Ship

Zero-emission inland shipping:

From TCO insights to financeability in practice

White paper Condor

CONDOR
zero emission inland shipping

Executive summary

This white paper shows that the transition to zero-emission inland shipping is not being held back by technology, but by financing logic. Economically, battery-electric shipping can already be competitive from now on when assessed over a 20-year period; the bottleneck lies in the first 5 to 10 years in which investments must be repaid. Three key messages are central in this white paper.

1 Battery-electric inland shipping is already possible — especially for short distances
With a TCO index of 107 (fossil = 100), battery-electric shipping is already virtually cost-competitive with diesel today. For the short-distance segment, investment decisions are realistic within 2 to 3 years. For the broader fleet, the tipping point lies around 2034-2035, driven by rising fossil costs due to CO2 pricing and regulation. Hydrogen (TCO index 241) remains structurally expensive and will only be market-ready around 2040. It is part of the long-term strategy, but not a solution for the current transition phase.

2 The real barrier is financeability, not technology
Even with a favourable TCO over 20 years, shipowners are often turned down by their bank. In the first 7 to 10 years - precisely the repayment period of a standard loan - the cash flows of zero-emission vessels remain below those of fossil-fuelled vessels. Banks assess financing on predictability and short-term robustness. This creates a structural gap between economic rationality and credit provision that requires targeted intervention.

3 Condor ZE actions
Condor focuses on making the business case work in the first 10 years. We do this through five connected actions.

Action 1 — Financing Accelerator and uniform assessment frameworks: Per case, we bring together a diverse group of financiers and parties that can provide additional credit support in order to make the case investment-worthy. In parallel, we are working with banks on uniform assessment frameworks, so that financing zero-emission inland shipping becomes routine rather than bespoke.

Action 2 — Continuously validated TCO model: Together with EICB, we keep the TCO model up to date with the latest market prices and practical data. The model serves as a shared frame of reference for the sector, policymakers and financiers, and shortens credit processes.

Action 3 — Unlocking additional revenue models: Through EREs, CO2 insetting and monetisation of PM and NOx reduction, an electric vessel has an estimated cumulative earning potential of EUR 3 to 4 million over 20 years. Within the 'Market workstream', Condor is working to unlock these revenues structurally for shipowners.

Action 4 — Standardisation for cost reduction: Standardisation of battery containers and charging infrastructure is estimated to deliver a 10% CAPEX reduction: EUR 80,000 for battery-electric and EUR 450,000 for hydrogen. Condor is addressing this in the Vessel workstream.

Action 5 — Aligning energy tax with the excise exemption: Diesel is exempt from excise duty; electricity is not. That difference costs an electric vessel EUR 1,000,000 over 20 years. Condor advocates swift alignment, in line with ongoing discussions at the Ministry of Infrastructure and Water Management.

Content

Introduction

Inland shipping faces a fundamental challenge. Climate and air quality targets require substantial emission reductions, while the long service life of vessels - on average 40 to 60 years - means that investment decisions taken today will determine the fleet from 2030 to well beyond 2050. To meet these targets, however, the sector cannot wait for 100% certainty regarding new technologies. The question is not whether the transition to zero-emission is necessary, but how that transition can be realised quickly, feasibly and in an economically sound way.

Condor ZE is a sector-wide public-private programme that aims to accelerate that transition. Our work programme focuses on three pillars: the vessel, the infrastructure and the market. At its core, everything revolves around one question: how do we make investments in zero-emission inland shipping possible? To that end, we are working to reduce the total costs of acquisition and operation, and to stimulate market demand. Our goal: to realise at least 150 investment decisions in zero-emission inland vessels before 2030.

The transition is proving difficult for two interrelated but distinct reasons. The first is economic: emission-free shipping costs more than conventional shipping in the current market. The second is financial: even when the total lifetime costs are favourable, skippers and shipping companies often fail to obtain the financing required. Two problems, two layers of analysis - but closely connected.

This white paper addresses both layers together. In Part I, we present the outcomes of the Condor ZE TCO model: a detailed analysis of total cost of ownership for battery-electric shipping, hydrogen shipping and conventional diesel sailing over a 20-year time horizon. We show where the costs arise, how they develop and which options can improve the competitiveness of emission-free shipping most rapidly.

In Part II, we go one layer deeper: why are positive TCO outcomes still no guarantee of financeability? We analyse what the inland shipping market looks like from the perspective of financiers, which assessment framework banks use and where the current bottlenecks lie. We conclude with concrete actions that Condor is taking in both the short and long term to actually improve financeability.

> This document is intended for entrepreneurs, policymakers, financiers and supply chain partners, each of whom plays a role in creating the conditions for zero-emission inland shipping. A shared understanding of the financing logic, the bottlenecks and the possible solutions is essential.

PART I

1. The costs of emission-free shipping

How competitive is emission-free shipping compared to conventional shipping, and how will that ratio develop over the next two decades? To answer that question, Condor ZE has developed a TCO model that maps total cost of ownership for three propulsion systems: conventional diesel (Stage V), battery-electric and hydrogen fuel cell. The insights have been validated in collaboration with the Expertise and Innovation Centre for Barging (EICB).

1. Why is the TCO model so relevant

In logistics, the total cost of ownership (TCO) model is a widely used way of assessing the competitiveness of a transport product. The model provides insight into costs over time and takes account of the depreciation cost of investments. In this way, an objective and comparable picture emerges.

This perspective is particularly crucial in inland shipping. Cargo owners focus primarily on cost and reliability. Margins are thin and pricing power is limited. This combination means that the viability of a propulsion system is determined primarily by the cost model.

The TCO model serves another purpose in the transition: it highlights both internal and external cost drivers. This gives the sector insight into which external cost drivers are responsible for the relatively higher costs, and therefore provides a concrete agenda for reducing costs across the chain. In this way, Condor works with the sector very specifically on cost reduction.

2. How does a TCO model work

The Condor ZE TCO model maps the total costs of battery-electric shipping and hydrogen (fuel cell) shipping respectively and compares these costs with regular diesel and HVO. The model is flexible: various parameters relating to the vessel, the route and future regulations can be included in the calculations, but can also be omitted if they are no longer relevant.

In this way, impacts can be visualised and segments identified where emission-free shipping becomes price-competitive first. New insights and experience can also be easily incorporated into the model, ensuring it can always be updated and enriched with practical experience.

In addition to Condor ZE, the Expertise and Innovation Centre for Barging (EICB) has also developed a TCO model. Although both models make different choices in some respects, we have aligned the key assumptions as much as possible so that the outcomes are highly comparable. This increases both the reliability of the conclusions and support for them.

In Chapter 4, we analyse the models further and briefly explain the differences.

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3. Principles of the analysis

We have applied five principles in the analysis. These ensure that differences in outcomes arise purely from the underlying business case and not from variations in financing structure, vessel, sailing route or assumptions about the development of energy prices.

Principle 1: Reference vessel

The analysis is based on one standardised reference vessel, so that differences in outcomes can be directly attributed to the propulsion system chosen and not to variations in design or deployment. The reference vessel has the following characteristics:

- Dimensions: 110 m x 11.4 m x 3.5 m
- Deadweight: approximately 3,000 tonnes
- Installed power: 1,527 kW
- Annual consumption (reference): approximately 311 tonnes of diesel

Principle 2: Propulsion configurations

For the comparison, three configurations have been applied to the same vessel:

Stage V (fossil – reference): Current market standard with proven technology, existing infrastructure and a predictable cost structure.

