TF Infrastructure – Interim report

This interim report provides an overview of the status of the work carried out so far within the TF-Infrastructure, as well as the main learnings to date. It also outlines possible next steps for the continuation of the taskforce's activities.

Short outline of the taskforce

The taskforce was agreed by the Programme and Monitoring Group (P&MG) on 26 June 2025 and launched thereafter. It is composed of 26 members representing airports, maritime and inland ports, fuel producers, fuel offtakers, and public authorities.

The TF-Infrastructure was established with the objective of developing actionable, cross-sectoral strategies to enable the efficient deployment, possible adaptation of existing infrastructure, and the development of new logistics necessary for the scale-up of renewable and low-carbon fuels (RLCFs) in the EU.

To this end, the taskforce aims to map, assess, and provide guidance on infrastructure needs across the RLCF value chain, from upstream infrastructure to distribution systems serving ports, airports, and end users.

To date, three taskforce meetings have been held. The kick-off meeting took place on 11 September 2025. During this meeting, the following work phases were agreed:

1. **Phase 1: Infrastructure mapping & feedstock logistics (Q4 2025 – Q2 2026)**
   Map all existing and planned assets and examine the mobility of feedstocks across the EU.

2. **Phase 2: Assessment of gaps & needs (Q4 2025 – Q3 2026)**
   Identify where capacity, access, or resilience falls short of projected demand: technical limits, retrofitting potential, permitting hurdles, and supply-chain security. The gap analysis will include the results of phase 1.

3. **Phase 3: Investment & roadmap (Q4 2025 – Q4 2026)**
   Analyse funding opportunities (EU/national programmes, private finance) and lay out a phased roadmap for closing the gaps and scaling infrastructure through 2030 and beyond. The elaboration of the roadmap will be based on the outcome of previous phases.

4. **Phase 4: Presentation to General Assembly 2026 (Q4 2026)**
   Based on the results of phase 3, the Chair will present the roadmap to the RLCF General Assembly.

5. **Phase 5: Final report (Q4 2026)**
   Finalisation of the report, including the results collected during the previous phases and publication in the RLCF Alliance website.

Two additional meetings were held on 2 October and 1 December 2025.

During these meetings, members were invited to provide input on the proposed work phases and on possible data sources to support the mapping of existing and planned infrastructure under Phase 1. The conclusions drawn from the work conducted so far are summarised in the following section.

Moreover, on 4 March 2026, the European Commission adopted the EU Ports Strategy, which sets out priorities and recommended actions to advance infrastructure for renewable and low-carbon fuels. This provides a relevant policy framework for the taskforce's work, which can contribute by further assessing practical challenges, identifying gaps, and supporting the implementation of these priorities at port level.

> *"To guide investment planning, the Renewable and Low-Carbon Fuels Alliance (RLCF) will, by the end of 2026, assess infrastructure capacity and future needs for the supply of renewable and low-carbon fuels in and to ports."*[1]

Interim conclusions of the TF-Infrastructure

Discussions within the taskforce and some additional data analyses have led to the following preliminary conclusions.

Sectoral perspectives

The different sectors represented in the taskforce (airports, maritime ports, inland ports, fuel producers, fuel suppliers and infrastructure operators) approach infrastructure development from distinct perspectives.

Waterborne transport

Ports play a distinct enabling/facilitating role in the deployment of renewable and low-carbon fuels for maritime transport, rather than acting as direct decision-makers on fuel choice. The selection of fuels in use or observed through fleet investments is influenced by a combination of market dynamics – such as large shipping and shipowner strategies - as well as fuel availability. Port authorities instead focus on creating the conditions for investment, by providing space, permitting, safety frameworks, and regulatory clarity that allow fuel suppliers and shipping companies to operate. However, the process is also shaped by broader factors, including the policy framework and the acceptance of port communities.

Ports are increasingly evolving from traditional logistics hubs towards multi-energy nodes where maritime fuels interact with broader hydrogen, ammonia and e-fuels value chains, when existing,

[1] https://transport.ec.europa.eu/document/download/8a1a9516-8efd-44ca-b308-4b3cafc59f38_en?filename=communication_on_EU_ports_strategy.pdf

serving industry, energy systems and transport. Recognising this systemic role can help better capture the contribution of ports to the deployment of renewable and low-carbon fuels.

