Powering green shipping: Kenya in the global power-to-x economy

Insight Brief

GETTING TO ZERO COALITION
GLOBAL MARITIME FORUM

KMA

International PtX Hub

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Executive Summary

The shipping industry's decarbonisation requires zero- and near-zero-emission (ZNZ) fuels, particularly scalable electro-fuels[1] (e-fuels) produced through power-to-x processes using renewable electricity. Without these, greenhouse gas emissions from global shipping are expected to continue rising significantly, undermining international climate goals. The International Maritime Organization (IMO) has set a trajectory to net zero by 2050 and a target of at least 5% ZNZ fuel use by 2030,[2] which will be supported by **concrete regulations** in the form of a mandatory global marine fuel standard and greenhouse gas (GHG) emissions pricing.[3]

Kenya's abundant wind, solar, and geothermal resources, combined with shipping's vital role in its economy, position the country as a promising location for e-fuel production. Kenya can produce e-fuels at globally competitive costs, particularly e-ammonia. However, it is important to take decisive steps to establish the maritime sector as a principal purchaser of these e-fuels, thereby generating a robust demand signal. A green shipping corridor that brings together public and private stakeholders to pursue coordinated first movement[4] on a specific route before 2030 is one way of stimulating this demand.

Several factors, if undertaken by the Kenyan Government, would support these objectives:

1. Creating policies and regulations targeted at green hydrogen and e-fuel project delivery, supporting and enabling the maritime sector as an offtaker by
   - → incentivising the uptake of e-fuels and streamlining the processes for their production and use, including land rights, permitting, and development of enabling infrastructure; and
   - → improving port readiness by developing port regulations supportive of increased e-fuel uptake and use.

2. Developing measures to address the cost gap between Kenyan-produced e-fuels and conventional fuels, including through
   - → global climate finance sources like the Green Climate Fund, the EU's Global Gateway Green Shipping Corridor Initiative or as part of the just and equitable transition (JET) requirements under the IMO's Net Zero Framework;
   - → risk-sharing mechanisms or blended finance vehicles with the private sector; and

1 Green hydrogen-based fuels (using hydrogen produced from electricity from renewable resources), such as e-ammonia or e-methanol.

2 IMO, **2023 IMO Strategy on Reduction of GHG Emissions from Ships**

3 As agreed during IMO Marine Environment Protection Committee 83 in April 2025, pending adoption.

4 First movement refers to taking early action to adopt and implement low- or zero-emission technologies and fuels before regulations or widespread market demand make it mandatory.

→ lowering investment costs, including through reducing the cost of capital by addressing macroeconomic and project-level factors.

3. Preparing for and enabling a market transition to e-fuels and maximising the benefits for the Kenyan economy through
   → demonstration of e-fuel projects,
   → investment in grid strengthening and expansion; and
   → enabling social dialogue with communities affected by developments.

4. Expanding international partnerships to overcome universal challenges, including e-fuel projects reaching final investment decisions, port readiness, and re-training/upskilling of workers involved in their production and application.

In the short term, it is recommended that the Kenyan Government:

1. Sets strategic goals for developing e-fuel use in the maritime sector, including exploring Kenya's potential role as a future regional bunkering hub.

2. Activates motivated industry stakeholders to connect significant interest in e-fuel production with the maritime sector (ports, shipping operators) as an offtaker, building on activities led by organisations such as the Kenya Green Hydrogen Association.

3. Focuses on developing the opportunities and overcoming the key challenges in the identified priority routes when further exploring the feasibility of a green corridor.

4. Considers all methods of stimulating demand, including
   → Leveraging the appetite of cargo owners to support a modal shift of cut flowers from air to sea freight and pay a premium for e-fuel production in Kenya, including through a book-and-claim system;[5]
   → Considering a focus on exporting e-fuels initially, to capitalise on policy incentives offered, for example by the EU, whilst building out Kenyan production and stimulating demand domestically;
   → Setting out a timeline and initiating delivery of e-fuel pilots at Kenyan ports before 2030. Lamu Port may be taken into consideration as a promising location for these pilots, with a focus on regional trade at the outset to develop capacity.

A more detailed version of this brief can be found here.

Priority Roadmap		
Next 6 months+: Engage across government ministries and industry actors (ports, ship operators, etc.) to consider priority next steps aligned with Kenya's strategic ambitions in the maritime sector.	Year 1-3: Develop pilot projects, explore demand for e-fuels, identify funding options, and engage regionally and internationally on best practices.	Years 2-5: Deploy pilots using e-fuels at Kenyan ports.

5 Book-and-claim is a chain-of-custody model that allows the environmental attributes of zero-emission fuels to be separated from their physical flow. This enables access to low-emission shipping services without requiring a direct physical link between cargo owners and the vessels using green fuels.

1. Context and approach

Content background

National and international commitments to decarbonisation, through United Nations processes at the IMO or as part of the UN Framework Convention on Climate Change, set a trajectory for decarbonising energy and transport sectors. To achieve these goals, the maritime industry will need large volumes of zero- and near-zero-emission (ZNZ) fuels. Countries that can synthesise these fuels from hydrogen produced with renewable electricity at globally competitive costs can access a growing international market and secure the economic benefits of responding to this demand. Kenya is well-positioned to explore this opportunity.

Kenya's maritime sector is economically critical, with over 90% of the nation's trade conducted by sea. The country also serves as a regional trade hub, particularly for landlocked neighbours. Of Kenya's nine major ports, Mombasa is the largest and busiest, whilst Lamu Port is emerging as a future logistics hub.[6,7]

Kenya is aligning its maritime policy with climate goals through multiple frameworks, including its fourth Medium Term Plan.[8] The National Action Plan for maritime decarbonisation[9] and Vision 2030[10] provide overarching direction, while the draft National Energy Policy[11] and emerging Green Hydrogen Strategy[12] support renewable energy expansion. However, specific hydrogen and e-fuel regulations remain under development, as does the draft National Maritime Transport Policy.[13]

A green corridor initiative develops coordinated first-mover action on a specific trading route to develop use of e-fuels ahead of, or around, 2030. These initiatives offer an opportunity for Kenyan government and industry stakeholders to develop a close partnership with a key trading partner, based on the shared objectives of catalysing demand and improving readiness for e-fuels.

