European Commission
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Belgium

Reykjavík, 3. November 2026

Ensuring a level playing field for maritime transport to and from Iceland

Feedback on the Commission proposal COM(2026) 616 amending Directive 2003/87/EC (EU ETS)

Summary

SVÞ recognize the role of the EU ETS and its objective of reducing greenhouse gas emissions from maritime transport. Independent evidence shows, however, that the same rule produces a markedly different effect on routes to and from Iceland. Ships serving Iceland require around 22% additional propulsion energy because of wind and waves, compared with around 5% in the Mediterranean, and the ETS cost per voyage between Reykjavík and Rotterdam is at least 50% higher than on the most common intra-European feeder routes, and more than double for larger feeder vessels.

This additional burden stems from distance and from some of the most severe sea conditions on the planet. No price signal can change either. Where incentives are exhausted, the carbon price no longer drives emission reductions; it becomes a cost without climate benefit, borne by businesses and households in an island nation that relies on maritime transport for virtually all of its trade.

Iceland is part of the internal market through the EEA Agreement and applies the EU ETS in full. The internal market is not an average of European conditions; it comprises all of its geographical areas. Equal conditions of competition, the core objective of the EEA Agreement, therefore require that the rules be designed for the internal market as it actually is.

The interests of the population of Iceland, be it the consumers or the companies is that the EU ETS **price the emissions that incentives can reduce, not the geography that they cannot.** To this end, SVÞ calls on the co-legislators to:

1. **Support a variation of ENVI Amendment 2694, point (b)**, providing for a 50% surrender obligation on voyages between the mainland of the Union and an island State without land borders, and **explicitly ensure that it applies to Iceland** as an island EEA State. A 50% surrender obligation is consistent with the disparity measured by DNV.
2. **Consider a measurement-based adjustment through the MRV framework**: a position-based, neutral and verifiable mechanism that recognises sea areas where exceptionally severe sea conditions prevail, building on the approach the Commission already proposes for ice conditions.
3. **Link the duration of this adjustment to the reality it corrects, not to a calendar date.** Distance and sea conditions are permanent; available technology is not. The adjustment should remain in place until zero-emission propulsion is a viable option on

long-distance North Atlantic routes, at which point a review is warranted. The phase-out schedule in Amendment 70 of the draft report should therefore not apply in such cases.

4. **Ensure that maritime transport to and from Iceland is assessed** in the Commission's future reviews and reports under the Directive, as it was not in the Impact Assessment accompanying the proposal, so that the regulatory framework reflects the internal market in all its geographical areas.

The two technical memoranda by DNV on which this feedback relies are attached as Annexes I and II.

1. About SVÞ and our support for the EU ETS

SVÞ represents the full maritime supply chain serving Iceland: the shipping companies operating the routes, and the importers, exporters, retailers and service providers that depend on them. Through them, we also speak for the wider public interest of an island nation of around 4000,000 inhabitants. Some 99% of goods traded to and from Iceland are carried by sea. There is no rail network, no inland waterway and no road or ferry alternative to the European mainland.

SVÞ recognize the role of the EU ETS as a market-based instrument. The inclusion of maritime transport has given operators a clear incentive to reduce emissions, and Icelandic operators have responded as the system intends: through fleet renewal, improved utilisation and route optimisation. This has yielded significant results in the reduction of emissions per tonne transported by since 2015.

This feedback builds on the joint contribution by SA, SVÞ and SAF to the call for evidence in July 2025 (Ares(2025)5519973), which identified the uneven playing field in maritime transport to and from Iceland. It also takes forward the proposal made by the Government of Iceland in the same consultation (Ares(2025)5519878): reduced ETS rates or other mitigating factors for direct shipping between a key port in another EEA State and a key port in a remote EEA island State, in Iceland's case the Reykjavík–Rotterdam route. This feedback provides the evidence for that proposal.

2. Same rule, unequal effect: the evidence

To establish the facts independently, the Icelandic business community commissioned DNV, one of the world's leading classification societies, to measure the effect of distance and sea conditions on ships serving Iceland. The hypothesis was simple: sea conditions around Iceland are exceptionally harsh and that affects energy usage. The results confirm it clearly.

Sea conditions. DNV analysed voyages of container vessels trading to Iceland in 2025 and compared them with hundreds of vessels in Europe and worldwide (Annex I). Around Iceland, ships require 22.4% additional propulsion energy because of wind and waves. Ships trading to Iceland encounter waves above 3.4 metres 10% of the time, compared with 2.1 metres for European trades.

Sea area	Added propulsion energy from wind and waves
Around Iceland	22.4%
US Emission Control Area	17.3%
North Sea	12.7%
Baltic Sea	5.6%
Mediterranean	5.4%

Distance. More than 80% of direct intra-EU feeder voyages to Rotterdam are shorter than 800–1,000 nautical miles. Reykjavík–Rotterdam is around 1,200 nautical miles (Annex II). Adverse weather also lengthens voyages by 4–8% compared with the shortest route, and up to 29% on individual voyages. Ships serving Iceland sail faster, on average 14.1 knots against 12.8 knots, because they carry fresh and time-sensitive goods consumed by European consumers.

ETS cost per voyage. Combining these factors, DNV calculated the ETS cost per voyage to Rotterdam for feeder container vessels (1,000–1,999 TEU) at 100% coverage and €76 per tonne of CO2 in 2026:

Port of departure	Distance to Rotterdam (nm)	ETS cost per voyage
Reykjavík	1,220	€39,451
Muuga	978	€17,654
Vigo	909	€16,662
Dublin	654	€13,585
Hamburg	317	€6,049
Antwerp	115	€2,792

The same rule, within the same internal market, imposes a burden per voyage at least 50% higher on Reykjavík–Rotterdam than on the most common intra-European feeder routes, and more than double for the larger feeder vessels analysed.

A global perspective. These findings are consistent with the evidence submitted to the International Maritime Organization in January 2026 (MEPC 84/6/5). Its world map of extreme wave heights places the most severe conditions on the planet in the North Atlantic south-west of Iceland. The same submission documents a 45% seasonal variation in the carbon intensity rating of a ro-ro vessel operating Rotterdam–Tórshavn–Þorlákshöfn, driven by weather alone.

3. Iceland is part of the internal market, as it is

Iceland participates in the internal market through the EEA Agreement and applies the EU ETS in full, including its extension to maritime transport (EEA Joint Committee Decision No 335/2023). The aim of the EEA Agreement is to strengthen trade and economic relations "with equal conditions of competition, and the respect of the same rules, with a view to creating a homogeneous European Economic Area" (Article 1(1)).

Equal conditions of competition require more than identical rules. The internal market is not an abstraction based on average European conditions. It extends from the Mediterranean to the North Atlantic and comprises all of its geographical areas, including an island some 1,200 nautical miles from the continental mainland, in some of the most severe sea conditions on the planet. A rule calibrated to sheltered, short-distance intra-European trades will, when applied unchanged to such an area, produce systematically unequal outcomes. Treating materially different situations in the same way is itself a departure from equal treatment.

EU primary law reflects this. Measures must be proportionate to their objectives (Article 5 TEU), and the internal market is to ensure conditions of effective competition (Article 26 TFEU). Article 174 TFEU calls for particular attention to regions which suffer from "severe and permanent natural or demographic handicaps such as the northernmost regions with very low population density and island, cross-border and mountain regions". Article 349 TFEU recognises that the situation of the outermost regions is compounded by their "remoteness, insularity, small size, difficult topography and climate". Iceland is not an outermost region in the meaning of that Article 349 TFEU, but each of these factors applies to it in full, and distance and climate apply to it more strongly than to the Atlantic outermost regions closest to Europe.

For the EU ETS to function as a market-based instrument across the whole internal market, its design must be informed by an analysis of that market as it actually is, in all its geographical areas. This requires that maritime transport to and from Iceland be assessed, and that the regulatory framework reflect the result.

4. When the incentive is exhausted

The EU ETS is a market-based instrument. Its purpose is not to raise revenue but to change behaviour: by putting a price on emissions, it rewards operators that invest in more efficient ships, switch fuels, optimise routes and reduce speed. Every allowance an operator does not need to buy is the reward for having done better.

A market-based instrument can only work where the market is able to respond. Its design must therefore be informed by an analysis of the market in which it operates. Iceland, its territory and its surrounding waters, are part of the internal market.

On routes to and from Iceland, a substantial share of emissions results from factors that operators cannot influence. No carbon price can shorten the distance between Iceland and the European mainland, and none can calm the North Atlantic. Once operators have taken the measures available to them, as Icelandic operators have, the remaining additional emissions are structural. On that share, the carbon price no longer acts as an incentive. It becomes a cost without climate benefit, which raises the price of imported goods for people living in Iceland and of Icelandic exports on European markets.

This is not an argument against carbon pricing. It is an argument for designing the instrument so that the same rule has the same effect throughout the internal market, which is the essence of a level playing field.

5. Consequences for the internal market and for people in Iceland

An uneven playing field. Icelandic importers, exporters and carriers compete within the internal market under the same rules as their European counterparts. Yet for reasons of geography alone, those rules weigh considerably more heavily on them. The result is a structural competitive disadvantage that the system was never designed to create.

Essential goods and social cohesion. Iceland has a short growing season and a small domestic production base. A high share of its food, medicines, fuel, machinery and everyday consumer goods is imported by sea; more than 98% of refined petroleum products, for example, come from Norway. The Commission's own Impact Assessment recognises that maritime services are essential "for the delivery of food, medical supplies, and other basic goods", that higher transport costs may affect access to "healthcare, education and employment", and that they could "increase the pressure to migrate for work or education" (SWD(2026) 616, Part 3/5, pp. 293–294 and 314). It also notes that outermost regions are more vulnerable "due to significantly longer voyage legs than other intra-EU journeys". Each of these observations applies to Iceland, whose voyage legs to the nearest major mainland port are longer than those of the Azores, Madeira or the Canary Islands (1,182 nautical miles, against 804, 536 and 701 respectively).

Icelanders' full participation in the internal market, in European cultural life and in the opportunities that the EEA Agreement was designed to secure depends on affordable and reliable maritime connections. An additional cost that delivers no emission reduction falls, in the end, on families, students and small businesses on an island in the North Atlantic.

A risk of route evasion that may increase emissions. Under Article 3ga of the Directive, voyages between Iceland and the Union are covered at 100%, while voyages between Iceland and North America are covered at 50%. This creates an incentive to bypass Iceland on transatlantic routes. . A container vessel sailing Portland–Reykjavík–Rotterdam (3,437 nm) emits only marginally more than a vessel sailing New Jersey–Rotterdam directly yet must surrender disproportionately more allowances. Should transatlantic services cease calling at Iceland, Icelandic imports and exports would still need to be carried, now via the European mainland and an additional feeder leg. The system would then not merely displace emissions; it could increase them, contrary to its own objective.

6. A gap in the Impact Assessment

The Impact Assessment accompanying the proposal does not assess maritime transport to and from Iceland. Its analysis of maritime derogations (SWD(2026) 616, Part 3/5, pp. 288–294) considers the four existing derogations, for outermost regions, small islands, ice-class ships and public service contracts, and two options: extending them until 2035 or letting them lapse. The specific conditions of North Atlantic routes, the distance between Iceland and the mainland, and the resulting differences in effect across the internal market are not examined.

This is understandable, given the scale of the review. But it means that the issue raised by Iceland in the call for evidence, together with a concrete proposal, has not yet been addressed.

The Regulatory Scrutiny Board also asked for "a more detailed analysis of the distributional impacts" of the proposal (SEC(2026) 616). This feedback aims to contribute to closing that gap with independent, verifiable evidence.

Because Iceland applies the EU ETS through the EEA Agreement, maritime transport to and from Iceland is part of the internal market that the Impact Assessment is meant to analyse. The Commission's Better Regulation framework also provides for the assessment of territorial impacts where a proposal may affect regions differently. SVÞ therefore calls on the Commission to complement its analysis accordingly, so that the legislation reflects the internal market as it is, in all its geographical areas, and not only its central part.