Battery-electric (BE): Electric propulsion with energy supply through swappable battery containers (pay-per-use), with energy storage included in the operating costs.

Hydrogen (H2-FC): Fuel cell configuration with battery support and storage through tank containers, also treated as an operating cost component.

Principle 3: Sailing profiles

The analysis takes account of different sailing distances and deployment profiles. For the comparison, we selected the most representative and economically optimal profile for each technology:

Profile	1	2	3	4	5	6	7	8
RETURN DISTANCE (KM)	**50**	100	**150**	200	250	300	400	500
ROUND TRIPS PER YEAR (#)	**350**	250	**175**	150	125	100	75	50

The capital costs of the energy carriers (batteries and tank containers), which represent a substantial share of the total investment, largely determine the economic viability of zero-emission vessels. Sailing profiles that allow operation with only one energy carrier are therefore the most competitive in the short term and have been chosen as the reference: profile 1 for battery-electric and profile 3 for hydrogen.

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Principle 4: Energy scenarios and price series

For the development of energy prices, the Stated Policies Scenario (STEPS) has been used as the lower bound. This scenario reflects enacted policy and provides a conservative basis for comparing fossil and zero-emission options. In addition to the STEPS scenario, two more ambitious policy directions have also been considered:

- Announced Pledges Scenario (APS): APS assumes full and timely implementation of all announced climate targets, including targets not yet translated into binding policy.
- Net Zero Emissions (NZE): a full 1.5°C pathway with rapid phase-out of fossil fuels and a dominant role for zero-emission solutions.

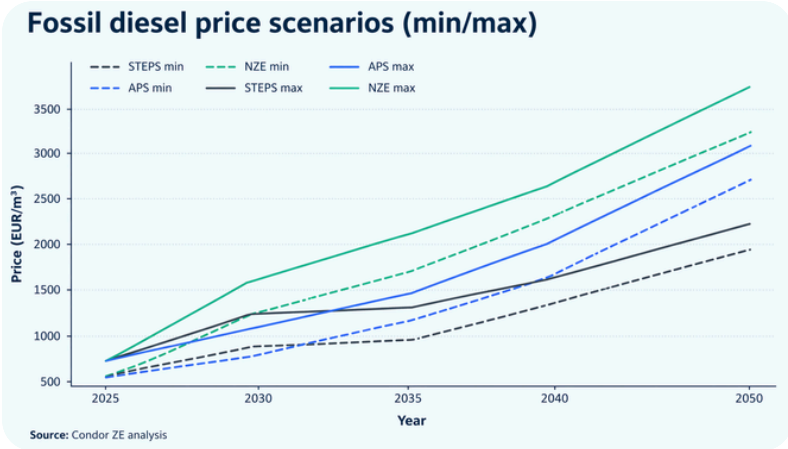

Figure 1 - dieselprice scenarios

The table below shows the price series used for each energy carrier (source: EICB). The range in hydrogen prices is particularly striking: from EUR 5.50/kg (optimistic: successful scaling of green H2 production) to EUR 21/kg (current market price). Electricity prices fall only modestly in the modelling; fossil prices rise structurally due to CO2 pricing.

		Minimum price level						Maximum price level					
Energie drager	**Eenheid**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Fossil diesel	€/ton	0.65	1.14	1.31	1.72	2.04	2.36	0.9	1.56	1.72	2.14	2.45	2.77
HVO	€/ton	1.25	1.4	1.41	1.41	1.4	1.24	1.9	2.08	2.09	2.08	2.07	1.92
Pay-per-use batteries	€/kWh	0.35	0.33	0.3	0.28	0.27	0.265	0.5	0.45	0.4	0.37	0.35	0.34
H2 green	€/kg	5.5	5.5	5.5	5.5	5.5	5.5	21.0	21.0	18.0	14.0	12.0	10.0

Principle 5: Financing assumptions

To ensure a fair comparison between technologies, uniform financing parameters were used:

- 50% debt / 50% equity
- Term: 10 years
- Interest rate: 6%

This ensures that any differences in TCO outcomes can be fully attributed to the inherent characteristics of the propulsion system, not to more favourable or less favourable financing structures.

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4. Cost structure and competitiveness of emission-free inland shipping

As indicated, we have used two TCO models alongside one another. The underlying principles described above have been aligned, so that the outcomes are highly comparable. Even so, some figures differ slightly or the emphasis falls on a different period. In the explanation below, we therefore use insights from both models.

Total cost build-up

To compare costs per propulsion system properly, we look at total costs over a 20-year period. Total costs consist of the initial investment (CAPEX) plus the operating costs required to keep the vessel in operation over 20 years (OPEX). Over this period, one point becomes immediately clear: energy costs are the key driver across all propulsion options. These energy costs include the financing costs of energy carriers and the logistics costs associated with switching energy carriers.

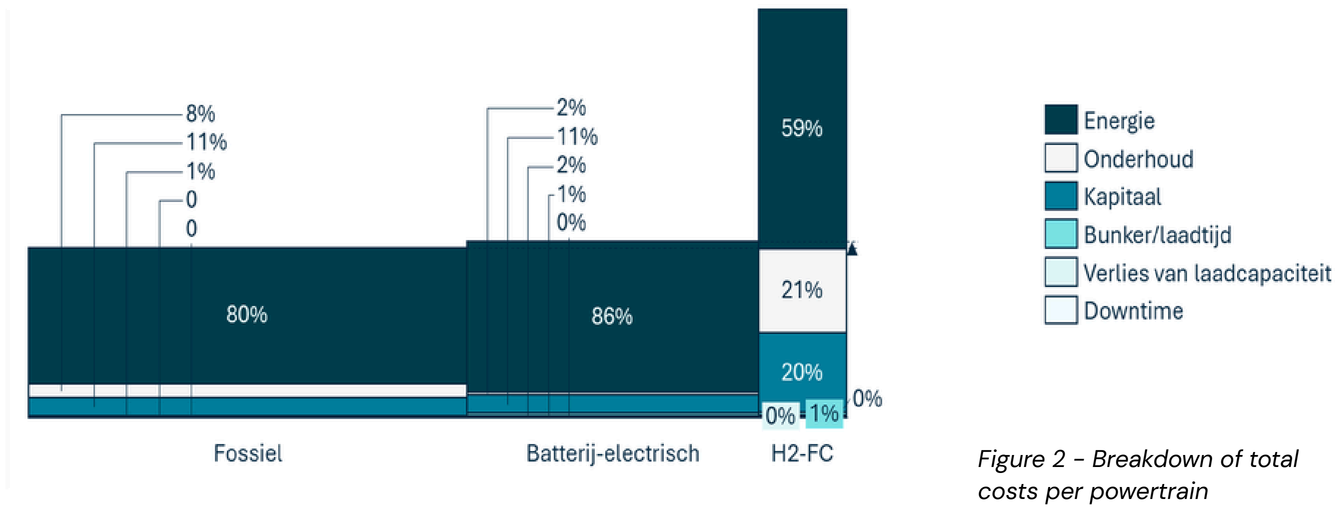

Figure 2 - Breakdown of total costs per powertrain

CAPEX – Initial investment

The initial investment levels for the three propulsion systems differ. Battery-electric is close to fossil, while hydrogen requires a substantially higher initial investment. The EICB model applies a range, but because the Condor ZE model does not, we have used the average of the EICB range in our own model.

