Hinicio Covalent IQ

WELCOME

FuelEU Maritime:

What does compliance really cost?

The cost behind fuel choices

We'll be starting shortly

Agenda

10 min — **Opening Remarks**
Hans Kulenkampff, CEO – Hinicio
Stanislavs Sabitovs, Founder & Managing Director – *CovalentIQ*

10 min — **Context: Enablers for Low-Carbon Shipping / FuelEU Maritime**
Flavien Lescanne, Policy & Regulation Vertical Leader – *Hinicio*

10 min — **Showcasing the LCOF and the FuelEU Planner Tools**
Stanislavs Sabitovs, Founder & Managing Director – *CovalentIQ*
Pilar Henríquez, Manager & Transport Leader – Hinicio

15 min — **Case 1: Transatlantic Liner Route, from Bunker Choice to Fuel EUMaritime Compliance Value**
Stanislavs Sabitovs, Founder & Managing Director – *CovalentIQ*

15 min — **Case 2: Bunkering the Regulated Routes to Capture FuelEU Maritime Value**
Pilar Henríquez, Manager & Transport Leader – *Hinicio*

5 min — **Closing**

Speakers

Hans Kulenkampff
CEO
Hinicio

Pilar Henríquez
Manager & Transport Leader
Hinicio

Stanislavs Sabitovs
Founder & Managing Director
CovalentIQ

Flavien Lescanne
Policy & Regulation Vertical Leader
Hinicio

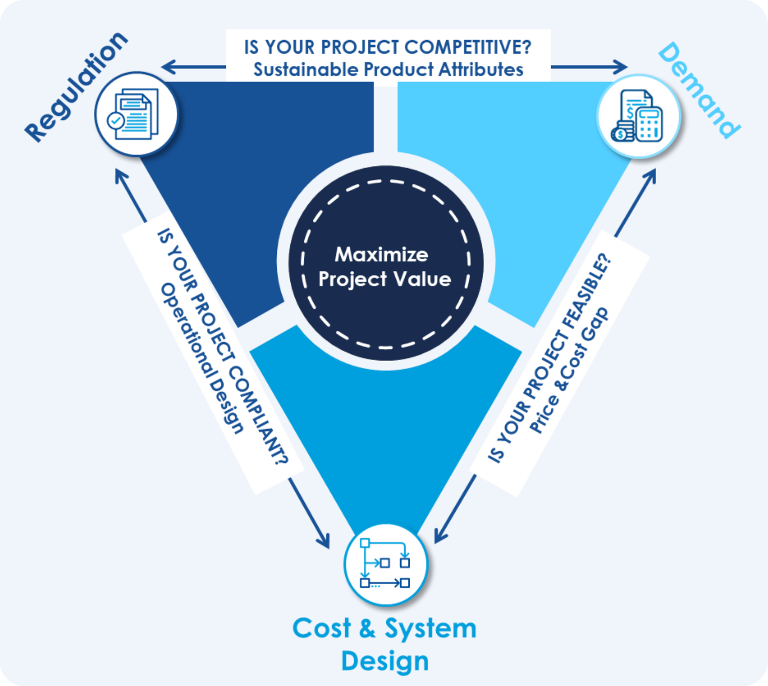
Nuria Hartmann
Manager
Moderator
Hinicio

Hinicio

Unified by purpose, driven by expertise

We decarbonize the hardest to abate sectors, now!

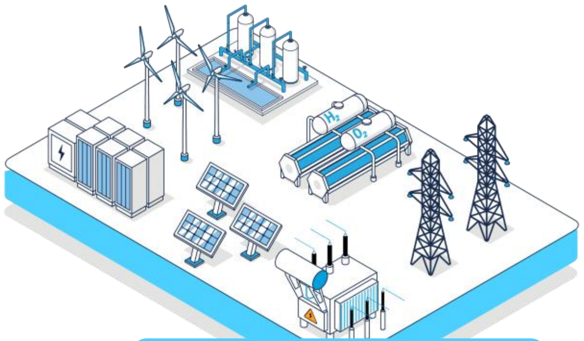
Our purpose: decarbonizing the hardest to abate sectors, now!



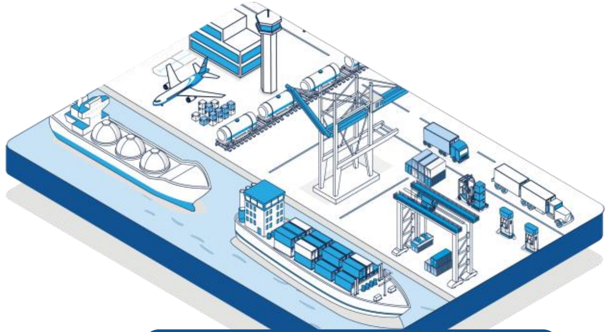
Consulting firm specialized in the **decarbonization challenges of hard-to-abate sectors** with ~20 years experience in hydrogen and its derivatives.

We help you with the following type of questions:

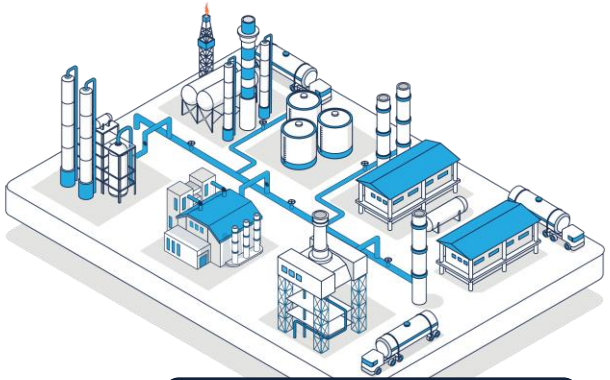
- How could **upcoming regulations (FuelEUM, ETS, IMO)** impact your **shipping operations and fuel choices**?
- Are your fuel choices fully aligned with the latest **compliance requirements**?
- What is the true **willingness to pay to avoid compliance costs?**
- What are the best **addressable** (regulated or voluntary) **markets** for your alternative fuels?
- How can **fuel producers optimize plant design** and scale based on anchor demand from shipping corridors?
- Can your plant produce **different products** from the same molecule to access multiple **premium markets**?



Integrated Energy Systems



Transport & Mobility



Process Industries

COVALENT IQ

Strategic insight for the chemicals value chain

We help the chemicals value chain answer their most critical questions

FEEDSTOCK & CARBON PATHWAYS

- Bio-based
- Hydrogen
- CO_2 capture
- Recycling

Primary feedstocks — **Base commodities** — **Specialty products** — **Distribution** — **Applications**

- Electrification
- Digital & AI
- Supply-chain security
- Regulatory

EXTERNAL FORCES ONTO THE VALUE CHAIN

Primary Research

- Executive expert interviews
- B2B surveys
- VoC & customer needs
- R&D
- Go-to-market
- Due diligence

Analytics & Modeling

- Market sizing
- Cost modeling
- Carbon abatement
- Valuation & financial modeling
- Project finance

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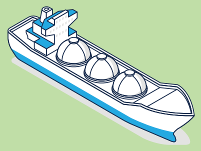
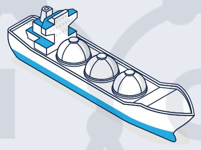
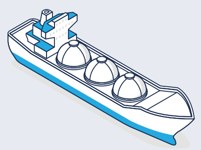
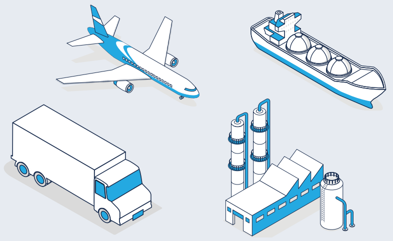
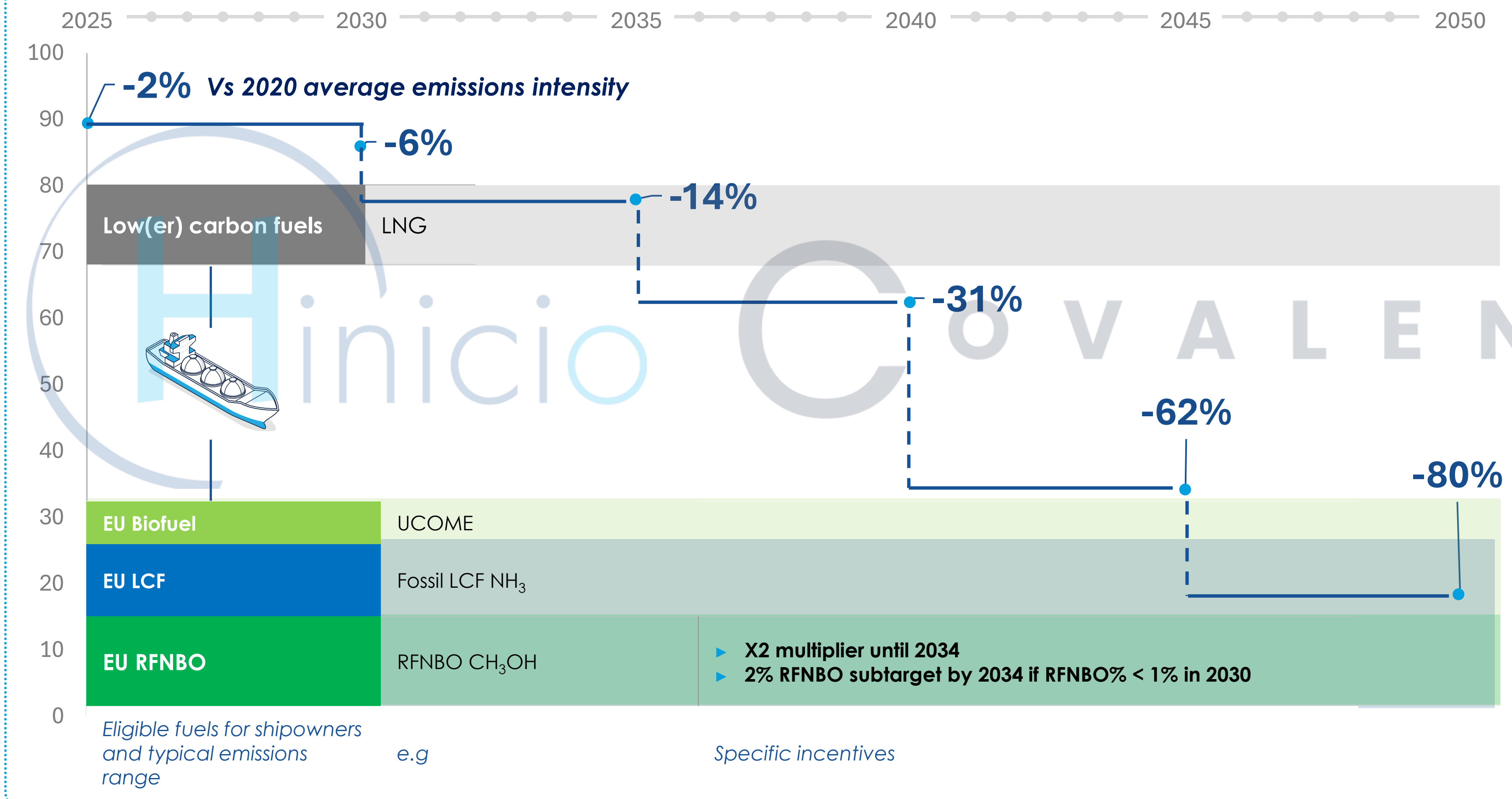
Context:
Enablers for low-carbon shipping / FuelEU Maritime

Maritime energy transition is becoming a compliance-cost problem, with Europe providing the regulatory signal to unlock low-carbon and RFNBO-based fuels

	Key features	Drivers for low-carbon fuels in shipping	Directly impacted parties
FuelEU Maritime	Obligation set on ship owners operating from/to/within the EU to cut by 80% their emissions in 2050	• Strong incentives for GHG abating fuels, and boosts the competitiveness of RFNBO until 2034 via a 2x multiplier on its abatement potential • Only EU regulatory framework enabling value for RFNBO & LCF in the country of production without mandatory delivery to the EU	
EU – Emissions Trading System (ETS)	Cap and Trade of emission allowances initially designed for the industrial sector recently expanded to shipping operations in the EU	Specific treatment for RFNBO and low-carbon fuels allowing for 0 ETS emissions and limiting costs of shipping	
IMO Net Zero Framework *Still not in force*	Global framework that will unlock low carbon Alternative Fuels following same basic principles as FuelEU Maritime	Strong signal for low-carbon emissions fuel applied to a much wider market	
Renewable Energy Directive (RED) – Transport & Industry	Binding targets Renewable Energy share in the EU economy along with specific RFNBO targets in transport and industry requiring -70% GHG emissions compared to fossil on well to grave i.e. including shipping	Shipping form integral part of RFNBO GHG emissions, represent one of the bigger contributors for imported molecules and directly impacts molecules market value -> **Less shipping emissions through renewable & low-carbon fuels/ More RFNBO molecule value**	

FuelEU Maritime obliges shipowners operating within/from/towards the EU to cut by 80% the emissions intensity of their onboard energy use

Well-to-Wake (WtW) FuelEU Maritime reduction target for emissions intensity of energy used on board
(in gCO_2e/MJ)



Vessels targeted:

Shipowners

- All **ships above 5,000 gross tonnage** (excluding military, fishing and governmental ships)

Scope:

100%
- Energy used on–board for **intra-EU shipping and at berth**

50%
- Energy used on–board for **shipping from/to an EU port**

Penalty:

2400 EUR/t_{VLSFO}

- If GHG intensity is higher than the threshold.
- Direct compliance cost

Surplus:

Market

- Can be sold to other operators or banked for future use

All together, FuelEU Maritime provides incentives for low-carbon shipping fuel business cases.

