Final Report - Annex Report

Medium and long term perspectives of IWT in the European Union

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Contents

ANNEX 1 SWOT Tables

Supply side

Table 1 SWOT as seen from the supply side

	Strengths	*Weaknesses*
Internal origin	• Sufficient fleet capacity, in particular large vessels • Much spare capacity on waterways to foster a growth of traffic • High amount of flexible entrepreneurs in the market	• Long life-time of inland vessels and engines • Ageing human resources, lack of influx, shortage of qualified staff • Fragmented and atomised SME structure resulting in low co-operation and missing scale effects in organisation, transport planning, marketing and acquisition • Overcapacity and small profit margins • Limited use of ICT systems • Missing infrastructure links, limited fairway conditions and lack of transhipment areas and multimodal connectivity • Poor safety culture for workers (internal safety)
	Opportunities	*Threats*
External origin	• Funding programmes for infrastructure • Stimulating policies for IWT to strengthen supply side • Pricing of competing modes: road transport and rail	• Growing pressure on space usage along waterways (e.g. housing projects) • Conflicts with ecology (nature reserve) • Internalisation of infrastructure costs for IWT • Possible negative impacts on water levels due to climate change effects

Demand side

Table 2 SWOT of IWT activities in general as seen from the demand side

	Strengths	*Weaknesses*
Internal origin	♦ Low freight rates ♦ Reliable transport operation ♦ Low carbon footprint ♦ Available transport capacity ♦ Available infrastructure capacity; growth potential, e.g. on the Rhine river ♦ High market share in traditional sectors (captive markets for IWT) ♦ Comparatively high safety levels; in particular external safety (risks for population or the environment) ♦ High level of innovation ♦ No excise duties in international markets	• Not all origins and destinations are located in the proximity necessitating the use of transhipment and other modes • Lack of visibility and poor image, knowledge and awareness at potential clients • Varying water levels causing a low predictability of service levels and changing freight rates • High or low a water levels and accidents can block parts of the waterway network for long periods • Dependence on a limited number of large customers and industries • Low operational speed • Low level of awareness of integral supply chain developments (door-to-door) • Limited knowledge of marketing and supply chain management • Industry fragmentation and reaction to external shocks (e.g. recent economic crisis).
	Opportunities	*Threats*
External origin	• Growing demand for low carbon transport solutions • Congestion on motorways • Limited capacity for rail freight development • Attracting new markets such as waste transport, bio fuels, LNG, pallets, continental containers • Increased awareness of safety and security problems • Growing number and position of inland container terminals • Commercial co-operation and increase of scale in (multimodal) logistics • Growth of world trade resulting in growth of maritime container market ♦ Infrastructure expansion projects (e.g. Seine-Schelde project)	• Loss of markets due to energy policy (e.g. coal and fossil fuel transports) • Impact of high-oil prices on various industries that are customers of IWT • Limited political support and funding resulting in poor condition of many waterways • Further liberalisation of rail transport markets • Introduction of Long and Heavy Vehicles for road haulage (e.g. 3 TEU truck) • Increased restriction of banks for investment as an aftermath of the crisis

Table 3 SWOT for IWT operations in the sand and gravel/ construction industry market segment

	Strengths	*Weaknesses*
Internal origin	♦ Extremely low freight rates ♦ Massive transport capacity could be mobilised ♦ Strong integration with gravel mining activities in certain rivers (especially Meuse and Rhine) ♦ Vessels could be used as storage facilities as well ♦ Fixed network of destinations in industrial sand and gravel market ♦ High market share in traditional sectors (captive markets for IWT) where there is almost a locked-in situation ♦ Natural proximity of course for all port- and waterways related infrastructure projects	• Many road and city related infrastructure projects are not close to the waterways network • Relatively old vessels are used and there is a low level of innovation in this particular market segment • The sub-market segment of project related transport is almost 100% without return shipments/ cargo (there is strong imbalance in freight flows), vessel capacity utilisation rates are therefore very low • Operators do not have a strong negotiating power with respect to shippers • Dependence on (limited) waterway levels in many situation • Inland ports and transhipment area's are under pressure (concrete production plants)
	Opportunities	*Threats*
External origin	♦ New flows will have to replace the present flows that are associated with river mining. More gravel will be transported from sea-locations for which IWT has an even stronger market position ♦ In addition this relocation may even create new market for sea-river transport as well ♦ More and better collaboration among the operators ♦ New infrastructure projects and dredging works	• Reduction of population and therefore the population related construction activities • Environmental requirements and taxation with respect to mining • Substitution of sand and gravel by other building materials • Low rate of recovery of construction industry from the impacts of the economic and financial crisis

Table 4 SWOT for IWT operations in the steel industry market segment

Internal origin	*Strengths*	*Weaknesses*
	♦ Input flows to the steel industry because of the low freight rates ♦ Massive specialised transport capacity could be mobilised (push convoys) ♦ Ore and coal flows related to seaport and the use of mega-carriers on sea trajectories ♦ Vessels could be used as storage facilities as well ♦ High market share: this is a captive market for IWT along the Rhine ♦ Seam-less integration of ores/ coal in logistic supply flows to steel factories	• Limited growth potential: stagnating market. Because the growth rates of customer industry/ steel industry are low as well • Position of IWT in output –flows, the metal products of project related transport is almost 100% without return shipments/ cargo (there is strong imbalance in freight flows) • Safety concerns with regard to stability of transport of metal products • Interaction with other waterway users can be a problem because of the sheer size of push convoys • Strong dependence on (limited) waterway levels because of the large scale of transport and the draft of barges • Not a high level of competition or market dynamics (limited number of parties involved) • Limited number of independent operators
External origin	*Opportunities*	*Threats*
	♦ Positive growth rates on the short run because of the recovery of steel industry from the impacts of the economic crisis ♦ Shift from rail transport/ the ore trains to IWT/ ore vessels	• Economic survival of European steel industry is a problem. Restructuring of the steel industry will lower production levels • High oil prices • Replacement of own EU steel production to other countries and steel import flows • Environmental impacts of steel industrial activities • Railway infrastructure expansion projects

Table 5 SWOT for IWT operations in the Agribulk market segment

	Strengths	*Weaknesses*
Internal origin	♦ Low value density of the products that are shipped in this market in general. ♦ Reliability; no congestion is a strong point because in this market segment in particular IWT has to compete with road transport ♦ Innovative and environmentally friendly transhipment systems are being used in some sites; ♦ Connection to seaports and sea transport for the import flows ex. animal feed, some grains)	• Cost advantages with respect to road and rail transport are not so high in this market segment because of the (relatively) limited scale of operation. • Dependence on seasons (harvest) and weather conditions • Imbalance in freight flows • Safety concerns with regard to food supply chains and an accompanying increase in customer requirements • Only a limited number of agricultural industries is located along or close to the waterway network
	Opportunities	*Threats*
External origin	♦ An entirely new market may arise in bio fuels. This could also be an opportunity for tankers. ♦ For this market segment a further increase of oil prices is therefore favourable	• The present IWT related agricultural sub market segment are expected to decrease in the next years because of decrease of cattle stocks, diminishing use of fertilizers and the liberalisation of the grain industry. • Smaller vessels are not interesting to invest in for new market entrants. So there will very likely be a vessel shortage in the future • Increasing demand on transport because of food-security concerns (e.g. GMP)

Table 6 SWOT for IWT operations in the coal transport to Power Plants

Internal origin	*Strengths*	*Weaknesses*
	♦ Strategic location of seaport accessible by sea bulk carriers as well as IWT operations ♦ Location of many power plant close to waterways and/ or the sea ♦ Sufficient loading capacity of IWT for hinterland transport ♦ Large scale of operations and the use of specialised equipment enabling low costs and dedicated service	• Limited capacity in waterways in parts of Germany (e.g. Saarland) • Transport is generally large scale and highly sensitive for draught limitations • Difficult competition in the market between different vessel types (push barges and large motor vessels) • Strongly fluctuating flow of cargo to be transported by IWTs because of seaport competition in this market segment • Interaction with the recreational use of waterways and other market segments of IWT • No return cargo; empty voyages
External origin	*Opportunities*	*Threats*
	♦ Shift to more imports from overseas regions or from Eastern Europe ♦ Peak-oil point to be reached in 2015. It is expected that then the use of crude oil quickly diminishes and all other fuel types will be required to fill the energy demand ♦ Growing concerns about nuclear power plants resulting in more transport needed to supply coal fired power plants	• Environmental concerns with regard to emissions of electricity generation in coal powered plants and also concern about coal storage locations in ports • Stagnation in the consumption of coals because of the envisaged replacement with gas or other types of fuels • Uncertainty with regard to the long term energy policies of various countries • Competition by rail and new rail freight infrastructure • Low profitability because operators in this market segments are often also active in the supply of cokes to the steel industry which is expected to decrease

Table 7 SWOT for IWT operations in the petrochemical and chemical market segment

Internal origin	*Strengths*	*Weaknesses*
	♦ Low cost and massive flows ♦ Location of storage and refineries in seaports which are accessible by mega tankers in the sea trajectory ♦ Transport via IWT is comparatively less damaging for the environment than for other modes ♦ High requirements barge shipping and well equipped vessels. E.g. EBIS system ♦ Relatively low external (for the general population) risk in the transport of hazardous goods ♦ Safety culture is fairly highly developed in this particular market segment	• Strong speculative waves in the market create a high level of uncertainty in demand for IWT • Strong dependence on seasonal flows and the IWT vessels are highly sensitive for draught limitations as well • Very difficult regulatory environment because of the process of phasing out of mono hull vessels until 2018 • Significant overcapacity in the market • The use of highly specialised vessels makes this type of transport often not very flexible • Strong imbalance in seaport related transport flows • Lack of qualified staff resulting in high labour costs
External origin	*Opportunities*	*Threats*
	♦ Continuous growth in the transport of chemical products ♦ Also an increase in LNG and LPG markets is expected ♦ Perhaps a new market segment will emerge in the transportation of bio-fuel ♦ Possible expansion of market shares in hazardous goods transport ♦ Further increase of safety amongst others because of the use of double-hull vessels ♦ Innovation e.g. by the use if new types of vessels made from alternative materials	• Gradual reduction of volumes and demand for fossil oils and crude oil will take place in the next years • High oil prices may accelerate the decline • Adverse safety impacts because of difficult financial position of companies as a result of the overcapacity in the market • Difficult position of the European chemical industry and possible transfer of activities to e.g. Asia and Middle-East • Increased investments related to safety requirements for vessels and loading/ unloading of vessels might be imposed on operators

Intermodality and logistics

Table 8 SWOT on intermodality and logistics

	Strengths	*Weaknesses*
Internal origin	♦ Good hinterland connections and strong position in seaports ♦ More substantial scale effects can be achieved in IWT compared to other modes ♦ Clean and low-noise transport ♦ Level of renewal and innovation in the fleet of container vessels ♦ Organising capabilities of operators and terminal operators ♦ Strong integration of IWT operations with inland terminal logistics ♦ Number and location of inland terminals ♦ Capacity of the waterway network	• Capacity problems and long waiting times in seaport terminals • Inefficiencies in seaport related activities (too many calls) • Lack of cooperation between operators • Structural imbalances between flows of loaded and empty containers • Low market share of IWT in the transport of continental containers • Limitation of heights of bridges; especially in regional parts of the network • Limited 24/7 operations on certain waterways • Stability problems because of lack of information (operators do not know weight of individual containers) • Limited information exchange of crew with staff terminals • Supply chain management skills and door-to-door thinking are lacking
	Opportunities	*Threats*
External origin	♦ High growth level are predicted for the container market, especially because of modal split commitments made by Port authorities the market volumes will increase significantly ♦ Continental (container) market could be developed ♦ Further increase of scale on main waterways could further decrease cost ♦ Possible expansion of market shares, e.g. in hazardous goods transport, perishables, waste transport ♦ New infrastructure projects will almost certainly create additional market volumes ♦ Port infrastructure projects will increase capacity in ports and may decrease waiting times	• Different standards of containers could diminish capacity • Getting personnel; well trained staff will become an important bottleneck • Developments in other modes of transport (e.g.. dedicated railway lines like Betuweline and road trains in road freight transport) • Lack of transhipment capacity inland terminals; land use planning in favour of other functions • Political lobbying by railway companies • New safety and environmental requirements for container vessels and operations • Security requirements in case of attacks by terrorists

External effects, climate and energy

Table 9 SWOT on external effects, climate and energy

	Strengths	*Weaknesses*
Internal origin	• Very **low noise emissions.** Several external costs studies attribute no noise costs to inland waterway transport. • Relative **low GHG emissions** per tkm. Especially the larger vessels have lower GHG emissions compared to trucks • The **costs of congestion** are quite low under normal circumstances.	• High dependency on fossil fuel in comparison with rail transport • **Specific emissions of** NOx and PM in inland shipping are relatively high compared to the main competitors road and rail (electricity). The expectation is that road transport will be able to lower its pollutant emissions faster since the shorter lifetime of engines and already existing emission standards resulting in emissions below 2 g/kwh.
	Opportunities	*Threats*
External origin	• The EU develops **climate policies for freight transport**. Since the specific GHG emissions of transport are low, IWT may benefit from this. • Supporting policies, incentives and funding for clean engines and fleet renewal • Application of new fuel types such as LNG, bio fuels • Due to lower external costs, internalisation of external costs may result in a competitive position for IWT • Increased attention from shippers for cleaner shipping resulting in financial incentives for application of low emission technology and new fuel types such as LNG (e.g. Akzo shuttle)	• **Long lifetime of ship and engines.** Generally, the lifetime of truck engines is approximately half the lifetime of an inland barge engine. • High infrastructure costs. • Crisis in the European economy resulting in pro-longed financial problems of vessel owners/operators, resulting in a low financial feasibility to invest in clean technologies.

ANNEX 2 Methodology and approach for forecasting

2.1 The basic variant for the Baseline scenario

As could be seen in section 3.1 of the Main Report the study uses forecast for the development of IWT for the future years 2020 and 2040, which are the chosen time horizon years for development in the medium in the medium (2020) and long (2040) term.

Such forecasts are based on certain scenarios for the future of IWT, and incorporate a number of key assumptions regarding:

1. The development of the world- en EU economy
2. Depletion of resources of raw materials, world market prices for resources
3. Demographic, social, technological and cultural developments
4. Economic and transport policy environment in the EU

The basic forecasts that were used in the present study were derived from other already existing study in particular on the TEN CONNECT 2 study. This is a successor project to the 2009 TEN CONNECT study, regarding development of a transport network model and estimation of traffic growth at a European scale. For the horizon year 2030 transport developments in the entire EU were estimated, using a freight model which was calibrated on the year 2005.

Data for the base year for the quantitative analyses were provided by ETIS/TRANSTOOLS data. The main reason for selecting 2007 as the base-year is that this is the most recent year for which the data on EU27 is available and considered as reliable. Another reason is that year 2007 was prior to the crisis that started in 2nd half of 2008 and caused substantial volatility in the observed freight flows. Furthermore, in the year 2007 the market situation was rather balanced in terms of supply and demand and there was no extreme water level situation in that year either.

IN TEN CONNECT 2 a Baseline Forecast for 2030 was made and three different infrastructure scenarios were modelled. For this a multi-modal modelling framework based on the STEMM concept was developed during the WORLDNET project in 2009. This methodology was used and has been calibrated and developed within the TEN-T Ports study in 2010. The forecast scenario Baseline 2030 from TEN CONNECT 2 study is in line with 2011 European Commission White Paper. The scenario settings are shown in table below:

<table>
<tr><th>Lever</th><th colspan="2">Setting</th></tr>
<tr><td>Year</td><td colspan="2">2030</td></tr>
<tr><td>Growth Assumptions</td><td colspan="2">ITREN (includes the effects of the financial crisis)</td></tr>
<tr><td rowspan="4">Policy Assumptions</td><td>Road Transport:</td><td>more expensive than base year due to internalisation of external costs.</td></tr>
<tr><td>Rail Transport:</td><td>no change compared to the base year setting: higher efficiency offset by lower subsidies.</td></tr>
<tr><td>Inland Waterway Transport:</td><td>no change compared to the base year setting.</td></tr>
<tr><td>Sea Transport:</td><td>more expensive than base year due to controls on sulphur emissions.</td></tr>
<tr><td>Infrastructure</td><td colspan="2">TEN-T projects according to ITREN2030 Integrated Scenario</td></tr>
</table>

Source: TEN CONNECT 2

2.2 Assumptions on the development of key economic, demographic and policy variables

As could be seen from the table key assumptions on the growth of transport in the TEN CONNECT 2 study were based on the EU iTREN 2030 integrated scenario. This was developed by the iTREN 2030 project to take into account the effects of the financial and economic crisis.

The iTREN-2030 project developed two scenarios: a Reference Scenario (REF) that describes a world in which current trends are continuing and policies are frozen in 2008, and an Integrated Scenario (INT) that is driven by changing framework conditions, a few breaks-in-trend as well as by energy and transport policies until 2030. Both scenarios are supplied with very detailed quantified indicators by Member State and EU region for energy, transport, vehicle fleets, environment and economic development until 2030 (some of these on the EU level are listed in table1). The iTREN-2030 Integrated Scenario describes a world shaped by the economic crisis, but which is also gradually recovering from it. Transport policy is being driven by newly emerging issues, i.e. climate policy and growing GHG mitigation requirements for the transport sector, demand- and supply-driven fossil fuel scarcity and new propulsion technologies, leading to the application of a diversity of fuels and engine technologies in the transport sector. An overview of those policies is included in table 2. Table 3 presents the infrastructure projects that were included in the ITREN forecasts for 2030.

Table 1 Key indicators of the iTREN 2030 scenario

Indicator	Absolute values		Aver.% change per year
	2005	2030	
Population total (1,000 persons)	488,594	494,331	0.0
GDP (billion euros 2005)	10,573	15,772	1.6
Oil price (euro 2005 per bbl)	44	90	2.9
Freight transport activity (billion tkms)	6,875	10,193	1.6
Road	*2,073*	*3,056*	*1.6*
Rail	*447*	*798*	*2.3*
Inland navigation	*192*	*335*	*2.2*
Maritime	*4,162*	*6,004*	*1.5*
Passenger transport activity (billion pkms)	6,457	7,873	0.8
Car	*4,665*	*5,633*	*0.8*
Bus	*615*	*585*	*-0.2*
Rail	*477*	*695*	*1.5*
Air	*442*	*628*	*1.4*
Slow	*259*	*333*	*1.0*
Gross Inland Energy Consumption (ktoe per year)	1,821,472	2,149,186	0.7
Oil	*669,119*	*646,031*	*-0.1*
Gas	*442,979*	*551031*	*0.9*
Coal, Nuclear	*582,937*	*641,535*	*0.4*
Renewables	*126, 437*	*310,589*	*3.7*
Share of renewables in final energy demand	8.3%	16.1%	2.7
Share of bio-fuels in transport demand	1.0%	9.9%	9.6
Car fleet size (1,000 vehicles)	211,062	294,212	1.3
Gasoline	*149,304*	*148,788*	*0.0*
Diesel	*57,588*	*135,371*	*3.5*
LPG/CNG	*3,229*	*2,016*	*-1.9*
Innovative	*941*	*8,037*	*9.0*
CO2 Transport emissions (million tonnes)	1,268	1,485	0.6

Source: iTREN-2030

Table 2 Overview of transport and energy policies in the iTREN integrated scenario

Measure	Type	Start year	Description
Road user charge trucks	P	2020	Implementation of Greening Transport Package using the cost values identified by the IMPACT Handbook on external cost of transport (about 7 to 10 €ct/vhc-km)
Road user charge cars	P	2025	Implementation of Greening Transport Package transferring the cost values identified by the IMPACT Handbook to car transport (about 2.5 €ct/vhc-km)
City tolls	P	2025	Implementation for metropolitan areas in EU27 only at the level of about 35.7 €ct/vhc-km during peak-period
Fuel tax harmonisation	P	2020	Following EC directive 2003/96/EC tax levels of 35.9 €ct/l gasoline and 41 €ct/l diesel introduced
Air transport into EU-ETS	P	2012	Inclusion of all air transport within or leaving the EU27 into EU-ETS with reduction targets of -3% in 2012 and -5% after 2012 compared to average of 2004 to 2006
Road transport into EU-ETS (upstream)	P	2020	Inclusion of road transport into EU-ETS by upstream approach (CO_2 price in 2020 about 28 €$_{2005}$ per tonne CO_2)
Railway liberalisation	P	2010	Implementation of 3rd railway package reducing passenger rail cost by -2%
CO2 limits cars	P	2015, 2020	Regulation setting CO_2 limits for average new car fleet with a limit value of 130 g CO_2/km in 2015, 105 g CO_2/km in 2020
CO2 limits LDVs	P	2015, 2020	Regulation setting CO2 limits for average new LDV fleet with a limit value of 175 g CO2/km in 2016 and 135 g CO2/km in 2020
Binding use of low resistance tyres HDV	P	2012	The binding use of low resistance tyres for trucks will reduce energy consumption by -3.5%
Battery electric cars	TA	2012	Breakthrough of battery technology and market diffusion of electric city cars after 2012
Battery electric LDVs	TA	2015	Breakthrough of battery technology and market diffusion of electric LDVs for urban deliveries after 2015
Hydrogen fuel cell cars	TA	2025	R&D support and support for market introduction will lead to market diffusion after 2025
Car efficiency labelling	P	2009	Effective labelling of cars according to their energy/CO2 efficiency affecting choices of car buyers to reduce CO2 emissions by -3.5%
Driver education for drivers of HDV	TA	2010	Driver education can reduce energy demand by -20%. It is assumed that due to changing framework conditions -10% is achieved by ambitious education programmes of companies
Increased implementation of CNG fuelling stations	TA	2010	The requirements of climate policy and price differentials increase attractiveness of CNG generating incentives to implement more CNG fuelling stations
GHG reduction target for the EU for 2020	P	2012	Agreement of binding reduction target of GHG emissions of EU27 of -20% until 2020 against 1990. Extension of EU-ETS with certificate price of 28 €$_{2005}$ per tonne of CO2 in 2020
Renewable energy target	O	2008	Harmonized renewable energy support premiums across the EU to reach 20% renewable energy by 2020
Energy efficiency action plan	P	2008	Increase of energy efficiency by 1% annually
Support for CCS	P	2010	Support of R&D and demonstration sites for CCS such that around 2030 first large-scale plants can be built

Source: iTREN-2030. P = policy, O = objective without specifying implementation, TA = trend adaptation

Table 3 Overview of infrastructure projects included in the iTREN integrated scenario

Priority axis	MSs involved	End of works confirmed by MS	Total cost in M EUR	Total investment before 2007 in M EUR	Total 2007-2013 in M EUR	Remaining investment in M EUR
PP1 Railway axis Berlin-Verona/Milan-Bologna-Napels-Messina-Palermo	AT, IT, DE	2024	47.054,61	22.370,53	14.285,63	10.398,45
PP2 High-speed railway axis Paris-Brussels/Brussels-Cologne-Amsterdam-London	BE, DE, NL, UK	2015	18.848,01	16.954,61	1.857,07	36,33
PP3 High-speed railway axis of south-west Europe	ES, FR, PT	2020	50.656,68	10.556,20	26.782,65	13.317,83
PP4 High-speed railway axis east	FR, DE	2013	5.255,00	4.521,60	590,60	142,80
PP5 Betuwe Line	NL	2008	4.776,40	4.361,00	415,40	0,00
PP6 Railway axis Lyon-Trieste-Divaca/Koper/Divaca-Ljubljana-Budapest-Ukrainian border	FR, HU, IT, SL	2025	60.741,96	7.827,03	10.427,94	42.486,98
PP7 Motorway axis Igoumenitsa/Patra-Athina-Sofia-Budapest	BG, GR, RO	2020	14.928,70	10.051,10	4.727,60	150,00
PP8 Multimodal axis Portugal/Spain-rest of Europe	ES, PT	2017	15.324,54	8.882,71	4.752,97	1.688,86
PP9 Railway axis Cork-Dublin-Belfast-Stranraer (COMPLETED)	IRL, UK	2001	357,00	357,00	0,00	0,00
PP10 Malpensa Airport (Milan) (COMPLETED)	IT	2001	1.344,00	1.344,00	0,00	0,00
PP11 Öresund fixed link (COMPLETED)	DK, S	2001	4.158,00	4.158,00	0,00	0,00
PP12 Nordic triangle railway-road axis	FIN, S	2016	11.746,37	4.364,40	5.705,37	1.676,60
PP13 UK-Ireland/Benelux road axis	IRL, UK	2015	7.526,44	3.285,65	4.057,80	182,99
PP14 West Coast Main Line	UK	2009	12.629,24	10.896,37	1.732,87	0,00
PP16 Freight railway axis Sines/Algeciras-Madrid-Paris	ES, PT	2020	8.899,04	48,80	1.100,34	7.749,90
PP17 Railway axis Paris-Strasbourg-Stuttgart-Vienna-Bratislava	AT, FR, DE, SK	2020	13.563,29	3.528,68	6.779,99	3.254,62
PP18 Rhine/Meuse-Main-Danube inland waterway axis	AT, BE, BG, DE, HU, NL, RO	2016	2.103,28	45,29	1.075,55	982,44
PP19 High-speed rail interoperability on the Iberian peninsula	ES, PT	2020	41.770,45	5.236,30	33.194,37	3.339,78
PP20 Fehmarn Belt railway axis	DE, DK	2018	7.930,70	36,72	2.680,50	5.213,48
PP22 Railway axis Athina-Sofia-Budapest-Vienna-Prague-Nürnberg/Dresden	AT, BG, CZ, DE, GR, HU, RO	2020	12.641,80	465,36	5.618,52	6.557,92
PP23 Railway axis Gdansk-Warsaw-Brno/Bratislava-Vienna	CZ, PL, SK	2017	6.159,17	1.384,42	3.296,22	1.478,53
PP24 Railway axis Lyon/Genoa-Basel-Duisburg-Rotterdam/Antwerp	BE, DE, FR, IT, NL	2020	22.647,29	2.103,69	5.421,19	15.122,41
PP25 Motorway axis Gdansk-Brno/Bratislava-Vienna	AT, CZ, PL, SK	2017	6.845,96	1.063,50	5.782,46	0,00
PP26 Railway-road axis Ireland/United Kingdom/continental Europe	IRL, UK	2020	6.242,82	2.356,39	2.473,43	1.413,01
PP27 Rail Baltica axis Warsaw-Kaunas-Riga-Tallinn-Helsinki	EE, LT, LV, PL	2020	3.198,19	50,00	1.556,19	1.592,00
PP28 Eurocaprail on the Brussels-Luxembourg-Strasbourg railway axis	BE, LUX	2013	1.183,19	18,76	1.083,23	81,20
PP29 Railway axis if the Ionian/Adriatic intermodal corridor	GR	2019	4.308,00	81,00	1.074,00	3.153,00
PP30 Inland waterway Seine-Scheldt	BE, FR	2016	4.422,41	21,31	4.097,70	303,40
Total			**397.262,54**	**126.370,42**	**150.569,57**	**120.322,55**

2.3 Initial forecasting results

In table 4 a selection of the key indicators with regard to the development of transport, either included as base data or growth predicted by the TEN CONNECT 2 model, until 2030 for the various modes are presented:

Table 4 Key growth indicators

EU27	*2005*		*2030 Baseline*		*2005-2030*
	bln tonnekm	*Modal Split*	*bln tonnekm*	*Modal Split*	*Annual growth*
total	2,718		3,932		0.0149
road	2,146	78.97%	3,032	77.11%	0.0139
rail	404	14.87%	671	17.07%	0.0205
iww	168	6.17%	229	5.82%	0.0126

Source: TEN CONNECT 2 study

In TEN CONNECT 2 the growth rates listed in the table are also available for different types of goods, different countries and different geographic orientation (domestic, import, export, transit).