Powertrain	Investment (indicative, 2028)
Stage V (fossil)	€ 750.000
Battery-electric	€ 800.000
Hydrogen (H_2-FC)	€ 4.500.000

Within Condor ZE, we look only at genuine zero-emission solutions. The EICB model also examines other fuel types. These are visible in Figure 2. In this comparison, we limit ourselves to battery swapping and H2 fuel cell.

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The difference in CAPEX between Stage V and battery swapping is unexpectedly small. This is because energy storage and carriers have not been included in CAPEX and are deployed through a pay-per-use model.

Hydrogen has a complex propulsion system in which fuel cells, batteries and an advanced control system need to be combined. As a result, average investments are considerably higher than for battery-electric propulsion. Here too, tank containers have been excluded from CAPEX and included as a lease component in the model.[1]

As a result, a substantial part of the costs shifts from CAPEX to OPEX.[2] This lowers the initial investment threshold, but leads to higher and structurally recurring operating costs over the asset lifetime.

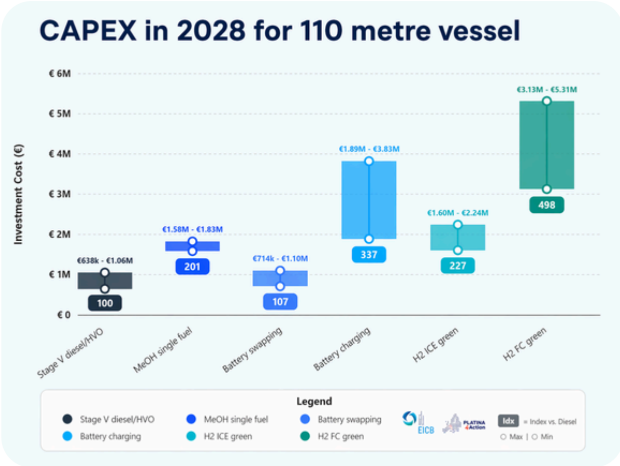

Figure 3 - CAPEX in 2028 for 110 metre vessel

Operating costs (OPEX)

Every entrepreneur aims to deploy an investment profitably so that CAPEX can be earned back over a longer period. A higher investment at the start is not necessarily a problem if operating costs are lower over the economic lifetime.

The operating costs of zero-emission inland shipping are not determined by one single factor, but by a combination of cost drivers:

- Energy costs and pricing structure: electricity and hydrogen have a different pricing structure from fossil fuels and are more dependent on policy, infrastructure and market development. This is the main driver, and hydrogen in particular still has a high cost per energy carrier.
- Energy carrier costs: in this model, batteries and hydrogen tank containers are procured as a service (pay-per-use or lease). EICB has included these costs in the energy price. This leads to recurring costs that are largely absent or lower for fossil fuels.
- Logistics and operational complexity: charging, changing batteries and bunkering hydrogen require additional logistical operations, infrastructure and planning. This raises both direct costs and operational dependencies. These effects are also reflected in a higher energy price.
- Uncertainty and risk premiums: immature markets and limited scale lead to higher costs for energy, maintenance, services and contracts. This uncertainty translates into more downtime, price mark-ups and less predictable operating costs.

The OPEX of zero-emission inland shipping is therefore primarily driven by the combination of energy costs, new logistics chains and the shift of investment costs to operating costs.

[1] In this analysis, we chose to compare the best-performing configurations. For that reason, we decided not to include fixed batteries. The EICB model does provide this option.

[2] The lease model also includes other cost components, such as transport costs for moving the battery containers and overhead or operating costs related to leasing. These costs are not decisive for the outcomes of the cost model and have been incorporated into the energy price.

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TCO – Lifetime costs (20 years)
As explained earlier, various scenarios can be used to classify future fossil fuel price developments. In this comparison, we follow the scenario EICB considers most likely: the STEPS scenario. Looking at total lifetime costs, the following picture emerges (STEPS scenario for fossil fuels and average prices for alternative energy, period 2028–2047):

Stage V Diesel:

€13,5 mln

TCO Index: 100

Battery-electric (profile 1)

€14,3 mln

TCO Index: 107 (2028)

Hydrogen (profile 3)

€32,5 mln

TCO Index: ~241

Over a 20-year period, battery-electric is virtually at the same cost level as fossil-fuel inland shipping (107 versus 100). Hydrogen still has a significantly higher cost structure (241). Figure 4 further supports this picture.

The figure shows the average daily TCO for the period 2028–2047 under the STEPS scenario. Stage V diesel (fossil) is the reference with an index of 100 and a daily cost range of EUR 1,678 to EUR 2,117. HVO as a drop-in fuel scores similarly or slightly lower.

Methanol (MeOH, single fuel) and battery-electric via battery swapping score 109 and 107 respectively - virtually the same as the fossil reference. Battery charging (charging through a fixed connection) scores higher due to higher energy costs and different charging logistics, including longer idle time and fewer sailing hours.

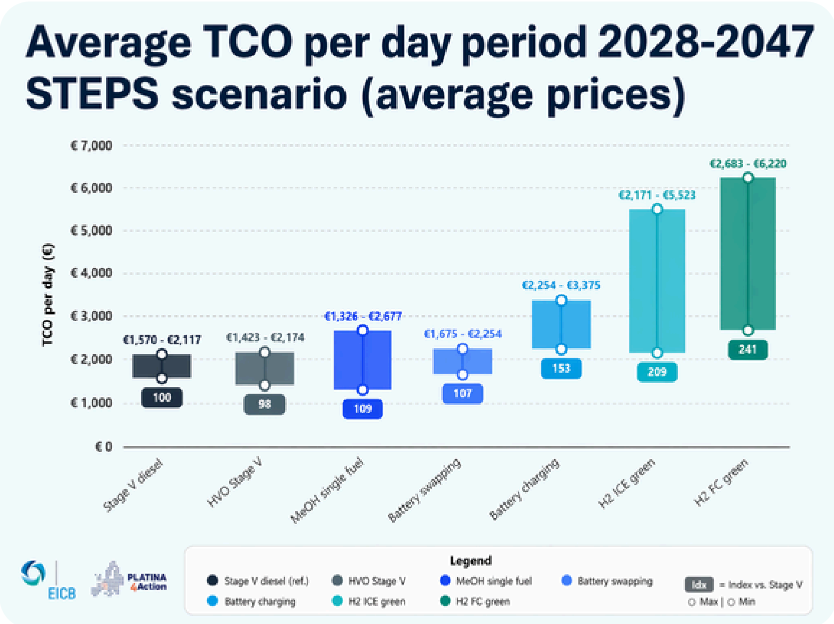

Figure 4 - Average TCO per day over the period 2028 - 2047 (STEPS)

Hydrogen-ICE (H2-ICE green) and hydrogen fuel cell (H2-FC green) show the widest cost range (the wider the range, the more uncertain the outcome): the index for H2-FC green is 241, with daily costs rising to EUR 6,220 in the maximum scenario.

