



ENVIRONMENTAL REPORT

2016





ENVIRONMENTAL POLICY

Together with operating safety, the averting of risks and dangers, economic efficiency, reliability and customer satisfaction, protecting the environment is also one of the main priorities of our Shipping Company's corporate strategy.

Our company has introduced an Environmental Protection Management System (EMS) in accordance with ISO14001 to implement its environmental protection strategy. The EMS forms an integral part of our Safety Management Systems (SMS), which is based on the following provisions and regulations

- ISM Code (International Safety Management Code),
- ISPS Code (International Ship & Port Facility Security Code) und
- ISO 9001 (Quality Management System).

as well as on many years of experience.

We guarantee that:

- our EMS is appropriate and supports our Shipping Company's strategy,
- our EMS is subjected to regular improvement and is constantly in accord with the relevant legislation and regulations in force,
- our environmental objectives are well-defined and their adaptation are planned as well as monitored,
- our environmental objectives are regularly and specifically reviewed with regard to their suitability and appropriateness,
- our environmental objectives are conveyed to all our staff both at sea and on shore,
- there are measures applying to emergency precautions and the averting of risks and dangers,
- the environmental policy and environmental report are accessible in the public domain.

Our EMS documentation sets out procedures for:

- the safe, environmentally friendly operation of our ships,
- environmentally friendly working at our on-shore facilities, as well as
- the avoidance of environmental damage, especially to the marine environment.

All the staff members of our company know how important their individual performance is within the EMS. They are obliged to familiarise themselves with the system documents relevant to their areas of responsibility, implement the contents of such documentation in their daily work and cooperate creatively in the monitoring and continual improvement of the system.

The Masters of our vessels and the Heads of Department on shore have co-responsibility for the planning, monitoring, correction, improvement, maintenance and updating of our EMS. They have the duty and the authority to identify relevant problems, obtain information from staff in relation to deviations or improvements, as well as propose and implement measures and monitor the effectiveness of the same.

Our EMS is reviewed annually by way of internal management audits and evaluated with regard to its effectiveness and possible improvement.

Our EMS is binding on the company's operations in Rostock, Hamburg and Bremerhaven, as well as for all vessels under our management.

Rostock, 01.02.2016

N.H. Schües
Speaker of the Board of Directors



As the first German shipping company we were certified with the Environment Management System according to DIN EN ISO 14001 in 1997.

DNV-GL

MANAGEMENT SYSTEM CERTIFICATE

Certificate No:
203684-2016-AE-NOR-NA

Initial certification date:
15 May 2014

Valid:
06 July 2016 - 22 May 2021

This is to certify that the management system of

Reederei F. Laeisz GmbH

Lange Strasse 1a, 18055 Rostock, Germany

and the Branch Office as mentioned in the appendix accompanying this certificate

have been found to conform to the Environmental Management System standard:
ISO 14001:2015

This certificate is also valid for all ships that hold a valid Safety Management Certificate issued to the shipping company.

This certificate is valid for the following scope:

**Ship Management including technical management, crewing and operation.
Commercial Management including marketing, chartering and operation.
Administration.**

Place and date:
Høvik, 14 July 2017



For the issuing office:
DNV GL – Business Assurance
Veritasveien 1, 1363 Høvik, Norway

Jøran Laukholm
Management Representative

Lack of fulfillment of conditions as set out in the Certification Agreement may render this Certificate invalid.
ACCREDITED UNIT: DNV GL Business Assurance Norway AS, Veritasveien 1, 1363 Høvik, Norway. TEL: +47 67 57 99 00, <http://assurance.dnvgl.com>



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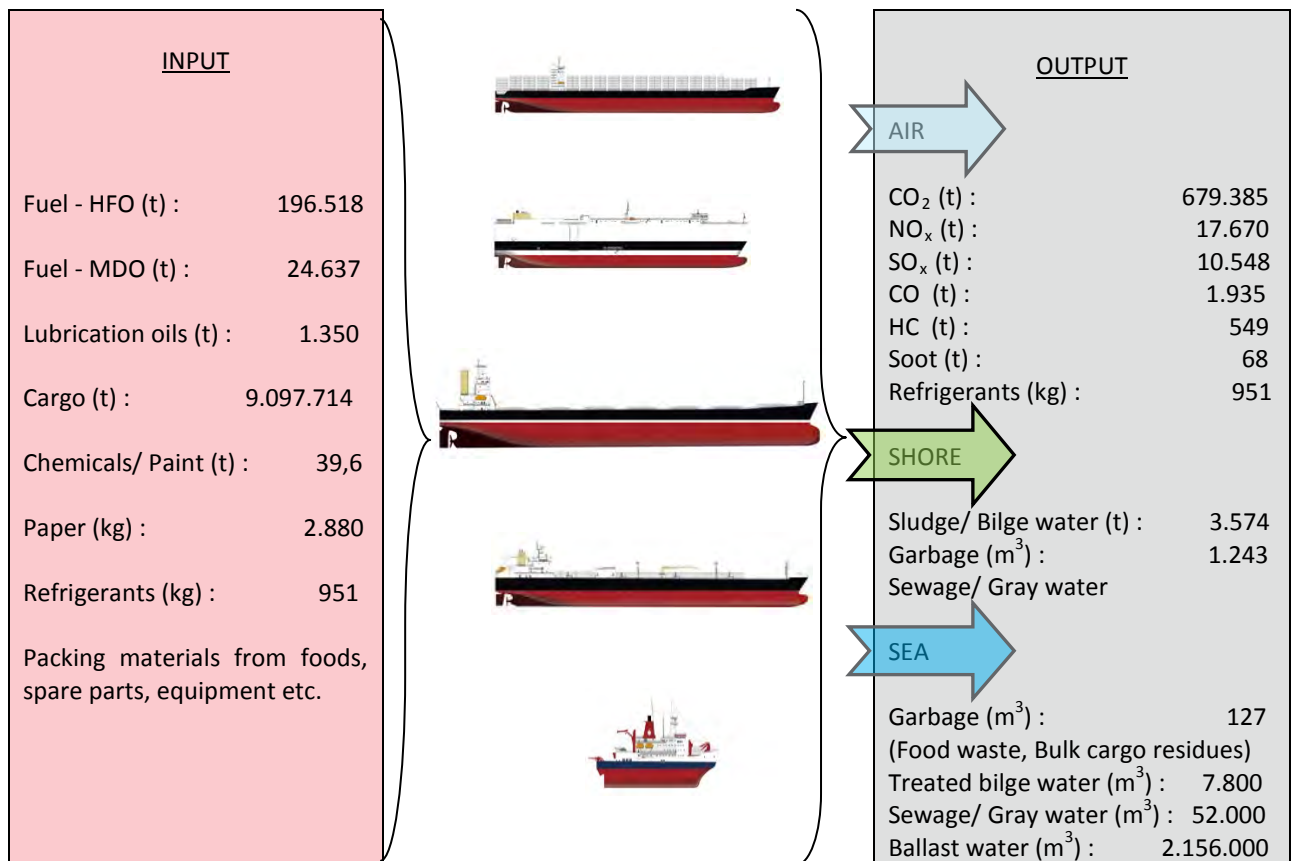


1. Principles

The operation of seagoing vessels, the cargo transportation as well as the work at the shore side facilities are involved with impairing effects on the environment. Being aware of this fact, our shipping company admits its responsibility for the protection of environment from the environmental impairments caused by the company's business activities.

The shipping company undertakes to adhere to all relevant national and international laws and regulations in the field of environmental protection. Duties resulting from such laws and regulations will be fulfilled with a high quality and, whenever practicable, implemented before they come into effect. In addition, the shipping company undertakes to deal with environmentally relevant individual problems and their implementation on a voluntary basis and in dependence on the economic feasibility and to implement the solutions for such problems. For this purpose, all activities and services are continuously inspected for their direct and indirect environmental impacts and the local, regional and global environmental aspects are included here.

2. Input-Output-Balance 2016

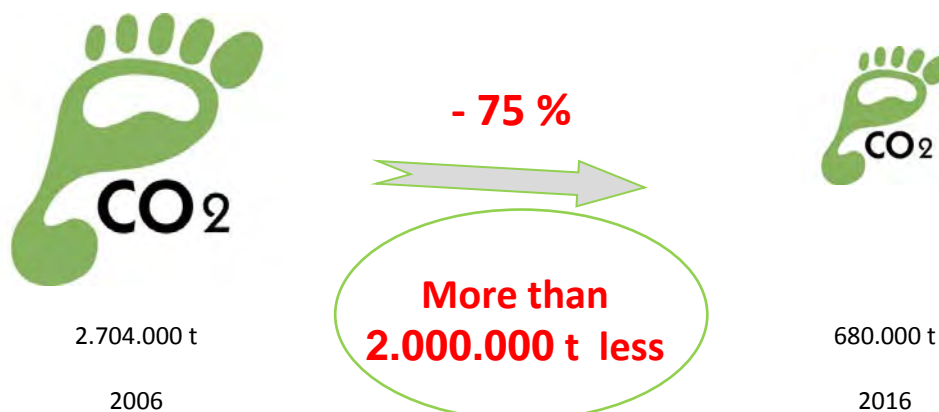


3. Summary of essential results

- A total of approximately 221.155 metric tons of **fuel** (HFO and MDO) were consumed on board the ships. In contrast to 2006, this is a reduction in the quantity used of about 639.300 tons (see Section 4.1.1.1 for details).



- The **annual consumption of fuel oil per ship** (2016 - 8.191 t) was reduced by 62 % compared with 2006 (see 4.1.1.1.1 for details).
- A total of 680.000 tons of the greenhouse gas **carbon dioxide (CO₂)** were released during shipping operations. The CO₂ footprint of our shipping company has therefore been reduced by about 75 % (see Section 4.1.2.1 for details).



- The average **EEOI of all vessels** was reduced by approx. 7 % compared with 2011 (Details siehe Anhang Tabelle 2 und 2a).
- The absolute emitted quantities of sulphur **dioxides (SO_x)**, nitrogen **oxides (NO_x)**, **carbon monoxide (CO)**, unburned hydrocarbons and soot were also considerably reduced when compared with the previous years, e.g. 10.548 tons SO_x were emitted in 2016 against 56.325 tons in 2006 (see Section 4.1.2.2 for further details).

	2006	Reduction	2016	
SO_x	56.325 t	45.777 t	10.548 t	- 81 %
NO_x	71.608 t	53.973 t	17.671 t	- 75 %
CO	7.703 t	5.768 t	1.935 t	- 75 %



- The **annual consumption of lubricating oil** per ship was reduced by nearly 66 % compared with 2008 (see 4.1.1.2 for details).