6 Kenya Ports Authority, **Ports & Terminals**

7 Kenya Ports Authority, Strategic Plan 2023/24-2027/28

8 The National Treasury and Economic Planning of Kenya (2024), **Fourth Medium Term Plan 2023 – 2027: Bottom-up Economic Transformation Agenda for Inclusive Growth**

9 In development.

10 **Kenya Vision 2030**

11 Ministry of Energy and Petroleum of Kenya (2025), **Draft National Energy Policy 2025-2034**

12 Ministry of Energy and Petroleum of Kenya (2023), **Green Hydrogen Strategy and Roadmap for Kenya**

13 State Department of Shipping and Maritime Affairs, **Draft National Maritime Transport Policy**

Project background

This analysis explored the technical, economic, and policy factors required to stimulate e-fuel production in Kenya, as well as their use in Kenya's maritime industry. A route assessment was undertaken to understand the feasibility and impact of possible green shipping corridors. The project focused on three fuels, namely e-ammonia, e-methanol, and e-MGO (marine gas oil, i.e., diesel), which are all derived from green hydrogen.

The **International Power-to-X Hub** and the **Global Maritime Forum** executed this project in close collaboration with the **Kenya Maritime Authority** and the **IMO GreenVoyage2050** team, and with critical input from **UMAS** and Dr. Evan Murimi. The activities in this study were funded through the International Power-to-X Hub. The International PtX Hub is implemented by the German federally-owned Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the German Federal Ministry for Economic Affairs and Energy (BMWE). Financed by the International Climate Initiative (Internationale Klimaschutzinitiative, IKI), the International PtX Hub is a contribution to the German National Hydrogen Strategy of 2020 and represents one of the four pillars of the PtX action programme initiated by the Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety (BMUKN) in 2019.

Methodology

This analysis employed a comprehensive, multi-method approach that combined desk research, stakeholder engagement, input from Kenyan national experts, and specialised technical analysis.

Stakeholder engagement and data collection: Over 20 interviews were conducted with public, private, and non-profit stakeholders from December 2024 to May 2025. Two workshops were held—one in Mombasa (February 2025) and one in Nairobi (May 2025)—with more than 50 participants from across the shipping value chain presenting objectives, discussing findings, validating assumptions, and identifying next steps.

Assessment of e-fuel potential: UMAS performed a techno-economic assessment to determine whether Kenyan e-fuels would be both technically feasible and economically viable. In the assessment, production costs across three e-fuels (e-ammonia, e-methanol, e-MGO) were estimated using eight scenarios with varying production locations for renewable electricity and green hydrogen, different production scales, and a range of transport options for electricity and e-fuels (see **Annex A**). The analysis built upon previous work by H2Global,[14] focusing on Mombasa as the primary port location.

14 H2Global Foundation (2025), **Renewable Ammonia: Kenya's Business Case**

Green corridor assessment: The Global Maritime Forum's green corridor assessment[15] guided the identification and prioritisation of potential shipping routes. The analysis involved UMAS's Fuse model using vessel-tracking data from 2023 to process shipping activity at Kenyan ports. The method combined quantitative shipping data with stakeholder inputs to evaluate route viability based on potential impact and feasibility of implementation across six key dimensions (see **Figure 1**).

Figure 1.
Criteria for identifying and assessing green corridors

Impact		Feasibility			
Trade scale	**Carbon intensity**	**Fuel pathway**	**Cargo and demand**	**Policies**	**Stakeholders**
Estimated cargo volume and energy demand, growth projections	Carbon intensity and current emissions on the route	Availability and cost of the supply of zero-emission fuels	Traded goods, relative price increase and Scope 3 importance within the traded sector(s)	Alignment of national policies of the participating countries	Ease of the stakeholder environment on the route

15 Based on Next Wave Report: Global Maritime Forum (2021), **The next wave: Green corridors**

2. Findings and implications

What is Kenya's e-fuel production potential?

Four key findings emerged from the supply-side analysis:

1. Kenya can produce e-fuels with green hydrogen at a levelised cost ($1,121 per tonne), which is competitive with other global production locations. However, they are at least four times the cost of low-sulphur fuel oil (LSFO) when compared equivalently.[16]

2. The most cost-effective combination of factors assessed for the production of e-fuels is large-scale, Mombasa-based green hydrogen and fuel production.

3. Addressing key limiting factors, particularly the cost of capital, would increase the global competitiveness of Kenya's e-fuel production.

4. Advancing e-fuel bunkering capability calls for strategies that boost demand and tie it directly to production to secure offtake commitments. Kenya could position itself as a regional e-fuel bunkering hub to support the utilisation of e-fuels.

5. A set of illustrative projects (see **Annex A**) was used to define a series of scenarios to understand the correlation between key factors and cost in the production of e-fuels.

E-ammonia is the cheapest of the three fuel options across all modelled production configurations in this analysis (**Figure 2**). The estimated price of e-ammonia is $1,121/tonne for the optimum combination of factors (**Figure 3**). For comparison, the recent H2Global pilot auction won by Fertiglobe for renewable ammonia production in the Suez Canal Economic Zone in Egypt saw an average product price of €811 (approximately $922) per tonne.[17] Although e-ammonia costs more to transport than e-methanol and e-MGO, this is far outweighed by the additional cost of sustainable carbon feedstock required for e-methanol and e-MGO production.

16 Note: this is the current cost comparison (2025) and does not consider any regulation which may impact cost in the future, such as international or national regulation.

17 H2Global Stiftung (2024), **Results of the pilot auction**

Ammonia is handled globally as a commodity today, with several advancements in engine and vessel design. However, further progress in the safe handling, storage, and bunkering of ammonia is required for its use as a maritime fuel.[18] Kenya's demand for ammonia in fertiliser production offers an additional offtake opportunity, alongside its potential use in shipping. This would support Kenya's objectives to shift 20% of ammonia imports to domestic production[19] and provide a more robust business case (with multiple offtakers and larger-scale plants) to seek early investment in developing a green ammonia supply chain.