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This confirms the view that, looking at the reference vessel from 2028 over a 20-year period, battery-electric (swapping) is already virtually cost-competitive with fossil fuel, while hydrogen - in both configurations - still has structurally higher costs and requires a different time horizon to become competitive.

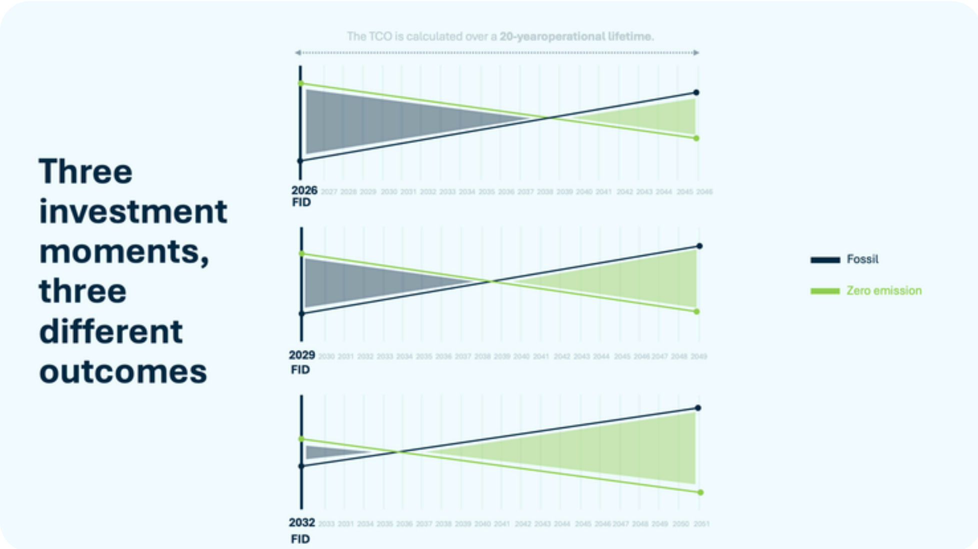

Figure 5 - FID 2026, FID 2029 en FID 2032

The investment decision
Figure 5 sets out the two business models — zero-emission and fossil — side by side. The figure shows that, based on an investment decision (FID) in 2026, zero-emission inland shipping moves towards cost parity over a 20-year lifetime, but is clearly more expensive than fossil fuel in the initial phase. The tipping point lies roughly halfway through the lifetime. The total TCO over 20 years is therefore comparable, but the earning capacity in the early years differs significantly.

The upper chart shows how costs develop over time. Zero-emission starts at a higher level, but gradually declines through technological development and economies of scale. Fossil costs, by contrast, show an upward trend due to the effect of CO2 pricing. The grey area before the crossing point represents the temporary additional cost of zero-emission; the green area afterwards shows the cumulative cost advantage in the future.

The figure also adds an important policy dimension: the timing of investment determines the size of the initial gap. With an FID in 2026, this gap is large. As the investment decision shifts later, for example to 2029 or 2032, the gap at the start becomes much smaller, because the early loss-making years fall outside the analysis and more of the profitable later years are included.
While fossil fuel is still price-setting in the early years, the picture shifts dramatically after the tipping point and zero-emission takes the lead, while fossil alternatives come under increasing structural pressure.

This is precisely the tension the TCO model makes visible. From a 20-year perspective, zero-emission is already a logical direction for part of the fleet, particularly in shorter sailing profiles and, from around 2028, for battery-electric reference vessels. At the same time, the cost structure in the early years requires a form of bridging to cover higher CAPEX and OPEX. How that bridging can be organised is central to Part II.

The accompanying graph also makes clear that for vessels with a short sailing profile the tipping point is already closer and the TCO over 20 years shifts in favour of zero-emission.

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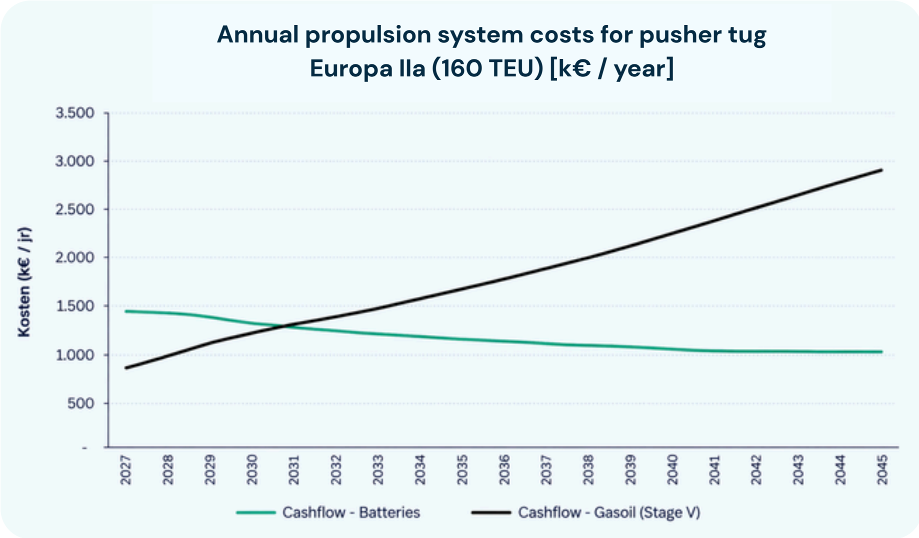
For these vessels, an investment decision should in fact already be a no-brainer in favour of ZE.

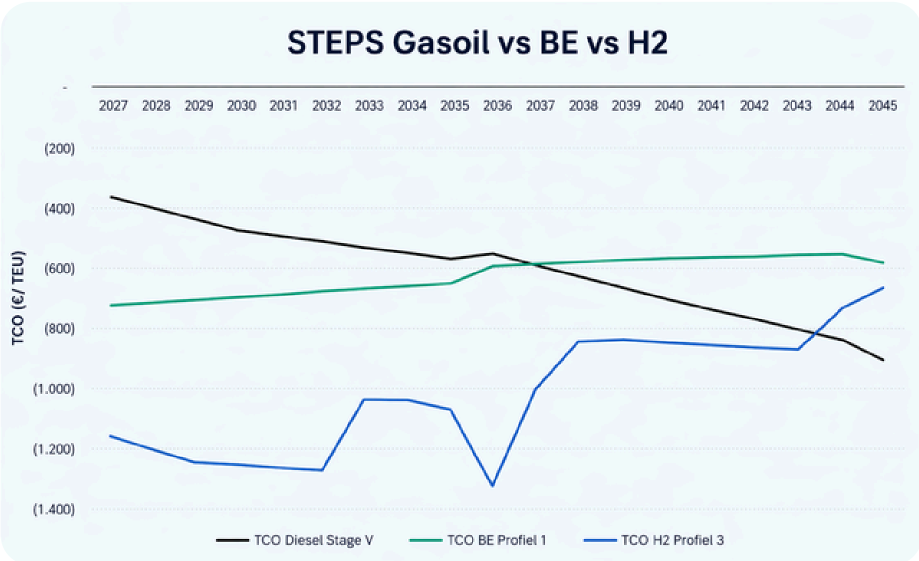
Figure 6 - Graph of electric operational costs for short sailing profiles



To further support this conclusion, we can look at the cash flow trend of three propulsion systems over the period 2027–2045 under the scenario of the Condor ZE Model (based on the STEPS model). In the graph below, the y-axis shows annual costs per day as negative values — the further down the line, the higher the cost burden.

