunkering of a specific fuel;
  - approval or prohibition of activities;
  - spatial planning of operations
  - licensing of activities with alternative fuel with mandatory safety procedures;
  - vetting of quality (audit) of stakeholders involved in bunkering;
  - the use of (IAPH/CMF) checklists .
- A contingency plan is developed and the incident response management is established with prepared:
- incident response organization;
  - port health organization;
  - enforcement organization;
  - relevant authorities.
- The port authority adapted its internal organization and prepared the internal organization for a multi fuel future by:
- internal communication and management of change to get personnel acquainted with the multi fuel future
  - trained and educated own personnel
  - trained safety officers, auditors, enforcement officers, incident response officers
  - adapted internal procedures for safety management for alternative fuel operations
  - reserve capacity and budget for support of the tasks due to the energy transition shipping

### - Domain: Infrastructure:

**Goal:** The port implemented the infrastructure roadmap of level 4 and developed infrastructure for calls of vessels sailing on the specific marine fuel, and bunkering of this specific marine fuel

#### Strategies and measures:

- The port implemented an admission procedure for vessels carrying low- and zero-carbon marine fuel
- Present infrastructure is adapted and relevant infrastructure is developed to facilitate the initial vessels sailing on alternative fuel and the start of bunkering of specific low- and zero-carbon marine fuel:

#### Considerations:

- Nautical safety studies are performed to ensure
  - o alternative fuelled vessels can enter the port safely
  - o locations for bunker operations of specific low- and zero-carbon marine fuel are suitable from a nautical perspective with a low risk level on collision or allision
  - o tidal and current and surge of passing vessels should be addressed
  - o mooring requirements or requirements for passing vessels should be based on above mentioned safety studies
  - o VTS and VTM is sufficient
- Present infrastructure is adapted and relevant infrastructure is, or will be, developed to facilitate vessels sailing on alternative fuel and bunkering of low- and zero-carbon marine fuel:
  - o engineering and technical aspects of necessary infrastructure are defined;
  - o existing port infrastructure can be used (or adapted to) for initial calls and initial bunkering in a start-up phase
  - o necessary infrastructure is established for the near future to host vessels and facilitate bunker operations;
  - o IT and digitalisation are supporting the Vessel Traffic Management process.
- The port defined future bunker scenarios and reserved space for land-based operations such as tank truck to ship bunkering and “spin-off” operations (waste collection, gas-freeing, delivery of auxiliary products, etc)
- The development of more and dedicated (long term) infrastructure and services is work in progress
- The development of preferred services for vessels sailing on low- and zero-carbon marine fuel is work in progress

### - Domain: Market, supply/demand (if applicable)

**Goal:** The port implemented the commercial roadmap of level 4 and developed commercial support to explore and accelerate the new opportunities for the specific marine fuel.

Strategies and measures:

- A commercial (business) management plan is developed

Considerations:

- The port operator or relevant authority for the port initiated and announced:
  - o port incentives for supporting the use of new fuels;
  - o supporting innovations and start-ups in energy transition.
- Green Corridors are moved into Select Phase
- Coalitions of stakeholders are formed which include the whole supply and value chain
- A market licensing scheme is developed to regulate the market (if applicable)
- Niches are explored and market opportunities are assessed
- Marketing, acquisition and market communication are performed

**Objective level 5 is achieved:**

**Confirmed**

**For the port sufficient measures are established, relevant tasks are performed, and a proper safety framework is established to facilitate calls of vessels sailing on the specific marine fuel or bunkering this specific marine fuel**

The strategies and measures of the domains within level 6 are being prepared



## Level 6 Proof of concept

**Objective of level 6:** to perform practical pilots within a designated area of the port under tightly controlled conditions (pilot/start up), to demonstrate and test the developed governance, safety framework and infrastructure for a vessel sailing the specific marine fuel and bunkering the specific marine fuel

The strategies and measures of the domains in level 5 have been evaluated and lessons learned are implemented.

