# WP 2 Trends and samples

Jari Claassen & Marlea Wagelmans – Rijkswaterstaat – The Netherlands

imaros$_2$

# WP 2 Trends and samples

| Work Package 2: Trends and Samples | | | |
|---|---|---|---|
| **Duration:** | M1- M18 | **Lead Beneficiary:** | **RWS** |

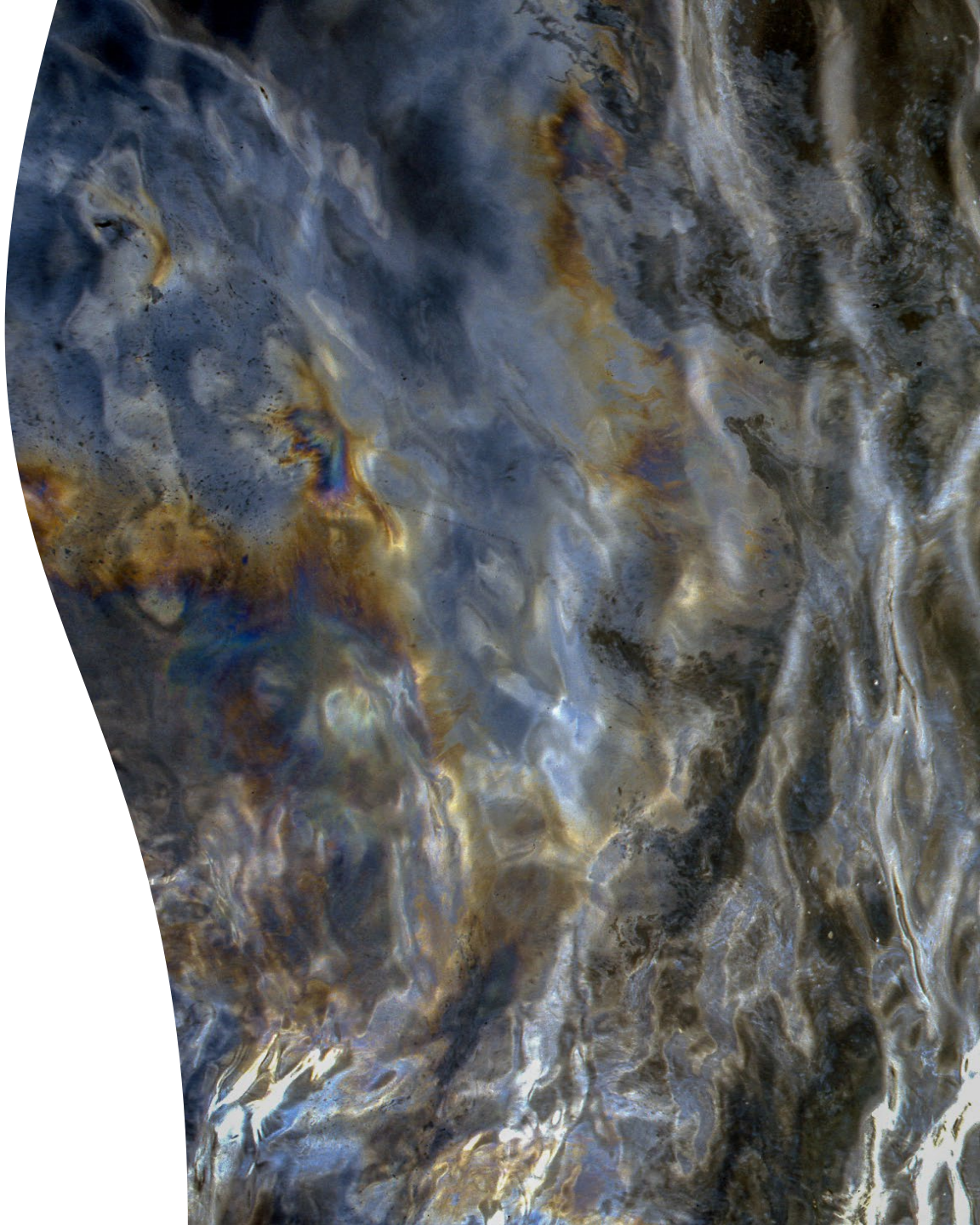
**Objectives**

- The objective of WP2 is to improve our understanding of the environmental risk from accidental spills of LSFO in Europe. The results from the IMAROS project underlined that the fuel market has been subject to substantial changes in the past two years. However, the picture is diverse, due to market trends and regulations. Updated information from ports, authorities and industry will be collected and form the basis for the selection of representative samples, based on updated information on fuels frequently encountered in European waters. Origin of the samples may or may not be from Europe.

**Activities and division of work (WP description)**

| Task No (continuous numbering linked to WP) | Task Name | Description of the task and expected result | Participants | | In-kind Contributions and Subcontracting (Yes/No and which) |
|---|---|---|---|---|---|
| | | | Name | Role (COO, BEN, AE, AP, OTHER) | |
| T2.1 | Data collection, trends and representativeness | Statistics and interviews with producers and suppliers and port authorities will form the basis for the selection of representative samples. The approach and methodology will be decided by the CPT based on the discussion in workshop 1. | **RWS**, All partners | BEN, COO | No |
| T2.2 | Collect small samples | Collect and distribute samples for WP3 | **RWS**, All partners | BEN, COO | No |
| T2.3 | Collect large samples | Collect and distribute samples for WP3, WP4 and WP5 | **RWS**, All partners | BEN, COO | No |