The most striking pattern is that of Diesel Stage V (black line): this line starts relatively favourably in 2027, but deteriorates strongly over the entire period as a result of rising fuel prices and the pass-through of CO2 pricing.

Figure 7 - Cash flow trend 2027-2045



Battery-electric Profile 1 (green) shows a virtually stable and gradually improving picture. Costs start higher than fossil fuel, but remain almost flat throughout the period and even decline slightly at the end. The crossing point with the fossil line lies around 2036–2037 — the moment at which battery-electric becomes structurally cheaper for the whole fleet than conventional inland shipping.

Hydrogen Profile 3 (blue) remains above the battery-electric level throughout the entire period. The line is more erratic because of greater sensitivity to hydrogen price developments, but stabilises towards 2045. What stands out is that hydrogen remains more expensive than both fossil fuel (in the early years) and battery-electric for almost the entire period in this scenario.

The graph makes the earlier conclusion particularly tangible: with an investment decision in 2027, the cost curve of Diesel Stage V high rises across the whole period, while battery-electric remains virtually stable and becomes structurally cheaper for the entire fleet around 2036–2037. The cost paths cross - not as a theoretical assumption, but visibly in the annual figures.

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The impact of CAPEX subsidy on TCO is limited
A CAPEX subsidy helps to lower the threshold to entry, but has no structural effect on operating costs. As long as OPEX remains structurally higher than fossil, there is insufficient room to earn costs back.

Powertrain	CAPEX	Subsidy 60%	TCO 20 years	Impact on TCO
Battery electric	€ 800.000	€ 480.000	€ 14,34mln	circa 3,3%
Hydrogen (H_2)	€ 4.500.000	€ 2.700.000	€ 32,49mln	circa 8,3%

5.Conclusions: what does the TCO model tell us?

The analysis yields a series of concrete conclusions about the competitive position of the various propulsion systems and the speed at which zero-emission inland shipping can become competitive. Below, we summarise the key insights.

HOOFDCONCLUSIE
Battery-electric inland shipping is, from 2028 onwards and over a 20-year horizon, virtually cost-competitive with fossil fuel for a large part of the fleet.

For the short-distance segment, the business case is already there in many cases. Investment decisions are realistic from now until within 2 to 3 years.

Deep dive 1: Battery-electric is already almost competitive — especially for short distances

With a TCO index of 107 (Stage V = 100), battery-electric inland shipping from 2028 is already virtually on a par with conventional inland shipping. For the short-distance segment — vessels operating on profile 1 (50 km return, 350 round trips per year) — conditions are already favourable enough to make the switch within the foreseeable future. Based on current market developments and subsidy opportunities, an investment decision for this segment is already realistic within 2 to 3 years.

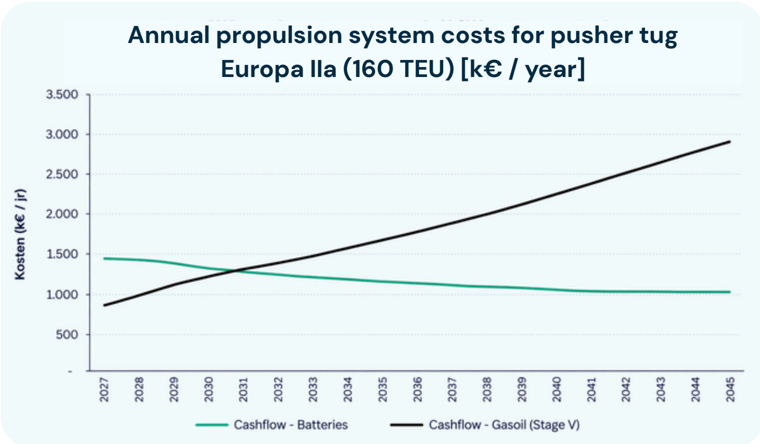

Figure 8 - Annual drivetrain costs pusher boat

For the short-distance segment, battery-electric inland shipping is already an economically sound choice over a 20-year horizon. The question is not whether it can be done, but how we organise the transition now.

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Deep dive 2: Battery-electric sets the price from 2035

From 2035 onwards, battery-electric becomes the price-setting model for the entire fleet; at that point, its price will be lower than fossil. In the coming years, this can already be seen in parts of the fleet, on short distances and particularly in the container market. Across the fleet as a whole — including medium and longer sailing profiles — battery-electric inland shipping is expected to become structurally competitive around 2035. That is the point at which declining energy costs, economies of scale in battery technology and the pass-through of ETS2 pricing come together to make the business case consistently positive. To be ready for that moment, shipowners will need to move towards FID already in the years before it, from 2028/2029 onwards.

With a TCO index of 241 and structurally higher energy costs per delivered kWh, hydrogen inland shipping is not economically competitive in the current market. The fundamental challenges — high production costs of green hydrogen, energy losses in the conversion chain, lack of infrastructure and limited scale — mean that this segment is likely to develop realistic competitiveness around 2040 or later. This applies across all segments, including longer-distance and heavier transport, where hydrogen theoretically has the greatest potential.

> Hydrogen deserves a place in the long-term strategy, but is not a short-term solution. Investments in hydrogen infrastructure for inland shipping are premature as long as the cost of green hydrogen does not fall substantially.

Deep dive 3: Subsidies accelerate entry, but do not change the structural cost logic

CAPEX subsidies such as the SRVB (Subsidy Scheme for the Sustainability of Inland Waterway Vessels) reduce the initial threshold and can bring forward investment decisions. They do not, however, change the structural OPEX position: higher operating costs resulting from energy carrier leases, logistical complexity and energy prices remain. Subsidies are therefore a useful instrument to get the market moving, but not a structural solution to the competitiveness problem in the early years.

Deep dive 4: Energy price developments determine the timing of competitiveness

The analyses show that if CO2 prices rise faster, or electricity and hydrogen prices fall faster (APS or NZE scenario), TCO parity is reached earlier. Energy price development is therefore the most decisive variable for the pace of the transition — more so than technology development or economies of scale in shipbuilding itself.

Waiting could cost shipowners more later

The TCO data sends a message that goes beyond a technical comparison: delaying investment is not a risk-free alternative. Fossil costs are rising structurally — due to rising CO2 pricing and stricter emission standards. Anyone investing in a fossil-fuelled vessel in 2028 locks in a cost burden that will almost double by 2045. Anyone investing in battery-electric opts for a stable and improving cost profile. This is even more pronounced for the short-distance segment: here, the business case is already strong enough today to explore seriously. The question is no longer whether emission-free inland shipping pays off — the question is when to step in.

> For ship owners in the short-distance segment: the economic case for an investment decision in battery-electric is now in place. Condor ZE supports the organisation of financing through the Financing Accelerator.