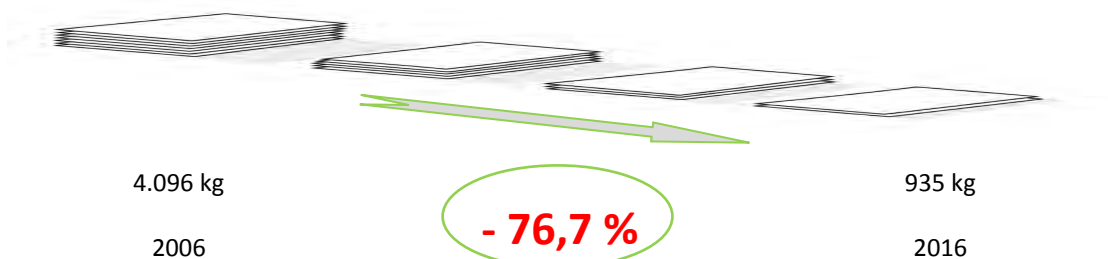
- The **annual consumption of refrigerant gases** per ship has been reduced by almost 85 kg since introduction of the refrigerant agent management plan at the beginning of 2009. For the shipping company as a whole, the reduction in the consumption of these greenhouse gases has an effect equivalent to about 9.400 tons CO₂ (see Section 4.1.2.3 for details).



- The on-board **incineration of oil sludge** has been continuously reduced from 1.206 tons in 2006 to 326 tons in 2016 - a reduction of 73 %. This meant approx. 2.750 tons less CO₂ emitted (see Section 4.1.2.4 for details).



- The introduction of electronic document archiving has meant an annual **saving in paper** on shore of more than 3,161 tons compared with 2006 (see Section 4.2.1).





4. Environmental impacts in detail

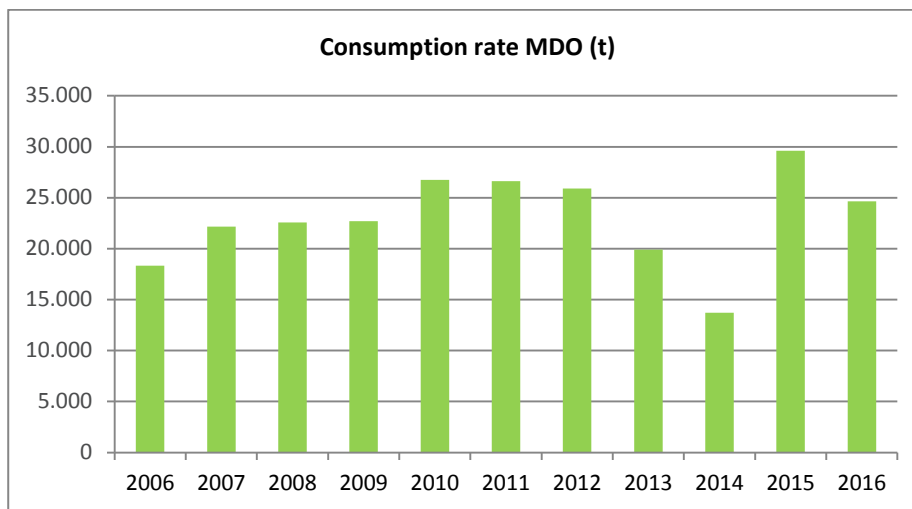
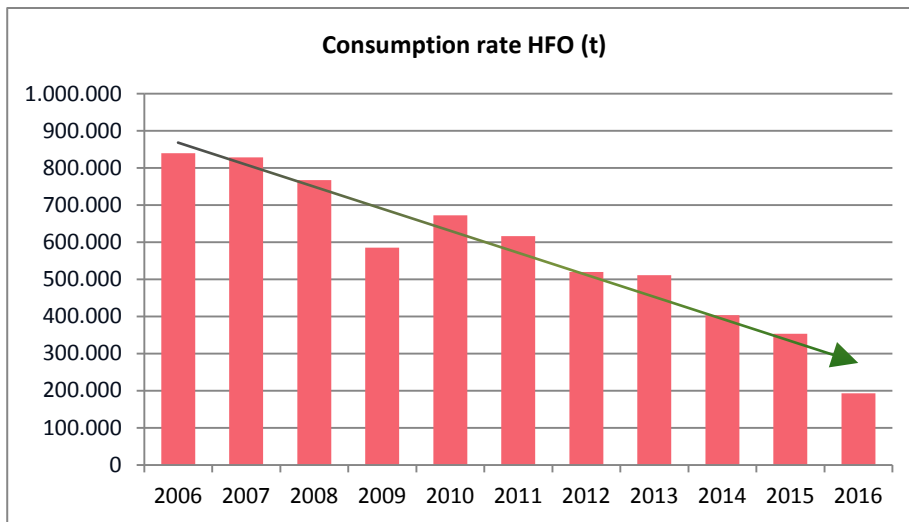
4.1 Environmental aspects - fleet

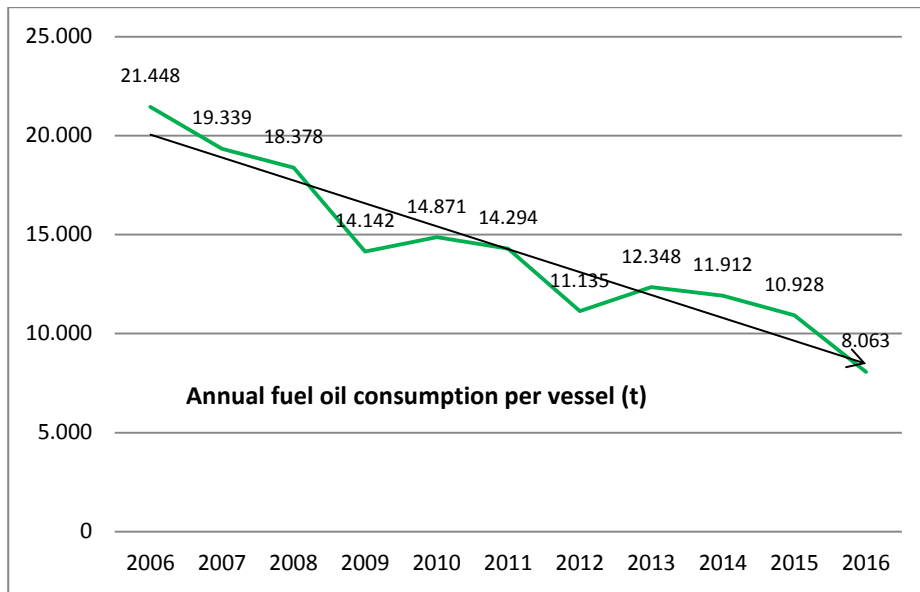
4.1.1 Consumption of resources

4.1.1.1 Fuel oil consumption

4.1.1.1.1 Consumption - total

Year	Vessels	Fuel oil consumption per year (t)			
		Total	HFO	MDO	Quantity (total per vessel)
2006	40	857.939	839.594	18.345	21.448
2007	44	850.902	828.735	22.167	19.339
2008	43	790.240	767.662	22.578	18.378
2009	43	608.091	585.403	22.688	14.142
2010	47	698.933	672.176	26.757	14.871
2011	45	643.211	616.576	26.635	14.294
2012	49	545.610	519.717	25.893	11.135
2013	43	530.946	511.045	19.901	12.348
2014	35	416.922	403.210	13.712	11.912
2015	35	382.495	352.897	29.598	10.928
2016	27	217.703	193.066	24.637	8.063

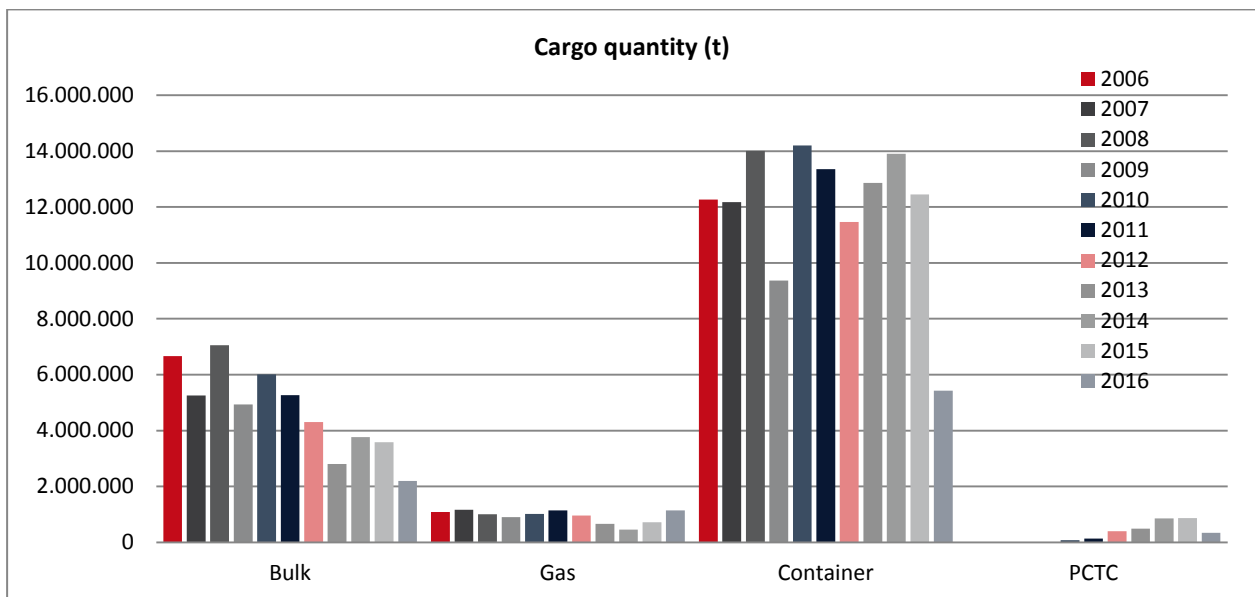




4.1.1.1.2 Consumption - specific

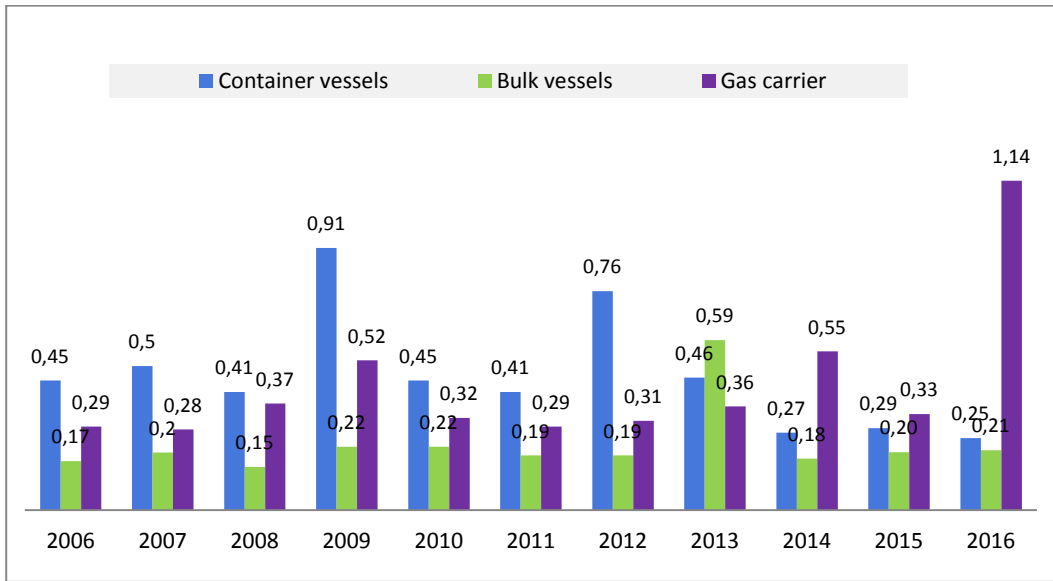
a. Cargo quantity

Year	Vessels		Cargo quantity per year (t)					
	Total	Cargo	Total	Bulk	Gas	Container	PCTC	RoRo
2006	40	38	20.629.242	6.667.352	1.080.037	12.268.714	0	613.139
2007	44	42	20.912.091	5.260.409	1.168.727	12.173.368	0	2.309.587
2008	43	41	24.344.538	7.055.661	999.882	14.008.395	0	2.280.600
2009	43	41	16.747.898	4.934.266	903.677	9.366.986	9.220	1.533.749
2010	47	45	22.196.161	6.017.215	1.011.938	14.210.560	73.449	882.999
2011	45	43	22.053.777	5.268.346	1.138.701	13.358.406	132.858	2.155.466
2012	49	45	18.673.835	4.301.579	960.567	11.464.103	401.340	1.546.246
2013	43	42	19.061.574	2.800.687	654.574	12.860.638	483.350	2.262.324
2014	35	34	18.982.062	3.766.397	453.654	13.903.564	858.448	0
2015	35	34	17.618.665	3.585.064	720.394	12.449.828	863.379	0
2016	27	26	9.097.714	2.197.289	1.138.125	5.423.458	338.842	0