7. The principle already exists

SVÞ is not asking for anything new on behalf of Icelandic interests. EU law and the current legislative debate already recognise that structural conditions beyond operators' control can justify an adjustment to the surrender obligation.

Ice-class ships. The Commission justifies the derogation for ice-class ships on the grounds that their higher emissions "are not due to inefficiency but to essential safety and design requirements", and notes that fuel consumption in ice conditions can be "up to 60% higher" than in open water (SWD(2026) 616, Part 3/5, p. 288). The same reasoning applies to added propulsion energy caused by wind and waves.

Adverse weather. The Directive already excludes from the definition of "port of call" stops "for the sole purpose of taking shelter from adverse weather" (Article 3, point (z), as amended by the proposal). The legislator thereby accepts that weather lies outside operators' control and should not determine their obligations.

Islands and outermost regions. The proposal extends the existing derogations "in light of the need to ensure territorial continuity, connectivity and affordability of essential maritime services" (recital 25). For ice-class ships, it goes further and provides for a review of whether the derogation should continue beyond 2035, given "specific technical and operational challenges".

The wider maritime framework. The same logic runs through the EU's maritime climate legislation as a whole. FuelEU Maritime (Regulation (EU) 2023/1805) takes account of the additional energy consumed in ice conditions, and the Commission now proposes to amend the MRV Regulation so that the distance, time, position and fuel consumption of ships sailing in ice conditions are monitored separately, and so that monitoring plans describe "the procedures for the application of any relevant derogation or adjustment under Directive 2003/87/EC" (COM(2026) 620). The amendments tabled in the European Parliament would also treat mainland enclaves without fixed road or rail connections to the European mainland as islands (Amendment 2694, point (c)). The common principle is clear: where geography or natural conditions impose unavoidable additional energy use, EU law adjusts the obligation rather than penalising it.

The debate in the European Parliament. Several amendments tabled in the ENVI Committee build on the same principle:

- Amendments 2627 (Kulmuni, Baljeu) and 2703 (Gieseke et al.) provide that a reduction should "correspond exclusively to the additional emissions resulting from

sailing in ice conditions", calculated against equivalent open-water operation and "to ensure a level playing field" (PE796.496). This is precisely the method that DNV has applied to sea conditions around Iceland.

- Amendment 199 (Gieseke et al.) to recital 25 states that "islands and outermost regions face permanent geographical constraints and depend structurally on maritime transport", and that derogations should cover "essential connections with ports under the jurisdiction of any Member State" (PE796.486).
- Amendment 90 (Fragkos) recalls the European Parliament resolution of 7 June 2022 on EU islands and cohesion policy, which found that insularity creates a "structural dependence on maritime and air transport" that "entails additional costs for the transportation of passengers and goods" (PE796.486).

SVÞ asks only that this established principle be applied consistently, wherever the conditions that justify it are present.

8. The requests to the co-legislators

8.1 Support Amendment 2694, point (b), and ensure that it applies to Iceland. Amendment 2694 (Liese, Montserrat, Moratti, Agius, Pereira; PE796.496) would require shipping companies to surrender allowances for 50% of their verified emissions on voyages between the mainland of the Union and an island Member State without land borders with another Member State. Iceland meets the substance of this criterion. To avoid any uncertainty upon incorporation into the EEA Agreement, SVÞ recommends that the provision, or the corresponding EEA adaptation, explicitly covers voyages between the mainland of the Union and an island EEA State without land borders with another EEA State, and that Iceland and its ports are included in the list to be published by the Commission.

A 50% surrender obligation is consistent with the disparity measured by DNV. For larger feeder vessels, where the burden per voyage is more than double that of comparable intra-European routes, it would restore parity; for smaller vessels, it would bring the burden broadly into line. Because all emissions would continue to be monitored, reported and verified, the environmental transparency of the system would be fully preserved.

8.2 Consider a measurement-based adjustment through the MRV framework. As a durable and technology-neutral complement, the co-legislators may wish to consider an adjustment based on monitored and verified data. The Commission's proposal to amend the MRV Regulation (COM(2026) 620) already introduces the separate monitoring of ships sailing in ice conditions and requires monitoring plans to describe the procedures for applying any relevant adjustment under the ETS Directive. The same architecture could be used to recognise sea areas where exceptionally severe sea conditions prevail. We would respectfully suggest that such a mechanism be guided by the following design principles:

- **Position-based.** The adjustment would be determined by the ship's actual recorded position during navigation, using positional data already available from shipborne systems such as AIS and GNSS, and would apply only to the portion of a voyage undertaken within a designated area.
- **Neutral.** It would apply irrespective of the flag, ownership or nationality of the company and of the port of departure or destination, so that it corrects for conditions, not for the identity of those affected.

- **Transparent.** The greenhouse gases physically emitted would continue to be monitored, reported and verified unchanged. An adjusted quantity would be reported separately and used solely for the purpose of the surrender obligation.
- **Evidence-based.** The designated areas and the scale of the adjustment would be determined by the Commission on the basis of objective, long-term metocean data, such as wave-height statistics, and kept under review.
- **Verifiable and efficient.** The mechanism would be integrated into the unified MRV system and subject to independent verification, without creating a separate reporting obligation.

The available evidence indicates the order of magnitude involved. DNV's finding that ships around Iceland require 22.4% additional propulsion energy because of wind and waves implies that close to one-fifth of the energy used in those waters is attributable to sea conditions rather than to operational choices.

Where it is combined with a route-based adjustment such as Amendment 2694, the two should be designed so that they do not apply cumulatively to the same emissions.

8.3 Link the duration to the reality it corrects. Distance and sea conditions will not change. Technology will. When zero-emission propulsion becomes viable on long-distance North Atlantic routes, the additional energy required by distance and weather will no longer generate additional emissions, and the case for the adjustment will diminish accordingly. The duration of the adjustment should reflect this:

- The adjustment for island States should remain in place until the Commission establishes, in a dedicated review, that zero-emission propulsion is technically and commercially available at scale for the routes concerned. This mirrors the review the Commission itself proposes for ice-class ships in recital 25, and the criteria-based approaches of Amendments 2696 (Bajada) and 2705 (Humberto et al.).
- The fixed phase-out schedule in Amendment 70 of the draft report (PE791.996), under which surrender obligations rise to 100% by 2040, should not apply to adjustments based on permanent and measurable structural conditions. We note that the schedule was designed for full exemptions; applied to a 50% surrender obligation, its initial steps would fall below that level, which suggests the two provisions require alignment in any case.
- A criteria-based approach also delivers the predictability that the rapporteur rightly seeks: it is set once, on objective grounds, and does not require renegotiation at every review.

8.4 Assess maritime transport to and from Iceland. We call on the Commission to include maritime transport to and from Iceland in its future reviews and reports under the Directive, including reports on island connectivity and the capacity of insular economies to absorb additional costs, as proposed in Amendments 3105 (Ricci; PE796.499) and 1118 (Knotek et al.; PE796.490). Such an assessment should treat Iceland as what it is: an integral part of the internal market whose conditions the legislation must reflect.

8.5 Ensure equal access to support for decarbonisation. The proposal increases support under the Sustainable Maritime Alternative Propulsion mechanism (Article 3gaa) by five percentage points for voyages to ports "located on an island". This provision should explicitly

apply to voyages to and from island EEA States, so that operators serving Iceland have equal access to the support that will help them reduce emissions.

9. Conclusion

The EU ETS works best when the same rule has the same effect across the internal market. On routes to and from Iceland, it currently does not. The reason is neither inefficiency nor a lack of ambition, but distance and sea conditions that are among the most severe on the planet.

Iceland is part of the internal market. The rules that govern that market should reflect it as it is, in all its geographical areas.

The evidence is independent and verifiable, the principle is already recognised in EU law, and the instruments to apply it are on the table. SVÞ respectfully calls on the co-legislators to use them, so that the EU ETS prices the emissions that incentives can reduce, not the geography that they cannot.

Reykjavík, 3. November 2026



Kristinn Már Reynisson

Legal Counsel

SVÞ – Federation of Trade and Services

Annexes

- Annex I: DNV, *Increased vessel propulsive energy when trading to Iceland due to harsh weather*, technical memorandum, 18 March 2026.
- Annex II: DNV, *Added compliance cost impact due to longer voyage distances and harsh weather conditions for small feeder and feeder size container vessels*, technical memorandum, 5 June 2026.

Annex I

Increased vessel propulsive energy when trading to Iceland due to harsh weather

DNV, technical memorandum, 18 March 2026

TECHNICAL MEMO

Memo to:
Icelandic Ministry of Infrastructure

Copied to:
Katrín Pálsdóttir
Hugi Ólafsson

Memo No: 10610670m01
From: M-DP-H
Date: 2026-03-18
Prep. By: Shuai Li
Approved By:

Added main propulsion energy due to harsh weather for feeder size container vessels in liner operation to Iceland

1 EXECUTIVE SUMMARY

The feeder size container vessels trading to Iceland spend about 7-8% more propulsive energy due to wind and waves than similar sized vessels trading to Europe or globally. It is the leg from the last port of call outside Iceland that experiences the worst waves, but the study evaluates the total propulsive energy for each selected vessel in 2025.Actual voyages are used as basis for the calculation.

2 BACKGROUND

Iceland depends on seaborn transport. The container ships that provide the goods must cross a part of the North Atlantic, an ocean known for harsh weather conditions. A ship travelling in wind and waves needs to spend more energy for propulsion to maintain the speed. The energy per transported unit increases. This means added fuel costs, in addition to increased emissions. International regulations and mechanisms like Fuel EU Maritime and EU ETS add costs to emissions. The possible IMO Net Zero Framework will penalize vessels that consume more. The Ministry of Infrastructure asked DNV Maritime Advisory to investigate the consequences of emission costs for vessels trading to Iceland, starting with an understanding of the added energy required for main propulsion due to harsh weather.

3 OBJECTIVE

The increase in main propulsion energy spent due to wind and waves for vessels trading to Iceland will be compared with the same increase for vessels in the same capacity range involved in European and global trade.

4 METHODOLOGY OVERVIEW

An outline of the methodology is provided in the following. DNV has worked with emission modelling and reporting for the last two decades [1]. Currently, the emission calculation model MASTERv2 is considered as state-of-the-art. This model uses the vessel characteristics together with the operational parameters to estimate the required propulsive power as well as energy usage for auxiliary engines and boilers. MASTERv2 is based on first principles, where the required propeller thrust balances different resistance components, including calm water resistance from hull friction, viscous pressure loss and wave generation, wind and wave resistance and effects of hull fouling. Accurate added resistance calculations is important for this study, and the applied model for wave resistance is that of Liu and

Papanikolaou [2], added resistance from wind employs wind coefficients from 28th ITTC report [3] and the required inputs are estimated with a regression formula proposed by Kitamura et al. [4]. The air resistance for the calm water situation used an average wind coefficient, while the windage area is found based on formulas from Kitamura et al. [4]. All these methods are well recognized and validated. The model is calibrated by comparing the predicted emissions for different vessel types and sizes with reported data available to DNV as a recognized organization performing MRV and DCS verification.

The operational data is provided by access to the automatic identification system (AIS) data. This provides information about the vessel position and speed.

Weather information is obtained from the Copernicus climate data. Specifically, the ERA5 fifth-generation ECMWF atmospheric reanalysis of global climate is used.

Current is not considered, and hull fouling is assumed to follow a 5-year cycle. The vessel draft is assumed to be around 85% of max draft.

The calculations are based on the historic voyages, which means that the vessel speed reflects the possible involuntary speed-loss due to harsh weather. The evaluation considers the fraction of additional power spent due to the harsh weather, and does not consider the additional time spent if the vessel is not able to make the planned speed.

5 VESSEL SELECTION

Vessel selection was done in two rounds, for slightly different purposes.

Based on AIS data, 19 container ships were found to have visited ports in Iceland in the year of 2025. Their cargo carrying capacity varies from 508 TEU to 2150 TEU. The voyages in 2025 are plotted in Figure 5-1, which shows that most of them have been travelling within EEA and north America. A few voyages went as far as to Africa, Middle East and Antarctica.