As shown in table 1, infrastructure deployment is more advanced for certain sustainable maritime fuels, reflecting the technological readiness of some type of fuels. Methane bunkering infrastructure is operational in nearly all European major ports, reflecting both technological maturity and existing ship demand. To fully capitalize on this existing infrastructural capital and transition seamlessly to bio-LNG as a drop-in fuel, future work could look into inland upstream logistics. Connecting European biogas and biomethane liquefaction facilities directly to maritime ports will unlock massive domestic production potential, reducing reliance on overseas imports. By contrast, methanol infrastructure is concentrated at the pilot or early commercial stage, whereas some existing infrastructure (e.g. gasoline storage) can be adjusted to store methanol, while hydrogen and ammonia bunkering remain largely planned, under assessment, or limited to small-scale demonstrations. Although some ports may decide to move first to gain a potential advantage, ports tend to enable fuels in line with demand certainty and risk exposure, with infrastructure advancing where near-term uptake is plausible and proceeding more cautiously where safety, cost, and demand uncertainties are higher.

At the same time, a multi-fuel strategy over early fuel specialisation seems to be preferred among EU larger ports. Most large gateway ports simultaneously accommodate methane, develop methanol readiness, and prepare regulatory frameworks for hydrogen-derived fuels. Some differentiation is nonetheless emerging: industrial and gateway ports show stronger positioning towards future hydrogen and ammonia value chains, whereas other ports prioritise near-term compliance through LNG and electrification. However, given the early stage of hydrogen and ammonia deployment, the evidence suggests that ports are deliberately maintaining strategic flexibility, enabling multiple options while avoiding premature lock-in to a single fuel trajectory.

Table 1: Ship-side alternative fuel & energy infrastructure in major EU ports - Summary

Note. The focus is on infrastructure that directly enables vessels to use alternative fuels, including bunkering and storage. The table synthesises the status of renewable and low-carbon fuel infrastructure across major EU ports. ***Full detailed data table including sources can be found in Table 4.***

Port (Top 10 EU + extras, ranked by Volume)	*Methane bunkering*	*Methanol bunkering*	*Hydrogen / ammonia bunkering*	*Port authority role/ strategy frame*	*Type of Companies / ecosystems' examples*
1) Rotterdam	Operational / scaling	Pilot → early commercial	Pilot / framework building	Multi-fuel enabler	Energy majors; shipping JVs
2) Antwerp Bruges	Operational	Operational	Small-scale + planned	Active multi-fuel gatekeeper	Methanol pioneers; gas TSO
3) Hamburg	Operational	Methanol-ready	Under assessment	Safety & permitting focus	Independent bunkers; utilities
4) Gioia Tauro	Import-ready (no bunkering)	—	—	Infrastructure facilitator	LNG terminal developers
5) Piraeus	Operational / developing	—	—	Policy implementation role	LNG suppliers; terminal operator
6) Valencia	Limited / niche	—	R&D / pilot interest	Decarbonisation lab	Public–EU funded consortia
7) Algeciras	Operational	Planned (EU-funded)	Planned (EU-funded)	Strategic gateway planner	Energy majors; storage firms
8) Bremerhaven	Operational	Pilot / methanol-ready	Concept	Regulated multi-fuel strategy	Local suppliers; public co-funding
9) Barcelona	Operational hub	Planned / contracted	Strategic hub planned	Energy-transition leader	Energy majors; cruise lines
10) HAROPA (Le Havre)	LNG-ready / operational	Production planned	Import / conversion planned	Electrification + LNG focus	Energy majors; e-fuel developers
Gdańsk	Operational (truck-to-ship)	Conditional	—	Demand-led follower	Regional gas suppliers
Marseille Fos	Operational hub	—	—	LNG-led transition	Energy majors; shipping lines
Constanța	Planned	—	Energy-sector only	EU-funded moderniser	Port authority; utilities
Amsterdam	Operational (multi-fuel)	Pilot / operational	Framework building	Safety-first multi-fuel port	Methanol bunkers; biofuel firms

Table 2: Fuel production, import & conversion facilities in major EU ports (contextual / future-oriented)

Focus: facilities that do not directly bunker alternative fuels today but potential long-term fuel pathways and specialisation. The data on hydrogen-related infrastructure, ammonia/methanol production projects, and port-based import/storage hubs refers to the planned or existing import of low-carbon energy carriers (e.g., ammonia, methanol, biofuels, LNG and other hydrogen derivatives) into the port area for storage, transhipment, distribution and potential conversion. It was derived from the full data in the Annex Table 4, however, the 'Strategic signal' column reflects an analytical interpretation based on the presence and combination of production, import, and conversion infrastructure, rather than explicit port authority statements.