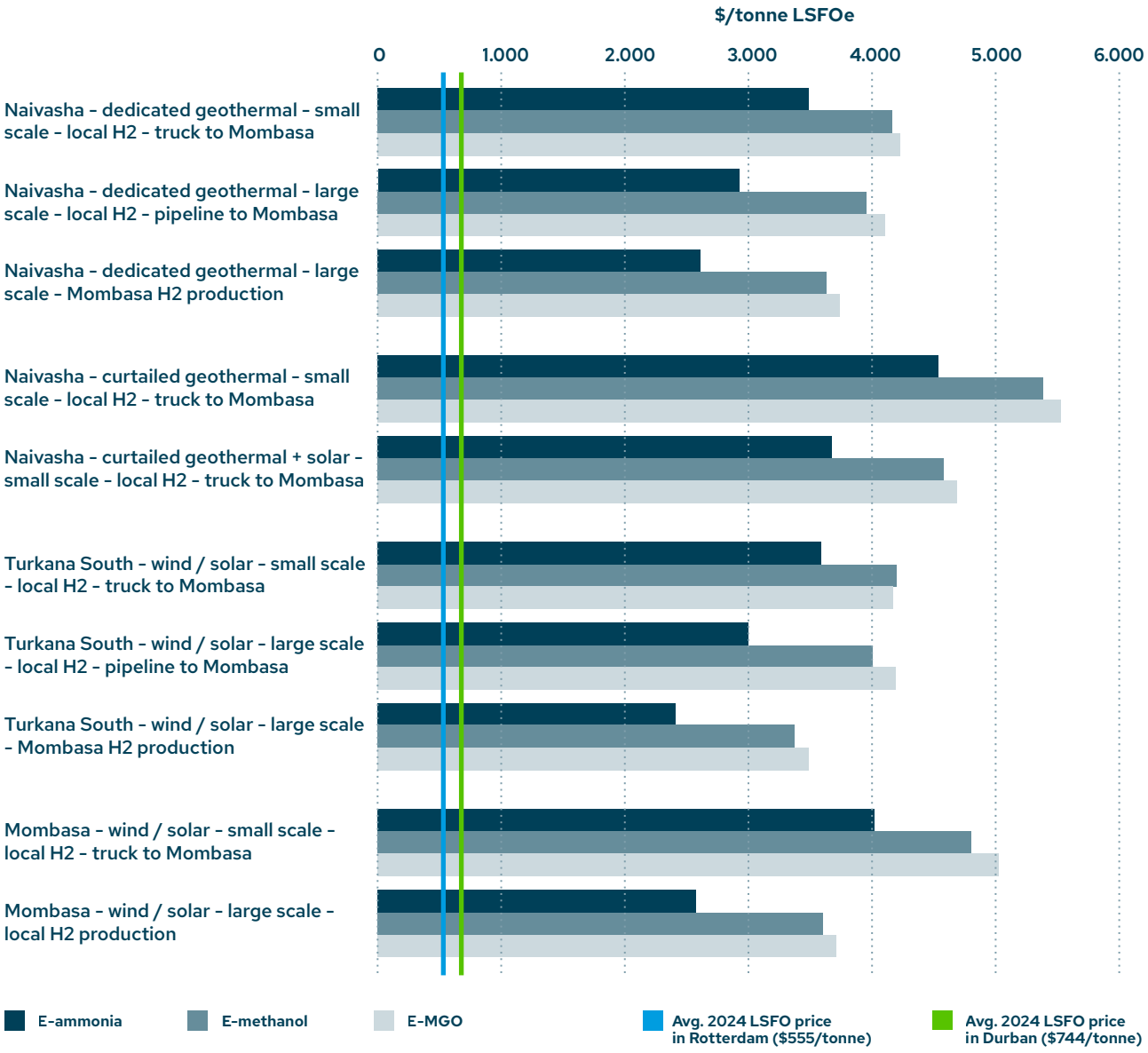


Figure2.
Cost of e-fuels delivered to Mombasa across different scenarios

18 Getting to Zero Coalition (2025), **From pilots to practice: Methanol and ammonia as shipping fuels**

19 Ministry of Energy and Petroleum of Kenya (2023), **Green Hydrogen Strategy and Roadmap for Kenya**

In comparison to e-ammonia, e-methanol and e-MGO are more costly options. E-MGO is the costliest option with estimated prices ranging from $3,729 to $5,902 per tonne. This is compared to the cheapest option for e-methanol production at $1,667/tonne, with top-end costs at no more than $2,660/tonne across both e-methanol and e-ammonia. Across all three fuels, the most cost-effective combination of production characteristics is large-scale (i.e., 50,000 tonnes of green hydrogen per year), Mombasa-based hydrogen production. Although the per tonne cost does not account for differing energy contents, **Figure 2** provides a comparison in the context of low-sulphur fuel oil (LSFO) equivalence. E-ammonia remains the lowest cost option amongst the e-fuels considered, although it is at least three times the cost of LSFO. It is important to note that while cost is a critical factor, there are others which influence fuel choice and will be shaped by the strategies of ship operators and other supply chain actors.