In order to arrive also at basic forecast for 2040 the average annual growth rates in the models for the period 2020-2030 were extrapolated to the period 2030-2040.

3.4 Modifying the forecasts based on industry expectations and other sources

In order to make at the most realistic and best forecasts, the initial TEN CONNECT 2 estimates were examined in detail

The "top-down" model based growth forecasts were modified and, if required, corrected by using "bottom-up" practical information from key supply chain experts which were approached by project team members in a number of in-depth interviews (see table 4 for the assignment of the number of interviews to market segments).

The expected developments paths of the supply chains were discussed with these experts, and the interviews specifically focussed on the way in which inland waterway transport activities might develop in the future, based on current industry trends and policies.

The information was supplied by large shippers, port authorities and large IWT operators. These parties were (amongst others) asked to evaluate the medium term growth perspectives in their markets segments. Using this approach, for various supply chains bandwidths, regions bounded by low and high growth paths (except Danube corridor), for the freight volumes for IWT in 2020 and subsequently also for 2040 were determined.

The interviews indeed led to a limited number of adaptations of the initial estimates. However, these adaptations

Table 5 Number of interviews per industry/ market

Industry/ Market	*Number of Interviews*
Coal for power plants	2
Steel industry	3
Petro-chemical industry	5
Agribulk food products industry	5
Construction industry	4
Containerised cargo	6
Intermodal Sea-River transport market	2
Total	**27**

Finally a comparison was made of the (modified) forecast with other forecast available from other sources. These other sources included a check with forecasts from the following studies:

- Inventory of available knowledge on Strategic Knowledge of Inland Waterway projects (PLATINA project report, 2010)
- Analysis of the Impact of the Current Economic and Financial Crisis on the EU Inland Waterways Transport Sector (NEA, Report prepared for the EC, July 2010)

The general results with regards to the quantitative forecast are presented in the Main Report (see chapter 3 of the Main Report sections 3.8 till 3.10).

3.5 Corridor results

Table 6 Danube forecast per NSTR commodity in million tonne km

NSTR		*2007*	*2020*	*2040*
0	agricultural produce	2,967	4,413	6,828
1	foodstuff and fodder	939	1,396	2,160
2	solid mineral fuels	2,094	2,094	2,094
3	petroleum and petroleum products	1,312	1,967	3,716
4	ores and metal waste	5,050	6,313	8,838
5	iron, steel and non-ferrous metals	2,070	3,105	5,865
6	crude minerals and building materials	2,549	2,828	3,456
7	fertilizers	930	955	1,264

8	chemical products	486	553	656
9	vehicles, machinery and other goods	1,544	2,059	3,089
	TOTAL	19,940	25,683	37,966

Table 7 East-West corridor forecast per NSTR commodity in million tonne km

NSTR		*2007*	*2020 low*	*2020 high*	*2040 low*	*2040 high*
0	agricultural produce	258	245	272	282	332
1	foodstuff and fodder	289	275	305	316	372
2	solid mineral fuels	585	702	744	819	883
3	petroleum and petroleum products	461	415	445	322	415
4	ores and metal waste	340	294	374	227	340
5	iron, steel and non-ferrous metals	265	247	335	282	529
6	crude minerals: building materials	640	616	648	647	716
7	fertilizers	137	129	139	116	142
8	chemical products	287	329	404	393	701
9	vehicles, machinery and other goods	286	363	458	553	954
	TOTAL	3,548	3,614	4,125	3,958	5,383

Table 8 North-South corridor forecast per NSTR commodity in million tonne km

NSTR		*2007*	*2020 low*	*2020 high*	*2040 low*	*2040 high*
0	agricultural produce	1,717	1,785	2,005	1,972	2,808
1	foodstuff and fodder	1,128	1,173	1,317	1,296	1,845
2	solid mineral fuels	2,054	2,398	2,525	3,167	3,607
3	petroleum and petroleum products	3,274	2,798	3,067	2,798	3,322
4	ores and metal waste	1,836	1,570	2,012	1,235	1,820
5	iron, steel and non-ferrous metals	1,494	1,358	1,881	1,567	2,968
6	crude minerals: building materials	6,268	6,774	7,133	7,945	9,055
7	fertilizers	852	799	863	722	881
8	chemical products	1,834	2,105	2,581	2,513	4,483
9	vehicles, machinery and other goods	2,905	4,266	4,659	10,289	13,594

NSTR		2007	2020 low	2020 high	2040 low	2040 high
	TOTAL	23,361	25,027	28,043	33,505	44,383

Table 9 Rhine corridor forecast per NSTR commodity in million tonne km

NSTR		2007	2020 low	2020 high	2040 low	2040 high
0	agricultural produce	6,216	5,900	6,547	6,783	7,988
1	foodstuff and fodder	7,478	7,098	7,876	8,161	9,610
2	solid mineral fuels	11,553	13,828	17,077	16,247	20,507
3	petroleum and petroleum products	15,007	13,685	14,448	10,531	13,583
4	ores and metal waste	10,076	8,616	11,040	6,776	9,989
5	iron, steel and non-ferrous metals	6,315	5,741	7,949	6,624	12,542
6	crude minerals: building materials	19,073	18,343	19,323	19,282	21,349
7	fertilizers	3,194	2,992	3,236	2,707	3,301
8	chemical products	8,842	9,926	12,613	11,876	22,365
9	vehicles, machinery and other goods	11,741	16,783	21,617	29,214	55,183
	TOTAL	99,496	102,911	121,726	118,201	176,418

ANNEX 3 Potential analyses Rhine corridor

3.1 Introduction

To further concretize the TEN-T corridors, the EC intends to develop corridor network development plans, also to illustrate the potential of the corridors for multimodal transport and taking cargo off the road. Core network projects will prioritize projects along the 10 implementing corridors on the core network. Inland waterway projects will be part of the following 7 multimodal corridors:

- Corridor 2 (Warszawa – Berlin – Amsterdam/Rotterdam – Felixstowe – Midlands): West-German Canals, Mittellandkanal, Hannover – Magdeburg – Berlin, Amsterdam locks
- Corridor 3 (Mediterranean Corridor): Milano - Mantova - Venezia – Trieste
- Corridor 4 (Hamburg – Rostock – Burgas/TR border – Piraeus – Lefkosia): Hamburg - Dresden - Praha – Pardubice and Děčín locks
- Corridor 6 (Genova – Rotterdam): Basel - Rotterdam/Amsterdam/Antwerpen
- Corridor 8 (Dublin – London – Paris – Brussel/Bruxelles): Le Havre – Paris
- Corridor 9 (Amsterdam – Basel/Lyon – Marseille): Maas, Albertkanal, Terneuzen – Gent, Canal Seine – Escaut, Waterways upgrade in Wallonia, Canal Saône - Moselle/Rhin, Rhône
- Corridor 10 (Strasbourg – Danube Corridor): Main – Main-Donau-Canal – Danube

The Rhine river is integrated in the corridor number 6 (Genova – Rotterdam). Within the framework of PLATINA the Rhine corridor was studied in more detail regarding the size and characteristics of IWT as well as the factors that are important for the modal shift from road to waterways.

The work was based on the latest TRANSTOOLS/ETIS data[1] as well as benchmarking tools for intermodal transport that was developed in the FP7 project BE LOGIC[2]. The results are relevant for the Study, in particular since they provide a more detailed view on the factors and circumstances that are important to raise the modal share of IWT. This Annex 3 is therefore providing arguments for the Policy Package 1 presented in chapter 8 of the report.

[1] ETISplus, FP7 project European Commission, 2011, see http://www.etisplus.eu/default.aspx

[2] Benchmarking logistics and co-modality (BE LOGIC), FP7 project European Commission, 2011, see http://www.be-logic.info

3.2 Factor for modal shift from road to IWT

The most important aspect in modal choice is the price of transport and the second most important aspect is the reliability and transit-time.

Another issue to take into account is the characteristics of the infrastructure network. In many cases the distance of the route via waterways is longer than the route by road. Also the optimal ship dimension cannot always be used due to limitations in dimensions of the waterways (e.g. low bridges, small locks, low fairway depth). Furthermore, events such as low water or blocked waterways are problematic for shippers. In case of low water conditions the price for transport (euro per tonne transported) can easily double on those routes that are affected[3]

When making a comparison with longer and heavier vehicles (LHV's) able to carry 3 TEU that are under discussion on European level, this break-even distance shifts to about 120 km (single trip). A recent study in the Netherlands however proved that the competition in the Netherlands with longer and heavier vehicles able to carry 3 TEU is negligible due to very limited market opportunities to use these specific trucks. In practise the possible matches of a 40" and 20" maritime containers while staying within the maximum weight of the truck are exceptional[4].

Another key aspect in the competition with road haulage is the quality of the service that is offered. The longer transit time of barge transport compared to road haulage can be a barrier despite the cost saving that is possible. Also a shipper demands high frequencies, for example connections each day. A critical aspect is therefore the critical mass that is needed to provide services of a high frequency. In order to acquire a critical mass cargo from different owners often needs to be consolidated. This consolidation requirement implies that agreements have to be made with more parties, which is often complex.

Moreover, shippers often demand a one-stop-shop 'door-to-door' solution and do not want to be involved in the organisation of the intermodal transport chain themselves.

[3] NEA study for Crisisberaad on development of freight prices during the crisis, 2009/2010

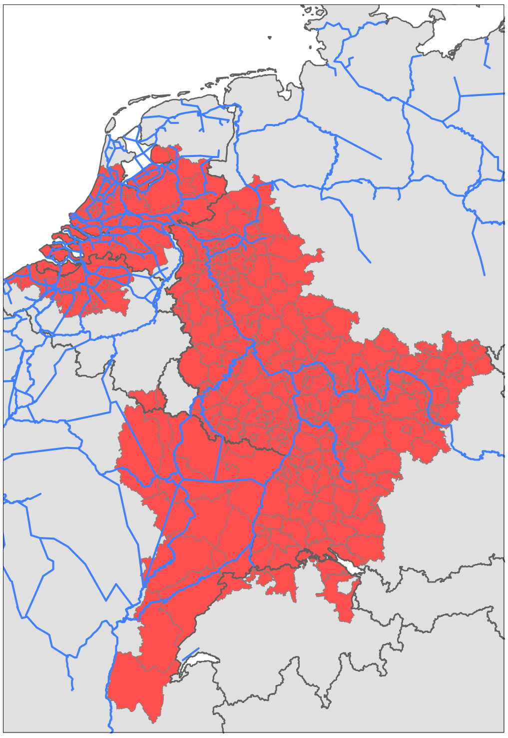
[4] NEA study for the Dutch Ministry of Infrastructure and Environment (Rijkswaterstaat, Dienst Verkeer Scheepvaart) monitoring modal shift of LHV's in The Netherlands, 2011

3.3 Results

The Rhine corridor consists of areas along the Rhine River and tributaries in the western part of Germany, northern part of Belgium, the Netherlands, Switzerland, the eastern part of France, and Luxembourg.

The size of OD-flows dataset by IWT (2007) for the Rhine corridor comprises 158.7 million tonnes (compared to 454 to EU27+rest of Europe). The objective is to analyse potential for inland navigation by means of accommodating freight flows that are currently transported on the roads. Because the pre- and end-haulage distance is critical for the possibility of IWT only origin and destination pairs were selected that are both close to the Rhine River. The selection does therefore not include IWT transport passing through the Rhine and going to other corridors[5]. The freight flows generated in the selected Origin-Destinations along the Rhine River are therefore a limited share of the overall transport carried out in the Rhine corridor area. The following figure shows the scope of the area studied.

Figure 1 Scope of study Rhine corridor



[5] For example transports between other corridors (Danube or East-West corridor) via, to or from origin-destinations along the Rhine waterway are excluded from the selection.

The following table presents for this selection the modal share results.

Table 1 Modal share 2007, data selection Rhine corridor (subset)

	Share in volume (tonnes)	*Transport performance (tonne kms)*
IWT	8%	16%
Road	90%	79%
Rail	2%	5%

Source: ETIS/Transtools

Because of the fact that the average distance of transport is much shorter in road haulage compared to IWT and Rail, the share in transport performance of the modes Rail and IWT is significantly higher compared to the share in tonnes transported. The next table presents within a distance category the transported tonnes and the share of each transport modes. As distances increase, the dominant role of road transportation decreases, making IWT and rail transport more attractive.

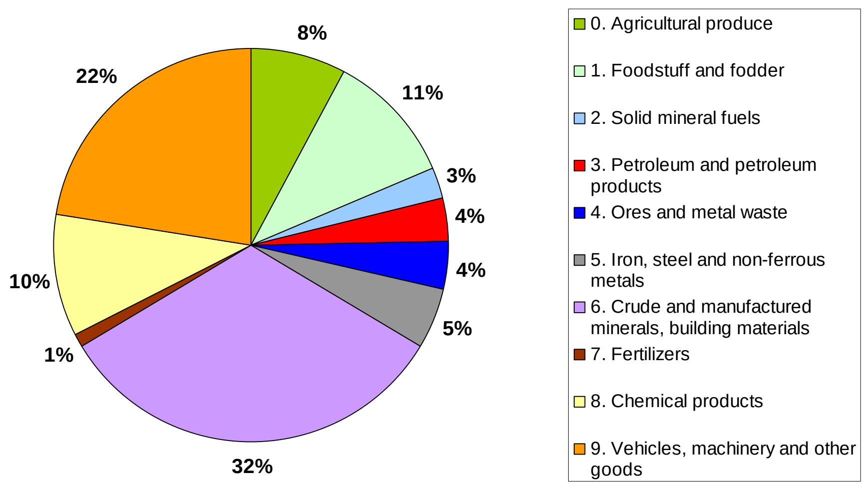
Table 2 Transport volumes (*1000 tonne) and share in % per transport mode by distance class in km on the Rhine corridor in 2007

Mode	*<50*	*50-100*	*100-200*	*200-300*	*300-400*	*400-600*	*600-800*
IWT	4%	7%	14%	24%	10%	20%	38%
Road	96%	93%	83%	72%	82%	70%	53%
Rail	0%	1%	3%	4%	8%	10%	9%

Mode	*<50*	*50-100*	*100-200*	*200-300*	*300-400*	*400-600*	*600-800*	*>800*	*Total*
IWT	33,384	27,107	31,147	32,537	6,902	15,784	11,286	586	158,732
Road	899,328	385,114	184,104	95,517	55,016	55,536	15,844	374	1,690,833
Rail	2,088	2,865	5,859	5,456	5,245	7,648	2,793	147	32,100
Total volume	934,800	415,086	221,109	133,509	67,163	78,968	29,923	1,107	1,881,665

It can be concluded that the majority of the transport takes place on relatively short distances. Also already quite a lot of transport by IWT (21%) by inland navigation takes place on distances below 50 kilometres. Furthermore, 78% of the transport by inland waterway transport takes place on distances below 300 kilometres. Referring to the 300 kilometre distance mentioned in the modal split objectives in White Paper, the volume of cargo above 300 km in this example is 126 million tonnes. This is 7.5% of the overall volume transported by road haulage. The following pie-chart shows the cargo transported between the ODs in this corridor.

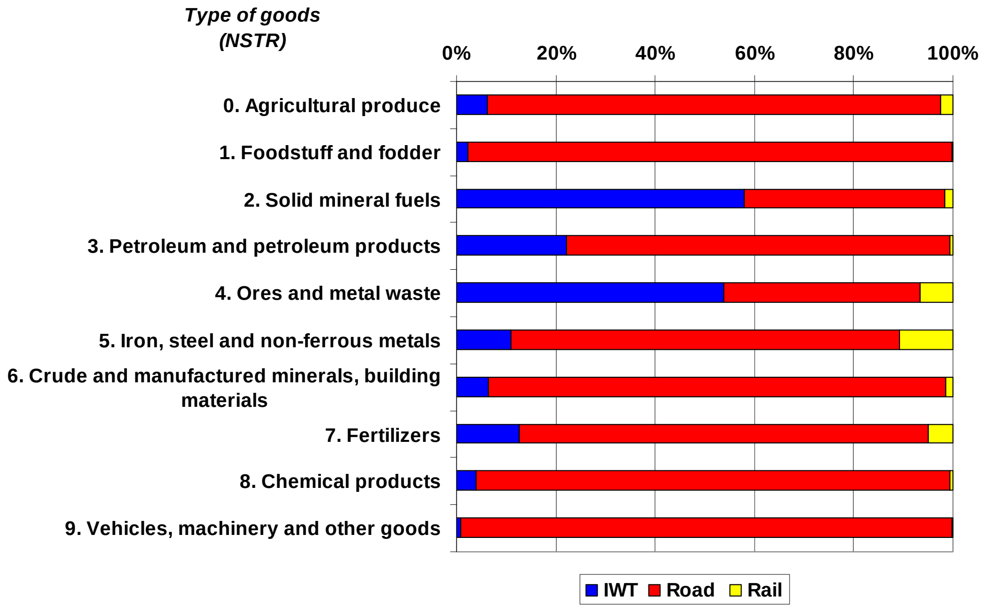
Figure 2 Breakdown of goods transported in 2007 between ODs along Rhine corridor (NSTR classification)



Source: ETIS/Transtools

The following figure shows the modal share for each type of commodity (NSTR).

Figure 3 Modal share per type of goods transported on Rhine ODs

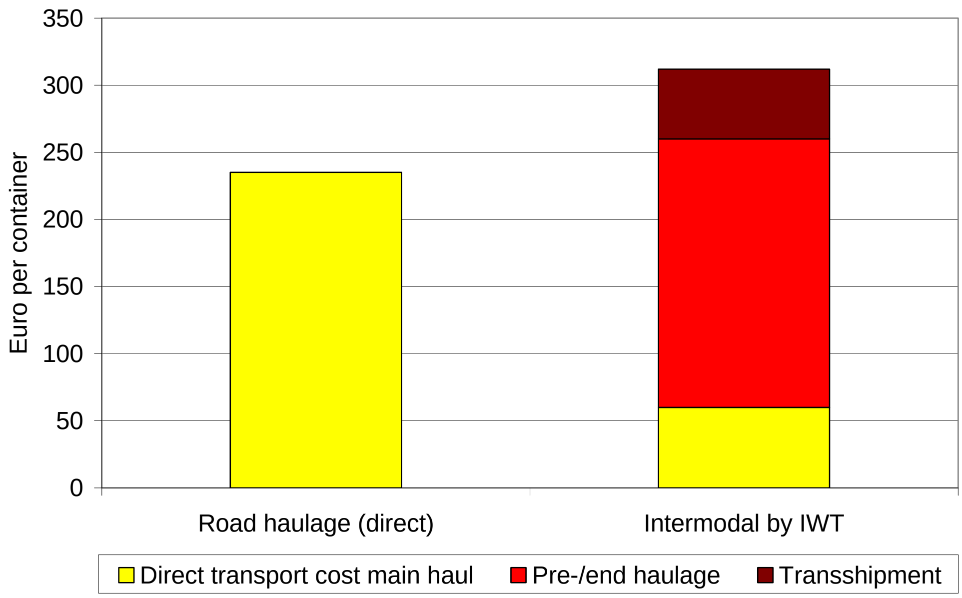


Source: ETIS/Transtools

The figures 2 and 3 make clear that the modal share of IWT is relatively high for the transport of ores and metal waste and solid mineral fuel (coal). For the foodstuff and finished goods however, road haulage is the dominant mode of transport. The latter type of goods is more time critical, more fragmented flows and the clients are not located directly along waterways. In order to serve the clients, cargo needs to be consolidated and intermodal chains are needed with pre- and end-haulage by road.

The main problem of IWT to increase modal share in a door-to-door supply chain is the additional cost for pre- and end-haulage and transhipment. The following figure shows the results for Düsseldorf (Neuss) to Frankfurt assuming a pre- and end-haulage distance of 25 kilometres on both ends and duration of 2 hours per roundtrip for the pre- and end-haulage operation.

Figure 4 Door-to-door costs Düsseldorf < > Frankfurt



Source: NEA, Ecorys, PLATINA WP5, 2011

The distance for road haulage in the example Dusseldorf-Frankfurt is approximately 233 km. Although the direct costs for the transport by barge are much lower compared to road, the pre- and end-haulage cost are very high. Therefore, the pre- and end-haulage situation is decisive for the feasibility of an intermodal transport chain by barge for continental cargo. Important is that this pre- and end-haulage process is done in the most efficient way without waiting times and with a high utilisation of the road truck. Another aspect is the distance between the terminal and the client. In case the distance is too long, the pre- and end-haulage operation will become too expensive and direct road haulage will be preferred. However, in such situations where the pre- and end-haulage costs can be avoided or be very limited, the overall door-to-door costs decrease drastically.

3.4 Conclusions

The competitive situation of IWT highly depends on the location of the origin and destination and the specific conditions. If the origin and destination are both located directly along waterways (‘wet locations’) transport distances from 20 kilometres onward, inland waterway transport can be competitive compared to road haulage[6]. As can be concluded from the table 2 in particular on these shorter distances there is the vast majority of transport demand. Therefore, if IWT is in the position to be competitive on short distances, there is a major potential for a shift from road transport to IWT.

[6] Policy Research Corporation, NEA, ‘ Policy strategy inland navigation, The Netherlands, 2005

However, if locations are situated away from waterways (Dry locations) pre-/end-haulage is needed, resulting in an increase of break-even distances. In practice there is a large bandwidth in the break-even distances as this depends on case-specific issues such as ship size, load factors, pre- /end-haulage distances, handling times and waiting times.

The price of transport in the door-to-door chains depends foremost on the pre-/end-haulage situation and transshipment costs. In such intermodal chains these costs typically sum up to 60% or 70% of the door-to-door costs for continental cargo. Only a small share of the total chain costs is required to cover the costs of running inland vessels (see figure 4). The feasibility of developing chains using IWT for the main haul therefore largely depends on the quality and efficiency of transhipment areas near the points of origin/destination of the transport chain. In general the longer the distance of the main transport leg, the more these starting costs of intermodal chains can be compensated.

Annex 4 Environmental performance of IWT in comparison with other modes

4.1 Introduction

In recent time, air pollutant emissions of all transport modes decreased due to the introduction of cleaner engines, however road transport emissions decreased more strongly than the pollutant emissions of the non-road modes. This can be explained by the long vehicle lifetimes of inland barge and diesel locomotive engines. Despite significant efforts and measures, air quality hot spots occur near busy road and at locations where a mix of source lead to exceedance of the limits set by EU Directive 2008/50.
Considering greenhouse gas emissions (GHG) by transport are expected to rise, the question arises on how the non-road modes could contribute to a less GHG intensive footprint of the transport sector. Traffic safety, noise and congestion/scarcity influence society in addition in a negative way.

This section describes the emission and other social impacts of freight transport modes and the potential of modal shifting. The objective of this Annex 4 is to:

To provide an overview of the current and future emissions and other social impacts of freight transport modes in a European context.

This analysis is based on the most recent analysis of emissions of transport modes by CE Delft (2011). In the context of the study, all relevant primary sources and studies on emissions of different transport modes were reviewed and assessed. In addition, the external costs estimations are also compiled on the basis of recent work.

4.2 Methodology

Environmental impacts included
Transportation has various impacts on the environment. These have been primarily been analysed by means of life cycle analysis (LCA). However, only for some of these categories it is possible to make a comparison of individual transports on a quantitative basis. The selection was made according to the following criteria:

- Particular relevance of the impact in one or more modes
- Proportional significance of cargo transports compared to overall impacts
- Data availability
- Possibility of quantitative comparison of individual transports.

The following parameters for environmental impacts of transports were selected; see the next table (1).

Table 1 Environmental impacts included

	Reason for inclusion
Carbon dioxide (CO2)	Global warming
Particulates (PM10)	Human toxicity, summer smog
Nitrogen oxides (NOx)	Human toxicity, Acidification, eutrophication, eco-toxicity, summer smog
Sulphur oxides (SOX)	Human toxicity, Acidification, eco-toxicity,

Policies and technologies assumed

While the 2009 data is based on statistics, projections need to be developed for 2020 emissions. Table 2 gives an overview of the legislations that have been taken into account for the emission factor calculations for 2020.

