Interreg North Sea

Co-funded by the European Union

North Sea Hydrogen Valley Ports

Output 1.1

Port of Den Helder Green Hydrogen Production and End-Use Strategy

DOCUMENT INFORMATION

Grant agreement number	
Project acronym	NSH2V Ports
Work package	WP 1
WP activity	Green Hydrogen Production Strategy & End-Use
Title of activity	
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Author(s)	

DOCUMENT HISTORY

version	date	description	reviewer
0.1		Initial outline	NEC
1.0		First draft	NEC
1.1		Final version ready for advisory board review	NEC

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Abbreviations

Table 1: Abbreviations

Acronym	Full Form
CTV	Crew Transfer Vessel
SOV	Service Operation Vessel
CSOV	Construction Service Operation Vessel
IRM	Inspection, Repair, and Maintenance
LH2	Liquid Hydrogen
MeOH	Methanol
O&M	Operations and Maintenance
OD NZKG	Omgevingsdienst Noordzeekanaalgebied
RED III	Renewable Energy Directive (recast)
CAPEX	Capital Expenditure
OPEX	Operational Expenditure

Executive Summary

This report presents a green hydrogen production and end-use strategy for the Port of Den Helder, developed within the framework of the North Sea Hydrogen Valley Ports (NSH2V Ports) programme. The analysis integrates a bottom-up quantitative demand forecast with a systematic qualitative assessment derived from structured stakeholder consultations, and situates these findings within the prevailing European and international regulatory landscape for maritime decarbonisation.

Seven principal themes emerged from the stakeholder analysis. Demand for hydrogen and hydrogen-derived fuels at Den Helder is anticipated rather than committed, with no binding offtake agreements currently in place. Fuel choice remains open and segment-specific: methanol emerges as the more scalable hydrogen-derived pathway for the majority of vessel segments, while direct hydrogen retains a credible but confined niche. Infrastructure and spatial constraints impose hard boundaries on what is achievable within the core port area. The absence of viable standalone business cases reflects multiple interacting barriers, including high production costs, insufficient demand volumes, grid congestion, and a mismatch between available public support instruments and the operational expenditure challenges that define the commercial gap. Permitting remains fragmented and unevenly understood, though it may not constitute the primary barrier. Stakeholders uniformly favour staged, pilot-led development. Finally, Den Helder is envisioned not as a self-sufficient local hydrogen market but as a coordinated node within a broader regional energy system.

The quantitative demand forecast projects that, under the base case, direct hydrogen demand would rise from 1.2 kt/y in 2030 to 3.8 kt/y by 2050, while hydrogen-derived methanol demand would grow from 15 kt/y to 70 kt/y over the same period. Offshore wind operations and maintenance emerges as the dominant demand growth engine across both fuel pathways. Even under the accelerated scenario, total direct hydrogen demand remains below 8.0 kt/y by 2050, confirming that the scale of opportunity at Den Helder lies primarily in methanol rather than in direct hydrogen bunkering.

The report recommends a three-phase infrastructure sequencing strategy. Phase 1 (2025–2030) focuses on foundation activities: truck-to-ship bunkering for hydrogen pilots, flexible methanol supply concepts, spatial reservation, and regulatory engagement, with no irreversible infrastructure commitments prior to the emergence of visible anchor demand. Phase 2 (2030–2040) introduces dedicated methanol handling and distribution as demand consolidates, with hydrogen infrastructure advanced contingent on anchor customer materialisation. Phase 3 (2040–2050) establishes permanent multi-fuel handling and storage nodes, integrated with offshore wind operations and maintenance spatial planning and regional hub coordination. Complementary policy actions are recommended, including public-sector fleet mandates, municipal zoning plan updates, sustainability weighting in public procurement, and regulatory measures to establish a level playing field for alternative fuels.

1. Introduction

1.1 Context and Purpose

The European Union's commitment to climate neutrality by 2050, as enshrined in the European Green Deal (European Commission, 2019) and reinforced through the REPowerEU Plan (European Commission, 2022), has positioned green hydrogen at the centre of the continent's energy transition strategy. The International Maritime Organization's revised greenhouse gas strategy similarly targets net-zero emissions from international shipping by or around 2050 (IMO, 2023), while the FuelEU Maritime Regulation establishes binding greenhouse gas intensity requirements for ships calling at EU ports (European Parliament and Council, 2023b). Ports, as critical nodes in the maritime transport and energy supply chain, are accordingly expected to play a pivotal role in the production, storage, distribution, and bunkering of hydrogen and hydrogen-derived fuels (World Bank, 2021; IRENA, 2022).

