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

H4D - ESMAP Webinar Series



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Background

Why decarbonise the shipping industry?

International shipping accounts for around **3% of global greenhouse gas emissions**.

Decarbonising the sector is essential to meeting global climate targets and futureproofing the shipping industry.

What is Power-to-X?

Power-to-X refers to converting **renewable electricity into green hydrogen and its derivatives**, such as **e-ammonia, e-methanol, and e-diesel**, which can be used as low-emission fuels in sectors like shipping.

The opportunity: Kenya as regional green shipping hub

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.

A green shipping corridor could be one way of **stimulating demand** for e-fuels.



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Kenyan Opportunity



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How can we make these opportunities a reality?

Study focus



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Understanding the zero-emission supply chain in Kenya

Demand side potential, focusing on green corridor feasibility

E-fuel production potential



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Shipping sector's economic relevance to Kenya

Key figures

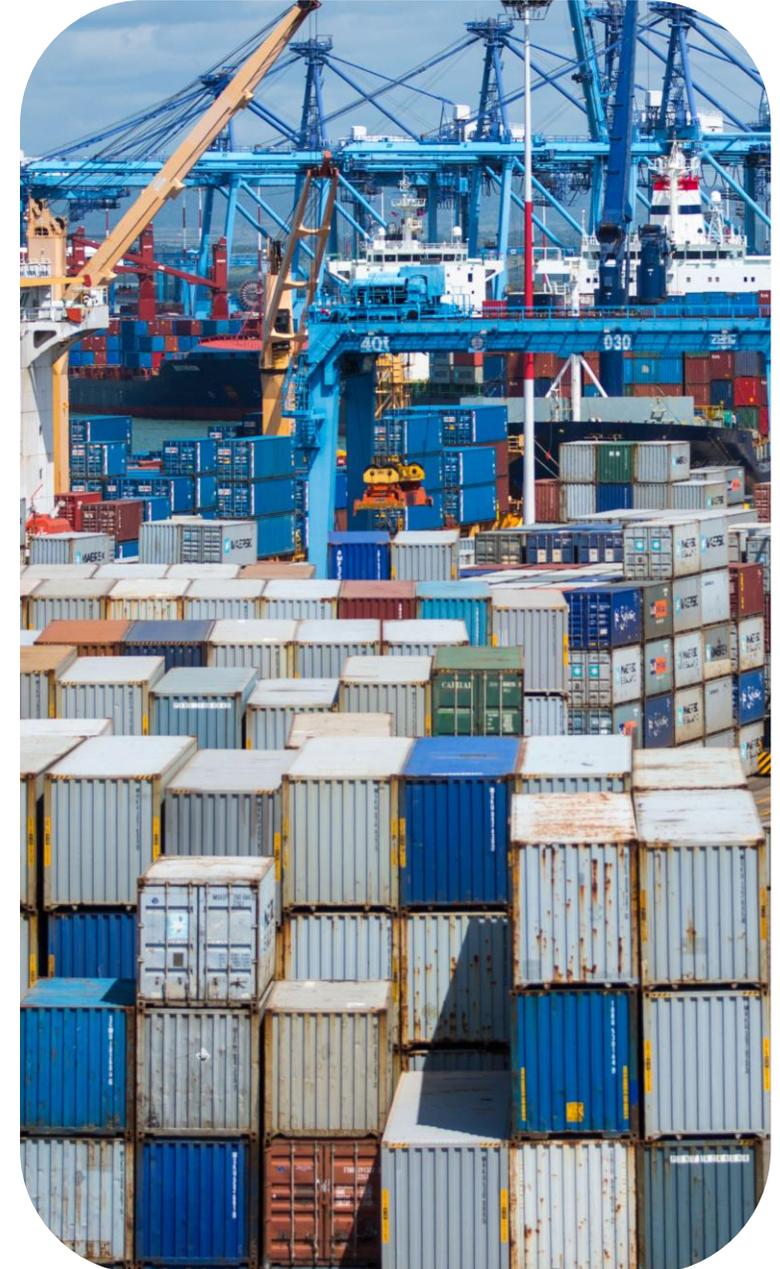
90% of Kenya's imports/exports via sea

727 ships called at Kenyan ports in 2023

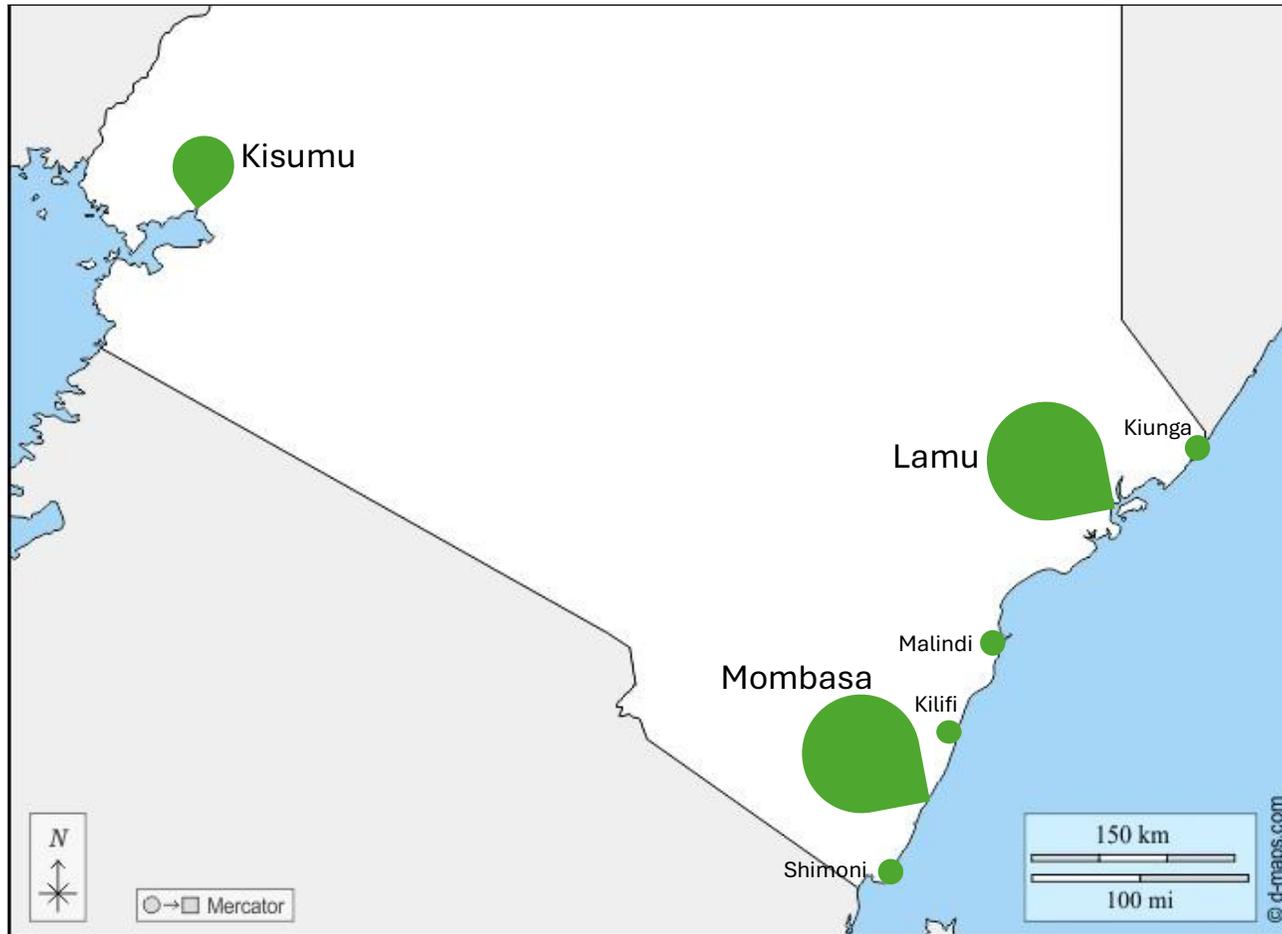
1,621 port calls in 2023