### - Domain: Governance:

**Goal:** The port tested the governance arrangements and processed feedback in the arrangements

Strategies and measures:

- A PRL benchmark to compare and learn from the readiness of other ports is performed
- The effectiveness of the governance arrangements and communication is tested, the arrangements and communication plan are improved based on the test results
- Information on the pilot, and pilot results is disseminated

Considerations:

- The effectiveness of governance arrangements is tested for:
  - o management of change program
  - o arrangements to act on lessons learned and feedback
  - o innovation and support program
  - o incentives program
  - o budget for supporting pilots
  - o human resource program for energy transition in shipping
  - o arrangements for CO2 footprint reduction to assess if this reduction is in line with the regulatory timeline for reduction of emissions
  - o the IT support and if this support is in line with the market- and technical developments in the port
- A presentation and other means of publication are developed to present the result of the pilot and reached out to international and national media, port stakeholders and public to give exposure to the pilot
- The message “from now on you can do safe operations with this specific fuel in our port” is disseminated
- The quality and effectiveness are tested of the:
  - o engagement & communication plan for stakeholders and public

- Q&A list and easy access feedback management
- public and stakeholder consultation
- perception management
- available communication and publication tools, such as a website, flyers, one pagers etc

**- Domain: Safety:**

**Goal:** the port performed a practical test of the developed safety arrangements within a designated area of the port under tightly controlled conditions, to examine and improve the safety preparation for more frequent activities of vessels with the specific marine fuel

**Strategies and measures:**

- A project team is arranged to manage safety and infrastructure issues for the first specific alternative fuelled vessel entering the port, or the first bunkering of a specific alternative fuel on pilot base.
- The quality and effectiveness of the developed safety framework is checked and tested, the framework is improved based on the test results

**Considerations:**

- The project team:
  - will contain members of all relevant and involved stakeholders on operational management level, such as the Harbour Master (representative) and other safety authorities, supplier, bunker operator, receiving vessel operator, terminal or site owner, competent authorities, vessel services, pilot organization and s
  - responsibilities are designated and defined
  - can be supported by a consulted specialist
  - reviewed the results of relevant safety studies
  - reviewed the developed safety framework and decides what parts are applicable for the pilot
  - defined the safety requirements for the pilot
  - addressed regulatory issues and requirements
  - arrange the request for approval from the competent authority
  - assessed the compatibility
  - developed an action plan for the first vessel sailing on a specific fuel
  - developed a joint plan of bunker operations based on the bunker management plans of involved vessels, local requirements, terminal or site operator requirements and location specific circumstances
  - inform defined parties on the entry in the port of the pilot vessel
  - inform defined parties on the start of the bunkering of the specific alternative fuel
  - supervise that pilots are carried out as outlined in the action plan or joint plan of bunker operations.
  - arrange supervision by the competent authority during the first test/pilot
  - make a first test or pilot report

- The quality and effectiveness of the safety framework for the specific fuel is assessed and confirmed, including:
  - the developed spatial planning for specific alternative fuel operations
  - the management system to approve locations and areas for activities with low- and zero-carbon marine fuel
  - the management system which ensures enough safety distance to vulnerable areas and populated areas
  - the management system to ensure the maritime safety and safety distances between berthed and passing vessels;
  - VTM, VTS
  - risk mitigation measures, operational requirements and procedures for bunkering of specific alternative fuel;
  - the required control-, exclusion zones and safety areas;
  - licensing and approval procedures;
  - requirements for the compatibility assessment;
  - the vetting of quality of stakeholders involved in the bunkering;
  - the use of checklists;
  - communication arrangements;
  - the internal preparation of the Port Authority Organization.

**- Domain: Infrastructure:**

**Goal:** the port performed a practical test of the developed infrastructure, or roadmap for the further development of infrastructure, within a designated area of the port under tightly controlled conditions to examine and improve the infrastructural preparation for more frequent activities of vessels sailing on the specific marine fuel

Strategies and measures:

- A project team is arranged to manage safety and infrastructure issues for the first specific alternative fuelled vessel entering the port, or the first bunkering of a specific alternative fuel on pilot base.
- The quality and effectiveness of the developed infrastructure is checked and tested, future planned development of relevant infrastructure is assessed, existing infrastructure or development plans are improved based on the test or assessment results.