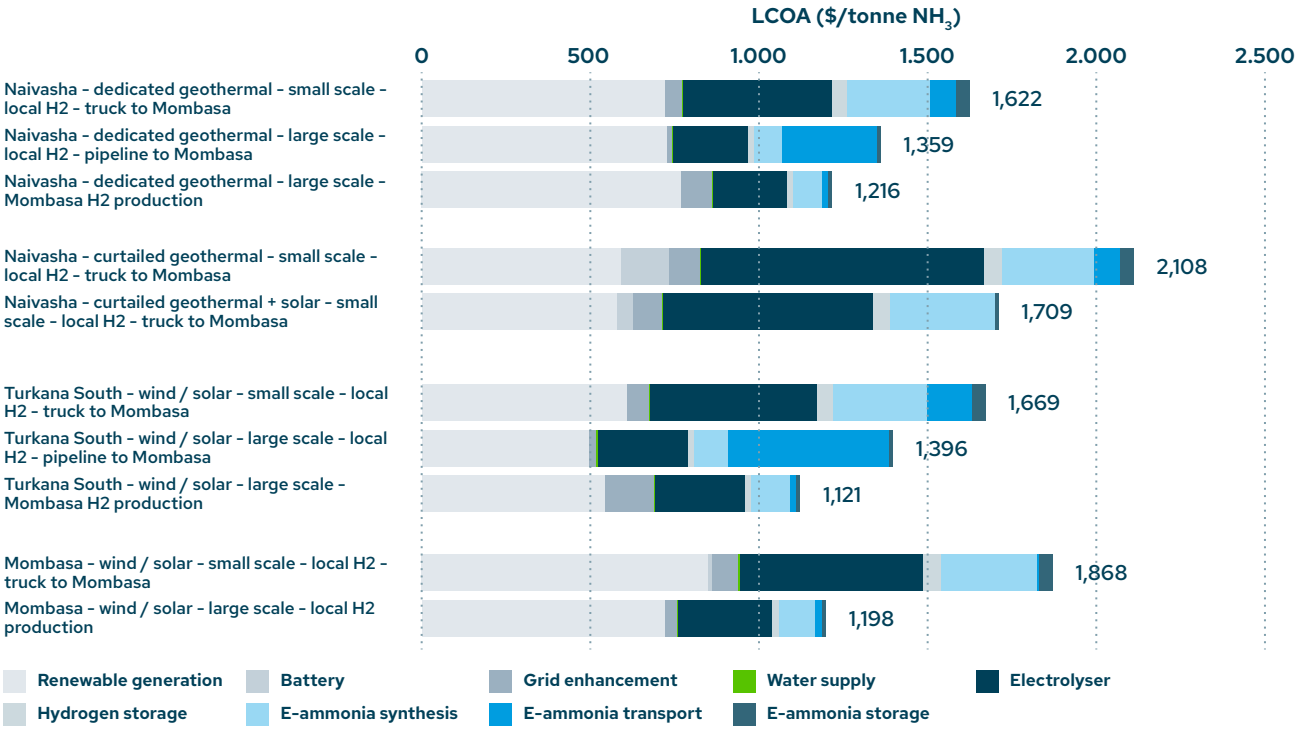


Figure 3.
Levelised cost of e-ammonia LCOA across illustrative production scenarios, with small and large-scale plants with different upstream renewable generation and production locations

Key challenges

Some key factors limiting e-fuel development include the cost of capital, port readiness, the need for grid expansion and strengthening, limited support for pre-feasibility assessments, and land rights.

Exploring one of these aspects further, a regional comparison highlights the significant impact of weighted average cost of capital (WACC)[20] on the levelised costs of renewable energy production (see **Annex B**).[21] For example, the levelised cost of e-ammonia for a large-scale project at Turkana South (Mombasa-based production) at a WACC of 13% is $1,121/tonne; this would fall to $750/tonne if the WACC were 6% or rise to $1,538/tonne if the WACC were 20%. A range of factors affect the cost of capital, including construction delays, lower-than-planned production volumes, as well as default, currency, and jurisdiction risk. Policy measures may be able to mitigate some of these factors. Initially prioritising projects that are export-focused may also attract a lower risk premium.

Opportunity: Kenya's potential as a regional bunkering hub

Kenya could position itself as a regional e-fuel bunkering hub, seeking to attract traffic to bunker e-fuels and improve the business case for further investment.

To become a regional e-fuel bunkering hub, Kenya will need to access e-fuels (whether produced domestically or imported), build infrastructure at ports to store and bunker these fuels, and attract ships that can use such fuels. The opportunity would be shaped by competition from other nearby bunkering hubs.

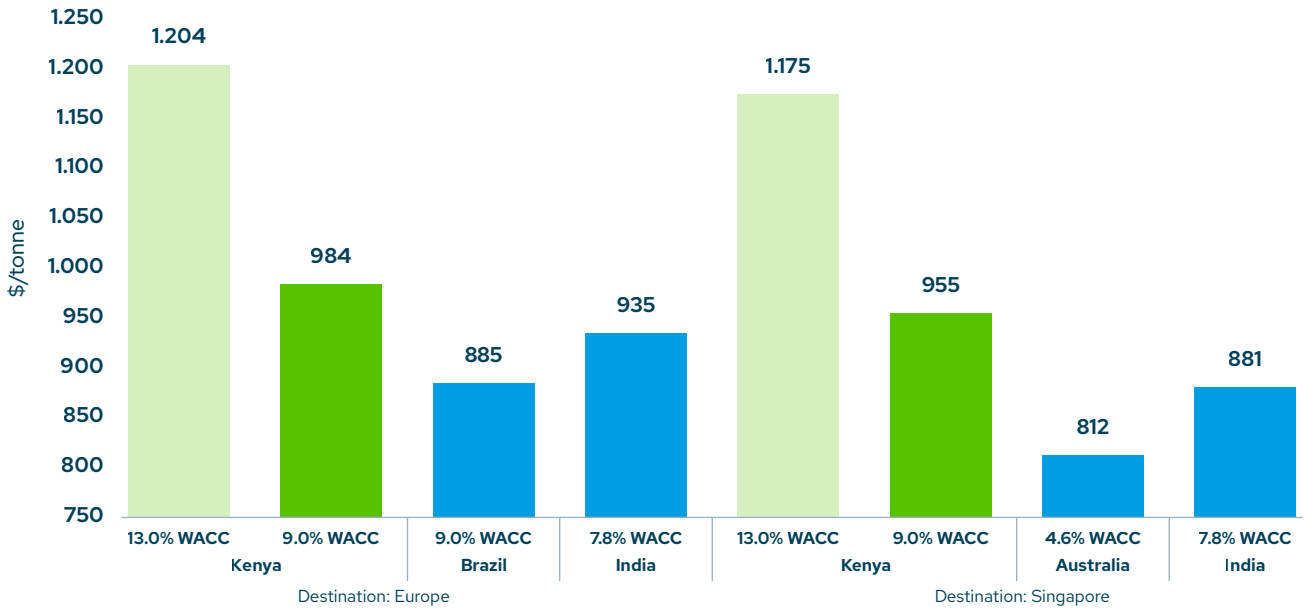
Kenya could consider targeting the smaller vessels which currently call at its ports. However, if demand is not sufficiently accumulated by smaller vessels, production plants able to reach final investment decision may be smaller in size. This will increase levelised costs (see **Figure 3**). Additionally, the scales of trade on the routes to and from Kenya may not offer a sufficient incentive for shipowners to replace these smaller vessels rather than prioritising larger vessels on other routes. The capital expenditure (CAPEX) to decarbonise these larger vessels is better offset by the larger scale of commodities transported. This is especially important early in the low-carbon transition when the cost gap is so high (at least three times the cost of conventional fuel when compared equivalently—a challenge faced by countries globally).

20 WACC represents the average interest rate that investors and lenders require to finance a project - essentially, how expensive it is to borrow money for the project. The higher the perceived risk of investing in Kenya, the higher the WACC.