The maritime sector is important for the Kenyan economy with >90% of Kenyan imports and exports traded by sea.

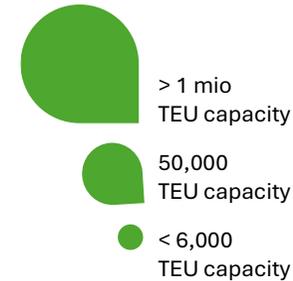
The majority of ships calling at Kenyan ports are **containerships**, making 671 calls in 2023 (259 calls for bulk carriers as second largest segment).



Kenya's biggest ports



Graphics source: Map outline



Of Kenya's 9 major ports, Mombasa is the largest and busiest with 2+ million TEU capacity, whilst Lamu Port is emerging as a future logistics hub.



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What does the zero-emission shipping supply chain look like in Kenya?

Key take-aways



Kenya's maritime sector is **economically critical**: Over 90% of Kenya's trade moves by sea. **Mombasa** is the primary port, with **Lamu** emerging as a future logistics hub under the LAPSSET corridor. Kenya is also an important **regional trade hub**, particularly for landlocked countries.



Trade disruptions present ongoing risks: Red Sea/Suez Canal disruptions affect ~15% of Kenya's foreign trade by volume.



Kenya exports **cut flowers, coffee, and tea** to **European markets** where there's strong demand for sustainable logistics



Kenya's regulatory environment is **evolving**: Kenya is aligning maritime policy with climate goals through its **National Action Plan (NAP)** and broader strategies like Vision 2030 and the **Green Hydrogen Strategy**. Specific hydrogen/e-fuel regulations are still under development.