Considerations and action points:

- The port developed or facilitated infrastructure for the pilot
- The project team:
  - defines for the pilot the involved vessel(s), bunker facilities and planned location
  - defines for the pilot the suitable route in the port for the involved vessels and a safe location to berth
  - defines the admission requirements for the pilot
  - defines for the pilot the safety zones and distances to vulnerable areas and public
  - check if the pilot is compliant with ports boundary and operational conditions
  - ask for approval for the pilot on the planned location from the competent authority
- The quality and effectiveness of the established infrastructure, and plans for future, infrastructure, for specific fuels are checked and tested, including:
  - admission procedure for specific alternative fuelled vessels

- engineering and technical aspects of necessary infrastructure
- vessel management and VTS for the near future
- IT management and digitalisation to support of the process
- reserving space for the increase of land-based operations
- the use of present infrastructure and the need for dedicated infrastructure
- the use of shore site infrastructure
- services for vessels sailing on low- and zero-carbon marine fuel

**- Domain: Market, supply/demand (if applicable)**

**Goal:** To create market confidence, a pilot is performed to proof the port is ready for operations with the specific low- and zero-carbon marine fuel

Strategies and measures:

- Port safety framework and infrastructure are fit for purpose, and it's disseminated the port is ready for regular calls of specific new marine fuelled vessels or regular bunkering of new marine fuels, allowing the value chain stakeholders to make Final Investment Decision (FID).
- A market strategy and market communication are for the next projects are developed based on the results of the PRL 6 assessment and feedback from stakeholders and clients.

Considerations:

- The quality and effectiveness of the market arrangements for specific fuels are assessed, including:
  - market strategy
  - the supply chain arrangements
  - the process for port incentives for supporting the use of new fuels
  - port pricing strategy
  - the system for supporting innovations and start-ups in energy transition
  - the market confidence levels
  - market communication

**Objective level 6 is achieved:**

Confirmed

**It is demonstrated by practical pilots the established governance, safety framework and infrastructure for calls of vessels sailing on the specific marine fuel, or bunkering of this specific marine fuel in the port, are sufficient and effective**

The strategies and measures of the domains within level 7 are being prepared

## Level 7 Project based approach

**Objective level 7:** to facilitate project-based calls of vessels sailing on the specific marine fuel, or bunkering of the specific marine fuel in the port, controlled by safety protocols and project teams.

The strategies and measures of the domains in level 6 have been evaluated and lessons learned are implemented.

### -Domain: Governance:

**Goal:** The port's formal policy on how to facilitate vessels using or bunkering the specific marine fuel on a project bases, has been accepted by relevant stakeholders. The port governance is able to support regular calls of vessels sailing on the specific fuel and the bunkering of this specific fuel

### Strategies and measures:

- The PRL level of the port is validated and entered into the deployment phase.
- The port call- and bunkering framework has been applied to multiple project scenarios with learnings incorporated
- A project-based approach is organized to facilitate the actual operations with specific low- and zero-carbon marine fuel
- Exposure is given to the start of regular calls of vessels sailing on a specific fuel
- Exposure is given to the start of regular bunkering of specific fuels
- The engagement & communication plan for stakeholders and public is implemented

### Considerations:

- Relevant safety organizations and authorities are acquainted with, and prepared for regular and structural calls of alternative fuelled vessels and bunkering of specific low- and zero-carbon marine fuel
- Funding and pricing opportunities are monitored
- Schooling and training institutes are supported to arrange a future resistance capacity of human resources
- The effect of the use of low- and zero-carbon marine fuel in the port on the CO2 footprint and air quality is monitored
- Port operations are supported by IT
- Port authority internal organisation is supported by IT tools that are adapted to new fuel operations
- Proper communication is established:
  - o The port information guide is updated
  - o experiences are shared with other ports

- stakeholders that are part of the supply chain are connected with potential customers
- The website of the port is update with the last information on the specific fuel
- The port monitors and published on specific fuel quantity of bunkering

#### - Domain: Safety:

**Goal:** Ports safety and regulatory framework is project based fit for facilitating calls of vessels sailing on the specific marine fuel, or bunkering of this specific marine fuel, controlled by safety protocols and project teams.