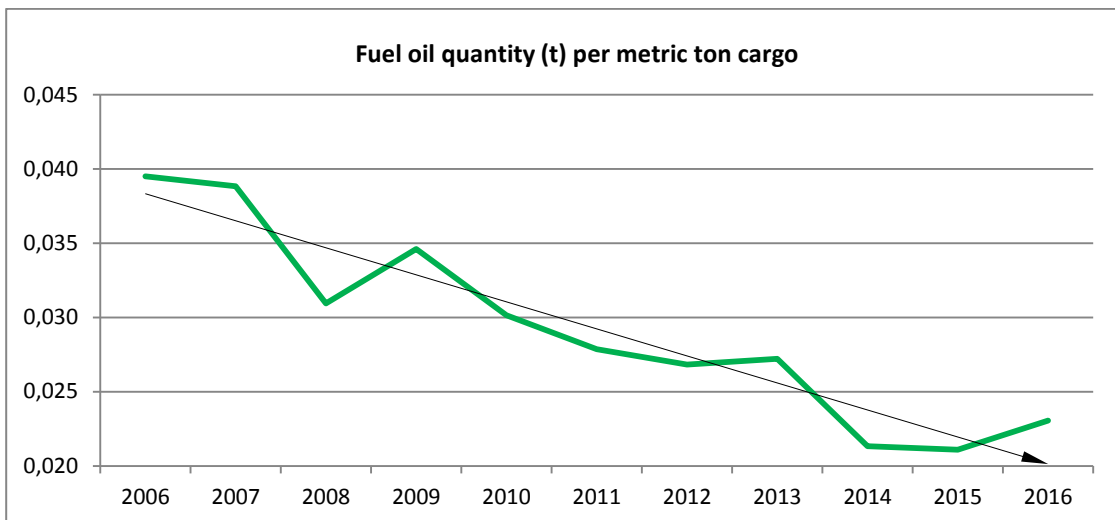


b. Specific fuel oil consumption (for container vessels, bulker and gas tanker in g/TNm)



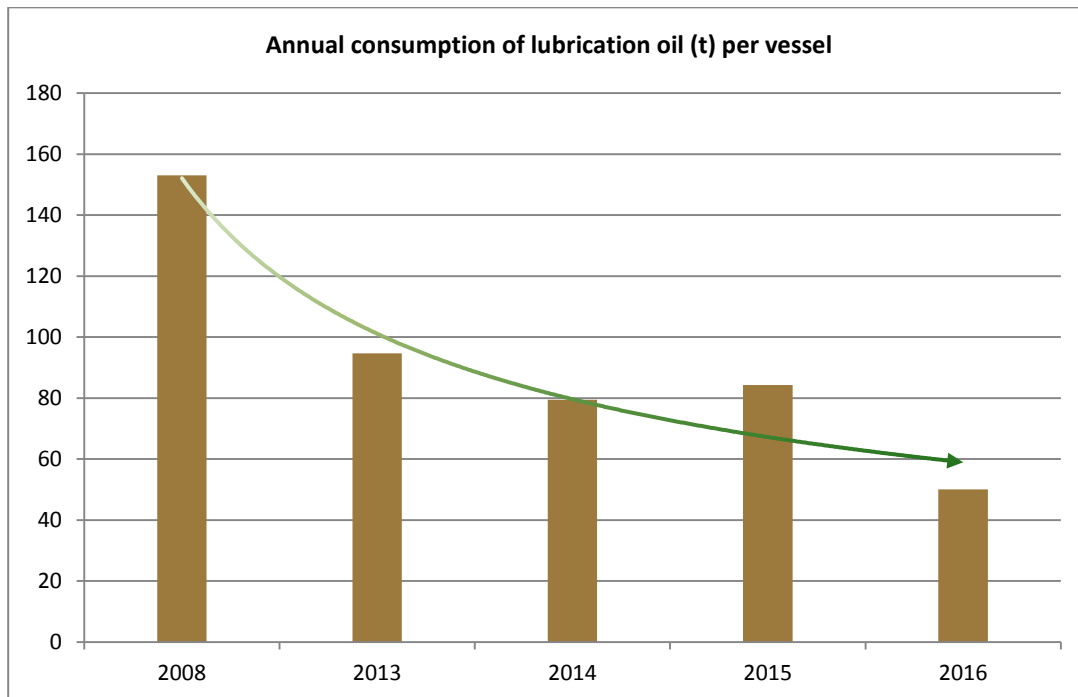
c. Fuel oil consumption (t) per metric ton transported cargo

Year	Quantity (t)		Fuel oil per metric ton cargo
	Cargo per vessel	Fuel oil per vessel	
2006	542.875	21.448	0,040
2007	497.907	19.339	0,039
2008	593.769	18.378	0,031
2009	408.485	14.142	0,035
2010	493.248	14.871	0,030
2011	512.879	14.294	0,028
2012	414.974	11.135	0,027
2013	453.847	12.348	0,027
2014	558.296	11.912	0,021
2015	518.196	10.928	0,021
2016	349.912	8.063	0,023