Table 2 Policies relevant for 2020

Transport Mode/ Pollutant	*Legislation*
Trucks	
CO_2	--
NO_x, PM_{10}	Euro VI will be introduced in 2013/14, (Reg. 595/2009)
Inland shipping	
CO_2	--
NO_x, PM_{10}	Phase IV will be introduced in 2016 by assumption; proposals are being discussed.
Sulphur	Maximum 10 ppm sulphur in 2011 (Reg. 2009/30/EG)
Rail	
CO_2	--
NO_x, PM_{10}	Tightening of emission standards in 2012/13 (Directive 2004/26),
Sulphur	Maximum 10 ppm sulphur in 2011 (Reg. 2009/30/EG)

For the 2020-2040 timeframe, it was assumed that the rail diesel emissions standards were tightened as well after 2020. The same values as for inland navigation engines were assumed.

Logistical data

Logistical data is based on average industry practice; see table 3 and 5 (CE Delft 2011).

Table 3 Load parameters for container transport

Mode and vehicle type	*Container unit Capacity (TEU/ vehicle)*	*Utilisation TEU capacity (Loaded TEU/TEU capacity)*	*Share of loaded container units*
Road			
Truck trailer	2	85%	75%
Rail			
Medium train	70	85%	65%
Inland waterways			
Rhine Herne Canal Ship	96	85%	55%

Long large Rhine ship	272	85%	55%
Rhinemax Ship	470	85%	55%

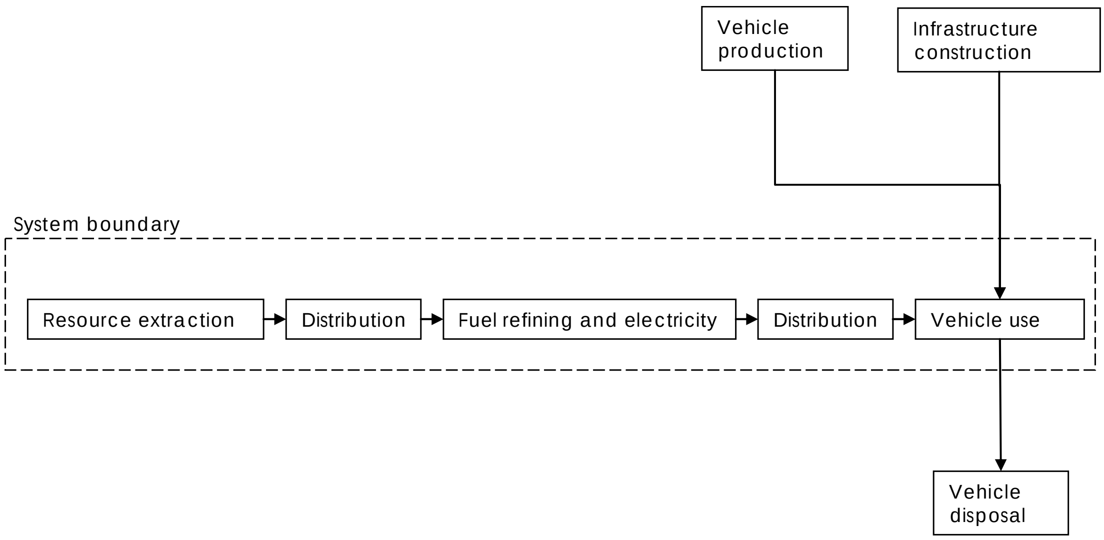
Table 4 Load parameters for bulk and average cargo transport

Vehicle type	*Load capacity (tonne)*	*Load factor loaded trips*	*Share of loaded vkm*	*Utilisation factor*	*Average load (incl. full and empty trips) (tonne)*
Truck trailer	26	98%	55%	**54%**	14
Rail					
Long train (44 wagons length 14 à 15 m)	2,668	98%	55%	**54%**	1438
Inland shipping					
Rhine Herne Canal Ship	1,350	90%	60%	**54%**	729

System boundaries

This analysis takes the entire transport chain into account, except vehicle and infrastructure construction. The reason for this is the limited availability of data. An overview of the processes included in the analysis is shown in the following figure.

Figure 1 System boundaries and processes included



Wear and tear emissions are not included.

Emission comparison between modes

For all modes the emission are expressed per tonne kilometre. The tonne kilometre is the unit of measure representing the transport of one tonne over one kilometre. The distances to be taken into consideration are the distances actually run to deliver the goods. When comparing different modes, detouring needs therefore to be taken into account. An international trip by inland barge is often longer than a trip by truck. See some illustrative examples in table 5. Furthermore, potential pre- and end-haulage needs to be taken into account.

Table 5 Detour factors for selected transport chains

Origin	*Destination*	*Distance (km)*				*Detour factor*			
		Road	*Rail*	*IWW*	*SSS*	*Road*	*Rail*	*IWW*	*SSS*
Port of Rotterdam	Köln	268	245	303	--	1.09	1.00	1.24	--
Rotterdam	Thionville	388	397	668	--	1.00	1.02	1.72	--
Rotterdam	Vienna	1,104	1,180	1,580	--	1.00	1.07	1.43	--
Rotterdam	Duisburg	240	241	253	--	1.00	1.00	1.05	--
Groningen seaport	Vienna	1,068	1,321	1,601	--	1.00	1.24	1.50	--
Amsterdam	Regensburg	759	788	1,047	--	1.00	1.05	1.55	--
Bilbao	Rotterdam	1,368	1,428	--	1,418	1.00	1.04	1.38	--

Source: www.ecotransit.org

By expressing the emissions per tonne kilometre they are expressed in relation to the achievement both in distance and delivered weight.

For all modes the well-to-wheel emissions per tonne kilometre (E_{tkm}) are defined as follows:

$$EF_{tkm,\mathrm{mod}\,e}(WTW) = \frac{EF_{vkm}(TTW) + EF_{vkm}(WTT)}{LC \times UF} \qquad (1)$$

With:

$EF_{vkm}(TTW)$	:	Exhaust (tank-to-wheel) emissions per vehicle kilometre
$EF_{vkm}(WTT)$	:	Emission of refining or electricity production (well-to-tank) per vehicle kilometre
LC	:	Load capacity
UF	:	Utilisation Factor = LF × LKF
LF	:	Load factor of loaded trips (=load/ Load capacity)
LKF	:	Loaded kilometre factor; the share of loaded kilometres in the total of kilometres (=1-empty kilometre factor)

The utilisation factor (UF) in the denominator takes into account the empty trips (with the factor LKF). When the loaded kilometres equal 50% (LKF = 0.5), the emission factor per vehicle kilometre is multiplied by 2 (=divided by 50%), accounting for the empty return trip.

More information on the data used for the specific modes (e.g. energy consumption, emission factors and logistical characteristics) can be found in CE Delft (2011).

For comparison of modes, the emissions are expressed per tonne km over the shortest link available. This means that for all modes, the total emissions generated for reaching the destination have been divided by the shortest amount of kilometres needed by any mode.

Emission per tonne kilometre over the shortest link (EF_{sl}) including detouring and pre- and end-haulage are calculated for a certain mode as follows:

$$EF_{sl} = \frac{EF_{\mathrm{mod}\,e} \times Dist_{\mathrm{mod}\,e} + EF_{trans} + EF_{EH} \times Dist_{EH}}{Dist_{sl}}$$

With:
EF_{mode}: Emission factor (g/tkm) of transport mode
$Dist_{mode}$: Distance covered by the transport mode
EF_{trans}: Emission per TEU/tonne transhipped
EF_{EH}: Emission factor (g/tkm) of End-Haulage per truck
$Dist_{EH}$: Distance of end-haulage per truck
$Dist_{sl}$: Distance to destination over the shortest link.

Case selection
In the next sections, the performance of IWT will be discussed in comparison with the main competing modes. Since logistical factors play an important role, the emission factors for the different modes are presented for a limited number of specific links, providing an illustrative overview.
On the basis of an exploration of market cases, the following links have been selected for which a modal shift may be relevant within the next 10 years. The cases are a mix of hardly any detouring and significant detouring.

<u>Container transport:</u>

- Rotterdam –Duisburg (with pre- and end-haulage to Essen/Dortmund)

Rotterdam –Duisburg (container)
In this case average container transport from Rotterdam to Duisburg is evaluated. The effect on the emission per tonne kilometre for after transport to Essen and Dortmund are included in the comparison. In the figures below the following cases are shown:

- Duisburg: Transport from Rotterdam to Duisburg
- Essen: Transport from Rotterdam to Essen; for rail and inland waterways containers are transhipped in Duisburg(26 km in addition)
- Dortmund: Transport from Rotterdam to Dortmund; for rail and inland waterways containers are transhipped in Duisburg(63 km in addition)

Bulk transport:

- Amsterdam – Regensburg (steel, with pre- and end-haulage to Munich)

Amsterdam-Regensburg (steel)[7]
In this case transport of steel from Amsterdam to Regensburg is evaluated. The effects on the emissions per tonne kilometre for end-haulage to Munich (141 km in addition) are included in the comparison.

[7] A Tata steel plant is located in the Amsterdam port area.

It should be noted that in the case of end-haulage, also the number of road kilometres changes, compared to the non end-haulage situation.

4.2.1 Energy efficiency and CO_2 (2009)

Figure 2 compares the results for the CO_2 emissions per tonne kilometre for container transport (average weight) with different modes. The lowest emissions per tonne kilometre are found for the electric train, the highest for truck. Detouring for the different modes on the track Rotterdam Duisburg is limited and the emissions per tonne kilometres over the shortest link are hardly increased by detouring. Introduction of end-haulage to Essen (26 km) or Dortmund (63 km) does not change the outcome of the comparison although for the non-road modes, the end-haulage to Dortmund has a rather large impact on the total CO2 emission per tonne kilometre.

Figure 2 **CO_2 emission per tonne km for container transport; case: Rotterdam-Duisburg**

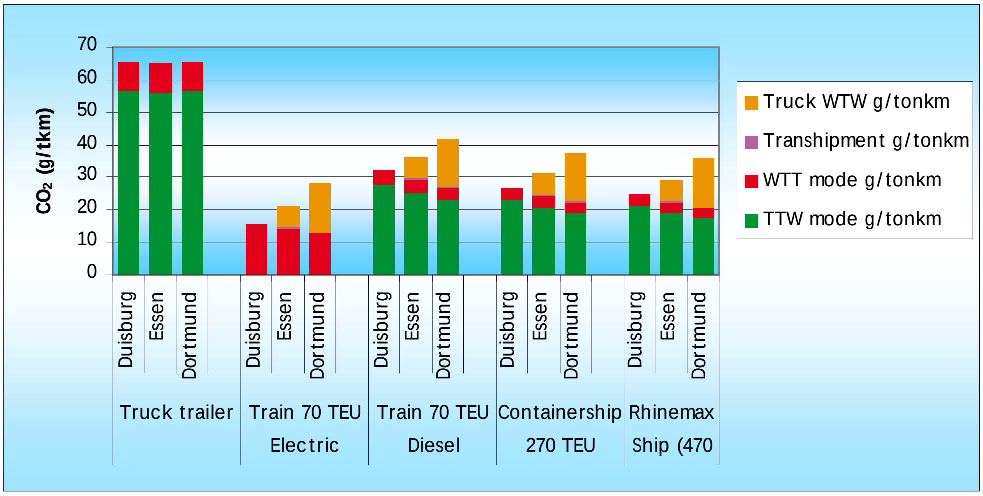


Figure 3 **CO_2 emission per tonne km for heavy bulk transport; case: Amsterdam-Regensburg**

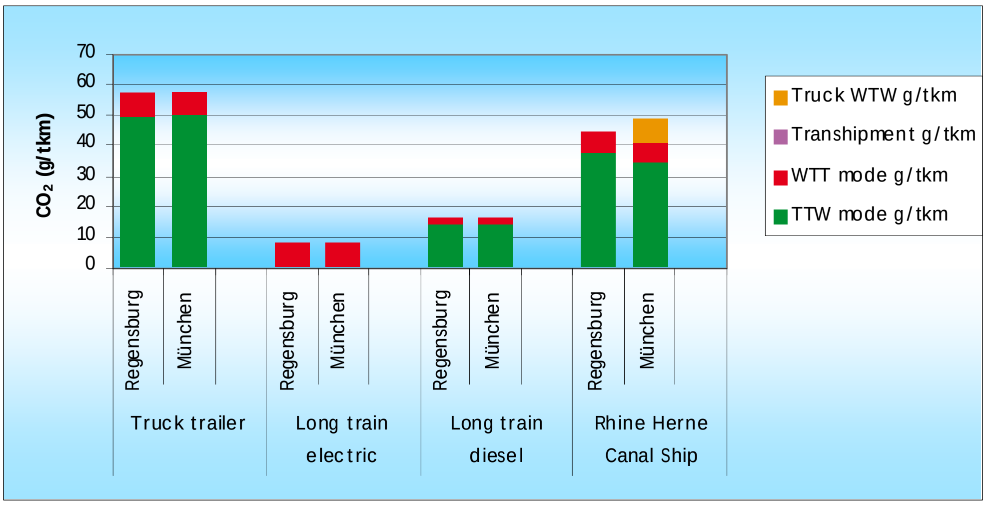


Figure 3 compares the results for the CO_2 emissions per tonne kilometre for the Amsterdam-Regensburg case (heavy bulk) with different modes in 2009. The lowest emissions per tonne kilometre are found for the electric train, the highest for road. Due to detouring, emissions per tonne kilometre for inland water transport come close to those of road, in particular for end-haulage by truck to Munich.

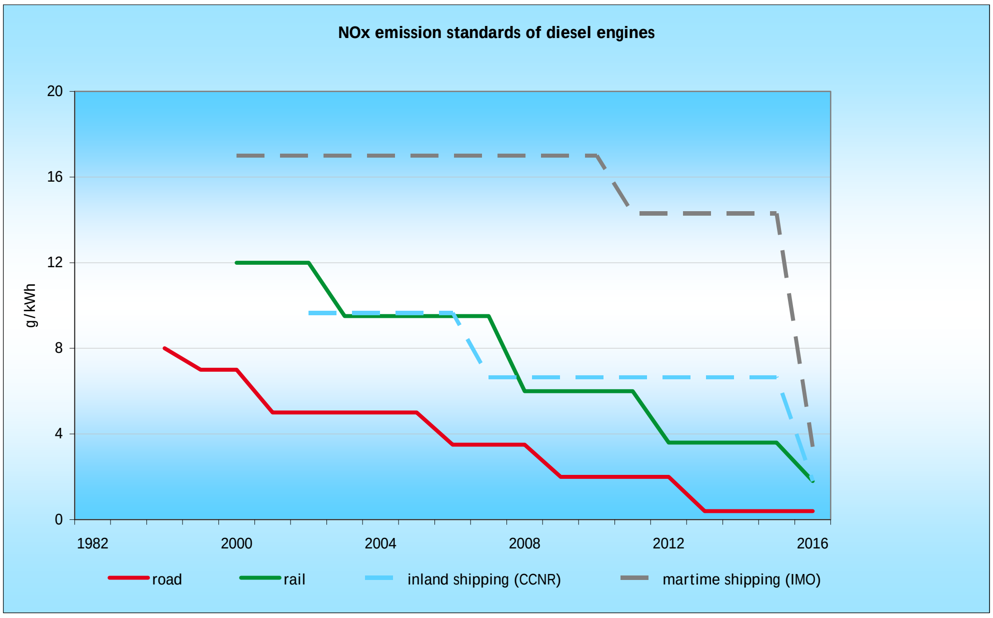
Conclusion
The cases show that generally truck transport CO_2 emissions are found to be the highest and electric rail transport emissions the lowest. However, the EU average power generation emissions play a role here. Different national figures may result in significant differences, although not to different conclusions.

For rail and inland waterway transport, the scale of transport, the need for pre- and end-haulage, detouring and the type of traction determine the specific emissions for a trip. However, only in cases worse than presented, the emissions of the non-road modes are higher than those of road transport. An example of this is a lower load factor (shallow water period) or smaller scale of transport.

4.2.2 Pollutant emissions (2009)

Due to a combination of the average age of inland barge engines and more stringent emissions legislation for trucks (so-called Euro standards), the specific emissions of inland barges are relatively high. VITO (2004) showed that the average age of an inland barge main engine was 13 years. However, the differences between engines are high. 65% of the main engines are younger than 10 years. This implies that a small share of the engines has a relatively high age (10% is older than 30 years). TNO (2009) assumes a median value for the inland barges of 9 years. Based on a sample of 100 ships, they conclude that the IVR database is outdated; see also chapter 4 concerning the fleet in the Main Report of the study.
Both the long average lifetime of engines and the relatively high emission standards (see figure 4) define the specific NOx emissions of inland shipping.

Figure 4 Comparison of emission factors per transport mode for new vehicles (g/kwh)



Note: data refer to new type approvals and are rounded of to year. IMO figures refer to slow speed engines (<130 rpm). Values for middle speed engines (900rpm) are 35% lower. Values from EU Directive 2004/26 are not included, since the CCNR- standards are more stringent and the market follows these standards. Emissions standard is based on 2,200 rpm engines. Inland shipping and rail figures for 2016 are not defined yet, but under discussion.

Due to the reasons mentioned, pollutant emissions of IWT are comparable to road transport. PM emissions are slightly higher than those of road transport. Generally, factors such as the utilisation rate, size of scale and other logistic transport characteristics do have a significant impact on the ratio between the modes. Electric rail transport is the most clean means of transport, since pollutant emissions associated with electricity generation are generally low. The figures below provide an overview of the specific emissions for the different cases selected.

Rotterdam-Duisburg

Figures 5, 6 and 7 compare the results for the pollutant emissions per tonne kilometre for container transport (average weight) with different modes in 2009. NOx and $PM_{2.5}$ emissions for electric trains are by far the lowest. The non-road modes score little worse than road transport regarding $PM_{2.5}$ and little better than road transport regarding NOx.

For electric trains, the effect of end-haulage is significant due its low own emissions. For the other non-road modes detouring and end-haulage to Essen and Dortmund has a lower impact.

Figure 5 $PM_{2.5}$ emission per tonne km for average container transport; case: Rotterdam-Duisburg (2009)

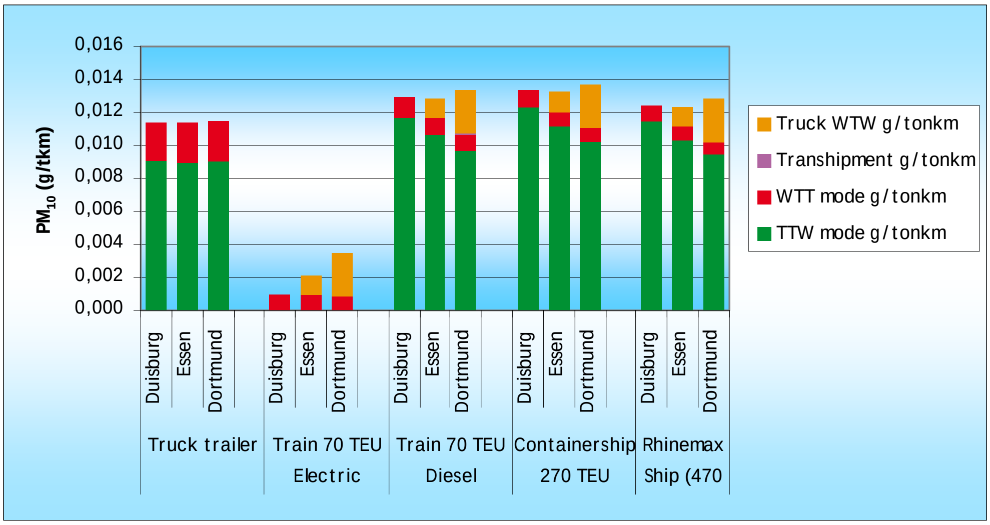


Figure 6 NO_x emission per tonne km for average container transport; case: Rotterdam-Duisburg (2009)

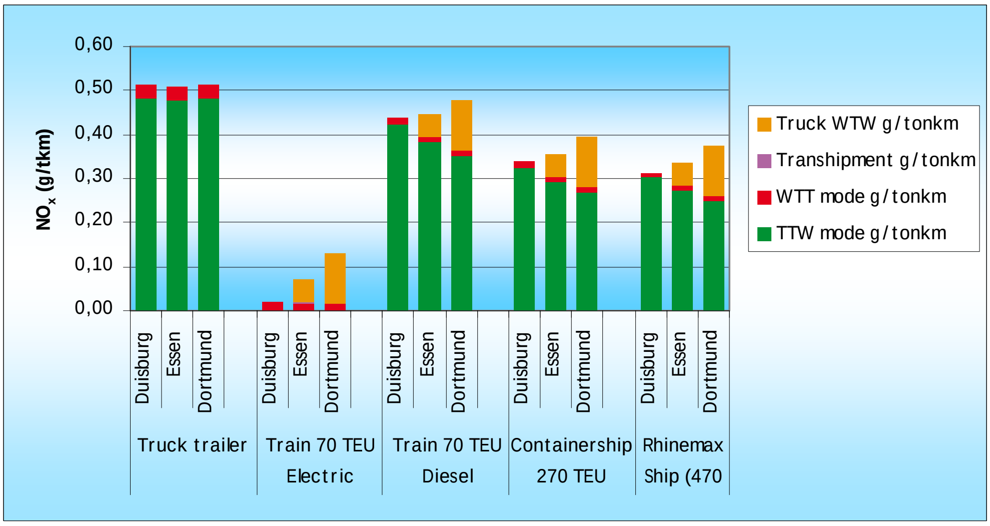
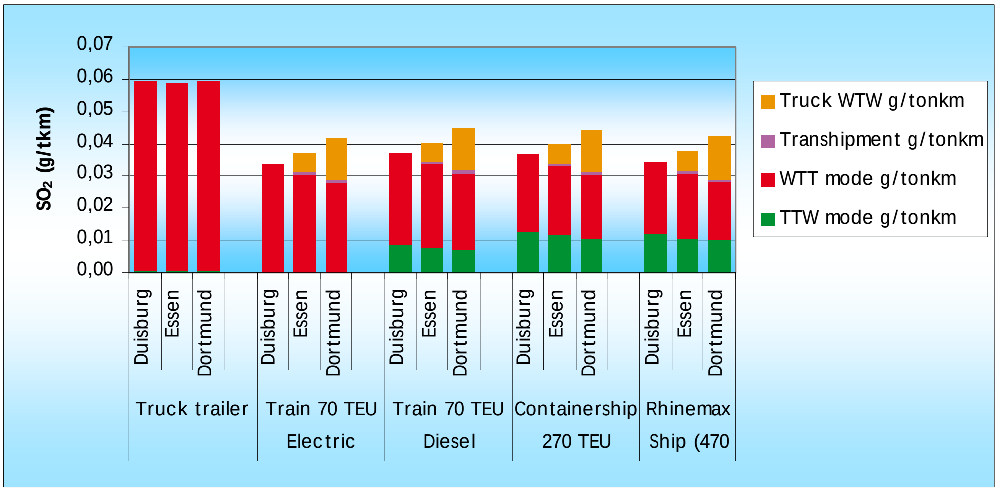


Figure 7 SO_2 emission per tonne km for average container transport; case: Rotterdam-Duisburg (2009)



Amsterdam-Regensburg

Figures 8, 9 and 10 do show the results for the pollutant emissions per tonne kilometre for heavy bulk transport between Amsterdam and Regensburg. NOx and $PM_{2.5}$ emissions for electric trains are by far the lowest on this track and the NOx and $PM_{2.5}$ emission for inland shipping are the highest.

Figure 8 $PM_{2.5}$ emission per tonne km for heavy bulk transport; case: Amsterdam-Regensburg (2009)

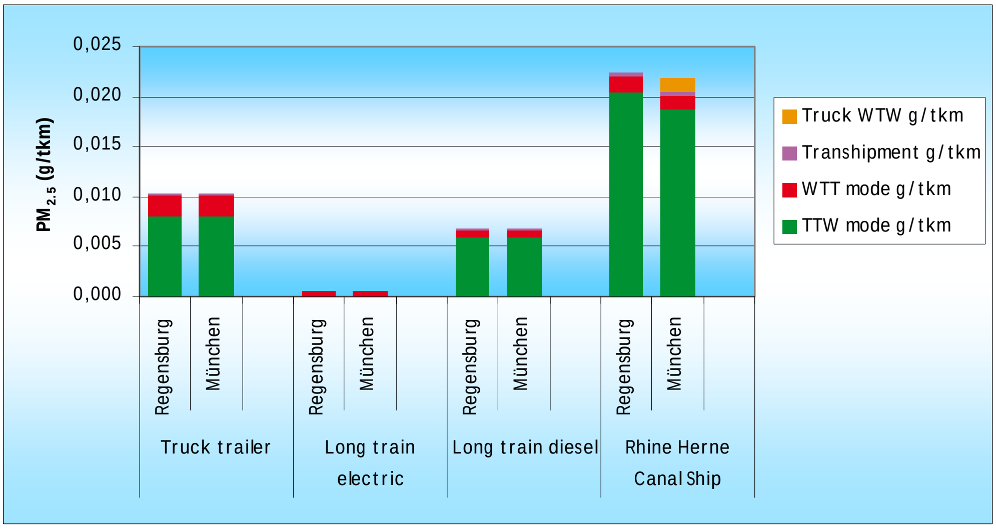


Figure 9 **NO_x emission per tonne km for heavy bulk transport; case: Amsterdam-Regensburg (2009)**

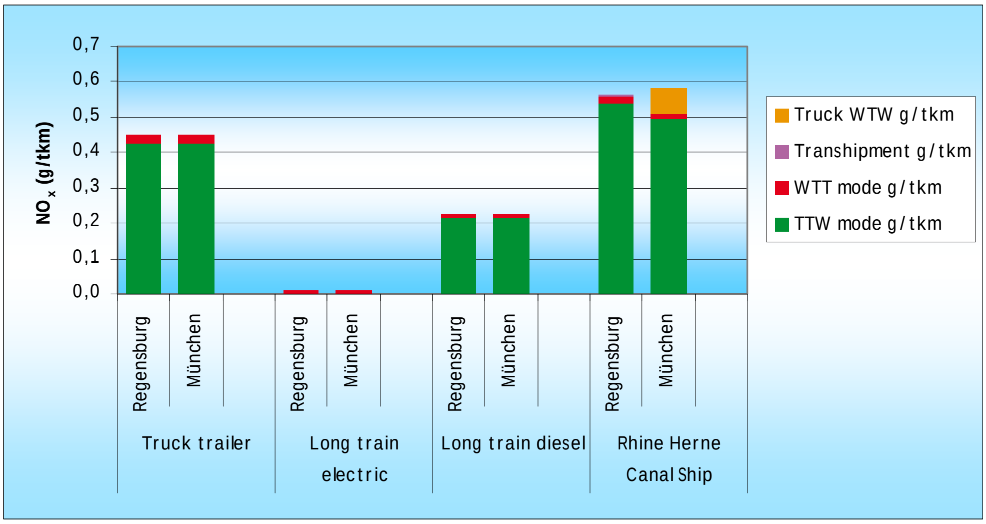
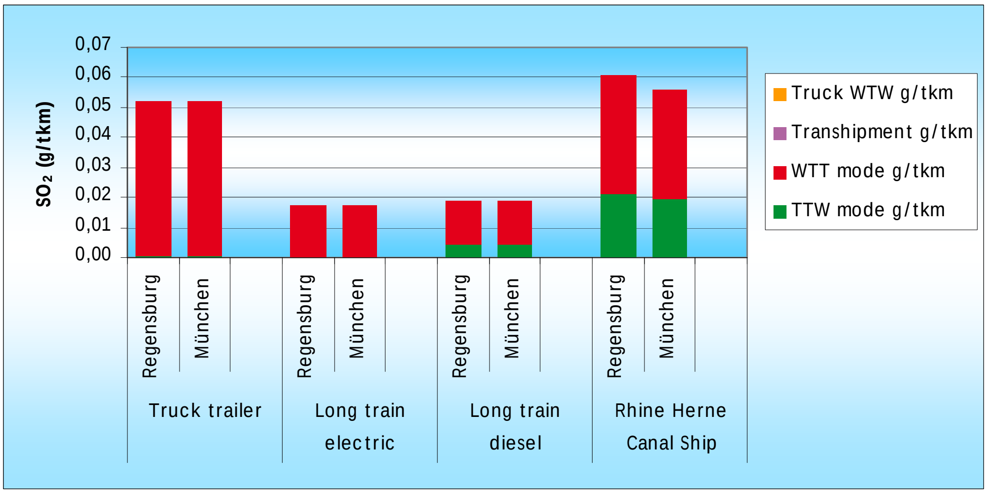


Figure 10 **SO_2 emission per tonne km for heavy bulk transport; case: Amsterdam-Regensburg (2009)**



Conclusion

In general electric trains have the lowest emissions except for the upstream SO_2 emissions. Detouring of rail transport can hardly undo the benefits electric rail has over the other modes.