#### Strategies and measures:

- A safety framework with regulations, safety procedures, and enforcement is in place to ensure safe operations controlled by project teams
- The internal organization of the competent authority has integrated low- and zero-carbon marine fuel in her system for safety management
- A project team is operational to manage on project base safety and infrastructure issues, and ensures approval of operations including required safeguards for calls of alternative fuelled vessels and bunkering of specific low- and zero-carbon marine fuel

#### Considerations:

- For bunkering the project team will contain of safety specialists of the competent authority and if necessary specialists of involved parties in the bunkering (supplier, bunker operator, receiving vessel operator, terminal or site operator, competent authority)
- The project team for bunkering:
  - is using defined spatial planning for operations to ensure sufficient safety distance between operations and vulnerable areas or public.
  - confirmed the involved vessel(s), terminal and bunker operators state of preparedness
  - ensures the approval of the competent authority is granted
  - ensures a compatibility check is performed
  - ensures a joint plan of bunker operation based on the bunker management plan of the involved vessel(s) is developed
  - checks the joint plan of bunker operations (JPBO) which should:
    - meet the regulatory and safety framework;
    - reflect best practice of the industry, guidance from branch organizations and standards;
    - include a compatibility assessment;
    - include control zones;
    - include safety requirements;
    - include SIMOPS safety measures;
    - include port specific risk mitigation;
    - include operational safety checklists.
  - ensures the bunkering will be performed conform the developed JPBO
  - informs defined parties on the planning and start of the bunkering of the specific fuel
  - arrange if necessary supervision by the competent authority during the bunkering
  - ensures the proper mandatory operational bunker checklist is used (IAPH STS-A)
  - ensured enforcement by safety specialists is in place and operational

- it is ensured relevant incident response is operational fuels with for specific fuels prepared:
  - incident response organization;
  - port health organization;
- The project team monitored parties and companies and their vessels involved bunker operations, to assess if they are ready to proceed to PRL level 8
- The port is preparing for PRL level 8 with a system-based safety approach for bunkering:
  - a structural licensing system for operations with low- and zero-carbon marine fuel is under development;
  - a system to ensure the quality of the parties involved in the bunkering is under development;
  - auditors are in training to check the quality of the parties involved in the bunkering
  - audits of bunker operators or other for safety responsible parties, are initiated

**- Domain: Infrastructure:**

**Goal:** Ports infrastructure is project based fit for facilitating calls of vessels sailing on the specific marine fuel or bunkering of this specific marine, controlled by safety protocols and project teams.

Strategies and measures:

- A project team is operational to manage on project base safety and infrastructure issues, and ensures approval of operations including required safeguards for calls of alternative fuelled vessels and bunkering of specific low- and zero-carbon marine fuel
- The project team for calls will ensure calls of vessels sailing on alternative fuel will act compliant to the admission policy.

Considerations:

- For a call of a vessel, the project team will contain nautical specialists from the competent authority, if necessary supported by relevant nautical service providers such as pilots or tugs operators.
- The project team for a call of a specific fuelled vessel:
  - execute the admission policy for vessels sailing on a specific fuel
  - ensures an approach and mooring plan is made
  - is using defined spatial planning for locations where specific fuelled vessels can berth
  - confirmed the suitability of the berth
  - checked the terminal- or site operators' preparedness
  - will inform VTM and VTS on the particulars of the vessel
  - will inform defined parties on the call of the vessel and her particulars
  - checked if suitable information for the emergency response is available