743 container vessels from 500 TEU to 2200 TEU capacity are detected to have travelled to Europe in 2025, excluding the previous 19. Their trade routes are plotted in Figure 5-2.

In addition, 300 container vessels in the same capacity range are randomly selected to represent global seaborn trade, and their routes are showed in Figure 5-3.

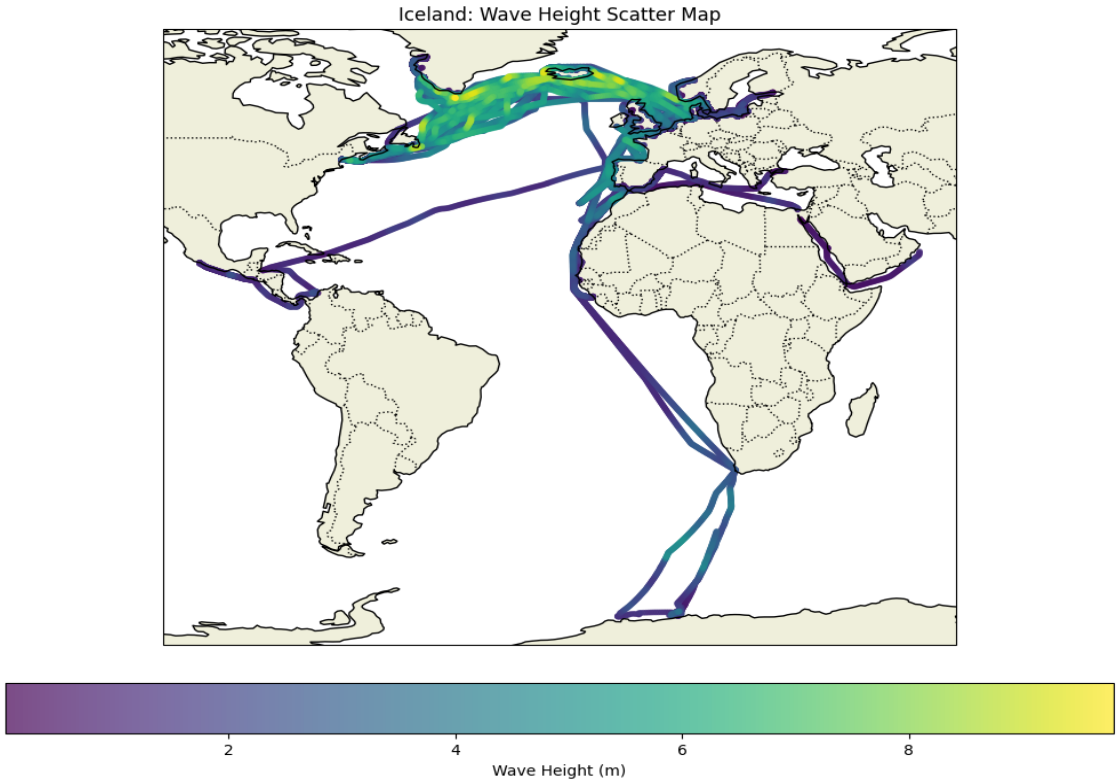


Figure 5-1 travelling routes of all 19 container ships visiting Icelandic ports

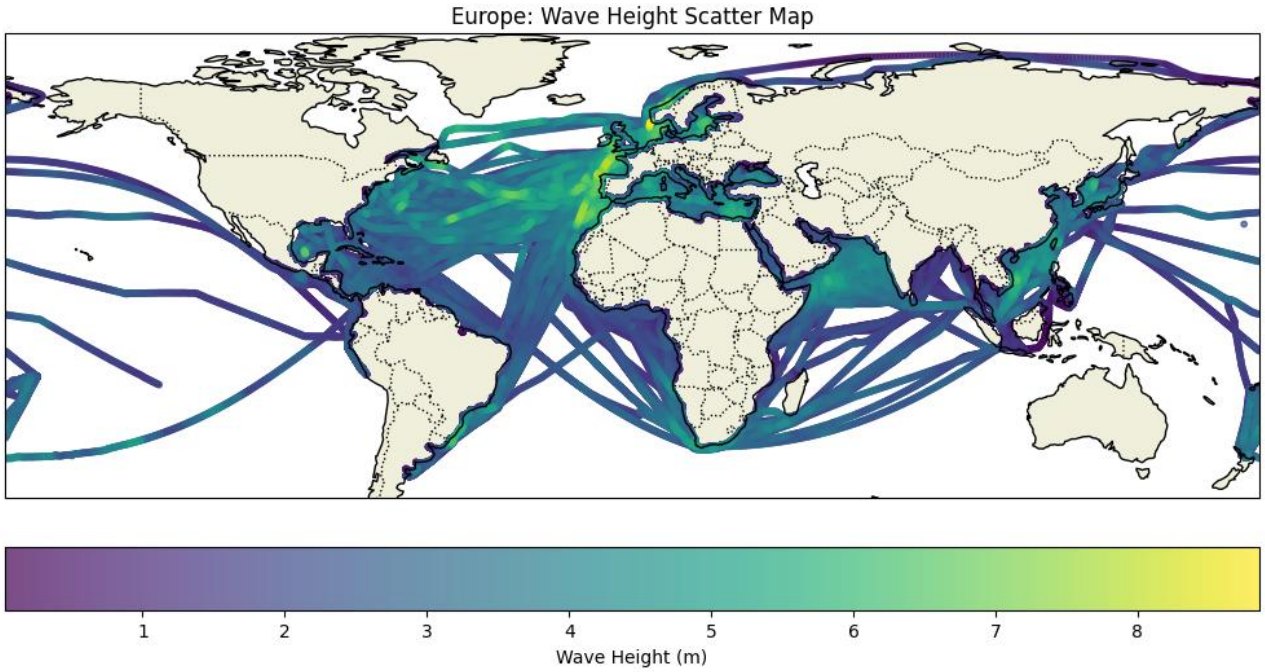


Figure 5-2 travelling routes of all container ships in the same cargo capacity range that traded to Europe (excluding Iceland)

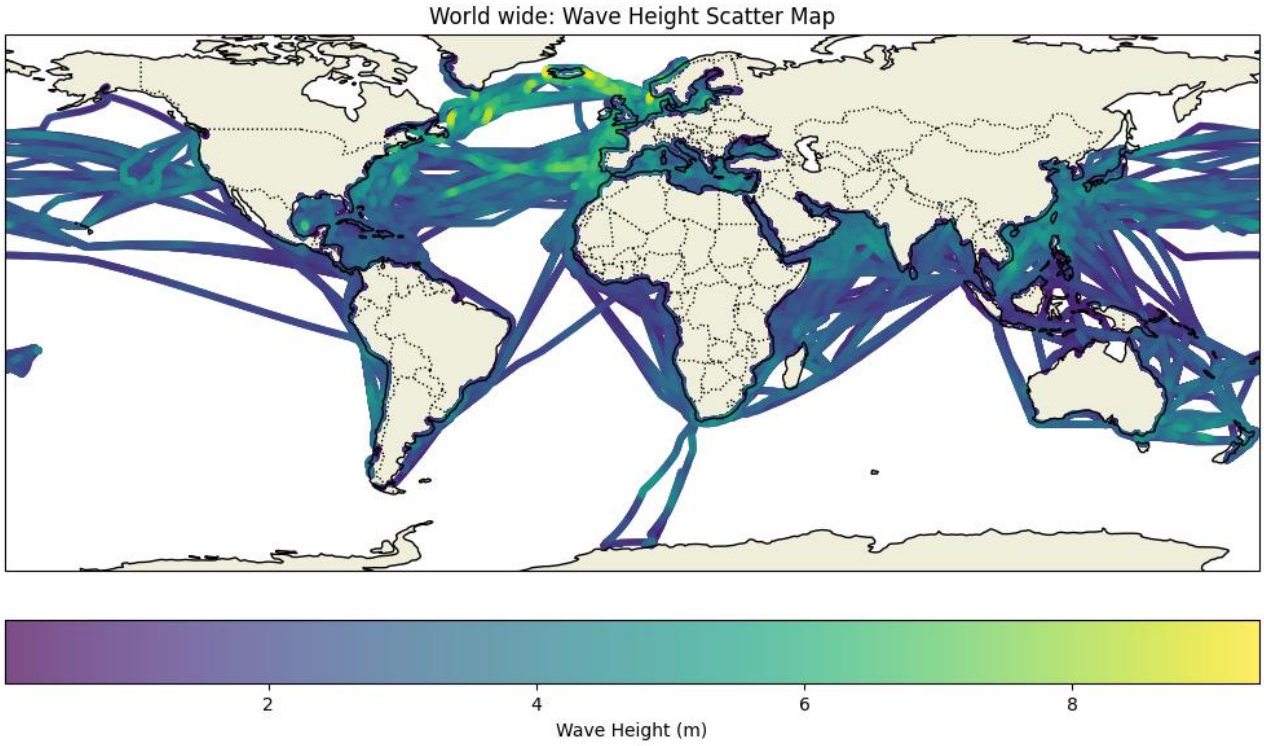


Figure 5-3 travelling routes of 300 selected container ships of the same capacity range for global trades

These first three sets representing trade to Iceland, Europe and globally were used to evaluate the typical experienced weather.

After the initial selection, a slightly different and reduced number of vessels were selected for the European and global trades. This was done to get a more manageable analysis scope for the calculated energy consumption, while retaining a data size that provided representative results.

6 EXPERIENCED WEATHER

For all vessels first selected in the three trade scenarios, the wind and waves they experienced during 2025 were queried, calculated and analysed. The travelling routes are coloured by the significant wave weight they experienced in Figure 5-1, Figure 5-2 and Figure 5-3. A summary is presented in Figure 6-1. It is evident that the waves experienced by container vessels in liner operation to Iceland are significantly higher than those on European or world-wide trade. The example included in the figure shows that the significant wave height that are likely to be exceeded 10% of the time for the vessels trading to Iceland is around 3.4m, while the same for European or global trade is just 2.1m.

The wave direction is quite uniform for trade to Iceland, with a significant wave height frequently above 2 meters from all directions. Vessels trading to Europe and globally meet less harsh conditions. This is illustrated in Figure 6-2.