The North Sea Hydrogen Valley Ports (NSH2V Ports) programme, co-funded through the Interreg North Sea initiative (NSH2V Ports, 2023), supports participating ports in developing evidence-based strategies for this transition. The Port of Den Helder has been tasked, within this programme context, with developing a green hydrogen strategy.

The relevant strategic question is not whether the Port should engage with hydrogen; the policy and regulatory environment makes such engagement inevitable. The question is rather how the Port should allocate finite resources across multiple fuel pathways under conditions of persistent uncertainty regarding demand timing, technology maturity, and competitive positioning. This question acquires particular urgency in the Den Helder context for three reasons. First, the Port's spatial envelope is exceptionally constrained: it is compact, proximate to residential areas, and bounded by Natura 2000 protections (European Commission, 2000), flood defences, and environmental case law. Second, the Port's demand base is an offshore-centric ecosystem in which vessel classes, operating patterns, and fuel requirements differ materially from those of major container or tanker ports. Third, the Port faces imminent spatial competition: offshore wind O&M activity is projected to grow substantially and will require additional land, berths, and logistics capacity drawn from the same constrained pool that would serve any future fuel infrastructure.

1.2 Scope

The scope of this analysis encompasses maritime bunkering demand and port-adjacent operational fuel demand directly attributable to the Den Helder port ecosystem. Included segments are: offshore support vessels, offshore wind O&M vessels (CTVs, SOVs, CSOVs, and IRM vessels), tugs and port workboats, government and service vessels, dredging and sand extraction operations, and coasters and freight calling at Den Helder. The analysis excludes fishing (for which no material hydrogen potential was identified), the TESO passenger ferry (for which electrification is the established pathway), large installation vessels not receivable at Den Helder, and inland transport outside the port perimeter.

1.3 Methodology

This report employs a mixed-methods research design that integrates quantitative demand forecasting with systematic qualitative analysis. Structured consultations were conducted with key port stakeholders to ensure that the analysis reflects prevailing market conditions. The quantitative demand forecast was constructed bottom-up from port-specific logic rather than derived from assumed electrolyser capacity, consistent with the demand-led approach recommended in international hydrogen strategy guidance (IEA, 2023).

2. Findings from Stakeholder Analysis

This chapter presents the principal findings of the qualitative analysis. Each theme is presented together with its underlying evidence, stakeholder coverage, and the resulting strategic implication for the Port.

2.1 Theme 1: Demand is Anticipated, Not Committed

This constitutes the most pervasive finding in the qualitative evidence. The majority of stakeholders characterised hydrogen demand as expected, conditional, or aspirational rather than as a present commercial reality anchored in binding agreements. Demand is accordingly best characterised as being in a pre-commercial phase, with the timing and scale of its materialisation contingent on external variables not yet resolved.

Strategic Implication. *Demand cultivation is the gating condition for every subsequent infrastructure decision. The Port cannot afford to maintain a passive posture. Active identification and engagement of anchor customers must be treated as a primary strategic activity.*

2.2 Theme 2: Fuel Choice Remains Open and Segment-Specific

The stakeholder evidence does not converge on a single dominant fuel. Instead, it produces a segmented view: different vessel classes, operating profiles, and route lengths point towards different fuel pathways. Methanol and electrification appear as more practical or nearer-term solutions for a majority of identified segments, while hydrogen retains a plausible niche in specific applications (see Figure 1).

Strategic Implication. *Multi-fuel infrastructure readiness is the best approach. An exclusive commitment to any single fuel pathway introduces unacceptable strategic risk given the current state of market and regulatory development.*

2.3 Theme 3: Infrastructure and Space Determine Feasibility

Physical and network conditions are described by the stakeholders as structural determinants that define the outer boundary of what is achievable in Den Helder. Space scarcity, zoning restrictions, residential proximity, grid congestion, and hydrogen backbone dependency recur are the key challenges mentioned by stakeholders.

Strategic Implication. *Large-scale liquid or compressed hydrogen storage within the core port is not viable under current conditions. The Port should pursue offsite or edge-of-port storage concepts linked to flexible quayside transfer.*

2.4 Theme 4: Bankability Depends on Costs, Volume, Contracts, and Support

The absence of viable business cases is a recurring finding, but the stakeholder evidence reveals that this is not a monolithic problem. It is the product of multiple interacting factors: high CAPEX and

OPEX, insufficient demand volumes, absent long-term offtake commitments, and public support instruments that do not consistently match the commercial barrier they are intended to address.