- Suitable infrastructure to facilitate calls of alternative fuelled vessels and bunkering specific fuels is available in the port:
  - o vessel management and VTS;
  - o bunker infrastructure
  - o procedures for truck to ship bunkering;
  - o procedures for ship-to-ship bunkering.
- In the port, space is reserved for land-based operations such as truck-to-ship bunkering
- In the port, space is reserved for “spin-off” operations like gas-freeing, delivery of auxiliary products etc.
- Locations for land-based operations are suitable and equipped for the planned operations
- Infrastructure is available to use for the land-based bunkering and delivering or collection of auxiliary products or waste
- Infrastructure (bunker vessels) is available to use for ship-to-ship bunkering of specific fuels
- A system-based infrastructure approach (PRL 8) is developed for calls of vessels sailing on alternative fuel:
  - o dedicated land-based infrastructure
  - o dedicated bunker vessels
  - o sufficient services for vessels sailing on low- and zero-carbon marine fuel
- The project team monitored shipping companies and operators and their alternative fuelled vessels, to assess if they are ready to proceed to PRL level 8

**- Domain: Market, supply/demand (if applicable)**

**Goal:** A starting bunkering market is developed, the port is exploring business opportunities for the specific marine fuel

**Strategies and measures:**

- Niches in the bunker market and market opportunities are explored and managed
- marketing, acquisition and market communication is performed

**Considerations:**

- Incentives for supporting the use of new fuels are provided;
- Support for innovations and start-ups in energy transition are available.
- The supply of fuels for projects is secured from suppliers
- Vessel’s bunkering will receive an ensured quantity and quality of fuel, controlled with an approved bunkering measuring system
- Best practice is established for the commercial terms of supply
- Stakeholder preference for origin of fuel (grey/blue/green) is addressed
- Port preference for origin of fuel is green
- Volumes of specific fuels supplied to project-based vessel bunkering are monitored
- The port is involved in Green Corridors project in construction phase
- Coalitions of stakeholders are formed which include the whole supply chain
- A market licensing scheme is in place (if applicable)



Objective level 7 is achieved:

Confirmed

**Calls of vessels sailing on the specific marine fuel, and the bunkering of this specific low- and zero-carbon marine fuel can take place in the port on project bases and is controlled by safety protocols and project teams.**

The strategies and measures of the domains within level 8 are being prepared

## Level 8 System based approach

**Objective of level 8: to facilitate on system bases calls of vessels sailing on the specific marine fuel and bunkering of this specific low- and zero-carbon marine fuel in the port, controlled by safety management**

The strategies and measures of the domains in level 7 have been evaluated and lessons learned are implemented.

### - Domain: Governance:

**Goal:** The port governance is able to support regular calls of vessels sailing on the specific marine fuel and bunkering of this specific marine fuel controlled by safety management

#### Strategies and measures:

- The PRL status of the port is disseminated to the port community and the public
- Port's policies and governance facilitate bunkering of specific low- and zero-carbon marine fuel to grow into a starting bunker market

#### Considerations:

- An ambition is set with a clear timeline for port's customers to be green
- The port's system based bunkering framework has been applied to multiple scenarios
- Incentives are effective to support the uptake of specific low- and zero-carbon marine fuel
- Schooling and training institutes are able to arrange sufficient capacity of human resources
- The effect of the use of low- and zero-carbon marine fuel in the port on the CO2 footprint and air quality is measured and reported
- Low- and zero-carbon marine fuel operations are supported by advance IT like digital twins
- Port authority internal management and organisation is properly adapted to manage new fuel operations
- The port information guide is updated
- The number and volumes of bunkering of specific fuels is reported and published
- Experiences and lessons learned are shared with other ports
- An exchange of information on granted licenses is exchanged with other ports to incorporate in their licensing process
- The website of the port is updated with the last information on the specific fuel

## - Domain Safety:

**Goal:** Port's safety and regulatory framework is system based fit for facilitating calls of vessels sailing on the specific marine fuel, or bunkering of this specific low- and zero-carbon marine fuel, controlled by safety management and compliance checks

### Strategies and measures:

- A safety- and regulatory framework is in place with requirements / conditions and an approval system for:
  - o licensing ship to ship bunkering
  - o licensing truck to ship bunkering
- The policy for specific low- and zero-carbon marine fuel defines when a system-based approach is applicable and when a project-based approach prefers. It also defines when to step back from a system-based approach to a project-based approach.

