



PRACTICAL EXPERIENCE WITH THE ADAPTION OF THE INLAND NAVIGATION FLEET TO CHANGES IN THE WATER DISCHARGE AND WITH THE REDUCTION OF FUEL CONSUMPTION

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Identification of the concerns



Adaptation of the fleet Facts & Figures



Total European inland shipping fleet, 2008

	Motorized freight vessels	Motorized tankers	Push boats	Tugs	Towing barges	Passenger vessels	Freight push barges	Tanker push barges	Towing vessels	Total
West European inland shipping fleet										
Belgium	1,252	269	72	27	64	37	272	7	5	2,005
Germany	1,074	460	181	116	85	748	995	36	3	3,698
France	960	35	147	11	0	4	475	70	0	1,702
Luxembourg	12	17	13	1	6	3	0	2	0	54
the Netherlands	3,301	862	170	533	391	617	1,038	43	1	6,956
Austria*	28	4	13	6	0	0	96	0	43	190
Switzerland	17	42	0	1	4	56	2	1	0	123

Total - 14.728

East European inland shipping fleet

Bulgaria*	22	0	22	28	9	0	99	0	1	181
Croatia*	2	2	10	36	0	0	44	0	1	95
Hungary*	10	5	16	14	1	0	0	0	1	47
Moldavia*	3	0	0	0	1	0	0	0	0	4
Poland*	10	0	236	9	0	76	384	0	5	720
Romania*	32	5	124	365	54	0	735	0	8	1,323
Serbia*	65	4	45	66	0	5	144	48	1	378
Slovakia*	12	0	34	2	0	0	0	0	2	50
Czech Republic*	67	0	20	85	0	67	0	0	2	241
Ukraine*	44	0	21	9	46	0	369	0	1	490

Source: www.informatie.binnenvaart.nl/ / IVR

* data from 2005

The entire East and West European inland shipping fleet consists of almost 19,000 vessels and units. The East European fleet revolves around the Danube, while the West European fleet is focused on the Rhine. A larger share of the East European fleet is taken up by push & tug vessels, more so than the West European fleet.