21 Levelised cost of energy represents the total cost of producing a unit of energy, including all upfront investments for building the needed infrastructure, operating costs, and financing costs over the assumed lifetime of the energy generator.

Opportunity: Kenya's potential as e-fuel exporter

On the supply side, export-oriented projects may benefit from lower cost of capital and larger production volumes, therefore attracting investment. Kenya could consider exporting e-fuels to bunkering hubs in close geographic proximity, like the Middle East, or further afield, such as the EU or Singapore. **Figure 4** indicates that Kenya can produce e-fuels at a cost that is competitive with countries that would likely be its competitors—particularly if it can reduce the cost of capital.



Note: The light green bars indicate the delivered cost of ammonia in $/tonne when Kenya's WACC is 13%, compared to the dark green bars when Kenya's WACC is 9%. The blue bars are the delivered cost of ammonia to the same locations from different countries.

*Note on assumptions: **Figure 4** includes the cost of storage and shipping. These are not representative figures of all possible projects in these countries; some projects are likely to be lower and higher in levelised cost. The comparison is intended to be indicative of the impact of WACC on levelised costs. More details on assumptions can be found in the* **long version of this report**.

Figure 4.
Cost of e-ammonia delivered to Europe and Singapore compared to other locations, with WACC comparisons, based on UMAS analysis

Considerations for national stakeholders

Greening Kenya's maritime sector presents a transformative opportunity to stimulate socio-economic development and support the delivery of several UN Sustainable Development Goals. Substantial economic and social benefits can be unlocked by adopting green technologies and supporting the production of e-fuels. This will attract investment, create jobs and invigorate local economies, particularly in key port cities such as Mombasa. These jobs would span sectors such as renewable energy production and green infrastructure maintenance,[22] requiring skilled labour across the supply chain.[23] The burgeoning green hydrogen

22 Tunley Environmental (2024), **Green Shipping Corridors: All You Need To Know**

23 State Department for Shipping and Maritime Affairs (2025), **Kenya backs Global Green shipping transition quest**

economy also presents an opportunity for localised economic growth and improved energy access. Renewable energy for green hydrogen projects will provide anchor demand, supporting the business case for expanding the grid and connecting more local communities.

These changes, impacting a diverse range of workers and communities, will require government officials, industry actors, and civil society representatives to integrate social dialogue into project planning, for example through co-designing re-skilling programmes with seafarer unions. This type of dialogue ensures reciprocal communication to understand the needs of affected groups and ultimately overcome project challenges to achieve the best outcome for all. As part of this, transparent grievance mechanisms and equitable compensation frameworks can help to avoid and mitigate land displacement, disruption of livelihoods, and loss of cultural heritage.[24]

Which routes offer the highest potential for a green shipping corridor?

Green corridors should create the conditions for scaling zero-emission shipping activity before 2030. They do this by focusing on trade routes that have specific characteristics that make them best placed to be first movers (e.g., favourable policy) and unlocking public-private collaboration.

The project analysed which trade routes would be best suited for green shipping corridor development, with five key factors considered in the assessment:

1. **Regularity** of a shipping type or set of ships calling at Kenyan Ports to identify routes with a consistent demand signal for, and eventual use of, e-fuels.

2. **Characteristics of shipping types** in Kenya, including the size of ships, to consider the scale of demand on any route.

3. **Scale and nature of commodities traded**, in particular the opportunity to access cargo owners' willingness to pay for more expensive e-fuels.

4. **Kenyan ports** involved in trade, considering readiness for e-fuels and scale of traffic, with a focus on Mombasa as Kenya's biggest port, whilst recognising the development of Lamu Port,

5. **Trading partners** involved in key routes who may be amenable to building an international partnership with Kenya and have a suitable level of readiness to develop an e-fuel green shipping corridor.

24 International Working Group on Indigenous Affairs (2013), Kanyinke Sena, **Lamu Port-South Sudan-Ethiopia Transport Corridor (LAPSSET) and Indigenous Peoples in Kenya**

This assessment focused on four shipping types: container ships, bulk carriers, general cargo ships, and vehicle carriers.

Container shipping

A green shipping corridor focused on container shipping could be explored further, addressing key challenges in transhipment, size of vessels, as well as scale and nature of cargo.

All of the 174 container ships calling at Kenyan ports in 2023 are of a size that typically operate on a regional scale (smaller than 8,000 twenty-foot equivalent units (TEU)). Approximately a third of these indicated a pattern of regular port calls. These primarily split out into services which sailed to the Middle East, South Asia (typically via the Middle East), or East Asia.

The transhipment challenge

European countries are importers of Kenyan goods but don't appear in the primary routes identified. This is because, while exports to some countries in the Middle East and Asia may travel directly (for example, tea to Pakistan), containerised goods travelling to the Americas, Europe, or further into Asia rely on transhipment via countries in the Middle East or Asia. Corridors on such transhipment routes, where cargo is transferred to another ship during the journey, may see a more complicated pathway to collaboration.

Understanding the dynamics of decarbonising both parts of the route (from Kenya to the transhipment hub and from the hub to the end destination, e.g., Europe) would be important from two key perspectives:

- If a feeder ship operates on the first leg, it is important to understand whether there is an incentive for a liner seeking those feeder services to decarbonise that part of the route (paying a premium to do so), rather than decarbonising their own fleet; and
- If both parts of the routes are operated by the same ship operator, it is important to consider what the advantage would be to bunker in Kenya and the Middle East at the transhipment point, rather than only the latter. This could be the case if Kenya produced cheaper e-fuels than the Middle East, but this is unlikely given influencing factors such as the scale of renewables, the Middle East's green hydrogen ambitions and government support.

Both scenarios are worth considering but face additional challenges around scale due to the small size of the containerships currently docking in Kenya, which would be more expensive to decarbonise than the large ships in operators' fleets. Dedicated feeder operators may have the appetite to do so, with some doing so in Europe already.[25]

25 Riviera (2024), **X-Press Feeders starts Europe's first green methanol network**

Kenya's high-value containerised export goods include tea, coffee beans, and clothing (see Figure 5). Large importers could be approached to cover the green premium, but the container ships will not be exclusively filled with the goods they import. Book and claim systems could partly respond to this.