Source: Hinicio based on FuelEU Maritime regulation

FuelEU Maritime opens flexibility for shipowners to cope with their obligation leading to further compliance optimization options

TYPICAL FUELEU MARITIME COMPLIANCE TIMELINE

1st Jan Y N+1	31st Jan	31st Mar	30th Apr	30th Jun
FuelEU reporting for year N	Reporting verification	Banking/ Borrowing/Pooling	Compliance settlement	

Banking/Borrowing/Pooling:

- Shipowners with excess credit may decide to bank credits to be used later
- Shipowners can sell excess credit / buy missing credit on the market
- Shipowners borrow credits that come with a 10% interest rate
- Shipowners can decide to pool vessels to create compliant pools

Compliance settlement:

- Compliant shipowners are freed from their obligation for year N
- Non-compliant shipowners pay penalty for year N and face an extra 10% penalty for year N+1

Source: Hinicio based on FuelEU Maritime regulation

Insights

- FuelEU Maritime provides flexibility mechanism that allow shipowners to resolve their potential non-compliance issues before having to pay the penalty.
- This opens further optimization dimensions for shipowners to develop the best compliance strategy and entails potential partnerships with other companies.
- As a last resort option, non-compliant shipowners must pay their penalty and increase next non-compliant years potential penalties.

Shipowners face many challenges and compliance options driving the needs for practical solutions taking into account operational constraints

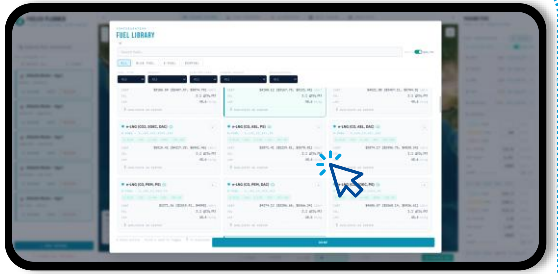
1 Perimeter of the obligation

What voyages shall be covered?

How does that translate into overall covered energy consumption?

What is then the overall emissions reduction that must be reached over time?

2 Compliance options

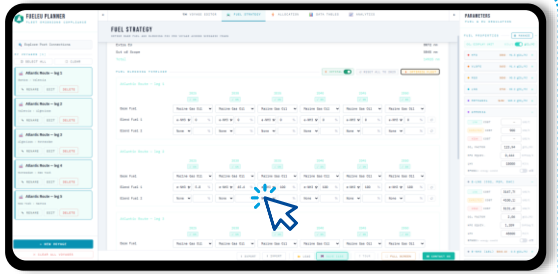


What eligible fuels?

What associated benefits?

What resulting quantities are needed taking into account specific incentives and multipliers?

3 Practical feasibility



What availability for these fuels on said routes?

What availability for required port & bunkering infrastructure?

What specific compliance requirements for these fuels?

4 Economic optimization & solving

What costs for these fuels?

What are buying risks & opportunities (long term vs spot, …)

What are potential costs and revenues linked to buying/selling credits or borrowing ones?

What opportunities for pooling?

Need for practical route-based decision support tools

Source: Hinicio based on FuelEU Maritime regulation

Showcasing the LCOF and the FuelEU Planner tools

The CovalentIQ LCOF Model open Excel-based model that calculates levelized cost and carbon abatement of marine fuels for 70 different alternative fuel pathways

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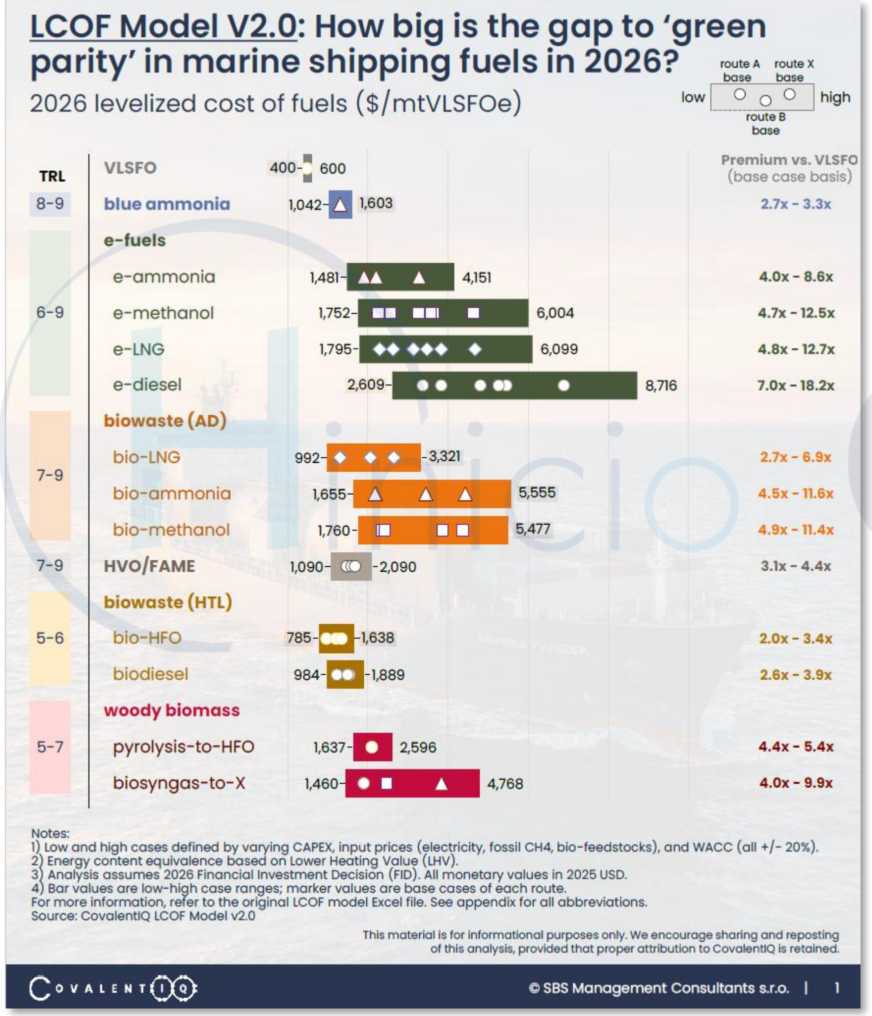
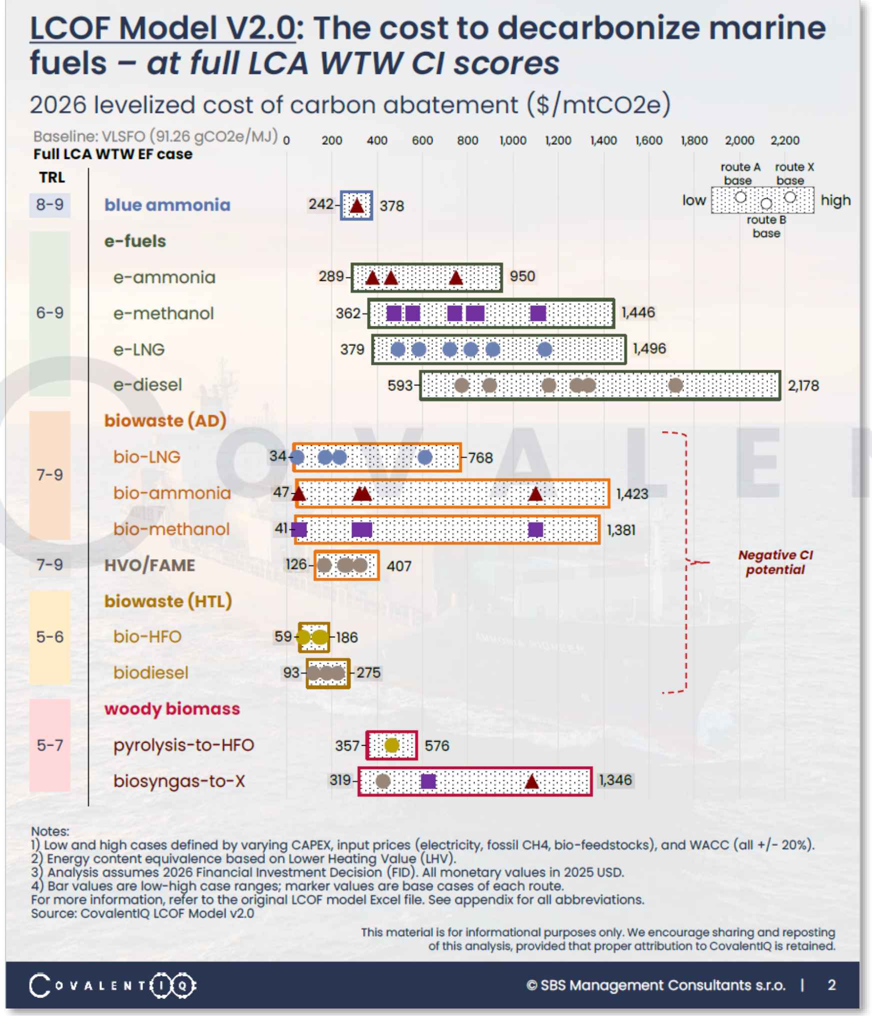




- Calculates the **levelized cost of fuel (LCOF)** for **~70 alternative marine fuel pathways** — e-fuels, blue fuels and biofuels
- Builds each fuel **bottom-up across the full value chain**: feedstock → intermediate → finished fuel (e.g. electrolytic H2 + captured CO2 → e-methanol)
- Quantifies **well-to-wake CO2e** emissions and **carbon intensity** for every pathway
- Translates emissions into **carbon abatement cost** ($/mtCO2e)
- Captures **CAPEX (annualized via WACC/CRF), OPEX, electricity, feedstock, and other** costs, benchmarked vs. fossil **VLSFO, MGO, HFO and LNG**
- Runs **Low / Base / High scenarios for the key cost & operating parameter inputs**

Every pathway is modelled bottom-up: from primary input to finished marine fuel

CovalentIQ Levelized Cost of Fuels Model V2.0 – Pathway taxonomy

	BLUE FUELS	E-FUELS	BIOFUELS
PRIMARY INPUTS & FEEDSTOCKS	Natural gas (CH_4) Air → N_2 (ASU)	Renewable electricity Captured CO_2 (PS / DAC) Water	Manure · sewage sludge MSW · agri-residues Wood · algae · veg. oil
CONVERSION	ATR + CCS Haber–Bosch synthesis	Electrolysis: AEL · PEM · SOEC RWGS · FT · synthesis	AD · gasification Pyrolysis · HTL · SMR
INTERMEDIATES	**blue H_2**	**e-H_2 · CO · e-CH_4**	**biogas · bio-CH_4 · bio-H_2 biosyngas · biocrude · bio-oil**
FINISHED MARINE FUELS	**blue ammonia (NH_3)**	**e-LNG e-ammonia e-methanol e-diesel**	**bio-LNG · bio-HFO biodiesel / HVO / FAME bio-ammonia · bio-methanol**