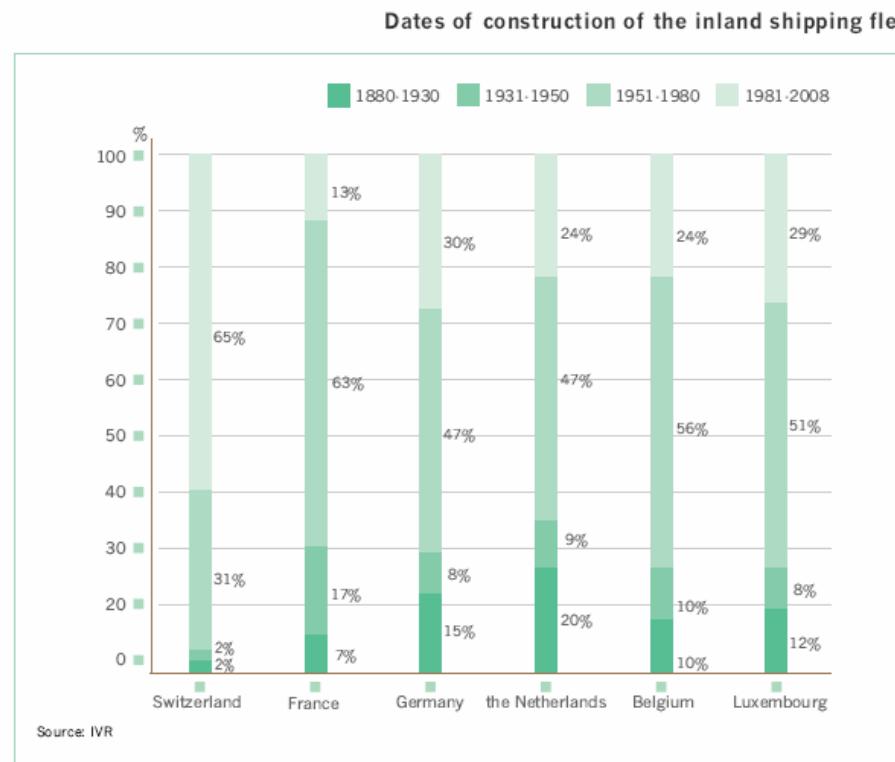
Total - 3.529

Adaptation of the fleet

Facts & Figures



25% of the Northwest European fleet consists of new vessels up to 20 years old



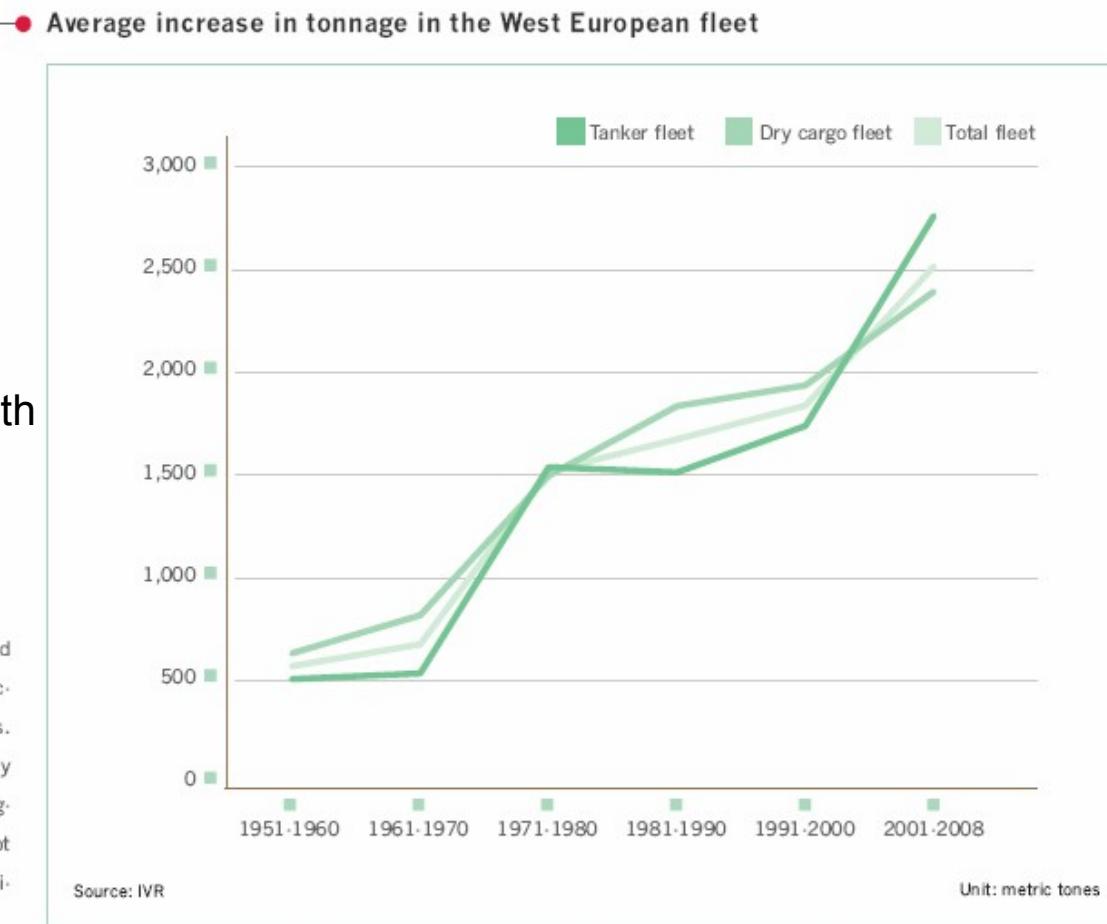
Vessels are highly durable. Provided they are well-maintained and regularly invested in, vessels tend to have a lifespan of over 50 years. About a quarter of the Northwest European fleet consists of new vessels up to 20 years old.

Adaptation of the fleet Facts & Figures - continued



Vessel's draught as it relates to waterdepth

Scaling up is the main trend in the inland shipping sector over the past 50 years. Increases in scale firstly occur in the tanker segment, as it is easier to adapt loading and unloading facilities for these vessels.



Facts & Figures of the fleet



Motorvessels						
Class		Length	Depth	CEMT Loading capacity	Number vessels	Loading capacity fleet
I	a	38.5	2.48	367	961	352.687
	a	50	2.45	535	320	171.200
II	b	55	2.58	616	139	85.624
	a	55	2.59	659	124	81.716
	b	67	2.53	794	104	82.576
	c	70	2.60	858	80	68.640
	d	67	2.55	909	354	321.786
	e	73	2.73	1046	135	141.210
	f	80	2.59	1134	426	483.084
	g	85	2.67	1259	152	191.368
Source: Climate change and inland shipping Port Research Centre Rotterdam - Delft December 2005						
	a	80	2.72	1365	176	240.240
	b	85	2.9	1533	267	409.311