> **Strategic Implication.** *No single de-risking instrument is sufficient. The bankability gap requires coordinated action across long-term contracts, risk-sharing partnerships, CAPEX and OPEX support, and tender design that assigns meaningful weight to emissions reduction.*

2.5 Theme 5: Permitting is Emerging and Unevenly Understood

Hydrogen and alternative-fuel permitting remains challenging for two reasons. The first is novelty: rules are incomplete, precedent is limited, and regulatory frameworks are evolving in real time. The second is coordination: responsibilities are distributed across government levels and agencies that do not necesarily align their requirements.

The permitting authority itself offers a distinctly different assessment, arguing that substantial knowledge has been accumulated and that licensing is not the principal constraint. This divergence is best understood as a difference in vantage point rather than a factual contradiction.

> **Strategic Implication.** *Permitting friction is substantive and unlikely to dissipate in the near term; Based on stakeholder reviews, it still constitute a major barrier. The Port and project developers should front-load regulatory engagement, support inter-authority coordination, and treat pilot projects as opportunities for permitting learning.*

2.6 Theme 6: Stakeholders Favour Staged Progress through Pilots

The preference for incremental development is the most uniformly held strategic view across the stakeholder base. Every stakeholder group—from the electrolyser developer to the permitting authority—articulates a version of the same principle: start with pilots, learn from real operations, build evidence, and scale only when that evidence justifies the commitment. This finding aligns with international best practice for hydrogen infrastructure deployment, which consistently emphasises demonstration projects and phased scale-up (World Bank, 2021; IRENA, 2022).

> **Strategic Implication.** *The evidence strongly favours a pilot-first strategy. However, staged progress must be purposeful rather than passive. Each pilot should be designed to generate learning, establish customer relationships, and produce the evidence required to trigger subsequent investment gates.*

2.7 Theme 7: Den Helder is Envisioned as a Coordinated Hub

The majority of stakeholders conceptualise Den Helder's future not as a self-sufficient local hydrogen market but as a node in a broader regional system. They made references to offshore wind production links, inland industrial connections, airport synergies, backbone export functions, and integrated energy systems.

Strategic Implication. *Den Helder's viability as a hydrogen and methanol location depends on its connections to the backbone, to regional demand centres, to offshore wind production, and to institutional partners. A purely local demand strategy is insufficient. The Port's planning must be embedded within regional and national system coordination.*

3. Fuel Pathway Assessment

The fuel pathway assessment integrates technical feasibility evidence from the studies already conducted by the Port of Den Helder (Royal HaskoningDHV, 2024a; Royal HaskoningDHV, 2024b) with the operational preferences expressed by stakeholders. The convergence between these two evidence streams is notable: both identify methanol as the more scalable hydrogen-derived pathway for the Den Helder vessel base, while assigning direct hydrogen a role that is credible but confined to specific niches. This finding is consistent with broader maritime fuel pathway assessments, including those by DNV (2023) and IRENA (2022), which identify methanol as one of the most commercially ready alternative marine fuels. Figure 1 presents the fuel pathway suitability mapping by vessel segment.