EU Ports indications from most of the earlier ones	*Hydrogen production / backbone*	*Ammonia or methanol production*	*Import / storage hubs*
Rotterdam	Large-scale hydrogen backbone under construction	Ammonia imports terminals planned; methanol ecosystem emerging	Major import hub for energy carriers
Antwerp–Bruges	Hydrogen network integration	Methanol production projects announced	Storage & distribution facilities
Hamburg	Hydrogen valley initiatives	Methanol and ammonia import and storage infrastructure under development	Limited import focus
Algeciras	Green hydrogen production projects	Ammonia & methanol derivatives planned	Export-oriented hub
Amsterdam	Hydrogen value-chain development	Methanol blending & storage	Biofuels/methanol storage & transhipment hub; no major hydrogen/ammonia import terminal announced
HAROPA (Le Havre)	Hydrogen integration projects	e-Methanol plant announced	Import-oriented
Gdańsk	National hydrogen strategy linkage	Not announced	Limited
Marseille–Fos	Hydrogen ecosystem projects	Bio-LNG production plans	Import-export hub
Valencia	Hydrogen corridor participation	Not announced	Limited
Constanța	Hydrogen bunkering & production intent	Not announced	LNG & future hydrogen import

As shown in table 2, upstream developments in hydrogen backbones and ammonia/methanol production or import facilities are often linked to broader energy-system and industrial decarbonisation functions, rather than immediate bunkering demand. It suggests that major gateway ports are positioning themselves as integrated energy nodes, where maritime fuel availability depends on wider hydrogen/ammonia supply chains. Overall, we see different transitioning logics, ranging from LNG-led bridging strategies to longer-term hydrogen-based pathways.

Overall, from discussions within the Task Force, desk research and exchanges with port authorities, the differences in investment strategies observed across the ports reflect variations in port function, demand certainty, and risk exposure with ports not being only one critical component. Large gateway and industrial ports are better positioned to engage in capital-intensive, upstream fuel infrastructure, while other ports prioritise incremental port-side bunkering readiness and safety frameworks and regulatory compliance (i.e.: OPS). In many cases, port authorities also play a coordinating role in attracting and enabling investment by facilitating permitting processes, infrastructure planning and collaboration between energy suppliers, terminal operators and shipping companies. The resulting pattern illustrates a pragmatic balancing of near-term requirements with long-term uncertainty, leading ports to maintain flexibility and avoid premature infrastructure lock-in, with port authorities primarily acting as facilitators rather than direct investors.

Inland waterways

Inland waterway (IWW) transport represents a specific case. Compared to maritime and aviation, inland navigation has a relative wider choice for decarbonisation. The sector however currently uses diesel in 99.9% of the current fleet and it is not subject to specific EU - binding fuel regulations, which results in less regulatory pressure. Nevertheless, the sector has demonstrated a commitment to decarbonisation and has started taking concrete steps in this direction. Today only a handful of pioneering vessels use batteries and hydrogen solutions while the number of LNG vessels is low. The replacement rate of the IWW fleet is very low and it is expected that it will be difficult to replace the current fleet in the short to medium-term.

Decarbonisation pathways and energy choices are primarily driven by operators voluntary willing to switch to new fuels. It is also expected that an increase in the production of sustainable alternative fuels – notably HVO and biomethane - compatible with the current fleet could potentially be used by the IWW as to reduce its CO2 emissions.

Airports

Fuel supply to EU airports is predominantly arranged via existing aviation fuel infrastructure, with major hubs connected to dedicated pipelines from refineries or coastal import terminals and smaller or less-connected airports relying on road tankers for deliveries (IATA, 2022). Sustainable aviation fuel (SAF) is generally blended with conventional jet fuel upstream at production terminal facilities and then distributed via the existing pipeline and truck network. This means airports do typically not require new systems or dedicated SAF storage infrastructure for uptake (ICAO, n.d.; IATA, n.d.). SAF is certified as a drop-in fuel and is therefore compatible with existing aircraft and airport refuelling procedures, indicating that remaining constraints are more likely to relate to supply availability and distribution logistics than to airport-side infrastructure limitations (IATA, 2022).

Early ReFuelEU Aviation reporting indicates that this approach is already delivering SAF to a growing number of EU airports and that current uptake levels are broadly consistent with meeting the initial 2% blending mandate from 2025. EASA's annual technical report documents that multiple fuel suppliers delivered SAF to many EU airports across several Member States in 2024, demonstrating operational integration into existing supply chains (EASA, 2025). Nevertheless, further analysis is needed to confirm that this supply model can be applied uniformly to all airports in scope and to

identify any locations where limited access to fuel infrastructure could make physical SAF delivery more challenging (EASA, 2025; European Commission, 2025).

Data availability

There is currently limited data available on existing or planned alternative fuel projects in ports or with bunker vessels. In some cases, data does not exist or could not to be shared due to competition/commercial concerns. Some developers in the sector are also reluctant to share information as there is potential risk of misinterpretation (e.g. perceptions that fuel availability at ports might be an issue) and could also undermine further infrastructure development. The European Alternative Fuels Observatory (EAFO) is collecting some infrastructure-related data, limited to onshore power supply (OPS) in seaports and LNG infrastructure. However, OPS data in seaports is currently outdated and incomplete. This information should be updated soon.