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Preliminary results: Supply side



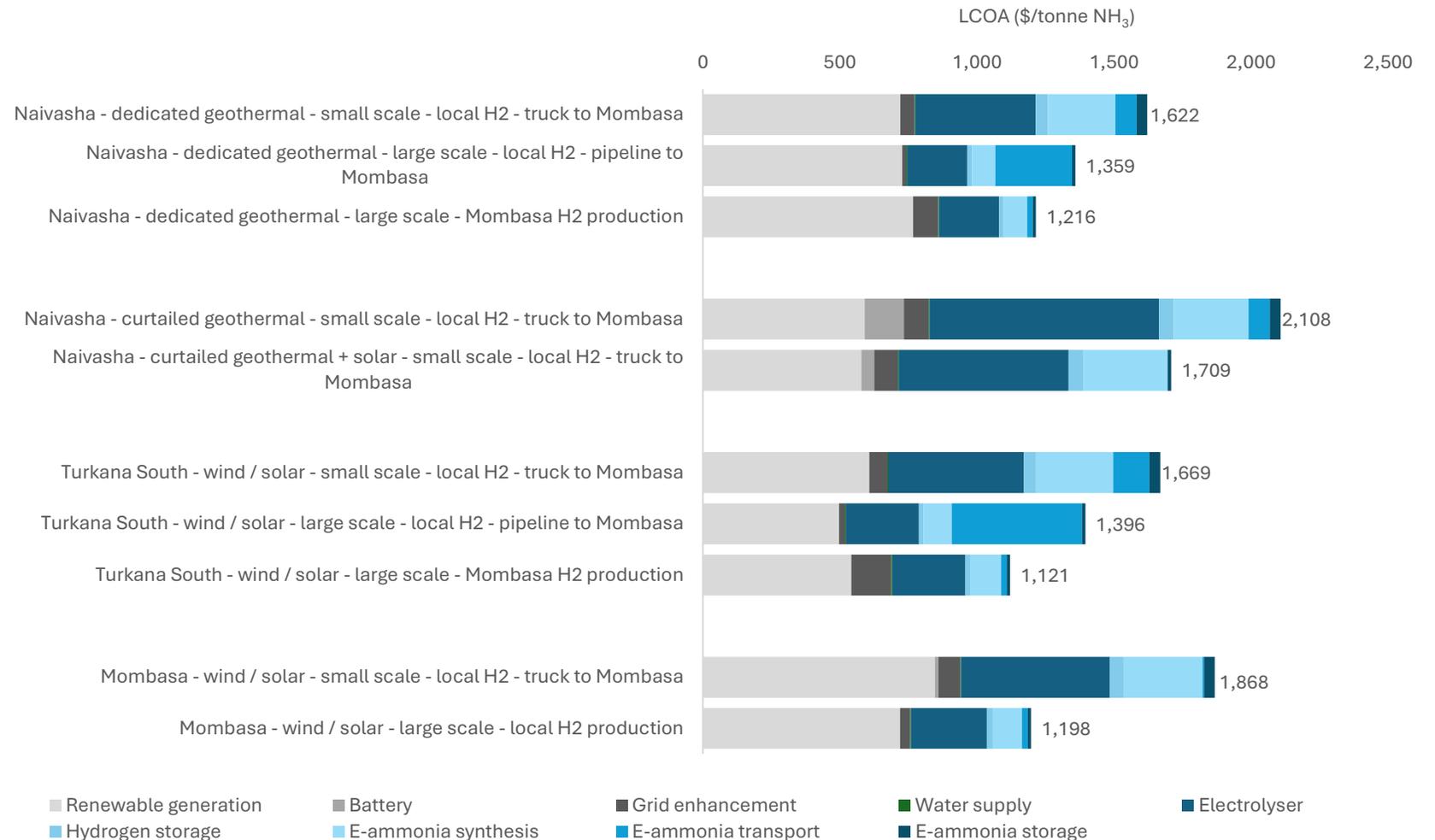
What is the e-fuel production potential in Kenya?

Levelised cost of e-ammonia (LCOA) for small and large-scale plants with different upstream renewable generation and production locations

E-ammonia currently offers the most competitive option for e-fuel production at USD 1,121/tonne.

For comparison, the recent H2Global pilot auction won by Fertigllobe for ammonia production in the Suez Canal Economic Zone in Egypt saw an average product price of EUR811/tonne (approximately USD922).

Beyond shipping, the agricultural sector is a large offtaker for e-ammonia for fertiliser production. This could further boost demand and lower costs.