Necessity to adapt the inland navigation fleet

Facts & Figures concerning the climate



Year	Annual Discharge		Summers in NL (June/July/August)				Klimaatverandering en inlandse vaartwatergangen		
	Minimal discharge m³/s		Average temperature (°C)		Sunshine (hrs)		Downfall (mm)		
	Day average	Month	Warmest		Sunniest		Dry		
1947	620	11	1947	18.7	1947	840	2003	74	
1949	635	11	2003	18.6	1976	814	1921	85	
1921	670	11	1976	18.4	1959	797	1983	88	
1954	680	11	1983	18.2	1911	738	1959	104	
1959	715	1	1995	18.2	1975	736	1949	110	
1971	760	10	1994	18.0	1995	725	1976	113	
1943	780	11	1997	18.0	1983	708	1984	133	
2003	780	11	1992	17.8	1949	704	1989	134	
1976	782	8	1911	17.6	1934	700	Port of Rotterdam	134	TU Delft
Sources: Climate change and inland shipping Port Research Centre Rotterdam - Delft 1955	794	916	1973	1976	1973	1976	1995	135	

December 2005

Necessity to adapt the inland navigation fleet

Facts & Figures concerning the climate



Load capacity	Motor vessel V (tons)	Motor vessel (ton)	Pushbarge V (ton)	Push barge fleet (ton)	Fleet (ton)
Unlimited waterdepth	39.089.952	241.965.936	101.532.384	137.852.856	379.818.792
Average waterdepth currently	39.089.952	241.965.936	100.043.520	136.178.740	378.144.676
Average in 2050	39.089.952	241.965.936	97.959.686	133.918.258	375.884.194
-loss	0	0	2.083.834	2.260.482	2.260.482

Source: Climate change and inland shipping Port Research Centre Rotterdam - Delft
December 2005

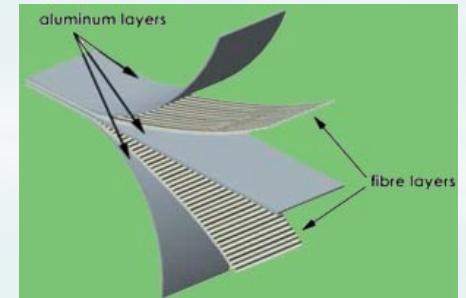


Results of the climate change in 2050 compared with the most “expensive” years thus far

Based on historic year	Total cost in million EUR/year (% increase in comparison to current conditions)			
	Current	Average	High	Drought scenario
1921	2992	3106 (+3.8%)	3233 (+8.1%)	3274 (+9.4%)
1949	2784	2801 (+0.6%)	2835 (+1.8%)	2921 (+4.9%)
1947	2620	2654 (+1.3%)	2712 (+3.5%)	2909 (+11%)
1959	2565	2564 (+0%)	2613 (+1.9%)	2862 (+12%)
1976	2524	2623 (+3.9%)	2682 (6.3%)	2979 (+18%)

Source: Climate change and inland shipping Port Research Centre Rotterdam - Delft
 December 2005

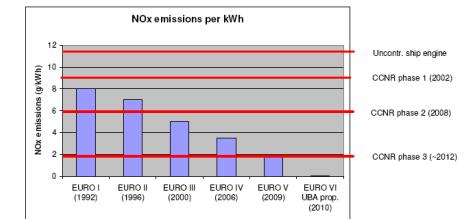
Practical solutions



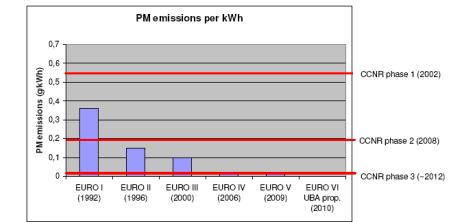
- Hydrodynamic solutions
- Cold Ironing – shore supply
- Human factor
- LNG Dual Fuel – Emission development engines



Source: Lightweight Structures B.V.

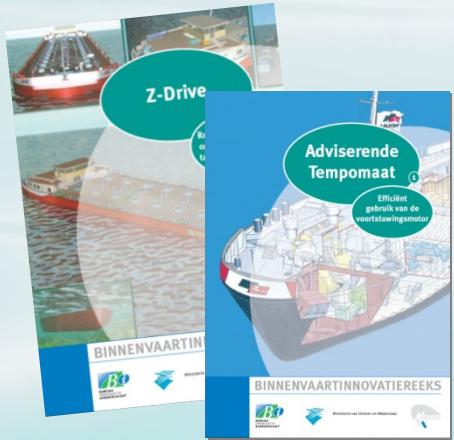


Figuur 2: Maximum NOx emissies volgens EURO (truck) en CCR (schip) standaarden



Figuur 3: Maximum PM emissies volgens EURO (truck) en CCR (schip) standaarden

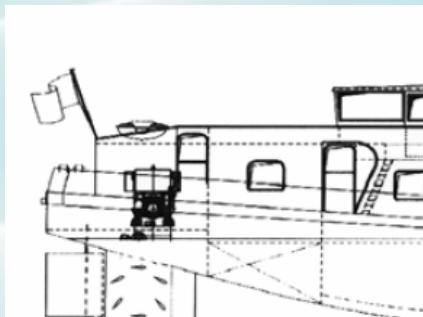
CO₂ reducing techniques for inland shipping



Vectorpropellor



Friction reducing coatings



Propulsion concept



Bio fuels (?)