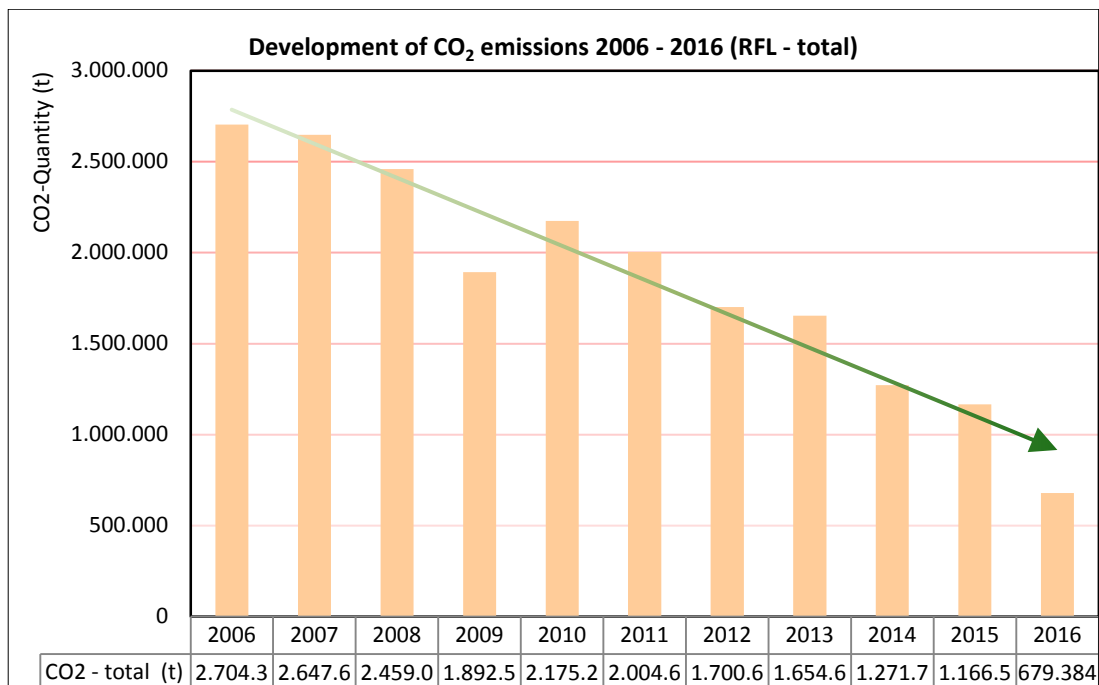
4.1.1.2 Lubricating oil



4.1.2 Emissions to the atmosphere

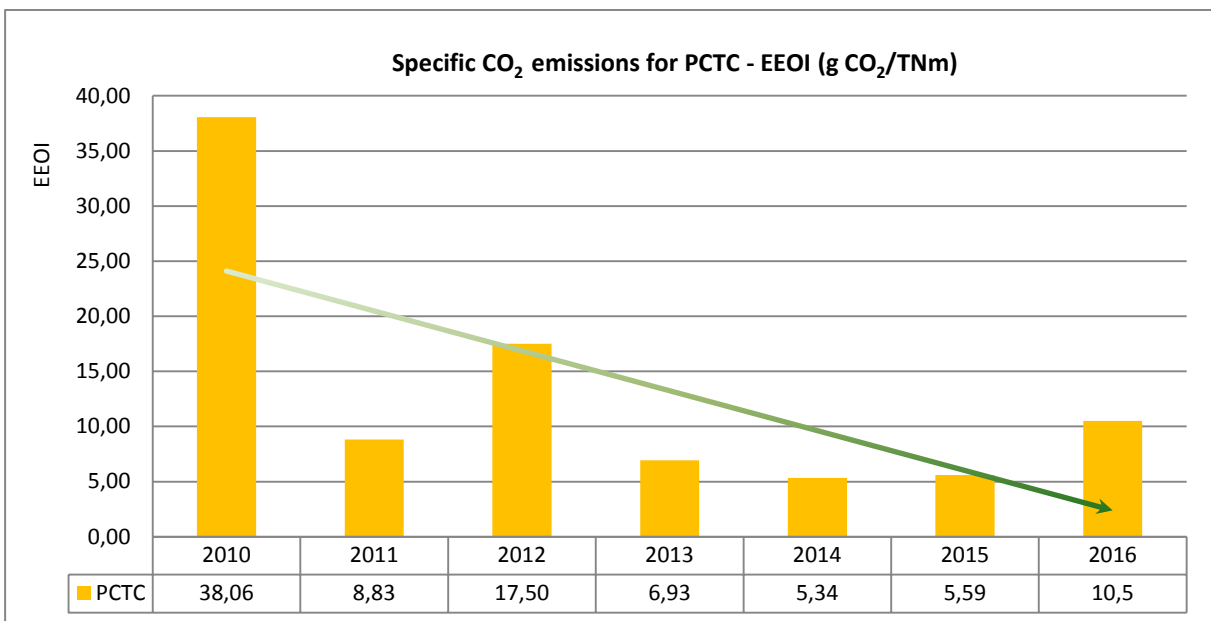
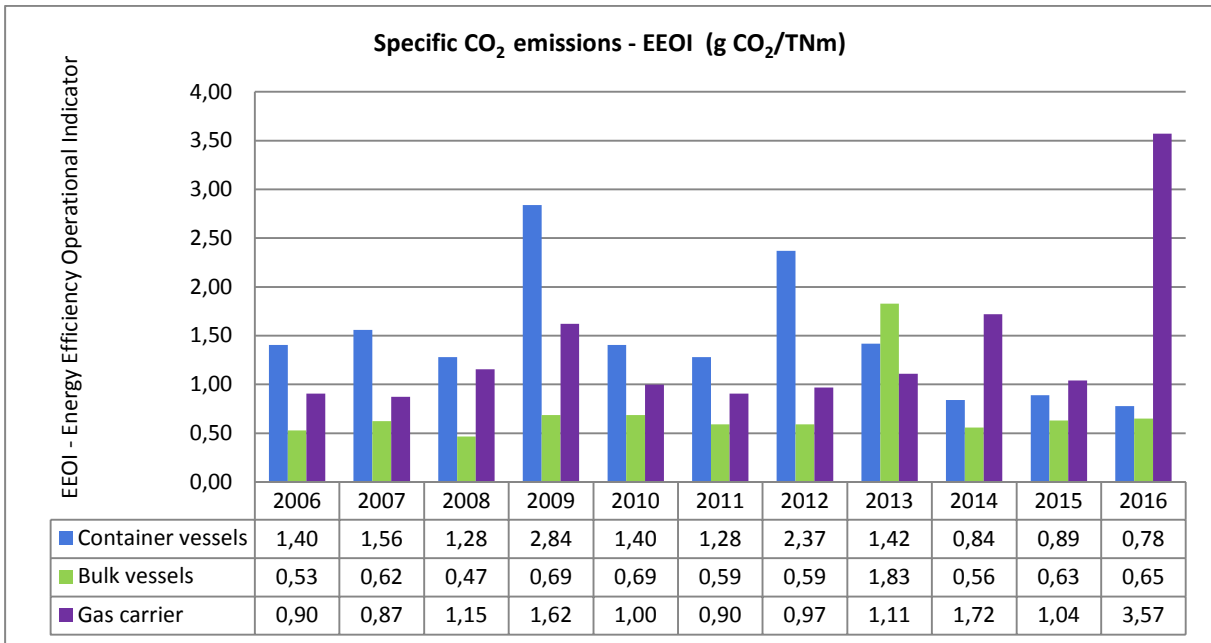
4.1.2.1 CO₂

a. Emissions - total





b. Energy Efficiency Operational Indicator (EEOI in g CO₂ / TNm)
(Specific emissions for selected vessel types)

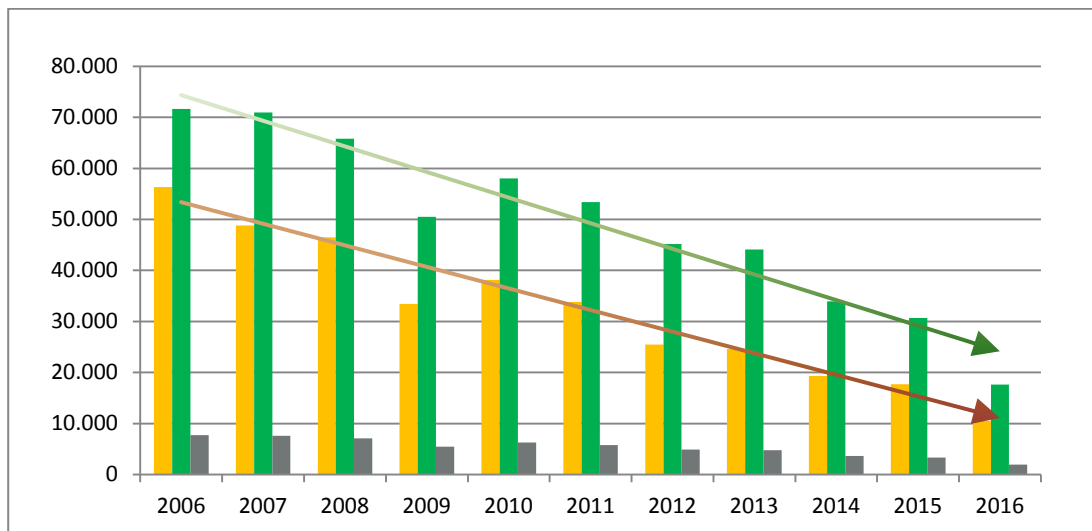




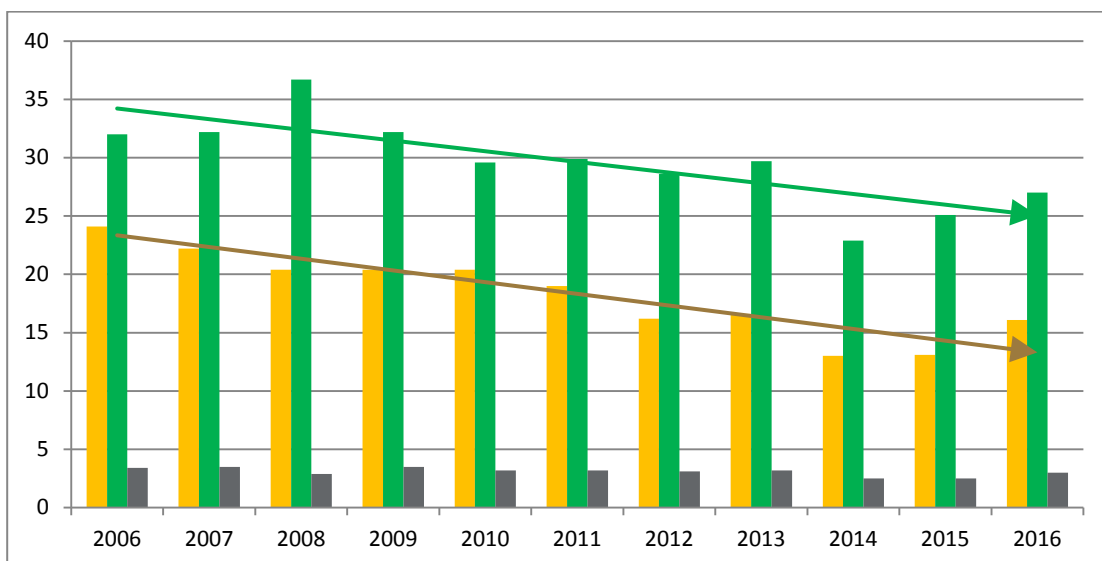
4.1.2.2 Gaseous emissions (except for CO₂ and HC)

Year	Quantity - total (t)			Specific emissions (mg/TNm)		
	SO _x	NO _x	CO	SO _x	NO _x	CO
2006	56.325	71.608	7.703	24,1	32	3,4
2007	48.821	70.921	7.636	22,2	32,2	3,5
2008	46.467	65.816	7.090	20,4	36,7	2,9
2009	33.425	50.512	5.450	20,4	32,2	3,5
2010	38.121	58.041	6.264	20,4	29,6	3,2
2011	33.840	53.364	5.762	19	29,9	3,2
2012	25.505	45.184	4.885	16,2	28,6	3,1
2013	24.591	44.102	4.759	16,6	29,7	3,2
2014	19.347	33.938	3.659	13	22,9	2,5
2015	17.722	30.679	3.337	13,1	25,1	2,5
2016	10.548	17.671	1.935	16,1	27	3
Difference 2016 : 2006	-45.777	-53.937	-5.768	-8	-5	-0,4
	-81,30%	-75,30%	-74,90%	-33,20%	-13,60%	-11,80%

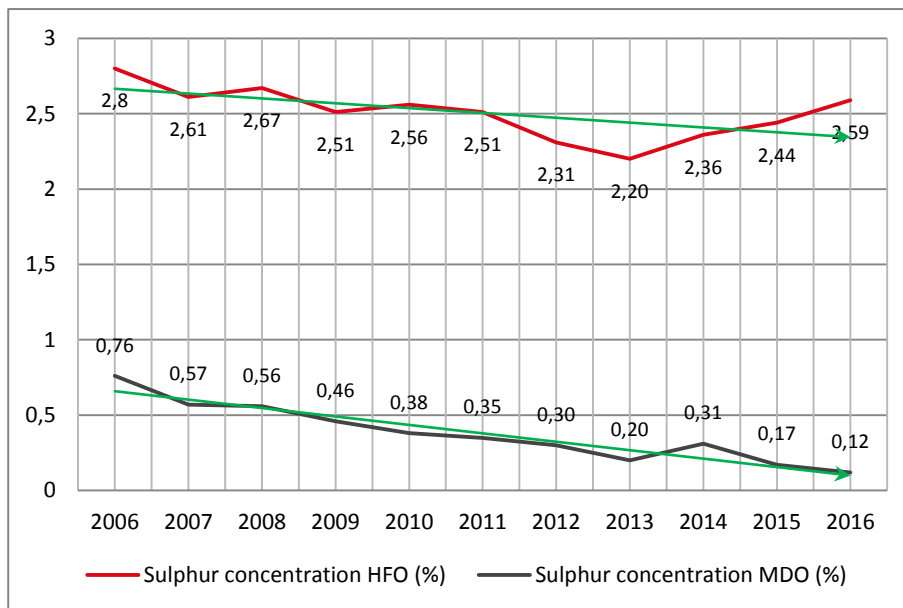
a. Emissions – total (t)



b. Emissions – specific (mg/TNm)