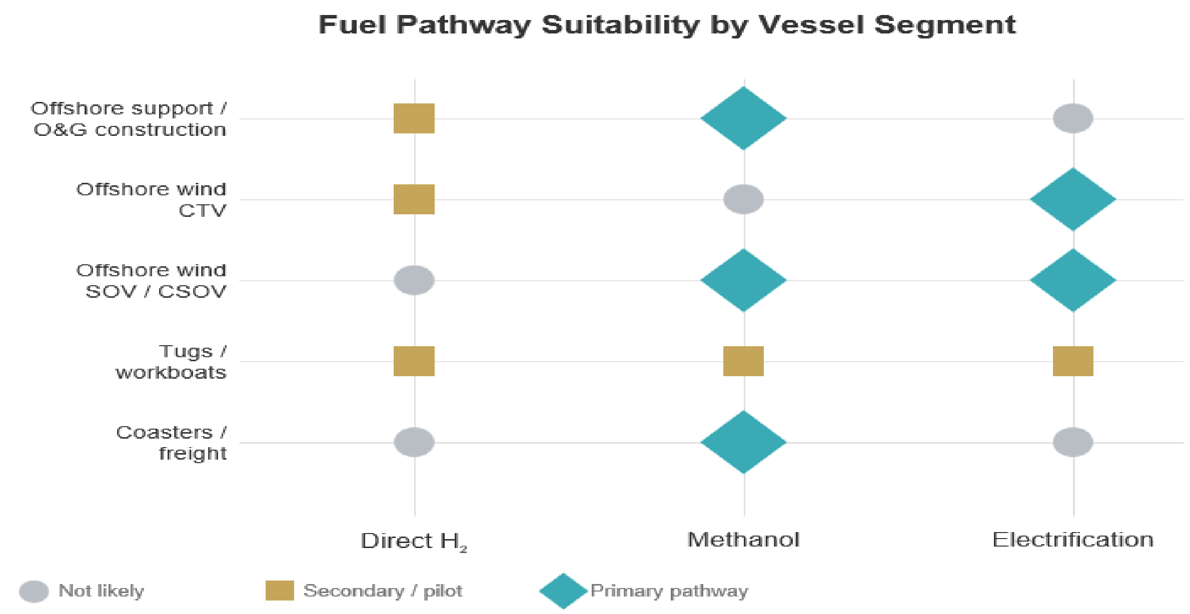

Figure 1: *Fuel Pathway Suitability by Vessel Segment Serving the Den Helder Port Ecosystem. Each combination of vessel type and fuel pathway is classified as a primary pathway (diamond), secondary or pilot pathway (square), or not likely (circle). Methanol emerges as the primary pathway across the widest range of vessel segments, while electrification is primary for short-range CTVs.*

Key Finding. *The evidence supports a clear positioning: methanol-ready and hydrogen-flexible. This is the strategy that emerges from the intersection of technical feasibility, stakeholder preference, and spatial reality.*

4. Quantitative Demand Forecast

4.1 Scenario Architecture

The quantitative forecast was constructed bottom-up from port-specific logic rather than derived from assumed electrolyser capacity. Table 2 presents the scenario architecture.

Table 2: Scenario Architecture

Variable	Conservative	Base Case	Accelerated
Anchor customers by 2030	One pilot user	1–2 credible adopters	Multiple anchor adopters
H2 uptake pattern	Niche pilots only	Selected offshore vessels	Broader minority fuel
Methanol uptake	Moderate adoption	Main scale pathway	Dominant maritime pathway
Infrastructure by 2030	Mobile and flexible only	Mobile plus initial dedicated	Early semi-permanent node
Policy and subsidy support	Limited	Targeted support	Stronger de-risking regime

4.2 Demand Outlook by Scenario

Figures 5 and 6 present the demand projections for direct hydrogen and hydrogen-derived methanol respectively across the three scenarios and planning horizons. The hydrogen demand range is intentionally narrower than the methanol range, reflecting the technology readiness gap for hydrogen bunkering and onboard storage and the absence of committed anchor demand. Table 3 consolidates the numerical projections.

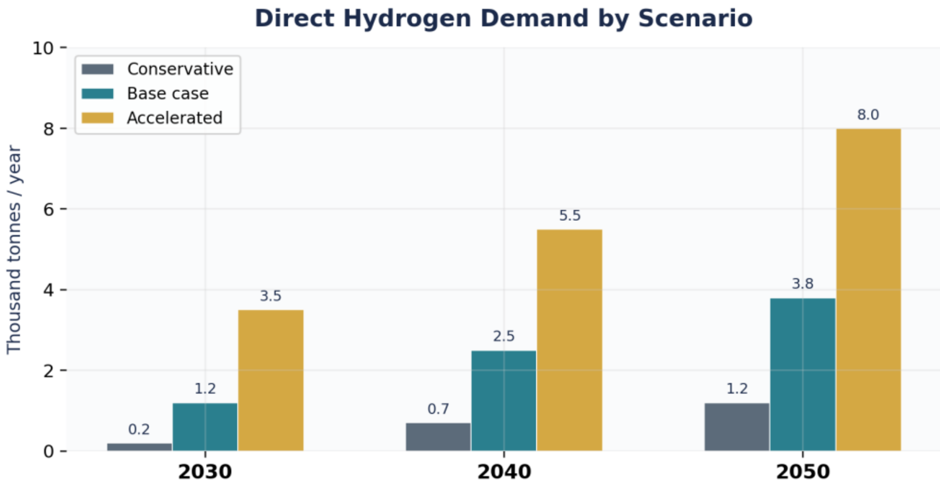

Figure 2: *Direct Hydrogen Demand Range by Scenario (kt/y). Under the base case, direct hydrogen demand rises from 1.2 kt/y in 2030 to 2.5 kt/y by 2040 and 3.8 kt/y by 2050. Even under the accelerated scenario, total hydrogen demand remains below 8.0 kt/y by 2050, reflecting persistent technology and demand constraints.*