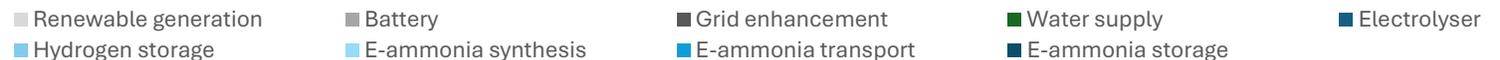
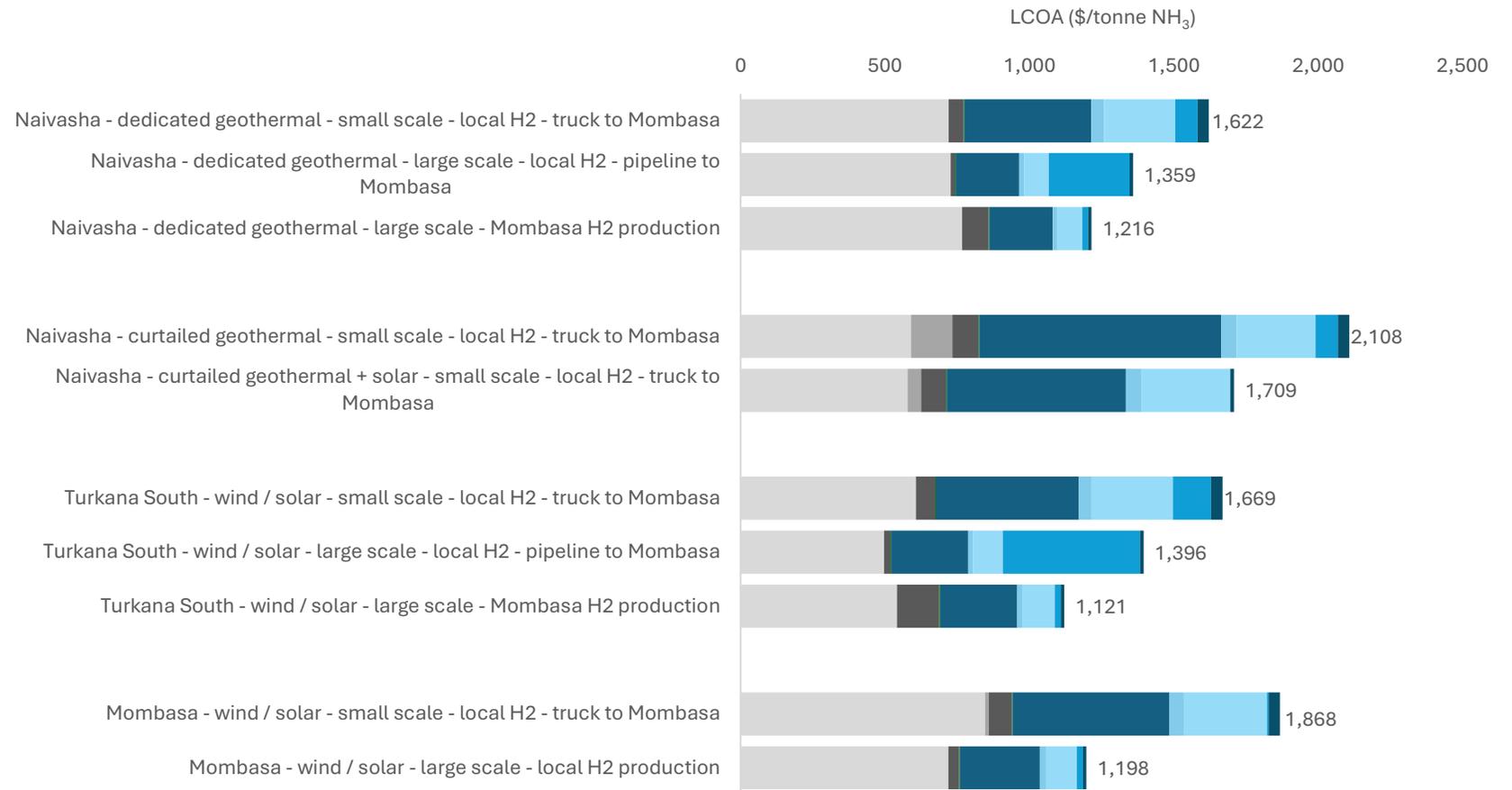
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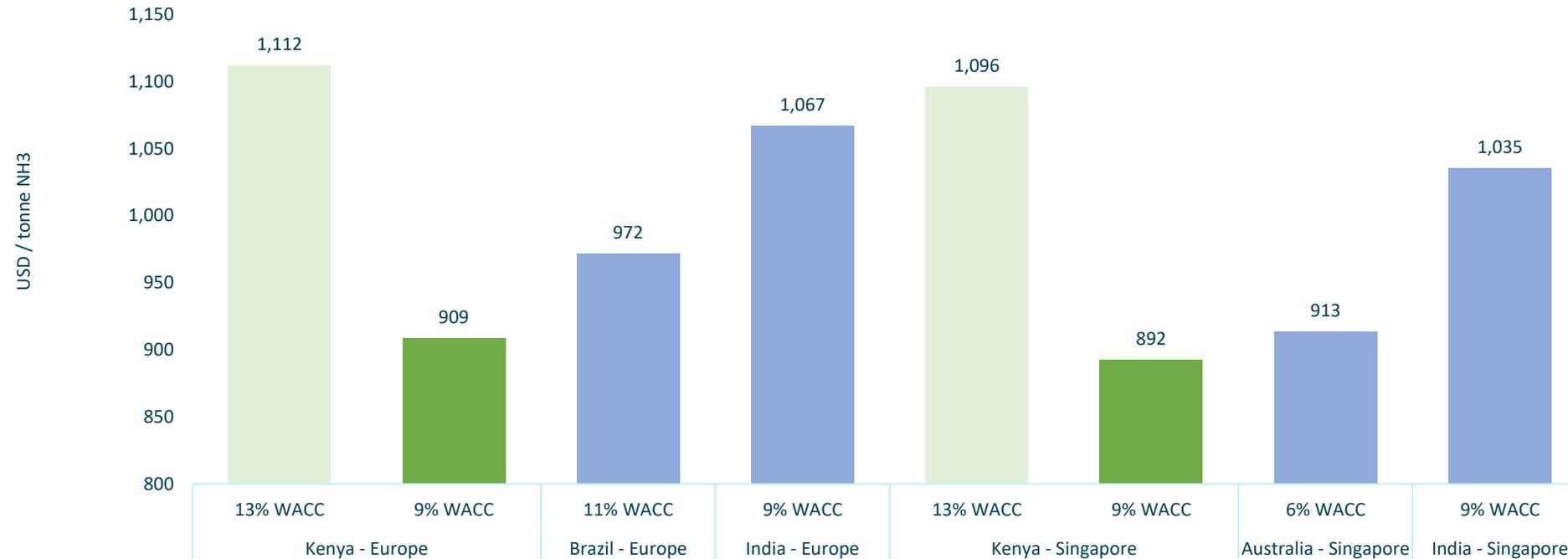