### Considerations:

- Parties and companies and their vessels involved in bunker operations, are monitored and visited regularly by enforcement officers to assess if they are compliant with the safety framework conditions, or have to be handled on project base (PRL7)
- Defined spatial planning is applicable for the bunkering of specific fuels.
- A system-based approach for bunkering of a specific fuel is used to ensure the safety of operations:
  - o a defined party involved in a bunkering of a specific fuel is long term licensed for doing bunkering of a specific alternative fuel.
  - o the quality and safety management of the license holder is checked by the competent authority (IAPH/CMF operator audit)
  - o the operational quality of bunker vessels is checked (IAPH/CMF vessel audit)
  - o operations are restricted to defined areas
  - o bunkering is restricted to approved locations alongside terminals with a prepared safety management
  - o a basic set of risk mitigation measures is implemented and mandatory
  - o a designated bunker checklist is used during bunker operations
- In case the conditions for system-based approach as defined in the bunker license, cannot be met, a project-based approach will be used (see PRL7)
- In case of a bunkering in vulnerable areas outside the defined areas, extra risk mitigation is required in addition to the basic set of requirements. The acquiring party has to prove the risk involved in the operation is accepted by the competent authorities
- A safety- and regulatory framework is in place with requirements, conditions for:
  - o reporting the kind of fuel a vessel is using for propulsion or auxiliary equipment;
  - o reporting commences activities and operations;
  - o safety distances between vessels;
  - o interaction with other port stakeholders not involved in low- and zero-carbon marine fuel operations;
  - o internal and external responsibilities;
  - o control and exclusion zones;
  - o safety distances for passing vessels;

- terminals (see IAPH/CMF Terminal Readiness) and other port users;
  - Simultaneous Operations (SIMOPS);
  - signalling or marking of vessels bunkering of a specific fuel;
  - approval or prohibition of activities;
  - vetting of quality (audit) of stakeholders involved in bunkering (see IAPH/CMF Audit).
- A, by all involved parties agreed party, will perform a compatibility check and initiate a joint plan of bunker operation based on the bunker management plan of the involved vessel(s)
  - The joint plan of bunker operations should:
    - meet the regulatory and safety framework
    - should reflect best practice of the industry, guidance from branch organizations and standards
    - include a compatibility assessment
    - include control zones
    - include safety requirements
    - include SIMOPS
    - port specific risk mitigation
    - mandatory use of checklists
  - Ports safety organizations are trained and prepared:
    - Incident response organization
    - Port health organization
    - Enforcement organization
    - Safety and environmental authorities
  - Trainings and drills are organized of the emergency response organisation together with port's stakeholders like shipping lines and bunker operators
  - The port authority internal organization is prepared for a multi fuel future by:
    - Trained and educated own personal
    - Trained safety officers, auditors, enforcement officers, incident response officers
    - Procedures within the port authority safety management for alternative fuel operations
    - Performed safety studies with implemented results
    - IT support

#### **-Domain: Infrastructure:**

**Goal:** Port's infrastructure is system based fit for facilitating calls of vessels sailing on the specific marine fuel and bunkering of this specific low- and zero-carbon marine fuel

#### Strategies and measures:

- Specific alternative fuelled vessels entering and leaving the port are handled "going concern"
- The port admission policy for vessels sailing on a specific alternative fuel is fully incorporated in port's vessel management

#### Considerations:

- A vessel management system is in place and VTS controls calls of vessels sailing on an alternative fuel
- Vessels sailing on specific alternative fuel are handled “going concern” conform port’s procedures
- The suitability of berthing locations is known and used for vessel management
- Initial infrastructure is available and increasing:
  - o dedicated infrastructure for alternative fuel cargo operations;
  - o dedicated STS bunker infrastructure (bunker vessels);
  - o dedicated land-based infrastructure for bunkering from trucks or a bunker facility.
- The port has infrastructure in place for delivering or collection of auxiliary products or waste

**- Domain Market, supply/demand (If applicable)**

**Goal:** A growing bunkering market is developed, the port is exploring business opportunities of the specific marine fuel

Strategies and measures:

- The supply of fuels is secured by a supplier
- Licensed bunker facility operators can provide low- and zero-carbon marine fuel to vessels

Considerations:

- Incentives are provided:
  - o port incentives for supporting the use of new fuels
  - o support for innovations and start-ups in energy transition
- Sufficient availability for the starting market is ensured
- Measuring and quality control systems are available
- An origin of fuel certificate system (grey, blue green) is in place
- Bunker volumes are regular reported
- The price of this specific fuel is monitored
- The port is involved in multiple Green Corridors
- Market coalitions are active in the port
- Marketing, acquisition and market communication for this specific new fuel is performed

**Objective level 8 is achieved:**

**Confirmed**

**Calls of vessels sailing on the specific marine fuel and bunkering of this specific low- and zero-carbon marine fuel can take place in the port on system bases and is controlled by safety management and compliance checks.**

The strategies and measures of the domains within level 9 are being prepared

## Level 9 Scaling up to going concern

**Objective of level 9: To offer competitive environment for calls of vessels sailing on the specific marine fuel and bunkering of this specific low- and zero-carbon marine fuel, incorporated in the regular port process, to ensure commercial success of the port**

The strategies and measures of the domains in level 8 have been evaluated and lessons learned are implemented.

### **-Domain: Governance:**

**Goal:** The port is future proof for vessels sailing on the specific marine fuel and the bunkering of this specific marine fuel

Strategy and measures:

- The port information guide and other communication tools are updated regularly
- Information on port's achievements and environmental performance is transparent available

Considerations:

- A network is developed to remain up to date with innovations and new trends (PRL level 1 status)
- The port is able to react in time on new developments and, if necessary, is able to step back in PRL level for a new development
- A monitoring and measuring system is developed for port's environmental performance for low- and zero-carbon marine fuels
- KPI's are developed KPIs for port's environmental performance

### **-Domain: Safety:**

**Goal:** Ports quality and safety management is future proof prepared for facilitating calls of vessels sailing on the specific marine fuel, and bunkering of this specific marine fuel

Strategy and measures:

- The port has a safety management system in place to ensure the quality and measure the effectiveness of the safety framework, including
- Compliance checks

#### Considerations:

- The port has an ISO 9001 validated quality management system in place to validate:
- The port has a management system in place to verification of:
  - o Measuring systems;
  - o Certificates of origin;
  - o Emission Trading System certificates;
  - o Book and claim certificates;.
- A PDCA cycle is incorporated in port's safety management system to check and improve its safety framework regularly

#### **-Domain: Infrastructure:**

**Goal:** Ports infrastructure is future proof prepared for facilitating calls of vessels sailing on the specific marine fuel and bunkering this specific low- and zero-carbon marine fuel

#### Strategy and measures:

- A network is developed to remain up to date with innovations and new trends on infrastructure and technical improvements for this specific new fuel

#### Considerations:

- A (maintenance) management system is in place for managing maintenance and infrastructure developments to be in time to react on upcoming infrastructure demand

#### **-Domain: Market, supply/demand (If applicable)**

**Goal:** The port contains a mature bunker market for the specific marine fuel

#### Strategies and measures:

- Multiple suppliers can supply this low- and zero-carbon marine fuel to customers
- Multiple bunker operators can provide this low- and zero-carbon marine fuel to vessels
- A strategy is developed to phase-out the market for conventional marine fuels and the (re)conversion to a market with new marine fuels

#### Considerations

- A mature supply chain for bunkering of this specific new marine fuel is established where:
  - o Suppliers can ask market conform prices
  - o Availability is in balance with the demand
  - o Shipping lines can negotiate with multiple suppliers
  - o Bunker infrastructure, like bunker vessels or locations to perform TTS bunkering, is sufficient
  - o Availability of green fuels is in balance with the demand
  - o Certification of origin is accepted

- Book and claim is accepted
- For this new marine fuel is a proper competition level established
- Contracts/agreements are signed with suppliers and customers
- Feasibility and financial viability are ensured

**Objective level 9 is achieved:**

**Confirmed**

**The port offers a competitive environment for calls of vessels sailing on the specific marine fuel and bunkering of this low- and zero-carbon marine fuel, incorporated in the regular port process, to ensure commercial success of the port**