$PM_{2.5}$ emissions for rail diesel and inland waterways in 2009 can be similar or higher than road transport, depending on the scale of transport and the amount of detouring. NOx emissions can be either higher or lower, depending on the factors mentioned.

In the presented cases exhaust SO_2, NO_x and $PM_{2.5}$ emission for short sea shipping are high compared to the other modes. The reasons for this are both, the small size of the ships selected that compete with other modes and the relatively high emissions per unit of work. In the case of ocean going ships, the emissions are significantly lower.

The emissions of transhipment hardly play any role on distances over 200 km.

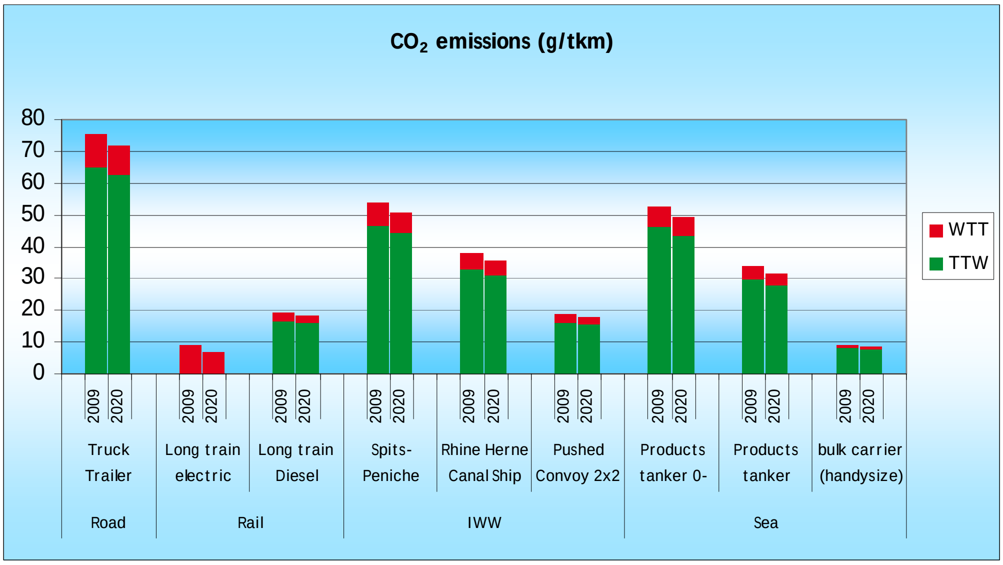
4.2.3 Development of pollutant and GHG emissions in the timeframe 2009-2020/2040

In this section the development of the emission from 2009 to 2020 are illustrated by the emission factors (g/tkm) of several selected vehicle types for average bulk and general cargo transport.

GHG emissions

As can be seen in the figures CO_2 emission the decrease of emission factors for CO_2 are quite similar (5%), but limited, for the different modes.

Figure 11 Comparison of CO_2 emissions 2009 and 2020 for selected vehicle types (average bulk and general cargo transport)



Pollutant emissions

For PM_{10} and NO_x emissions the reduction of emissions from 2009 to 2020 are the strongest for road, which can be explained by the European emissions standards for road (50-60%). For the other modes emission reduction are lower (20-30%), as a result of longer engine lifetimes and less strict emissions standards. This implies that the gap between road transport and the other modes is projected to increase over time.

The high SO_2 emissions in 2009 for diesel trains, inland waterway vessels, and in particular sea shipping are significantly reduced in 2020.

In 2020 only for sea shipping SO_2 exhaust emissions have a significant share in the total well-to-wheel emissions. For the other modes upstream SO_2 emissions are dominant in 2020.

Figure 12 Comparison of $PM_{2.5}$ emissions 2009 and 2020 for selected vehicle types (average bulk and general cargo transport)

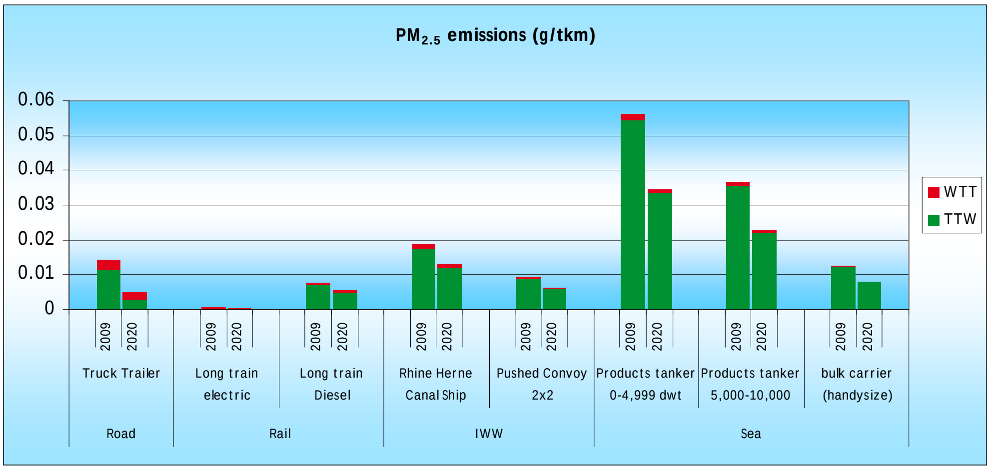


Figure 13 Comparison of NO_x emissions 2009 and 2020 for selected vehicle types (average bulk and general cargo transport)

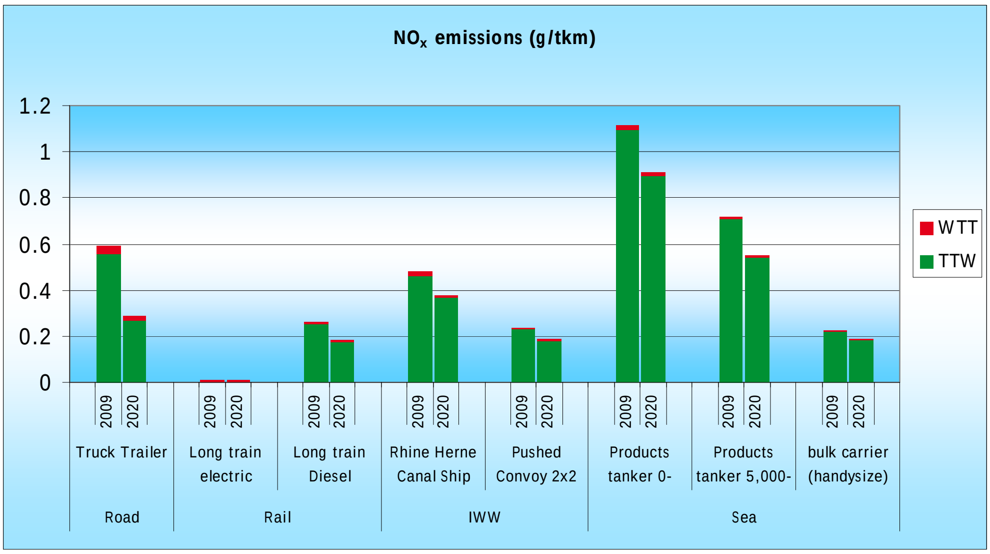
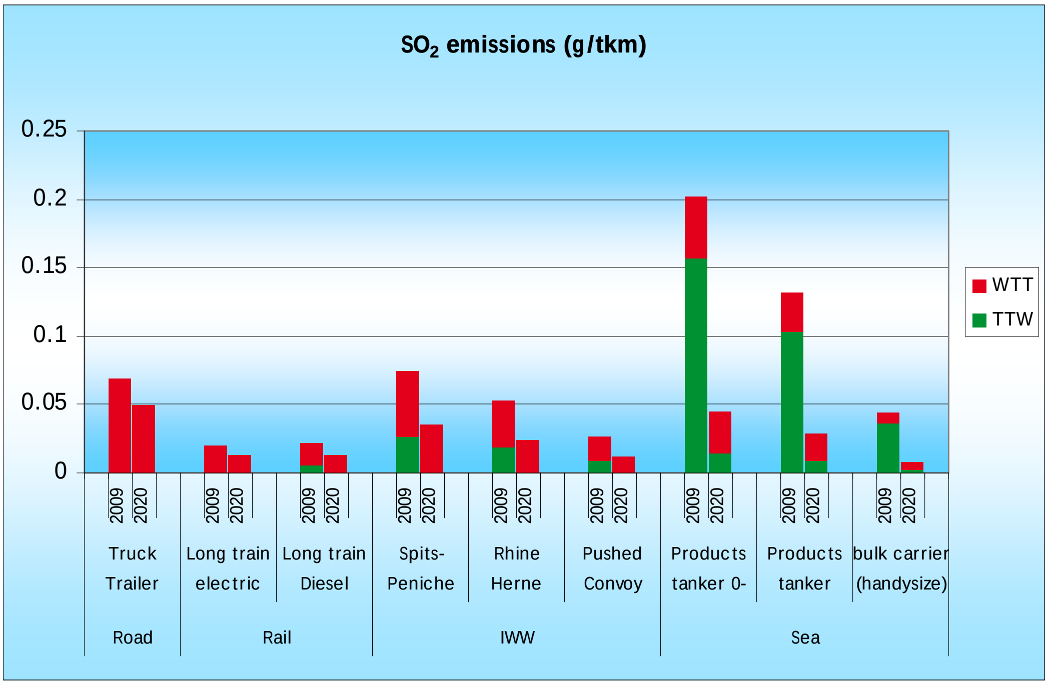


Figure 14 Comparison of SO_2 emissions 2009 and 2020 for selected vehicle types



Developments in the 2020-2040 periods

Available studies do not cover the 2020-2040 periods. Therefore, the analysis for the 2040 period is mainly based on extrapolations and expert judgements.

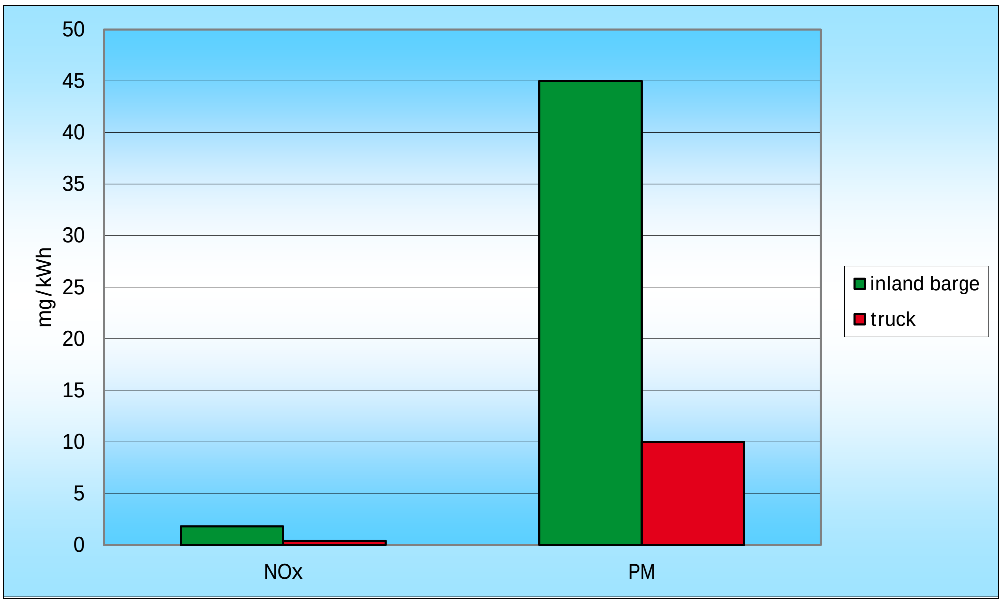
New heavy truck and inland barge engines are estimated to be 23-24% more fuel efficient in 2040 than in 2010 (Hill et. all, 2010). This implies that the differences will not change significantly. However, the European Commission is evaluating the options for curbing the fuel consumption of trucks. This may put road vehicles at lead.

Most important is the question whether inland navigation will be able to change the developments depicted for the 2009-2020 period, regarding air pollutants. Assuming Phase IV legislation introduced in 2016, the inland barge fleet will be completely renewed with updated technology, in the next 30 - 40 years. However, the emission factors for Euro-VI trucks are lower (0.4 g/kWh NOx versus 1.8 g/kWh NOx and 10 mg/kWh PM versus 45 mg/kWh PM for trucks and inland barge engines respectively) than those for phase IV inland barge engines. A complicating factor is, however, the difference in the age structure of the engines.

The pollutant emissions of inland barge engines will drop dramatically due to the effect of phase IV legislation, but the phase out of all CCR-2 engines –the standard in the 2008-2016 period- will take several decades (under a business as usual scenario). In addition, the trend of an increase in ship capacity will continue, resulting in lower emissions per tonne km. In chapter 4 (Fleet) of the Main Report of the study it was highlighted that the there is an increase in the average loading capacity over the last decades, which is expected to continue.

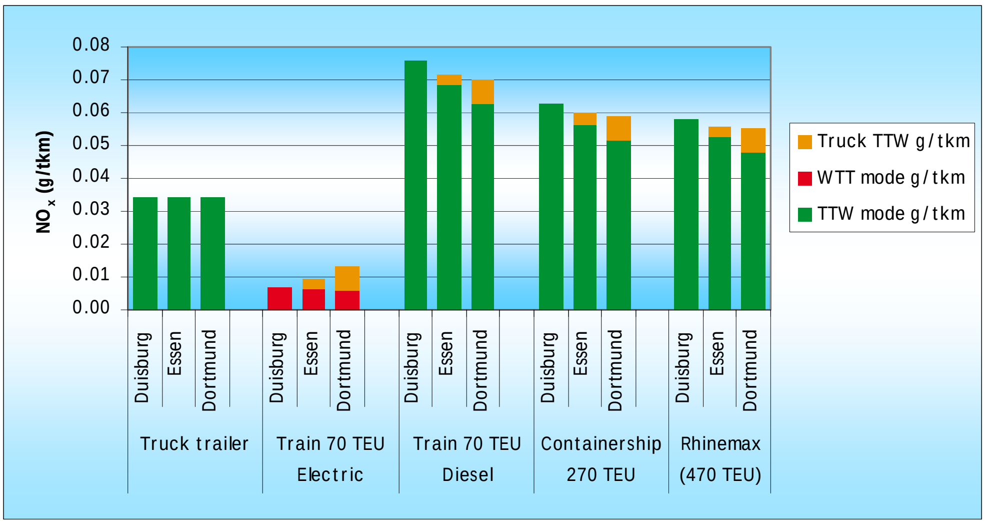
If no stricter emission legislation will be introduced and no additional measures are taken after 2020, the emissions would develop as presented in figure 15

Figure 15 Comparison of NOx (g/kWh) and PM (mg/kWh) emission standards for new vehicles in fleet after 2020



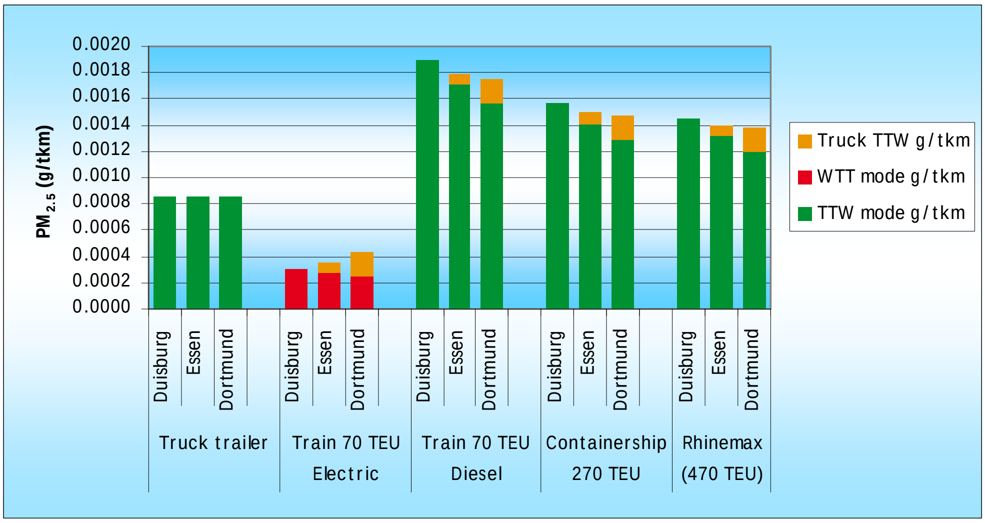
The figure shows that the emissions standards for inland barges that are under discussion at the moment are less stringent than for trucks. If we take the logistical characteristics for the modes into account from the cases presented above, emissions per tonne km worsen compared to road transport, as depicted in figures 16 and 17.

Figure 16 Comparison of NOx emission standards for new vehicles in fleet (g/tonne km): Rotterdam-Duisburg case in 2040



Note: for electric rail transport a 50% emissions reduction compared to 2020 has been assumed, well-to-tank emissions not included for the other modes. Potential off-cycling not taken into account.

Figure 17 Comparison of $PM_{2.5}$ emission standards for new vehicles in fleet (mg/tonne km): Rotterdam-Duisburg case in 2040



Note: for electric rail transport a 50% emissions reduction compared to 2020 has been assumed, well-to-tank emissions not included for the other modes. Potential off-cycling not taken into account.

It is likely that the pollutant emissions of inland navigation per tonne km will be higher in 2040 than that of trucks, if the current proposals are not tightened. The gap between trucks and inland barges is much smaller per tonne km than per unit of fuel burned, since inland barges are more fuel efficient.

If the case for Amsterdam-Regensburg would be applied, the situation would be worse, since the logistical characteristics (smaller size ship/detouring) of that case result in higher emissions per tonne km, measured over the shortest distance.

All in all, the pollutant emissions of all transport modes are expected to drop significantly, with a lead for road transport, due to the significantly lower Euro-VI standard. Therefore, to become competitive on the field of air pollutant emissions, a strengthening of the phase IV targets will be needed.

4.3 Other environmental and social impacts

4.3.1 Accidents

Accident statistics for inland waterways are incomplete and contain many data gaps. For example, Eurostat (2011) only provides for 6 countries information on the number of accidents with inland ships involved. Due to this lack of reliable accident statistics comparisons of accident rates between modes are hardly available. Only for the Netherlands such a comparison was found. CE Delft (2004) compares the number of fatalities and injured people in 2002 which could be allocated to road freight transport, rail freight transport and inland shipping.[8] The main results of this comparison are given in table 6. The total number of victims allocated to inland waterways and rail freight traffic is rather low compared to road freight transport. However, this is partly the consequence of the small number of vehicle kilometres of rail and inland waterways transport compared to road transport. Therefore, the accident figures have been corrected for the number of vehicle kilometres. The resulting figures show that inland waterways have a lower number of accident victims per billion vkm than trucks and rail freight traffic.

Table 6 Number of victims in traffic accidents with freight transport modes involved in the Netherlands in 2002

	Number of victims		*Number of victims per billion vkm*	
	Fatalities	*Injuries*	*Fatalities*	*Injuries*
Road freight traffic: vans	102	1,140	11	121
Road freight traffic: HDV	144	586	116	469
Rail freight traffic	2	13	213	1,318
Inland waterways	<1	10	5	147

Source: CE Delft (2004)

4.3.2 Noise

Noise annoyance due to inland waterway transport is limited, because emission factors are rather low and most of the activities occur outside densely populated areas. For these reasons, negative impacts of noise due to inland waterway transport are often assumed to be negligible.

Road and rail transport, on the other hand, do cause significant negative impacts due to their noise emissions[9]. Of these adverse impacts, the most widespread is simply annoyance. However, traffic noise can also result in more severe health effects like disturbed sleep patterns, cardiovascular diseases (raised blood pressure, various types of heart diseases) and disturbed cognitive functioning (especially in children). CE Delft (2007) roughly estimates that in 2000 over 210 million people in Europe are exposed to road traffic noise levels above 55 dB(A). Rail traffic noise was estimated to be a burden for about 35 million Europeans.

[8] The victims in multilateral accidents are allocated based on the intrinsic risk of the vehicles involved in the accident. This allocation approach recognizes that *every* traffic participant poses an intrinsic danger. Generally speaking, mobility always involves a certain intrinsic risk, even when traffic regulations are adhered to. More specifically, the heavier and faster a vehicle, the greater the danger it poses to exposing other road users. This intrinsic risk of vehicles is taken into account by allocating the victims from multilateral accidents to the opposing party. For example, in an accident between a passenger car and a truck, the victims in the car are allocated to the truck and vice versa.

[9] Noise emission in road freight transport is mainly due to tyre/road contact and only limitedly the result of engine noise.

It should be noticed that only part of the noise nuisance could be attributed to freight transport. CE Delft (2007) estimates that ca. 47% of total social cost due to road transport noise could be allocated to freight transport. For rail, about 37% of the social noise cost could be attributed to freight transport.

4.3.3 Congestion

External congestion costs refer to the costs vehicles cause for other users of the infrastructure by entering the infrastructure. E.g. a car entering a congested road may increase the time delays of other cars on this road; the related costs could be regarded as external congestion costs.

Congestion on roads can have a range of impacts: increased travel time, increased vehicle operating costs (including fuel costs), costs due to less reliable travel times, etc. The total external congestion costs of road transport in Europe are estimated at € 29 billion (CE Delft et al., 2011a). About 12.5% of these road congestion costs could be allocated to freight transport.

For inland waterways total congestion costs are assumed to be much lower, although empirical evidence is lacking. Different kind of congestion/scarcity costs exists (GRACE, 2006):

- Congestion at locks
- Congestion at bridges
- Scarcity on waterways: during periods of draught the capacity of inland waterways can be less than usual. This means that the class of the waterway can be reduced and certain vessels are not longer able to pass. Therefore, part of the initial transported goods on this route has to shift to other routes or modes. The resulting additional shipment costs due to reduced capacity are scarcity costs.

Although European inland waterways in general do not face capacity problems, case studies from GRACE (2006) found a number of local bottlenecks at locks, although they are much depending on local conditions. Delay times range between zero and 160 minutes, in the latter case passage costs per ship are found to increase € 50 in case demand increases by 1%. With regard to scarcity costs, GRACE conducted a case study for the river Rhine where a low water surcharge already exists in order to compensate the additional transport costs of the shipping agents. The result of the calculation was as follows: The increase in cost per TEU when the water level drops with 1 cm varies from € 0.38 to € 2.50 at Kaub and from € 0.65 to € 1.25 at Duisburg-Ruhrort. However, since the available information is limited and case-specific, no calculations could be made. However, the figures mentioned lead to negligible external cost.

In contrast to non-scheduled transports, like road and inland waterways transport, for rail not congestion but the scarcity of tracks is relevant. Scarcity costs are related to the foregone profit or benefit which can not be realised by an operator because he is not able to obtain the desired slots for reasons of capacity shortage. IMPACT (2008) states that scarcity costs are indirectly included in some existing pricing schemes by considering demand or quality level of tracks. Moreover, IMPACT concludes that scarcity costs need to be estimated on an individual basis, since these costs heavily depend on local circumstances. Therefore, aggregate cost estimates for the EU on scarcity costs for rail transport are not available.

4.3.4 Costs of infrastructure use

Next to the external costs described above, also the infrastructure costs caused by the various modes are a cost factor to society. Due to the social character of these costs and the fact that the various travel modes do not pay directly for these costs, they should also be included in the analysis. As the external costs, the infrastructure costs could be charged by the government via taxes.

In this study we will define transport infrastructure as the physical and organizational network, which allows movements between different locations (HLG, 1999). These are the roads (road transport), tracks (rail transport) and waterways (inland navigation), but also railway stations and harbours. Transport infrastructure also includes the organization of the traffic (e.g. police, systems managing).