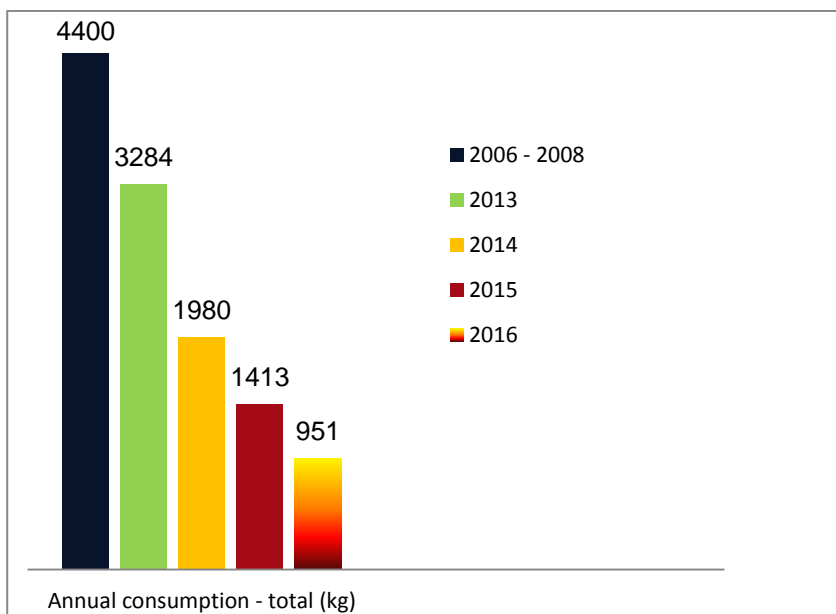


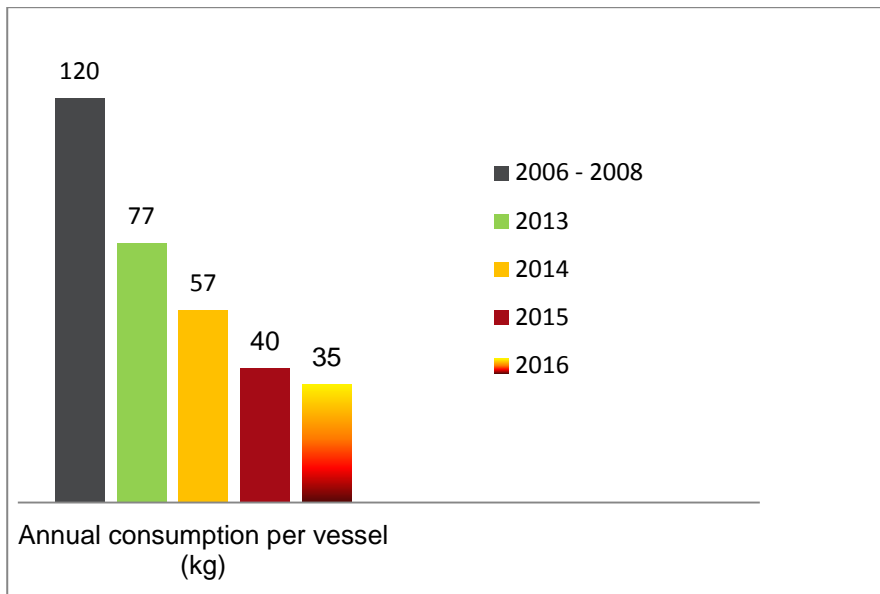
c. Development of the medial sulphur content in fuel oils (2006 - 2016)



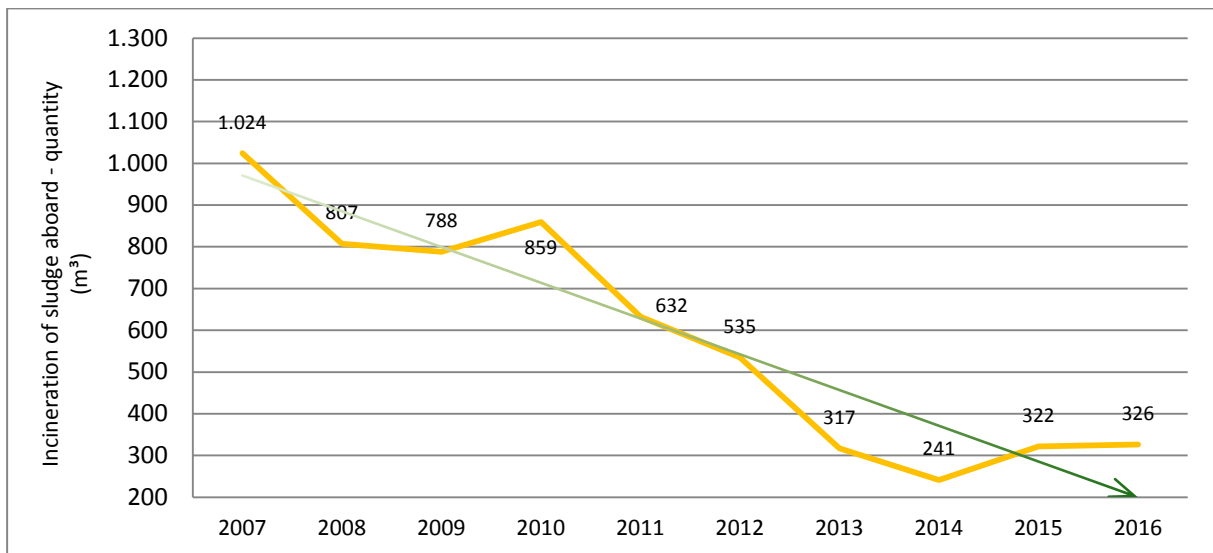
4.1.2.3 Emissions of refrigerant gases (predominant R404a)

Year	Annual sum on average RFL - total (kg)	Annual consumption on average per vessel (kg)
Ø 2006 - 2008	4400	120
2013	3284	77
2014	1980	57
2015	1413	40
2016	951	35





4.1.2.4 Incineration of sludge



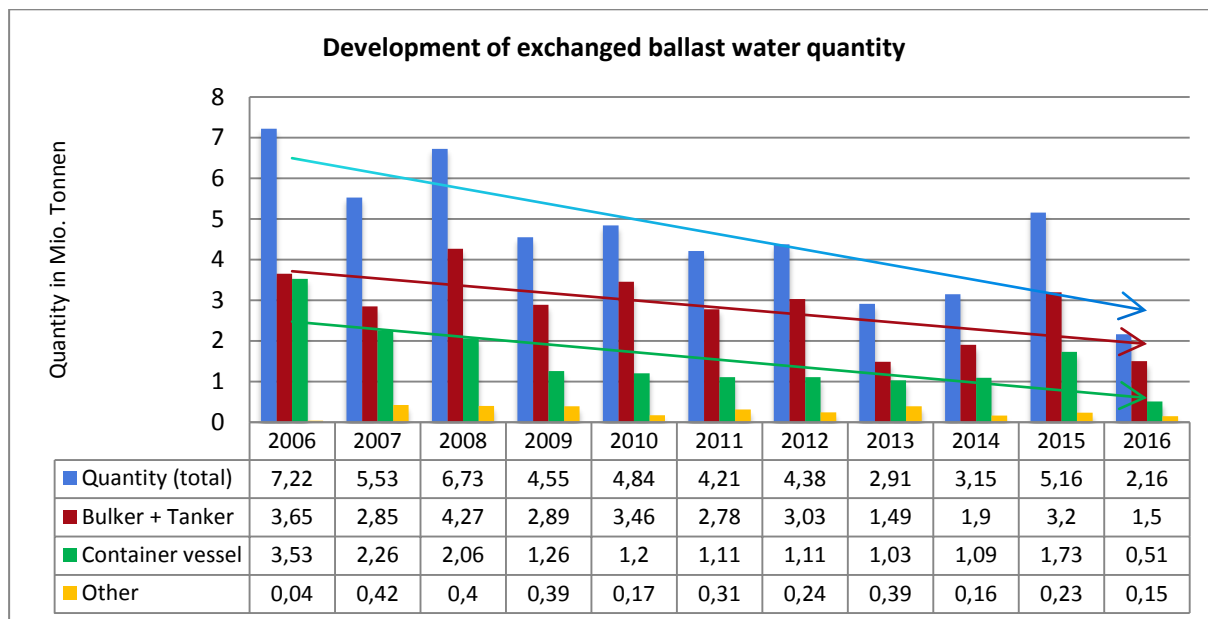
Incineration in 2016 released about 1.000 tons CO₂ (compared to 2006 - 3.800 tons).

4.1.3 Emissions in the sea

4.1.3.1 Oily waste water - Bilge water

Equipment installed on board the ships for the removal of oil from bilge water (max. 15 ppm residual oil) treated a total of 5.660 m³ oily water (see Attachment, Table 4 for details).

4.1.3.2 Ballast water

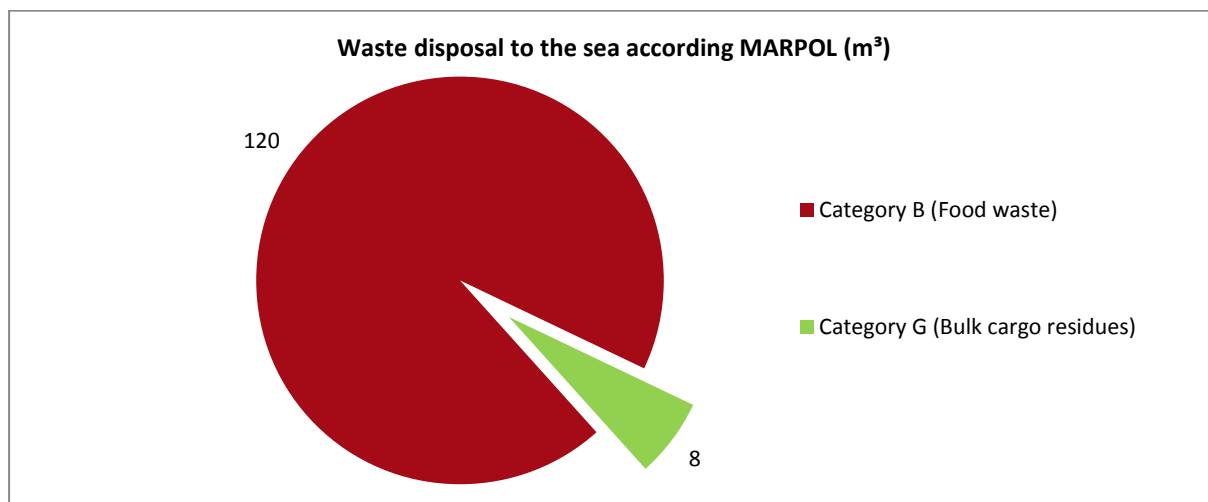


The environmentally-relevant effects of this reduction lie in the fuel savings for operating the BW-pumps and the direct reduction in CO₂ emissions due to that as well as the reduction in the risk of spreading foreign organisms due to the replacement of ballast water (see Attachment, Table 4 for details).