# Bunker fuel trends analysis



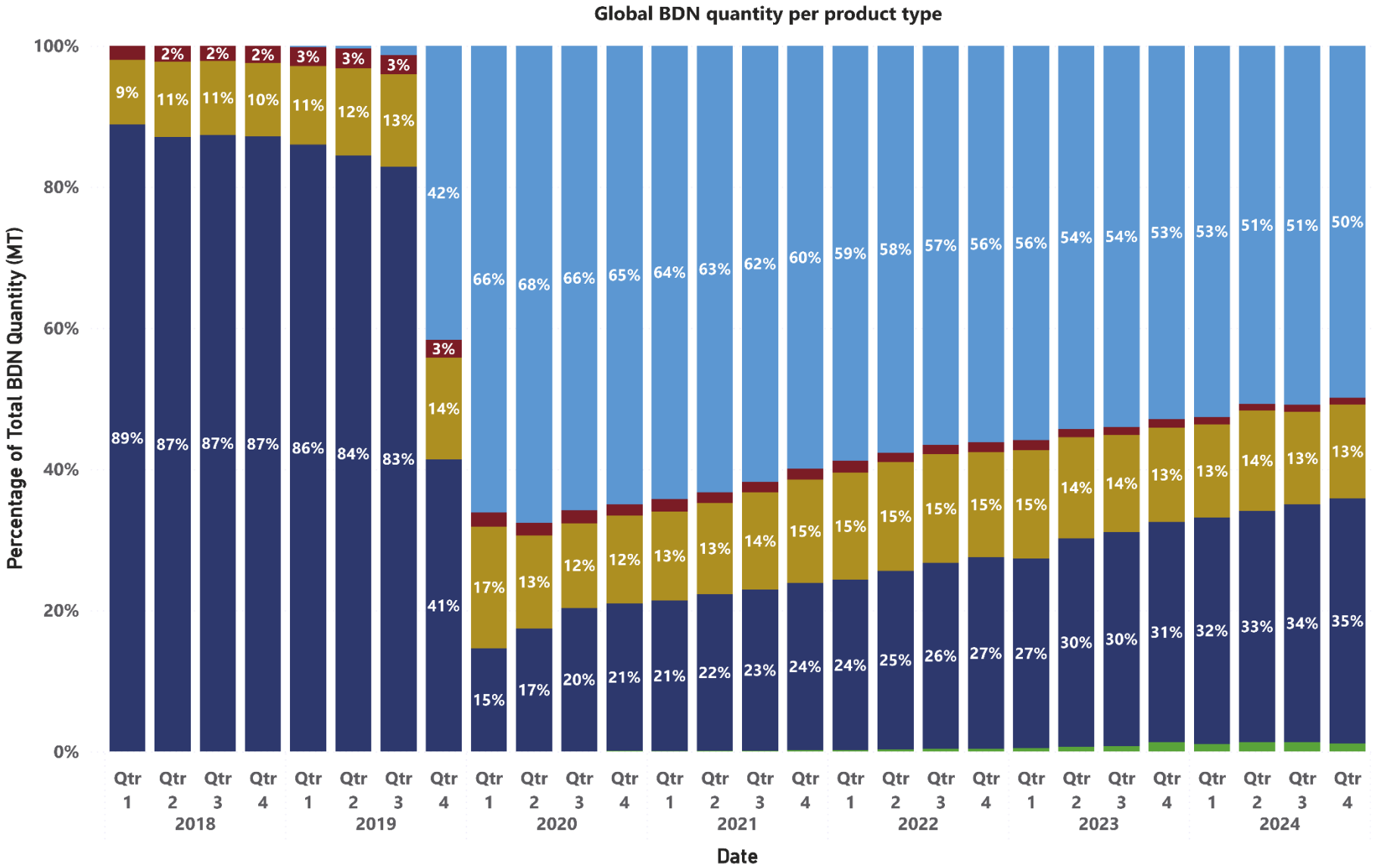
Data from Veritas Petroleum Services (VPS)

Data origin : Veritas fuel quality testing (ISO8217)

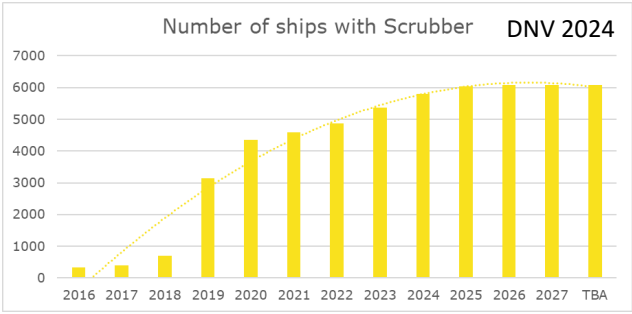
Time period : 2018 – 2024 (781.656 bunker reports)