The costs of transport infrastructure consist of three components (CE Delft, 2008):

- Construction costs: all costs of new infrastructure or expansion of existing infrastructure with respect to functionality and/or lifetime. Construction costs are based on annual investments cost, taking a long depreciation period into account (35 years).
- Maintenance and operational costs: all costs of maintaining the functionality of existing infrastructure within its original lifetime (maintenance costs) and costs of the organisation of an efficient use of the infrastructure (operational costs).
- Land use costs: costs related to the land use of infrastructure (e.g. financing costs). A distinction can be made between direct and indirect land use costs. Direct land use refers to actual land use of the infrastructure. Indirect land use refers to the limited application possibilities of land near infrastructure, e.g. due to noise zoning. In this study we will only take direct land use costs into account.

A distinction can be made between variable and fixed infrastructure costs (Ecorys & CE Delft, 2006). Variable infrastructure costs vary with the transport volume while the functionality of the infrastructure remains unchanged. Part of the maintenance and operational costs belongs to this cost category. Fixed costs do not vary with transport volume while the functionality of infrastructure remains unchanged, or they enhance the functionality or lifetime of the infrastructure. Construction and land use costs are examples of fixed infrastructure costs. Fixed costs can be allocated to navigation, but also to water management. In this report only the first category will be taken into account, which is about 60% of the total fixed infrastructure costs (CE Delft et al., 2010).

4.4 External and infrastructure cost

In this section we compare the external and infrastructure costs caused by the various freight transport modes. This comparison will be based on European average cost figures for both 2009 and 2020. To make a fair comparison between modes possible, we will express all (external) cost figures in €$_{2009}$/tonne. First, we will briefly describe the methodology used. In section 1.4.2 the results will be presented. Since the cost figures do not apply to specific cases, no detouring and application of per- and end-haulage like applied in the previous section is applied.

4.4.1 Methodology

The methodology used to estimate the external and infrastructure costs of the various modes is discussed in this section. First we discuss why we present average cost figures instead of marginal ones (as for example in CE Delft et al., 2010). Next, the estimation approach for the various external costs and infrastructure costs are described.

Average external and infrastructure costs

The comparison of the various freight modes will be based on average external and infrastructure costs in the EU-27. In other studies, like for example IMACT (IMPACT, 2008) and CE Delft et al. (2010) marginal cost estimates instead of average ones are presented. However, in those studies the overview of external (and infrastructure) costs of the various modes was especially meant as input for the modelling work on some internalisation measures. In that case, marginal cost estimates are more appropriate since the internalisation of these type of costs will result in an efficient allocation of traffic movements (the so-called Marginal Social Cost Pricing; for more information see IMPACT (2008). In this study we would like to compare the social impact of the various modes; in that case average cost figures are more appropriate since they provide a completer picture of all the costs caused by the various modes. For example, average costs do take fixed cost elements into account, while these elements are not covered by marginal cost figures.

External costs

In this study we consider the following five external cost categories: air pollution, climate change, noise, accidents and congestion. There are some more external cost categories, like costs due to adverse impacts on nature and landscape or water pollution, but the knowledge on their valuation is less sophisticated as for the five main cost categories. Additionally, the size of these ‘other’ external costs is relatively small compared to the main five ones. Therefore, we will focus in this study on the latter ones.

Air pollution

The external costs (per tkm) of pollutant emissions will be estimated by multiplying the emissions per tkm with so-called shadow prices[10]. CE Delft (2011b) provides a state-of-the-art overview of shadow prices to be applied for transport emissions[11]. With regard to NO_x and SO_2 it is recommended to use shadow prices estimated by the NEEDS project (NEEDS, 2008). As shadow prices for particulate matter emissions the ones presented by HEATCO (2006) are recommended for valuating transport emissions. The latter shadow prices are differentiated to urban metropolitan, urban and rural traffic situations, since the impact of these types of emissions depends heavily on the population density near the transport infrastructure.

In table 7 an overview of the shadow prices for pollutant emissions is presented. In this table also the shadow prices for 2020 are shown. These figures are based on the 2009 values, but are corrected for GDP/capita developments[12].

Table 7 Shadow prices of pollutant emissions.

Pollutant		*Shadow price (€$_{2009}$/t of pollutant)*	
	Urban Metropolitan	*Urban*	*Outside built-up areas*
Shadow prices 2009			
$PM_{2,5}$ (exhaust)	342,089	113,366	58,734
NO_x		9,354	
SO_2		8,998	
Shadow prices 2020			
$PM_{2,5}$ (exhaust)	390,670	129,465	67,075
NO_x		10,683	
SO_2		10,276	

Source: CE Delft (2011b), adjusted by CE Delft

Climate change

Based on detailed assessments IMPACT (2008) derived recommended shadow prices for CO_2 emissions. These shadow prices are presented in table 8. Since the uncertainty in the estimated CO_2 prices is rather large, both a central value and upper and lower values are given. In this study we will use the central value for the estimation of the average external climate change costs.

[10] Shadow prices are constructed prices for goods or production factors that are not traded in actual markets.
[11] The same shadow prices are applied in CE Delft et al. (2011a), in which external cost estimates for all modes are estimated for 27 European countries.
[12] The value people attach to a clean environment is assumed to be dependent on their income level. The higher their income, the more people are willing to pay for a clean environment. Therefore, the future shadow prices for air pollutants have to be corrected for GDP/capita developments (taking an income elasticity of 0.85 into account). More information on this transfer approach can be found in IMPACT (2008).

Table 8 CO_2 shadow prices (in €/tonne CO_2), expressed as central estimates and lower and upper values

Year of application	*Lower value*	*Central value*	*Upper value*
2010	7	25	45
2020	17	40	70
2030	22	55	100
2040	22	70	135
2050	20	85	180

Noise

As mentioned in section 1.3.2 the adverse impacts of noise due to inland waterways transport are negligible. Therefore, the external noise costs for this mode will be zero. For road and rail transport the external noise costs will be based on CE Delft et al. (2011a), which provides state-of-the-art average noise cost estimates for all European countries as well as an average value for the whole of Europe. CE Delft et al. (2011a) provides cost figures for 2008. Based on GDP/capita developments these cost figures are transferred to 2009.

For the 2020 we assume the same average noise costs as for 2009. On the one hand, vehicles may become quieter, due to more stringent noise policies. On the other hand, the willingness to pay for a quiet environment is expected to increase since people will become wealthier. As a rough estimation we assume in this study that these both effects compensate each other.

Accidents

For inland waterways information on (external) accident costs is almost entirely lacking (IMPACT, 2008). Therefore, we are not able to quantify this cost category in this study. For road and rail transport the external accident costs are based on CE Delft et al. (2011a). Again, cost figures were transferred to 2009 based on GDP/capita developments.

Accident rates have decline sharply last decades and this trend is expected to continue in the period 2009-2020. Based on CE Delft et al. (2010) we therefore assume that the accident rates (and hence total number of fatalities and injuries) will decrease with 20% in this period. Additionally, a correction of the 2009 figures for GDP/capita developments is applied.

Congestion

As mentioned in section 1.3.3 only case study results are available with regard to congestion/scarcity costs of inland waterways transports. Since these costs depend heavily on case-specific factors, these values could not be transferred to more aggregate levels. Therefore, we are not able to quantify this cost category in this study. For the same reasons also the scarcity costs or rail freight transport will not be quantified. For road transport the external congestion costs will be based on CE Delft et al. (2011a)[13].

For the congestion costs in 2020 no estimates are available. A simple extrapolation of the figures for 2009 is not appropriate, since the congestion cost do show a linear relationship with total vehicle kilometres (they depend, among other things, on the available infrastructure, total vehicle kilometres, and governmental policies w.r.t. congestion). Due to these uncertainties we will keep the average congestion costs for 2020 equal to the 2009 figures.

Infrastructure costs

Studies estimating and comparing the infrastructure costs of the various freight modes (road, rail and IWT) are scarce. Especially estimates for the infrastructure costs of IWT are hardly available in the literature. An exemption is a study of CE Delft et al. (2010) on the external and infrastructure costs of freight transport on the corridor Paris-Amsterdam. In this study infrastructure cost estimates for road, rail and IWT freight transport in France, Belgium and the Netherlands are presented. In this study we will present a rough estimation of the European infrastructure costs based on the results presented by CE Delft et al. (2010)[14]. Therefore, we will take the average of the infrastructure cost figures for France, Belgium and the Netherlands and assume that these are a good approximation for the European average infrastructure costs.[15]

From various studies (CE Delft, 2009; ProgTrans/IWW, 2007) it becomes clear that current (2006/2007) and future (2020) infrastructure costs of road transport are comparable. Both studies show only small differences in road infrastructure costs, because two important cost drivers (cost increase, traffic increase) compensate each other. In this study we will also assume that the infrastructure costs of road transport in 2020 is equal to the 2009 cost values. Due to a lack of information on the relationship between current and future infrastructure costs of rail and IWT transport, we will also assume the same values for both years for these modes.

[13] It should be noted that CE Delft et al. (2011a) provide rather rough estimates of the congestion costs of road transport, which is due to the relatively weak data basis for these costs. This should be considered when interpreting the external cost estimates presented in section 1.4.2.

[14] Notice that the main share of IWT transport in Europe takes place in these three countries + Germany. Since it may be assumed that infrastructure costs in Germany are comparable to the costs in these three countries, estimating infrastructure costs based on CE Delft et al. (2010) seems appropriate for this study.

[15] The results in CE Delft et al. (2010) show that the differences in average infrastructure cost figures between France, Belgium and The Netherlands are rather small. Taking the average of the cost figures for these three countries seems therefore acceptable.

4.4.2 Results

In this section we present the external cost estimates for the various freight transport modes. We will present figures for both bulk and container transport, for the estimation of the external costs of road transport we assumed the following share of road/region types: 70% interurban motorway, 10% other interurban road, 10% urban motorway and 10% metropolitan motorway. For rail and IWT transport 90% interurban regions, 5% urban regions and 5% metropolitan regions were assumed.

Average infrastructure and external costs in 2009

In figure 18 and figure 19 the external and infrastructure costs for container and bulk transport are presented. The estimates for both types of transport are largely comparable. This can be partly explained by the fact that for some cost categories (infrastructure cost, noise, accidents, congestion) no distinction between both types of transport could be made. Therefore, the difference in average costs figures are all related to differences in air pollution and/or climate change costs.

The results show that the infrastructure costs are highest for rail transport, followed by road transport and IWT. Especially the fixed infrastructure costs of rail transport are relatively high. This can partly be explained by the relatively lower usage of the rail network compared to the road network.[16]

The external costs of road transport are significantly higher than for rail and IWT transport. This is especially the result of the relatively high congestion and accident costs of road transport. Also the noise and air pollution costs are higher for road transport, although the latter is also relatively high for small IWT ships.

[16] Remember that the infrastructure cost estimates are based on estimates for France, Belgium and The Netherlands, three countries with a high usage of the road network.

Figure 18 External and infrastructure costs of container transport in 2009 (€$_{2009}$ per 1000 tkm)

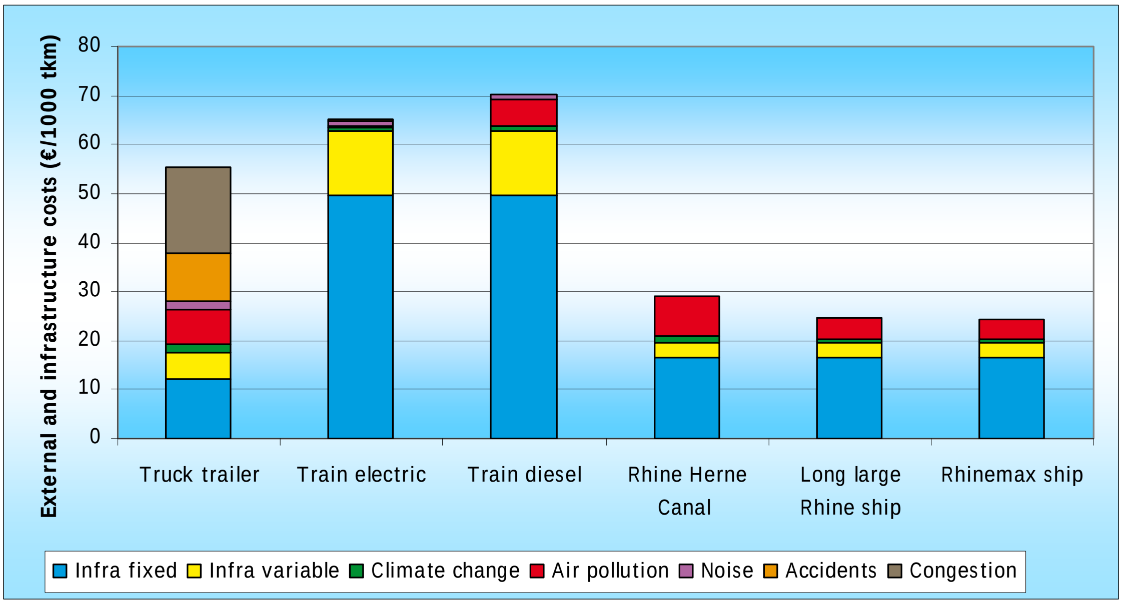
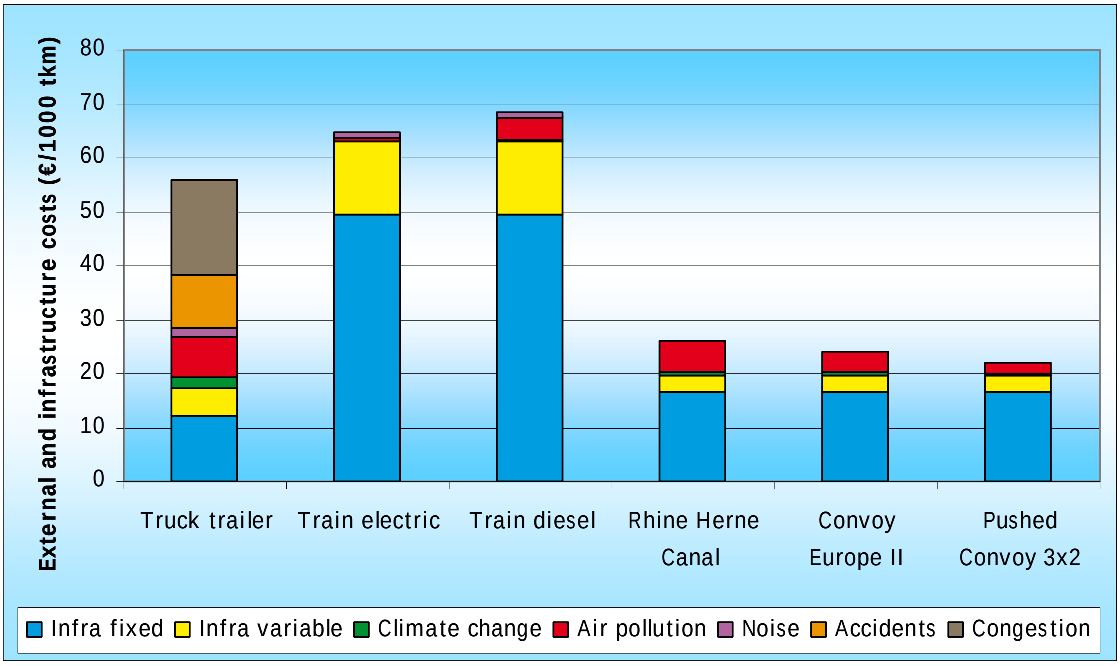


Figure 19 External and infrastructure costs of bulk transport in 2009 (€$_{2009}$ per 1000 tkm)



Detouring and pre- and end-haulage

In the previous section, it was shown that detouring may have a significant impact on the emissions and hence on external and infrastructure costs of inland and. In cases of significant detouring, external and infrastructure costs may come close to those of road transport. Furthermore, it should be remarked that the possible additional external costs for pre- and end-haulage are not included in the figures 18 and 19.

Average infrastructural and external costs in 2020

In figures 20 and 21 the external and infrastructure costs for container and bulk transport are presented. As for 2009, the figures for both types of transport are largely comparable.

Figure 20 External and infrastructure costs of container transport in 2020 (€$_{2009}$ per 1000 tkm

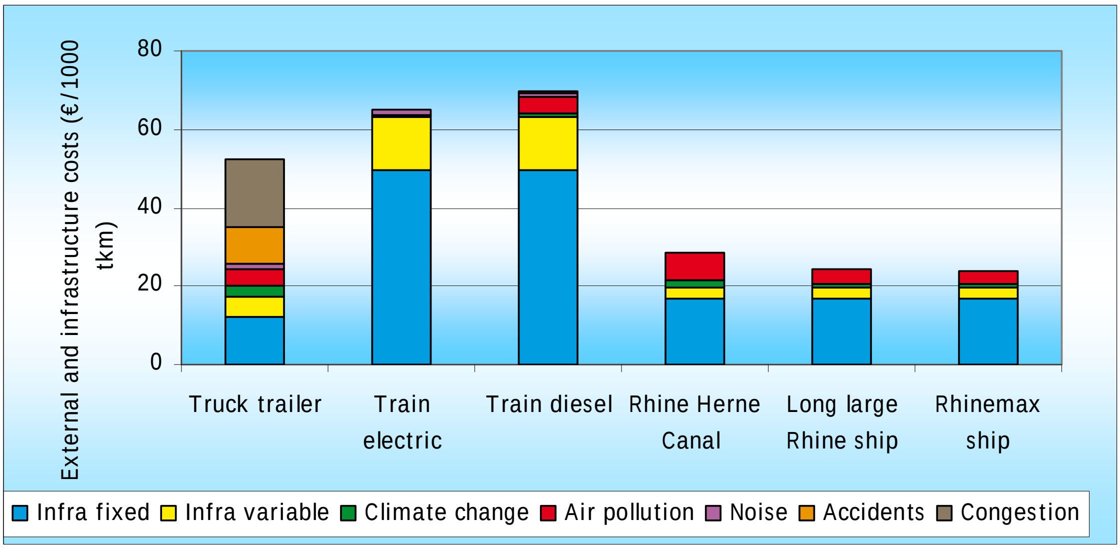
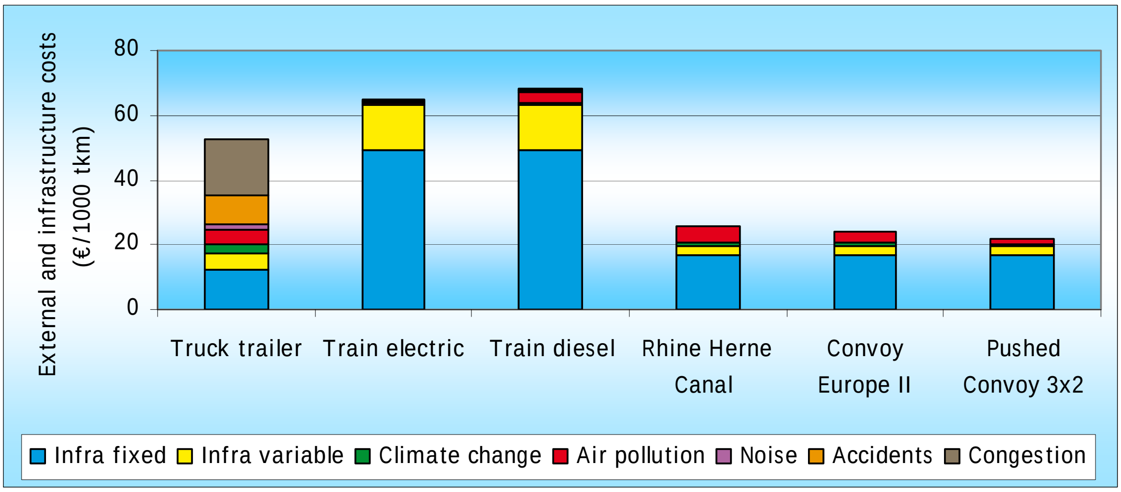


Figure 21 External and infrastructure costs of bulk transport in 2020 (€$_{2009}$ per 1000 tkm)



In figure 22 a comparison of the external costs values for 2020 with the 2009 values is presented, for individual external cost categories as well as for the total external cost figures. In this figure no values for noise, congestion and infrastructure costs are shown, since it was assumed that these costs were equal for 2009 and 2020. Here, we only compare 2009 and 2020 values for container transport. However, the figures are largely comparable for bulk transport.

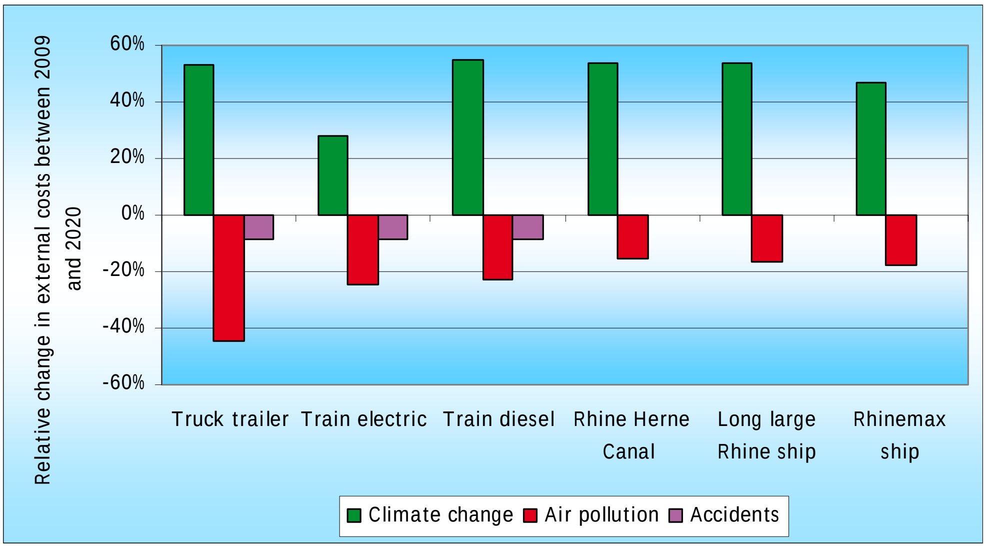
From figure 22 it becomes clear that the climate change costs increase between 2009 and 2020. Although the CO_2 emissions per tonne kilometre decrease for (almost) all modes this is outweighed by the increase in the shadow price of CO_2. The relative increase in climate change costs is rather comparable for most modes, with the exception to electric rail transport (which is due to larger decreases in CO_2 emissions per tonne kilometre for this mode).

The decrease in air pollutant costs is largest for road transport (about 44%). The decrease in air pollutant costs for rail and especially IWT transport is more limited, respectively 23%-25% and 15%-18%. This can be explained by the more limited decrease in air pollutant emissions per tonne kilometre for these modes.

The relative decrease of accident costs is the same for road and rail transport (ca. 9%). Remember that IWT transport do not cause (significant) external accident costs.

Finally, the total external costs per tonne kilometre decrease by ca. 8% for road transport. For rail and IWT transport a decrease of 1%-2% is estimated. The smaller decreases in total external costs per tonne kilometre for the latter modes is especially caused by the smaller reduction in air pollutant costs of these modes compared to road transport.

Figure 22 Relative changes in some external cost categories between 2009 and 2020 (container transport).



4.5 Comparison of external costs with Marco Polo calculator

4.5.1 Introduction

Recently, the 2011 call in the Marco Polo programme was opened. Part of the selection of proposals is a benefit calculation by calculating external cost of the reference situation and after project implementation. Both sources (Brons, 2010) and this study show differences in the outcomes. In the following the differences in external cost figures used in this study and from the Marco Polo (MP) calculator is analysed. In table 9 the external cost figures from both sources are presented. We only take climate change and air pollution costs into account, as those are the only cost categories relevant for inland shipping in the Marco Polo external cost calculator.

Table 9 Overview of external costs from both sources

	Climate change (€/1000tkm)	*Air pollution (€/1000tkm)*
This study (2009, average load)		
Container		
Truck trailer	1.8	7.1
Train electric	0.4	0.6
Train diesel	0.8	5.4
Rhine Herne Canal	1.2	8.3
Long large Rhine ship	0.6	4.3
Rhinemax ship	0.6	4.0
Bulk		
Truck trailer	1.9	7.4
Train electric	0.3	0.4
Train diesel	0.6	3.8
Rhine Herne Canal	0.9	5.7
Convoy Europe II	0.6	3.9
Pushed Convoy 3x2	0.3	2.0
Marco Polo Calculator (2010, EU-27)		
Road (motorway)	3.9	8.6
rail electric	1.5	1.0
rail diesel	1.9	10.3
IWT>3000 tonnes	1.1	8.7
IWT 1500-3000 tonnes	1.5	11.8
IWT 1000-1500 tonnes	1.6	12.1

There are a number of differences between the two studies that imply the cost coefficients from this study to be lower than those from MP. In general terms the Marco Polo figures are up to factor 1.5-2 higher than the figures used in this study. External cost calculations have three main parameters that influence the outcome of the calculations:

- Loading of vehicles
- Emission factors and fuel consumption
- Economic valuation

Therefore, the more important parameters as mentioned above are discussed in the following.

4.5.2 Vehicle loading

In the table below, an overview of the average load of vehicles is shown. The source for the Marco Polo calculator is the TREMOVE model, using average data per mode. CE (2011) has performed a market consultation. This consultation was done because statistical data is very limitedly available, and does not provide information for different market segments (e.g. bulk/container) within a single mode, which was needed for the study.

CE (2011) differs between bulk and general cargo and containers. In addition for both types of transport a distinction between voluminous goods, average goods and heavy goods was made.

Table 10 overview of average load between both sources

	Marco Polo	*This study*	
	Average load (tonne/veh.)	*bulk, average cargo (tonne/veh.)*	*Container, average weight class (tonne/veh.)*
Road	8.7		
Truck-trailer		12	13
Rail diesel*	300	617	406
Rail electric*	440	617	406
IWT >3000 tonne*	921		
IWT Large Rhine ship (3013 tonne cap.)		1356	1335
Convoy Europe II		2475	
IWT 1000-1500 tonne*	297		
Rhine Herne Canal ship (1350 tonne cap.)		608	471

*Note: *EU figure based on most relevant countries (>60% of total tkm in EU-27)*

As can be seen from table 10, the differences in load factor explain to a high degree the differences in external costs. Bulk transport especially has the highest share in rail and inland waterway transport. Comparing the data from the Marco Polo calculator with bulk transport from CE (2011), the data in CE (20110 is 50% higher or more in all cases.