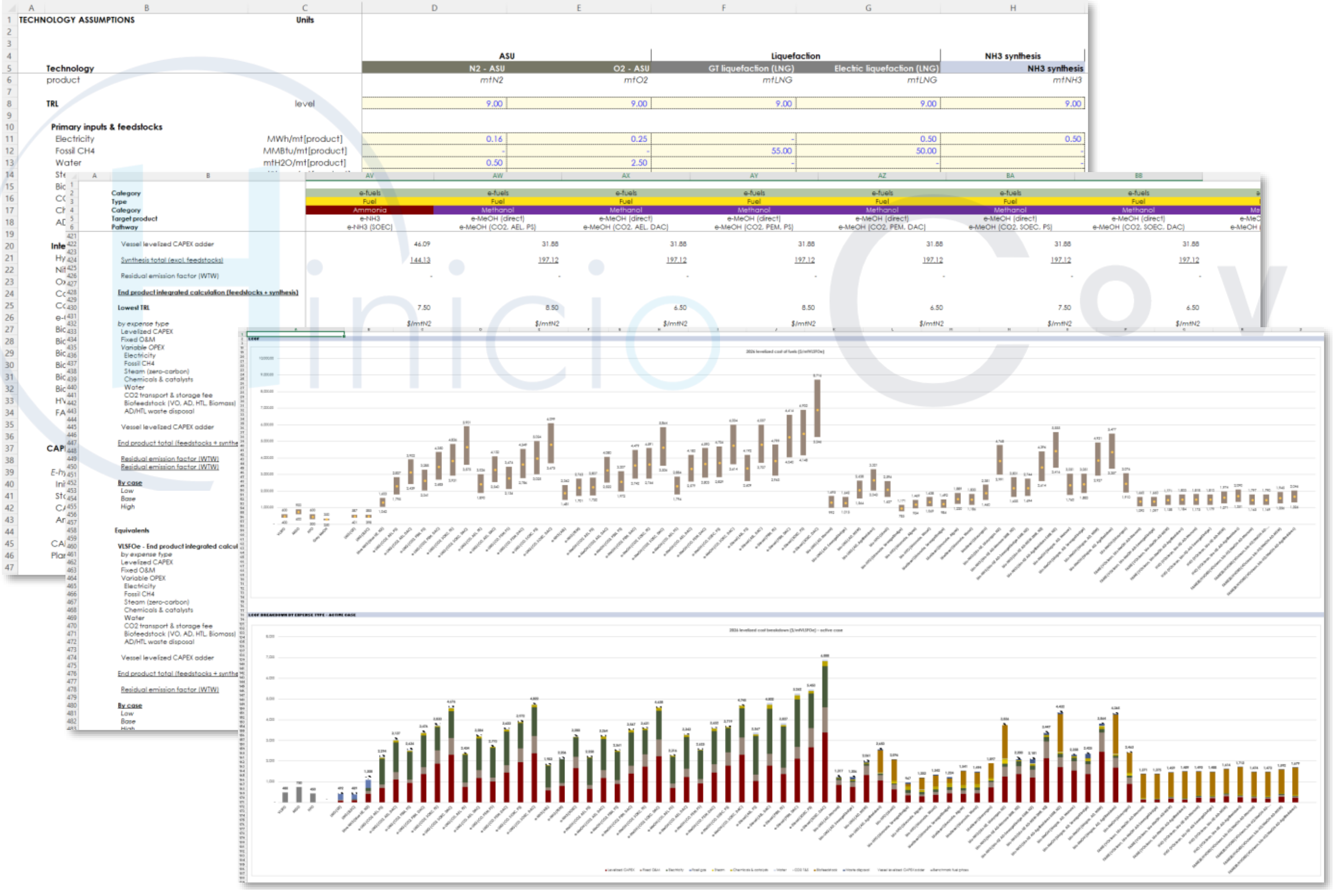
70+ pathways, each costed (LCOF) and carbon-scored (WTW / TTW CO_2e). Source: CovalentIQ 2026 LCOF Model

The modular structure of the LCOF model allows for combining various feedstocks and processes, as technically feasible, resulting in >70 potential marine fuel pathways

A fully open Excel-based model file for your use

Participants of this webinar can access the model along with the report via following link:

- Download the model and the LinkedIn publication



https://covalent-iq.com/fueleu-maritime/

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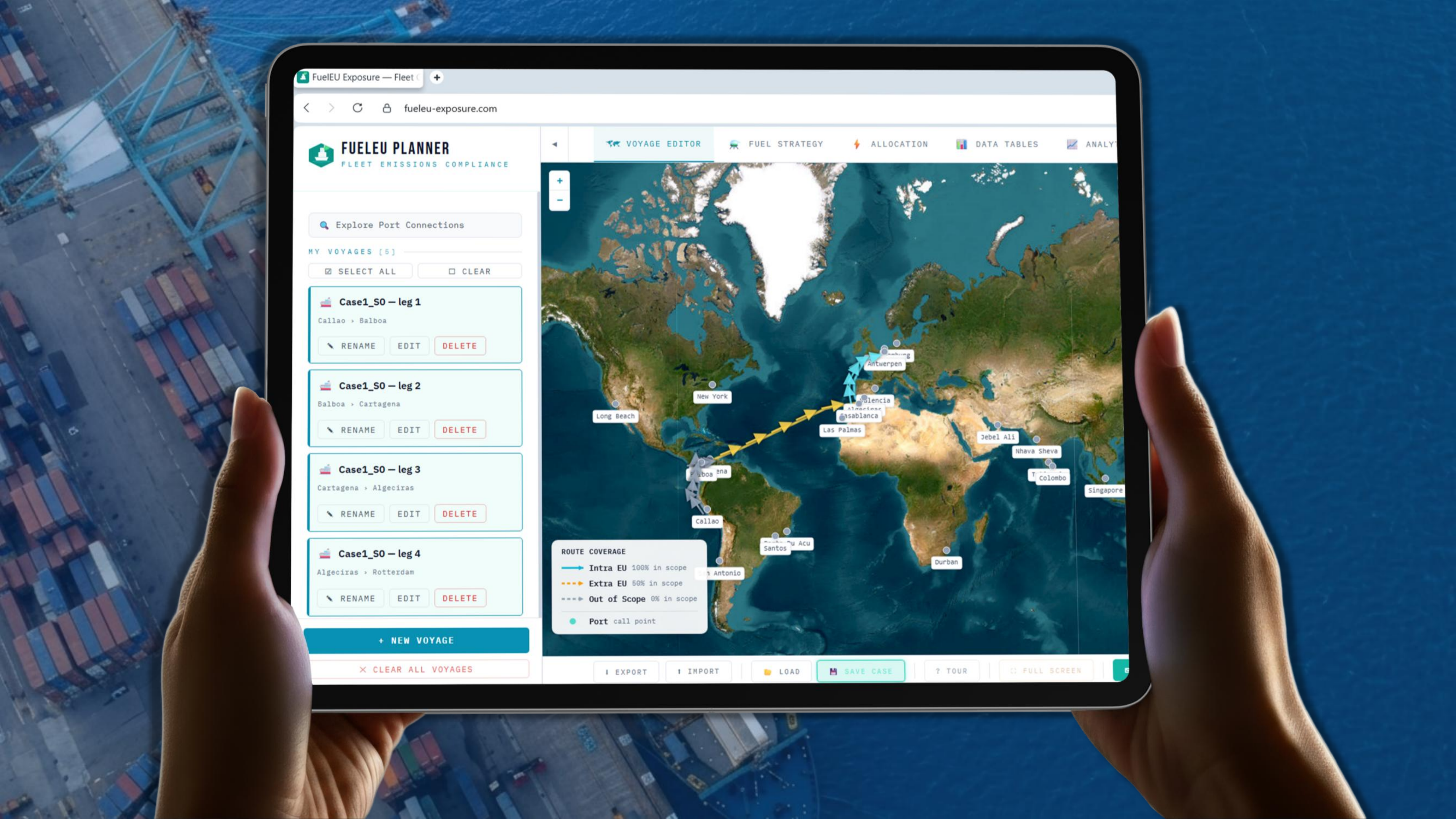
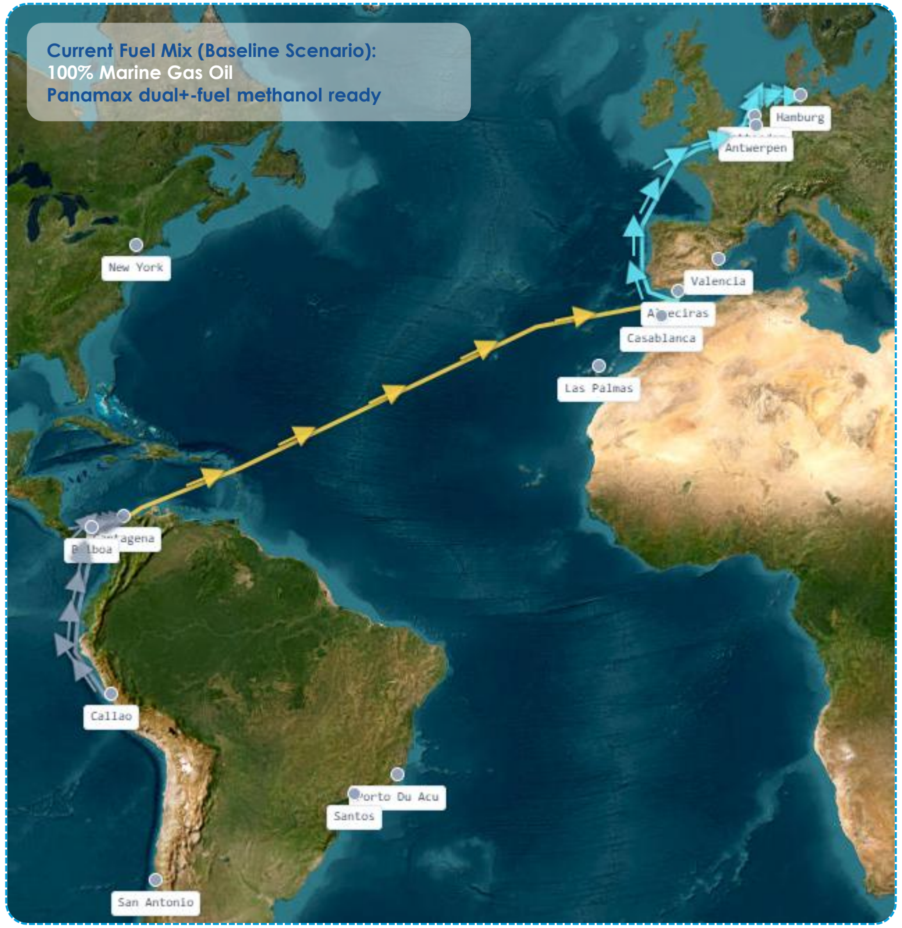
Case 1:
Transatlantic liner route, from bunker choice to FuelEU Maritime compliance value


FuelEU Exposure — Fleet
fueleu-exposure.com
FUELEU PLANNER
FLEET EMISSIONS COMPLIANCE
VOYAGE EDITOR
FUEL STRATEGY
ALLOCATION
DATA TABLES
Explore Port Connections
MY VOYAGES [5]
SELECT ALL
CLEAR
Case1_S0 — leg 1
Callao › Balboa
RENAME EDIT DELETE
Case1_S0 — leg 2
Balboa › Cartagena
RENAME EDIT DELETE
Case1_S0 — leg 3
Cartagena › Algeciras
RENAME EDIT DELETE
Case1_S0 — leg 4
Algeciras › Rotterdam
RENAME EDIT DELETE
+ NEW VOYAGE
CLEAR ALL VOYAGES
Antwerpen
New York
Long Beach
Casablanca
Las Palmas
Jebel Ali
Nhava Sheva
Colombo
Singapore
Callao
Santos
Durban
ROUTE COVERAGE
Intra EU 100% in scope
Extra EU 50% in scope
Out of Scope 0% in scope
Port call point
EXPORT
IMPORT
LOAD
SAVE CASE
TOUR
FULL SCREEN

Case 1: What is the minimum clean fuel procurement strategy required to comply with FuelEU Maritime at the lowest possible cost



Transatlantic route from Callao (Peru) to Hamburg (Germany), including intermediate calls in Panama, Colombia, Spain and Rotterdam

For global shipping operators, regulatory exposure is driven by European port calls rather than by the entire voyage footprint

FuelEU Maritime applies only to voyages involving European ports, making route configuration a key determinant of compliance exposure

To illustrate the implications of the regulation, an existing South America–Europe shipping route has been assessed. While the route originates in Peru and includes multiple intermediate port calls, only voyages to and between European ports are considered under the FuelEU Maritime emissions accounting framework.