- BIO - 1.854
- MGO - 324.014
- HSFO - 195.635
- VLSFO - 239.871
- ULSFO - 20.282

# Bunker delivery Global

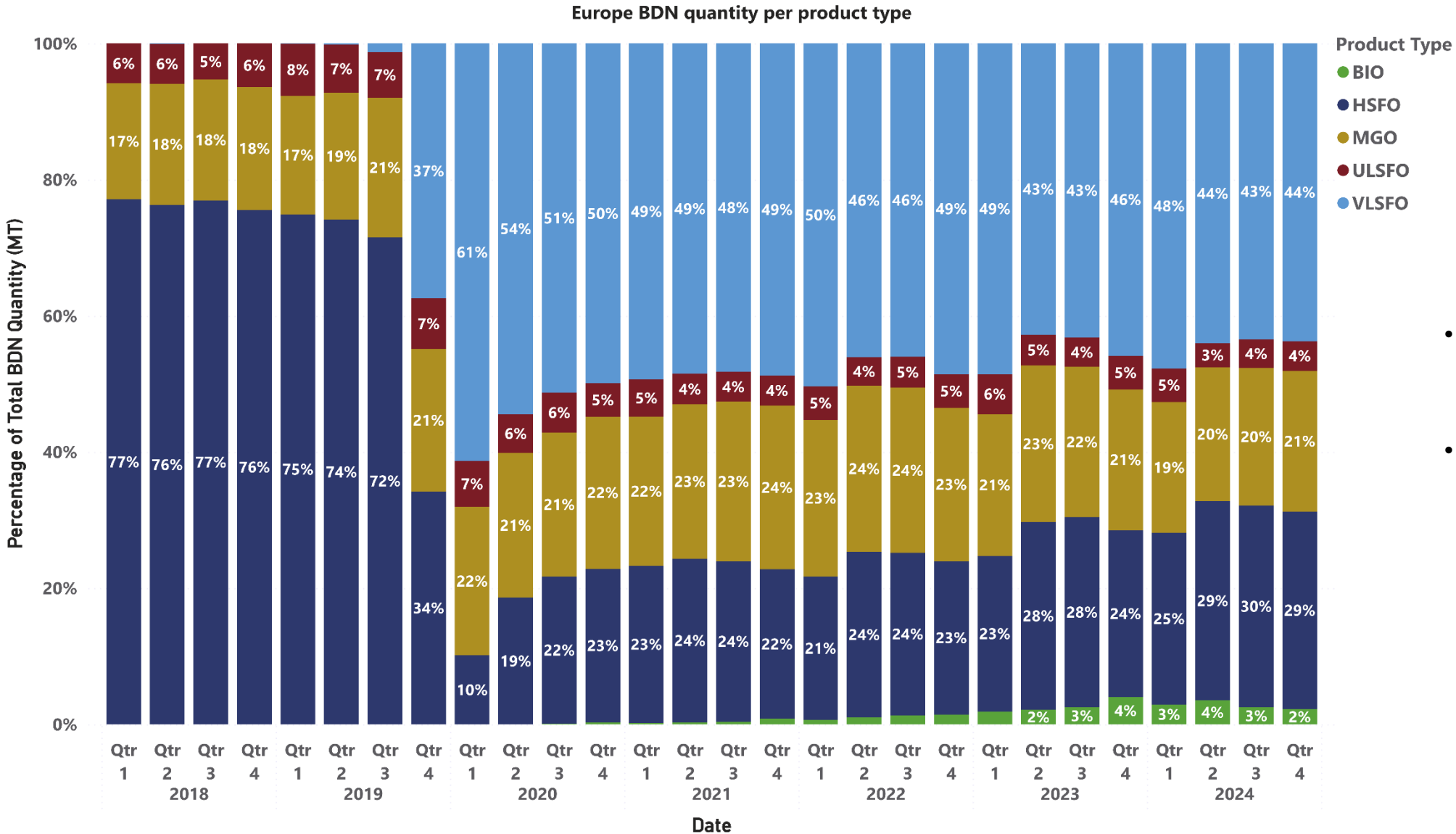



- 2020 IMO Sulphur cap
  - increase of HSFO
  - decrease of LSFO




- MGO stable ~14%
- Bio fuels since 2022

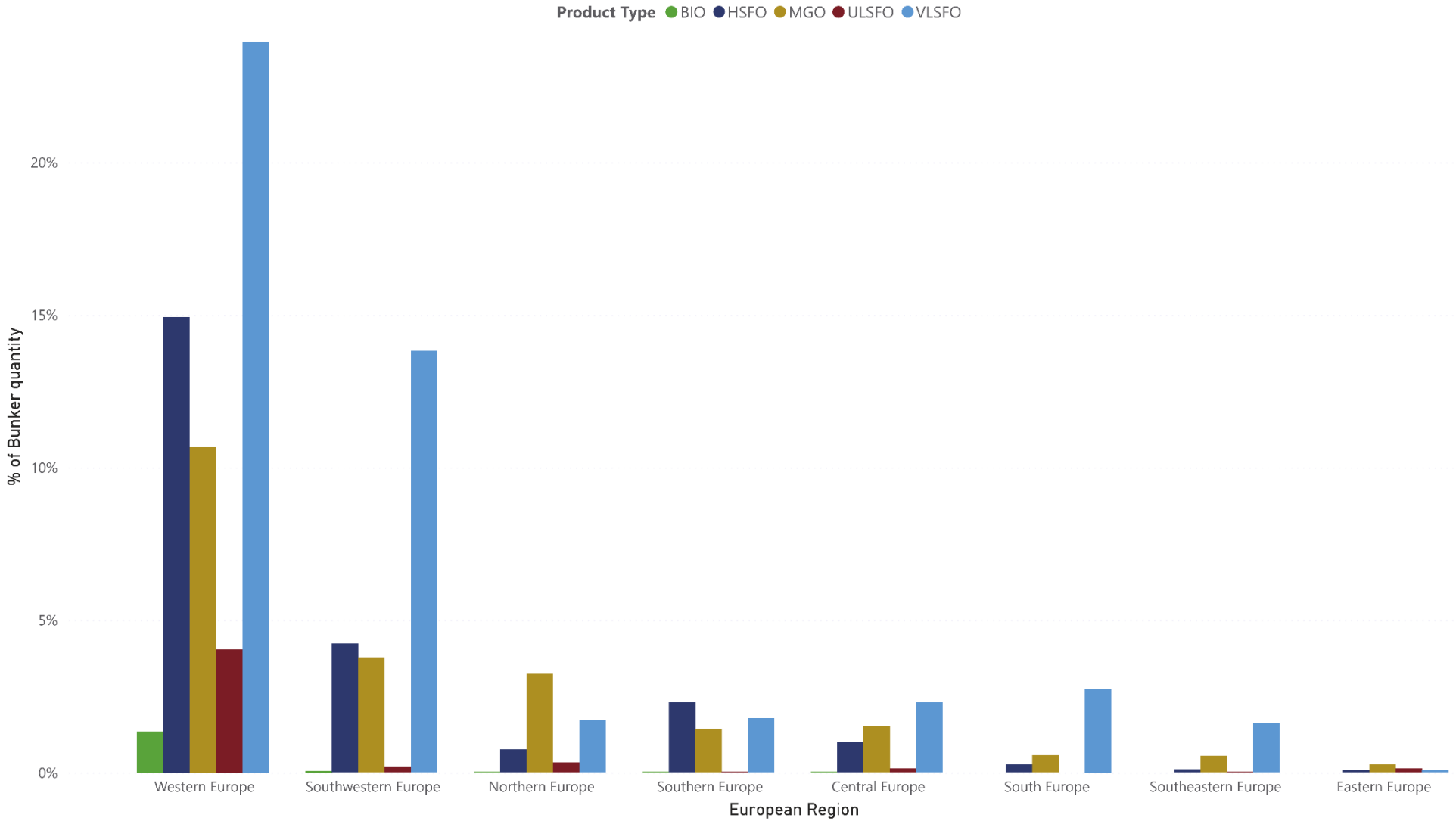
# Bunker delivery Europe




- 2020 IMO Sulphur cap
  - More or less stable fuel market
- MGO sales stable ~22%