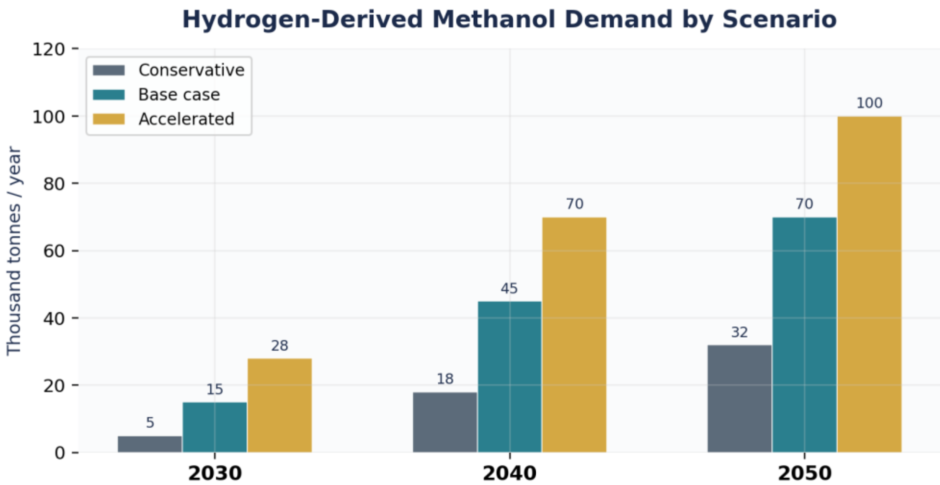

Figure 3: *Hydrogen-Derived Methanol Demand Range by Scenario (kt/y). Methanol demand substantially exceeds hydrogen demand across all scenarios. Under the base case, methanol demand reaches 15 kt/y by 2030, 45 kt/y by 2040, and 70 kt/y by 2050, confirming methanol's role as the primary scale pathway.*

Table 3: Total Annual Demand by Scenario (kt/y)

Horizon	Cons. H2	Base H2	Accel. H2	Cons. MeOH	Base MeOH	Accel. MeOH
2030	0.2	1.2	3.5	5	15	28
2040	0.7	2.5	5.5	18	45	70
2050	1.2	3.8	8.0	32	70	100

4.3 Segment-Level Composition and Bunkering Translation

Figure 4 decomposes the base-case demand by vessel segment. Offshore wind O&M emerges as the dominant growth engine across both fuel pathways. In the base case, wind O&M methanol demand rises from 3.5 kt/y in 2030 to 33 kt/y by 2050, overtaking traditional offshore support as the single largest demand segment. This trajectory is consistent with the substantial expansion of North Sea offshore wind capacity anticipated over the coming decades (Royal HaskoningDHV, 2024b).

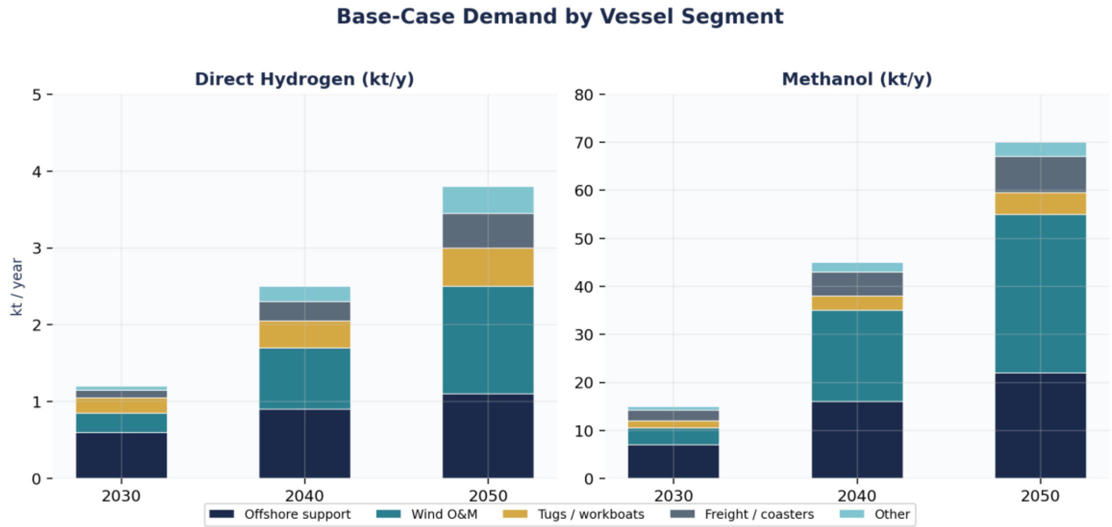

Figure 4: *Base-Case Demand Decomposition by Vessel Segment. The stacked charts present both direct hydrogen (left panel) and methanol demand (right panel) disaggregated by vessel category. Offshore wind O&M (teal) progressively dominates both fuel pathways through 2050, highlighting the strategic importance of integrating fuel and wind O&M planning.*

Table 4 translates demand volumes into operational bunkering parameters to inform infrastructure sizing.