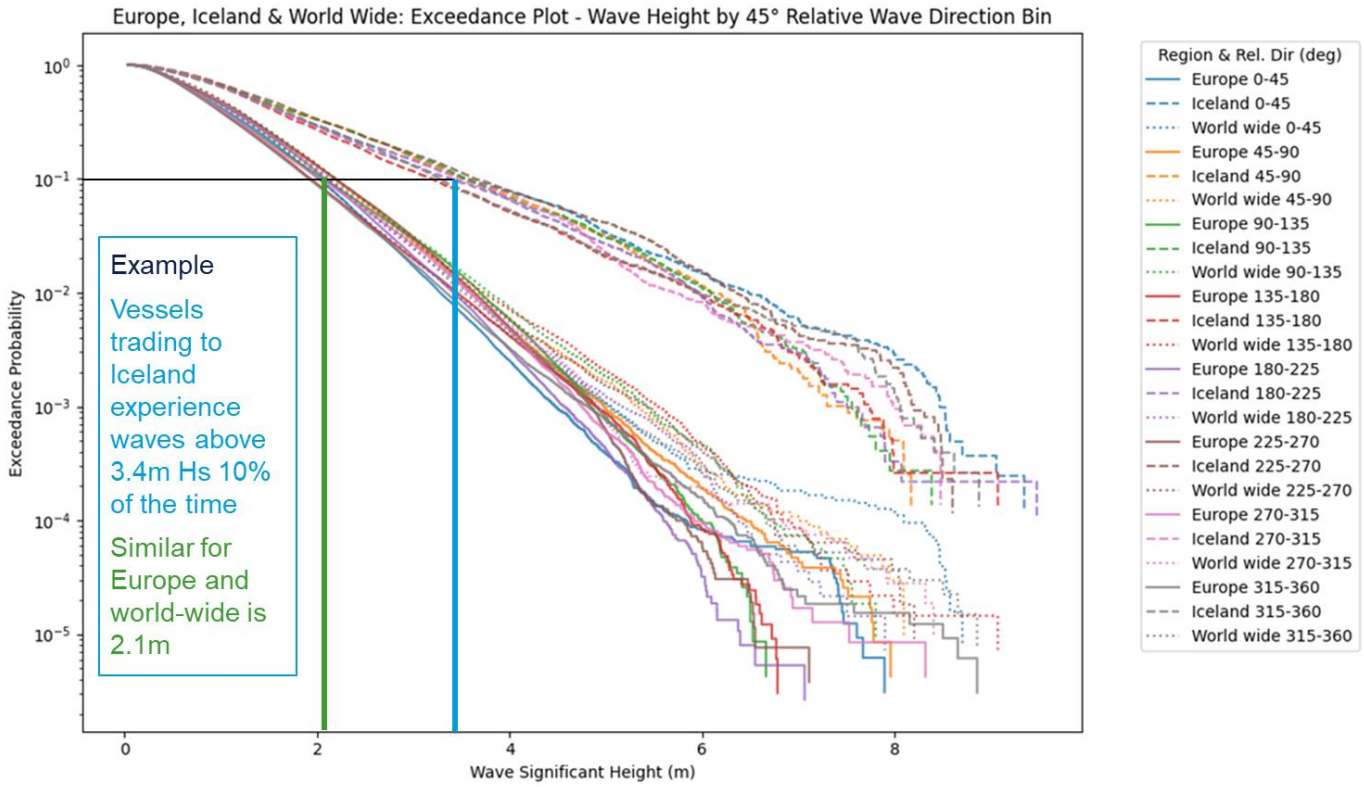


Figure 6-1 wave height exceedance plot

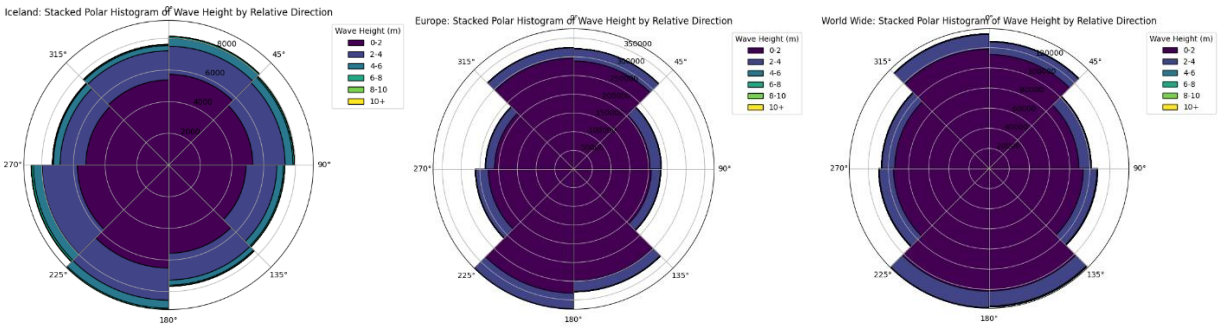


Figure 6-2 wave height and wave direction

7 ENERGY CALCULATIONS AND COMPARISON

Added energy due to wind and waves varies across different routes and seasonal conditions. Vessels may need to increase the propulsion power by 5% or less for coastal trips in the summer, while 30% or higher are common when crossing the North Atlantic in wintertime. Figure 7-1 illustrates how the energy used for main propulsion increases depending on wave direction and significant wave height for the vessels trading to Iceland. It is evident that the higher added energy occurs in head sea and high waves. Each box represents a range of wave direction and significant wave height, and the percentage is an average of the added propulsion energy for all the ships and periods within these ranges.

The vessel main propulsion energy is calculated for 3 scenarios with and without weather for the whole year travels in 2025.

Scenario 1 includes the feeder size container vessels involved in the liner operation to Iceland. The size range is from 500 to 2200 TEU capacity. The resulting list includes all 19 vessels detected. The added propulsion energy percentage (compared to no wind and no wave) is indicated by colour in Figure 7-2.

Scenario 2 considers similar sized container vessels operating more than 50% of the time within European ECA zones, excluding the vessels trading to Iceland. A random selection of 150 vessels is used to keep the analysis time at a reasonable level. This is considered enough to get accurate results. A down sampled plot of propulsion increase percentage is given in Figure 7-3.

Scenario 3 includes 150 container vessels within the defined size range. These are randomly picked among all that operate world-wide. The fraction of additional main propulsion energy spent due to wind and waves is illustrated by colour in Figure 7-4 (down sampled due to the limit of computer's memory).