In addition, the European Maritime Space (EMS) Forum has initiated compliance monitoring activities through the Project List, which aims to identify investment priorities of ports and Member States, including those related to alternative fuels. The Project List and the associated compliance monitoring will be updated on an annual basis.

Data availability for airport fuel infrastructure is generally more straightforward.

The following table 3 corresponds to the list of sources that were shared by the members of the taskforce.

Table 3: Input collection for resources and data in view of mapping

Name of the source / data	Short description (sector, geography, granularity, etc.)	Link
IATA	Aviation, global analysis of 123 largest airports	Access to fuel infrastructure to enable aviation's decarbonization
T&E /PRO aviation	Aviation, Europe, Access to jet fuel infrastructure, section 2.5	202504_e-kerosene_report
DNV	Ammonia bunkering infrastructure assessment compa red to 2020 level in Chapter 3.2.3 Infrastructure	DNV: Ammonia in shipping tracing the emergence of a new fuel
Netherlands Ministry of Defense	Aviation, Netherlands (+Belgium, Luxemburg, France and Germany), Central European Pipeline System (CEPS)	https://english.defensie.nl/topics/defence-pipelines/documents/leaflets/2017/06/01/corporate-brochure-dpo-fueling-your-wings
CINEA	Maritime / ports: projects selected in the AFIF second cutoff. For example, 24 ports will receive funds to deploy onshore power supply, to green their port operations, and to **invest in ammonia bunkering infrastructure.**	c152fb88-a997-432a-b28c-5b33a1995abf_en
LGE	The 2040 and 2050 Renewable Liquid Gas Outlook presents a comprehensive analysis of the potential for renewable liquid gases (RLG), such as renewable LPG and renewable	RLCF

	dimethyl ether (renewable DME), to contribute to Europe's decarbonization efforts.	
Concawe, S&P	Mapping RED III long-term supply & demand for alternative fuels in Europe. Provides insights and data regarding decrease of imports of crude oil to Europe, but also underlines increase in imports of bio feedstock, and heavy products like bitumen.	https://www.concawe.eu/publication/study-on-the-potential-evolution-of-refining-and-liquid-fuels-production-in-europe/
Concawe	Sustainable bio feedstock supply chains for advanced biofuels in Europe towards 2050	Sustainable bio feedstock supply chains for advanced biofuels in Europe towards 2050

Proposed next steps:

Based on the discussions held so far, the following possible next steps have been identified:

- Consider dividing the work into two dedicated workstreams, one focusing on airports and one on ports.
- Deepen the infrastructure mapping exercise for airports, including supply chains and bottlenecks.
- Deepen the infrastructure mapping for ports, including the 'upstream' segment (import bulk terminals, storage tanks, dedicated inland distribution networks).

The following guiding questions are suggested by the taskforce for the future work of the two workstreams:

Aviation	Maritime
Considering that SAF must be physically supplied at all union airports by 2035 (Article 5 of ReFuel EU Aviation): • What infrastructure developments would best support SAF supply across European airports, including in Central and Eastern Europe? • Where do stakeholders see remaining gaps or practical challenges in enabling physical SAF availability at all Union airports by 2035 (including but not limited to lack of competition, access to infrastructure, market concentration, restrictions to supply at airports, etc.)? • How can SAF supply be facilitated in airports with limited physical access routes, such as island airports?	• How should "bunkering infrastructure" be defined to ensure it captures market realities in the deployment of sustainable maritime fuels? • What are the key challenges faced by ports / fuel suppliers / terminal and storage operators in enabling the deployment of infrastructure for low-carbon fuels, including capacity gaps, future infrastructure needs and investment barriers? • What are the measures that ports, fuel suppliers, shipping operators, terminal and storage operators can implement to enable the deployment and integration of low-carbon fuels bunkering infrastructure within ports, or in their vicinity, including:

• Is the current midstream/downstream logistics infrastructure (specifically off-site blending terminals and multiproduct pipelines) sufficient to handle escalating SAF mandates without operational disruption and contamination risks? • To what extent might the existing logistics infrastructure - particularly off-site blending terminals and multiproduct pipelines - be capable of accommodating rising SAF mandates without encountering operational challenges?	○ Adaptation or repurposing of existing infrastructure ○ Development of new storage, handling and transfer systems, including permitting procedures ○ Implementation of safe and interoperable fuel transfer operations (e.g., methanol or ammonia from vessels to storage) ○ Practical models for integrating fuel suppliers within port concession systems • How to ensure efficient integration between maritime bunkering, inland transport (pipeline, rail, truck), and upstream production or import terminals, including identifying future infrastructure needs across the supply chain? • Can we identify potential patterns within Europe about bunkering infrastructure needs between larger ports and other ports, i.e. can we talk about “fuel distributor ports” vs “bunkering ports”? • What are possible lead times for infrastructure construction at ports, and how does this interact with other projects (construction in parallel or construction in sequence)?