Shore supply - cold ironing



Project sponsored
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- Case study “Drechtsteden”
- 25 shore supply portals
- 86 hook ups
- Payment system – Ecocard – Creditcard – Text messaging etc.
- Essential : “technical uniformity throughout Europe”

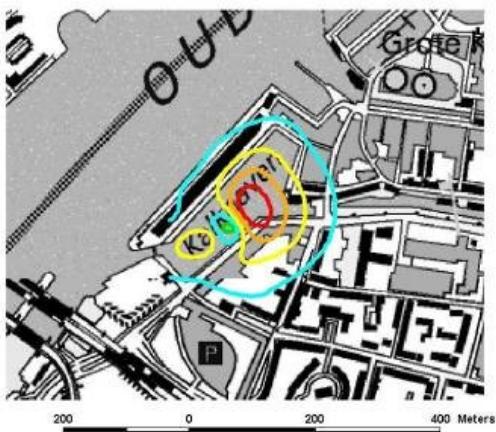
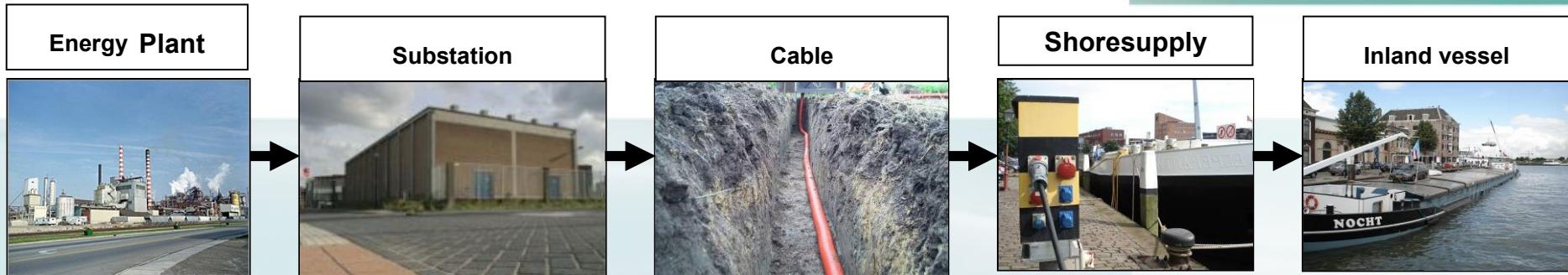
Category	Power (kVA)	Fuel consumption (liters/24 hrs)
WT small	< 50	50
WT large	> 50	150
Passenger vessel	150 - 250	300



Shore supply - cold ironing



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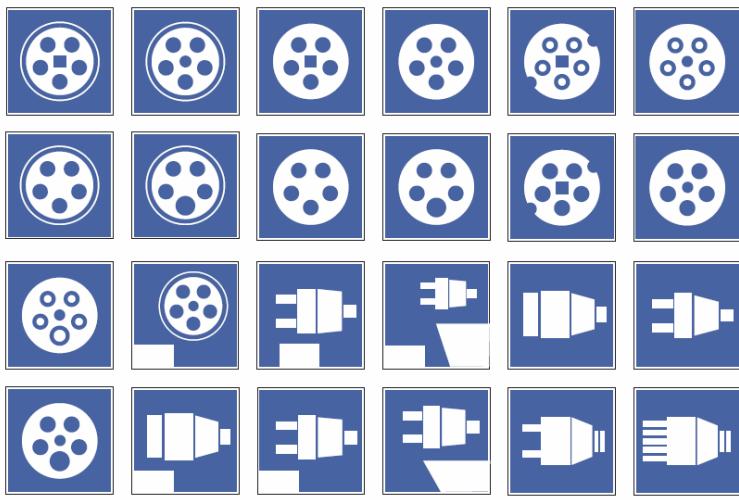
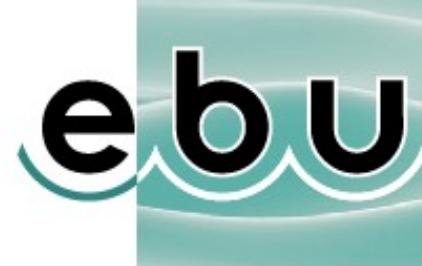