Challenges for e-fuel development in Kenya



Key barrier: Cost of capital

Delivered cost of e-ammonia to Europe compared with other locations, with WACC comparisons





What is the e-fuel production potential in Kenya?

Key take-aways



Kenya can produce e-fuels with green hydrogen at a levelised cost as low as 1,121 USD/tonne which is **competitive** with other global production locations, particularly **e-ammonia** and **e-methanol**



Most cost-effective combination of production characteristics is **large-scale, Mombasa-based** green hydrogen and e-ammonia production (small-scale projects are not achieving economies of scale required to make costs levelised costs competitive)



Addressing key limiting factors – particularly the relatively high **cost of capital** - would **increase competitiveness** of Kenya's fuel globally



Bunkering and use of e-fuels in Kenya is contingent on **stimulating demand** and connecting this with production to **secure offtake**. Kenya could position itself as a regional e-fuel bunkering hub to support this but will face some key challenges in achieving this



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Preliminary results: Demand side

Route assessment methodology

1. University of Maritime Advisory Studies Fuse model
2. Global Maritime Forum's green corridor methodology



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

A **longlist of routes** was created and filtered into a **shortlist of promising candidates**.



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Overview of Kenyan shipping activity



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Shipping type	No. of ships	No. of calls at Kenyan ports
Containerships	174	671
Bulk carriers	237	259
Oil/chemical tankers	135	210
General cargo ships	57	144
Other vessels	19	137
Vehicle carriers	62	98
Liquefied gas carriers	19	55
Passenger/RoRo ships	18	40
Cruise ships	4	5
Reefer ships	2	2