Annex

Note. Below the detailed versions of the information of tables 1 and 2 are displayed into Table 3, containing the complete rationale with corresponding sources.

Table 4: Detailed Version of Ship-side alternative fuel & energy infrastructure in major EU ports

Port (Top 10 EU + extras)	*LNG / bio-LNG bunkering*	*(Bio)-methanol bunkering*	*Hydrogen / ammonia bunkering*	*Onshore Power Supply (OPS)*	*Port authority role*	*Type of Companies / ecosystems' examples*
1) Rotterdam	Operational, expanding ship-to-ship bunkering in 2028 (Total Energies, 2025; Ship Technology, 2025)	Pilot (bio)-methanol bunkering completed; port at early commercial readiness; bio-methanol accessible from 2026. (Port of Rotterdam, 2026)	Ammonia bunkering pilot completed; safety and regulatory framework for commercial operations under development, new partnerships for developments are announced (Ammonia Energy, 2025). Hydrogen is just there as a small bunkering station under construction (Port of Rotterdam, 2026)	OPS deployment underway, with rollout across major container and cruise terminals planned/ expanding. E.g. ABB (Worldcargo news, 2026), Cruise Port Rotterdam (Cruise Europe, 2024)	*Facilitates* **multi-fuel bunkering**; spatial planning and safety frameworks (Port of Rotterdam, 2026)	*TotalEnergies & CMA CGM* (joint venture for LNG bunkering vessels and logistics) (Offshore Energy, 2025); *Shell* & *CMA CGM* for (bio)-LNG bunkering (Advanced Bio Fuels, 2021);
2) Antwerp–Bruges	Operational LNG & bio-LNG bunkering (Port of Antwerp-Bruges, 2026)	Operational (first green methanol bunkering completed) (Port of Antwerp-Bruges, 2023), (Offshore Energy, 2023)	Small-scale hydrogen bunkering already possible (CMB fuel station); large-scale hydrogen and ammonia	OPS deployment planned and in rollout at key terminals in line with EU greening ports/AFIR requirement	Actively *authorises* bunker suppliers; strong **multi-fuel bunkering** positioning (Port of Antwerp-Bruges,	*Proman & Stena Bulk* (methanol bunkering via Tamariva barge) (Offshore Energy, 2023); *Fluxys* (LNG and bio-LNG bunkering

			bunkering under development via planned import terminal and hydrogen network (Port of Antwerp-Bruges, 2026)	(A. Antolini, 2025).	2026) (Manifold Times, 2023)	activities) (Fluxys, 2021).
3) Hamburg	LNG bunkering has been operational in Hamburg since 2019 (cruises) (Ship and Bunker, 2025), with ship-to-ship LNG bunkering now approved at (container) terminals. (Port of Hamburg, 2025; LNG Industry, 2025)	The same two terminals have been declared "methanol-ready" (Ship and Bunker, 2025), LNG Industry, 2025)	Ammonia bunkering is under active investigation, with HPA planning ammonia bunker sites (Port of Hamburg, 2024) Ammonia import terminal planned (MB Energy in Port of Hamburg) Methanol import and storage tanks planned (MB Energy in Port of Hamburg)	OPS for cruise & container terminals and the program will be expanded. (Hamburg Port Authority, 2026)	Focus on terminal readiness, approval and risk assessments (PortNews, 2025)	Independent bunker companies (including MB Energy at Cruise Center Steinwerder) carry out LNG and methanol bunkering; HPA provides the regulatory framework. RWE Supply & Trading supported risk assessment.
4) Gioia Tauro	Authorised LNG regasification terminal that could *support* future LNG bunkering, but **no** operational LNG or bio-LNG bunkering service announced	**No** announced methanol or bio-methanol bunkering infrastructure or pilots identified.	**No** dedicated hydrogen or ammonia bunkering facilities announced; any future option would likely depend on LNG/ energy-impo	Cold-ironing / quay electrification programme under implementation, funded by Italian state and port authority, to enable	Port authority focuses on *enabling* LNG terminal development and quay electrification through *state-backed investment*	*LNG Medgas (Iren, Sorgenia)* as LNG terminal proponent; no specific bunker suppliers announced yet for alternative fuels. (Gen, 2026; Ports of Europe, 2025)