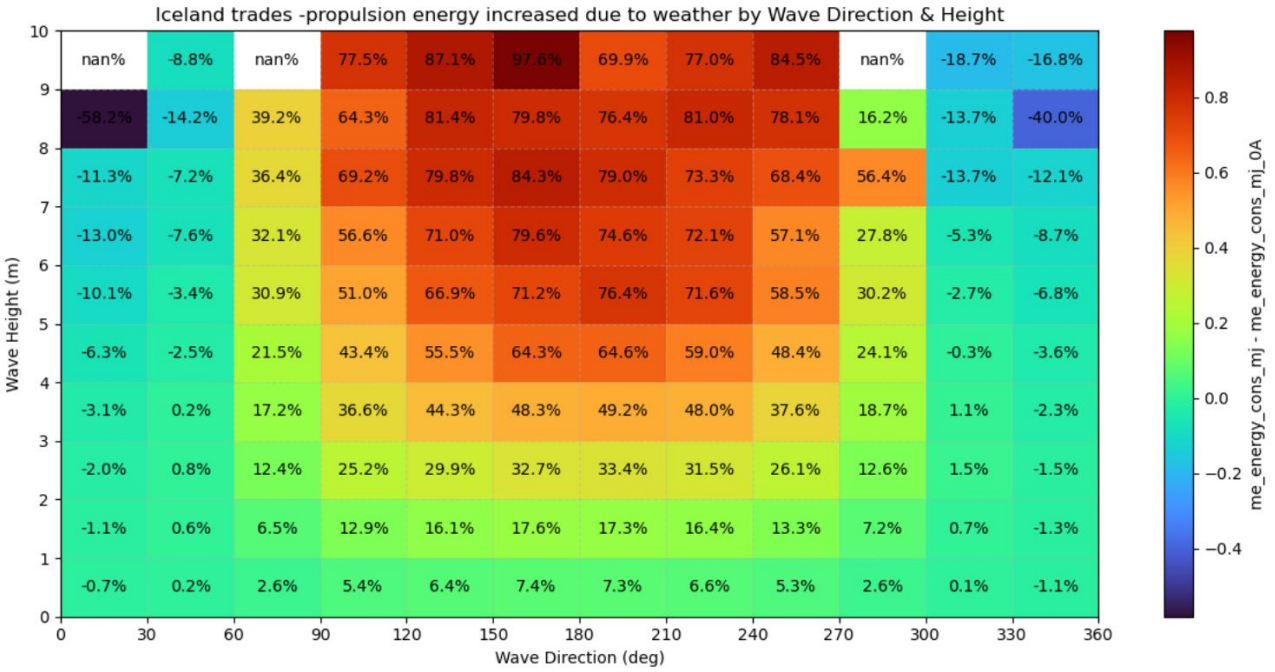


Figure 7-1 propulsion energy increased due to weather

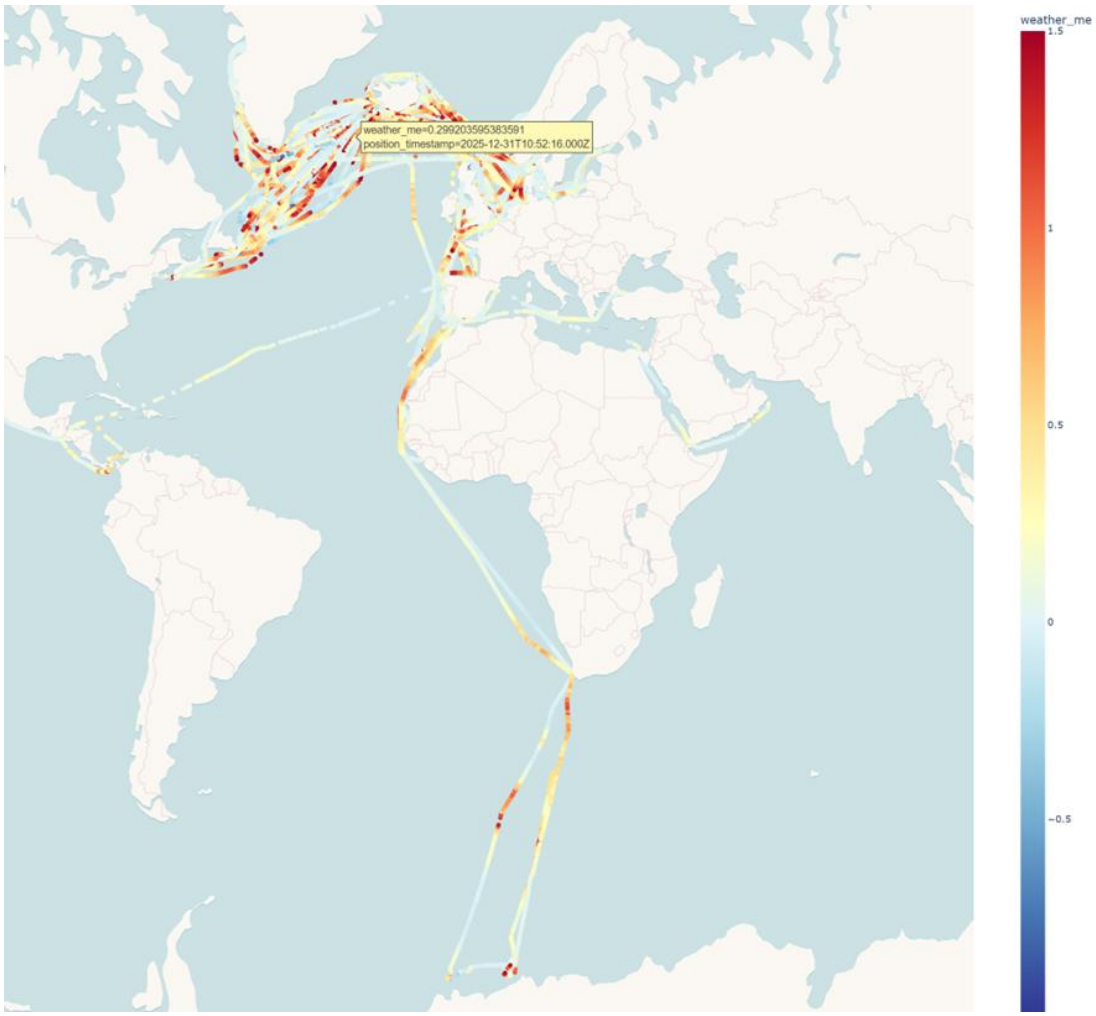


Figure 7-2 propulsion energy increase in percentage for trade to Iceland

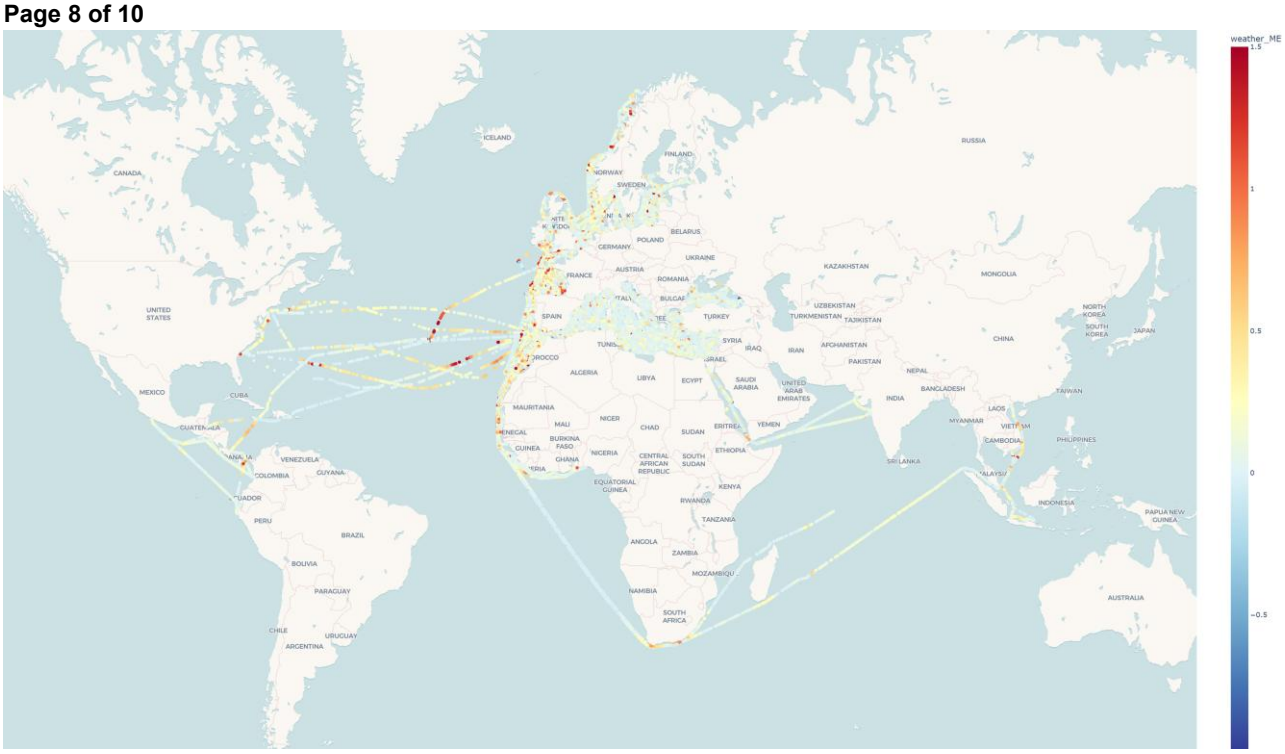


Figure 7-3 propulsion energy increase in percentage for Europe trade



Figure 7-4 propulsion energy increase in percentage for global trade

The average of increase in propulsion energy due to wind and waves for the three scenarios is given in Table 7-1. The result shows clearly that the vessels transporting goods to Iceland spend significantly more of the total propulsive energy to overcome the added resistance due to wind and waves. The difference is 7.8% comparing to Europe average and 7.3% comparing to global average, based on the 2025 numbers, with an uncertainty in the estimate of around plus/minus 1%.

Table 7-1 Mean increase of propulsion energy for different scenario

	Selection Criteria	$\frac{weather\ added\ energy\ consumption}{propulsion\ \ energy\ in\ calm\ water}$
Iceland trading vessels	All 19 vessels found having travelled to Iceland in 2025	**17.2%**
Europe trading vessels	150 vessels of the same size group randomly selected from vessels that have spent more than half of their time in Europe	**9.4%**
Global trading vessels	150 vessels of same size group randomly selected from the global fleet	**9.9%**

8 DISCUSSION

The vessels typically spend a large part of the transit time in coastal and more protected areas in Europe. This is included and leads to conservative (lower) added energy estimates. If only the last part of the voyage to Iceland would be basis for the comparison (last port of call outside of Iceland to an Icelandic port), the added energy would be much higher compared to average voyages within Europe.

For trade to Iceland the added energy is mainly due to the North-Atlantic crossing. The increase in propulsion energy percentage due to wind and waves for different geographical areas is shown in Figure 8-1. The percentages are calculated based on the operation of the selected vessels within these areas in 2025.

Other negative effects of operations in relatively harsher weather are not considered but may have a significant impact on the cost of transporting goods. The length and duration of the voyage may increase due to weather routing or speed-loss. Container vessels in a liner trade typically operate within a tight schedule, and they need to minimise speed-loss by increasing propulsive power. Still, in harsh weather conditions, the installed power may not be sufficient to maintain speed. The voyage takes longer time, and the total consumption increases.

Harsh weather affects ship motions, and the smaller container vessel operating to Iceland are more exposed than larger vessels operating to larger ports. Motions and loads affect equipment wear and tear as well as cargo securing efforts.

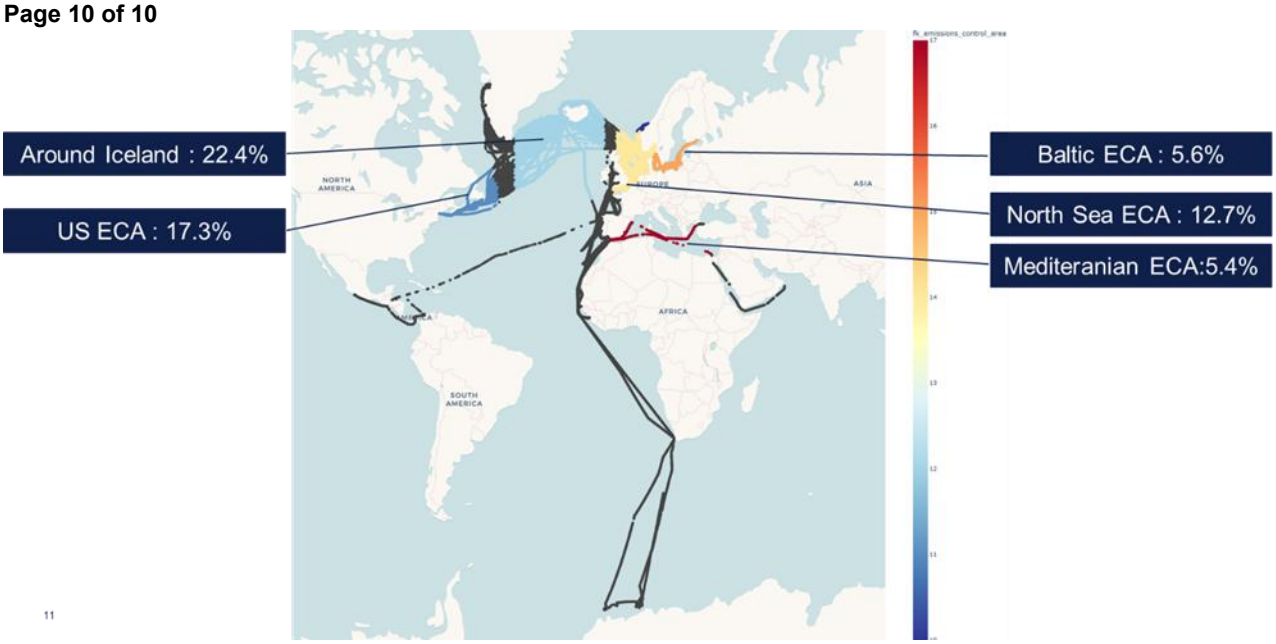


Figure 8-1 propulsive energy increase percentages due to wind and waves for different areas for the 19 vessels operating to Iceland during 2025

9 CONCLUSIONS

The result of this study supports the hypothesis that container vessels transporting goods to Iceland use more energy due to harsh weather conditions. The analyses are based on evaluation of the propulsive energy spent for vessels during 2025. The feeder size container vessels in liner operation to Iceland need around 7.5% more propulsion energy due to wind and waves compared to container vessels of similar size trading to Europe or globally.

10 REFERENCES

[1] DNV, “MASTERv2 - VERDE AIS Model Documentation form GRD,” 2021.

[2] S. K. Liu and A. Papanikolaou, “Fast approach to the estimation of the added resistance of ships in head waves,” *Ocean Engineering,* pp. 211-225, 2016.

[3] Specialist Committee on Performance of Ships in Service of 28th ITTC, “ITTC Quality Systam Manual Recommended Procedures and Guidelines,” 2017.

[4] F. Kitamura, M. Ueno, T. Fujiwara and N. Sigihara, “Estimation of above water structural parameters and wind loads on ships,” *Ships and Offshore Structures,* vol. 12, no. 8, pp. 1100-1108, 2017.

Annex II

Added compliance cost impact due to longer voyage distances and harsh weather conditions for small feeder and feeder size container vessels

DNV, technical memorandum, 5 June 2026

DNV

TECHNICAL MEMO

Memo to:
The Confederation of Icelandic Enterprise and the Federation of Trade and Services
Copied to:
Hugrún Elvarsdóttir
Kristinn Már Reynisson

Memo No: 10624840m01
From: M-DP-A
Date: 2026-06-05
Prep. By: Oda Myklebost
Shuai Li

Approved by: Olav Rognebakke
Kine Kyrkjeboe

Added compliance cost impact due to longer voyage distances and harsh weather conditions for small feeder and feeder size container vessels trading to Iceland

1 EXECUTIVE SUMMARY

This memo presents a quantification of compliance cost impacts under EU ETS and FuelEU Maritime for small feeder and feeder container vessels operating a direct Reykjavik–Rotterdam route, based on AIS data and fuel consumption modelling for 2025.

The study's results show that vessels operating Reykjavik -Rotterdam routes have higher fuel consumption, CO_2 emissions and compliance costs per voyage than vessels trading within continental Europe. For the routes analysed, the EU ETS cost per voyage is at least 50% higher for the Iceland-Rotterdam routes compared to routes within the distance range covering the majority of intra-European traffic.

The higher emissions and associated compliance costs are explained by a combination of route characteristics and operating conditions identified in the analysis. These include longer voyage distances, additional sailing distance due to routing and weather, higher weather-related energy use and higher average operating speeds.

The Reykjavik–Rotterdam route (~1,200 nm) is longer than typical intra-European feeder trades, where more than 80% of voyages occur below 800–1,000 nm. This places Icelandic routes at the upper end of the observed distance and cost distribution (see **Figure 1** below). Actual sailing distances between Reykjavik and Rotterdam average approximately 1,220–1,230 nm, corresponding to around 4–8% above the shortest route, with individual voyages extended further due to routing and weather.

This study builds on a previous DNV study (ref. 1), which quantified weather-related impacts along the complete trading routes[1] and found that feeder vessels operating to Iceland require approximately 7–8% more propulsive energy due to wind and waves than similar vessels trading within Europe or globally under comparable operating conditions. In contrast, this analysis focuses on direct port-to-port voyages, allowing for a more isolated assessment of distance, routing and weather effects. For direct Reykjavik-Rotterdam voyages, the average increase in energy consumption due to wind and waves is estimated at 17%, compared to an average increase of 8% observed across intra-European voyages within selected ECA regions, representing an additional ~9 %.

[1] Complete trading routes" refer to the vessel's full set of voyage legs over time between various ports. In contrast, this study focuses on direct port-to-port voyages to isolate route-specific effects.

In addition, vessels operate at higher average speeds (14.1 knots compared to 12.8 knots) to maintain schedule reliability under longer distances and under variable operating conditions.