# Sub-division Europe

Percentage of Bunker quantities per fuel type between 2020-2024

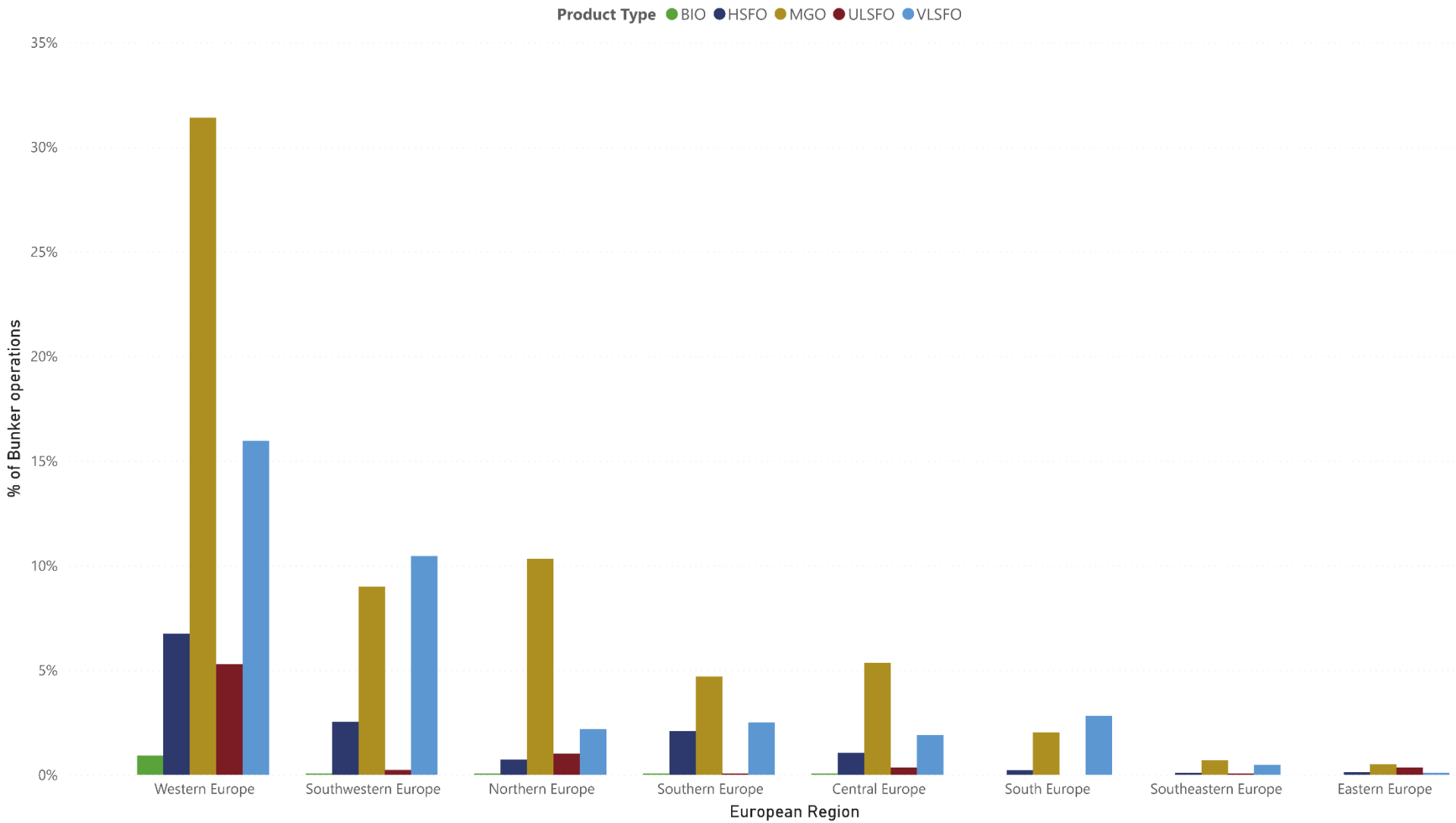


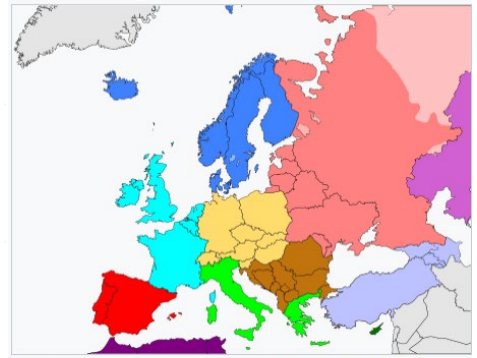

Subregions of Europe based on *The World Factbook*:

- Central Europe
- Eastern Europe
- Northern Europe
- South-eastern Europe
- Southern Europe
- South-western Europe
- Western Europe

# Sub-division Europe

Percentage of Bunker operations per fuel type between 2020-2024

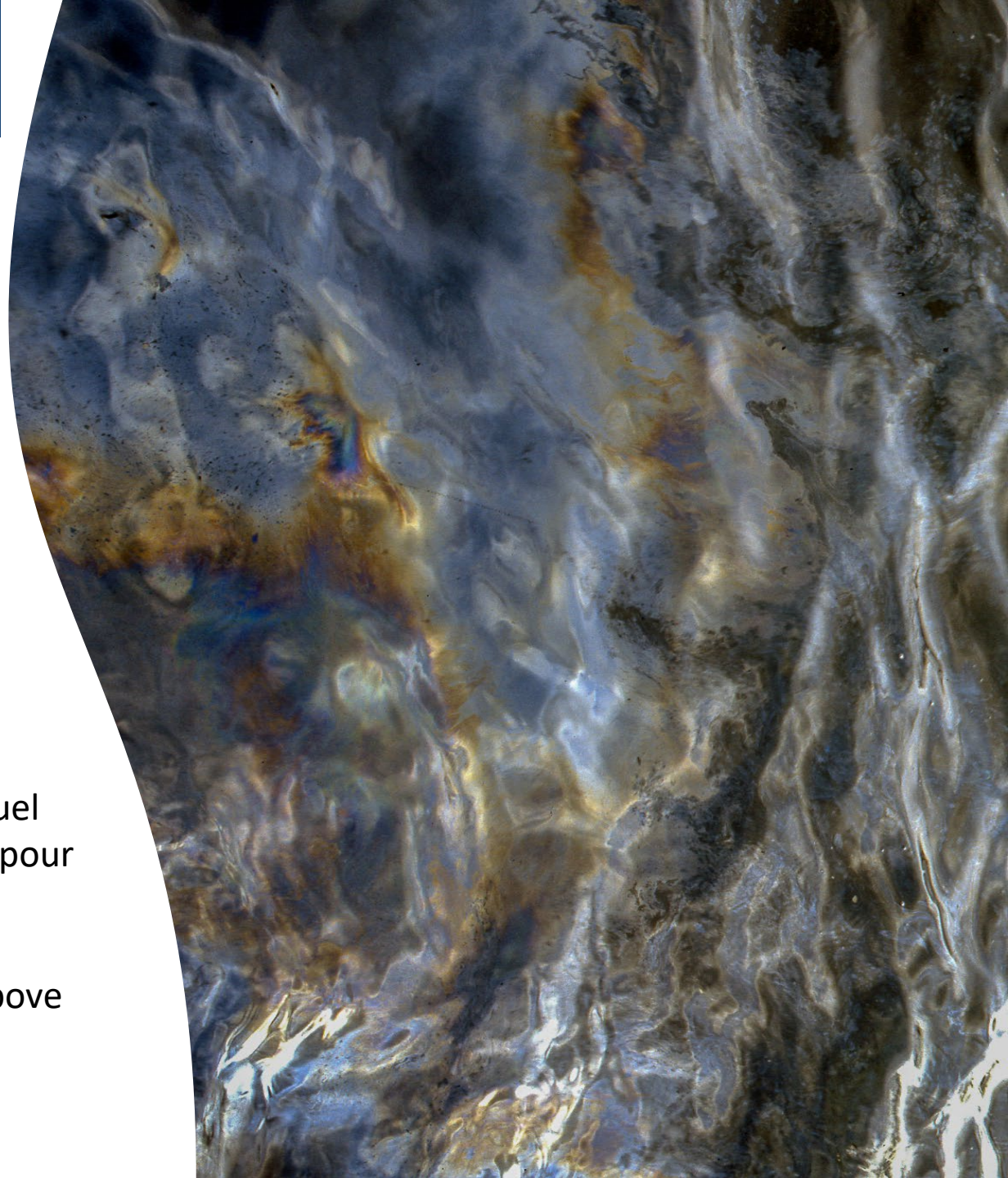


Subregions of Europe based on *The World Factbook*:

- Central Europe
- Eastern Europe
- Northern Europe
- South-eastern Europe
- Southern Europe
- South-western Europe
- Western Europe

# Fuel properties distribution



**Data : 2020-2024**

**Density, Viscosity and Pour Point**

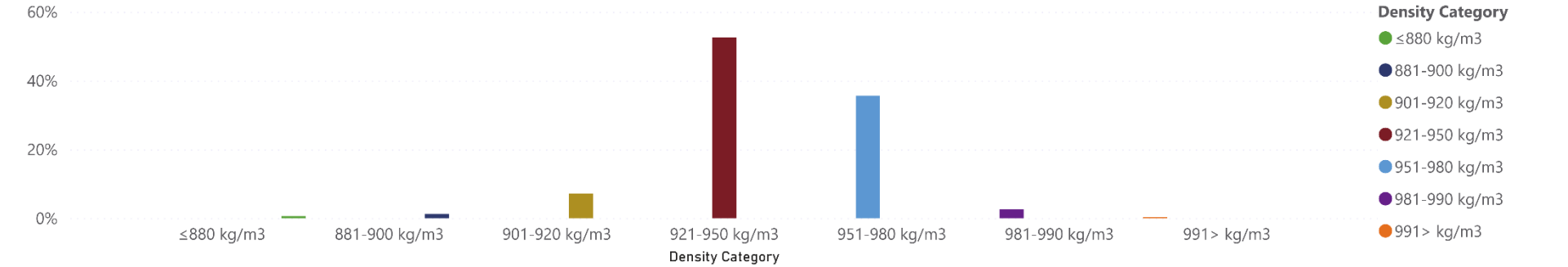
- **(HSFO)**
- **VLSFO**
- **ULSFO**

Summary
The analysis of HSFO over the 2020–2024 period reveals a fuel type with persistently high density, extremely viscosity, and pour points below 25 °C.

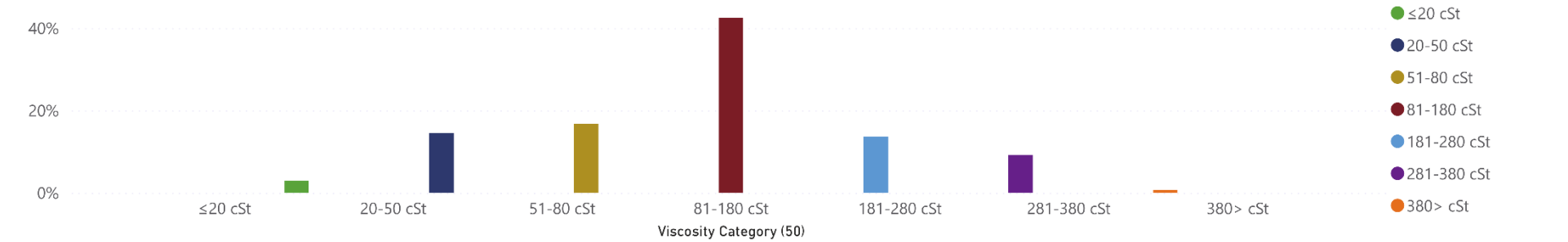
Any unknown HFSO spill would most likely have a density above 951 kg/m3 and a viscosity of 280cSt or higher.