Table 4: Bunkering Demand Translation

Horizon	H2 Volume	H2 Events/y	MeOH Volume	MeOH Events/y	MeOH Buffer (t)
2030	1.2 kt/y	~200	15 kt/y	~125	250–600
2040	2.5 kt/y	~250	45 kt/y	~250	700–1,700
2050	3.8 kt/y	~270	70 kt/y	~280	1,500–3,500

Governing Principle. *Early infrastructure must remain modular and reversible. Permanent commitments should follow demonstrated demand, not precede it. This sequencing is consistent with the unanimous stakeholder preference for staged progress and with international best practice on hydrogen infrastructure phasing (IEA, 2023; IRENA, 2022).*

5. Barriers and Enablers

The market environment for hydrogen and derivative fuels at Den Helder is characterised by a set of barriers that currently outweigh the available enabling conditions. This imbalance is characteristic of a pre-commercial market in which the requisite technologies exist but the commercial conditions for their deployment have not yet been established. Table 5 identifies the nine principal constraints and their specific implications for the development of hydrogen and methanol infrastructure at the Port of Den Helder.

Table 5: Principal Constraints on Hydrogen and its Derivatives at the Port of Den Helder

Constraint	Implications for Den Helder
Absent bankable demand	No vessel operator, fleet owner at Den Helder has committed to hydrogen purchase volumes sufficient to underwrite dedicated production or bunkering infrastructure. The supply chain, spanning electrolysis, storage, and ship-side delivery, remains commercially underdeveloped at the port.
No viable standalone business case	At current green hydrogen production costs (approximately €6 per kilogram in Northwest Europe, compared with €1 to €2 per kilogram equivalent for marine diesel), projects at this port cannot achieve commercial viability without public subsidy. The cost gap is too wide for market forces alone to close within the 2025–2035 horizon.
Electrical grid congestion	The regional electricity grid serving the Den Helder area is at capacity. This constrains both electrolysis operations (which require large volumes of renewable electricity to split water into hydrogen and oxygen) and shore-power expansion for docked vessels.
Logistics bottleneck before backbone	Hydrogen delivered by road in tube trailers is economically unviable at industrial volumes due to low per-truck payload. The long-term solution is connection to the Netherlands' planned national hydrogen backbone, a network of repurposed natural gas pipelines, but the construction timeline and routing to Den Helder have not been confirmed by the national government.
OPEX support mismatch	Existing Dutch and EU public support instruments predominantly fund capital expenditure (equipment, construction). However, one of the key commercial challenges in the value chain is operational expenditure: the ongoing cost of producing, transporting, and dispensing green fuel, and the running costs for vessel operators using it. Without OPEX support, infrastructure may be constructed but remain economically unviable to operate.
Absence of long-term offtake contracts	No vessel operator, charterer, or fuel buyer at Den Helder has signed the five-to-ten-year fuel purchase contracts that infrastructure investors require for revenue certainty. Without such contracts, project finance structures, in which lenders rely on predictable cash flows, cannot close.
Technology immaturity in maritime hydrogen	Hydrogen fuel-cell vessels have been piloted by some of the key stakeholders, but early operational experience has revealed integration challenges, technical faults, and reliability concerns. Hydrogen propulsion

	for maritime applications has not yet reached the level of routine commercial maturity required for fleet-wide adoption.
Permitting fragmentation	Regulatory approval for hydrogen and methanol projects are still evolving. Processing times for hydrogen bunkering permits currently extend to months, compared to days for conventional fuel permits.
No mandatory Scope 3 emissions requirements	Clients who charter vessels that use Den Helder as their base are not yet required to account for the emissions of their chartered vessels (known as Scope 3 emissions). Without such requirements, charterers have no commercial incentive to pay the premium for green fuel, and vessel operators face no customer pressure to switch.

Against these barriers, several conditions either exist or could be established through deliberate policy intervention. These conditions are presented below. Table 6 identifies enabling conditions: factors that are already present or could be activated within the current institutional and market framework.