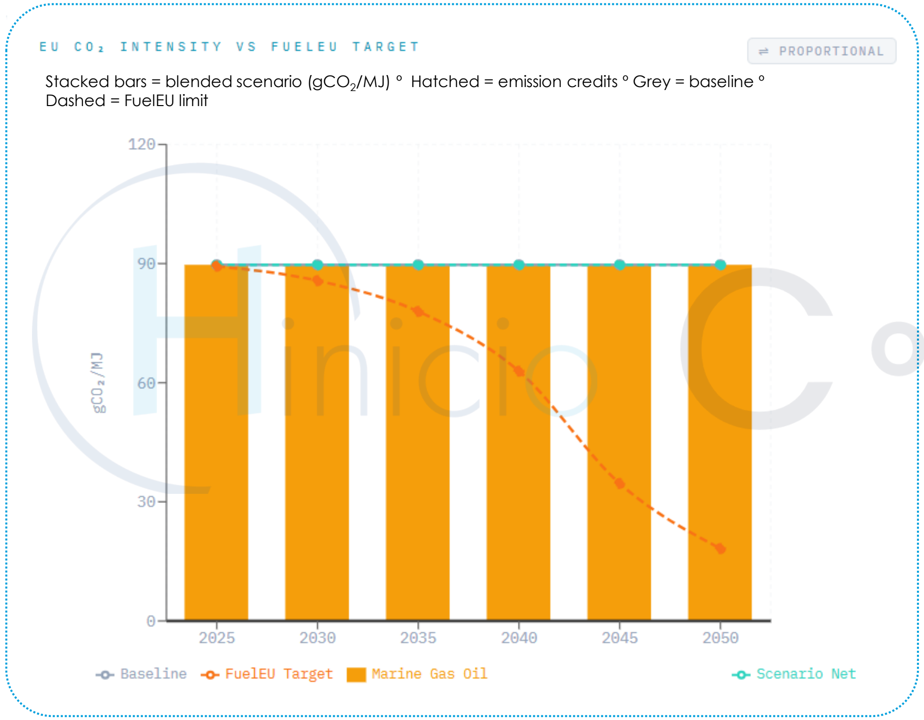
The assessed route comprises the following voyages:

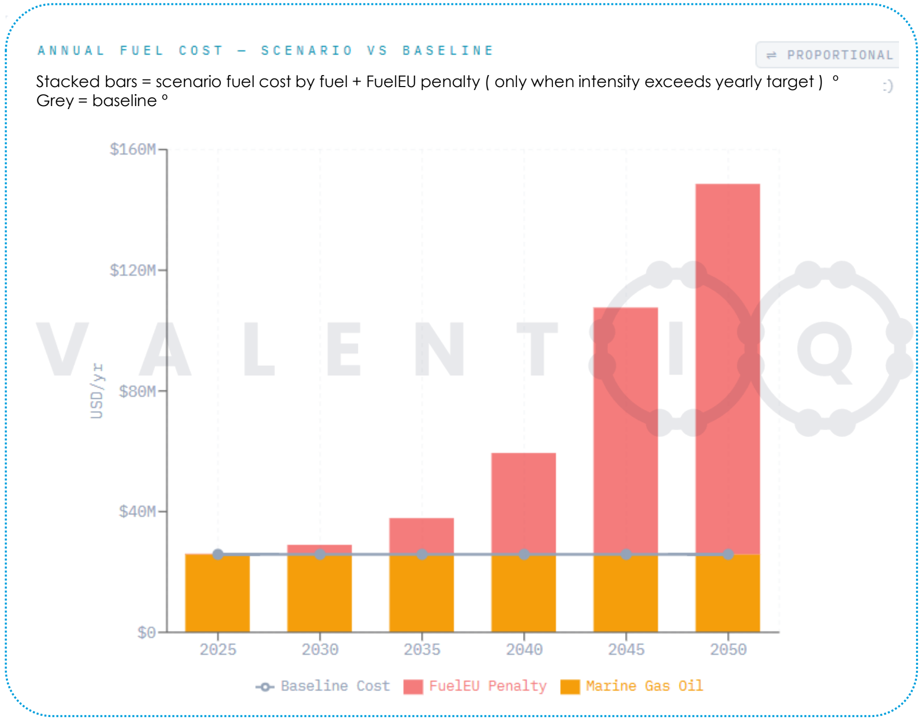
- Voyage 1: Callao – Balboa → **Outside compliance scope**
- Voyage 2: Balboa -- Cartagena → **Outside compliance scope**
- Voyage 3: Cartagena – Algeciras → **Partial (50%) compliance scope**
- Voyage 4: Algeciras – Rotterdam → **Full compliance scope**
- Voyage 5: Rotterdam – Hamburg → **Full compliance scope**

Illustrative Assumptions:

- Stakeholder perspective: **Shipping Fleet Operator**
- Vessel type: **Panamax Container Vessel** (~5,000 TEU)
- Trade route: **Peru-Europe**
- Annual frequency: **35 trips per year**
- Fuel configuration: **dual-fuel (MGO + methanol-ready)**

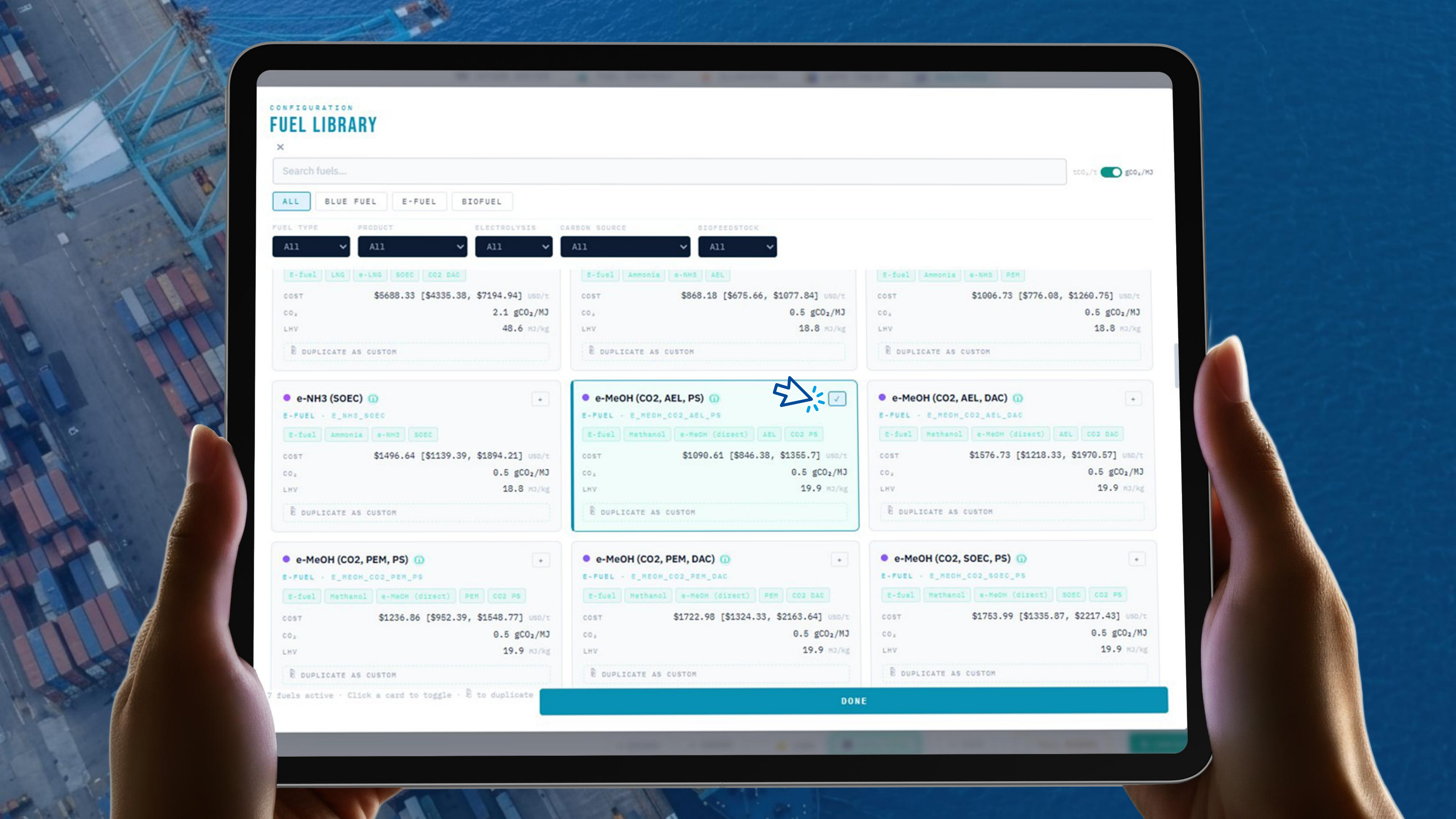
Scenario 0: Continuing the status quo of burning fossil MGO is a costly option, especially from 2035 onwards





Insights

- **Non-compliance starts immediately in 2025:** the MGO baseline holds at ~90 gCO_2/MJ, already above the FuelEU limit, triggering a first penalty of ~USD 1M.
- **Penalty exposure escalates sharply as the target tightens:** the annual FuelEU penalty rises from ~USD 3M in 2030 to ~USD 122M in 2050 as the required GHG-intensity falls from ~89 to ~18 gCO_2/MJ and the compliance gap widens every period.
- **By 2040 the penalty overtakes the fuel bill;** total annual cost reaches ~USD 148M by 2050 versus a broadly constant fossil fuel cost of ~USD 26M/year.
- Doing nothing turns FuelEU into a structural, escalating cost rather than a one-off charge, making the case for blending renewable fuels (Scenarios 1–2) to cap penalty exposure.

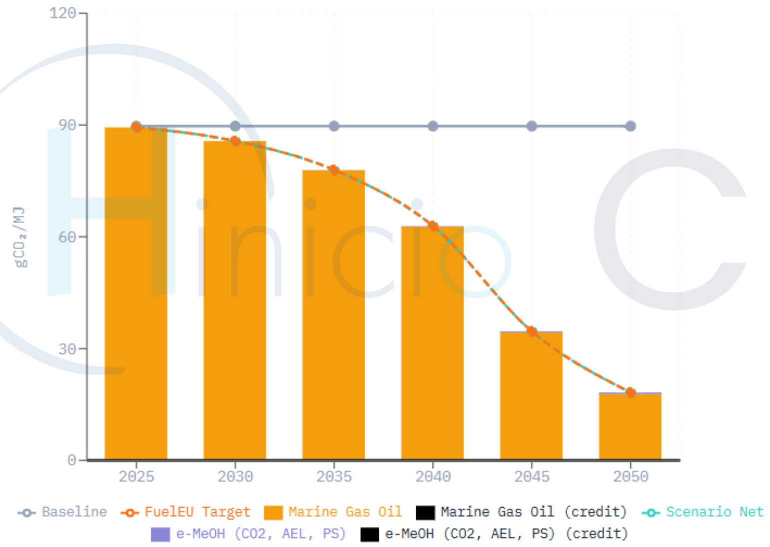

CONFIGURATION
FUEL LIBRARY
Search fuels...
ALL
BLUE FUEL
E-FUEL
BIOFUEL
FUEL TYPE
PRODUCT
ELECTROLYSIS
CARBON SOURCE
BIOFEEDSTOCK
All
COST
$5688.33 [$4335.38, $7194.94]
2.1 gCO₂/MJ
48.6
DUPLICATE AS CUSTOM
$868.18 [$675.66, $1077.84]
0.5 gCO₂/MJ
18.8
$1006.73 [$776.08, $1260.75]
e-NH3 (SOEC)
$1496.64 [$1139.39, $1894.21]
e-MeOH (CO2, AEL, PS)
$1090.61 [$846.38, $1355.7]
19.9
e-MeOH (CO2, AEL, DAC)
$1576.73 [$1218.33, $1970.57]
e-MeOH (CO2, PEM, PS)
$1236.86 [$952.39, $1548.77]
e-MeOH (CO2, PEM, DAC)
$1722.98 [$1324.33, $2163.64]
e-MeOH (CO2, SOEC, PS)
$1753.99 [$1335.87, $2217.43]
DONE

Scenario 1: An optimized blend of e-methanol offers a much better case for compliance