	Avoided NO _x emission [kg/yr]	Avoided CO ₂ emission [ton/yr]	Noise emission Lp at 10m in dB(A)
Dordrecht			
Achterhakkers	3.921	232	63
Bomhaven / Leuvehaven	2.741	162	63
Buiten Walevest	6.487	384	63/71
Kuipershaven	224	13	63/71
Merwedekade	2.928	173	63/71
Wantijkade	2.975	176	63
Kolenhaven	1.405	38	63
ZwijndrechtZomerlustkade	176	10	63
Sliedrecht Schuttevaerkade	8.361	495	63

Cold Ironing - Shore Supply



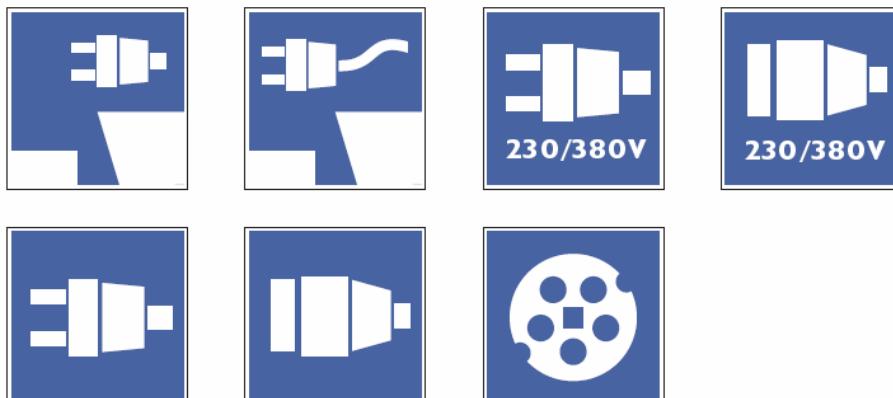
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Reglement van politie voor de rijnvaart

Rheinschifffahrtspolizeiverordnung

Reglement de Police pour le navigation du Rhin



CO₂ Competition - Human Factor



Case Study – CO₂ Competition

First competition 2008

Second competition 2009 underway

Ecorys Study

Reduction results top 5 after 8 weeks of competition

2008	
1. Danser	25,4 % ↑
2. Vopak	17,9 % ↑
3. Chemgas	17,4 %
4. Veerhaven	15 % ↑
5. Wijgula	10 % ↑

Eindstand Schepen

De eindstanden van het scheepssklassement na 8 weken CO₂-competitie

1. Alsace-Hollande (Danser)	54,2 % ↑
2. Pasteur (Vopak)	40,5 % ↑
3. Laurent-Laurens (Danser)	31,8 % ↑
4. Faraday (Vopak)	31,7 % ↑
5. Chubasco (Chemgas)	31,2 % ↑
6. Embata (Chemgas)	26,9 % ↓
7. Maxwell (Vopak)	25,8 % ↓
8. Veerhaven 5	23,9 %
9. Veerhaven 10	22,9 % ↑
10. Lorentz (Vopak)	22,2 % ↑
11. MarlaDuo-Marla (Danser)	21,9 % ↑
12. Brise (Chemgas)	18,7 % ↓
13. Veerhaven 9	18,6 % ↓
14. Karin (Wijgula)	16,5 % ↑
15. Veerhaven 4	16,2 % ↓
16. Grindelwand-Müren (Danser)	15,1 % ↓
17. Pascal (Vopak)	15 % ↓
18. Ina (Wijgula)	13,9 % ↑
19. Veerhaven 7	11,7 % ↓
20. Veerhaven 8	10,4 % ↓
21. Synthese-4 (Wijgula)	7,7 % ↓
22. Veerhaven 2	7 % ↓
23. Synthese-1 (Wijgula)	1,1 % ↑
24. Eigen Nordwand (Danser)	0 % ↓