	(Ports of Europe, 2025)		rt infrastructure development.	shore-side power for berthed ships. (ETrasporto Europa, 2026)	agreements, rather than directly driving specific fuel bunkering projects. (Ports of Europe, 2025; ETrasporto Europa, 2026)	
5) Piraeus	LNG bunkering being developed via Revithoussa-supplied truck-to-ship operations and a 3,000 m³ LNG bunkering vessel based in Piraeus, alongside new biofuel bunkering offered at Piraeus Container Terminal. (LLoydlist, 2025; EIB, 2020; Poseidon Med2, 2026)	**No** operational methanol or bio-methanol bunkering announced to date; Piraeus' alternative fuel activity currently centres on LNG and biofuel blends.	**No** dedicated bunkering facilities or pilots publicly announced.	Apart from highlighted to be important by the Greek minister, no transparent communication of the status was found (Shipping Telegraph, 2023)	Port authority expected to implement national green-transition policy by enabling LNG/biofuel bunkering and OPS deployment at Greece's largest port, maintaining competitiveness under EU climate rules. (Needs, 2023)	*LNG Medgas/Revithoussa and the EIB-financed* 3,000 m³ LNG bunkering vessel underpin *future LNG supply, while COSCO-controlled Piraeus Container Terminal has launched biofuel bunkering services under Greece's updated marine fuel standard. (EIB, 2020) Poseidon Med2, 2026)*
6) Valencia	Limited LNG activity: Operational LNG bunkering for ferries since 2018, multi-truck-to-ship MTTS; Sagunto terminal adapted for LNG bunkering logistics. (Offshore Energy, 2018; Enagas, 2023)	**Not** yet operational; **no** public methanol bunkering service announced.	Strategic interest stated both on hydrogen and ammonia ; various research projects (Valencia Port, 2025; Fundacion Valencia Port, 2025)	Flagship OPS project: first OPS installation and new substation under construction at Transversal de Costa–MSC quay, EU- and state-funded (Port of Valencia, 2023; Offshore	Port authority positions Valencia as a decarbonisation lab, prioritising electrification (OPS) and hydrogen pilots as core tools for clean shipping (Port of	OPS infrastructure funded by port authority and grid operators; exploratory partnerships with hydrogen and e-fuel developers aligned with EU funding programmes (CEF).

				Energy, 2026).	Valencia, 2026)	
7) Algeciras	Operational LNG and bio-LNG ship-to-ship bunkering for large container vessels (Axpo STS LNG and Spain's first STS bio-LNG operation) (Ship & Bunker, 2025)	Planned ship-to-ship methanol bunkering system under EU AFIF project, linked to green methanol production and storage in port. (Manifold Times, 2025)	Planned ammonia bunkering as part of the Andalusian Green Hydrogen Valley, with EU-funded ship-to-ship ammonia bunkering system (Manifold Times, 2025)	OPS under advanced development; it is a European reference port with most ferry and many container OPS connections installed or contracted (T&E, 2025)	Port Authority of the Bay of Algeciras integrates OPS and alternative fuels into its 2030 Energy and Climate Transition Strategy, leveraging its Strait gateway role. (MHBland, 2026)	Moeve (formerly Cepsa) coordinating EU-funded ammonia and methanol bunkering projects; Evos (green methanol/ammonia storage); (Moeve, 2024) Axpo (LNG/bio-LNG STS bunkering); (Port Technology, 2025) OPS co-developed with REE and terminal operators (El Estrecho, 2025)
8) Bremerhaven	LNG bunkering available since 2015 via existing bunker infrastructure for container ships and car carriers. (Port News, 2025)	Operational methanol bunkering framework with first pilot operation completed; ports declared 'methanol-ready' with local suppliers (Safety for Sea, 2025; Port News, 2025; Argus media, 2025)	**Not** announced apart from 'future fuels', where it announces mostly that it works on safety aspects.	OPS roll-out underway: five shore-power systems (two mobile, three fixed) being installed for container, cruise and RoRo terminals with substantial EU and federal co-funding. (Port News, 2025; BLG Logistics, 2026)	Port authority pursues a multi-fuel port strategy by 2030 and prioritises safe, regulated introduction of methanol, LNG and future fuels (Sustainable World ports, 2026).	Local methanol suppliers; LNG bunkering by existing operators; shore power investments coordinated by Bremenports with EU CEF and German federal co-funding (Seatrade Maritime, 2025; Port of Bremenhaven, 2026)