# VLSFO

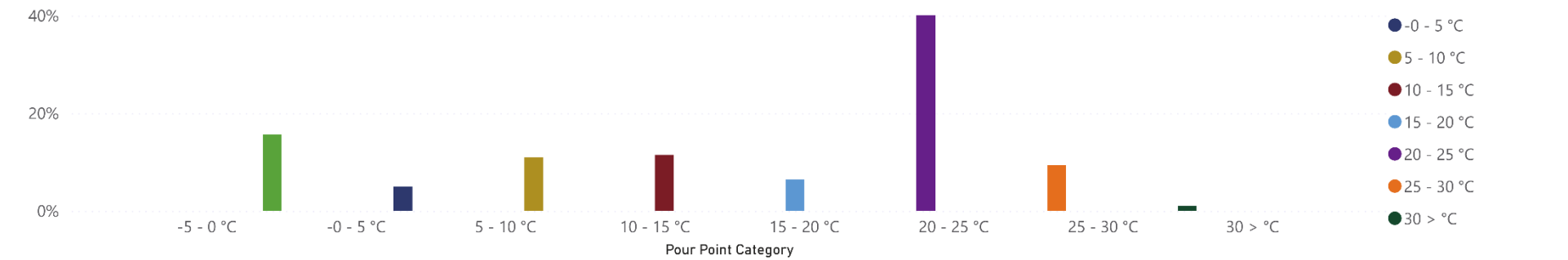
## Density distribution




## Viscosity distribution

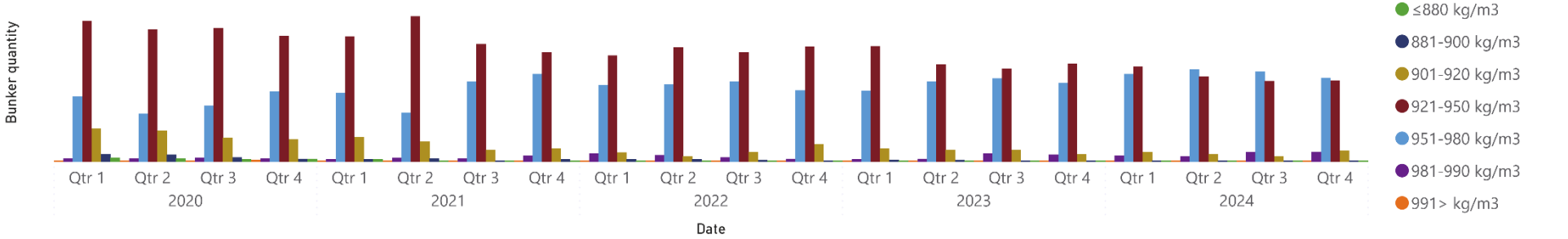



## Pour point distribution

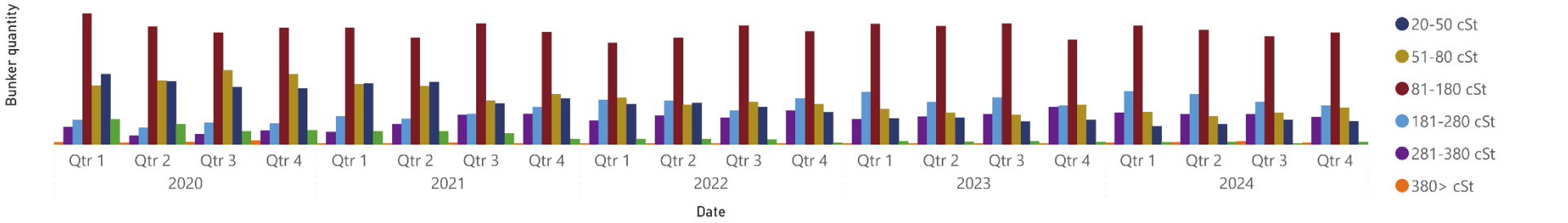


# VLSFO

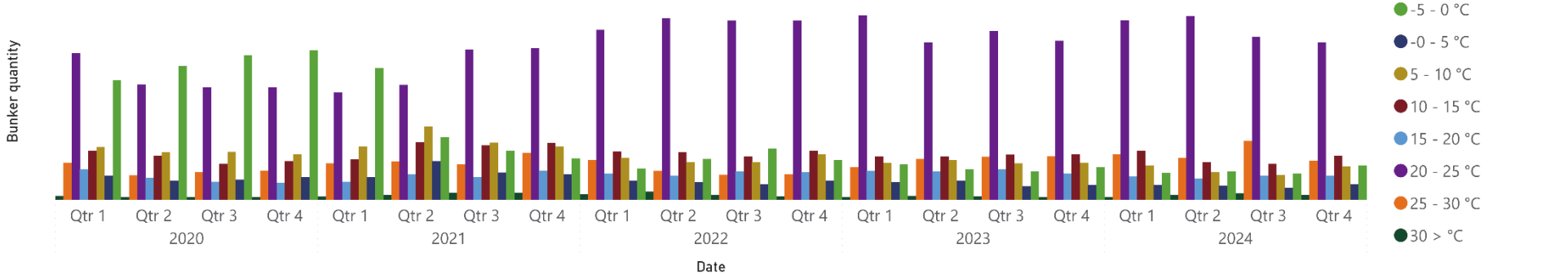
Density distribution




Viscosity distribution




Pour point distribution



# VLSFO

## VLSFO

Density category 921-950 kg/m3 (no. reports 20662)

| Viscosity Category (50) | -5 - 0 °C | -0 - 5 °C | 5 - 10 °C | 10 - 15 °C | 15 - 20 °C | 20 - 25 °C | 25 - 30 °C | 30 > °C |
|---|---|---|---|---|---|---|---|---|
| ≤20 cSt | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 20-50 cSt | 2% | 0% | 2% | 1% | 0% | 1% | 1% | 0% |
| 51-80 cSt | 2% | 1% | 2% | 2% | 1% | 3% | 2% | 0% |
| 81-180 cSt | 3% | 2% | 4% | 6% | 4% | 14% | 8% | 1% |
| 181-280 cSt | 1% | 1% | 1% | 2% | 2% | 9% | 4% | 1% |
| 281-380 cSt | 0% | 1% | 1% | 2% | 2% | 7% | 3% | 0% |
| 380> cSt | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

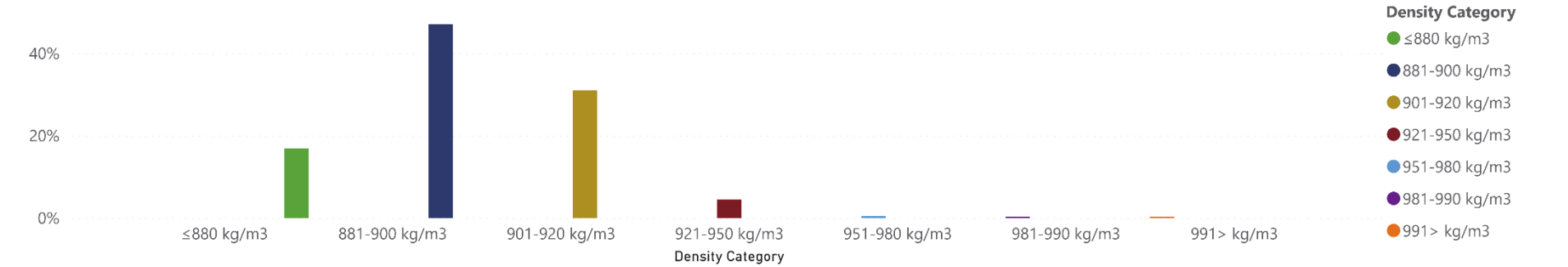
## VLSFO

Density category 951-980 kg/m3 (no. reports 26951)

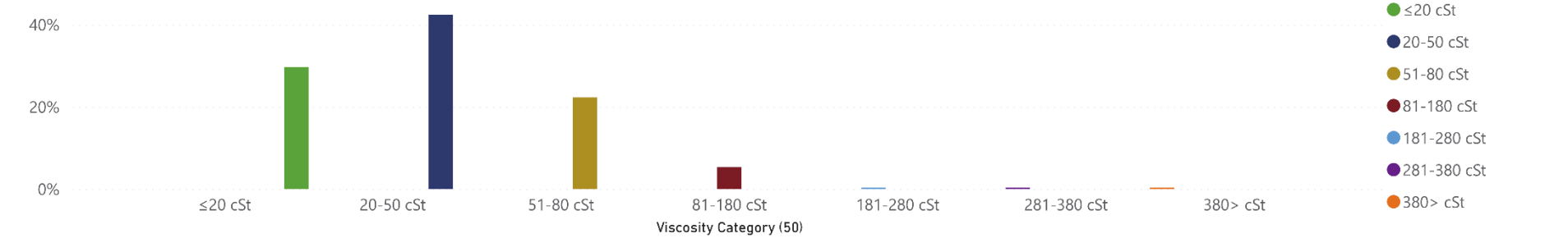
| Viscosity Category (50) | -5 - 0 °C | -0 - 5 °C | 5 - 10 °C | 10 - 15 °C | 15 - 20 °C | 20 - 25 °C | 25 - 30 °C | 30 > °C |
|---|---|---|---|---|---|---|---|---|
| | 0% | | | 0% | | 0% | | |
| ≤20 cSt | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 20-50 cSt | 1% | 0% | 1% | 1% | 1% | 1% | 0% | 0% |
| 51-80 cSt | 3% | 1% | 3% | 2% | 1% | 1% | 1% | 0% |
| 81-180 cSt | 4% | 3% | 5% | 4% | 1% | 10% | 1% | 0% |
| 181-280 cSt | 1% | 1% | 3% | 2% | 1% | 11% | 1% | 0% |
| 281-380 cSt | 2% | 3% | 4% | 3% | 1% | 16% | 1% | 0% |
| 380> cSt | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% |