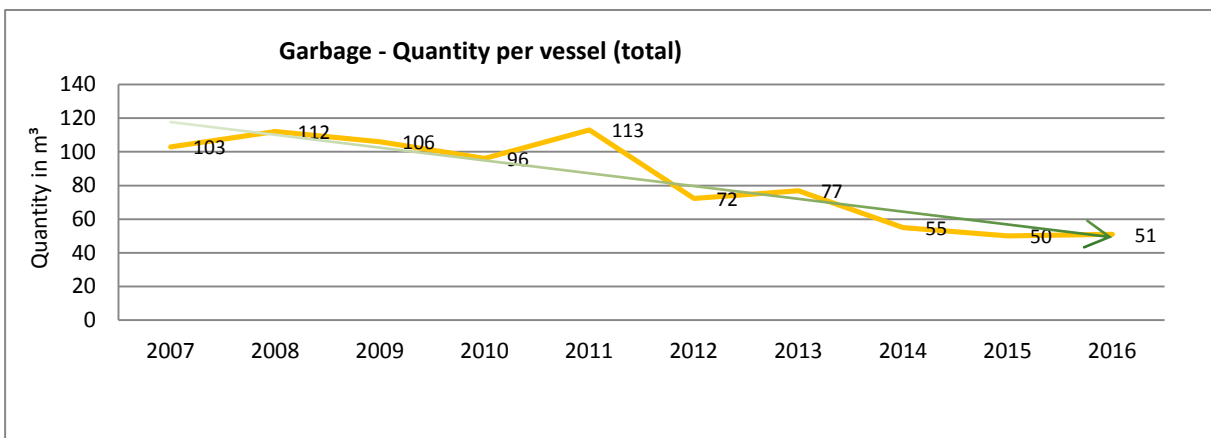
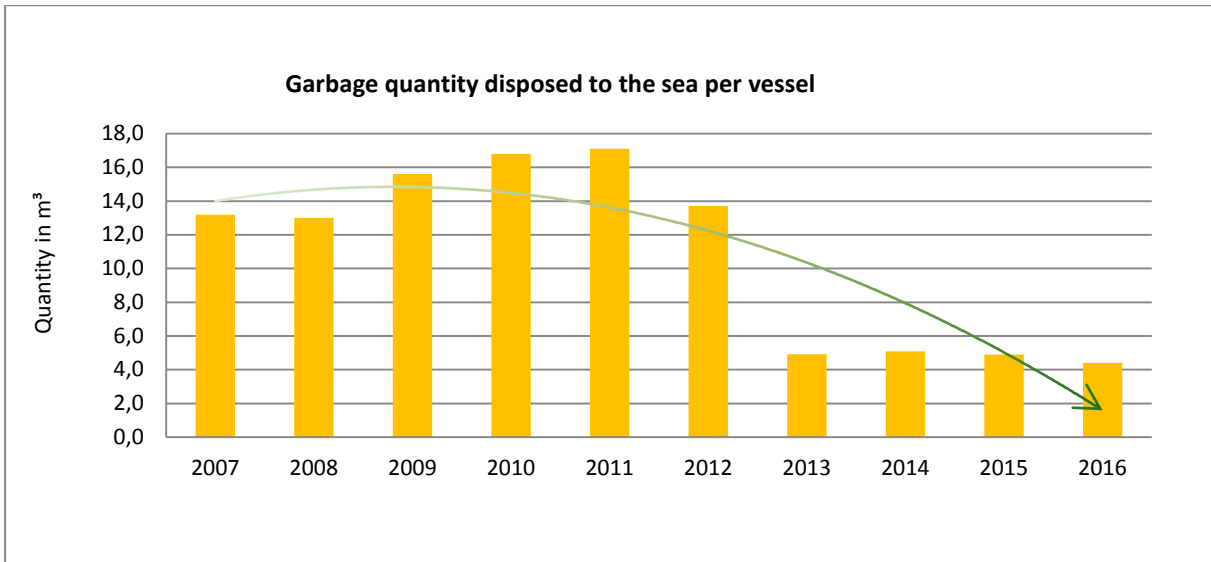
4.1.3.3 Gray and Black water

The total quantity of gray water and black water produced was 52,000 m³. This is divided into 7.800 m³ black water that is treated in the on-board waste water processing systems before being discharged into the sea, and 44.200 m³ gray water (see Attachment, Table 4 for details).

4.1.3.4 Garbage

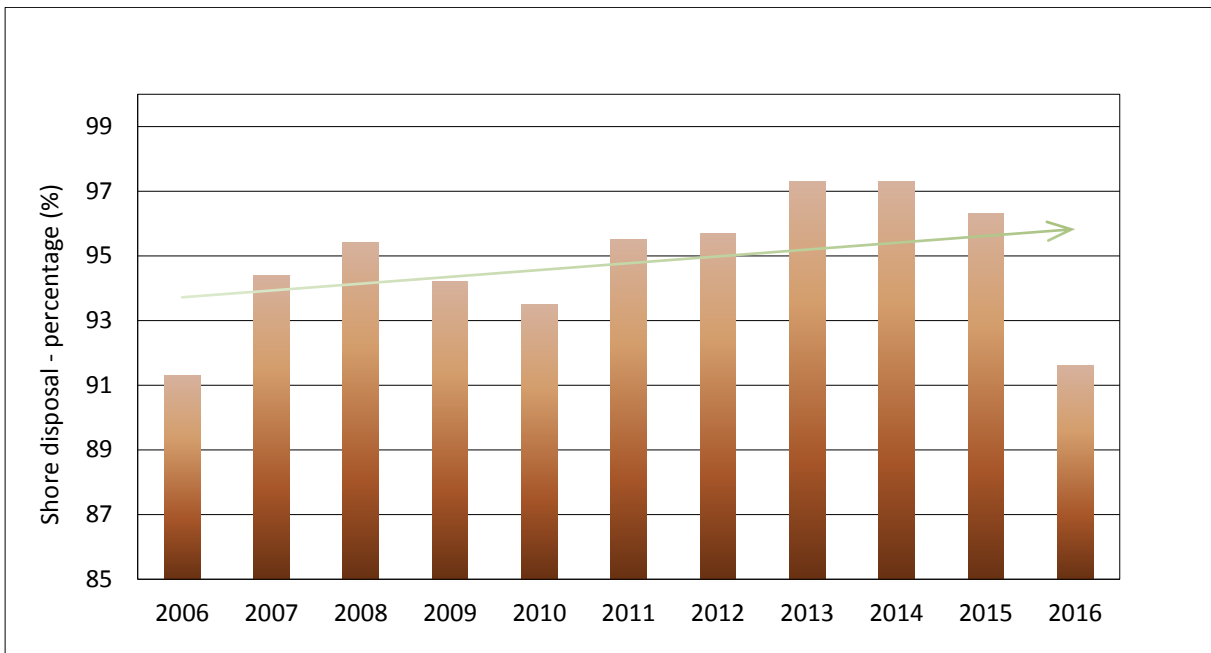


128 m³ garbage were disposed to the sea in accordance with MARPOL regulations, Annex 5, (see Attachment here, Table 5 for further details).



4.1.4 Disposals to shore

4.1.4.1 Sludge



In 2016, a total of 3.900 m³ oil sludge was produced on board our ships. Of that, 91,6 % were disposed of on shore.



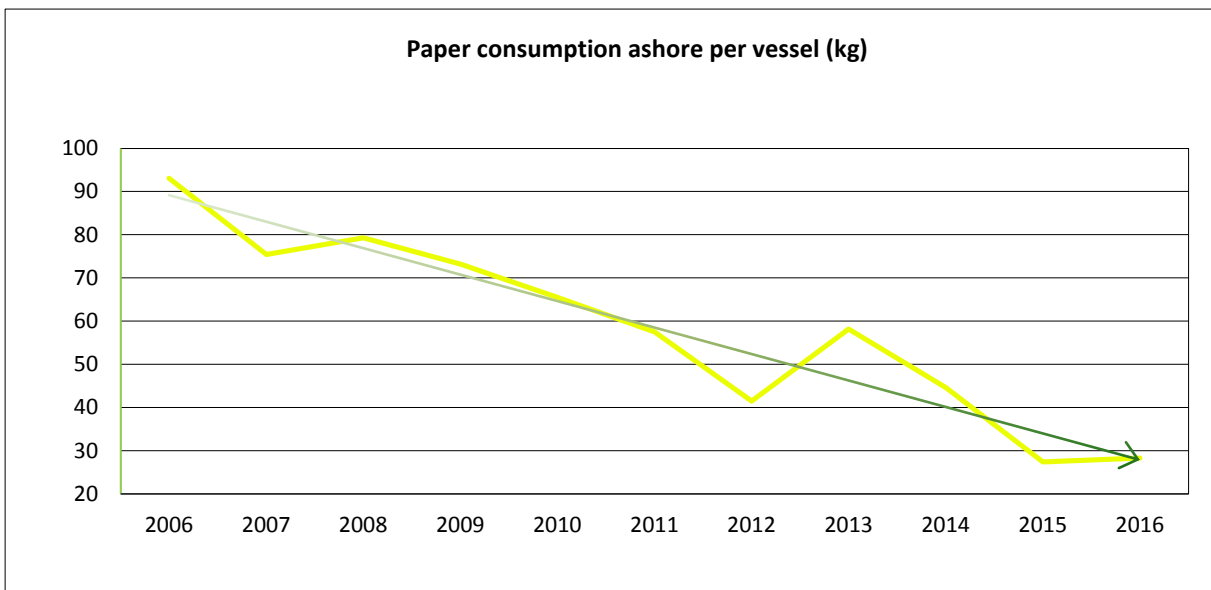
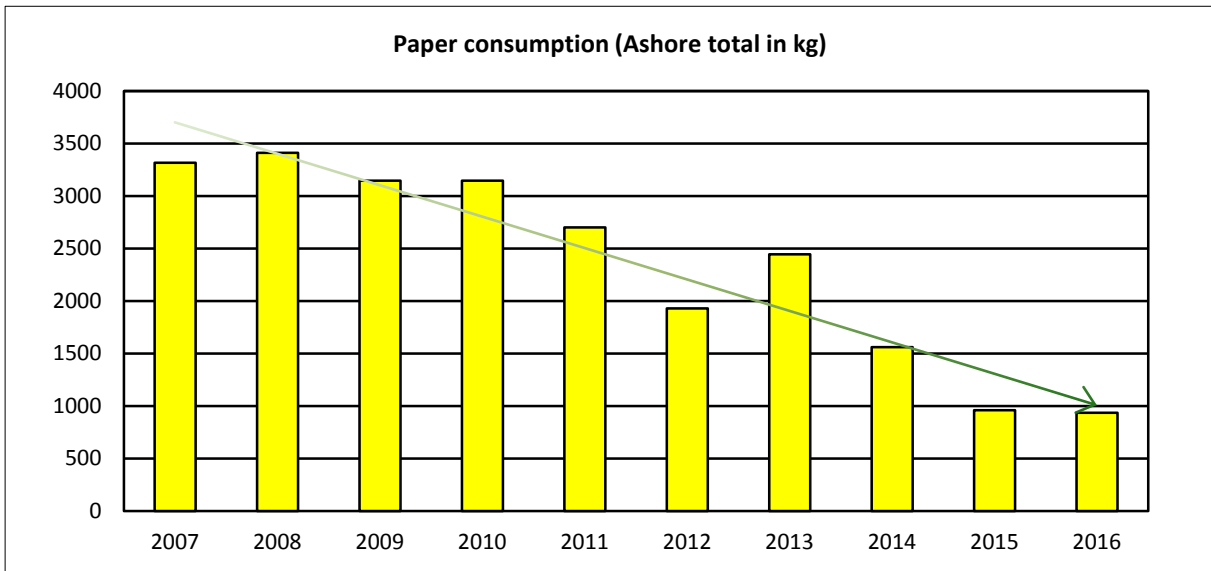
4.1.4.2 Garbage

The amount of ship refuse disposed of on shore or incinerated on board was 1.243 m³ in 2016. That is 90,3 % of the total garbage quantity. (see Attachment, Table 5, for further details).

4.2 Environmental aspects - Shore

4.2.1 Paper consumption

The paper consumption in offices increased to a total of 936 kg respectively 28,4 kg per ship.