4.5.3 Emission factors

The source for emission factors is TREMOVE. The main source for road transport emission factors is TNO. For rail transport and inland shipping both studies use more or less the same basic primary energy consumption data.

With respect to truck emissions, several approaches can be used to estimate vehicle emissions:

- "Average Speed Models" use a database on measured emissions and apply regression functions to obtain the emission factors as function of the average cycle speed. Example for such a model is COPERT.

- "Aggregated Kinematic Models" use a database on measured emissions and apply regression functions to obtain the emission factor as function of kinematic parameters of the cycle (e.g. the distribution of velocity, acceleration. An example for such a model is the VERSIT+ model from TNO.

The TREMOVE model uses COPERT as a source, while this study uses data from the VERSIT+ model of TNO.

4.5.4 Economic valuation

The following differences explain the differences in economic valuation:

- In this study prices are updated to 2009, for Marco Polo to 2011.
- In order to reflect an increase in willingness-to-pay as a result of real GDP growth, this study uses an income elasticity of 0.85. For Marco Polo an income elasticity of 1 is used.
- In this study the costs per tonne CO2 emitted is €25. For MP this is €31.
- In this study the valuation (shadow prices) of some of the pollutants (NO_x and CO_2) is based on the NEEDS (2008) study instead of CAFE CBA (2005).
- The shadow prices of pollutants used in the NEA study (Table 7) appear to be EU27 aggregate values. In MP Member-State specific shadow prices are used to calculate cost coefficients which are later aggregated, using mileage as weights.

4.5.5 Assessment

External cost calculations are sensitive to a significant number of variables that need to be quantified. Examples of these are illustrated above. The recently published Marco Polo calculator (Brons, 2010), to be used for selection of proposals by calculating external cost of the reference situation and after project implementation, uses the same basic methodology, but due to the use of different data sources, the calculated external cost for specific vehicle categories deviates from the results from this study.

However, as far as concerns inland navigation, the same conclusion can be drawn from the Marco Polo calculator results as from this study: air pollution costs are higher than those for trucks, especially for small ships. The costs of climate change are lower.

Annex 5 Policy measures to improve the environmental performance of IWT

5.1 Introduction

Due to the limited capability to invest in new technologies and the limited benefits of individual ship-owners on short term in case of reducing air pollutant emissions from existing ships, government policies may be needed to stimulate the IWT sector to improve its environmental performance.

This Annex 5 covers both technical measures and the policy instruments needed for implementation are discussed. Following from the SWOT analysis, the following policy aims should be realized to improve or safeguard the position of IWT:

- **Reduction of the specific fuel consumption of IWT transport**

Rail transport is the most fuel efficient transport mode (in terms GHG emissions per tonne kilometre), followed by inland navigation. GHG reduction is high on the political agenda (see for instance the White Paper on Transport 2011). The Commission is studying obligatory fuel standards for trucks at the moment. US truck fuel efficiency is standardised already. To anticipate on this development and the pressure that will be put on the IWT sector, regarding their contribution to the 60% GHG reduction in 2050, as cited in the 2011 White Paper, IWT will need to reduce its fuel consumption.

- **Reduction of the specific air pollutant emissions of IWT (g/tkm)**

The air pollutant performance of IWT will improve on a lower pace than in road transport (CE Delft, 2011). An important condition for the future market opportunity of IWT is a situation with a comparative emission level as for road transport. New engine emission standards are under development, but the level of ambition under discussion does not live up to the standards for road transport and since fleet renewal is slow, penetration of the impacts of standards for new engines will take a long time. Therefore, also policies directed to the emissions of the existing fleet are needed. Here we will focus on the latter type of policies.

- **Organisation of market for clean and efficient transport**

In addition to policy measures to reduce the emissions of transport, the recently set up green award system will be expanded to an exchange, where shippers and ship owners can find each other.

- **Internalisation of external costs for all modes (c.f. Transport White paper)**

The recent Transport Whiter paper of the European Commission has the objective of internalisation of all external costs. As a result, inland navigation will be subject to charges due to marginal external cost internalisation, in the same way as road transport.

This Annex 5 starts with an overview of technical measures to reduce the environmental impact. The chapter finishes with an overview of policy measures that foster the implementation of technical measures.

5.2 Setting the scene: overview of inland shipping emissions

As to be able to illustrate the effect and costs of introduction of technical measures in the fleet, we provide an overview of the EU emissions, including a distribution over countries and ship types.

Detailed information on the emissions of inland navigation in the EU as a whole is not accessible easily, since statistics are limited, and often mixed with other sources like coastal shipping and river cruising. The TREMOVE model provides and estimate of the EU inland navigation emissions. In the table below, the emissions of NOx, PM and CO2 are tabled. In comparison with the Dutch national emission inventory, TREMOVE uses relatively low vehicle utilization parameters, conservative emissions factors in the case of NOx and PM, resulting is a relatively high emission estimate.

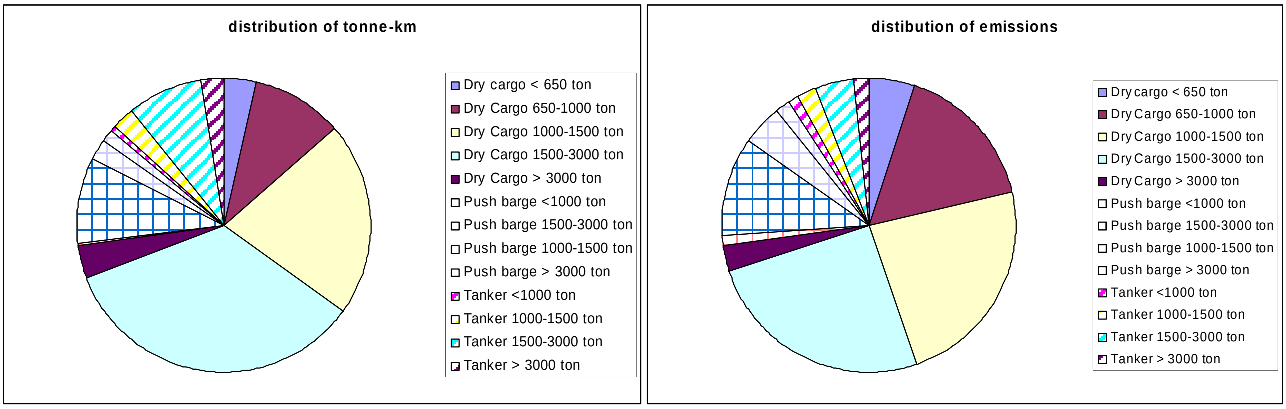
Table 1 Overview of inland shipping emissions

		2010	*2020*	*2030*
transport performance	million tkm	144,229	168,901	186,865
traffic performance	million vkm	413	450	487
CO2 emissions	ktonne	8,884		
NOx emissions	ktonne	136		
PM emissions	ktonne	4		

Note: countries included are NL, DE, BE, FR, RO, AT, HU, PL, SK, CH

As can be seen in the figure 1 the main part of emissions is emitted by dry cargo ships. The figure illustrates the relatively inefficiency of small ships. The share of 650-1000 tonne dry cargo ships in the performance is smaller than the share in emissions.

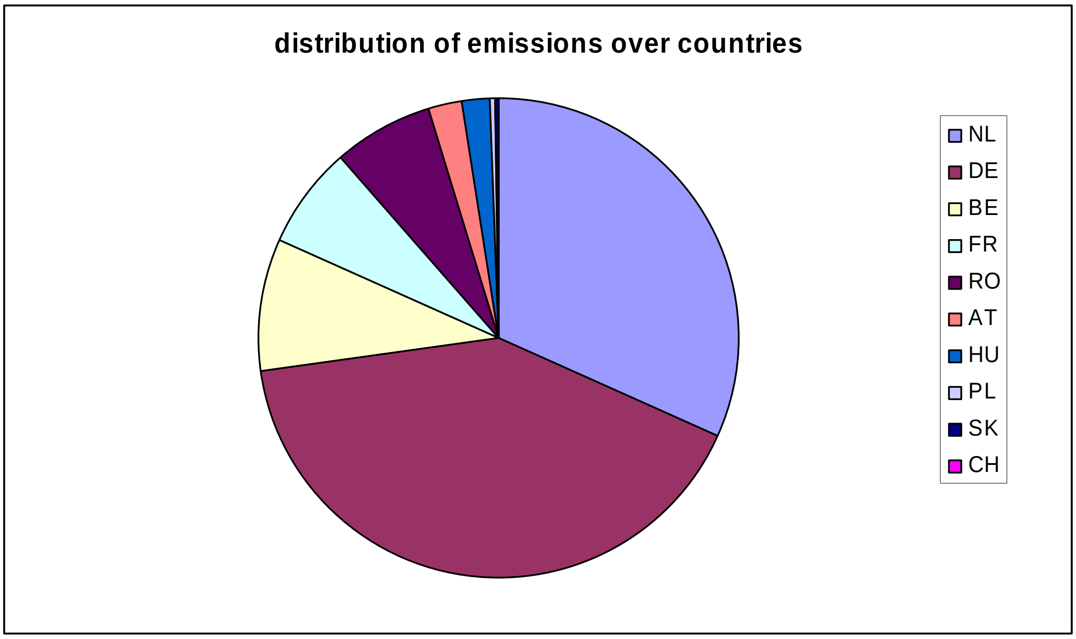
Figure 1 Distribution of performance and emissions over ship types



Note: the distribution of emissions over different ship categories applies NOx, PM and CO_2.

Figure 2 shows the distribution of the total emissions over the different EU countries. The shares of Germany and the Netherlands, followed by France are the highest, reflecting the significant performance of this mode in these countries.

Figure 2 Distribution of emissions over countries



Note: the distribution of emissions over different ship categories applies NOx, PM and CO_2.

5.3 Technical options

5.3.1 Air pollutants

Concerning the reduction of air polluting emissions, we will discuss the technologies Selective Catalytic Reduction (SCR) and Diesel Particulate Filter (DPF) in the following paragraphs. These technologies have been selected, because these already have been applied in pilot projects for existing ships/engines under available subsidy regimes.

In case of new ships other technologies can be applied as well, such as the application of LNG as alternative for diesel, diesel-electric propulsion and the application of multiple truck engines on inland barges. The reason why these techniques are at present generally evaluated as non-feasible for existing ships is due to the additional high installation costs (e.g. on-board energy infrastructure). In specific circumstances and in a changed business environment this will have to be re-examined. Moreover, the LNG propulsion systems are only recently introduced in the market[17] and could become cheaper within a few years. Possibly after a while, LNG could become also an alternative for existing ships/engines.

5.3.2 Selective Catalytic Reduction (SCR)

Concept

Selective Catalytic Reduction (SCR) is a technology where a reducing agent is injected in order to remove NOx emissions. The technology has been installed for several years already on Euro-IV and IV trucks. An SCR system can be retrofitted and can be applied on main engines as well as on auxiliary engines. In most cases ammonia is used as agent to reduce NOx into nitrogen and water.

Emission reduction

Up to 95% of NOx emissions can be reduced when using urea as agent. According to measurements on a SCR system on an inland shipping vessel 85% of NOx emissions can be reduced for all loads (De Wilde and Kos, 2004) in (CREATING, 2005a). Urea consumption is approximately 5% of fuel consumption.

Application, advantages and disadvantages

The expected lifetime of SCR is around 10.000-40.000 hours, but depends strongly on the sulphur content of the fuel.

A disadvantage of using SCR is ammonia slip, which can be overcome by the installation of an oxidation catalyst after the SCR system. Another disadvantage is the limited temperature window of the system: SCR can only be used in a temperature window between 250°C and 520°C (CREATING, 2005b) Arcadis, TML and DLR (2011) refer to a French study[18] in which the following disadvantages are also mentioned: the integration of the system within the vessel, the freezing point of urea at -11°C, the distribution infrastructure needed for urea. However, the same study mentions the following advantages: the SCR system has little impact on the engine and the operation of the system does not depend on the sulphur content of the fuel and the availability and easy handling of urea.

Costs

The costs for retrofitting a SCR-installation on a vessel range between 20 and 65 euro/kW, exclusive of engineering and installation costs. A rough estimate for installation costs is 50,000 euro. However, the costs of installation strongly depend on ship dependent factors. In case of new-build system, installation costs are significantly lower. Prices for the 40% urea solution needed depend are between 300 and 400 euro per metric tonne. The costs for urea range between 4-5 €/MWh.

Pilot projects

SCR technology has been applied in several ships, mainly in after treatment systems, since engine manufacturers do not apply integrated systems yet. With

[17] The first LNG propelled vessel “MTS Arganon” with duel fuel systems became active in the market in November 2011)

[18] (TL&Associés Consulting en Cabinet Lebéfaude, 2010 Etude sur les pratiques de navigation et les technologies dan le domaine de la performance énergétique due transport fluvial des marchandises. Fiches Innovations)

the introduction of phase-IV in 2016, engine manufacturers will probably need to install the SCR technology. For the new-build market, the costs for SCR catalysts may reduce due to size of scale advantages. However, the size of the market is limited.

Market consultation has shown that the costs of after treatment installations will probably not drop in case of significant market expansion, since retrofit installations need to be specifically designed per ship.

Costs of implementation in the fleet

On the basis of the investment costs figures presented above and fleet information from chapter 4 in the Main Report and the TREMOVE model, the total costs and emissions reduction of applying SCR catalysts on different segments of the fleet have been calculated in table 2. The calculations are based on 3,000 engine hours per year, 10 g NOx/kWh, 90% reduction efficiency, an average engine load of 55%, 40-60 €/kW investments depending on ship size and 50,000 euro installation costs (among other studies, Arcadis, 2011). The used depreciation period is three years and the used interest rate is 8%. The annual cost calculation is from a private perspective point of view.

Table 2 Costs, effects and cost effectiveness of SCR application (2009)

Tonnage (tonne)	*# ships*	*average engine power (kW)*	*total power installed (1000 kW)*	*total investment (mln euro)*	*engineering + installation costs (mln euro)*	*total costs (mln euro)*	*annual costs (mln euro)*	*total reduction (ktonne)*	*cost effectiveness (euro/kg NOx)*
<400	1617	185	299	18	81	99	€ 40	4	9.1
400-1000	2819	350	987	59	141	200	€ 84	15	5.7
1000-2000	3137	700	2196	110	157	267	€ 117	33	3.6
2000-2500	1140	1600	1824	73	57	130	€ 62	27	2.3
>2500	1974	2000	3949	158	99	257	€ 125	59	2.1
total	10688		9255	341	313	653		137	

Note: Due to small differences between the various datasets, this calculation is not fully consistent with the results depicted in table 1

The data shows that the overall investment costs amount over 650 million euro if SCR catalysts would be installed on the entire fleet, not taking possible lower costs of installing SCR catalysts on new build ships into account. It has to be remarked that the operational costs (e.g. differences in maintenance costs, possible impacts on fuel consumption) are not taken into account[19]. Moreover, the prices of equipment are based on the current situation. A larger demand (e.g. through additional incentives or legislative measures) could result in lower purchasing prices for the equipment manufacturers.

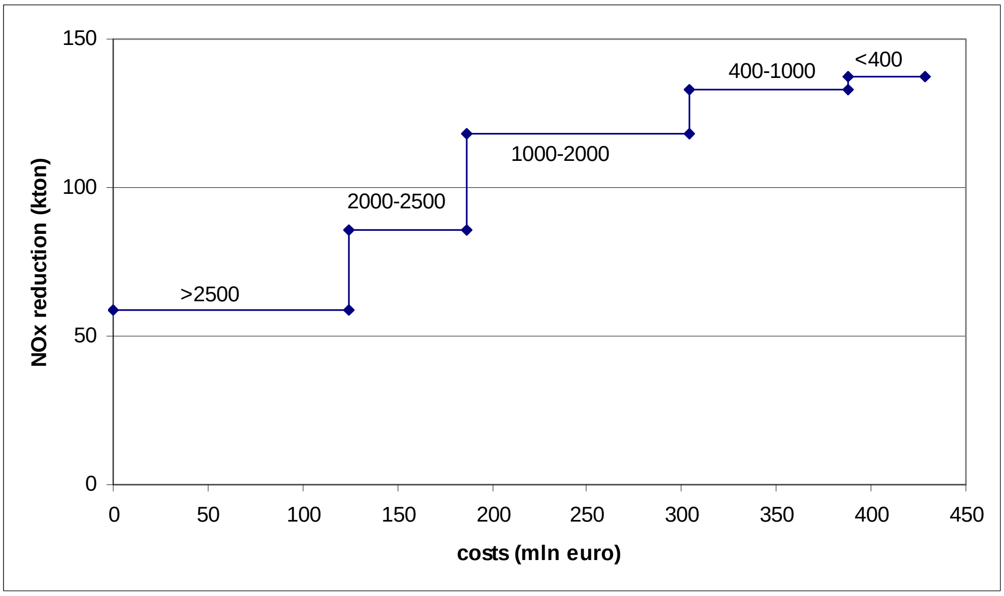
Table 2 illustrates the costs and effects for different ship sizes. The table clearly shows that the application of SCR catalyst in the larger ship categories is most

[19] On the basis of the figures reported by TREMOVE, a change of fuel consumption of 1% amounts to around 20 million euro on the overall expenditure on fuel costs per year

cost effective. The application of SCR in ships above 2000 tonne result in 63% emission reduction, while this ship category only represents 44% of the total costs.

Research by Arcadis (2011) has shown that from a society point of view the benefits of measures outweigh the costs.

Figure 3 Overall annual costs (investment and operational costs) and NOx reduction per ship segment (in tonne of load capacity)



5.3.3 (Diesel) Particulate filters

<u>Concept</u>
Diesel particulate filters (DPFs), or particulate traps, are used to 'catch' the particulate matter from the exhaust gas in a filter. DPFs are already widely used in road transport for several years. DPFs can be applied on the main engines as well as on the auxiliary engines.

Different types of DPFs exist: wall-flow filters (closed filters) and partial flow filters (open filters). In case of wall-flow filters most (95%) of the particulate matter is removed, because the exhaust gas is forced to pass the filter material. In case of partial flow filters, as the name already suggests, only a part (40-50%) of the flow is filtered. Due to their higher reduction potential, wall-flow filters are state-of-the-art.

In order to deal with the increased backpressure as a result of particulate capturing, the DPF needs to be regenerated periodically. Particular matter will be combusted at a temperature between 550°C and 600°C, a temperature which normally will not be reached, since the average engine load is limited. Therefore, active or passive regeneration is needed to remove the particulate matter. In case of active regeneration the pressure in the DPF is monitored continuously. The collected particulate matter in the filter causes backpressure in the filter, which results in an increase in fuel use of 2 to 3%. When the limit is reached, regeneration will start. Examples of active regeneration methods are: engine throttling, fuel injection in the exhaust gas and electrically heated regeneration. Passive regeneration can be done with the use of a catalyst, oxidation by NO_2 or non-thermal plasma. DPFs can be part of integrated systems that also reduce NOx emissions (CREATING, 2005a).

Application, advantages and disadvantages

Compared to the application of DPFs in trucks, the allowable backpressure of inland shipping engines is lower. This results in the need for larger filters and associated higher costs. The size of DPF systems can be a problem for especially smaller vessels. In general it can be said the space required by a DPF is 2-3 times the engine volume.

In case of applying DPFs the quality of lubricating oil and especially the ash content of lubricating oil is an import factor related to the clogging of a filter, because 60% of the ash in a filter comes from lubricating oil. The costs for lubricating oil with lower ash content are higher, but this premium price is compensated for, by fuel use savings and less maintenance costs.

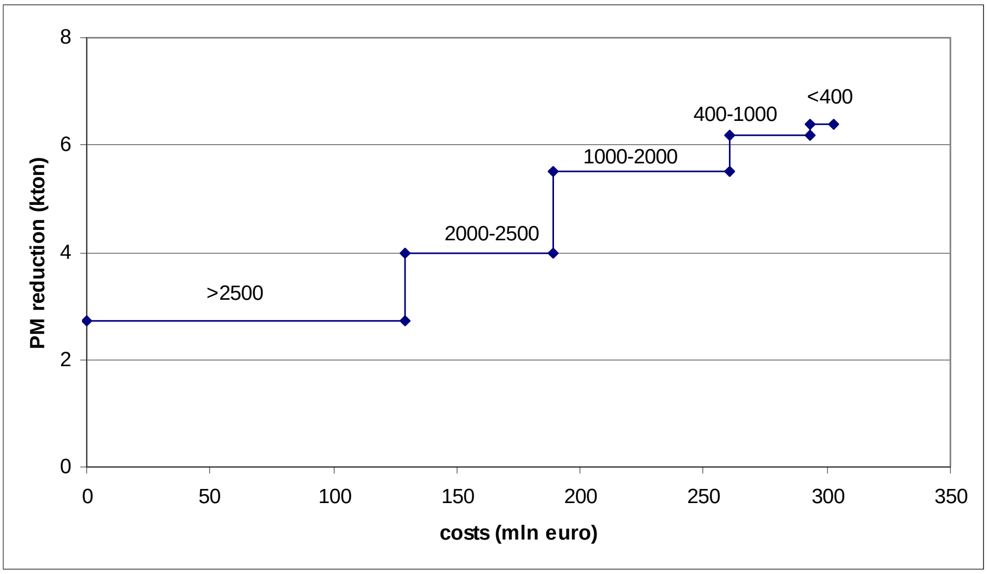
Costs

According to Arcadis (2011) the investment costs for inland vessels are €70-110/kW, plus costs for the installation of the filter. However, if the DPF is installed together with the SCR, additional installation costs are insignificant. Cost estimations for DPFs vary strongly. Estimates from the US show much lower cost figures for new engines. However, these figures are representative for the US new build market. Important factors that influence costs are the type of filter and the maximal allowable back pressure of an engine.

Costs of implementation in the fleet

The overall investments costs for DPF installation on the entire fleet amount 550 million euro, not taking into account installation costs, since these can be covered by the installation cost of the SCR catalyst. In figure 3 the annual costs and effects for different ship types are depicted. The calculations are based on 3,000 engine hours per year, 0.45 g PM/kWh, 95% reduction efficiency, 2% fuel consumption increase, an average engine load of 55%, 65-85 €/kW investments, depending on the ship size, and no additional installation costs in addition to the costs already mentioned under SCR application (among other studies, Arcadis, 2011). The used depreciation period is three years and the used interest rate is 8%. The annual cost calculation is from a private perspective point of view.

Figure 4 **Overall annual costs (investment and operational costs) and PM reduction per ship segment (in tonne of load capacity)**



Again, the effectiveness of application of DPFs on the largest ships is more effective and cost effective. Research by Arcadis (2011) has shown that from a society point of view the benefits of measures outweigh the costs.

5.3.4 Emulsified fuels

General
Emulsion fuels are a mixture of hydrocarbons, water and additives. The main interest of introducing water into the combustion process is reducing the nitrogen oxides contained in the exhaust of diesel engines by lowering the peak temperatures in the combustion process, in particular in the upper load and speed range. To avoid the separation of the components, so-called emulsifiers must be added in the production process. The water content is 30 per cent by volume.

NOx and PM reduction
Studies have shown that, in modern engines, a NOx reduction of about 20 to 30% can be achieved by using emulsion fuels. Particulate emissions, too, can be reduced by about 80% (Germanische Lloyd, 2001).

The emission of uncombusted hydrocarbons (HC), carbon monoxide (CO) as well as fuel consumption increases:

- A reduction in performance. Maximum performance of the engine decreases roughly at the same rate as the increase in water content in per cent.
- The influence on the wear at the injection system is not sufficiently known.

- Increase in consumption. Up to 20 per cent of added water content is fuel consumption-neutral. In case of modern engines with fuel injection systems, the use of emulsions has a negative impact on fuel consumption.

5.3.5 Liquefied Natural Gas (LNG)

Concept and potential

Liquefied Natural Gas is gas liquefied by the use of compression, and cooling down to a temperature of -162°C. The temperature at which LNG ignites spontaneously is very high, namely: 537ºC. The two types of engines are used for the combustion of LNG:

- the lean-burn gas engines and
- dual-fuel engines

Both engine types have a mechanism to cope with this high ignition temperature. In case of a lean-burn gas engine, a spark plug is used, which works according to the Otto principle (like most gas engines). In case of the dual-fuel engines, diesel (10%) is used to ignite the gas/diesel mixture. A dual-fuel engine is also able to run on 100% diesel. The reduction potential for LNG is estimated to be 75-80% for NOx and 97% for PM. The use of LNG can reduce GHG emissions by 10-25%, depending on the methane slip. The pollutant emission reductions are however, unsure for gas-diesel mixtures higher than a 10% diesel content (CMTI, 2011).

LNG needs to be stored on board of the vessel, which requires space. CTMI (2011) states that for a return trip from Rotterdam to Basel on 100% LNG two times the storage capacity of diesel is needed. This equals 50 m3 for a 110m ship. For safety reasons, special cryogenic containers are needed. Because the containers need to be cylindrical, extra space is required. Storage of LNG can be done on the deck as well as below the deck. In the last case extra requirements are required.

The available infrastructure is limited at the moment. Until a good infrastructure has been established, bunkering of ships can be done by lorries. The distribution and use of LNG is forbidden at the moment by the European safety legislation. However, the use of LNG in inland shipping is discussed in a European context at the moment.

Costs

Retrofitting a LNG-system asks for radical changes and is therefore expensive. According to CMTI (2011) the focus should therefore be on the installation of LNG-systems on new vessels. There is no information on the investment costs for LNG in inland shipping yet. Obviously more research and development is needed in this area, in particular to study the possibilities to apply LNG as an option for existing vessels.
There is however some information on the costs for maritime shipping. Total costs for retrofitting a LNG system on a beam trawler (~2000 kW) are estimated around €500,000-700,000 (Hart, 2009). According to CE Delft (2010) and CMTI (2011), the additional costs of retrofitting could be two to three times the costs for applying LNG in new vessels.