EU CO₂ INTENSITY VS FUELEU TARGET

⇌ PROPORTIONAL

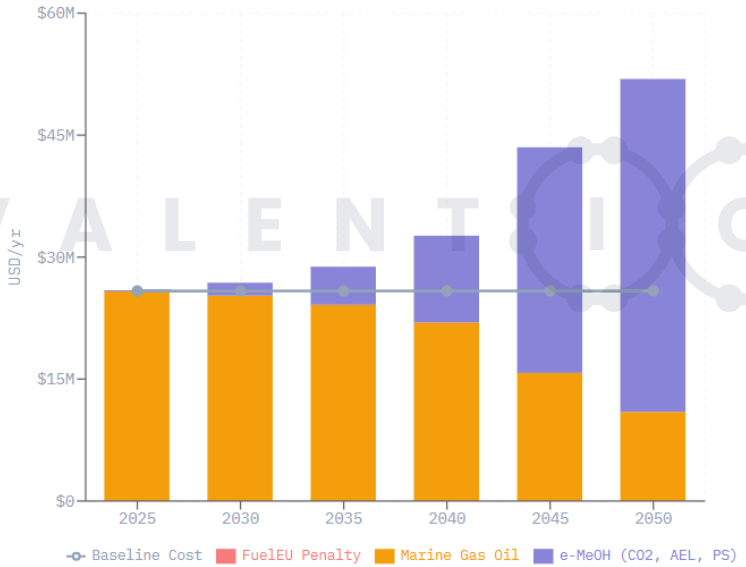
Stacked bars = blended scenario (gCO_2/MJ) ° Hatched = emission credits ° Grey = baseline ° Dashed = FuelEU limit



ANNUAL FUEL COST – SCENARIO VS BASELINE

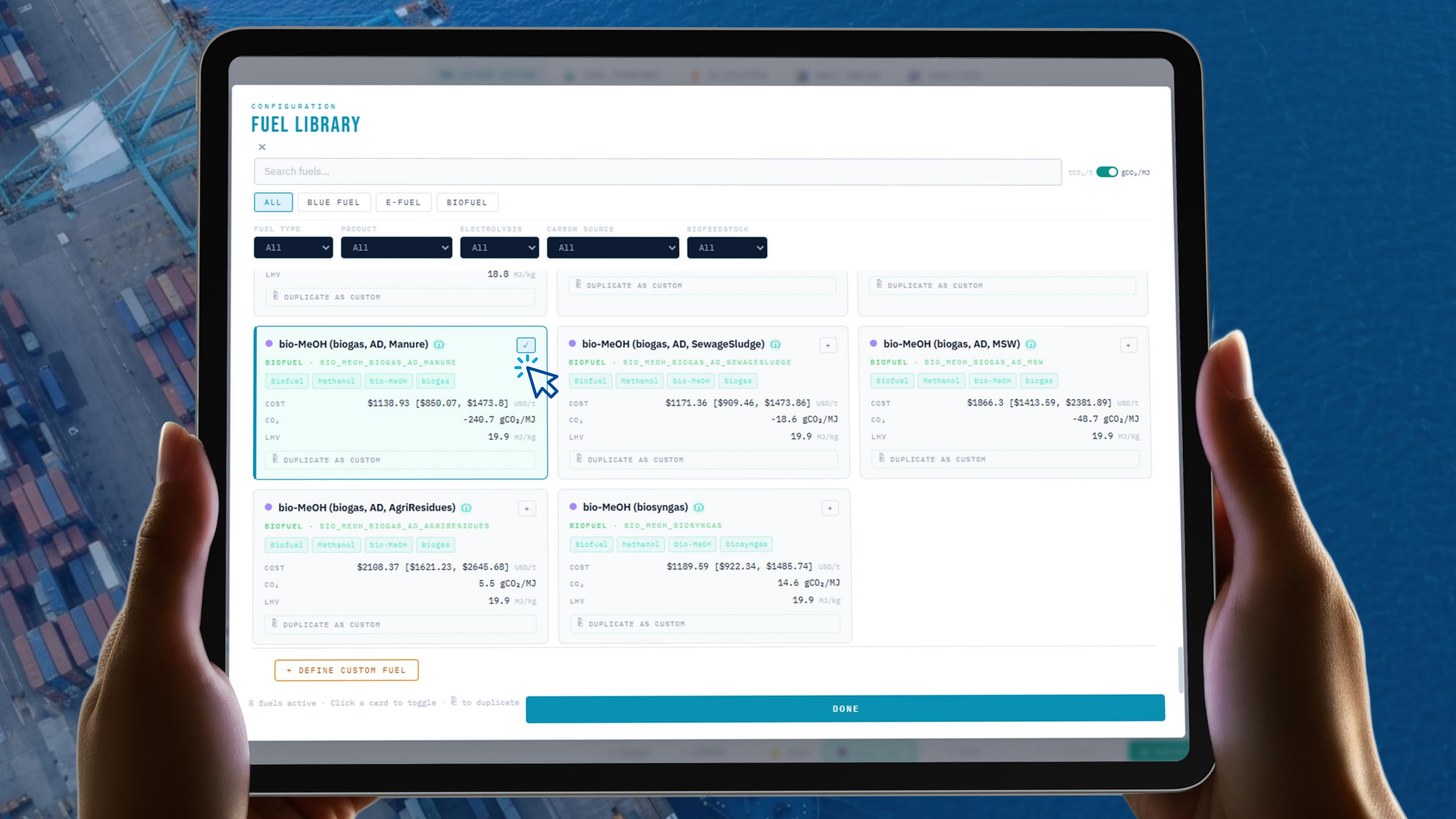
⇌ PROPORTIONAL

Stacked bars = scenario fuel cost by fuel + FuelEU penalty (only when intensity exceeds yearly target) ° Grey = baseline °



Insights

- **Blending e-methanol cuts GHG intensity in line with the FuelEU target:** net intensity falls from ~89 to ~18 gCO_2/MJ, tracking the tightening limit each year and keeping the vessel compliant.
- **FuelEU penalties are essentially avoided:** with net intensity meeting the yearly target, the escalating penalty from Scenario 0 (~USD 122M/year by 2050) effectively disappears.
- **Compliance cost shifts to the e-methanol premium:** annual fuel cost rises from ~USD 26M in 2025 to ~USD 52M by 2050 as the e-MeOH share grows and MGO use shrinks.
- Switching fuel keeps total annual cost (~USD 52M by 2050) well below the do-nothing penalty path (~USD 148M), turning compliance into a predictable fuel investment.

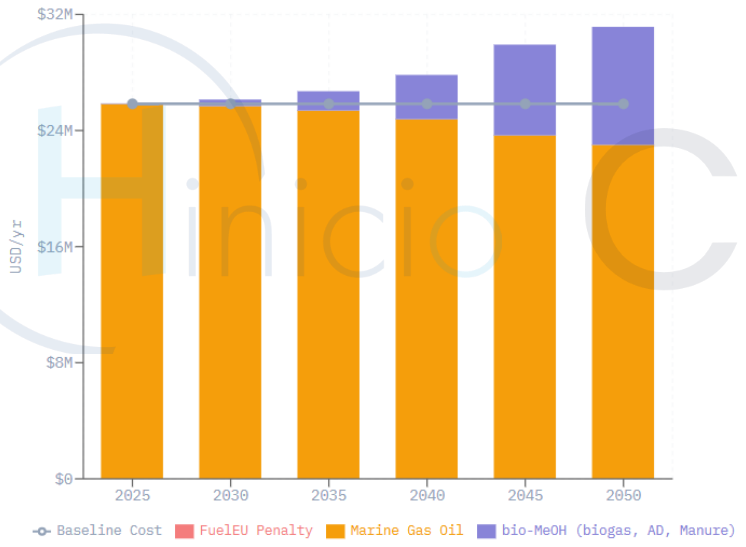

CONFIGURATION
FUEL LIBRARY
Search fuels...
gCO₂/MJ
ALL
BLUE FUEL
E-FUEL
BIOFUEL
FUEL TYPE
PRODUCT
ELECTROLYSIS
CARBON SOURCE
BIOFEEDSTOCK
All
LHV 18.8 MJ/kg
DUPLICATE AS CUSTOM
bio-MeOH (biogas, AD, Manure)
BIOFUEL · BIO_MEOH_BIOGAS_AD_MANURE
Biofuel Methanol bio-MeOH biogas
COST $1138.93 [$850.07, $1473.8] USD/t
CO₂ -240.7 gCO₂/MJ
LHV 19.9 MJ/kg
DUPLICATE AS CUSTOM
bio-MeOH (biogas, AD, SewageSludge)
BIOFUEL · BIO_MEOH_BIOGAS_AD_SEWAGESLUDGE
Biofuel Methanol bio-MeOH biogas
COST $1171.36 [$909.46, $1473.86] USD/t
CO₂ -18.6 gCO₂/MJ
LHV 19.9 MJ/kg
DUPLICATE AS CUSTOM
bio-MeOH (biogas, AD, MSW)
BIOFUEL · BIO_MEOH_BIOGAS_AD_MSW
Biofuel Methanol bio-MeOH biogas
COST $1866.3 [$1413.59, $2381.89] USD/t
CO₂ -48.7 gCO₂/MJ
LHV 19.9 MJ/kg
DUPLICATE AS CUSTOM
bio-MeOH (biogas, AD, AgriResidues)
BIOFUEL · BIO_MEOH_BIOGAS_AD_AGRIRESIDUES
Biofuel Methanol bio-MeOH biogas
COST $2108.37 [$1621.23, $2645.68] USD/t
CO₂ 5.5 gCO₂/MJ
LHV 19.9 MJ/kg
DUPLICATE AS CUSTOM
bio-MeOH (biosyngas)
BIOFUEL · BIO_MEOH_BIOSYNGAS
Biofuel Methanol bio-MeOH biosyngas
COST $1189.59 [$922.34, $1485.74] USD/t
CO₂ 14.6 gCO₂/MJ
LHV 19.9 MJ/kg
DUPLICATE AS CUSTOM
+ DEFINE CUSTOM FUEL
8 fuels active · Click a card to toggle · to duplicate
DONE

Scenario 2: Carbon-negative biomethanol an even more effective fuel to reach compliance but is subject to strict certification and availability

ANNUAL FUEL COST – SCENARIO VS BASELINE

⇌ PROPORTIONAL

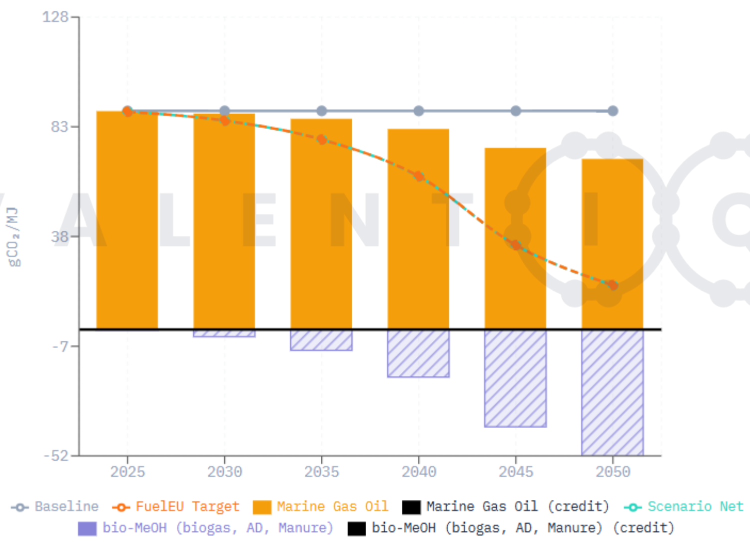
Stacked bars = scenario fuel cost by fuel + FuelEU penalty (only when intensity exceeds yearly target) ° Grey = baseline °



EU CO_2 INTENSITY VS FUELEU TARGET

⇌ PROPORTIONAL

Stacked bars = blended scenario (gCO_2/MJ) ° Hatched = emission credits ° Grey = baseline ° Dashed = FuelEU limit



Insights

- **Bio-methanol from manure-derived biogas is carbon-negative:** produced via anaerobic digestion of dairy manure, it avoids methane emissions that would otherwise be released, earning negative emission credits on top of displacing fossil MGO.
- **It reaches compliance more effectively than a conventional blend:** the negative credits pull Scenario Net right to the target intensity through 2050 with a smaller blend, so the target is met and penalties avoided.
- **Because less fuel is needed, compliance cost stays low:** annual fuel cost rises only from ~USD 26M (2025) to ~USD 31M (2050), well below the e-methanol path (~USD 52M) and the do-nothing penalty path (~USD 148M).
- But the upside is conditional: FuelEU Maritime only counts the negative emissions if they are strictly certified, and manure-derived feedstock is scarce — so the pathway cannot scale to the whole fleet. It shows fuel choice is driven by the carbon-intensity profile and sourcing, not cost alone.