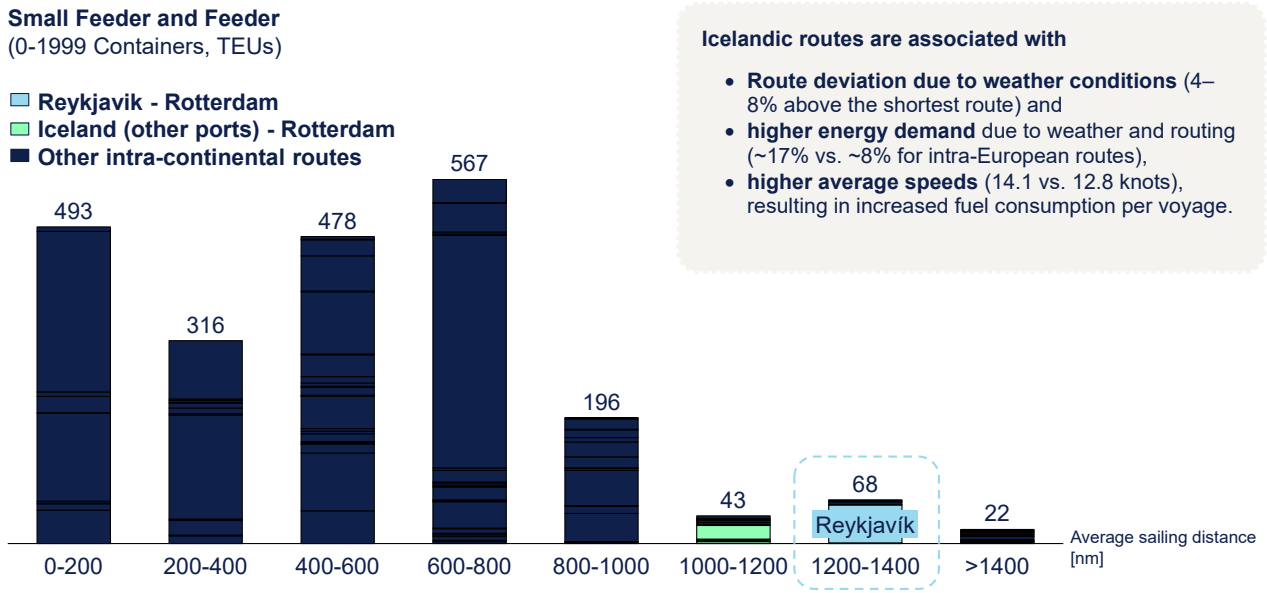


Figure 1 Distribution of direct voyages to Rotterdam by sailing distance, showing that Icelandic routes occur at longer distances and are associated with higher energy demand due to weather exposure and routing compared to typical intra-European trades.

Overall, the analysis shows that higher emissions and compliance costs on the Icelandic routes analysed are primarily driven by longer voyage distances, weather exposure, route deviations and the need to maintain regular liner schedules under these conditions, which is associated with higher operating speeds. Fuel consumption, CO_2 emissions and associated compliance costs increase with sailing distance, and Icelandic routes are located at the upper end of the observed range for both EU ETS and FuelEU Maritime costs.

2 BACKGROUND

This study builds on previous work by DNV, which identified increased vessel propulsive energy requirements when operating on Icelandic trade routes due to harsh weather conditions (ref. 1). The earlier analysis highlighted that vessels operating between Iceland and continental Europe are subject to weather-related impacts, leading to increased energy use compared to more sheltered intra-European routes. The feeder size container vessels trading to Iceland spend about 7-8% more propulsive energy due to wind and waves compared to similar-sized vessels trading to other locations in Europe or globally.

3 OBJECTIVE

The objective of this study is to quantify the additional compliance cost burden faced by Icelandic shipping operators, driven by longer voyage distances and more challenging weather conditions on North Atlantic routes, compared to ship operators trading within continental Europe.

4 METHODOLOGY OVERVIEW

The analysis quantifies the additional compliance cost burden for Icelandic operators by assessing differences in voyage distance, operational conditions and fuel consumption compared to intra-European routes.

Voyages between Reykjavik and major European ports (e.g. Rotterdam) for the past 3 years are studied. The distance sailed for each voyage is collected and quality assured from MRV reports and AIS[2] data. The added sailing distance is quantified as the difference between the average travelling distance and the shortest route (the normal route if weather allows is considered as the shortest route travelled).

The analysis compares Icelandic trade routes with representative intra-European routes for similar vessel segments. The Reykjavik–Rotterdam route (~1,200 nm) is used as the Icelandic reference and benchmarked against typical intra-European trades to/from Rotterdam based on AIS data.

Fuel consumption and CO_2 emissions are estimated on a per-voyage basis, combining reported fuel consumption data and AIS-based modelling (ref. 2) where required. The resulting emissions are used to assess compliance cost impacts under EU ETS and FuelEU Maritime.

5 ROUTE SELECTION

The vessel selection was based on the previous study *"Added main propulsion energy due to harsh weather for feeder size container vessels in liner operation to Iceland"* delivered March 2026. Based on AIS data, 19 container ships were found to have visited ports in Iceland in the year of 2025. Their cargo carrying capacity varies from 508 TEU to 2,150 TEU, further categorized as Small feeders (0-999 TEU), Feeders (1,000-1,999 TEU) and Feedermax (2,000-2,999 TEU). Analysis of their 2025 voyages from Reykjavik, identified Rotterdam as the most frequent port of call, making it the primary port when selecting comparable voyages inside the EEA. The distance between Reykjavik and Rotterdam is about 1,200 nautical miles. Only Small feeders and Feeders sailed directly to Rotterdam in 2025 and therefore only these vessel types were considered in the further analysis.

The voyages, based on AIS data, for all container feeders (500–2,200 TEU) sailing in EEA waters calling Rotterdam in 2025 were analysed to identify relevant trade routes for comparison. The voyages were first grouped into distance categories based on the sailed distance from the last port call to Rotterdam to enable comparison across trade patterns. Ports with most frequent calls to Rotterdam within each distance category were selected for further assessment by vessel segment (Small feeders and Feeders). Only direct voyages between EU/EEA ports are included in the sample. Figure 2 and Figure 3 show all direct voyages between origin ports and Rotterdam derived from AIS data. Within each distance category, labelled ports represent those with frequent direct calls to Rotterdam and were selected for further route-level analysis. The selected routes represent 62% and 81% of the total number of direct EU/EEA-to-Rotterdam voyages in the small feeder and feeder samples, respectively.

For voyages above 1,400 nm, there were no recurring liner trades; instead, only one-off or very limited voyage occurrences were identified. These have therefore been grouped together to represent the >1,400 nm distance category.

[2] Automatic Identification System (AIS) is a tracking system used on ships to automatically broadcast and receive data such as position, speed, course, and vessel identity. It is mandatory on ships above 300 GT on international voyages and above 500 GT on domestic voyages, and all passenger ships. The system operates continuously and is a key input for vessel tracking, collision avoidance, and maritime analytics.

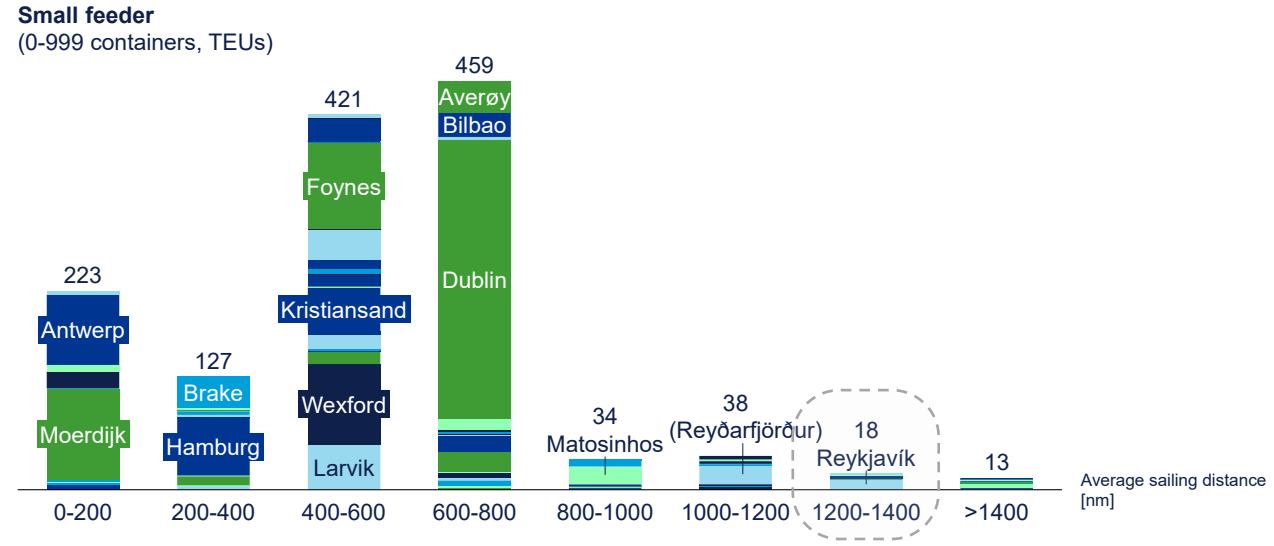


Figure 2 Distribution of Small feeder voyages (0–999 TEU) from origin port to Rotterdam by sailing distance. Most voyages are concentrated in short intra-EU trade lanes (<800 nm), while Iceland (Reykjavík) appears as a clear outlier at significantly longer sailing distances.

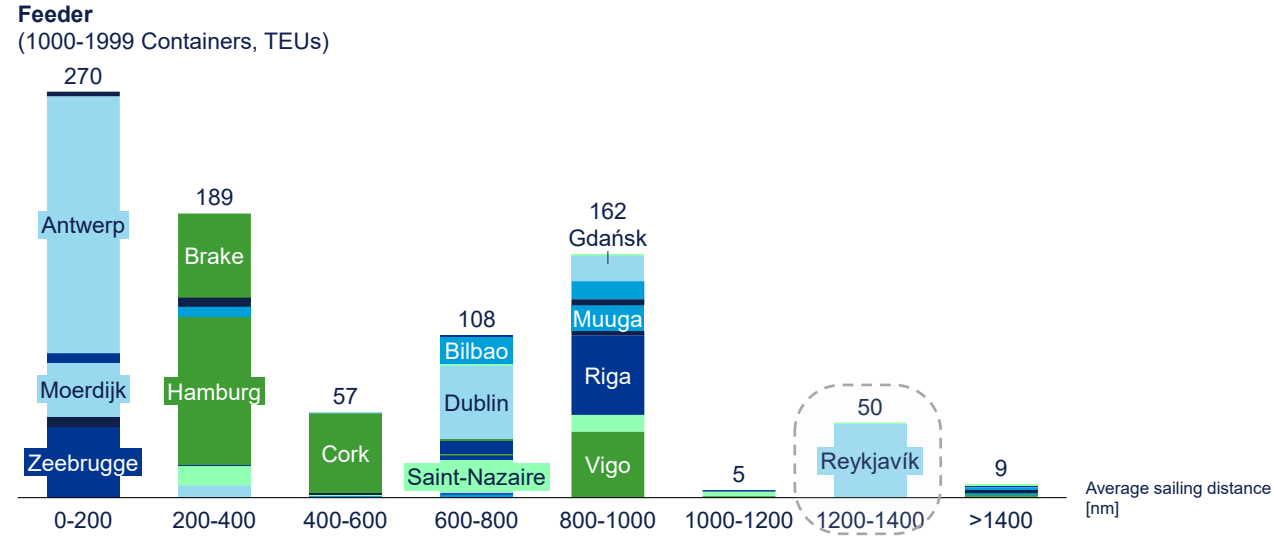


Figure 3 Distribution of Feeder voyages (1,000–1,999 TEU) from origin port to Rotterdam by sailing distance. Most activity is occurring on short to medium intra-EU routes, while Iceland (Reykjavík) remains an outlier with significantly longer voyage distances.

6 ESTIMATION OF ADDITIONAL DISTANCE SAILED DUE TO WEATHER ROUTING

The great-circle distance between Reykjavik Port and the Port of Rotterdam is 1096.5 nautical miles. However, the shortest route for shipping will be a bit longer considering environmental and navigational limitations. Based on operational data of container vessels since 2023 as reported for MRV, the shortest recorded sailing distance for container vessels between the two ports was 1,175 nautical miles, while the longest reached 1,521 nautical miles, with an average of 1,223.9 nautical miles.