CMTI concludes that at this stage, LNG is mainly interesting for application in new build projects. The investment costs of new LNG-driven vessels (like Argonon) are 8-15% higher than comparable diesel-driven vessels.

Over the last 20 years, LNG has proven to be 45% cheaper than marine gas oil (DNV, 2010). This implies that, in contrast with the application of DPF and SCR, the technology provides benefits in the use phase. The payback time for the case of the beam trawler (Hart, 2009) was between three and five years, depending on the assumptions for fuel prices.

Pilot projects

Norway is most experienced in the application of LNG in shipping and the experience of this country shows the application of LNG is possible in practice. Already in 2000 a first ferry used LNG as fuel. This number has increased in the last years and concerns mostly ferries and supply ships.

In inland shipping, the first pilot project has started in July 2009 by Deen Shipping, Pon Power and INEC. They have worked on a LNG system on the tanker "Argonon" equipped with Caterpillar main engines. The vessel will start sailing end of 2011. By this project those stakeholders will gain insight in the application of LNG. The project was realised by a subsidy of the Dutch ministry of Transport with the aim to stimulate innovation in inland shipping and a European subsidy from the European Fund for Regional Development.

5.3.6 Climate

GHG emission reduction will be on the agenda in both the short and long term. Therefore, the overview of measures provided covers both measures with short and long or unknown payback times.

According to Hazeldine et al. (2009), no systematic studies on GHG-reduction options for inland shipping exist at the moment. In the following table the main technical options from that study and a recent CCNR conference[20] on reduction of GHG emissions are summarized.

In the table two categories of technical options are distinguished: power train efficiency improvements and reduction of required propulsion. Both the reduction potential and payback time are presented. Both categories are elaborated in the next table (3).

[20] See for more information: http://www.ccr-zkr.org/temp/workshop120411_en.htm

Table 3 GHG emissions reduction potential of the technical inland shipping options

Technical option	*Current reduction potential on ship level where applicable*	*Current payback time*
Power train		
More efficient engines	15% to 20%	> 10 years
Waste heat recovery	10%	
Diesel-electric propulsion	10%	> 10 years
LNG optimized engines	20%	Short payback time
Improved propeller systems	20-30%	Short payback time
Whale tail/experimental *propulsion* systems	25%	Unknown (experimental)
Reduction of required propulsion		
Larger units (economy of scales)	Up to 75% depending on difference in scale	No general conclusion possible
Hull form optimisation	10-20%	Short payback time
Computer assisted trip planning and speed management	5-10%	< 1 year
Lightweight hulls	5-15%	> 10 years (experimental)
Air lubrication	10%	Unknown (experimental)

Note: The reduction potential of the individual options cannot be summed up.

Source: Hazeldine et al., 2009; CCNR, 2011

Below, the different technical options are elaborated (Hazeldine et al., 2009)

1) Power train efficiency improvements

More efficient diesel engines
More efficient common-rail diesel engines are being developed which feature technologies such as high-pressure fuel injection combined with turbo-loaded engines. Therefore, replacement of less efficient older engines (15 years or more) is an option for reducing GHG.

Optimising conventional propeller propulsion
Several optimized propeller designs such as ducted propellers, contra-rotating propellers and propeller boss cap with fins are being tested or have already been introduced to the market.

Revolutionary new propeller designs
In view of the fact that conventional propellers have restricted axial propulsion efficiency, revolutionary new designs such as whale-tail propellers with much higher efficiencies could emerge in time.

Application of diesel-electric power trains in special situations
Diesel-electric propulsion can be an efficient option when lower engine power makes up a relatively high proportion of the drive cycle.

2) Reduction of required propulsion

Improved hull designs
Improved hull designs can increase speed or reduce the required propulsion power on inland barges.
Larger barge units
Larger barge units are often more efficient on larger inland waterways because viscous water resistance is reduced. However, on small waterways, small ships will experience less resistance than big ships. In addition, elongating ships can improve their performance since this also acts to reduce water resistance.
Computer assisted trip planning
Computer assisted trip planning and speed management (i.e. Tempomaat) could help to optimise ship engine power with the aim of striking a balance between minimising emissions and achieving delivery schedules.
Lightweight ship hulls
The introduction of very lightweight ship hulls for transporting fluids, manufactured from materials such as carbon fibre, are already being tested.
Air lubricated hulls
Viscous water resistance is very important for inland ships travelling at relatively low speeds. Setting aside the resistance caused by imperfect streamlines and waves, viscous resistance can often amount to 80 percent.

5.4 Options for policy measures

5.4.1 Regulation

Emission standards for existing ships
Stricter NOx and PM emissions standards to existing engines can be achieved by the use of Diesel Particulate Filters (DPF) and SCR catalysts or the use of alternative fuels such as LNG. A regulation which prescribes stricter standards is potentially quite effective, but needs to be carefully examined with respect to its technical, economic and legal implications. A detailed Impact Assessment study would be needed to study the various options and their costs and effects in detail.

As a first and rough illustration of the investment needed for a significantly cleaner fleet, the cost of applying the upcoming phase-IV standard for the entire fleet is presented. This cost estimate should be seen as a first rough estimate and is based on current practise and cost figures. R&D efforts and size of scale effects might lead to lower costs.

Based on current prices and available equipment the data from literature[21] shows that the overall investment costs amount over 650 million euro if SCR catalysts are installed on the entire European fleet, not taking possible lower costs of installing SCR catalysts on new build ships into account. The additional overall investments costs for a DPF installation on the entire fleet amount 550 million euro. The order of magnitude of the costs would not be very different in case of large application of the LNG technology in ships.

However, it is highly questionable if all engines would be equipped with SCR and DPF. From the viewpoint of effectiveness priority could be given to larger vessels with a high number of operational hours. Moreover, at least a part of the engines could be replaced, which would also induce other economic and external cost benefits due to fuel savings. Secondly, there may be other options to installing emission reduction technologies, such as the use of alternative fuels.

Similar examples exist of legislation on emissions applying to existing installations. In 2008 the IMO agreed an upgrade with respect to NOx emissions for certain existing engines. Other examples of setting standards for existing installations can be found in the IPPC Directive (1996/61/EC). Existing coal fired power generation plants and waste incineration installations have been adapted since the early nineties. Also within CCNR, new legislation is applied to existing ships using a system of transition periods.

The application of DPF can be difficult in cases of low pressure tolerance. In such cases the needed volume of the filter is higher and as a consequence the costs are higher. Arcadis (2011) indicates that for small ships, the space on board may be too limited in some cases.

The measure can be implemented most successfully at EU level. A recent study by Arcadis, TML and LDR Lawyers (2011) indicates that national measures that deviate from harmonised EU legislation are difficult and will need to very thoroughly be underpinned if the internal market is affected. As an example, the study cites the Dutch 'particulate filter case'[22] that was rejected by the European Commission. In her rejection the Commission referred to the alternative of increasing the budget for subsidy programmes.

Environmental zoning

An alternative to the application of mandatory emission standards for all existing ships is the designation of environmental sensitive zones. For example in the Port of Rotterdam, inland barge engines will have to meet CCR-2 regulation from 2025 on. The decision was made in the context of the expansion of the Maasvlakte area. The measure was needed to ensure that Rotterdam is able to comply with the air quality Directive 2008/50/EC.

The introduction of an environmental zone may on the one hand, reduce the attractiveness for industry to settle and hence reduce the number of port calls.

[21] Source: Arcadis, 2011

[22] In this case, the Netherlands proposed to enforce particulate filters on newly sold vans, while the harmonised EU legislation did not.

On the other hand, the environmental performance of inland ports will become increasingly important as a license to operate, especially in a scenario of growth.

The environmental criteria set in Rotterdam will be limitedly effective in the period until 2020. Furthermore, it is questionable if inland ports are willing to introduce such a scheme, since it may reduce their attractiveness for industry to settle and hence the number of port calls.

From a theoretical point of view, inland ports could join the Rotterdam scheme in a coordinated way. However such environmental zones could potentially conflict with European objectives related to the Internal Market[23] as zones could make regulations in Europe more complex and could conflict with level playing field. Therefore, such schemes seem mainly feasible if they are needed in the context of difficulties with meeting air quality standards set by Directive 2008/50/EC.

Organization of market for clean and efficient transport (voluntary standardization)

Better market organization through voluntary standardisation and incentives can lead to improved environmental behaviour, if also shippers are interested in better environmental performance. Shippers can also be willing to do this in the context of their image to their clients and their corporate social responsibility. Voluntary standardisation and incentives from shippers that compensate for additional costs by ship-owners to invest in clean technologies (e.g. LNG, SCR, DPF), could therefore contribute to an expansion of the number of clean vessels.

Voluntary standardization and voluntary environmental measures are applied in several economic sectors in the EU. A certain certificate improves the market position of best performing companies. An example is environmental award criteria in e.g. public transport procurement. Another example is the encouragement of companies with a better environmental performance in tendering processes, as a result of fictively lowering the price of the bid on the basis of the environmental performance.

In case of inland shipping, parties such as shippers brokers and operators could select only clean vessels to fulfil their transport demand, although the costs to charter those clean vessels might be higher. In the Netherlands, a voluntary standardisation scheme has been developed by the Green award foundation, which already operates a global safety and environment certification scheme for seagoing ships, on request of the inland shipping authorities, subsidised by the seaports and the Dutch government.

The requested certification scheme has been developed with the ambition of:

- leading to recognition of and motivation for clean ships
- serving as a tool for charterers to choose clean ships

[23] See http://europa.eu/legislation_summaries/internal_market/index_en.htm

The Green award scheme's requirements[24] include the following items:

- Compliance with CCR-2 (additional points for SCR, DPF, LNG, diesel-electric drive)
- Dry bilge
- Propeller shaft seals
- High-level alarm in fuel bunkers
- Closed grey water system
- Connection for OPS
- Course 'Smart steaming'
- Fuel consumption monitor / cruise control
- Waste management plan

It's expected that 50 inland vessels will enter the program during 2011, and the goal is to have 550-600 inland vessels certified in the fifth year. Certified ships are listed on the website of Green award (www.greenaward.org). In the first years, the Green award scheme for inland barges will be financed by subsidies. During this period, the system needs to reach maturity. This means that for a significant increase of the number of clean engines, ports and shippers will need to provide incentives (discounts or operational benefits, better market position) for certified ships. At the moment, the number of incentive providers (charterers and inland ports) are limited (one), but discussions with the main seaports in the Netherlands are underway.

For a significant effect on the environmental performance of inland barges, attention might be paid to:

- Exploration of the willingness of shippers for providing incentives to ship-owners with Green award certificates. For an effective scheme, it needs to be very clear to what extent ship-owners can count on additional rates on the spot market depending on the environmental performance of the vessel. It needs to be investigated how this can be organized and of and how this can be done in a transparent way, within the legal boundary conditions (e.g. forbidden price agreements). Ports can relatively easy provide reductions on their published tariffs, but with flexible cargo rates, this is more difficult.

- International extension of the scheme.

On both issues, the European Commission might give short term support to better organise the shipper part of the system to establish a market that favours clean vessels, by investigating the options and bringing demand and supply together.
Voluntary environmental initiatives and certificates can be mainly found in business-to-consumer markets. Inland waterway transport is, however, mainly a business-to-business market (coal, sand, gravel animal fodder, chemicals). This may make it more difficult to introduce voluntary environmental initiatives and limits their potential effectiveness.

[24] Detailed information can de be found here: http://www.greenaward.org/greenaward/file.php?id=214&hash=0b56d501187be02986eac46d230b1f6f

Energy Efficiency Design Index (EEDI) and Energy Efficiency Operational Index (EEOI)

As with the other transport modes a certain kind of energy efficiency regulation may be needed to increase the energy efficiency of ships. To improve fuel efficiency and hence reduce the CO_2 emissions of IWT transport, the maritime sector has developed two standardisation schemes that can relatively easily be transformed into CO_2 standards for IWT. Two basic approaches are available: EEDI and EEOI. Basically, both kinds of indices measure the emissions emitted against the transport work produced.

Figure 5 Basic principle of energy indexing

$$\text{EE Index} = \frac{\text{Air pollution (emitted } CO_2\text{)}}{\text{Transport work}}$$

EEDI

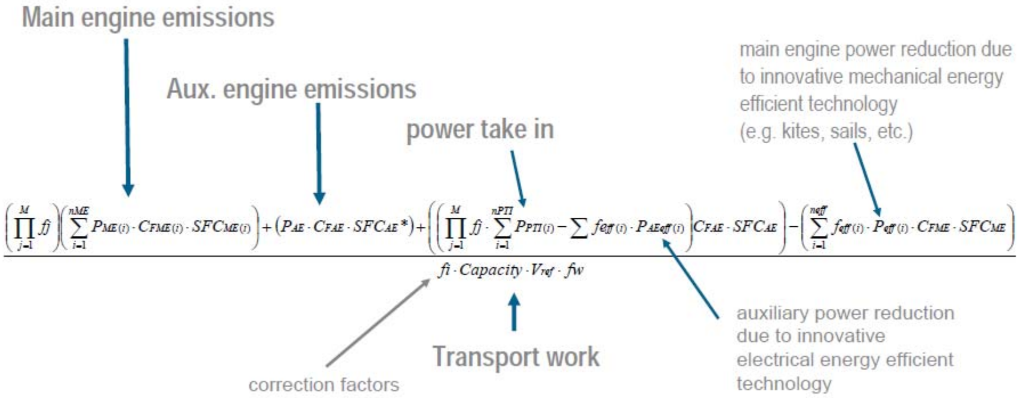
To stimulate the uptake of technical CO_2 measures in the inland waterway fleet, an instrument that measures the efficiency of new ships could be used. For seagoing ships, such an instrument, called EEDI, has been developed by IMO. The EEDI has been studied for several years and was implemented in 2011.

The EEDI (MEPC.1/circ. 681) will apply to new ships over 400 GT, or ships that have undergone major conversion. The EEDI formula calculates the CO2 produced by the ship's propulsion and auxiliary power systems and any secondary energy usage by machinery such as shaft propulsion motors and generators. Any CO_2 saved through innovative energy saving technologies like kites or sails is then subtracted. The resulting CO_2 figure is divided by the ship's transport work or 'benefit to society' (in effect, the ship's capacity multiplied by its speed) to arrive at the final EEDI in grams CO_2 per tonne mile. The EEDI formula is shown in figure 6.

The EEDI will become mandatory from 2015, and will apply to the largest segments of the world merchant fleet, with different standards applying to different commercial ships. These standards will be strengthened over time, with the aim of a 10% improvement for ships built in 2015-19, 15-20% for 2020-24, and 30% for ships delivered after 2024.

To be useful for inland navigation, addition research is needed. A pre requisite for the use of EEDI is a set of baselines for different ship types. Additional research needs to clear up the use of EEDI baselines, especially in cases of push barges since the configuration of push barges is flexible.

Figure 6 EEDI formula



Source: GL, 2011

EEOI

The EEOI is defined as (MEPC.1/Circ.684):

$$EEOI = \frac{\sum_i \sum_j FC_{i,j} \times C_{F,j}}{\sum_i m_{cargo,i} \times D_i}$$

Where:

- j is the fuel type.
- i is the voyage number.
- $FCi\ j$ is the mass of consumed fuel j at voyage i.
- CFj is the fuel mass to CO_2 mass conversion factor for fuel j.
- *m*cargo is cargo carried (tonnes) or work done (number of TEU or passengers) or gross tonnes for passenger ships. And,
- D is the distance corresponding to the cargo carried or work done.

Per voyage, the amount of fuel consumed, the distance sailed and the cargo shipped are needed to calculate the EEOI over a period of one year. The use of the EEOI as a self assessment tool will obligatory as part of the ship energy efficiency management plan (SEEMP). Every ship over 400 GT needs to have a SEEMP from 2013 on.

Germanische Lloyd (2011) concludes that the EEOI could be easily adjusted and applied in inland navigation for different ship types.

5.4.2 Economic instruments

Introduction

Economic instruments could be applied for reaching various types of objectives (CE Delft et al., 2008): to influence behaviour (e.g. to reduce the environmental impacts), to generate revenues (e.g. to finance infrastructure investments) or to increase fairness (e.g. to level the playing field between transport modes). For that reason economic instrument are very well suited to realise many of the policy aims as presented in the beginning of this chapter. More specifically, economic instruments could be used to internalize the external costs of IWT transport and to reduce its environmental impacts.

Pricing principles

The pricing principles applied to design the economic instruments depend heavily on the policy objectives to be met. In case of internalisation of external costs, described in the White Paper as a specific objective for all surface transport modes, marginal social cost pricing (MSCP) is from an economic point of view the first best option[25]. Marginal costs in this context mean the additional costs of an additional transport activity (e.g. an extra kilometre driven). This type of transport pricing is an appropriate way to overcome externalities and to achieve an economic efficient transport system. For these reasons, the proposed internalisation measures for road freight transport, as described in the amendment of the Euro vignette Directive, were inspired by this theoretical concept. Although some concessions still have be made in the amendment of the Directive for pragmatic and political reasons, the internalisation measures contain clear elements of MSCP (e.g. differentiated kilometre charges for air pollutant emissions). It seems reasonable that future internalisation schemes for other transport modes will be based on the same principles as the one for road transport.

Although MSCP may also be applied to reduce the environmental impacts of IWT, also other design options for the economic instruments could be applied. An interesting option in this regard is the so-called target-oriented pricing (CE Delft et al., 2010). In this approach, the economic instruments are designed to reach specific targets, e.g. a specific reduction level of CO_2 emissions. Applying this approach may result in tax levels that are higher than the (marginal) external cost. Although this results in a less efficient transport market than MSCP, it may be preferred from a more pragmatic point of view.

[25] It should be noted that in section 4.1.5 of the Main Report, we compared social impact of the various modes; in that case average cost figures are more appropriate since they provide a completer picture of all the costs caused. In case of reducing externalities, internalising the marginal external costs is more appropriate.

Various types of economic instruments

A wide range of economic instruments could be used to internalize the various external costs of inland navigation. With regard to CO_2 emissions, CE Delft et al. (2008) recommend fuel taxes as the most proper way, but also ETS may be considered. For internalising air pollution costs differentiated kilometre charges could be used, but also specific air pollutant taxes (e.g. a NO_x tax) or differentiated mark-ups on harbour dues could be implemented. Finally, subsidies could be used to support the relatively small IWT companies to invest in rather expensive emission reduction technologies.

To reach the various objectives (internalisation, reduction of both CO_2 and air pollutant emissions) a combination of policy instruments is probably needed. From a political point of view it is also not likely that these policy instruments will be implemented for IWT only, but implementation for all surface transport modes (road, rail, IWT) seems more appropriate. In the remainder of this section we will therefore also discuss policy packages combining various policy instruments for various modes.

Using revenues of economic instruments

Economic instruments (with the exception of subsidies) generate revenues. These revenues can be used in many ways. A rough classification that can be made is between using the revenues for specific purposes (earmarking), such as subsidising emission reduction technologies for IWT ships or adding the revenues to the general budget[26]. From an economic point of view, the latter option is in general more efficient than the former one. There is no guarantee that the earmarked projects are the most efficient projects available to achieve the policy aims. However, earmarking the revenues of transport pricing enhances public acceptability. In the case of IWT, it may also provide the opportunity to support small IWT companies to finance the relatively high investment costs for emission reduction technologies by using the revenues to (partly) subsidizing these investments. In the REVENUE project it was concluded that the arguments for or against earmarking are more or less balanced (REVENUE, 2006).

Structure of this section

In the remainder of this section we will first discuss the various economic instruments that could be applied with respect to IWT. Next, combinations of these instruments (policy packages) and their impacts on transport and the environment will be discussed.

Subsidies

Subsidy programmes to accelerate the introduction of CCR-2 engines, DPFs and SCR catalysts existed in the Netherlands, Germany and Belgium in the period 2007-2010. In the table 4, the main details of the Dutch and German subsidies are presented.

[26] In the latter case the government could decide to lower existing taxes (e.g. labour taxes) which may lead to a distortion of the market.

Table 4 CO_2 Eligible costs within the Dutch and German subsidies

	Retrofit SCR	*CCR-2 engine*
<750 kW	99 €/kW	22.5-27€/kW
>750 kW	86 €/kW	
Installation	Real costs (20,000 in case of new)	6€/kW (existing ship)
Urea use		
< 500 kW	36 €/kW	
500 – 750 kW	72 €/kW	
750-1000 kW	108 €/kW	
>1000 kW	144 €/kW	
Lie up	6 €/kW	
maintenance	13€/kW	
Emission measurement	4,500 €	

Note: The subsidy amounts maximum 50% of the eligible costs for major companies, 60% for middle size companies, and 70% for small size companies. Before 2008, the figures were lower.

In the Netherlands 4.8% of the fleet was renewed on the basis of the VERS subsidy. This is 13% of the total allocated budget. Mainly small auxiliary engines have been replaced and the replacement rate was lower than expected. SCR was only applied in 2.6% of all cases. Uncertainty with respect to costs and functioning are mentioned as reason. The programme has been assessed as ineffective (SenterNovem, 2009). The main issue is that the subsidy does not cover the full investment (and operational) costs and there are no additional financial incentives (e.g. environmental taxes) to make investments in these technologies economically profitable. Furthermore, the immaturity of the SCR technology was also identified as a bottle neck. The evaluation ends with the recommendation that to increase the sense of urgency within the sector, additional flanking policies are needed.

In Germany, a subsidy has been introduced in 2007, using the details from table 4. Also in Germany, the regulation has been limitedly effective, since no more than 40% of the allocated funds were used during the first years of the subsidy regime. Mainly re-engining with CCR-2 engines has happened, including the application of DPFs in a number of cases. No SCR catalysts have been subsidized until mid-2010. The Netherlands stopped subsidizing CCR-2 engines after the introduction of CCR-2 as the CCR industry standard in 2007, to prevent from the problem of free riding. As a result, in 2008 the number of applications for subsidies was nearly nihil. Arcadis, TML and LDR lawyers have shown that subsidizing CCR-2 engines was also possible –under conditions- after the introduction of the CCR-2 standard. Germany continued the subsidy with the additional criterion of 30% PM reduction compared to the CCR-2 standard.

Scrapping schemes could be evaluated as an alternative to the schemes ran over the last years. However, they basically have the same problem as the subsidy schemes described: the financial incentive provided is not sufficient for ship-owners to replace their ships by new ones.

Fuel taxes

Since CO_2 emissions are proportional to the amount of fuel used, a fuel tax is a good instrument to internalize the costs of and reduce the amount of CO_2 emissions of IWT (CE Delft et al., 2008). By using this instrument incentives could be provided to reduce transport demand, and improve fuel and transport efficiency. Besides, an undifferentiated fuel tax is a second-best instrument to reduce air pollutant emissions. By introducing a fuel tax the number of kilometres travelled by IWT will diminish, which will result in less air pollutants. However, this instrument does not provide ship owners incentives to invest in techniques to reduce air pollutant emission (e.g. SCR or particulate filters). In addition, there will be no indirect incentive (via relative lower shipping rates) for shippers to choose for the cleanest ships, since for all ships the same fuel tax rates (per litre fuel) holds. These disadvantages of using a fuel tax to reduce air pollutant emissions of IWT could be overcome by differentiating the tax to NO_x or PM. This type of policy instrument will be discussed below.

Empirical research on the effectiveness of fuel taxes for IWT is rather scarce (PBL and CE Delft, 2010). Most available research results refer to the impacts of (generalised) transport price changes; these results will be presented at the discussion of kilometre charges for IWT). PBL and CE Delft (2010) do present some qualitative evidence for the impact of fuel prices on the speed of ships; the relatively high fuel prices in 2008 stimulated ship owners to reduce the speed of their ships to improve their fuel efficiency.

Fuel taxes could best be applied on a European scale. Since differences in tax rates or tax exemptions between countries will prompt vessels that are engaged in cross boarder traffic to bunker in the country where the fuel is relatively cheaper, fuel taxes implemented on a national scale will not be an effective environmental instrument, and will cause market distortions.

According to the Council Directive on the taxation of energy product (EC, 2003) a tax can be levied on fuel used for navigation on inland waterways, but Member States are not obliged to do so. Currently, all Member States, with the exception of Portugal and Greece, grant tax relief to domestic navigation (BMF, 2003). Moreover, Belgium, Germany, France, the Netherlands and Switzerland, which are member states of the Central Commission for Navigation on the Rhine, have agreed in the Mannheim Convention not to levy charges on the gas oil used by ships on the Rhine and its tributaries. Since the Rhine is the most important river for the freight IWT in Europe, changing the Mannheim Convention on this aspect is crucial to use fuel taxes as an effective environmental policy measure for IWT.

Emission taxation (NOx tax) and NOx fund

From a theoretical perspective, a NOx tax is an effective and efficient measure to reduce NOx emissions, since the incentive base is directly linked to the emission that needs to be reduced. However, to be effective the tax burden on ship-owners could result to financial problems, like e.g. ability to finance abatement technologies.

In Norway, a fiscal NOx tax of 1.9 euro (15 NOK) was introduced on the 1st of January 2007, per kg NOx. Propulsion engines exceeding 750 kW and boilers over 10 MW are subject for taxation. Emissions from sources that are subject to the so-called Norwegian Environmental Agreement are exempted from the NOx tax. Affiliated enterprises pay 0.5 euro per kg NOx to the NOx Fund, instead of paying the government tax.

Undertakings that join the Environmental Agreement are obliged to apply for support for measures to reduce NOx emissions in situations with a return-on-investment time shorter than three year, taking the fiscal NOx tax and the support from the fund into account. Support will be granted for investment costs (up to 80%) as well as operating costs. Between 2011 and 2016, the NOx fund is committed to reduce emissions by 16 kton. The NOx fund has granted significant parts of the overall granted budget for LNG and SCR investment projects, mainly for seagoing ships. The NOx fund is a business organisation, set up by 15 co-operating business organisations.
For both the NOx tax and the NOx fund, the maritime sector needs to report the emissions of their fleet, on the basis of engine certificates and bunker delivery notes.