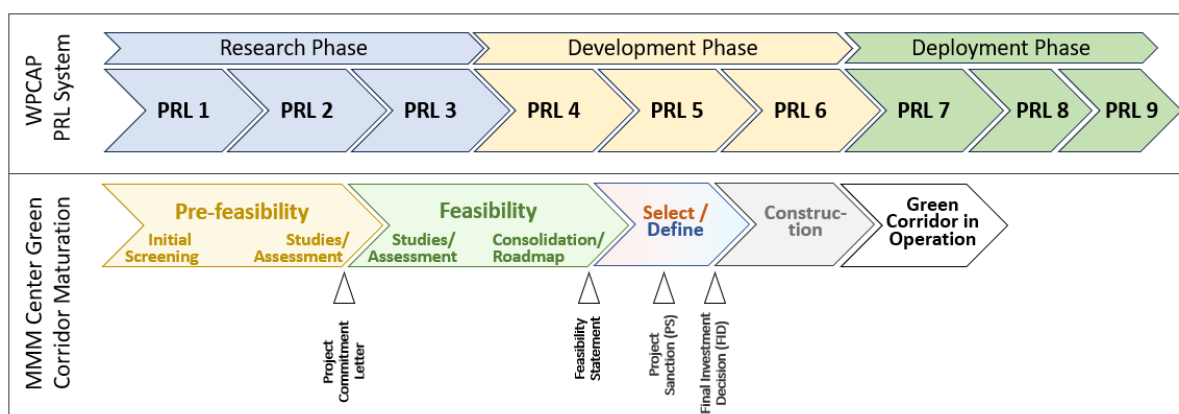


# Port Readiness Level in a Green Corridor

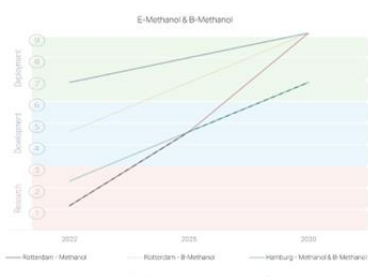
For the first decade(s) of implementing low- and zero-emission fuels, the deployment will take place on dedicated routes, where sufficient benefits (technical, policy, commercial) exists: green corridors. These corridors, will require minimum one bunkering options on the route, but will need all ports on the string to be able to accept port of call. The PRL tools can help the ports. Ports with a clear view on their future PRL levels are more likely candidates for ports for the green corridors, than those ports with no or limited self-assessment of their ability to handle the future fuels.

### Example of using PRL in green corridors

Green corridors are specific commercial shipping routes where the initial deployment of low- and zero-emission fuels take place. The corridor project gathers the full value chain the attempt to make an assessment of the feasibility of the corridor concept. As part of this assessment, it is mandatory that the port(s) on the corridor demonstrate their technical maturity. For corridor projects to initiate/participate in feasibility studies for green corridors, the ports of relevance have to have performed minimum PRL 2 (See Figure XX).



For a Feasibility Road Map to be produced for the corridor, the ports need to be at PRL 4. For a corridor project to be sanctioned the ports need a PRL of 5, and for Final Investment Decision of the corridor project, the ports need to be at a minimum of PRL 6, allowing the corridor project to be the 'bunkering established for specific project' = PRL 7. As the assessment carried out through the feasibility assessment and further on, are resulting in investments and commitments to various degrees, the port assessment needs to be qualified by a quantitative assessment. For initial green corridor screening (pre-feasibility) ports need to indicate/communicate their expected PRL development over time, thus indicative tell when the ports expect to reach PRL 3, 5 and 6 for *bunkering* and *call* respectively. With this information, the green corridor pre-feasibility assessment can pin-point ports which are more prone for being part of green corridors than others, though no irreversible de-selection should take place. As the assessment carried out in the pre-feasibility assessment is a desktop study with no/minor investments and commitments, the port assessment can be qualified by a qualitative assessment based on overall visions and aspirations.



When ports have made a quantified PRL, it stimulates the rest of the value chain members to conduct studies at similar level of details. In this way, the PRL and associated checklist can provide an important driver for establishing green corridors as fast as possible.