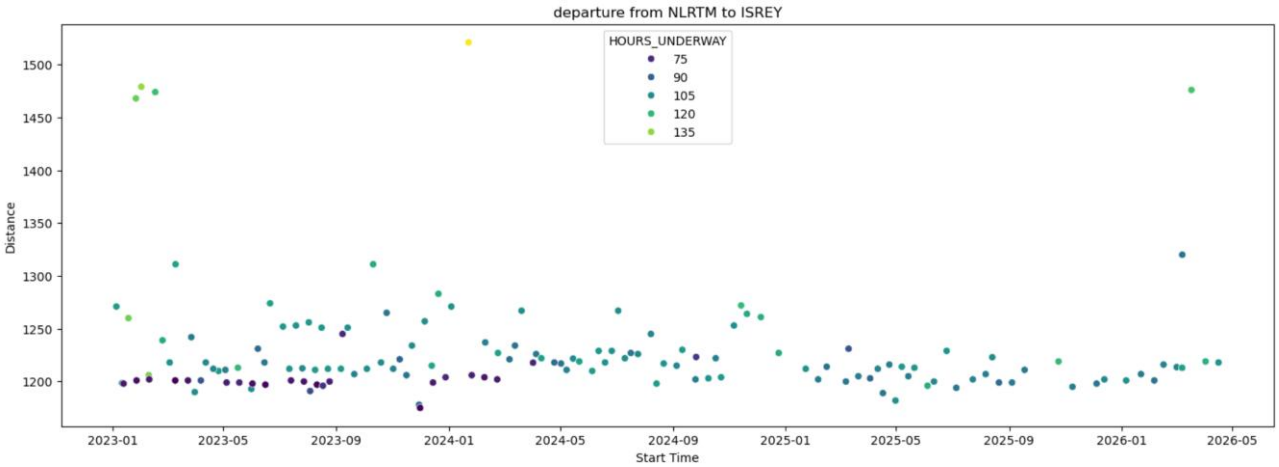


Figure 4 Distances travelled by container vessels from Rotterdam to Reykjavik

As illustrated in Figure 4, vessels frequently deviate from the nominal route, with some sailing distances exceeding the baseline by more than 29%. These deviation are evident when visualizing the actual routes travelled, see Figure 5. As an example, the distance sailed on the route including the date November 7th 2025 is significantly longer than that sailed including May 30th 2025. On an annual basis, even when accounting for the shortest and more direct voyages, the average distance remains at least 4.2% longer than the recorded minimum.

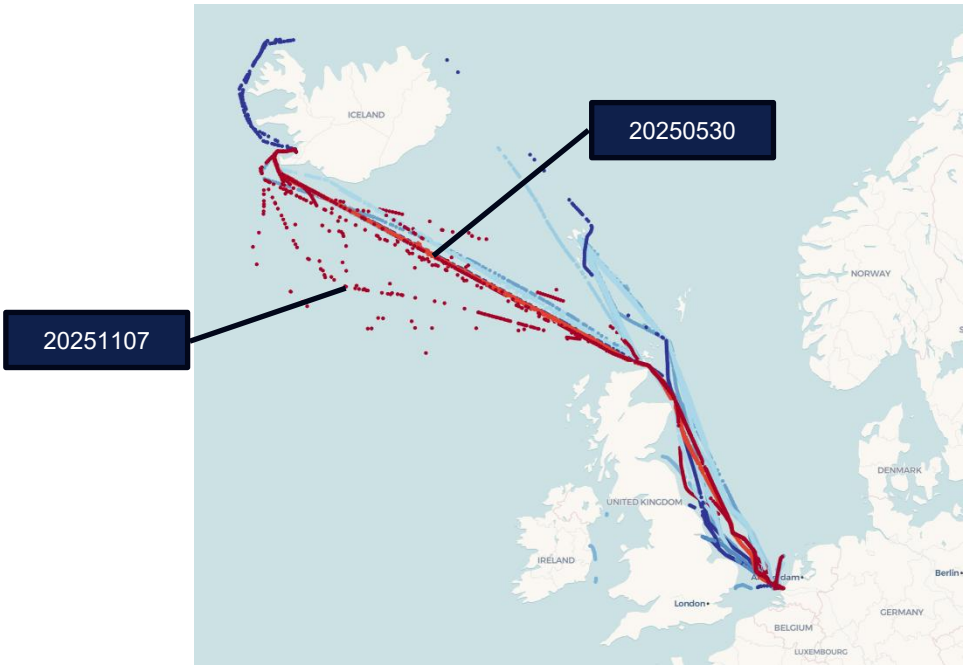


Figure 5 Example routes from Iceland to Rotterdam (down sampled for better illustration)

Such voyages are also studied based on AIS data. We queried all AIS data with destination of Reykjavik and Rotterdam for the past 3 years and found all voyages by limiting the voyage intervals, finally filtering out the ones with actual departure and arrival outside these 2 ports. A total of 201 voyages were detected, resulting in similar findings as from the MRV data. The identified distance difference was higher. The average distance is 7.7% longer than the recorded minimum. A detailed comparison is given in Table 1.

Table 1 statistics of voyages between Reykjavik and Rotterdam

	From AIS DATA (filtered)			From MRV Report
	RTM to REY	REY to RTM	total	total
valid voyages	55	146	201	209
min distance (nm)	1,195.1	1,139.6	1,139.6	1,175
max distance (nm)	1,597.7	1,392.5	1,597.7	1,521
mean distance (nm)	1,254.6	1,217.4	1,227.5	1,224
mean/min	1.050	1.068	**1.077**	**1.042**
max/min	1.337	1.222	1.402	1.294

For other European ports, similar results are obtained. Vessels departing for Iceland are expected to travel further in harsh weather conditions. For example, voyages from Tórshavn in Faroe Islands to Reykjavik have on an average 6.4% longer travelled distance than the minimum for this route, for voyages from Vestmanna the same number is 22%.

Icelandic shipping routes are heavily dependent on transporting fresh and time-sensitive goods. This affects operational requirements and the need to maintain reliable schedules. Due to the longer route and tight schedules for the liners, these vessels must sail at a higher speed. Based on the previous study (DNV, 2026), 19 container vessels traded to Iceland in 2025, and their average sailing speed (sailing is defined as the period when the vessel speed >5 knots) is 14.12 knots, while the 150 randomly selected Europe trading container vessels of the same size are sailing at 12.76 knots by yearly average.

Additionally, it is important to consider that voyages to Iceland inherently incur higher energy consumption due to adverse wind and wave conditions. For all the 19 container vessels travelled to Iceland in 2025, we detected 57 direct voyages between Rotterdam and Reykjavik by querying all AIS data with destination of Reykjavik and Rotterdam in 2025. We found all voyages by limiting the voyages intervals, finally filtering out the ones with actual departure and arrival outside these 2 ports. The average increased energy consumption due to wind and waves is about 17%. Then we analysed the increased energy consumption due to wind and waves for Europe trading vessels in 2025. 150 randomly selected container vessels of similar size of these 19 vessels in previous study (DNV, 2026) are employed here again, but we limited the travels to ECA Baltic zone, ECA Mediterranean zone and ECA North Sea zone, and the average increased energy consumption is 8.15%. This means that in addition to much longer travel routes and higher speed, vessels need about 9% more (17% - 8%) energy travelling between Reykjavik and Rotterdam than intra-Europe travels just for wind and waves. (Please be noted here intra-Europe travels only includes 3 ECA zones mentioned above, shipping to Gran Canaria, Greenland, etc. and other coastal shipping is not included).

7 ESTIMATED FUEL CONSUMPTION AND EU ETS COST IMPACT FOR SELECTED ROUTES

For each selected route, average fuel consumption and associated CO_2 emissions have been estimated based on an analysis of all recorded sailings along the respective voyage leg.

Where available, and when at least three vessels have reported data for a specific voyage leg, the averages are based solely on reported fuel consumption and associated emissions. In cases where fewer than three vessels have reported data, fuel consumption has also been estimated using AIS data in combination with the DNV MASTER model[3].

For the cases where fewer than three vessels have reported data, the final average fuel consumption and emissions values are derived using a weighted average, combining reported data and model-based estimates.

Table 2 and Table 3 present the estimated fuel consumption, CO_2 emissions and associated EU ETS costs per voyage across selected intra-European routes and the Reykjavik route, segmented by vessel size.

For voyages between Reykjavik and Rotterdam, fuel consumption and CO_2 emissions have been adjusted to account for weather effects (+9%) based on findings in chapter 6.. As sufficient reported data were not available, emissions have been estimated using the DNV MASTER model and reported data in combination (weighted average).

For the 1,000–1,200 nm distance category, there were insufficient voyages to establish representative averages, reflecting that most intra-European trades occur at shorter distances, while the Reykjavik route is a long-distance outlier.

An EU ETS carbon price of 76 €/tCO_2 has been applied, reflecting average market levels observed in 2025. A phase-in factor of 70% is applied for 2025, meaning that only 70% of emissions are subject to compliance costs, increasing to 100% coverage from 2026 onwards. The EU ETS cost per voyage is calculated as the estimated average CO_2 emissions per voyage multiplied by the carbon price and the applicable phase-in factor.

[3] Averages are calculated on a per-voyage basis. Where reported data is available for at least three vessels on a given voyage leg, averages are derived directly from reported fuel consumption and associated emissions. For cases with fewer than three vessels, additional estimates are generated using AIS-based modelling (DNV MASTER). In these cases, reported and modelled values are combined using a weighted average based on the number of voyage observations.

7.1 Small feeder (0-999 TEUs)

Table 2 Estimated fuel consumption, CO_2 emissions and EU ETS cost per voyage for small feeder vessels (0–999 TEU) across selected intra-European routes to Rotterdam and the Reykjavik route. Results are grouped by sailing distance and based on reported data and AIS-based modelling where applicable.

Dist. Category [nm]	Start port to Rotterdam (NLRTM)	Number of port calls to NLRTM/year	Avg. Sailed distance	Avg. Fuel cons./ voyage [MT]	Avg. CO2 emission/ voyage [MT]	Avg. Cost of EU ETS/ voyage (2025, 70%)	Avg. Cost of EU ETS/ voyage (2026, 100%)
0-200	Moerdijk	101	27	1	5	242 €	345 €
	Antwerp	79	112	11	33	1 778 €	2 541 €
200-400	Brake	35	268	19	56	2 955 €	4 221 €
	Hamburg	64	329	23	70	3 748 €	5 355 €
400-600	Kristiansand	49	427	34	105	5 602 €	8 002 €
	Larvik	51	515	37	113	6 027 €	8 610 €
	Wexford	90	592	52	164	8 715 €	12 451 €
	Foynes	96	599	55	174	9 231 €	13 187 €
600-800	Dublin	313	626	50	153	8 150 €	11 643 €
	Averøy	36	792	39	123	6 553 €	9 361 €
	Bilbao	27	793	55	173	9 179 €	13 113 €
800-1000	Matosinhos	19	961	71	224	11 901 €	17 001 €
1000-1200	-	-	-	-	-		-
1200-1400	**Reykjavík**	**10**	**1227**	**107**	**335**	**17 836 €**	**25 480 €**

7.2 Feeders (1000-1999 TEUs)

Table 3 Estimated fuel consumption, CO_2 emissions and EU ETS cost per voyage for feeder vessels (1,000–1,999 TEU) across selected intra-European routes to Rotterdam and the Reykjavik route. Results are grouped by sailing distance and based on reported data and AIS-based modelling where applicable.

Dist. Category [NM]	Start port to Rotterdam (NLRTM)	Number of port calls to NLRTM/year	Avg. Sailed distance [NM]	Avg. Fuel cons./ voyage [MT]	Avg. CO2 emission/ voyage [MT]	Avg. cost of EU ETS/ voyage (2025, 70%)	Avg. cost of EU ETS/ voyage (2026, 100%)
0-200	Moerdijk	36	32	2	6	315 €	450 €
	Zeebrugge	47	113	11	22	1 182 €	1 689 €
	Antwerp	171	115	12	37	1 954 €	2 792 €
200-400	Brake	56	274	22	66	3 528 €	5 040 €
	Hamburg	98	317	26	80	4 234 €	6 049 €
400-600	Cork	53	588	48	148	7 870 €	11 243 €
600-800	Saint-Nazaire	20	654	53	165	8 792 €	12 560 €
	Dublin	49	654	57	179	9 510 €	13 585 €
	Bilbao	18	788	55	173	9 199 €	13 142 €
800-1000	Gdańsk	16	769	58	177	9 422 €	13 460 €
	Vigo	44	909	72	219	11 663 €	16 662 €
	Riga	53	969	66	206	10 977 €	15 682 €
	Muuga	17	978	75	232	12 358 €	17 654 €
1000-1200	-	-	-	-	-	-	-
1200-1400	**Reykjavík**	**49**	**1220**	**167**	**519**	**27 616 €**	**39 451 €**

8 ESTIMATED FUEL EU MARITIME COST IMPACT FOR SELECTED ROUTES

The methodology to calculate the fuel consumption for the selected routes is the same as described in section 7.