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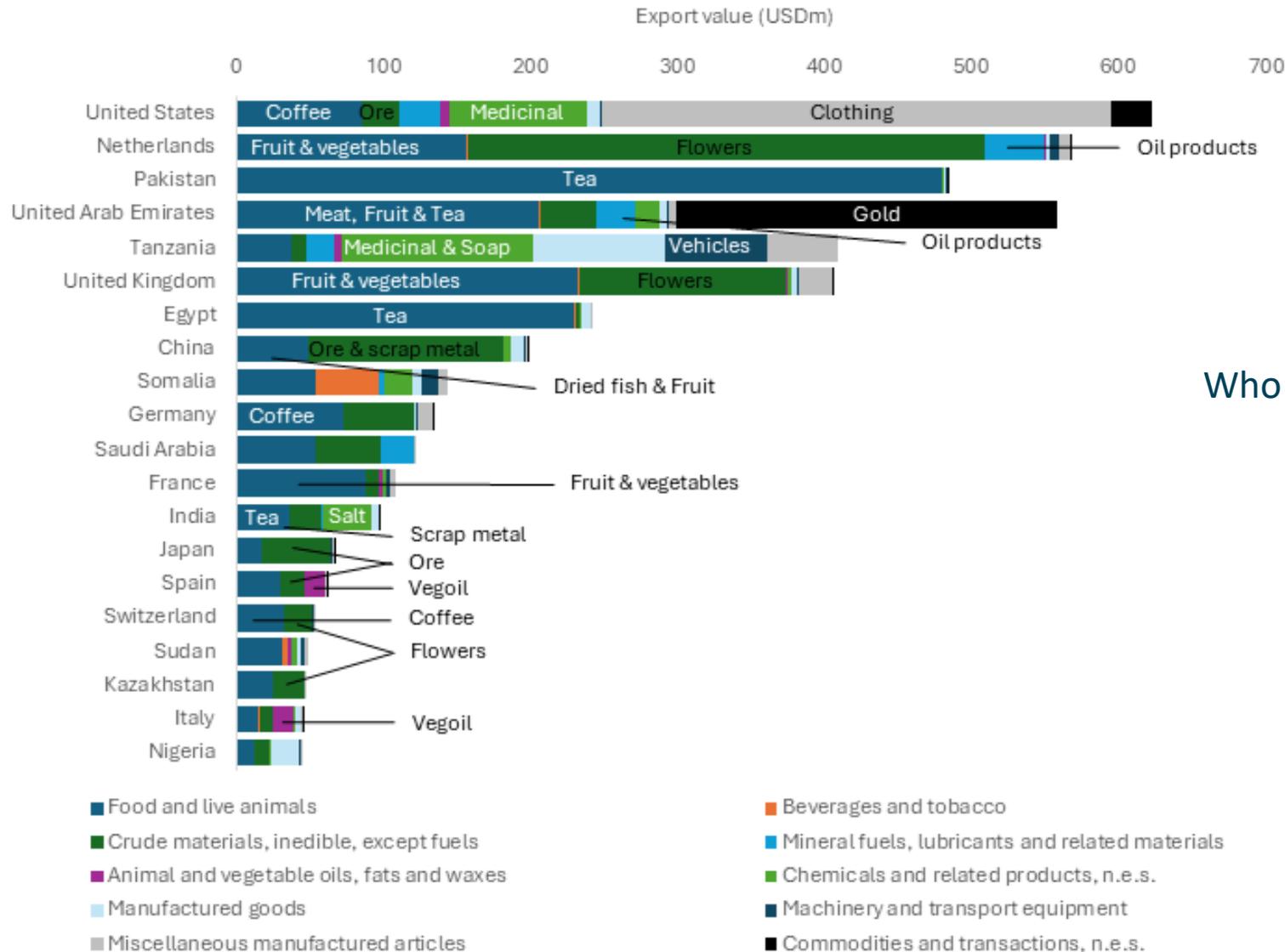
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Kenyan exports



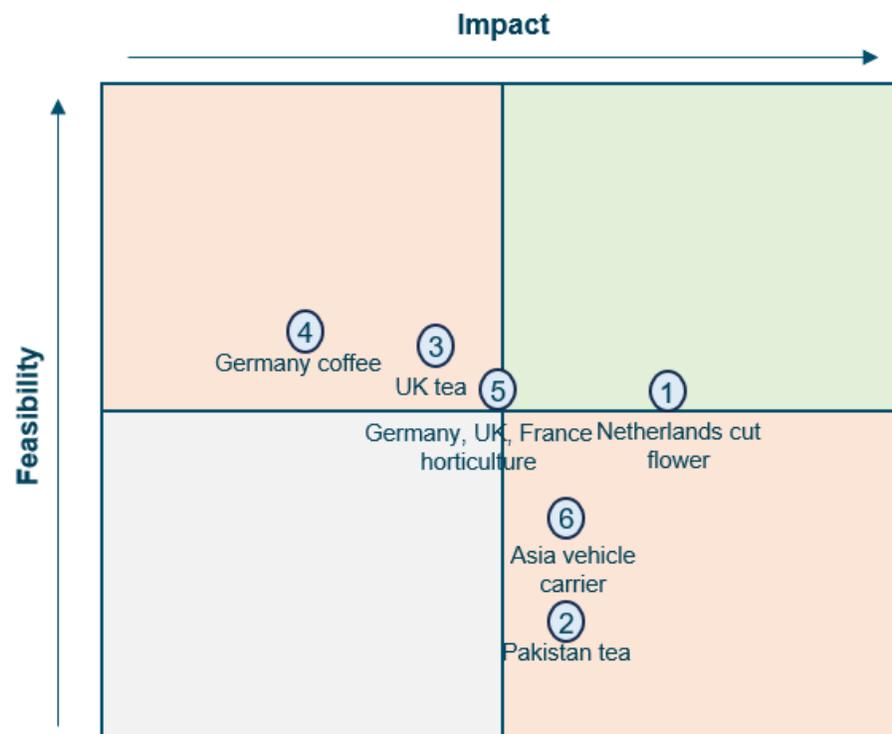
Who are these exporters?



What is the potential for Green Shipping Corridors in Kenya? Which routes are most promising?

Creating a shortlist with the green corridor prioritization framework

Routes on the longlist were mapped according to their feasibility and impact ratings, which were based on the economic, regulatory and stakeholder analysis, as well as the analysis on the potential for e-fuel production.



Higher feasibility, why?

- Enabling environment, subsidy, supportive regulation
- Willing stakeholders
- Willingness to pay
- Regularity of route

Higher impact, why?