2009

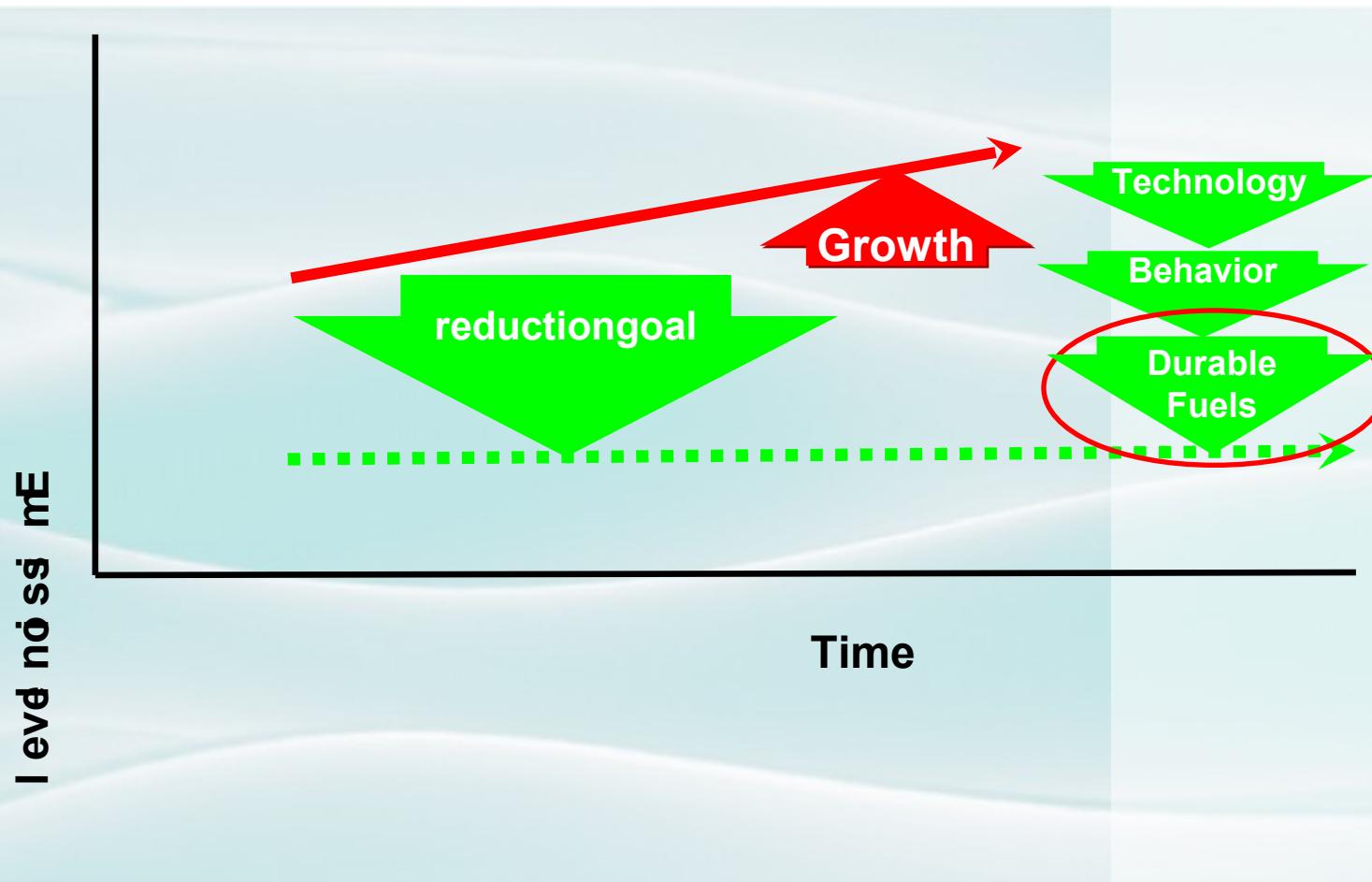
	t/m mei	t/m april
1. Interstream Barging	44,1 % ↑	10,7 %
2. Chemgas	59,3 % ↑	51,9 %
3. Thyssenkrupp Veerhaven	2,76 % ↓	10,4 %
4. Caruton	0 %	0 % ↓
* Victrol NV		