Table 6: Enabling Conditions

Enabling Condition	Contribution to Development
Incremental development pathway	The supply chain need not be constructed in a single phase. Den Helder can begin with a single vessel user and mobile refuelling equipment, then scale to semi-permanent and permanent infrastructure as demand develops. Each stage generates operational learning and reduces the risk of subsequent investment.
Targeted pricing instruments can bridge the green premium	Instruments such as contracts for difference (whereby a public entity covers the differential between the green fuel price and the fossil fuel price) or operational subsidies can make hydrogen or methanol commercially attractive to vessel operators at Den Helder. Several operators have indicated willingness to switch fuels if the price gap were narrowed through such support.
Proven provincial subsidy model	Provincie Noord-Holland already operates a subsidy scheme that covers 50 per cent of the cost of adapting vessels for shore-power connection. This model is administratively established and directly replicable for alternative fuel transition support, for example by subsidising vessel engine conversion to methanol dual-fuel capability.
Closed local energy systems as grid bypass	Implementation of a battery energy storage system (BESS) offers a partial response to grid congestion. Such closed-loop systems bypass the congested regional grid, offering a partial but immediately available response to the electricity supply constraint.

6. Conclusions and Recommendations

6.1 Conclusions

The evidence assembled in this report supports the following principal conclusions regarding the prospects for green hydrogen and hydrogen-derived fuels at the Port of Den Helder.

First, hydrogen demand at Den Helder is real in prospect but pre-commercial in character. No binding offtake agreements exist, and the timing and scale of demand materialisation remain contingent on external variables that have not yet been resolved.

Second, methanol, rather than direct hydrogen, emerges as the primary scale pathway for maritime decarbonisation at this port. The fuel pathway assessment, corroborated by both technical feasibility evidence and stakeholder preferences, identifies methanol as the more scalable hydrogen-derived fuel across the widest range of vessel segments. Direct hydrogen retains a credible but confined role in specific niche applications. The appropriate strategic posture is therefore methanol-ready and hydrogen-flexible.

Third, the barriers to development are structural, multiple, and mutually reinforcing. The absence of bankable demand, high production costs, electrical grid congestion, logistics constraints pending hydrogen backbone connection, mismatched public support instruments, permitting fragmentation, and the absence of mandatory Scope 3 emissions requirements collectively constitute a barrier environment that no single intervention can overcome. Coordinated action across demand stimulation, financial de-risking, regulatory reform, and infrastructure planning is required.

Fourth, the spatial constraints specific to Den Helder preclude large-scale on-site hydrogen storage and production within the core port area. Offsite or edge-of-port storage concepts linked to flexible quayside transfer represent the more credible infrastructure pathway.

Fifth, offshore wind operations and maintenance constitutes the dominant demand growth engine for both hydrogen and methanol at Den Helder. Under the base case, wind operations and maintenance methanol demand rises from 3.5 kt/y in 2030 to 33 kt/y by 2050. Strategic integration of fuel infrastructure planning with offshore wind operations and maintenance spatial planning is therefore essential.

Finally, Den Helder's viability as a hydrogen and alternative fuel location depends not on local demand alone but on its integration within the broader regional and national energy system, including connections to the hydrogen backbone, regional demand centres, and offshore wind production.

6.2 Strategic Recommendations

6.2.1 Infrastructure Sequencing

Figure 5 presents the recommended three-phase infrastructure sequencing that responds to these constraints.