9) Barcelona	High-volume LNG and emerging bio-LNG bunkering hub, with 199 LNG bunkering operations (143,000 m^3) in 2023 and more than 500 LNG/bio-LNG operations in 2025 supported by the Haugesund Knutsen bunker barge. (Ship & Bunker, 2026; Bunkerindex, 2026)	Methanol bunkering not yet operational but under preparation: port plans a methanol bunkering pilot in 2026 and has an 8-year agreement to supply renewable methanol to cruise ships from 2029. (Manifold Times, 2026; Bunkerindex, 2025; Ship & Bunker, 2026)	Strategic hydrogen hub in development, with plans to produce around 100,000 t/year of sustainable fuels (biomethane and synthetic fuels) by 2030 and to deploy infrastructure for hydrogen derivatives such as ammonia and methanol, linked to H2MED and a future 'Hydrogen Ring' in the port. (Port of Barcelona, 2026)	Flagship OPS port: first OPS for container ships in the Mediterranean entered operation in 2024, followed by ferry OPS the same year, with cruise OPS scheduled by 2027 as part of the NEXIGEN programme. (Container News, 2025; cruisetermint, 2025 Saftey4sea, 2025; Sustainable World Ports, 2024)	Port authority leads an Energy Transition Plan targeting a 50% CO_2 reduction by 2030 and carbon neutrality by 2050, using large-scale OPS deployment, local renewables and sustainable fuel production to position Barcelona as a multi-fuel green energy node. (Port of Barcelona, 2025; Safety4sea, 2025)	Shell/Knutsen-Scale Gas (LNG/bio-LNG bunker barge Haugesund Knutsen), (Ship & Bunker, 2026) Balearia (LNG-fuelled ferries), Repsol & NCLH (biofuel and renewable methanol supply contract), (Bunkerindex, 2025) Plus public–private investment from the Port of Barcelona, Spanish government and EU funds under the NEXIGEN and Energy Transition Plan frameworks. (Container news, 2024)
10) HAROPA (Le Havre)	LNG-ready Ro-Ro terminal with certified 'LNG Ready Terminal' status and first ship-to-ship LNG bunkering operation completed for Ro-Ro vessel Lake Travis using TotalEnergies' Gas Agility bunker vessel. (Ship & Bunker, 2025; Port of Hapora, 2025)	Large-scale e-methanol production and logistics (Methavert project) under development in the industrial port area; methanol bunkering not yet operational(Advanced Biofuels USA, 2024; Hydrocarbon processing, 2024; Saftey4sea, 2024).	Green hydrogen and ammonia import and conversion facilities planned via an Air Products renewable hydrogen hub importing ammonia and reconverting it to hydrogen, but no dedicated	OPS already operational and expanding at cruise terminals, with three high-capacity shore-power berths being equipped under the RENAQ project to deliver zero-emission calls for large cruise ships. (Cruisemapper, 2025;	HAROPA Port focuses on electrification and LNG transition, using 'LNG Ready' terminal certification and cruise OPS investments to reduce emissions at berth while maintaining the port's role as a strategic	*TotalEnergies* (Cape Ann FSRU and Gas Agility LNG bunker vessel) (Ship & Bunker, 2025; TotalEnergies, 2023) *Qair* (Methavert e-methanol and hydrogen project on HAROPA site) (Advanced Biofuels USA, 2024; Hydrocarbon processing, 2024) *Air Products* (green

			bunkering service announced yet (Hydrogen Europe, 2024)	Cruise Europe, 2024; Port of Hapora, 2025)	energy hub. (Port of Hapora, 2025; Bunker Index, 2025; Cruise Europe, 2024)	hydrogen/ammonia import hub). (Hydrogen Europe, 2024)
Gdańsk	Operational truck-to-ship LNG bunkering at Obrońców Westerplatte Wharf using mobile solutions, with a preliminary plan for LNG bunkering and power-supply stations in the port. (Port Gdansk, 2026; Manifold Times, 2019)	Conditional readiness for methanol bunkering, with port stakeholders indicating they can apply existing truck-to-ship concepts to methanol once shipowners commit and demand emerges (Baltic Sea & Space Cluster, 2023)	**Not** announced	OPS limited but under preparation, supported by a 2023–2027 EU-funded study and investment plan that identifies Obrońców Westerplatte and Baltic Hub as priority locations for first shore-power installations (Baltic Sea & Space Cluster, 2023; Port Technology, 2023; Maritime Economy Forum, 2026)	Port authority follows a reactive, demand-led strategy, developing LNG and OPS infrastructure in line with EU requirements and signalling that methanol facilities will be built when shipowner demand justifies them. (Manifold Times, 2019; Port Gdansk, 2026; Baltic Sea & Space Cluster, 2023)	LNG bunkering services provided by *PGNiG group companies* and other *regional LNG suppliers* via truck-to-ship, with potential *methanol suppliers* expected to enter the market once shipowners choose methanol. (Seatrade Maritime, 2020; Baltic Sea & Space Cluster, 2023; Port Gdansk, 2026)
Marseille –Fos	Operational LNG (and bio-LNG-ready) ship-to-ship bunkering hub, with TotalEnergies'	**Not** yet operational; LNG is the current alternative marine fuel, with CMA CGM's LNG-fuelled,	**No** dedicated ammonia or hydrogen bunkering service announced.	OPS network expanding: shore-power connections already available for Corsica	Port authority pursues a strong LNG-transition and electrificati	TotalEnergies (Gas Vitality LNG bunker vessel and bio-LNG project with EveRé and Elengy) and CMA CGM