* Gegevens nog niet bekend

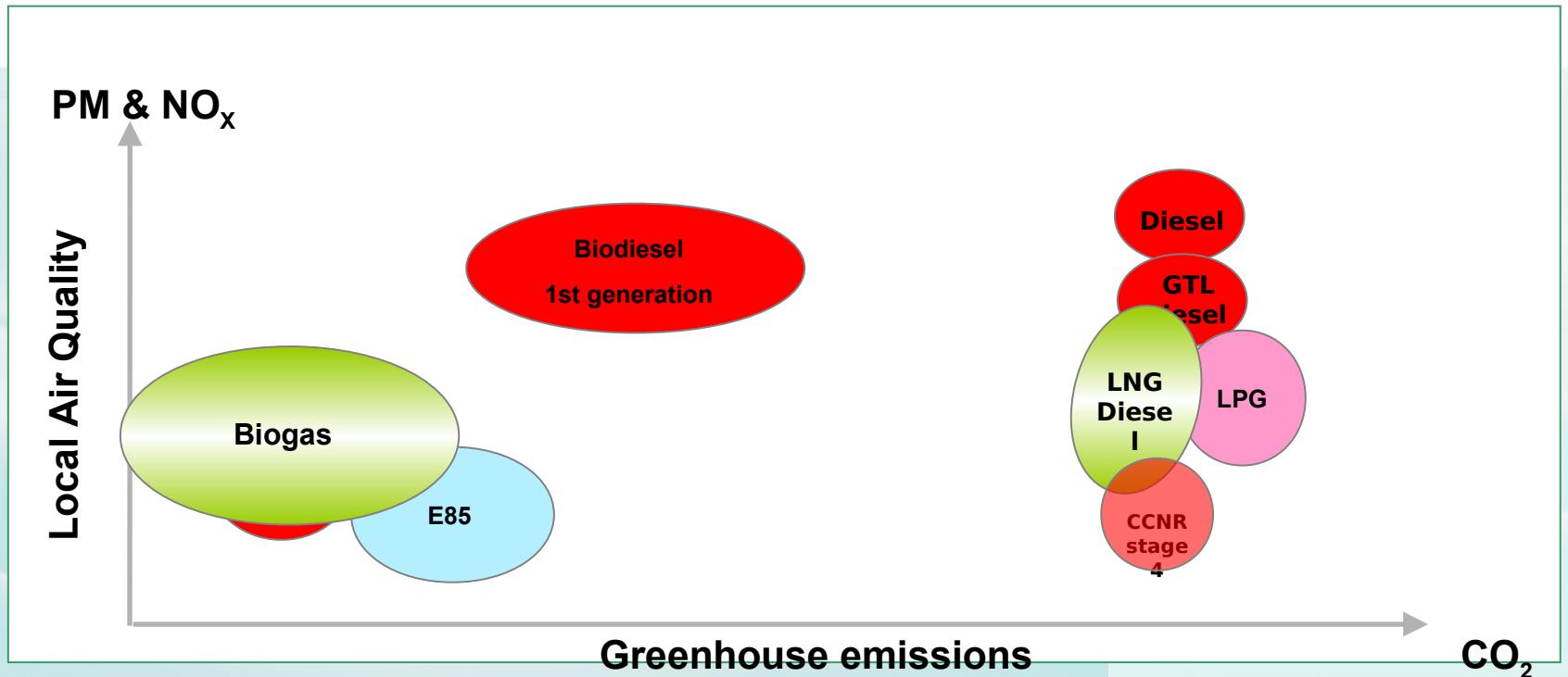
Preliminary results

	t/m mei	t/m april
1. Solano (Chemgas)	78,8 % ↑	76,3 %
2. Maxwell (Interstream Barging)	60,7 % ↑	55 %
3. Chinook (Chemgas)	58,4 % ↑	42,1 %
4. Lorentz (Interstream Barging)	44,2 % ↑	38 %
5. Dongestroom (Interstream Barging)	44,4 % ↓	45,1 %
6. Noortstroom (Interstream Barging)	38,9 % ↑	37,2 %
7. Hartelstroom (Interstream Barging)	38,7 % ↑	16,7 %
8. Giessenstroom (Interstream Barging)	38 % ↑	38,7 %
9. Cycloon (Chemgas)	36,6 % ↑	0 %
10. Geulstroom (Interstream Barging)	36 % ↑	31,4 %
11. Dintelstroom (Interstream Barging)	27,9 % ↓	29,5 %
12. IJsselstroom (Interstream Barging)	26,3 % ↑	19,2 %
13. Zaanstroom (Interstream Barging)	21,8 % ↓	22,2 %
14. Curie (Interstream Barging)	20,8 % ↑	0 %
15. Chamsin (Chemgas)	19,4 % ↓	41,3 %
16. Zennestroom (Interstream Barging)	13,3 % ↑	0 %
17. Amstelstroom (Interstream Barging)	8,7 % ↑	0 %
18. Eemstroom (Interstream Barging)	7,9 % ↑	12,5 %
19. Veerhaven 4	7,6 % ↓	12,2 %
20. Bernissestroom (Interstream Barging)	6,3 % ↑	4,6 %
21. Berkelstroom (Interstream Barging)	4,6 % ↓	14,7 %
22. Pasteur (Interstream Barging)	4,5 % ↑	0 %
23. Reggestroom (Interstream Barging)	4 % ↓	15,3 %
24. Veerhaven 7	2,8 % ↓	15,4 %
25. Veerhaven 8	0,4 % ↓	10,6 %
26. Veerhaven 2	-	4,9 %
27. Veerhaven 10	0 % ↓	0 %
28. Veerhaven 9	0 % ↑	0 %
29. Waalstroom (Interstream Barging)	0 % ↑	0 %
30. Galileo (Interstream Barging)	0 % ↑	0 %
31. Veerhaven 5	0 %	-