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6. Three options to accelerate cost competitiveness

The TCO model is not only an analytical instrument but also an action agenda. Based on the analysis, Condor ZE identifies three concrete options that can accelerate the cost competitiveness of emission-free inland shipping. For each option, the effect on the TCO is quantifiable, allowing targeted choices to be made.

1. Unlocking additional revenue models
Zero-emission vessels can generate additional revenues through certificate trading (EREs), CO2 insetting for shippers (Scope 3) and the monetisation of other environmental effects (PM, NOx). Actively unlocking these revenue models in a way that allows as much of the value as possible to accrue to shipowners improves the business case.

Below, by way of illustration, we use an electrically powered vessel (1,250 MWh of annual use / equivalent to 350,000 litres of diesel). The estimated avoided CO2 footprint is approximately 1,100 tonnes per year.

	Current prijs	Potential revenues
ERE-E (BRE-E)	0,05-0,08 euro per kWh[3]	62.500-100.000
CO2-insettting	70-100 euro per tonne[4]	77.000-110.000

For other environmental effects (PM, NOx), it is still more difficult to establish initial price indications. This translates into a cumulative earning potential of EUR 3-4 million over 20 years, excluding the monetisation of other environmental effects and based on current price indications.

There is currently a lack of a concrete and fundamental perspective on price development as well as an instrumentarium that helps channel these revenues back to shipowners as much as possible. This makes it difficult to include them in the business case. Condor is therefore working with partners in the Market workstream to make this additional earning potential more concrete and to unlock it more effectively.

2. Aligning energy tax with the excise exemption (0%)
Diesel for inland shipping is exempt from excise duty. Electricity and hydrogen do not fall under the same exemption, which creates an uneven playing field. Aligning energy tax with the excise level for diesel (effectively 0%) reduces the operating costs of zero-emission inland shipping immediately and structurally.

With electricity use of approximately 1,250 MWh per year and a current energy tax of EUR 0.04/kWh, the total fiscal energy burden over 20 years amounts to EUR 1,000,000 per vessel (EUR 50,000 per year) - compared with an effective excise burden of zero for diesel users in inland shipping.

Talks on this are already taking place within the Ministry of Infrastructure and Water Management. Condor ZE continues to advocate swift implementation of this measure, which can have a major transition impact at relatively limited budgetary cost.

[3] Mobilyze, monthly publication of ERE prices per segment.
[4] The ETS II price forecast was used as the reference point; see Bloomberg's EU ETS II Pricing Scenarios. In general, the expectation is that the actual insetting price will be slightly above this level.

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3. Standardisation to improve interchangeability
Standardisation of systems and components (battery containers, coupling interfaces, charging infrastructure) can lead to an estimated 10%[5] reduction in the initial investment cost. The financial impact is as follows:

Battery-electric
€ 80.000
10% × CAPEX €800.000

Hydrogen (H_2)
€ 450.000
10% × CAPEX €4.500.000

Standardisation not only lowers investment costs, but also enables interchangeability of energy carriers and broader fleet deployability, increasing operational flexibility. Condor is taking this work forward in the Vessel workstream.

7. From economics to financing: the gap in the business case

The outcomes of the TCO model provide reason for cautious optimism. Battery-electric inland shipping is already nearly competitive today, and with the right policy instruments that threshold can be lowered quickly. The conclusion seems clear: the economic case for emission-free inland shipping exists, especially in the long term.

But this is where things tighten. In practice, a shipowner seeking to finance a business plan will often still get a no from the bank. How can it be that an investment that makes economic sense over 20 years is not financeable today?

The answer lies in a fundamental difference in perspective. The TCO model looks at the full lifetime of a vessel. A bank looks at the term of a loan — typically 5-7 to 10 years. And in those early years, the cash flows of a zero-emission vessel are structurally higher than those of a fossil-fuelled vessel. Precisely in the phase in which the loan must be repaid, the zero-emission vessel is not yet competitive.

> The TCO reflects total economic performance over the lifetime. Financeability, however, is assessed on the basis of the robustness and predictability[1] of cash flows in the first years of operation. This is not a shortcoming of banks - it is the essence of credit assessment.

In Part II, we analyse this tension in detail. We look at what the inland shipping market looks like through the eyes of a financier, which assessment framework is used and where the concrete bottlenecks lie. We close with the actions Condor is taking to remove these bottlenecks.

[5] Generic assumption about the effect of standardization on capex

PART II

2. From positive TCO to financing

The transition to zero-emission inland shipping is not held back by technology. It is held back by the fact that the interplay between operations, asset value and risk allocation provides too little visibility on repayment. This part analyses the financing issue from the inside: from the financier's logic.

1. Why is financeability a separate challenge?

A large part of the inland shipping sector depends on external financing - in most cases from conventional banks. Banks look at the business case as well as the risks that may prevent that business case from becoming reality, or from doing so only to a limited extent. This broader perspective determines to what extent a bank is willing to provide financing to shipowners. This is what we call the financeability of emission-free inland shipping.

Because the sector was long accustomed to more or less predictable developments in cargo flows and to reliable fuel technology, financing used to be fairly straightforward. Now that the market is facing a transition, the risks are increasing: which technology will play a role, when will the infrastructure be ready, and who is willing or able to pay for temporarily higher costs?

This white paper therefore approaches the transition primarily as a financeability issue. The aim is to make explicit why emission-free inland shipping is currently still only partly financeable, despite technological progress and policy ambition. This lays the foundation for the activities of Condor ZE: as a programme, we focus on creating the conditions under which emission-free inland shipping does become financeable.

2. The market from the perspective of financiers

2.1 The position of inland shipping in the logistics chain

Inland shipping is a crucial but not highly visible link in European logistics chains and is often treated as a self-evident part of the system. Compared with other modalities, the sector is efficient, operates on low margins and has limited pricing power. Low margins mean, from a bank perspective, limited buffer when things go wrong, and therefore stricter requirements on cash flow stability.

From the perspective of cargo owners, CO2 emissions from inland shipping fall under Scope 3 [6] (indirect emissions in the value chain). This means that cargo owners, who still often prioritise Scope 1 reductions in their own operations, generally attach relatively low priority to greening inland shipping as a service provider. Willingness to pay more is generally limited and focuses on additional operating costs, rarely on the total cost including structural long-term investments in newbuild or retrofit.

2.2 The capital position of the inland shipping sector is vulnerable

Inland shipping is highly fragmented: many vessels are owned by individual entrepreneurs whose capital is largely tied up in the vessel.[7] In general, the sector holds limited liquid buffers relative to the investment required to shift to emission-free inland shipping. After all, many vessels have been fully or partly paid off, resulting in low capital charges and a competitive cost price - a model that works well with relatively stable fuel prices[8] and conventional deployment.

[6] Scope 3 (GHG Protocol) covers all indirect greenhouse gas emissions in an organisation's value chain, both upstream and downstream, that are not included in Scope 1 (direct emissions) or Scope 2 (purchased energy). This includes emissions from suppliers, transport, product use and end-of-life treatment.

[7] CBS/Rijkswaterstaat figures – The Dutch inland fleet consists of approximately 4,600 vessels sailing under the Dutch flag (2024). Around 70–75% of the fleet is owned by individual owner-operators, either self-employed or operating through small partnerships. The share of entrepreneurs owning only one vessel is declining, but they still represent the majority. The picture is similar at European level: the CCNR reports that more than 80% of companies operate 1–2 vessels.