- Bigger impact on emissions reductions
- Size of route



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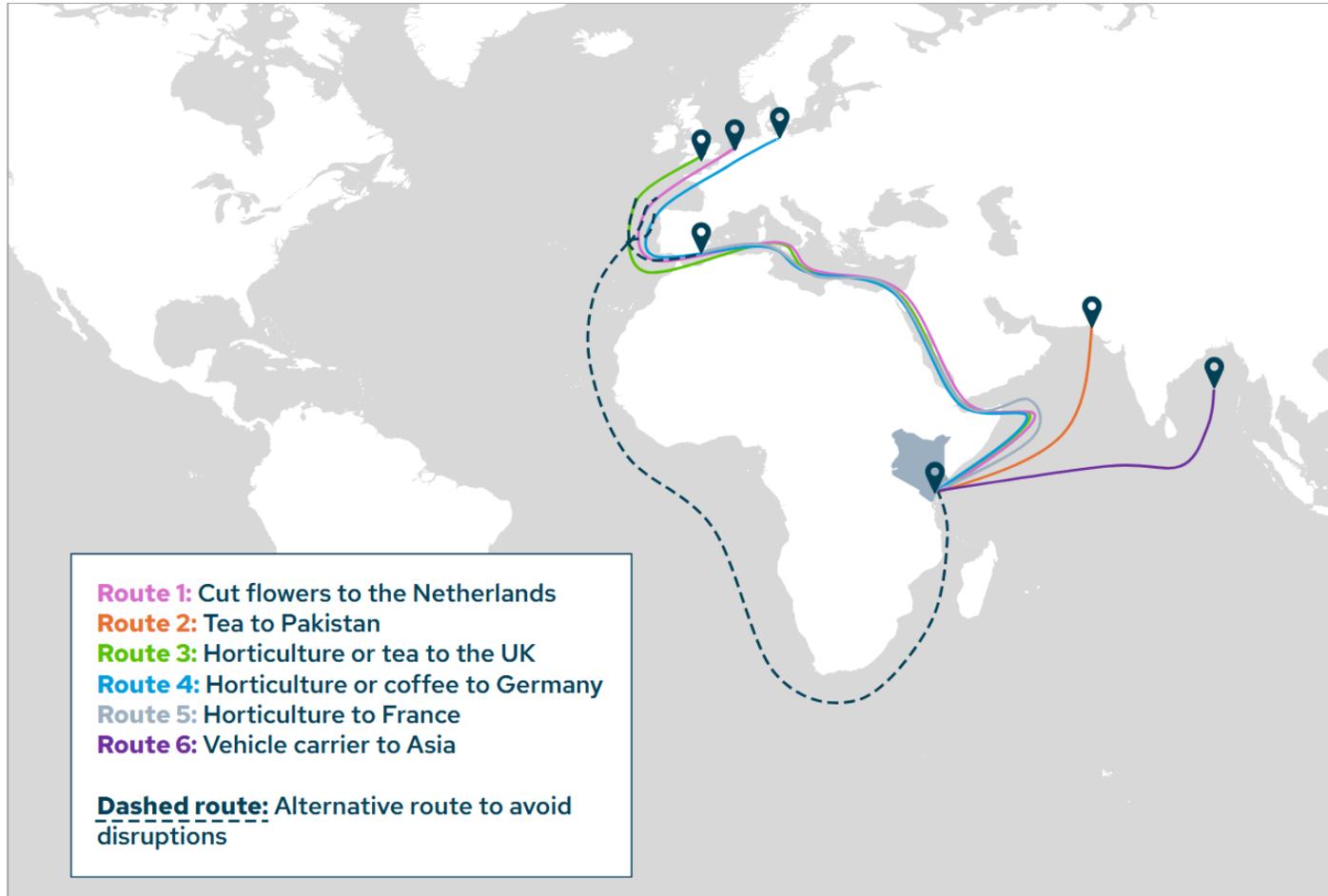
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4 What is the potential for Green Shipping Corridors in Kenya?
Which routes are most promising?

Map of shortlisted green shipping corridor routes



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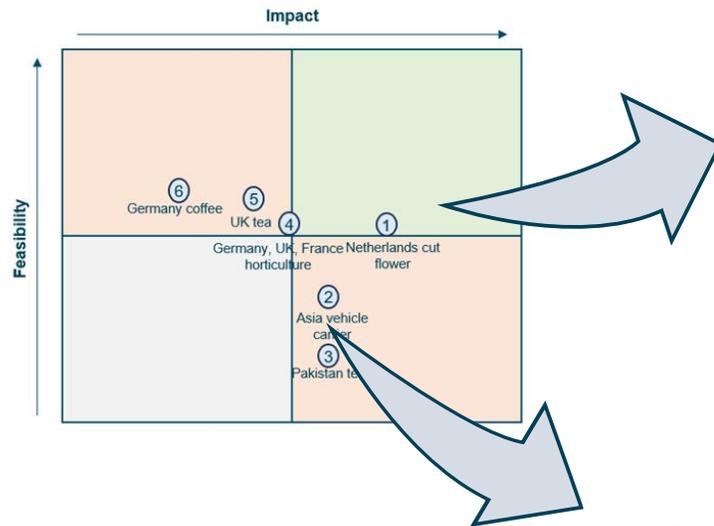
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4 What is the potential for Green Shipping Corridors in Kenya? Which routes are most promising?