Cut flowers are commonly transported by plane, but stakeholder interviews revealed that a shift is underway. Ten to 15 containers of cut flowers are now being shipped to Europe each week, and there have been improvements to cool logistics with greener reefers.[26] Coffee beans also offer a strong opportunity, with significant interest from cargo owners to help pay the premium, some of whom are members of the Zero Emission Maritime Buyers Alliance (ZEMBA).[27]

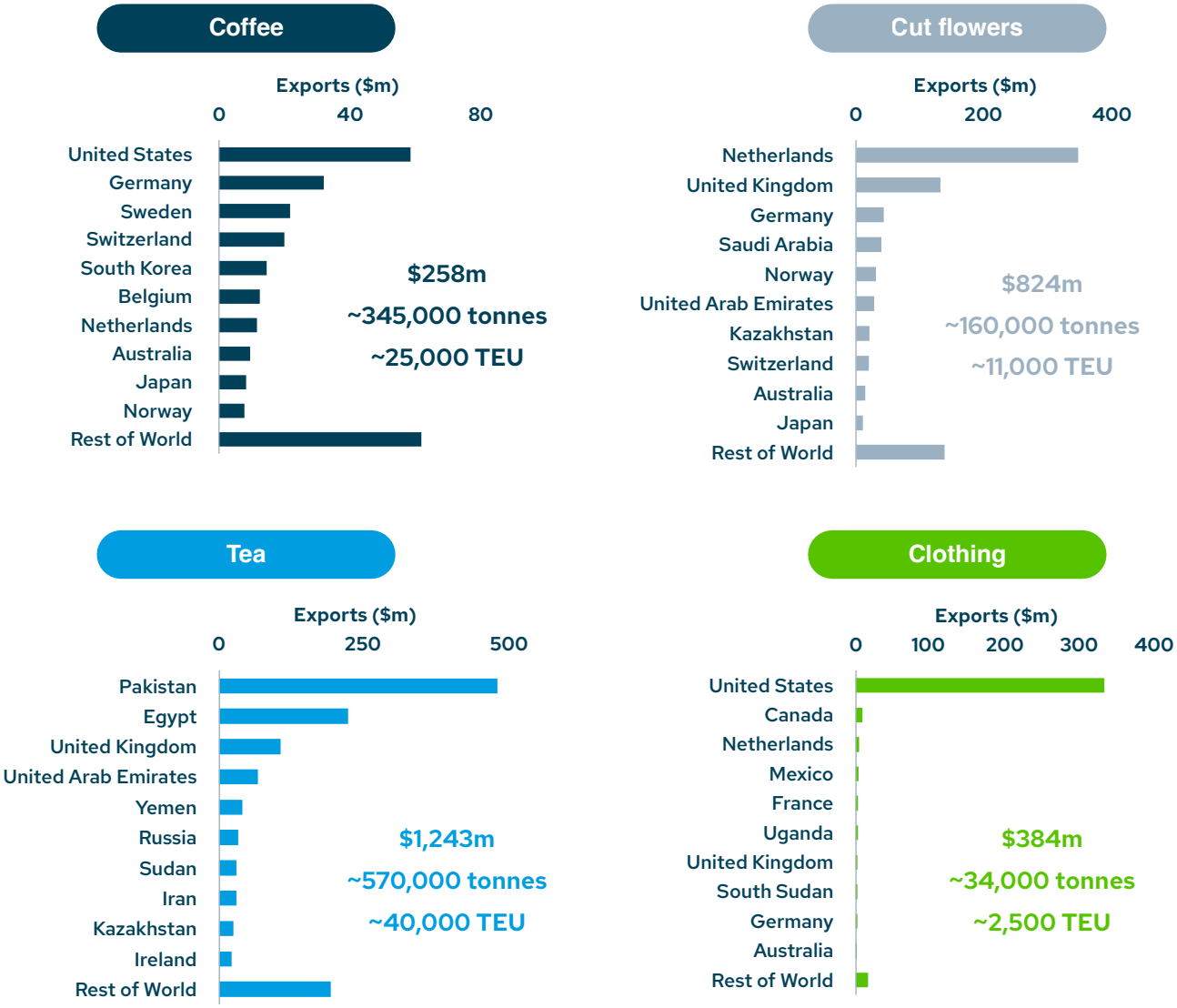


Figure 5.
Value and destination of Kenyan key export goods according to 2023 UNCTAD data (Graphic from UMAS)

26 Green Cooling Initiative, Greener Reefers in International Maritime Transport

27 Zero Emission Maritime Buyers Alliance – ZEMBA

Bulk shipping

A green shipping corridor focused on bulk shipping is unlikely to be feasible due to the irregularity and nature of trading patterns, as well as the type of commodities exported and imported from Kenya.

Seaborne transport of dry bulk is generally described as "tramp" shipping: visiting a wide range of ports according to demand. This lack of regularity raises a challenge for a green corridor and would likely require a change in the way that ships currently operate.

Bulk carriers calling at Kenyan ports were relatively small (approx. 90% of them were Handysize to Ultramax, all with a deadweight tonnage under 70,000), which could create challenges in eliciting the right demand signal for the supply of e-fuels.

Rare mineral ores and soda ash are the bulk commodities exported from Kenya in the largest volumes. Due to the high value of rare mineral ores, consumers may consider paying a premium for green shipping, as the cost of shipping is a small proportion of the overall cost of the goods. However, mining depletion and regional multi-port calls would present challenges for a green shipping corridor focused on these types of commodities.

Lastly, imported bulk commodities are generally lower-cost and more price-sensitive than exports, including grains. The seasonality of these products, in addition to the low willingness to pay a premium (and considering that this premium would likely land on Kenyan consumers), would make a green corridor focused on bulk imported commodities challenging.

General cargo shipping

A green shipping corridor focused on general cargo shipping would be challenging due to the regional nature of trade, size of ships, and cargo traded.

While the trading profile of general cargo ships can be as global and irregular as bulk carriers, given their smaller size (and thus more expensive transportation cost on a per-tonne of cargo basis), voyages are typically shorter than those of bulk carriers. The 57 general cargo ships calling at Kenyan ports in 2023 largely arrived from or departed to other ports in Kenya or to other countries within the region. In total, 21 ships called more than once in Kenya and nine called more than five times in 2023. The regularity of these ships could offer a good basis for a green corridor. This type of regional trade may align well with the objectives and benefits of the African Continental Free Trade Area.[28]

28 The African Continental Free Trade Area, **About the AfCFTA**

The range of cargo that is carried on these routes makes it harder to understand cargo patterns and seek out cargo owners willing to support the premium cost of e-fuels. Additionally, the ships are generally smaller on these routes and therefore the CAPEX to shift that ship/route to e-fuels is proportionately higher relative to the cargo carried.