	Gas Vitality performing the first STS LNG bunkering of CMA CGM's 15,000 TEU LNG-powered containerships in Marseille–Fos, positioning the port as France's first LNG bunkering hub for Mediterranean shipping. (LubMarine, 2022; LNG Prime, 2022; Ship & Bunker, 2022; Port Technology, 2022)	'e-methane ready' fleet and a local bio-LNG project (EveRé–Elengy–TotalEnergies–CMA CGM) seen as a bridge towards future biomethane/e-methane and methanol solutions. (Storage Terminal, 2022)		ferries and being extended in phases to North Africa ferry berths, the repair hub and the cruise terminal, with the aim to supply all ferries and two cruise ships simultaneously. (Sustainable World Ports, 2019; Medcruise, 2021; Safety4sea, 2019)	on strategy, using LNG bunkering with Gas Vitality and a large OPS investment programme to cut emissions at berth and establish Marseille–Fos as a Mediterranean decarbonisation hub (CMA CGM, 2022; Sustainable World Ports, 2019; Medcruise, 2021)	(growing LNG-fuelled, 'e-methane ready' fleet supplied in Marseille–Fos) are the key private actors driving LNG/bio-LNG hub development and influencing future synthetic fuel uptake. (Ship & Bunker, 2022; CMA CGM, 2022; Storage Terminal, 2022)
Constanța	Planned LNG refuelling via small-scale LNG terminal and bunkering facility for barges and trucks in the port area, with designs for a 5,000 m³ LNG terminal and an LNG bunkering & modern barges/pushers facility at Constanța. (WKO, 2016; Constanta Port, 2017; Interreg, 2018)	**No** methanol or bio-methanol bunkering infrastructure publicly announced to date.	Hydrogen-related energy projects (e.g. a new gas-fired Palas power plant prepared to operate with green hydrogen blends) indicate emerging hydrogen use, but no dedicated hydrogen or ammonia bunkering facilities are yet announced. (Energynomics, 2025)	OPS contract signed for the EU-funded 'E-COLD' project, ensuring shore-side electrical connectivity for vessels in Constanța port under the CEF-financed cold-ironing programme. (Seenews, 2025; LinkedIn Post Port of Constanta, 2025)	Infrastructure investment in OPS and electricity distribution is strongly driven by EU funding, with the Maritime Ports Administration Constanța leading CEF-backed projects to modernise the grid and implement shore-power connection	OPS and grid upgrades co-funded by the Connecting Europe Facility and national funds, implemented by the Maritime Ports Administration Constanța together with contractors such as TIAB SA, alongside separate energy-sector investments near Constanța (e.g. Palas power plant with future hydrogen capability) (Container News, 2025; Energynomics, 2025)

					s. (LinkedIn Post Port of Constanta, 2025; Container News, 2025; Seenews, 2025)	
Amsterdam	LNG and low-carbon fuels available via the existing bunker market and permit system, within a multi-fuel strategy for emission-free shipping by 2050. (GoodFuels, 2016; Sustainable World Ports, 2025; Sustainable World Ports, 2023)	Operational/pilot methanol bunkering: in May 2025 the Port of Amsterdam completed its first ship-to-ship methanol bunkering, supplying 500 tonnes of ISCC-certified green methanol by Unibarge's bunker vessel Chicago to Van Oord's offshore installation vessel Boreas. (Ship & Bunker, 2025; Offshore Energy, 2025; Bioenergy International, 2025; LinkedIn Post Methanol Institute, 2025; Safety4sea, 2025)	Safety and permitting frameworks for new fuels under development, with the port introducing a bunker-permit system and dedicated work on safe distances and procedures for alternative fuels such as hydrogen, methanol and ammonia as part of its 'multi-fuel port' vision. (Sustainable World Ports, 2025; Sustainable World Ports, 2023)	OPS already widely available for inland and river-cruise vessels (around 71 installations with 205 plugs), with a 30 MVA sea-going cruise shore-power connection planned near Amsterdam Central Station and further OPS developments underway at IJmuiden, container terminals and other quays. (Sustainable Ships, 2025)	Port authority emphasises the safe introduction of new fuels, aiming for emission-free shipping in the port area by 2050 through a multi-fuel strategy, strict bunker-permit and safety-distance regimes, and parallel investments in OPS. (Sustainable World Ports, 2025; Sustainable World Ports, 2023; GoodFuels, 2016)	*Unibarge* (methanol bunker licences and Chicago bunker vessel in Amsterdam–Rotterdam–Antwerp), (Manifold Times, 2025) *VARO and other fuel suppliers* active in biofuels and methanol, with methanol bunkering operations facilitated under the port's bunker-permit regime. (Ship & Bunker, 2025)

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