Minimizing compliance cost is a route-level decision: fuel CI, certification, and port availability matter as much as fuel price

Across the three scenarios, the 2050 annual cost varies roughly five-fold:
~USD 148M doing nothing, ~USD 52M with e-methanol, ~USD 31M with carbon-negative bio-methanol

FUEL AND PROCUREMENT REALITIES IN THE CONTEXT OF FUELEU MARITIME

- **Doing nothing is the costliest path:** no investment, but FuelEU penalties escalate uncontrollably as targets tighten through 2050.
- **E-fuels (e-methanol):** scalable and compliant, but expensive and dependent on RFNBO certification and still-thin bunker supply.
- **Biofuels (bio-methanol from biogas):** can be carbon-negative and cheapest to comply, but feedstock is scarce and the negative emissions must be certified to count.
- **In practice, procurement is phased and contracted:** blends ramp over time under secured multi-year offtake of certified volumes, bunkered only where compliant fuel is available.
- **Regulation and port availability shape the choice:** certification eligibility and the fuels on offer at each bunkering port can matter more than headline price.

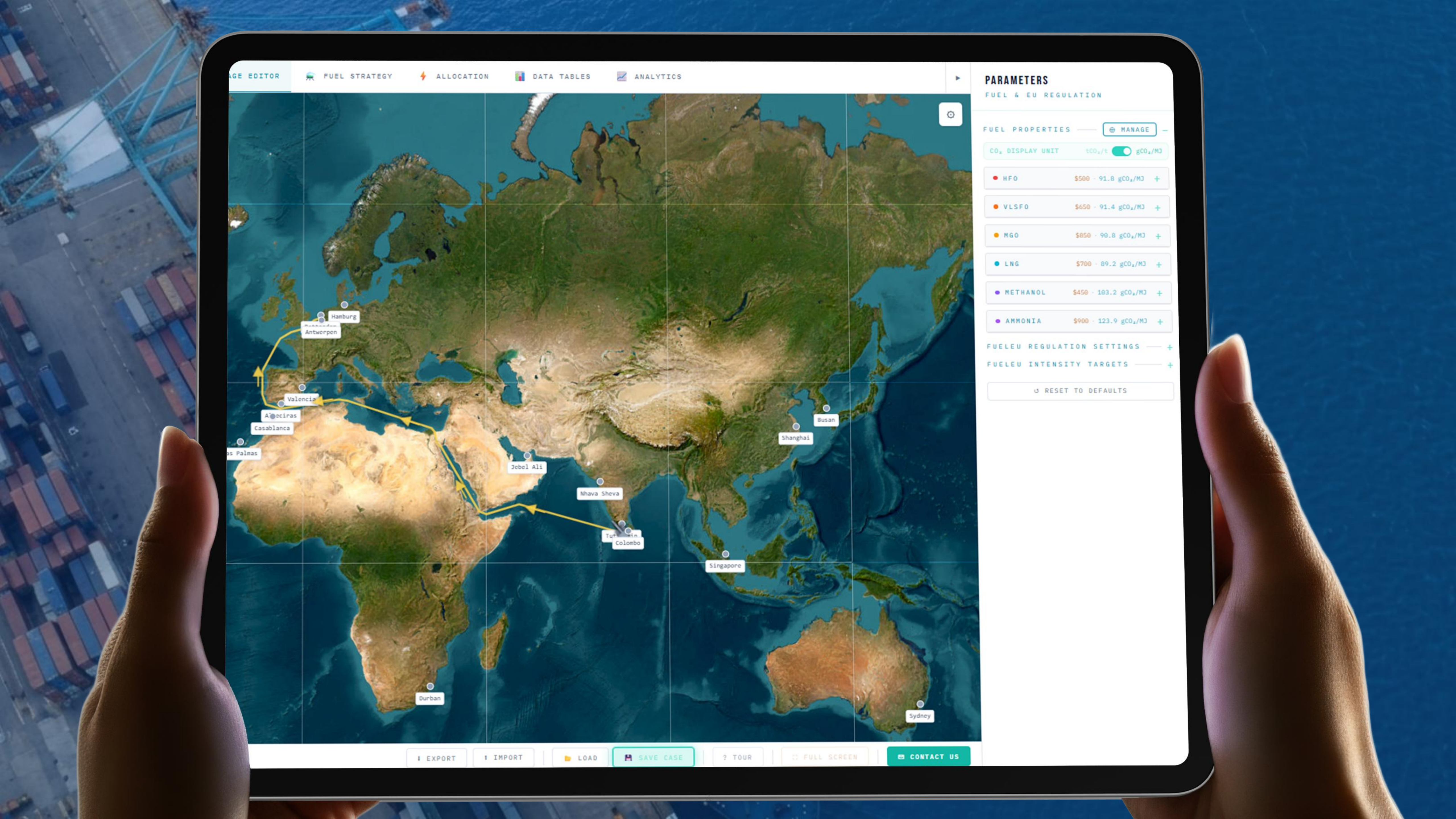
KEY FACTORS TO MINIMIZE COST OF COMPLIANCE

- **Fuel carbon intensity (well-to-wake),** including any certified negative-emission credits – not $/tonne alone.
- **Certification & eligibility:** RFNBO status for e-fuels; RED II/III sustainability and certified negative emissions for biofuels.
- **Fuel price, volatility and offtake security** through long-term supply contracts.
- **Availability & bunkering infrastructure** for the fuel at the relevant ports.
- **Route & port configuration:** which legs fall in FuelEU scope (50% in/out-bound, 100% intra-EU) and where to bunker.
- **FuelEU flexibility mechanisms:** pooling, banking and borrowing of compliance balances.
- **Interaction with other schemes:** EU ETS, CBAM and the IMO Net-Zero Framework.
- **Vessel/engine compatibility** and any retrofit CAPEX for the chosen fuel.
- **Penalty trajectory and tightening targets,** and the timing/phasing of the transition to avoid lock-in.

No single fuel wins – the cheapest path to compliance combines the right low/negative-CI fuels, certification, bunkerability, and smarter optimized routing. And the sooner you act, the less you pay.

Case 2:

Bunkering the regulated routes to capture FuelEU Maritime value



FUEL STRATEGY
ALLOCATION
DATA TABLES
ANALYTICS
PARAMETERS
FUEL & EU REGULATION
FUEL PROPERTIES
MANAGE
CO₂ DISPLAY UNIT tCO₂/t gCO₂/MJ
HFO $500 · 91.8 gCO₂/MJ
VLSFO $650 · 91.4 gCO₂/MJ
MGO $850 · 90.8 gCO₂/MJ
LNG $700 · 89.2 gCO₂/MJ
METHANOL $450 · 103.2 gCO₂/MJ
AMMONIA $900 · 123.9 gCO₂/MJ
FUELEU REGULATION SETTINGS
FUELEU INTENSITY TARGETS
RESET TO DEFAULTS
Hamburg
Antwerpen
Valencia
Casablanca
Jebel Ali
Nhava Sheva
Colombo
Singapore
Shanghai
Busan
Durban
Sydney
EXPORT
IMPORT
LOAD
SAVE CASE
TOUR
CONTACT US

Case 2: How can fuel producers and ports outside Europe translate FuelEU Maritime compliance needs into bankable demand for low-carbon marine fuels?

Hinicio COVALENTIQ

For port operators and project developers, renewable fuel availability can create value by changing both the fuel pathway and the route configuration

India–Europe container route from VOC Port / Tuticorin to Rotterdam, currently served via Colombo transshipment and compared with a future direct VOC Port–Rotterdam route enabled by renewable molecule bunkering at VOC Port.

FuelEU Maritime creates a compliance-driven demand signal for vessels calling at European ports. For ports and project developers, this creates an opportunity to assess whether low-carbon fuel supply can support new routing options, not only reduce emissions on existing routes.

The case compares the current Europe-bound logistics pathway from VOC Port with a future direct-routing scenario enabled by renewable molecule bunkering at VOC Port. Public sources indicate that VOC Port's Europe-bound container connectivity is currently largely served via Colombo transshipment, while direct VOC–Europe calls have been reported as limited or ad hoc.

The assessed route comparison comprises two configurations:

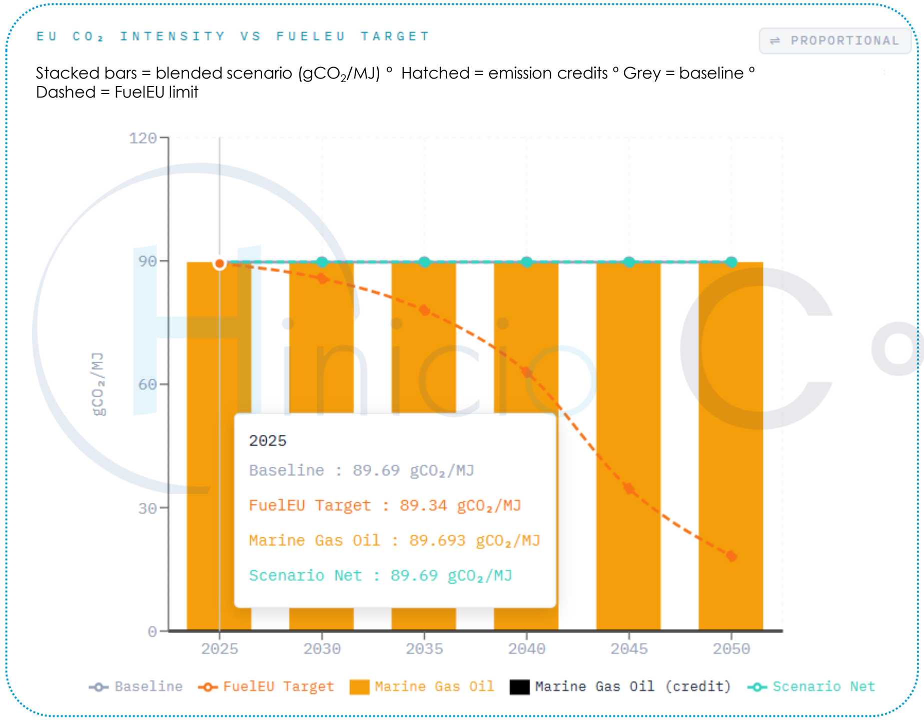
Current route: VOC Port – Colombo – Rotterdam
Existing Europe-bound logistics pathway using Colombo as a transshipment hub.

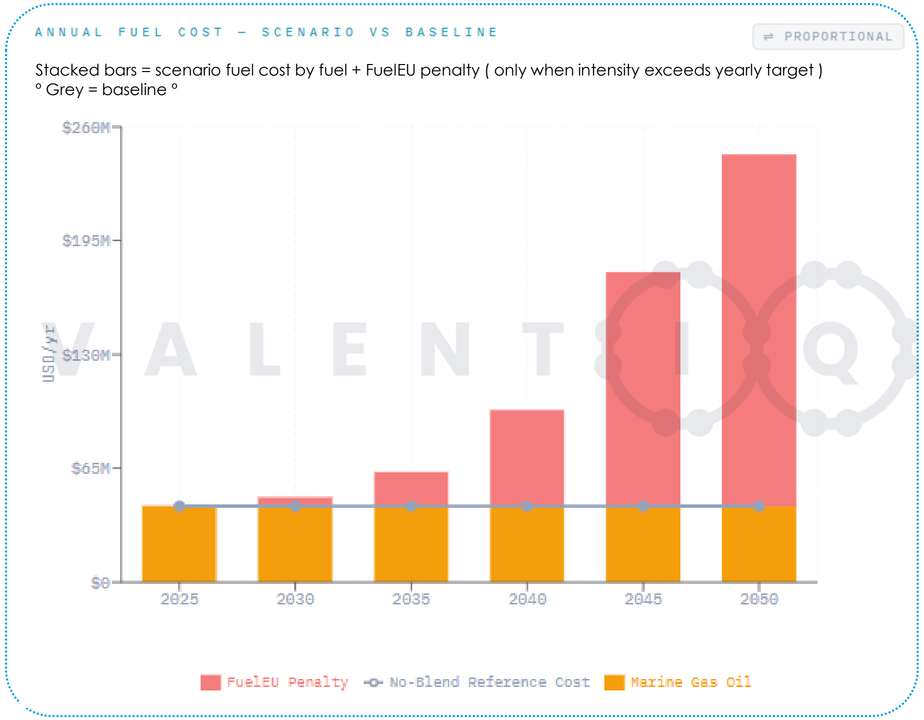
Alternative route: VOC Port – Rotterdam
Future direct EU-bound route enabled by renewable molecule bunkering at VOC Port.