Vehicle carriers

A green shipping corridor focused on vehicle carrier trade would likely benefit from consumer willingness to pay but may face challenges with the amount of calls to other ports these vessels make.

Vehicle carriers transport cars, trucks and other equipment from the centres of production (Europe, Asia, and the United States) to global markets. **Table 1** indicates the trading profile of vehicle carriers calling at Kenya, loosely split into five types.

Trading profile	No. of calls in Kenya	Total capacity calling at Kenya (no. of cars)
Asia - Africa - Americas - Asia	3	19,062
Asia - Africa - Asia	55	312,919
Asia - Africa - Europe - Americas - Asia	18	111,923
Asia - Africa - Europe - Asia	11	63,050
Europe - Africa - Asia	11	70,643

Table 1.
High-level trading profile of vehicle carriers calling at Kenyan ports in 2023

Although the proportion of these ships' time sailing to and from Kenya is limited, the end-to-end voyage profiles indicate that these ships typically operate regular trading patterns with consistent ports of call.

A vehicle carrier green corridor could benefit from consumer willingness to cover part of the cost gap for green fuels,[29] and the best opportunity in Kenya's case is likely to be the Asia-Africa-Asia route (see **Table 1**). However, given the time spent by these ships calling at other locations, a green corridor coalition may face some complexities around e-fuel availability, unless e-fuel is only used on certain legs of the voyages.

29 BCG (2024), **The Real Cost of Decarbonizing in the Shipping Industry**

Green shipping corridor feasibility

The assessment across key shipping types in Kenya resulted in a longlist of routes. This list was further refined using the Global Maritime Forum's multicriteria assessment (see **Figure 1**) to produce a shortlist of routes identified in **Figure 6**. Recognising the ongoing Red Sea challenges, **Figure 6** includes an indicative route passing the Cape of Good Hope.

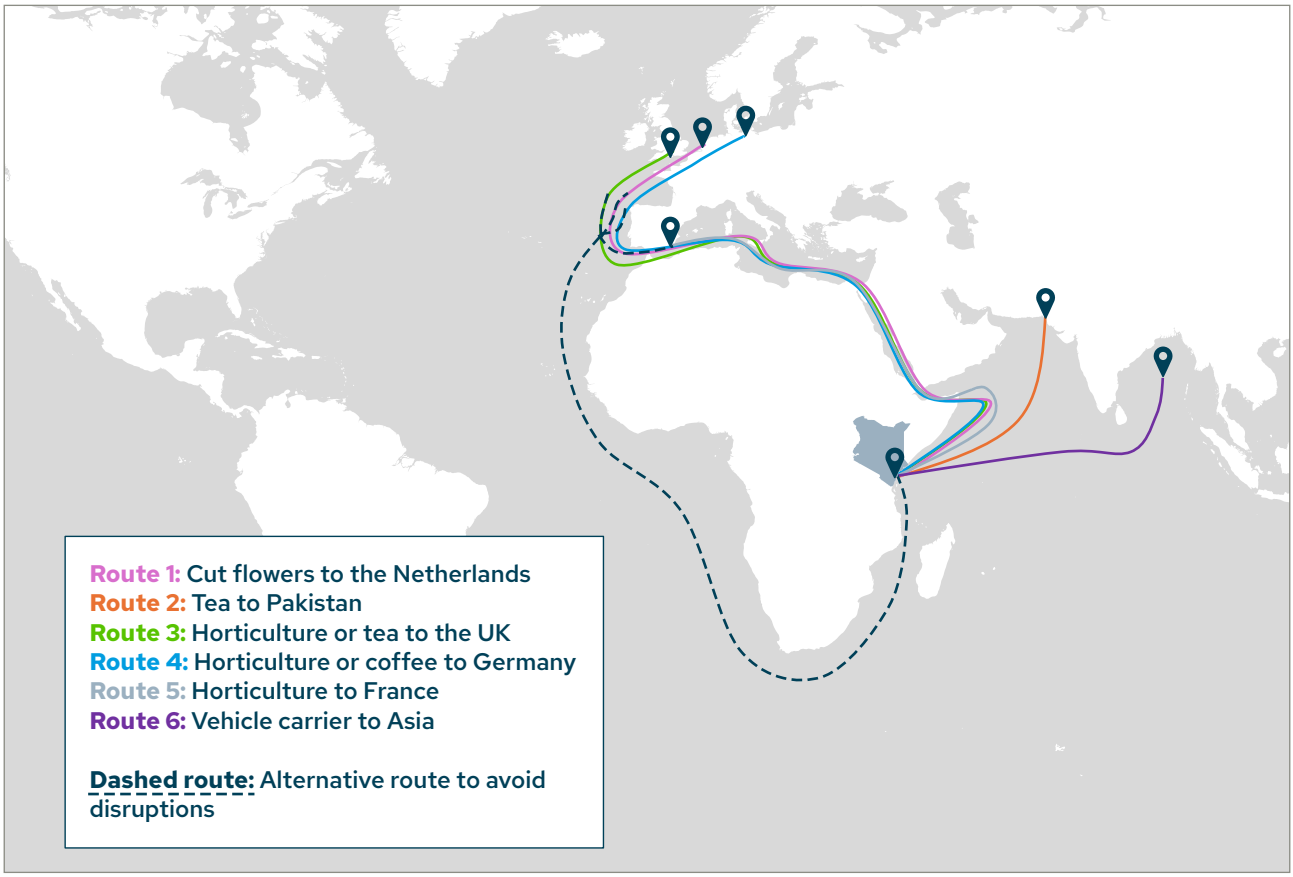


Figure 6.
Map of shortlisted green shipping corridor routes

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Graphics sources: **Kenya outline**, **World map**