[8] Relatively stable fuel costs means that fuel price increases or decreases affect the sector broadly and simultaneously. As a result, the relative cost position of individual operators changes only marginally, and their earning capacity is not significantly distorted.

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In the transition to more capital-intensive zero-emission technology, this creates a challenge. Newbuild or retrofit of emission-free vessels requires higher investments and often also involves temporarily higher operating costs. For entrepreneurs, this is not only a business-economic decision but also a personal balance-sheet risk, which can dampen willingness to invest, especially later in a career. For an overview of average investment and additional costs, see Part I, Chapter 4.

2.3 Willingness to transition differs by segment

Inland shipping is a diverse sector. Segment differences affect both investment capacity and operational certainty:

Main segment	Share of fleet (indicative)	Typical vessel size (tonnes)	Typical company size	Average vessel age	Dominant voyage type	Typical revenue model
Dry cargo	± 60–65%	500 – 3.000 (veel <2.000)	small SME	45–55 jaar	Spot market, ad hoc voyages, partly fixed charterer	Price-driven, low margins, high sensitivity to fuel and regulation
Container	± 15–20%	2.000 – 4.500	mid-sized SME -> shipping company	30–40 jaar	Liner services, fixed rotations	Contractual, predictable cash flow, high utilisation
Tanker	± 15–20%	2.000 – 6.000	large SME / shipping company	25–35 jaar	Contract / time charter	Relatively stable, higher CAPEX, stricter compliance

Dry bulk, by far the largest segment, is the most fragmented, dependent on spot contracts and price fluctuations, and faces the greatest financing challenge. Inland container shipping has more predictable cash flows and is relatively younger. Tanker shipping has high safety requirements that make it more difficult to experiment with alternative propulsion systems.

2.4 Energy prices: difficult to predict, crucial to the business case

The operating costs of emission-free inland shipping are still higher than conventional inland shipping in many cases, while contract durations in the market remain short or even spot-driven. In addition, electricity and hydrogen prices do not always move in line with fossil fuels. If sustainable energy carriers become relatively more expensive while fossil costs fall, the cost difference may temporarily widen. The reverse may of course also be true.

More fundamentally, policy instruments such as emissions trading and renewable energy obligations influence the relative position of fossil and zero-emission. RED III, for instance, obliges fuel suppliers to deploy renewable energy and to trade EREs, which stimulates the market for sustainable fuels and gradually raises the price of fossil alternatives. This still does not provide price stability, however. As long as that is missing, fuel price remains an unpredictable factor in the business model - for both fossil and emission-free inland shipping.

2.5 Inland shipping can only partially finance the transition itself

The market analysis shows that inland shipping operates in a historically relatively efficient, but highly fragmented and price-driven system with short contracts and limited pass-through of costs. That model has long functioned well, but despite the broad recognition of the need for zero-emission inland shipping it does not provide sufficient certainty. The question whether an investment in zero-emission is financeable is therefore ultimately about how these investments are assessed, including the new uncertainties.

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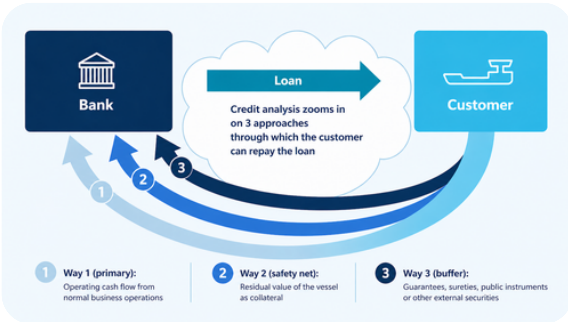
3. The assessment framework of financiers: the 3-Ways-Out model

Financiers look first and foremost at repayment certainty. In a capital-intensive sector, the pace of the transition is ultimately determined by the extent to which investments are financeable. Implicitly, three possible sources are considered from which a loan may be repaid within its term (often 10, but sometimes also 5 years). This framework is known as the 3-Ways-Out model.

3.1 The 3-Ways-Out model

The model assumes three possible 'sources of repayment' through which a financier can manage risk:

- Way 1 (primary): operational cash flow from normal business operations
- Way 2 (safety net): the residual value of the vessel as collateral
- Way 3 (buffer): guarantees, sureties, public instruments or other external securities



This can be visualised as a triangle, with each corner representing one of the routes out. Financeability sits in the centre of that triangle: only when all three corners are sufficiently robust does a stable credit basis emerge. Way 1 forms the primary pillar, Way 2 acts as a safety net and Way 3 looks at whether risks can be temporarily softened or distributed.

3.2 Way 1 – Operational cash flow

The first and most important route out is operational cash flow from normal business operations. This is the primary source of repayment. Contract duration, counterparties, certainty of volumes, cost structure, solvency, historical performance and pricing are decisive here.

For many sectors, and for conventional vessels with broad deployability and relatively limited investment costs, this model works very well. Because fuel prices have been relatively stable, technology familiar and competitors exposed to the same cost drivers, operations can be assessed predictably.

Because operational cash flow is the primary source of repayment, it is by far the most important element in credit assessment. The principle is this: as long as a loan is repaid out of regular cash flow, the bank can serve the client with limited monitoring and associated low capital and management costs. This is an important consideration for banks.

3.3 Way 2 – Asset and residual value

The second route out is the asset and its residual value. If operations disappoint and the bank has moved the client into special management, the vessel must remain deployable or saleable at a value that largely covers the outstanding credit. Residual value is not a theoretical exercise or just a number in a valuation; it suddenly becomes an essential safety net.

Uncertainty regarding technological development, future regulation or reusability directly affects valuation. For conventional vessels with broad market applications, residual value has always been relatively easy to estimate. Even though banks broadly understand that a zero-emission vessel will have better residual value in the long term than a fossil vessel, this is still difficult to quantify in current applications for zero-emission vessels.

Financiers prefer to see this route as secondary. Selling the vessel is never really the desired scenario, but a fallback option. A strong residual value can therefore partly compensate for weaker operations, but rarely fully.

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3.4 Way 3 – Additional securities and credit enhancement
The third route concerns additional securities and credit enhancement. Of the three sources of repayment, this is the one the bank wants to rely on last. Think of:

- Guarantees or sureties from third parties
- Availability of new risk-bearing capital or subordinated loans
- Public instruments from government
- Strong contractual counterparties able and willing to take over operations

In the 3-Ways-Out model, Way 3 therefore acts as an additional stabiliser. When Way 1 and Way 2 are sufficiently strong, external support can remain limited. When operations and residual value are uncertain, Way 3 becomes more important - but even then it remains a supporting source. As long as these three elements are not in balance, financing remains bespoke rather than routine.

3.5 Banks will not assess sustainability differently
The 3-Ways-Out model aligns with standard credit assessment in asset-based finance, ship finance and project finance and is also embedded in international banking risk frameworks (BIS Basel Framework). Supervisors assess banks on the way they manage their portfolios.

> It is not plausible to expect banks to start financing sustainable propositions en masse when operations are loss-making in the early years and to deviate structurally from the accepted risk framework. The solution therefore lies not in circumventing this framework, but in strengthening the three pillars themselves.