# ULSFO

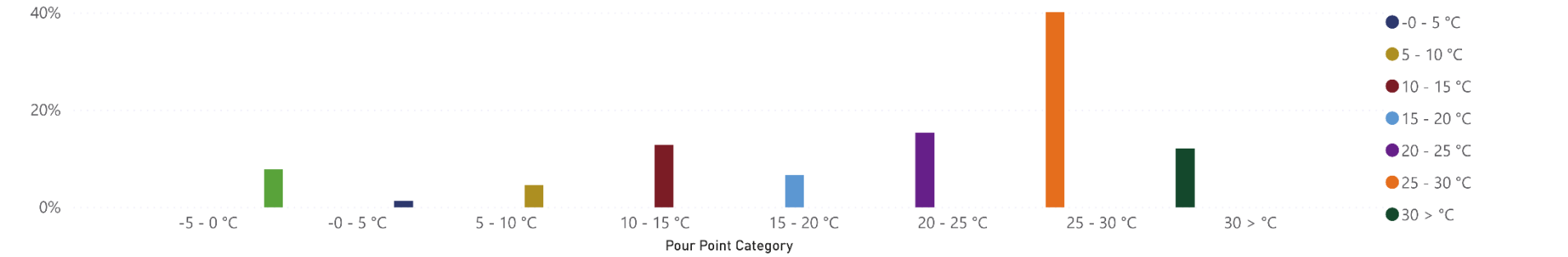
Density distribution




Viscosity distribution



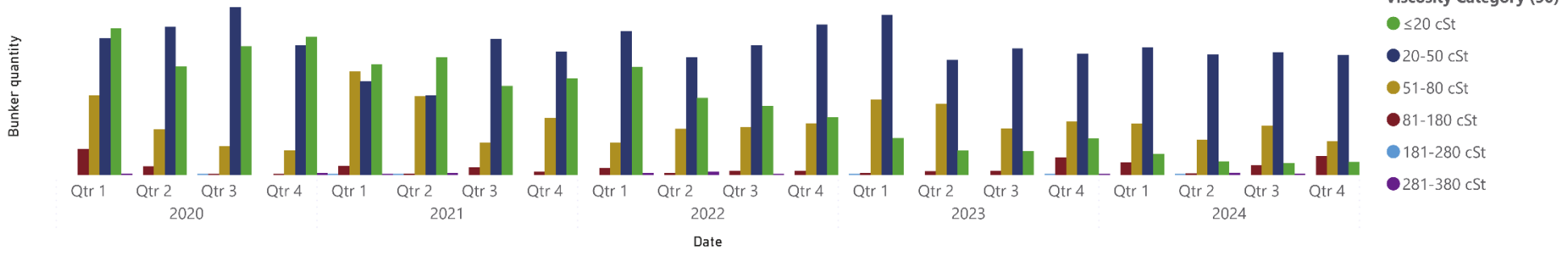

Pour point distribution



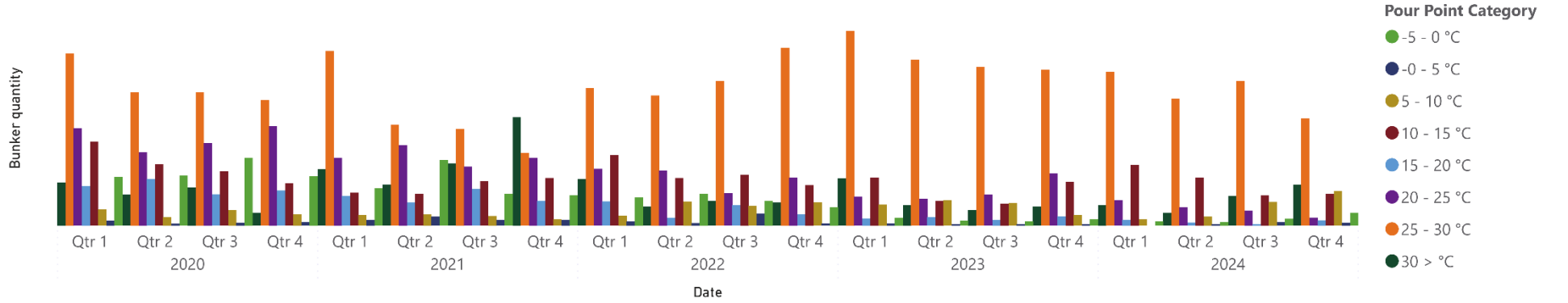
# ULSFO

Density distribution


Viscosity distribution




Pour point distribution



# ULSFO

## ULSFO

Density category 881-900 kg/m3 (no. reports 6397)

| Viscosity Category (50) | -5 - 0 °C | -0 - 5 °C | 5 - 10 °C | 10 - 15 °C | 15 - 20 °C | 20 - 25 °C | 25 - 30 °C | 30 > °C |
|---|---|---|---|---|---|---|---|---|
| ≤20 cSt | 0% | 0% | 1% | 1% | 1% | 2% | 1% | 0% |
| 20-50 cSt | 0% | 0% | 1% | 2% | 1% | 6% | 37% | 6% |
| 51-80 cSt | | | | 0% | 0% | 2% | 27% | 8% |
| 81-180 cSt | | | | | | | 2% | 1% |
| 181-280 cSt | | | | | | | | 0% |

## ULSFO

Density category 901-920 kg/m3 (no. reports 5614)

| Viscosity Category (50) | -5 - 0 °C | -0 - 5 °C | 5 - 10 °C | 10 - 15 °C | 15 - 20 °C | 20 - 25 °C | 25 - 30 °C | 30 > °C |
|---|---|---|---|---|---|---|---|---|
| ≤20 cSt | 1% | 0% | 0% | 1% | 0% | 1% | 2% | 1% |
| 20-50 cSt | 0% | 0% | 9% | 32% | 10% | 6% | 6% | 2% |
| 51-80 cSt | 0% | 0% | | 0% | 0% | 1% | 11% | 8% |
| 81-180 cSt | | | 0% | | 0% | 0% | 4% | 5% |

## ULSFO

Density category <880 kg/m3 (no. reports 2421)

| Viscosity Category (50) | -5 - 0 °C | -0 - 5 °C | 5 - 10 °C | 10 - 15 °C | 15 - 20 °C | 20 - 25 °C | 25 - 30 °C | 30 > °C |
|---|---|---|---|---|---|---|---|---|
| | | 0% | | 0% | | | | |
| ≤20 cSt | 7% | 2% | 6% | 6% | 5% | 18% | 22% | 7% |
| 20-50 cSt | 0% | | 0% | 1% | 1% | 3% | 6% | 13% |
| 51-80 cSt | 1% | 1% | 0% | 0% | 0% | 0% | | |
| 81-180 cSt | | | 0% | 0% | 0% | 0% | | 0% |