Two of these routes merit further consideration: one transporting cut flowers to the Netherlands, and one trading coffee with Germany. The Netherlands and Germany are among the top importers of Kenyan cut flowers and coffee, respectively (see **Figure 5**), and with an appetite from European cargo owners to decarbonise these supply chains, a green shipping corridor could be considered for either. This appetite is reflected in, for example, the ambitions of Royal FloraHolland, which handles 90% of the Dutch flower trade,[30] and leading German coffee company Tchibo, both of which are taking steps to reduce their supply chain emissions.[31,32] The potential of these routes also aligns with Kenya's plan to move 50 percent of its horticulture exports from air to sea freight by 2030.[33]

30 Harvard Business School (2024), **A Day at Royal FloraHolland: The Epicenter of the Global Flower Market**

31 Royal Flora Holland (2024), **Annual Report 2024**

32 nafsgreen (2023), **ZEMBA To Accelerate Maritime Shipping Decarbonization**

33 Delegation of the EU to Kenya (2023), **Kenya's green move to shift 50 percent of horticultural exports from air freight to sea freight**

Growing readiness of Dutch and German ports, as well as evolving incentives to use greener shipping fuel in the EU, would also support the corridors' efforts. However, two key challenges would face these corridors: the low volumes of goods currently being moved (and therefore a limited opportunity to mobilise cargo owners to pay a sufficient premium), and the transhipment of both commodities via the Middle East.

Exploring transhipment routes further

Kenya has a basis for public-private collaboration, in addition to existing international partnerships that would support the coordination of the full ecosystem in any green corridor initiative. However, there are some key challenges facing transhipment routes connected to the upcoming international regulations from the IMO (see **Annex C**). Some key assertions from this analysis can be made in this project's context:

1. On a feeder route from Kenya to the Middle East, a compliance pathway where penalty payments are made (the so-called "pay-to-pollute" option) may be favoured due to the cost of e-ammonia in either Kenya or Saudi Arabia.

2. Kenyan e-ammonia will struggle to compete with Saudi Arabian e-ammonia. Neither will be competitive in the near-term without IMO rewards, but Kenya's reward would need to be significantly higher to trigger the scale of offtake required.

3. The level of IMO reward has not yet been set, and a reward that is focused specifically on e-fuels and prioritises a just and equitable transition may make Kenyan ammonia on these routes more viable.

Additional opportunities for first mover activity

For first mover activity prior to 2030, Kenya could focus on several non-route-based measures to maximise maritime potential. These could be pursued as a phased approach whilst testing further interest in green corridor routes, as they offer tangible opportunities that match Kenya's priorities and ambitions in the maritime space.

Leveraging voluntary demand – By leveraging voluntary demand from cargo owners to reduce emissions, for example in the EU, Kenya could build on existing momentum in sectors like cut flowers, where the shift from air to sea freight has already begun. Book-and-claim systems offer a means to aggregate demand from different cargo owners, shipowners, and ship operators. This approach enables cost-sharing across the value chain, thereby addressing the cost gap between conventional and green fuels.

Accessing policy incentives – Kenyan fuel producers could access existing subsidies offered by e-fuel importing countries, whilst building out production capacity and domestic demand in the shipping sector and beyond.

Regional e-fuel pilot projects – Kenya could initiate e-fuel pilot projects to test processes and advance the value chain's readiness for large-scale e-fuel bunkering/use. Beyond operational insights on, for example, fuel handling, such projects could support policy development, capacity building, and grid strengthening—all of which will help position Kenya for the mass market transition to e-fuels by the mid-2030s.

3. Future direction

As global shipping accelerates, the opportunities identified in this analysis provide Kenya with multiple pathways to establish itself as a leader in maritime decarbonisation. Success will require coordinated action across government, industry, and international partners to implement supportive policies, develop necessary infrastructure, and create enabling conditions for investment.

As global shipping accelerates its transition to zero-emission fuels, Kenya's early action in developing e-fuel production capabilities and demonstrating their viability will position the country advantageously in the emerging green maritime economy. The next phase should focus on translating these opportunities into concrete action plans, securing financing for pilot projects (including through global sources like the Green Climate Fund), and establishing the regulatory frameworks necessary to support Kenya's maritime decarbonisation ambitions.

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Supported by:

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Annexes

Annex A

Illustrative projects modelled by UMAS to cover a range of locations and types of renewable energy resources.

Renewable generation location	Renewable generation type	Project scale (hydrogen production)	H2 plant location	Transport electricity to plant site	Transport e-fuels to Mombasa port
Inland (Naivasha)	Geothermal	1,000 annual tonnes	Inland	N/A	Truck
		50,000 annual tonnes	Inland	N/A	Long distance pipeline
		50,000 annual tonnes	Mombasa	Enhanced grid capacity	Short distance pipeline
	Geothermal curtailment	1,000 annual tonnes	Inland	N/A	Truck
	Geothermal curtailment & solar	1,000 annual tonnes	Inland	N/A	Truck
Inland (Turkana South)	Wind & solar	1,000 annual tonnes	Inland	N/A	Truck
		50,000 annual tonnes	Inland	N/A	Long distance pipeline
		50,000 annual tonnes	Mombasa	Enhanced grid capacity	Short distance pipeline
Near Mombasa	Wind & solar	1,000 annual tonnes	Mombasa	Enhanced grid capacity	Truck
		50,000 annual tonnes	Mombasa	Enhanced grid capacity	Short distance pipeline

Annex B

Weighted Average Cost of Capital (WACC) impact on levelised costs of hydrogen and ammonia.

Variable	Kenya	South Africa	Mozambique	Tanzania	Saudi Arabia
Assumed WACC (%)	13	10	19	12	7
Solar CAPEX (USD per MW)	606	606	606	606	455
Solar capacity factor (%)	16	16	16	16	16
Solar LCOE (USD per MWh)	73	63	95	70	43
Wind CAPEX (USD per MW)	1,337	1,337	1,337	1,337	1,361
Wind capacity factor (%)	42	42	42	42	42
Wind LCOE (USD per MWh)	66	57	84	63	49
Small-scale production (1,000 tonnes H_2 per annum)					
LCOH (USD per kg H_2)	8.5	7.4	10.9	8.2	6.1
LCOA (USD per tonne NH_3)	1,868	1,614	2,415	1,793	1,321
Large-scale production (50,000 tonnes H_2 per annum)					
LCOH (USD per kg H_2)	5.9	5.2	7.6	5.7	4.2
LCOA (USD per tonne NH_3)	1,198	1,036	1,545	1,150	846

Annex C

Lowest total cost of ownership (TCO) for each compliance / fuel option.