Illustrative Assumptions:

- Stakeholder perspective: **Project Developer / Port Operator**
- VOC Port / Tuticorin – Colombo: **Feeder container vessel, ~1,000 TEU with MGO, ~122 one-way voyages/year**
- Colombo – Rotterdam: **Post-Panamax container vessel, ~8,000 TEU with MGO , ~52 one-way voyages/year**

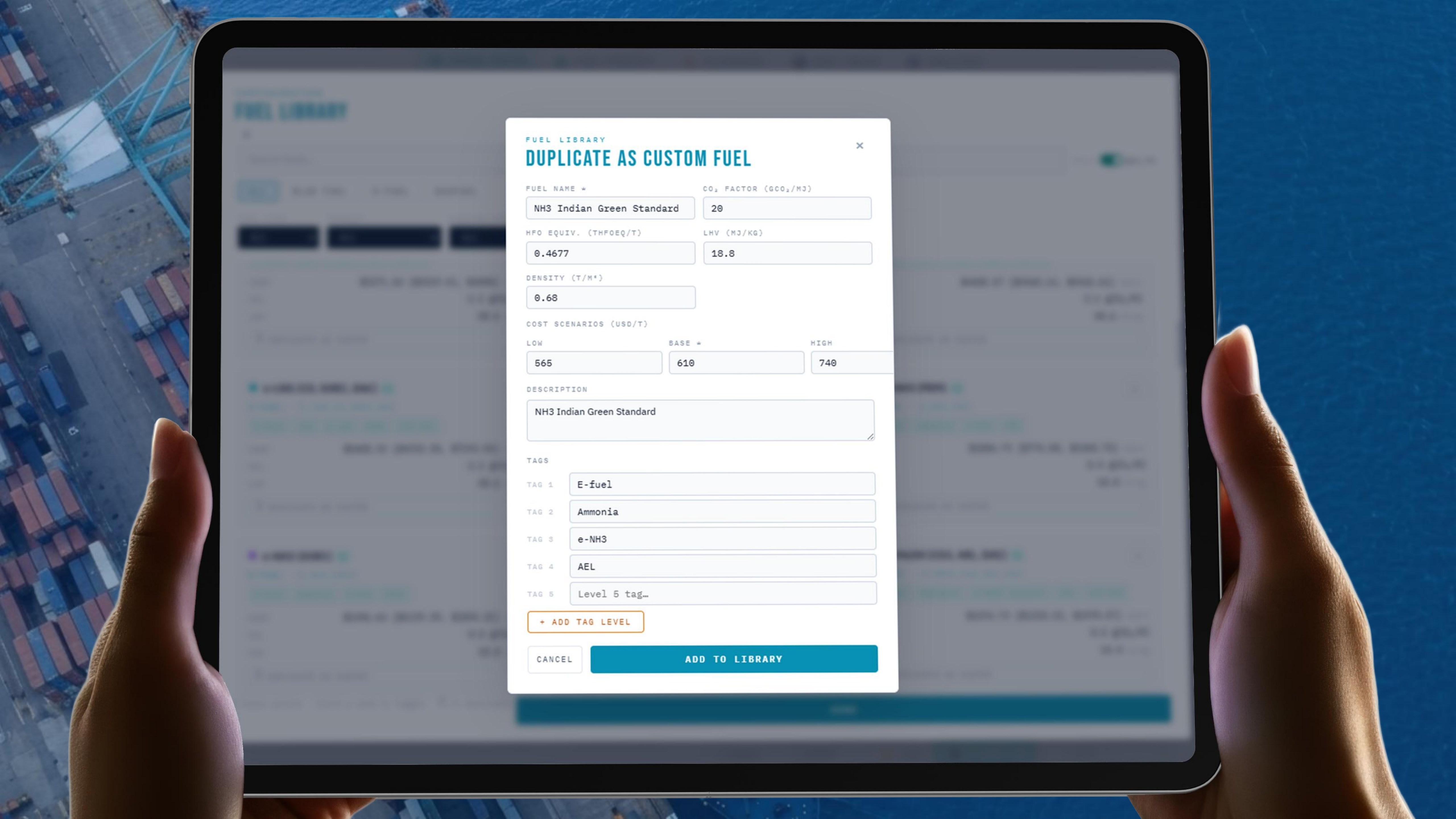
The current fossil MGO route starts non-compliant in 2025 and becomes structurally cost-exposed under FuelEUM, with penalties increasing from USD 0.3M from 2025 to USD 200.8M by 2050 periods.



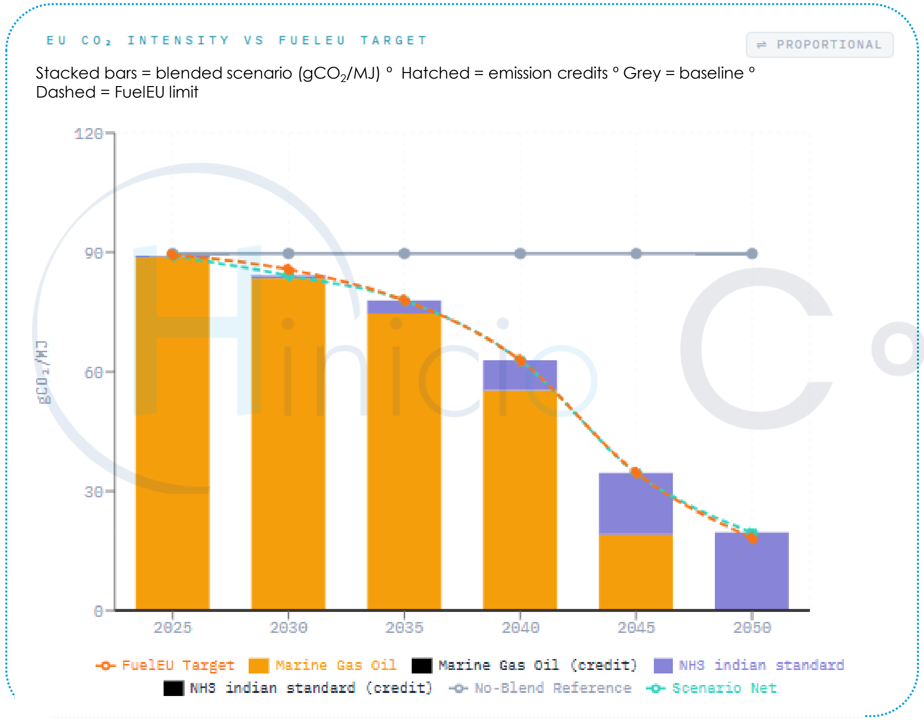


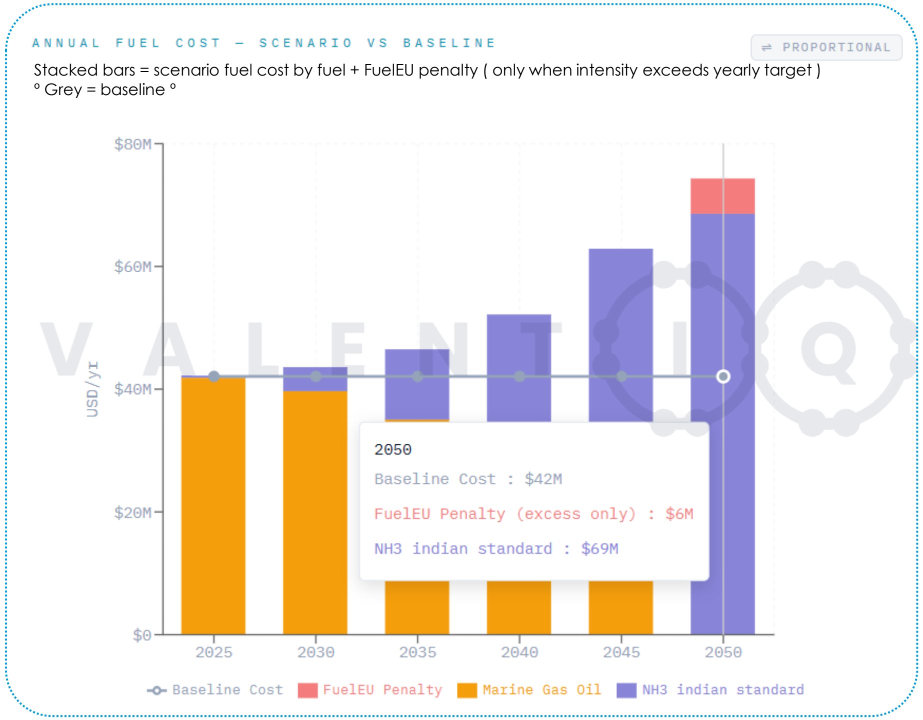
Insights

- **Non-compliance starts immediately in 2025**, with the fossil route already above the FuelEUM threshold and incurring a first penalty of USD 0.32M.
- **FuelEU exposure increases sharply over time:** annual penalties rise from USD 5.2M in 2030 to USD 200.8M in 2050 as targets tighten and multipliers increase.
- **By 2040, penalties overtake the fossil fuel bill;** by 2050, total annual cost reaches USD 244.2M, versus a roughly constant fossil fuel cost of USD 43.4M/year.
- This makes compliance a structural issue, supporting the need to introduce renewable molecules over time and assess VOC Port bunkering as a route-level mitigation lever.


FUEL LIBRARY
DUPLICATE AS CUSTOM FUEL
×
FUEL NAME *
NH3 Indian Green Standard
CO₂ FACTOR (GCO₂/MJ)
20
HFO EQUIV. (THFOEQ/T)
0.4677
LHV (MJ/KG)
18.8
DENSITY (T/M³)
0.68
COST SCENARIOS (USD/T)
LOW
565
BASE *
610
HIGH
740
DESCRIPTION
NH3 Indian Green Standard
TAGS
TAG 1
E-fuel
TAG 2
Ammonia
TAG 3
e-NH3
TAG 4
AEL
TAG 5
Level 5 tag…
+ ADD TAG LEVEL
CANCEL
ADD TO LIBRARY

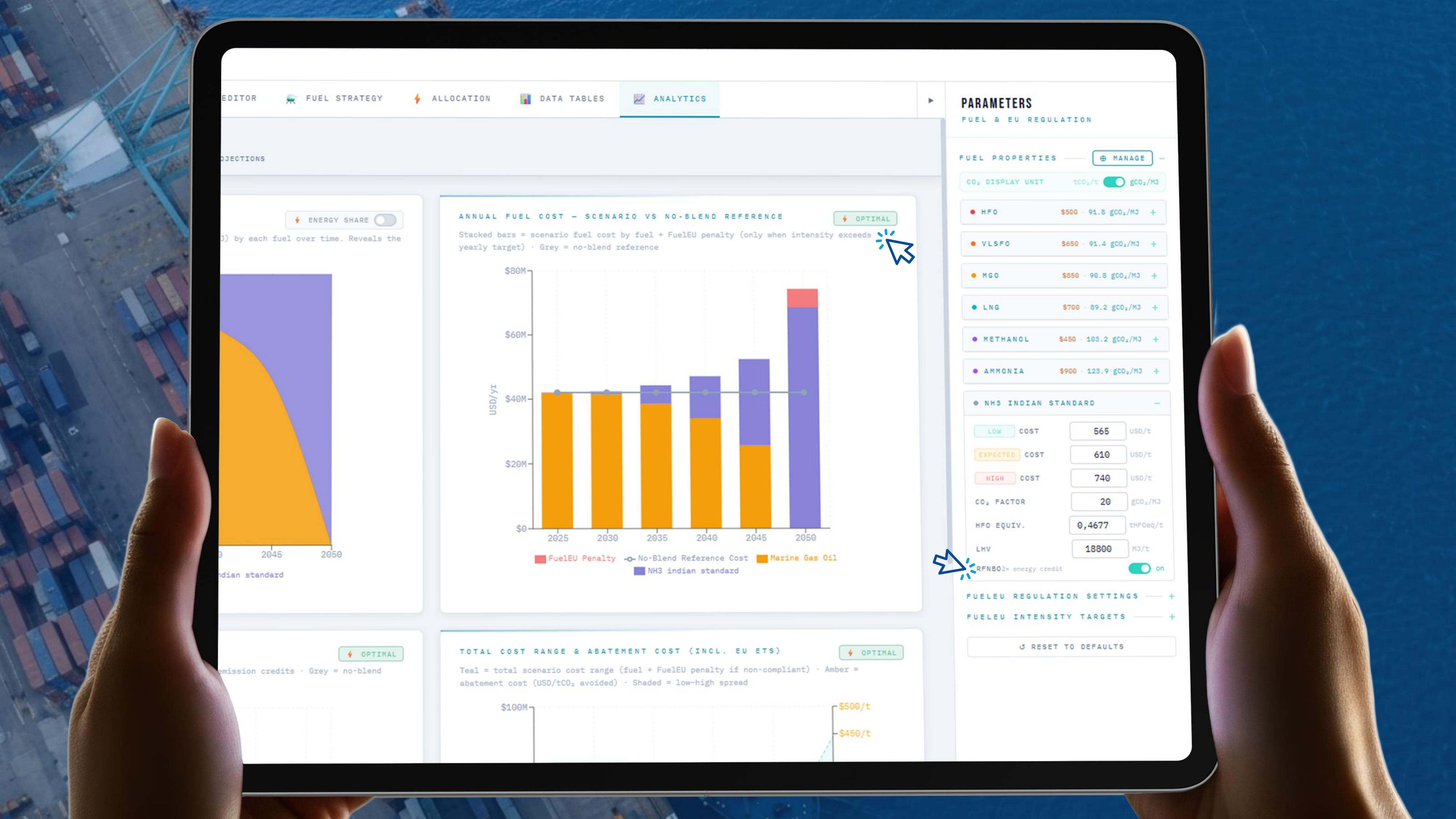
Custom-coding an Indian-standard NH_3 molecule in the tool shows that direct VOC Port–Rotterdam bunkering can largely avoid FuelEU penalties until 2045 period





Insights

- The tool can test bespoke fuel pathways **by adding and coding new molecules**, here applied to Indian-standard NH_3.
- The direct VOC Port–Rotterdam route **remains compliant from 2025 to 2045**, with zero FuelEU penalties throughout this period.
- By 2050, the route is only slightly above the threshold, resulting in a **limited USD 5.7M penalty** and an **all-in cost of USD 74.3M.**
- This materially improves route economics relative to the fossil MGO case, while demonstrating the model's value for testing alternative bunkering strategies.