# Samples

Based on the above analysis of HSFO, VLSFO and ULSFO , representative large samples for this project would have the following characteristics.

| Sample | Fuel Type | Density (kg/m³) | Viscosity (cSt @50°C) | Pour Point (°C) | Trend Context |
|---|---|---|---|---|---|
| 1 | VLSFO | 921–950 | 81–180 | 15–20 | Stable 2020–2022 baseline |
| 2 | VLSFO | 951–980 | 181–280 | 20–25 | Post-2022 upward trend |
| 3 | ULSFO | 881–900 | 20–50 | 20–25 | Consistent across all quarters |

# Samples

| Samples | Nature | Origin |
|---|---|---|
| **IM-20** | VLSFO | Stena, Sweden |
| **IM-21** | ULSFO | Stena, Sweden |
| **IM-22** | VLSFO | BunkerOne, Sweden |
| **IM-23** | ULSFO | BunkerOne, Sweden |
| **IM-24** | VLSFO | Preem AB, Finland |
| **IM-25** | VLSFO | Neste, Finland |
| **IM-27** | VLSFO | Bunker One, Denmark |
| **IM-28** | VLSFO | Zeta Energy, Malta |
| **IM-29** | ULSFO | Stena Oil, Sweden |
| **IM-30** | VLSFO | FincoEnergies, Netherlands |
| **IM-31** | VLSFO | FincoEnergies, Netherlands |
| **IM-32** | ULSFO | FincoEnergies, Netherlands |
| **IM-33** | VLSFO | FincoEnergies, Netherlands |
| **IM-34** | ULSFO | FincoEnergies, Netherlands |
| **IM-36** | VLSFO | Bunker from Cargo ship, Netherlands |
| **IM-37** | VLSFO | Bureau Veritas, Malta |
| **IM-38** | VLSFO | Bureau Veritas, Malta |
| **IM-39** | VLSFO | Peninsula Antwerp, Belgium |
| **IM-40** | VLSFO | ExxonMobil, AmSpec, Netherlands |

# VLSFO

## VLSFO

Density category 921-950 kg/m3 (no. reports 20662)

| Viscosity Category (50) | -5 - 0 °C | -0 - 5 °C | 5 - 10 °C | 10 - 15 °C | 15 - 20 °C | 20 - 25 °C | 25 - 30 °C | 30 > °C |
|---|---|---|---|---|---|---|---|---|
| ≤20 cSt | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 20-50 cSt | 2% | 0% | 2% | 1% | 0% | 1% | 1% | 0% |
| 51-80 cSt | 2% | 1% | 2% | 2% | 1% | 3% | 2% | 0% |
| 81-180 cSt | 3% | 2% | 4% | 6% | 4% | 14% | 8% | 1% |
| 181-280 cSt | 1% | 1% | 1% | 2% | 2% | 9% | 4% | 1% |
| 281-380 cSt | 0% | 1% | 1% | 2% | 2% | 7% | 3% | 0% |
| 380> cSt | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

## VLSFO

Density category 951-980 kg/m3 (no. reports 26951)

| Viscosity Category (50) | -5 - 0 °C | -0 - 5 °C | 5 - 10 °C | 10 - 15 °C | 15 - 20 °C | 20 - 25 °C | 25 - 30 °C | 30 > °C |
|---|---|---|---|---|---|---|---|---|
| | 0% | | | 0% | | 0% | | |
| ≤20 cSt | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 20-50 cSt | 1% | 0% | 1% | 1% | 1% | 1% | 0% | 0% |
| 51-80 cSt | 3% | 1% | 3% | 2% | 1% | 1 | 1% | 0% |
| 81-180 cSt | 4% | 3% | 5% | 4% | 1% | 1 | 1% | 0% |
| 181-280 cSt | 1% | 1% | 3% | 2% | 1% | 11% | 1% | 0% |
| 281-380 cSt | 2% | 3% | 4% | 3% | 1% | 16% | 1% | 0% |
| 380> cSt | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% |

# ULSFO

## ULSFO

Density category 881-900 kg/m3 (no. reports 6397)

| Viscosity Category (50) | -5 - 0 °C | -0 - 5 °C | 5 - 10 °C | 10 - 15 °C | 15 - 20 °C | 20 - 25 °C | 25 - 30 °C | 30 > °C |
|---|---|---|---|---|---|---|---|---|
| ≤20 cSt | 0% | 0% | 1% | 1% | | 2% | 1% | 0% |
| 20-50 cSt | 0% | 0% | 1% | 2% | | 6% | 37% | % |
| 51-80 cSt | | | | 0% | 0% | 2% | 27% | 8% |
| 81-180 cSt | | | | | | | 2% | 1% |
| 181-280 cSt | | | | | | | | 0% |

## ULSFO

Density category 901-920 kg/m3 (no. reports 5614)

| Viscosity Category (50) | -5 - 0 °C | -0 - 5 °C | 5 - 10 °C | 10 - 15 °C | 15 - 20 °C | 20 - 25 °C | 25 - 30 °C | 30 > °C |
|---|---|---|---|---|---|---|---|---|
| ≤20 cSt | 1% | 0% | 0% | 1% | 0% | 1% | 2% | 1% |
| 20-50 cSt | 0% | 0% | 9% | 32% | 10% | 6% | 6% | 2% |
| 51-80 cSt | 0% | 0% | | 0% | 0% | 1% | 11% | 8% |
| 81-180 cSt | | | 0% | | 0% | 0% | 4% | 5% |

## ULSFO

Density category <880 kg/m3 (no. reports 2421)

| Viscosity Category (50) | -5 - 0 °C | -0 - 5 °C | 5 - 10 °C | 10 - 15 °C | 15 - 20 °C | 20 - 25 °C | 25 - 30 °C | 30 > °C |
|---|---|---|---|---|---|---|---|---|
| | | 0% | | 0% | | | | |
| ≤20 cSt | 7% | 2% | 6% | 6% | 5% | 18% | 22% | 7% |
| 20-50 cSt | 0% | | 0% | 1% | 1% | 3% | 6% | 13% |
| 51-80 cSt | 1% | 1% | 0% | 0% | 0% | 0% | | |
| 81-180 cSt | | | 0% | 0% | 0% | 0% | | 0% |


# Thank you

Questions

Jari Claassen – jari.claassen@rws.nl

Marlea Wagelmans – marlea.Wagelmans@rws.nl