4.2.2 Company cars

The following fuel types and quantities were required for company vehicles in 2016:

	Petrol (l)		Diesel (l)
	total	thereof E10	
Consumption	26.469	2.561	55.787
Annual sum	82.256		

The pollution emissions resulting from this:

Fuel		Mileage 2016 (km)	Emissions (rounded values)					
Kind	Average consumption l / 100 km		CO ₂ (kg) ⁽³⁾	NO _x (kg)	CO (kg)	HC (kg)	Soot (kg)	Benzene (kg)
Petrol	9	294.000	61.600	18 ⁽¹⁾	20	210	9	4,5
Diesel	8	700.000	147.000	280 ⁽²⁾				n.a.
2016 total		994.000	208.600	298	20	210	9	4,5

⁽¹⁾ - per km emissions of approximately 0,06 g NO_x

⁽²⁾ - per km emissions of approximately 0,39 g NO_x

⁽³⁾ - CO₂-Emission per litre: petrol = 2,33 kg / Diesel = 2,63 kg

4.2.3 CO₂-emissions caused by air travel (Business trips/ Crew change)

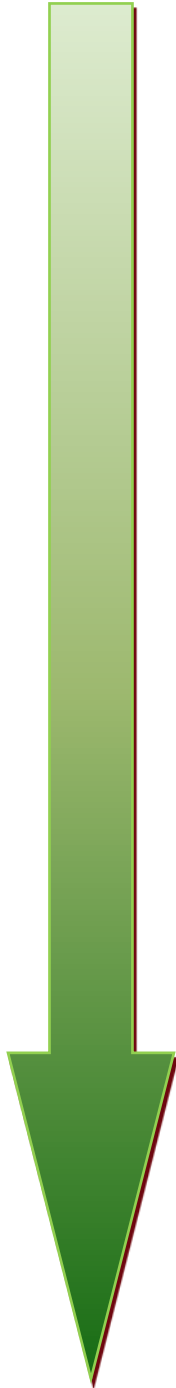
The CO₂-emissions, which were caused by air travel, constitute about 3.700 t in 2016.

4.2.4 Energy consumption 2016 (Electrical energy, heat energy)

Site office	Electrical energy (kwh)	Heat energy (kwh)
Rostock	No invoice until now	
Bremerhaven	8.902	n.a.



5. The next steps: Where have we come from and where do we want to go?



	Introduction of the ECO Assistant Program on 21 vessels
	Introduction of SEEMP on all ships
2013	Realization of the US EPA Vessel General Permit (VGP) Regulations for all vessels in US traffic
	Revised Garbage Management Plans for all vessels

	FS Polarstern: Retrofit with Ballast Water Treatment Plant and LED lighting
2014	EEOI improvement for the whole fleet round 23% by comparison to 2013

	Modification of bow sections and propellers for two container vessels
2015	Use of fuels with a maximum sulphur content of 0.1% in SECA's
	Preparation for the implementation of the reporting programm Navigator Insight/ECO Insight aboard

	Implementation of an Energy Management System according ISO50001
2016	Implementation and practical daily use of the reporting system Navigator Insight/ECO Insight aboard of all vessels
	Commission of 5 gas carriers equipped with modern green technology (SCR, Scrubber, Ballast Water Treatment Plant)

2017 Energy Management System - Certification according ISO50001



Acknowledgment

It is not possible to put such a report together on one's own. I would therefore like to thank all those involved on board our ships and on land who took part directly and indirectly in the various projects, for the groundwork which was the basis for this report and for the large amount of advice given.

In the years to come, this commitment will also be necessary to the same or even greater extent to meet the constantly growing requirements. I look forward to our working together again for the benefit of our shipping company and the environment.

Uwe Hauer





Appendices



**Table 1 : Basic data**

Vessel	Total mileage (sm)	Transported cargo (t)	Crew (on average aboard including passengers)
Bulk vessel +Gas carrier			
Pacific	84.486	250.460	21
Polar	57.070	380.726	23
Yara Kara	45.671	142.994	23
Yara Nauma	29.690	92.539	22
Yara Sela	12.492	13.780	20
Yara Aesa	44.362	176.982	21
Yara Freya	21.580	80.645	21
Peene Ore	73.206	1.096.594	24
Paganini	64.513	380.471	21
Pugnani	51.185	720.224	21
Container vessel			
Beethoven	77.981	391.777	20
Kaya	85.278	788.597	17
Perla	43.200	696.971	19
Pinara	57.743	173.998	19
Pona	91.376	1.042.199	22
Porto	73.532	565.565	21
Posen	73.495	783.491	20
Pontresina	92.418	980.860	20
PCTC			
Paganella	86.357	88.111	24
Paganino	86.162	94.023	22
Paglia	72.361	25.392	20
Pagna	82.828	33.157	22
Parana	60.425	33.509	22
Passama	67.525	25.111	22
Passero	99.446	14.860	22
Patara	73.709	24.679	22
Research vessel			
Polarstern	41.766	0	95
Annual sum	1.749.857	9.097.714	646





Tabelle 2: Specific fuel consumption - EEOI

Vessel	Total mileage (Nm)	Transported cargo (t)	Tons*Nautical Miles (t * Nm)	Total fuel consumption HFO + MDO (t)	EEOI (t CO ₂ / t*Nm)
Bulk vessel + Gas carrier	484.255	3.335.414	203.617.514.793	56.885	2,69E-06
Pacific	84.486	250.460	21.160.363.560	9.083	1,34E-06
Polar	57.070	380.726	21.728.022.547	6.807	9,81E-07
Yara Kara	45.671	142.994	6.530.696.329	4.478	2,15E-06
Yara Nauma	29.690	92.539	2.747.469.846	2.524	2,86E-06
Yara Sela	12.492	13.780	172.139.760	763	1,38E-05
Yara Aesa	44.362	176.982	7.851.275.484	3.532	1,40E-06
Yara Freya	21.580	80.645	1.740.308.742	1.355	2,43E-06
Peene Ore	73.206	1.096.594	80.277.260.364	16.235	6,30E-07
Paganini	64.513	380.471	24.545.312.720	6.932	8,81E-07
Pugnani	51.185	720.224	36.864.665.440	5.177	4,37E-07
Container vessel	595.023	5.423.458	423.008.342.846	85.468	7,85E-07
Beethoven	77.981	391.777	30.551.162.237	15.564	1,59E-06
Kaya	85.278	788.597	67.249.974.966	13.697	6,34E-07
Perla	43.200	696.971	30.109.147.200	5.102	5,29E-07
Pinara	57.743	173.998	10.047.166.514	4.853	1,50E-06
Pona	91.376	1.042.199	95.231.975.824	15.652	5,12E-07
Porto	73.532	565.565	41.587.125.580	6.917	5,23E-07
Posen	73.495	783.491	57.582.671.045	8.814	4,79E-07
Pontresina	92.418	980.860	90.649.119.480	14.871	5,11E-07
PCTC	628.813	338.842	27.311.178.088	65.863	1,05E-05
Paganella	86.357	88.111	7.609.001.627	10.229	4,20E-06
Paganino	86.162	94.023	8.101.209.726	10.385	4,01E-06
Paglia	72.361	25.392	1.837.404.984	7.131	1,21E-05
Pagna	82.828	33.157	2.746.327.996	7.818	8,89E-06
Parana	60.425	33.509	2.024.781.325	6.272	9,67E-06
Passama	67.525	25.111	1.695.630.404	7.520	1,38E-05
Passero	99.446	14.860	1.477.757.615	8.232	1,74E-05
Patara	73.709	24.679	1.819.064.411	8.276	1,42E-05
Research vessel					
Polarstern 1) 2)	41.766	0	0	9.487	n.a.
Annual sum	1.749.857	9.097.714	653.937.035.727	217.703	1,04E-06
Legend:					
1) only MDO					
2) no cargo transport, therefor reference value for specific consumption= fuel per driven route unit (kg/Nm)					
3) without research vessel					
	3)				





Table 2a
Energy Efficiency Operational Index – EEOI (2011 – 2016)

Vessel	2011	2012	2013	2014	2015	2016
	EEOI	EEOI	EEOI	EEOI	EEOI	EEOI
	(t CO ₂ /t*Nm) * 10 ⁻⁶	(t CO ₂ /t*Nm) * 10 ⁻⁶	(t CO ₂ /t*Nm) * 10 ⁻⁶	(t CO ₂ /t*Nm) * 10 ⁻⁶	(t CO ₂ /t*Nm) * 10 ⁻⁶	(t CO ₂ /t*Nm) * 10 ⁻⁶
Bulk vessels + Gas carrier						
Pacific	1,04	1,12	1,25	1,56	1,31	1,34
Polar	1,13	1,2	0,96	1,87	0,77	0,98
Yara Kara	n.a.	n.a.	n.a.	n.a.	n.a.	2,15
Yara Nauma	n.a.	n.a.	n.a.	n.a.	n.a.	2,86
Yara Sela	n.a.	n.a.	n.a.	n.a.	n.a.	13,8
Yara Aesa	n.a.	n.a.	n.a.	n.a.	n.a.	1,40
Yara Freya	n.a.	n.a.	n.a.	n.a.	n.a.	2,43
Peene Ore	0,54	0,69	0,64	0,38	0,68	0,63
Paganini	n.a.	n.a.	n.a.	0,68	0,64	0,88
Pugnani	n.a.	n.a.	5,75	0,43	0,17	0,44
Container vessels						
Beethoven	n.a.	n.a.	5,51	1,44	0,85	1,59
Kaya	n.a.	5,14	0,73	1,08	0,68	0,63
Perla	0,79	0,44	0,32	0,26	0,29	0,53
Pinara	n.a.	n.a.	1,91	0,38	0,54	1,50
Pona	0,75	0,78	0,63	0,43	0,47	0,51
Porto	1,29	0,99	0,93	0,89	0,64	0,52
Posen	0,42	0,66	0,46	0,44	0,51	0,48
Pontresina	1,62	0,46	0,66	0,42	0,46	0,51
PCTC						
Paganella	9,34	2,13	4,31	6,47	3,55	4,20
Paganino	10	7,79	8,04	11	1,40	4,01
Paglia	7,64	9,19	6,93	7,16	1,59	12,1
Pagna	8,36	5,1	5,91	4,39	1,83	8,89
Parana	n.a.	10,2	7,81	5,02	9,98	9,67
Passama	n.a.	6,26	2,2	0,88	8,09	13,8
Passero	n.a.	22,7	9,86	1,7	1,14	17,4
Patara	n.a.	29,6	8,32	6,18	6,83	14,2
Total average	1,12	1,08	1,12	0,86	0,86	1,04