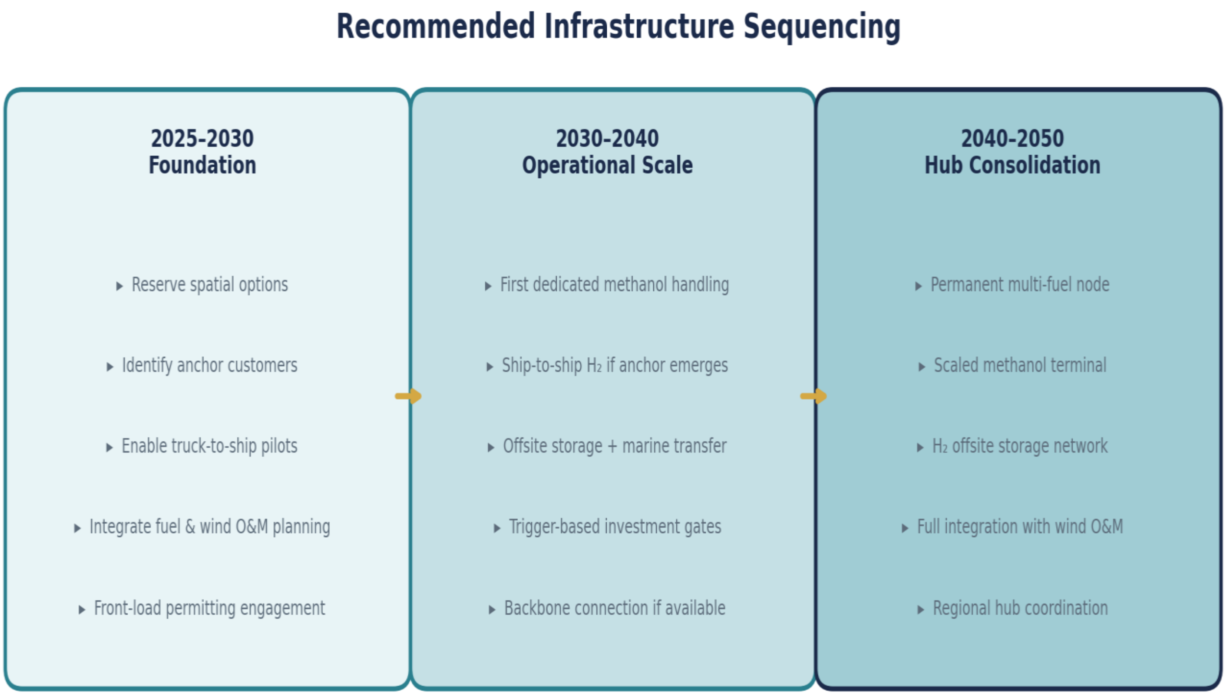

Figure 5: *Recommended Three-Phase Infrastructure Sequencing.*

Phase 1 (Foundation, 2025–2030) deploys truck-to-ship bunkering for hydrogen pilots and flexible methanol supply concepts. No irreversible infrastructure commitments are made prior to the emergence of visible anchor demand. Priority is accorded to spatial reservation and regulatory engagement.

Phase 2 (Operational Scale, 2030–2040) introduces dedicated methanol handling and barge- or terminal-linked distribution as methanol demand consolidates. For hydrogen, ship-to-ship or offsite-storage-plus-marine-transfer concepts are advanced contingent on anchor customer materialisation. Trigger-based investment decision gates govern all commitments.

Phase 3 (Hub Consolidation, 2040–2050) establishes permanent multi-fuel handling and storage nodes. Offsite hydrogen storage connected to marine transfer is assessed as more credible than a large fixed cryogenic core-port facility. Full integration with offshore wind O&M spatial planning and regional hub coordination is achieved.

6.2.2 Five No-Regret Actions

The following actions are classified as no-regret because they generate value under all three demand scenarios, do not foreclose future options, and address constraints that will intensify regardless of which fuel pathway ultimately prevails.

No-Regret Action	Rationale	What Should Wait
Reserve spatial options for bunkering and offsite storage	Space is the binding constraint, confirmed by eight of ten stakeholders.	Large fuel-specific fixed infrastructure within the core port area.
Identify and cultivate anchor customers	Demand certainty is the gating condition. Nine of ten stakeholders describe demand as uncommitted.	Terminal-scale investment prior to anchor demand materialisation.
Enable flexible multi-fuel pilot bunkering	Generates operational learning, permitting experience, customer relationships, and technical validation.	Exclusive commitment to any single fuel pathway.
Integrate fuel planning with wind O&M spatial planning	Both functions draw on the same constrained spatial resource.	Separate, siloed development tracks.
Develop trigger-based decision gates	Prevents both premature overbuilding and reactive under-investment.	Committing capital absent demonstrated demand.

6.2.3 Scale-Up Triggers

The following conditions should govern the transition from the foundation phase to operational-scale infrastructure. These are formulated as observable, verifiable conditions rather than aspirational targets:

- One or more anchor customers with recurring bunkering demand, confirmed through binding agreements or substantive letters of intent.
- Direct hydrogen demand exceeding approximately 2 kt/y, or methanol demand exceeding approximately 30 kt/y, evidenced by actual throughput or contractual commitment.
- A validated offsite-storage-plus-marine-transfer concept demonstrated not to crowd out offshore wind operations and maintenance functions.
- National hydrogen backbone reaching operational status, or a firm and funded government timeline commitment for the Den Helder connection.
- Permitting pathway established for alternative-fuel bunkering operations with processing times under 30 days.

6.2.3 Demand Cultivation Strategy

The research identifies demand cultivation as the single most critical near-term activity. The recommended demand cultivation strategy comprises five elements:

- Public-sector fleet conversion through targeted procurement criteria;
- Offshore wind operations and maintenance partnerships with service operation vessel operators

- Methanol-first sequencing to generate early revenue and operational experience
- Risk-sharing contracts to facilitate bankability; and
- Advocacy for operational expenditure-inclusive support frameworks aligned with the demonstrated commercial barriers.

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