Shortlist of the two most viable routes



Route 1: Netherlands Cut Flowers

A green shipping corridor between Kenya and the Netherlands, likely the Port of Rotterdam, could access appetite from European cargo owners to decarbonise their commodity supply chain for cut flowers. The growing readiness of Dutch ports and evolving incentives to use greener shipping fuel in the EU would also support the corridor's efforts.

Two key challenges would face this corridor however, with goods being transhipped via the Middle East before going to Europe (facing disturbances) and the required modal shift of cut flowers from air to sea freight at sufficient volumes to mobilise willingness to pay of cargo owners and cover the green premium.

This corridor could engage with organisations seeking to green refrigerated cargo ships (reefers), making them more climate and environmentally-friendly to maximise impact.

Route 6: Germany Coffee

A green shipping corridor between Kenya and Germany could also access appetite from European cargo owners and benefit from the increasing readiness of German ports for greener fuels. Similarly to Route 1 however, this route is also transhipped via the Middle East and due to low volumes of cargo, would likely need to be aggregated across multiple European routes to fill enough ships to meet the offtake requirements for new e-fuel production.

Note on low volumes: you could establish a corridor with multiple cargoes (with some willingness to pay a premium on part of the cargo), but the rest of the cost gap would need to be closed through other means e.g. public/private mechanisms.

What is the potential for Green Shipping Corridors in Kenya? Which routes are most promising?

Key take aways



Green corridors are an opportunity to coordinate efforts on zero-emission shipping. They align stakeholders across the value chain to deploy zero-emission fuels and technologies along specific trade routes.



There are some routes which Kenya could consider further for a green shipping corridor initiative, including to Europe. Six routes were identified in this study as showing the greatest potential, across container shipping (cut flowers, tea, coffee) and vehicle carriers.



Aggregating demand is essential to secure investment. Individual routes are often too small from Kenya. Combining multiple export flows would be required to stimulate enough demand certainty.



Early action can unlock long-term leadership for Kenya. By initiating e-fuel pilot projects before 2030, Kenya can position itself as a regional leader in green maritime trade and attract climate-aligned investment.



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Policy recommendations for the Kenyan government

Policy-recommendations

1

Create a supportive policy environment for e-fuels

Incl. measures that enable streamlined processes for hydrogen and e-fuel developments; measures targeting the cost gap and barriers to e-fuel offtake; measures targeting port expansion and skills development

2

Facilitate financing for e-fuels

Incl. government subsidies for e-fuels; implement and support risk-sharing mechanisms or blended finance vehicles with the private sector; address project-level factors like scale of production; lower cost of capital by addressing macro-economic risks and project-level factors

3

Position Kenya to benefit from revenues disbursed by the IMO

I.e., improve port readiness for green fuels, expand and strengthen the electricity grid. These actions will set Kenya up to receive revenues that the IMO will disburse under the Global Fuel Standard mechanism.

4

Engage in international partnerships for knowledge exchange and technical cooperation

This might also include accessing international funds. Recommended focus areas for international collaboration are port readiness and market and policy development for e-fuels

Policy recommendations for the Kenyan government

Action-oriented recommendations



5

Connect supply and demand by engaging with industry stakeholders

Incl. matchmake supply and demand for e-fuels; engage in public-private partnerships for e-fuel production and use

6

Consider viability of a green shipping corridor to stimulate demand for e-fuels

Explore shipping as offtake sector for e-fuels through collaborating with international trading partners to explore green corridors

7

Stimulate demand for e-fuel, e.g. through,

- a) Targeting cargo owners interested in Kenyan goods (cut flowers, tea, coffee) with a higher willingness-to-pay, for instance utilizing a book-and-claim system
- b) Considering export of e-fuels (beyond domestic use) to close the cost-gap
- c) Initiating e-fuel pilot projects at Kenyan ports before 2030, e.g. at Lamu Port

Conclusions

Kenya could explore the development of a green shipping corridor, in particular the two routes identified to be most viable in this report: a German coffee route and Netherlands cut flower route.

Concurrently or in a phased approach, Kenya could pursue some first steps before 2030 in the following high opportunity areas:



E-fuel production, focused on e-ammonia and e-methanol. There is an opportunity to focus on export at the outset to capitalise on policy incentives offered e.g. by the EU, and build out Kenyan production and stimulate demand domestically



Leveraging 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



Future-proof local port infrastructure in preparation for global market shift to improve readiness for green shipping and position Kenya at the forefront of the transition



Maximise the benefits to the Kenyan economy through securing green jobs and establishing resilient supply chains



Insight Brief
A summary of the key insights can be found here



Full report
A more detailed version of the insight brief can be found here



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