Case Study Dual Fuel LNG

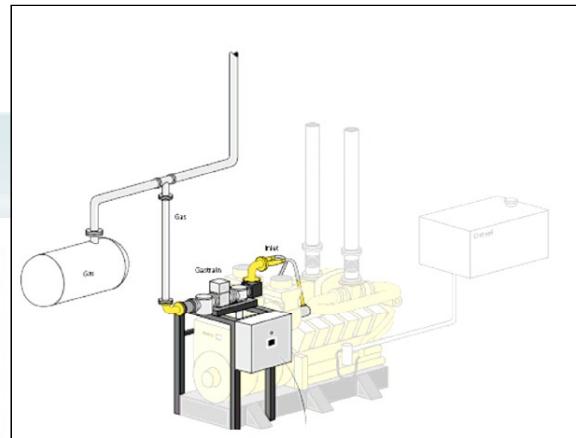


Case Study Dual Fuel LNG



E85 = 85% Ethanol and 15 % Gasoil

Case Study Dual Fuel LNG



**ROSR - Fp > 55
°C**

**RheinSchUO
RVBR**

Case Study Dual Fuel LNG 2400 kW vessel

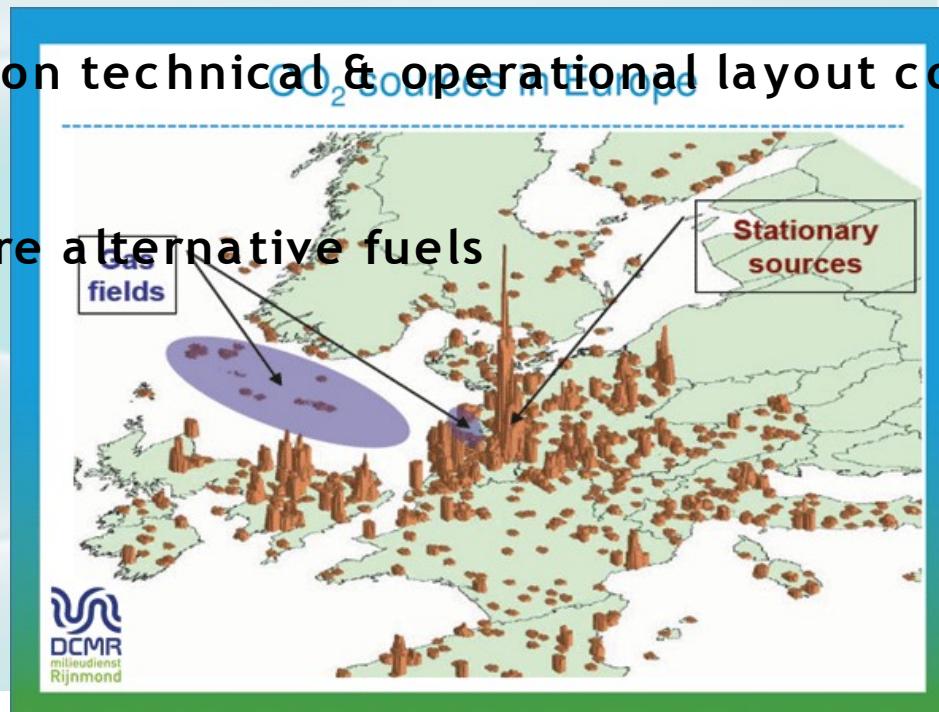
- 50% reduction in NOx ($5,5 \text{ ton/yr} = 0,02\% \text{ IWT Netherlands (total)}$)
 - 80% reduction in PM ($0,5 \text{ ton/yr} = 0,04\% \text{ IWT Netherlands (total)}$)
 - 15% reduction in CO₂ LNG ($110 \text{ ton/yr} = 0,006 \% \text{ IWT Netherlands (total)}$)
 - 80% reduction CO₂ LBM ($600 \text{ ton/yr} = 0,03 \% \text{ IWT Netherlands (total)}$)
-
- Installation costs: SCR+PM filter (but with CO₂ reduction)
 - Fuel: -5% to -10% vs. fossil diesel (-15% tot -25% vs. biodiesel)

Questions & Answers

Thank you



- Additional research through Platina - WP2 Fleet hydrodynamic solutions
- Harmonisation technical & operational layout cold ironing
- Legislature
- Infrastructure alternative fuels



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