**Table 3: Exhaust gases from ships operation**

Vessel	Fuel consumption					Kind of emission and quantity (t)					
	Total (t)	HFO (t)	Sulphur content (%)	MDO (t)	Sulphur content (%)	SOx	NOx	CO2	CO	HC	Soot
Bulk vessels + Gas carrier											
Pacific	9.083,10	8.450,60	2,90	632,50	0,08	515,70	747,17	28.323,57	81,12	22,83	2,85
Polar	6.806,80	4.974,10	2,66	1.832,70	0,09	281,32	525,95	21.301,00	59,43	17,38	2,17
Yara Kara	4.478,10	3.371,10	2,47	1.107,00	0,04	175,79	348,49	14.008,14	39,20	11,42	1,43
Yara Nauma	2.523,90	2.346,70	2,70	177,20	0,10	133,43	207,58	7.870,29	22,54	6,35	0,79
Yara Sela	762,90	762,90	3,26	0,00	0,00	52,23	64,08	2.375,98	6,87	1,91	0,24
Yara Aesa	3.531,90	3.184,60	1,57	347,30	0,04	105,29	288,00	11.019,06	31,44	8,90	1,11
Yara Freya	1.354,50	1.186,00	3,15	168,50	0,04	78,60	109,57	4.227,82	12,02	3,42	0,43
Peene Ore	16.234,70	16.072,50	2,25	162,20	0,06	759,63	1.359,66	50.570,37	145,95	40,62	5,08
Paganini	6.932,20	6.430,40	2,52	501,80	0,09	341,25	569,76	21.617,54	61,89	17,43	2,18
Pugnani	5.177,10	5.145,40	2,20	31,70	0,45	238,02	434,08	16.125,32	46,56	12,95	1,62
Container vessels											
Beethoven	15.563,50	15.533,50	2,86	30,00	0,04	932,97	1.306,58	48.472,63	140,04	38,91	4,86
Kaya	13.697,00	13.598,40	2,96	98,60	0,05	845,38	1.148,08	42.663,42	123,17	34,26	4,28
Perla	5.101,50	4.557,50	2,55	544,00	0,45	249,19	414,93	15.918,36	45,37	12,86	1,61
Pona	15.651,70	15.599,40	2,58	52,30	0,05	845,23	1.313,44	48.748,56	140,81	39,14	4,89
Porto	6.917,00	3.426,00	2,60	3.491,00	0,09	193,66	493,75	21.736,40	58,76	17,99	2,25
Posen	8.813,60	8.812,20	2,89	1,40	0,78	534,84	740,31	27.449,15	79,32	22,03	2,75
Pontresina	14.870,83	14.805,83	2,76	65,00	0,25	858,49	1.247,52	46.317,33	133,77	37,19	4,65
Pinara	4.852,80	4.840,50	2,06	12,30	0,01	209,40	407,33	15.114,24	43,66	12,13	1,52
PCTC											
Paganella	10.228,60	8.209,40	2,17	2.019,20	0,09	377,92	808,72	31.968,22	90,04	25,98	3,25
Paganino	10.385,36	8.594,60	2,29	1.790,76	0,09	416,70	827,60	32.443,73	91,68	26,32	3,29
Paglia	7.130,50	7.123,50	2,92	7,00	0,09	436,83	598,79	22.207,62	64,17	17,83	2,23
Pagna	7.818,05	6.858,07	2,29	959,98	0,08	331,42	632,72	24.401,91	69,40	19,74	2,47
Parana	6.272,30	5.619,30	3,10	653,00	0,09	367,05	510,55	19.570,76	55,80	15,81	1,98
Passama	7.520,16	7.506,76	2,64	13,40	0,01	416,18	631,36	23.421,53	67,67	18,80	2,35
Passero	8.231,79	7.990,19	2,77	241,60	0,04	464,99	685,43	25.650,52	73,84	20,63	2,58
Patara	8.276,27	8.066,97	2,20	209,30	0,01	372,74	689,97	25.787,25	74,28	20,73	2,59



Research vessel											
Polarstern	9.487,00	0	0	9.487,00	0,07	13,95	559,73	30.073,79	75,90	25,61	3,20
Annual sum	217.703,16	193.066,42	2,59	24.636,74	0,12	10.548,16	17.671,15	679.384,52	1.934,69	549,19	68,65

**Table 4: Oily waters / Sewage + Gray water / Ballast water**

Vessel	Oily waste water					Crew (including passengers)	Person related waste water (m ³)				Ballast water (m ³)
	Sludge/ Slop (m ³)	Sludge / Percentage of fuel (%)	Incinerated (m ³)	Shore disposal (m ³)	Disposal BWTP (m ³)		Sewage (Black water)	Gray water	Sum Sewage + Gray water	Liter per person and day	
Bulk vessels + Gas carrier											
Pacific	493,7	2,21	175,3	25,0	293,4	21	196	2.000	2.196	286,50	65.032
Polar	272,3	1,59	72,22	35,9	164,2	23	295	2.010	2.305	274,57	239.820
Yara Kara	243,9	1,51	51,5	15,9	176,5	23	200	400	600	145,74	70.049
Yara Nauma	191,2	0,85	9	12,5	169,7	22	74	653	728	268,92	43.067
Yara Sela	69,6	0,00	0	0,0	69,6	20	35	320	355	522,06	4.325
Yara Aesa	356,8	0,19	6,8	0,0	350,0	21	75	750	825	238,10	119.331
Yara Freya	114,3	0,84	11,35	0,0	102,9	21	224	336	560	317,46	19.835
Peene Ore	616,9	1,83	0	297,9	319,0	24	158	3.308	3.466	395,66	649.574
Paganini	304,1	1,58	0	109,2	194,9	21	548	1.642	2.190	285,71	80.786
Pugnani	104,1	1,23	0	63,7	40,4	21	31	390	421	54,92	209.239
Container vessels											
Beethoven	632,1	1,44	0	223,5	408,6	20	975	1.950	2.925	400,68	29.800
Kaya	635,9	1,34	0	184,1	451,8	17	540	1.270	1.810	291,70	84.185
Perla	129,7	2,05	0	104,5	25,2	19	504	1.508	2.012	290,12	42.160
Pona	322,9	0,70	0	109,6	213,3	22	375	1.080	1.455	181,20	6.330
Porto	277,0	1,98	0	137,0	140,0	21	800	1.400	2.200	287,02	17.000
Posen	262,9	1,82	0	160,3	102,6	20	700	2.200	2.900	397,26	40.677
Pontresina	628,2	1,93	0	287,7	340,5	20	300	1.500	1.800	246,58	81.896
Pinara	104,1	1,31	0	63,7	40,4	19	31	390	421	60,71	209.239
PCTC											
Paganella	431,3	3,44	0	352,3	79,0	24	185	2.600	2.785	317,92	30.000
Paganino	420,1	2,61	0	271,2	148,9	22	201	1.771	1.972	245,58	15.597
Paglia	401,1	1,84	0	131,0	270,1	20	360	1.460	1.820	249,32	12.800
Pagna	342,3	2,46	0	192,7	149,6	22	202	1.900	2.102	261,77	6.926
Parana	325,0	2,32	0	145,8	179,2	22	230	2.040	2.270	282,69	24.290
Passama	762,2	1,46	0	110,0	652,2	22	110	1.460	1.570	195,45	10.303
Passero	456,6	1,63	0	134,2	120,2	22	260	1.560	1.820	226,65	10.077
Patara	346,6	1,63	0	135,0	211,6	22	135	1.845	1.980	246,58	23.056



Research vessel											
Polarstern	521,2	2,86	0	271,0	250,2	95	50	6.470	6.520	188,03	11.170
Annual sum	9.766,14	1,65	326,17	3.573,75	5.664,08	646	7.794	44.213	52.007	265,14	2.156.564



Table 5 : Garbage

Vessel	Crew incl. Passenger	Garbage according MARPOL Annex V (m ³)					Quantity without Cat. G per person + day (l)
		Category A, C - F, H, I (Shore disposal only)	Category B Shore / into the sea		Category G Shore / into the sea		
Bulk vessels + Gas carrier							
Pacific	21	39,93	0,25	3,34	0,00	0,00	5,66
Polar	23	86,00	0,12	7,23	0,00	0,00	11,09
Yara Kara	23	19,93	0,70	2,41	0,00	0,00	5,60
Yara Nauma	22	8,78	0,20	1,75	0,00	0,00	3,97
Yara Sela	20	0,00	0,00	0,60	0,00	0,00	0,88
Yara Aesa	21	15,47	0,90	0,96	0,00	0,00	5,00
Yara Freya	21	8,70	0,48	0,60	0,00	0,00	5,54
Peene Ore	24	69,26	4,46	1,08	0,00	1,00	8,52
Paganini	21	71,94	0,98	6,79	0,20	0,94	10,37
Pugnani	21	41,76	1,66	2,81	0,00	5,80	6,01
Container vessel							
Beethoven	20	21,93	0,43	4,80	0,00	0,00	3,71
Kaya	17	79,43	0,18	2,87	0,40	0,00	13,32
Perla	19	67,82	0,19	3,30	0,00	0,00	10,25
Pona	22	53,75	0,15	6,32	0,00	0,00	7,48
Porto	21	91,93	0,78	3,40	0,00	0,00	12,50
Posen	20	82,72	0,96	2,39	0,00	0,00	11,76
Pontresina	20	28,53	0,08	3,46	0,00	0,00	4,38
Pinara	19	34,99	0,36	5,80	0,00	0,00	5,92
PCTC							
Paganella	24	89,88	4,23	1,56	5,28	0,00	1,09
Paganino	22	49,77	0,47	3,23	0,00	0,00	0,66
Paglia	20	23,49	0,00	4,45	0,00	0,00	0,38
Pagna	22	35,40	0,89	5,78	0,00	0,00	0,52
Parana	22	44,00	0,00	5,34	0,00	0,00	0,61
Passama	22	40,38	0,00	6,53	0,50	0,00	0,58
Passero	22	28,60	0,00	8,46	0,00	0,00	0,46
Patara	22	31,58	0,00	10,76	0,00	0,00	0,53
Research vessel							
Polarstern	95	51,80	0,40	13,72	0,00	0,00	1,90
Annual sum	646	1.217,77	18,87	119,74	6,38	7,74	5,14





Abbreviations + Definitions

BW	Ballast water
BWMP	Ballast water management plan
BWTP	Bilgen water treatment plant
CO ₂	Carbon dioxide
CO	Carbon monoxide
EEOI	Energy Efficiency Operational Index (g CO ₂ / TNm)
Gray water	Waste water from galley, laundry, showers, wash-basins etc.
HC	Unburned hydrocarbons
HFO	Heavy Fuel Oil
IMO	International Maritime Organization
MARPOL	International Convention for the Prevention of Pollution from Ships
MDO	Marine Diesel Oil
MEPC	Marine Environment Protection Committee
Garbage categories according MARPOL Annex V	Cat. A Plastic
	Cat. B Food waste
	Cat. C Domestic waste (e.g. paper products, rags, glass, metal, bottles, crockery etc.)
	Cat. D Cooking oil
	Cat. E Incinerator ash
	Cat. F Operational waste
	Cat. G Cargo residues
	Cat. I Fishing gear
Nm	Nautical Mile (1 Nm = 1,852 km)
NO _x	Nitric oxides
Passengers	Each person, who doesn't belong the crew.
PCTC	Pure Car/Truck Carrier
ppm	Parts per Million - dimensionslose Konzentrationsangabe
R404a	Refrigerant gas mixture for air conditions and provisions cooling plants
SECA	Sulphur Emission Control Area according MARPOL Annex VI
SEEMP	Ships Energy Efficiency Management Plan
Sewage („Black water“)	Waste waters from the toilet installations and the medicinal treatment room
SO _x	Sulphur oxides; formed through the oxidation of in the fuel contained sulphur
Specific Fuel Consumption	Specific fuel consumption, abbreviated SFC, compares the ratio of the fuel used by an engine to a certain force such as the amount of power the engine produces. Specific fuel consumption allows engines of all different sizes to be compared to see which is the most fuel efficient.
TNm	Tons*Nautical Miles = Size of the transport performance
VCS	Container vessel