4. How financeable is emission-free inland shipping today?

In the previous chapters, the market dynamics have been outlined and the assessment framework of financiers has been explained. We now test the market against that framework. Concretely, the analysis shows how all three repayment sources from the 3-Ways-Out model, taken together, are relevant factors for the financeability of zero-emission inland shipping.

4.1 Challenge 1: loss-making years in the initial phase (Way 1)
Operational cash flow is the primary source of repayment for financiers. Comparing the TCO of fossil and zero-emission vessels over 20 years shows that in many scenarios the differences have now become limited. In some cases, investing in a ZE vessel can even already be rational, because total lifetime costs are comparable or more favourable.

As the TCO model shows, the tipping point lies around 2035. The loss-making years in the first 5-10 years, versus the positive business case over a 20-year lifetime, create a mismatch between long-term rationality and short-term financeability. Although lifetime TCO may be comparable, cash flow in the early years is often not competitive - precisely in the phase in which financing must be attracted and repaid. This weighs heavily for financiers because of the combination of loan tenors of 5-10 years and the frequent absence of long-term certainty such as long-term contracts.

This means that a currently profitable operation with future risk (fossil) but limited short-term uncertainty is financeable, while a short-term loss-making operation with future potential (ZE) is often judged to be unfinanceable.

In short: as long as positive cash flow is not secured - through longer-term contracts, supply-chain agreements or targeted policy instruments - the main source of repayment remains vulnerable. Even if the economics of emission-free inland shipping make sense over 20 years, as long as cash flow is negative in the first years, financeability remains fragile on the basis of an operating model with financing terms of 5-10 years.

4.2 Challenge 2: residual value and reusability (Way 2)

Now that operations prove uncertain in the early years, residual value becomes more important: the vessel acts as a safety net for the financier. Precisely in the transition to zero-emission, certainty about residual value is less self-evident.

New propulsion technology introduces uncertainty regarding future cash flows, regulation, infrastructure, competitive position and tradability. The value of a vessel is determined by what it can earn. Financiers look at future cash flows and market position, not at build cost. In stable markets, investment and value are close to one another; with higher costs or more uncertainty, valuation falls.

Investment subsidies reduce construction costs, but do not automatically improve earning capacity. As long as operations cannot compete structurally with fossil alternatives, residual value remains under pressure. If both operations and residual value are uncertain, the security available to financiers weakens considerably.

An investment of EUR 10 million in a zero-emission newbuild does not mean that the vessel will always be worth EUR 10 million upon delivery. Residual value is a function of earning capacity and market position - and these are still difficult to quantify for emission-free vessels today.

4.3 Challenge 3: risk allocation and credit enhancement (Way 3)

When operations (Way 1) and residual value (Way 2) are less robust, the focus shifts to Way 3: additional securities and risk allocation. In practice, this often happens through subsidies or public instruments that reduce investments or influence costs, but do not remove the structural uncertainty in operations and competitive position.

Risk allocation can also take place through stable cash flows elsewhere in the fleet, guarantees, the availability of new risk-bearing capital, programme-level support or operations within larger structures. For individual shipowners, however, this is difficult to organise independently. Without supply-chain collaboration or collaboration within a larger fleet, risk allocation remains fragmented and incidental.

If fundamental public incentives and securities are limited and chain agreements are often absent, the transition risk lands almost entirely with the individual shipowner (and indirectly the financier). This severely restricts the financeability of emission-free inland shipping.

4.4 The combination makes emission-free inland shipping difficult to finance

The transition does not stall on one single barrier, but on the combination of reinforcing factors:

- Loss-making years in the initial period of operation are not covered by long-term certainty
- The logic of residual value is not yet sufficiently anchored
- Risk allocation is still only organised to a limited extent on a structural basis

The conclusion is sharp but constructive: emission-free inland shipping is not financeable because the financing landscape is not yet organised around the specific characteristics of this transition. That is not unwillingness on the part of banks - it is a market failure that calls for targeted intervention.

FROM ANALYSIS TO ACTION

How Condor is working on financeability

The previous chapters show that zero-emission inland shipping is not held back by technology, but by the fact that the interaction between operations, asset value and risk allocation provides too little visibility on repayment. The direction of the solution is clear: we need to strengthen the three pillars of the 3-Ways-Out model simultaneously. That is exactly what Condor ZE does.

That is why we keep the TCO model up to date together with EICB. We test assumptions, validate outcomes and incorporate new insights. In this way, we offer a shared frame of reference for costs and assumptions that reduces differences in interpretation between entrepreneurs, financiers and policymakers. This shortens credit processes and makes decision-making less dependent on individual judgement.

In addition, Condor will be taking concrete steps in the coming period to strengthen financeability in a coherent way. To this end, we have defined the actions below.

Financing Accelerator and strengthening the financial toolkit

We are setting up the Financing Accelerator. Entrepreneurs with a positive business case over 20 years of operation but who cannot secure financing can submit their case to the Condor Financing Accelerator. Per case, we will work with a diverse group of financiers and parties that can provide additional securities to determine exactly how the case can be made investment-worthy.

The group meets every quarter and is tailored to the specific case. The aim of this initiative is to unlock more than 50 investment decisions by 2028.

> Within the Financing Accelerator, we work per case on a combination of instruments that together make the three pillars of the 3-Ways-Out model sufficiently strong.

These cases also provide input for further embedding a functioning financial toolkit. To that end, Condor ZE works with a group that analyses and combines existing financing instruments and public schemes in a coherent manner. The goal is to make clear how bank loans, guarantees, subsidies and risk-bearing capital can be fundamentally and effectively stacked.

By working out and standardising different combinations in advance, conditions are made explicit and financing can be structured faster, more consistently and at greater scale. One of the steps being explored is the development of fleet cases in which multiple vessels - diesel-electric (ZE-ready) and emission-free - fall under one operating and financing structure.

> In the transition phase, this mix is essential for increasing financeability: fossil vessels provide stable cash flows, while ZE capacity is scaled up gradually and the investment pace can be adapted to the market. The objective is not one successful project, but a reproducible model for broader application.

Link with the broader Condor agenda

The actions above do not operate in isolation, but form part of the broader Condor programme, which works on four connected themes: standardisation of vessels and components, financing arrangements and cost-driver reduction, infrastructure development (feasibility studies and portfolio approach), and market activation (EREs, in-setting, PM NOx). Financeability is a precondition that affects all pillars - and for which the actions above form the connecting links.

Concluding remarks

Zero-emission inland shipping is technically possible, increasingly logical from an economic perspective, but still insufficiently accessible financially. This white paper lays bare where the tension sits: not in the technology, not in legislation, but in the gap between the 20-year logic of a sound investment and the 5- to 10-year lens of the financier.

That gap is not insurmountable. With targeted action on the three pillars of the 3-Ways-Out model - strengthening operational certainty, securing residual value and organising risk allocation - the transition can be accelerated.

> In the coming years, the sector, financiers and government must work together to bring short-term cash flow logic and the long-term necessity of transition closer together. Condor ZE is there to facilitate, accelerate and anchor that movement.

CONDOR
zero emission inland shipping