Table 4 and Table 5 present the estimated energy consumption (MJ) and associated FuelEU Maritime costs per voyage across selected intra-European routes and the Reykjavik route, segmented by vessel size for every 5-year to reflect the tightening of the threshold.

The FuelEU Maritime cost implications are calculated using the FuelEU Maritime regulations (ref. 3) applicable for ships above 5,000 GT transporting cargo or passengers for commercial purposes in the EU/EEA. The FuelEU Maritime, effective from 1 January 2025, establishes stringent well-to-wake GHG emission intensity (gCO2eq/MJ) requirements. The requirements start with a 2% reduction in GHG intensity from 2025 to 2029, relative to the average GHG intensity in 2020 (91.16 gCO_2e/MJ). This reduction target then increases to 6% from 2030 to 2034, to 14.5% from 2035 to 2039, to 31% from 2040 to 2044, to 62% from 2045 to 2049 and ultimately achieve an 80% reduction by 2050.

In this calculation example are we showing a “sail and pay” scenario where it is assumed that MGO is used towards 2050. The WtW GHG intensity for MGO of 90.77 gCO2e/MJ is used in the calculation and based on the factors provided from the regulations (ref. 3). The penalty is set to €2,400 per tonne VLFSO energy equivalent (ref. 4).

8.1 Small feeder (0-999 TEUs)

Table 4 FuelEU Maritime cost per voyage for small feeder vessels (0–999 TEU) across selected intra-European routes to Rotterdam and the Reykjavik route. Results are grouped by sailing distance, with cost projections presented for FuelEU Maritime targets from 2025 to 2050, based on reported data and AIS-based modelling where applicable.

Dist. Category [nm]	Start port to Rotterdam (NLRTM)	Energy consumption (MJ)	FuelEU 2025 (EUR/leg)	FuelEU 2030 (EUR/leg)	FuelEU 2035 (EUR/leg)	FuelEU 2040 (EUR/leg)	FuelEU 2045 (EUR/leg)	FuelEU 20450 (EUR/leg)
0-200	Moerdijk	62 034	57 €	203 €	513 €	1 115 €	2 245 €	2 902 €
	Antwerp	465 665	429 €	1 526 €	3 853 €	8 369 €	16 856 €	21 784 €
200-400	Brake	794 944	733 €	2 604 €	6 577 €	14 288 €	28 775 €	37 188 €
	Hamburg	980 377	904 €	3 212 €	8 112 €	17 620 €	35 487 €	45 862 €
400-600	Kristiansand	1 441 424	1 329 €	4 722 €	11 926 €	25 907 €	52 176 €	67 430 €
	Larvik	1 591 720	1 468 €	5 215 €	13 170 €	28 608 €	57 616 €	74 461 €
	Wexford	2 220 020	2 047 €	7 273 €	18 368 €	39 901 €	80 359 €	103 853 €
	Foynes	2 351 336	2 168 €	7 703 €	19 455 €	42 261 €	85 113 €	109 996 €
600-800	Dublin	2 123 228	1 958 €	6 956 €	17 567 €	38 161 €	76 856 €	99 325 €
	Averøy	1 669 133	1 539 €	5 468 €	13 810 €	29 999 €	60 419 €	78 082 €
	Bilbao	2 357 379	2 174 €	7 723 €	19 505 €	42 369 €	85 332 €	110 279 €
800-1000	Matosinhos	3 031 427	2 796 €	9 931 €	25 082 €	54 484 €	109 730 €	141 811 €
1000-1200	-							
1200-1400	**Reykjavík**	4 583 339	4 227 €	15 015 €	37 922 €	82 377 €	165 906 €	214 410 €

8.2 Feeders (1000-1999 TEUs)

Table 5 FuelEU Maritime cost per voyage for feeder vessels (1000–1999 TEU) across selected intra-European routes to Rotterdam and the Reykjavik route. Results are grouped by sailing distance, with cost projections presented for FuelEU Maritime targets from 2025 to 2050, based on reported data and AIS-based modelling where applicable.

Dist. Category [NM]	Start port to Rotterdam (NLRTM)	Energy consumption (MJ)	FuelEU 2025 (EUR/leg)	FuelEU 2030 (EUR/leg)	FuelEU 2035 (EUR/leg)	FuelEU 2040 (EUR/leg)	FuelEU 2045 (EUR/leg)	FuelEU 20450 (EUR/leg)
0-200	Moerdijk	82 324	76 €	270 €	681 €	1 480 €	2 980 €	3 851 €
	Zeebrugge	462 117	426 €	1 514 €	3 824 €	8 306 €	16 728 €	21 618 €
	Antwerp	507 141	468 €	1 661 €	4 196 €	9 115 €	18 357 €	23 724 €
200-400	Brake	924 697	853 €	3 029 €	7 651 €	16 620 €	33 472 €	43 258 €
	Hamburg	1 106 033	1 020 €	3 623 €	9 151 €	19 879 €	40 036 €	51 740 €
400-600	Cork	2 028 434	1 871 €	6 645 €	16 783 €	36 457 €	73 424 €	94 891 €
600-800	Saint-Nazaire	2 266 113	2 090 €	7 424 €	18 750 €	40 729 €	82 028 €	106 009 €
	Dublin	2 446 518	2 256 €	8 015 €	20 242 €	43 971 €	88 558 €	114 449 €
	Bilbao	2 335 439	2 154 €	7 651 €	19 323 €	41 975 €	84 537 €	109 252 €
800-1000	Gdańsk	2 464 489	2 273 €	8 074 €	20 391 €	44 294 €	89 209 €	115 289 €
	Vigo	3 083 773	2 844 €	10 103 €	25 515 €	55 425 €	111 625 €	144 260 €
	Riga	2 822 441	2 603 €	9 246 €	23 353 €	50 728 €	102 166 €	132 035 €
	Muuga	3 184 249	2 936 €	10 432 €	26 346 €	57 231 €	115 262 €	148 960 €
1000-1200	-							
1200-1400	**Reykjavík**	7 129 752	6 575 €	23 357 €	58 991 €	128 143 €	258 080 €	333 532 €

9 DISCUSSION

The analysis of voyage distances between Reykjavik and Rotterdam demonstrates that operational shipping routes consistently exceed the theoretical great-circle distance due to environmental, meteorological, and navigational constraints. While the baseline distance is 1096.5 nautical miles, both MRV report and AIS datasets confirm that actual sailing distances are notably longer, with average values exceeding the minimum route by approximately 4–8%. Harsher weather conditions further amplify this discrepancy, as vessels frequently deviate from optimal routes, in some cases extending voyages by more than 29%. The consistency between MRV-reported and AIS-derived results strengthens the reliability of these findings, despite differences in data filtering and sample size. Similar patterns observed for other North Atlantic routes reinforce the conclusion that voyages to Iceland are particularly sensitive to harsh weather conditions, leading to systematic route extensions.

Icelandic shipping routes are heavily dependent on transporting fresh and time-sensitive goods. Unlike many continental European countries, Iceland does not have alternative land-based transport options such as rail. This affects operational requirements and the need to maintain reliable schedules. These longer distances, combined with tight liner schedules, contribute to higher operational speeds compared to typical European trades, which in turn increases fuel consumption. When coupled with the estimated 8.89% rise in energy demand due to adverse wind and wave conditions, the results clearly indicate that Icelandic trade routes impose significantly higher operational and environmental burdens than standard intra-European shipping routes.

The distribution of voyages by sailing distance shows a clear difference between Icelandic and intra-European trades. For both small feeders and feeders, most intra-European voyages are concentrated at shorter distances, primarily below 800 nautical miles. The highest frequency of voyages is observed in the 400–800 nm range for Small feeders (56 %) and between 0–400 nm for Feeders (50% of the voyages), reflecting dense regional trade within continental Europe. Over 80% of the voyages fall below 800 nm and 1,000 nm for the small feeder and feeder samples, respectively.

In contrast, the Reykjavik–Rotterdam route appears as an outlier, with significantly longer sailing distances in the range of 1,200–1,400 nm. The limited number of voyages in the 1,000–1,200 nm category further reinforces that Icelandic routes represent outliers within the observed trade patterns. For voyages above 1,400 nm, there were no recurring liner trades; instead, only one-off or very limited voyage occurrences were identified, and these are therefore not considered representative of a defined trade route.

This indicates that Icelandic trades operate under a different distance profile, resulting in higher transport work and associated emissions per voyage compared to typical intra-European routes.

Further, the analysis shows a clear increase in fuel consumption, CO_2 emissions and EU ETS cost per voyage with sailing distance. Short intra-European routes have relatively low per-voyage costs, while longer routes move into significantly higher cost ranges. The Reykjavik–Rotterdam route represents the upper end of this range. The average EU ETS cost per voyage is at least 50% higher than that observed within the distance ranges where over 80% of intra-European traffic is concentrated[4], and even higher when compared to shorter-distance voyages. This highlights a higher cost burden for Icelandic trade compared to typical intra-European operations.

Section 8 further shows that FuelEU Maritime costs increase sharply with sailing distance and over time due to tightening GHG intensity targets. The Reykjavik route remains at the upper end of the cost range, reinforcing a structural and widening cost disadvantage for Icelandic trades compared to intra-European routes.

[4] The comparison is based on identifying the distance ranges covering over 80% of voyages for the small feeder (<800 nm) and feeder (<1,000 nm) samples. The highest average EU ETS cost per voyage within these ranges was selected as a benchmark and compared to the corresponding cost for the Reykjavik–Rotterdam route. The percentage difference is calculated based on these representative upper-bound values within the main intra-European trade distribution.

10 CONCLUSION

This study shows that small feeder and feeder container vessels operating on the Icelandic routes analysed have higher fuel consumption, CO_2 emissions and compliance costs per voyage than comparable vessels operating on intra-European routes.

A primary driver of these differences is the voyage distance. The Reykjavik–Rotterdam route is around 1,200 nm, while more than 80% of the intra-European feeder voyages in the sample occur below 800–1,000 nm. The Icelandic route is therefore located at the upper end of the observed distance distribution. In addition, actual sailed distances between Reykjavik and Rotterdam are on average approximately 4–8% above the minimum recorded route, indicating that vessels regularly deviate from the shortest route due to weather-related routing and the need to maintain schedule, which contributes to increased fuel consumption per voyage.

The analysis also indicates higher energy demand associated with wind and wave conditions on the Icelandic route segment. The previous DNV study, which assessed complete trading routes, found that feeder vessels operating to Iceland required approximately 7–8% more propulsive energy due to wind and waves compared to similar vessels trading within Europe or globally. In the present study, which isolates direct port-to-port voyages, the average increase in energy consumption due to wind and waves is estimated at approximately 17% for Reykjavik–Rotterdam, compared with approximately 8% for intra-European routes in the selected ECA regions.

A further observed difference is average operating speed. The vessels on the Icelandic routes analysed operate at an average speed of 14.1 knots, compared with 12.8 knots for the intra-European reference vessels. The higher average speed is associated with longer voyage distances and route deviations, requiring vessels to increase speed to maintain schedule reliability.

Taken together, the results show that the Icelandic routes analysed differ from the intra-European reference routes in several measurable respects: they are longer, the actual sailed distance is higher relative to the minimum route, the estimated weather-related energy demand is higher, and the average operating speed is higher. These factors contribute to higher fuel consumption and CO_2 emissions per voyage.

For the routes analysed, this results in materially higher regulatory costs. The average EU ETS cost per voyage is at least 50% higher than for routes within the distance range covering the majority of intra-European traffic, and the FuelEU Maritime results show the same overall pattern. Overall, the analysis indicates that vessels transporting goods on the Icelandic routes analysed face higher compliance costs per voyage than comparable vessels operating on typical intra-European routes, reflecting the distance profile and operating conditions identified in this study.

11 REFERENCES

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