EDITOR
FUEL STRATEGY
ALLOCATION
DATA TABLES
ANALYTICS
OJECTIONS
ENERGY SHARE
) by each fuel over time. Reveals the
2045
2050
ndian standard
ANNUAL FUEL COST — SCENARIO VS NO-BLEND REFERENCE
OPTIMAL
Stacked bars = scenario fuel cost by fuel + FuelEU penalty (only when intensity exceeds yearly target) · Grey = no-blend reference
$80M
$60M
$40M
$20M
$0
USD/yr
2025
2030
2035
2040
2045
2050
FuelEU Penalty
No-Blend Reference Cost
Marine Gas Oil
NH3 indian standard
OPTIMAL
emission credits · Grey = no-blend
TOTAL COST RANGE & ABATEMENT COST (INCL. EU ETS)
OPTIMAL
Teal = total scenario cost range (fuel + FuelEU penalty if non-compliant) · Amber = abatement cost (USD/tCO₂ avoided) · Shaded = low-high spread
$100M
$500/t
$450/t
PARAMETERS
FUEL & EU REGULATION
FUEL PROPERTIES
MANAGE
CO₂ DISPLAY UNIT
gCO₂/MJ
HFO $500 · 91.8 gCO₂/MJ
VLSFO $650 · 91.4 gCO₂/MJ
MGO $850 · 90.8 gCO₂/MJ
LNG $700 · 89.2 gCO₂/MJ
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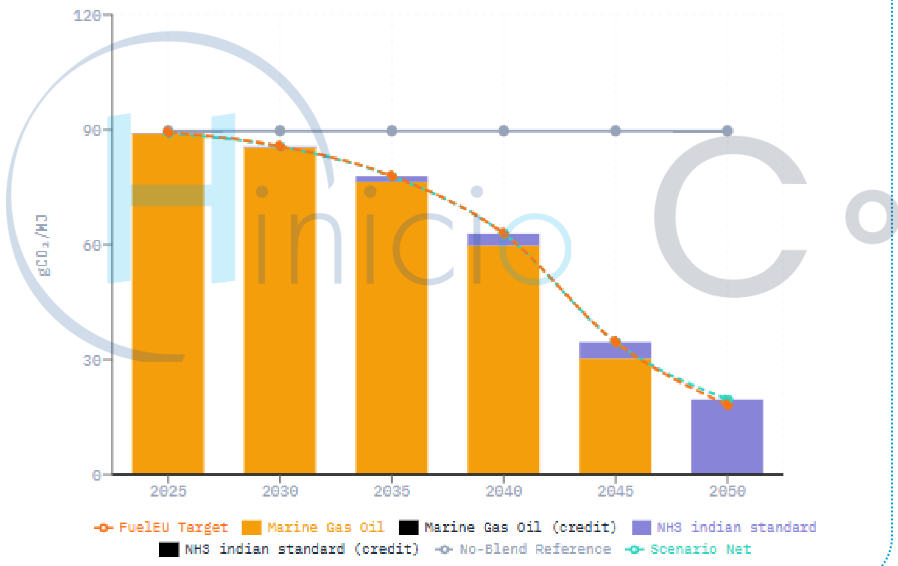
NH3 INDIAN STANDARD
LOW COST 565 USD/t
EXPECTED COST 610 USD/t
HIGH COST 740 USD/t
CO₂ FACTOR 20 gCO₂/MJ
HFO EQUIV. 0,4677
LHV 18800 MJ/t
RFNBO
on
FUELEU REGULATION SETTINGS
FUELEU INTENSITY TARGETS
RESET TO DEFAULTS

Certifying NH_3 as RFNBO unlocks ~USD 1.1M/year in savings by 2030 vs LCF, while energy allocation further reduces costs by up to USD 10.4M by 2040 vs proportional CI calculation

EU CO_2 INTENSITY VS FUELEU TARGET

OPTIMAL

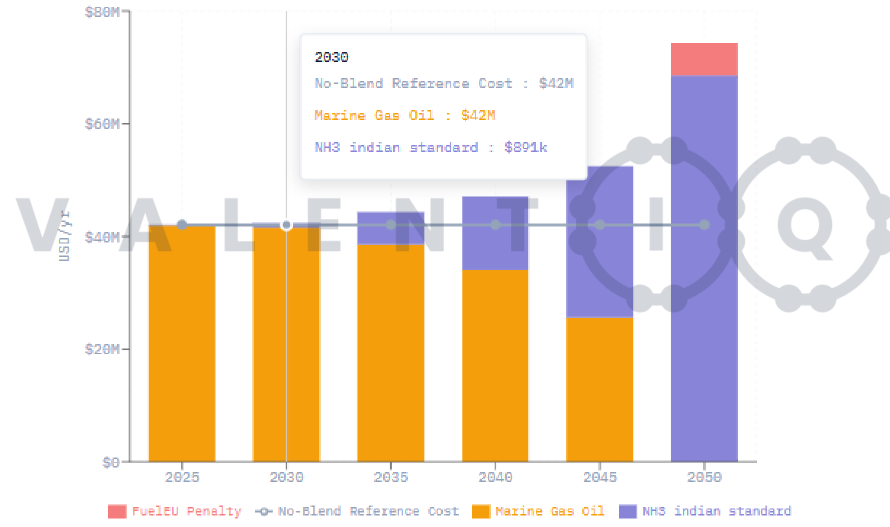
Stacked bars = blended scenario (gCO_2/MJ) ° Hatched = emission credits ° Grey = baseline ° Dashed = FuelEU limit



ANNUAL FUEL COST – SCENARIO VS NO-BLEND REFERENCE

OPTIMAL

Stacked bars = scenario fuel cost by fuel + FuelEU penalty (only when intensity exceeds yearly target) ° Grey = baseline °



Insights

- **RFNBO certification improves compliance efficiency** vs LCF, reducing fuel requirements and overall costs until 2034 (2030 period).
- **Annual all-in cost savings reach USD 1.2M in 2030** when ammonia is certifies as RFNBO.
- **Optimizing energy allocation** under FuelEU Maritime **allows to reduce all-in route fuel costs** while maintaining compliance at ship level
- Compared with the non-certified NH_3 case, this configuration keeps the direct VOC Port–Rotterdam route FuelEU-compliant from 2025 to 2045 while improving route economics.
- Efficient yearly energy allocation for the this case allows savings of USD 10.4M in 2045.

FuelEU Maritime is not only a compliance requirement, it is a demand signal that can unlock entire fuel infrastructure and shipping corridors investments

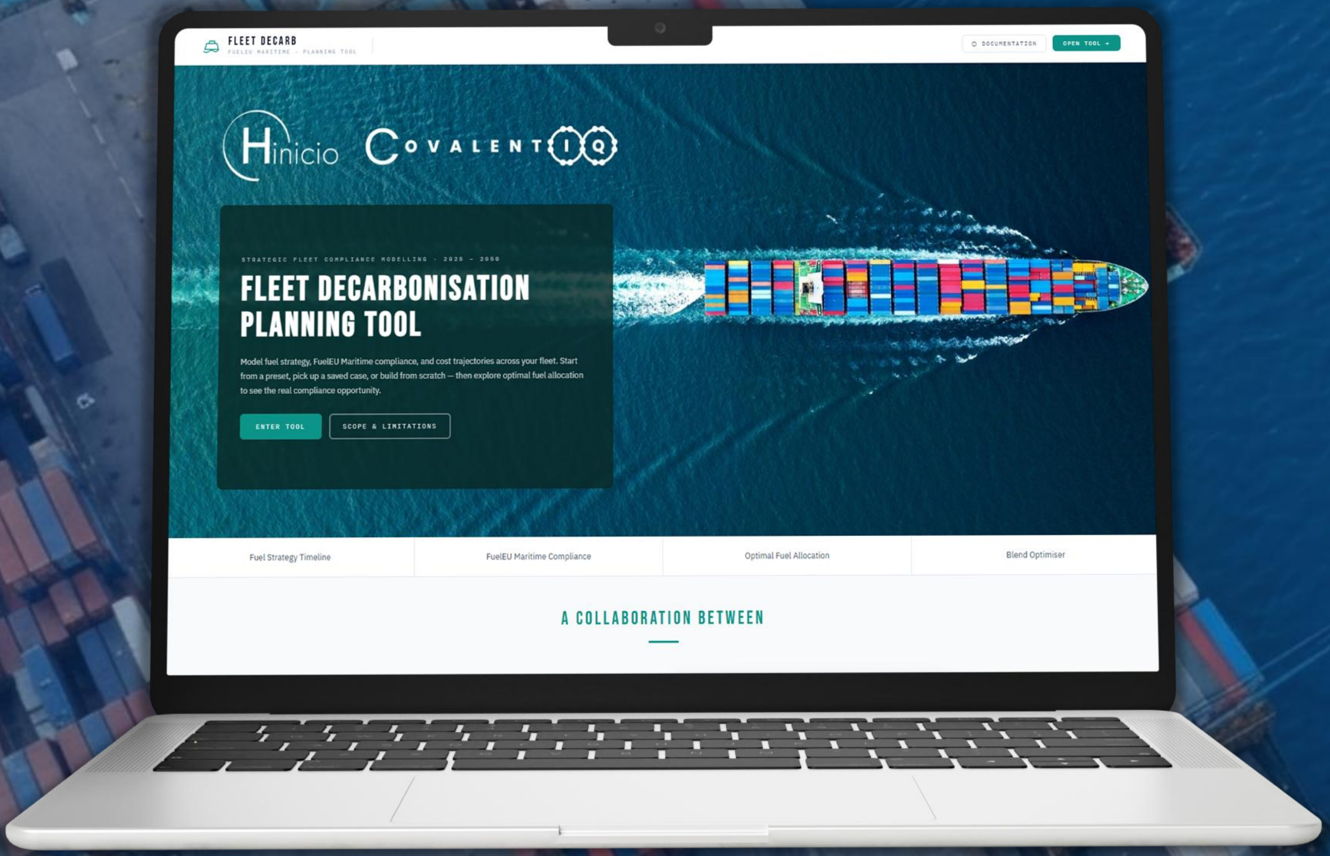
ACCESS TO FUEL EUM REGULATED ROUTES ENABLES EARLY VALUE CAPTURE FOR PORTS AND FUEL PRODUCERS

- FuelEU Maritime creates regulated demand anchored in EU-bound routes
- Ports can evolve into energy hubs linking bunkering, certification and demand
- Fuel producers move from selling energy to selling compliance value
- Early positioning enables participation in first compliance-driven markets
- The same molecule can serve and capture more value in multiple regulated markets when is RFNBO (FuelEU + RED III)

KEY MESSAGES FOR CASE 2: VOC (INDIA) – ROTTERDAM (THE NETHERLANDS)

- Fossil routes become structurally exposed to compliance cost
- Low-carbon fuel supply at origin can reshape routes and unlock new corridors
- Certification (RFNBO / LCF) is a critical value driver, not a technical detail
- Strategic bunkering locations can bridge supply and regulated demand
- Early surplus generation and banking strategies can further optimize compliance

Ports and fuel producers can create value beyond the molecule —by enabling compliance, certification and access to regulated markets.



Access the tool and evaluate your own compliance strategy

Scan the QR code or visit the link

https://fueleu-exposure.com

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