CE (2004) estimated that for the average incentive level for investment in SCR, the most cost effective measure should be around 2.5 euro per kg NOx. The Norwegian NOx tax is close to this incentive level. State aid is not applicable in case of a business fund, and therefore grants could be higher than 50-70% of the investment costs. This increases the attractiveness of investments under a NOx fund for industry.

The Mannheim convention does not seem to explicitly forbid a levy on NOx emissions. NOx emissions are not directly related to inland shipping, since in principle the emissions can be reduced to zero by technical means, although such a reduction would be costly. However, whether or not such a levy will hold, remains subject of discussion (CE, 2004). The tax can either be introduced for PM.

In the EU, such a NOx tax approach and NOx fund approach (including a fall back option) can be used to reduce emissions. The advantage for the sector of the NOx fund is that the payment levels are lower, and that levies paid are reinvested in industry again. National governments are the most obvious regulative bodies to introduce of NOx tax. At EU level however, the introduction of such instruments would need to overcome significant political obstacles, since taxation measures require unanimity.

Emission trading system

An alternative policy instrument to internalize the external CO2 costs (and hence reduce the CO2 impact) of IWT is an emission trading scheme (ETS). This could be realised by adding IWT to the existing European emission trading scheme (as will be the case for aviation, which will be included in the European ETS in 2012) or by implementing a separate ETS for transport or IWT.

An advantage of the first option is that overall the cheapest reduction options are implemented. However, the consequence of this is that, depending on the sectors included and the GHG mitigation costs in these sectors, there may be no guarantee that emission trading results in GHG reduction in the transport sector (or in IWT)27. In addition, including transport (IWT) in the existing ETS may increase the risk on carbon leakage28, i.e. due to the ETS CO2 producing activities are relocated to countries outside the EU and hence lower global CO2 reduction is realised.

A separate emission trading system for the surface transport (or IWT) sector, on the other hand, has the advantage that it will not impact the competitive position of parties involved, as they do not compete with transport outside the EU. So there is no risk of carbon leakage or negative economic impacts due to a loss of competitive advantage to companies outside the EU. Additionally, a separate system would also ensure that the CO_2 emissions of the transport sector itself reduce, which is not automatically the case in the European ETS. The main disadvantages of a separate ETS system for transport (IWT) are the lower (cost) efficiency of CO_2 reduction compared to including transport (IWT) in the existing ETS and the rather high implementation costs. Additionally, the smaller market size and the constant increasing marginal abatement cost curve makes prices in such a scheme more volatile than in the current ETS system.

In case of a separate ETS, the impacts of the instrument will be equal to a fuel tax: lower transport demand and increased fuel and transport efficiency. No studies are known for the impacts of including IWT in an emission trading system.

Kilometre charges

CE Delft et al. (2008) regards differentiated kilometre charges an option to internalize the external costs of air pollution of IWT. By charging a price per kilometre transport demand could be reduced (e.g. by increasing load rates), while the differentiation of the charge could provide incentives to apply reduction techniques for air pollutants (e.g. SCR or particulate filters) on existing ships or to replace existing ships by new ones earlier. Since differentiation in kilometre charges will maybe be reflected in transport rates, this instrument could also provide shippers an incentive to choose a cleaner ship for their transport.

[27] If mitigation costs in transport are higher than in other economic sectors, reduction options will be realised in these other sectors. For the transport CO_2 emission allowances will be bought to meet the annual CO_2 cap. In the literature there is no agreement on how GHG mitigation costs in transport compare to mitigation costs in other sectors. Many studies (e.g. CE Delft, 2007; OECD, 2008) calculated relatively high mitigation costs for transport and in that case it would be efficient to reduce CO_2 in the other economic sectors. However, other studies (e.g. McKinsey, 2008) suggest that in transport there is a whole range of mitigation options available against negative costs. If that is the case, reduction options in transport will be realised.

[28] If mitigation costs in transport are higher than in other economic sectors, including transport in the existing ETS result in higher prices of CO_2 allowances. These higher prices may harm the competitive position of companies which are competing with companies outside the EU. These companies may decide to relocate their activities to countries outside the EU, resulting in carbon leakage.

Next to an instrument for internalizing the costs of and reducing the amount of air pollutant emissions, kilometre charges could also be applied as a second-best instrument to reduce CO_2-emissions. However, compared to first-best CO_2-policies like fuel taxes and ETS, kilometre charges are less effective in reducing the CO_2 impact of IWT.
This instrument only provides an incentive to reduce transport demand, while instruments like fuel taxes and ETS also provides incentives to improve the fuel efficiency of the transport (improve fuel efficiency of the ship, reduce speed, etc.). Finally, kilometre charges could be used to internalize the external costs of accidents as well as the infrastructure costs.

In the literature, no specific empirical evidence is available for the effectiveness of (differentiated) kilometre charges for IWT. However, PBL and CE Delft (2010) present some empirical evidence on the transport impacts of changes in total transport prices. The review of price elasticity performed by this study shows the lack of agreement in the literature on the exact price sensitivity of IWT. In addition, large differences in price elasticity between different types of goods are found. However, it could be concluded that on average IWT transport is rather price elastic, which indicates that implementing kilometre charges could have transport impacts.

To improve the environmental effectiveness of differentiated kilometre charges (part of) the revenues could be used to finance subsidies for air pollutant reduction technologies (e.g. via a NO_x-subsidy). Although this allocation of revenues is not efficient from a macro-economic point of view, it may be needed to provide small ship owners the financial possibility to invest in these reduction technologies.

As for fuel taxes, it holds that introduction of a kilometre charge for IWT is hampered by the Mannheim Convention. Adjustment of this convention is necessary, because if the IWT on the Rhine would be exempted from such a charge, the effectiveness of this charge would be rather poor. The initial costs for the implementation of the instrument can be expected to be quite high, because not all Member States do levy infrastructure charges for IWT at the moment (CE Delft et al., 2008).

Differentiated port dues

Differentiated port dues can be used to provide incentives for clean shipping. However, port dues are not directly related to emissions. Therefore, this instrument does not provide an incentive to reduce the emissions of inland navigation by improving transport efficiency (e.g. increased load factors). Port of Rotterdam for example recently introduced differentiated port dues that provide an option for discount if vessels are equipped with clean engines[29]. Other ports are also implementing such schemes.

[29] http://www.portofrotterdam.com/en/Shipping/harbour-dues/Pages/harbour-dues-inland-shipping.aspx

CE Delft (2004) did investigate this approach and concluded that port dues are too low if they are used as a single incentive to promote SCR application. However, port dues could be effective as part of a broader package of measures and incentives. For example CE Delft (2004) calculated that the needed incentive is roughly 10 times higher than the current port dues in the Port of Rotterdam, if port dues were only differentiated in the Port of Rotterdam. Based on differentiation in both the origin and destination port, the needed financial incentive is roughly 3-4 times higher than the current port dues.

In case of an environmental mark-up on the port dues for existing ships with the amount of twice the current port dues, the incentive needed is roughly 2 times higher than the mark-up, see table 5. This would lead to a situation where ships with the current average environmental performance pay three times the current port dues and ships equipped with SCR the current port dues.

Table 5 Overview of port dues and needed incentives (euro) for SCR investment

	Average incentive needed for SCR investment on one return trip	*2011 port dues return trip*	*Mark-up of port with twice the current port dues*
1000-1500 tonne	760	225	450
1500-3000 tonne	1386	405	810
>3000 tonne	2097	630	1260

Note: the port dues are based on data for the Port of Rotterdam. The average incentive needed is based on 50€/kW investment costs, 3€/Mwh operational costs and a depreciation period of 3 years and 8% interest.

Source: adapted from CE Delft (2004); Port of Rotterdam.

The analysis shows that port dues would need to be increased significantly for ships to make investing in SCR catalysts profitable. In case of the combination of DPF and SCR, the needed incentive is even bigger. In case of cheaper measures the incentive needed is lower (e.g. internal engine measures to achieve a CCR-2 level).

Data from the TREMOVE and TRANSTOOLS model show transport costs are between 0.015 and 0.07 €/tkm. Taking these figures into account for a 1500-3000 tonne ship and a single trip distance of 500 km, an environmental mark-up on the port dues with a height of twice the current port dues would lead to an increase of overall costs with 1-2%.

The port of Rotterdam did increase port dues for ships that do not meet the CCR-2 standard with 10% as of 2012. The profits will be used for air pollutant innovation projects. Port dues are determined by the local governments or private port authorities. The proposed increase is, however, not high enough to achieve significant effects. Without governmental intervention, especially inland port authorities will not be keen to increase the port dues as significantly as needed, because of economic reasons.

Packages of economic instruments

By combining different types of economic instruments various policy objectives could be met. A combination of a fuel tax and a kilometre charge could for example be used to both reduce CO_2 and air pollutant emissions. Combining policies could also be applied to improve the efficiency of individual instruments; the latter will especially be the case if there are some market imperfections to overcome. For IWT the current market structure (with many small IWT companies) hamper the relatively large investments in emission reduction technologies; the financing opportunities of small companies will be more limited than for large companies. By combining a tax with a subsidy instrument, this investment barrier could (partly) be overcome.

CE Delft et al. (2010) investigated several packages of pricing policies for surface transport modes on the corridor Paris – Amsterdam.

The main ones are:

- Pragmatic MSCP: for all modes a differentiated kilometre charge (based on the marginal external costs) and a (CO_2 differentiated) fuel tax is implemented.
- Euro vignette proposal: for road transport a kilometre charge is introduced based on the full infra costs and marginal air pollution, noise and congestion costs. No new instruments are implemented for road and rail.
- Euro vignette proposal – extended: the Euro vignette proposal scenario is extended by a carbon tax for road, rail (diesel) and IWT and a kilometre charge for IWT and rail based on marginal infrastructure, air pollution and noise costs.

In table 6 a more elaborated overview of the various pricing scenarios is presented.

Table 6 Overview of policy packages assessed in CE Delft et al. (2010)

Policy packages	*IWT*	*Road*	*Rail*
Pragmatic MSCP	- CO_2 differentiated fuel tax - Km-charge based on marginal infra + external costs - All subsidies abolished	- Existing fuel tax - Km-charge based on marginal infra + external costs + congestion charge - Abolishment of vehicle taxes	- CO_2 differentiated fuel tax diesel rail - Existing electricity tax and ETS electric rail - Km-charge based on marginal infra + external costs - All subsidies abolished
Euro vignette proposal	- Existing fuel tax - Existing km-charges - All subsidies abolished	- Existing fuel tax - Km-charge based on full infra, air pollution and noise costs + congestion charge - Existing vehicle taxes	- Existing fuel taxes - Existing km-charges - All subsidies abolished
Euro vignette proposal extended	- Existing fuel tax + carbon tax + upstream emissions - Km-charge based on marginal infra + air pollution costs - All subsidies abolished	- Existing fuel tax + carbon tax + upstream emissions - Km-charge based on full infra, air pollution and noise costs + congestion charge - Existing vehicle taxes	- Existing fuel tax + carbon tax + upstream emission diesel rail - Existing electricity tax and ETS + upstream emission electric rail - Km-charge based on marginal infra, air pollution & noise costs - All subsidies abolished

The assessment of the various scenarios show that external cost based pricing has significant impacts on freight transport on the corridor. As expected, the impacts are highest in the scenario with the highest price incentives (Euro vignette). The Euro vignette scenarios show a relatively high modal shift to IWT and rail transport (ca. 15% and 10-15% increase of tonnes shipped by IWT and rail respectively). The smallest changes are found for the pragmatic MSCP scenario (max. 10% increase of tonnes shipped by IWT and rail).

In terms of tonne kilometres, IWT and rail gain considerably in all pricing scenarios (up to 20% increase for IWT and for rail). Load factors increase due to higher prices while hauliers will try to reduce transport distances. Therefore, the vehicle kilometres of road transport decrease even stronger than the number of tonnes and tonne kilometres.

All scenarios also show considerable lower emission levels. Overall CO_2 emissions decline by 6% in the pragmatic MSCP scenario, and about 20% in the Euro vignette scenarios. Additionally, air pollutant emissions diminish by 7-8% in the pragmatic scenario, and 11-20% in the Euro vignette scenarios. Finally, all scenarios show reductions in other external and infrastructure costs too.

It should be mentioned that the results as presented by CE Delft et al. (2010) should be considered as first order results rather than being very precise predictions. However, since other quantitative studies in this field are extremely scarce, the results of this study are very useful.

5.5 Conclusions

Air pollutants

In 2020, the average emission level of air pollutants of inland navigation ships will be higher than that of trucks in many cases. Without significant improvement, the gap will become even bigger in the period 2020-2040, without adaptation of the current proposals for tightening inland barge engine emissions. To achieve a level of pollutant emissions comparable to that of road transport for new engines, a strengthening of limit values after phase-IV is needed in the period after 2016.

For a significant drop of the average pollutant emission level of inland barge engines, not only measures to reduce the emissions of new engines are needed, but also measures aimed at the reduction of the emissions form existing ships. However, to develop a sophisticated package of measures, a detailed and indisputable overview of the current fleet is needed. Ideally, the IVR database should be the basis for information about the age distribution of the fleet. However, several studies that included questionnaires under ship-owners showed significant deviations from the IVR database. Additional research may be needed to improve the quality of the database, as basis for additional policy. The introduction of RIS (European Hull Database) may overcome the problem of data availability. The introduction of RIS may overcome the problem of data availability, as the age and classification of vessels and engines is part of the European Hull database. The European hull database is to be implemented as from 2012.

The analysis has shown that several measures could be implemented to lower the emission level of the existing fleet. The subsidy regimes applied in different countries over the last years have shown limitedly effective, since the financial incentive for ship-owners is not sufficient to balance the investment and operational costs. Therefore, to reduce the emissions of the existing fleet, stronger incentives are needed to reduce the emission level of the existing fleet. Options are:

- standardisation
- environmental zoning
- emission taxation (cf. NOx tax and NOx fund)

- differentiated km-charges
- differentiation of port dues
- voluntary standardization and shipper incentives (cf. current Green award)

The legal constraints of the different options have been studied limitedly and should be further studied. The technology to reduce emissions is available; several techniques have been tested in subsidy programmes.

A standard would be most effective, but the overall costs of adapting the existing fleet would probably be high, since ships with limited activity should invest too in order to guarantee a level playing field. A subsidy system is legally simple, but as a single instrument not effective and subsides are not well performing in terms of cost effectiveness as a result of free rider behaviour. Economic incentives like differentiation of port dues and taxation of emissions are cost effective measures, since the market will find the most efficient solution to the incentive, but the scope for differentiation may be an insufficient incentive for making this measure effective. The deployment of voluntary instruments will not lead to guaranteed significant emission reductions in the absence of other measures. However, such instruments lead to cost effective investments and face no legal constraints.

Subsidies and voluntary instruments may not provide enough basis for ship-owner behaviour. The NOx tax (incl. a business fund) has been proven in Norway as an effective instrument. The advantage of this option is that costs for the sector can be kept on a lower level in combination with an investment fund, compared to a standard.

Further work is required on a further exploration of the options and a detailed (legal) analysis of options listed.

<u>Economic impact</u>

Air pollutants
The analysis has shown that achieving a phase-IV level for the entire fleet, as defined as the target for 2020 will need significant investment costs of roughly € 1 billion, taking current cost estimates for SCR and DPF into account.

Greenhouse gases
Greenhouse gas reduction in inland shipping can be guaranteed if a kind of standardisation or economic instruments (fuel tax or ETS) will be implemented. The IMO has proposed ship efficiency indicators using a principle that could also be used in inland shipping. Further research, mainly for the EEDI indicator, should be performed to investigate the usability of the EEDI indicator and redesign it for inland shipping.

Internalisation of external costs
The analysis also shows, that in case of maintaining the level playing field, internalisation of external costs can be beneficial for inland waterway transport, under the condition that the same kind of measures are implemented for road transport.

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Annex 6 Specification policy packages and measures

This Annex 6 presents the relation between the policy packages and the individual measures that are presented and described in the Annex 8.

6.1 Policy package 1

Table 1 Policy package 1 measures

Measure	*Reference to individual measures in tables chapters 3-7 *)*	*Description*
Eliminate inland waterway bottlenecks and support development plans and construction of missing links in European waterway network (e.g. Seine – Schelde, Rhine-Rhone, Sava river, Straubing-Vilshofen)	I1. Support the elimination of bottlenecks and missing links	Improve fairway conditions and thereby facilitate better vessel utilisation, more efficient operations and more competitive market prices
	I2. Coordinate development of European core network	Coordinate development of core waterway network and keep IWT projects high on the agenda by means of an active role in the Connecting Europe Facility (e.g. providing input for Corridor Development Plans)
Develop high quality network of inland ports including waterside logistics sites: funding for ports and transhipment sites	I8. Provide funding for the equipment of ports and transhipment sites	Establish efficient handling facilities and infrastructure and thereby reduce logistics costs and facilitate modal shift
Provide support for development and implementation transport logistics information services (RIS including integration with e-Freight, Single Window)	R10. Stimulate the commercial and logistics use of RIS	Create awareness among relevant logistical RIS users, definition and implementation of support programmes, which reduce the entry barrier for such users.
	R11. Support creation of eFreight and seamless handling formalities	Develop RIS further - and integrate it with other modes through eFreight; moving towards paperless transport for inland waterways consistent with the eMaritime Single Window concept.
Provide neutral logistics advice to potential IWT customers to raise knowledge level and awareness on opportunities of IWT	M7. Support networking activities of modal shift experts and logistics advisors	Bundle know how of modal shift moderators; exchange know-how and implement joint projects and lobbying initiatives with key users of waterways thereby raising the modal share of IWT
	M8. Explore new markets	Support for the industry to develop promising markets which currently either do not exist all or are not served by IWT (e.g. pallets, perishables, waste, automotive, LNG).

Measure	*Reference to individual measures in tables chapters 3-7 *)*	*Description*
Support cooperation between IWT operators and cooperation of IWT operators with operators using other modes	M9. Support cooperation between IWT and other modes (rail and road operators)	By means of supporting R&D projects and collecting and disseminating good practices on multimodal logistic organisation and transport planning the market is supported to improve cooperation between modes of transport.
	M10. Support the development of cooperation models between IWT operators	Identify and disseminate good practices in the field of cooperation models. Analyse possible barriers in competition rules, foster cooperation to enhance overall competitiveness

**) The measures have been listed in the tables in the various chapters of the Main Report (3 to 7) for each policy field. They are further detailed in Annex 8 under the respective category I = Infrastructure, R = RIS, M = Market etcetera and the consecutive number.*

6.2 Policy Package 2

Table 2 Policy package 2 measures

Measure	Reference to individual measures in tables chapters 3-7 *)	Description
Adopt standards and develop other appropriate incentives and retrofit programmes to reduce pollutant emissions of existing engines	F1. Investigate and implement options to reduce pollutant emissions of existing engines	Study and introduce policy instruments to reduce emissions of existing engines (e.g. setting standards to existing engines, implement environmental zones, introducing a NOx business fund, differentiate port dues)
	F2. Implement efficient eco-refit concepts	Design and implement approaches to speed up the implementation of technical innovations into the existing vessels (refitting technologies and strategies) by means of funding schemes.
	F3. Financial incentives from shippers and ports for eco-innovation investments	Define market driven awards for innovation investments until 2015, roll-out the award at an annual basis.
Revise engine emission standards beyond introduction of phase IV engines	F6. Revise engine emission standards beyond introduction of phase-IV	The relevant legislation for engine emissions are updated beyond the introduction of the phase IV standard (e.g. Euro-VI truck level)
Promote access to capital and funding programmes	M14. Promote access to capital and funding programmes	Raise capital within the sector and provide knowledge and awareness of funding opportunities to allow for further market expansion and innovation
Improve and implement education and training programmes related to fuel-saving sailing behaviour and safety	E14. Provide smart steaming courses and support decision support applications	Support applications and education and training measures to improve sailing behaviour

**) The measures have been listed in the tables in the various chapters of the Main Report (3 to 7) for each policy field. They are further detailed in Annex 8 under the respective category I = Infrastructure, R = RIS, M = Market etcetera and the consecutive number.*

6.3 Policy Package 3

Table 3 Policy field / sub-group MARKET

Measure	*Reference to individual measures in tables chapters 3-7 *)*	*Description*
a) Improve general knowledge and information on IWT and the opportunities	M1. Provide neutral information and data on available inland waterway transport services	Increase market transparency by providing information on suppliers and available services in order to increase modal share in the long run
	M2. Collect and disseminate successful multimodal modal shift projects	Collect and disseminate good practices on how to shift cargo onto waterways in order to trigger multiplier effect and common learning
	M3. Creation of IWT multimodal integration kit	Demonstrate how most frequent problems in multimodal transport can be overcome and thereby raise share of multimodal transport
	M4. Initiate IWT innovator of the year award	Collect and disseminate good practices, acknowledge efforts of the private sector and trigger multiplier effect
	M5. Support setup of business-to business conferences	Raise general awareness, bring together supply-side and demand-side (logistics service providers with potential customers), raise modal share of IWT
	M6. Operate and maintain European information portal as general point of entry for information	Improve knowledge basis on IWT for potential customers, political decision-makers and other interested groups to raise awareness
	M12. Provide market information, observation and forecasting	By means of funding research a regular investigation is carried out on economic trends and specific aspects of inland waterway transport, improve knowledge basis on IWT for potential customers, IWT operators, banks and policy makers.

b) Support financial strength of the sector by preventing disruptions in the market due to overcapacity	F9. Monitor (over) capacity in market segments	Simplify legal framework with regard to market disturbance (Directives 96/75, Regulations 181/2008, 718/1999, 805/1999 and 169/2009) and survey quantitative indicators regarding the IWT fleet as a basis for (over)capacity measures in specific market segments

**) The measures have been listed in the tables in the various chapters of the Main Report (3 to 7) for each policy field. They are further detailed in Annex 8 under the respective category I = Infrastructure, R = RIS, M = Market etcetera and the consecutive number.*

Table 4 Policy field / sub-group FLEET

Measure	*Reference to individual measures in tables chapters 3-7 *)*	*Description*
a) Support research, innovation & technology transfer as well as roll out planning	F4. Introduce policy instruments to reduce fuel consumption and co-fund research	The measure to be considered can be a design or operational index, of a fuel tax. Additional research and development shall be supported on technologies and innovations to reduce fuel consumption and CO2 emission.
	F5. Maintain and implement technical requirements for inland vessels and create eco-competitive technical regulations	Review of Directive 2006/87/EC on technical prescriptions for inland waterway vessels and NRMM Directive 79/68/EC with a view of reducing implementation barriers for vessel innovations such as application of LNG as alternative fuel
	F7. Create innovation roadmap and accompanying innovation deployment plans: integration in EU RTD and funding instruments	Prepare an Innovation Roadmap defining intermediate steps until 2015 and update the roadmap on a regular basis, carry out research and innovation funding instruments.
	F8. Support innovation and technology transfer and roll out planning	Create critical mass for specific IWT innovations, bundle know how and guide transition from research to implementation, support innovation clusters
b) Support the development and use of waste collection systems	F10. Analyse waste disposal practice in inland navigation (ship waste)	Carry out pilot projects and define sustainable and environmentally friendly approaches for ship waste disposal.

**) The measures have been listed in the tables in the various chapters of the Main Report (3 to 7) for each policy field. They are further detailed in Annex 8 under the respective category I = Infrastructure, R = RIS, M = Market etcetera and the consecutive number.*

Table 5 Policy field / sub-group Employment & Education

Measure	*Reference to individual measures in tables chapters 3-7 *)*	*Description*
a) Support solutions for lack of qualified staff	E1. Support European and national recruitment campaigns	Raise awareness on IWT careers and widen potential pool of newcomers to the IWT sector by supporting European and national recruiting campaigns aimed at young people and job seekers
	E2. Develop career changers programmes	Facilitate access to the IWT labour market for career changers by recognition of equivalent qualifications and offering tailor-made training programmes
	E3. Support Joint Working Group on Professional Competencies	Create standards on professional competencies and thereby raise mobility on the labour market
	E4. Optimise and harmonise manning requirements	Analyse and harmonise crew composition regarding number and qualifications of crew members and possibilities for automation of functions
	E5. Harmonise and implement education and training standards (STCIN)	Develop and implement EU-wide Standards of Training and Certification in Inland Navigation (STCIN)
	E6. Support standardisation and certification of simulators	Develop standards for different kinds of simulators used in IWT education and training in order to facilitate mutual recognition of education programmes and reduce education time
	E7. Support education and training networks and school exchanges	Support the bottom-up approach of existing school networks to harmonise and modernise IWT education and training
	E8. Harmonise working time regulations	Improve working conditions, raise safety levels and facilitate efficient enforcement by implementing new tailor made working time arrangements that are currently negotiated by the social partners.
	E9. Harmonise and establish social security rules in European IWT labour market	Solve implementation problems regarding EC regulation on the coordination of social security systems
b) Improve and implement education and training programmes related to safety and logistics	E10. Strengthening safety culture of IWT staff	Contents of education and training in inland navigation will be geared towards achieving higher safety standards. Education will focus more on dangers related to specific goods (e.g. chemicals, containers).

Measure	*Reference to individual measures in tables chapters 3-7 *)*	*Description*
	E11. Integrate IWT knowledge in transport logistics education	Implement a European strategy for the integration of IWT knowledge in general logistics education.
	E12. Incorporate better and more extensive logistics knowledge in IWT training courses and education	Stimulate that integral practical supply chain knowledge and understanding of supply chain organisation in particular is more extensively included in curricula of IWT education and training programmes is included.
	E13. Develop strategy to overcome language barriers in IWT	Support implementation of "River speak" on European waterways

**) The measures have been listed in the tables in the various chapters of the Main Report (3 to 7) for each policy field. They are further detailed in Annex 8 under the respective category I = Infrastructure, R = RIS, M = Market etcetera and the consecutive number*

Table 6 Policy field / sub-group INFRASTRUCTURE

Measure	*Reference to individual measures in tables chapters 3-7 *)*	*Description*
a) Develop a high quality of inland ports network including waterside logistics sites	I7. Extend and promote network of quay side power in ports	Offer landside power supply to reduce local emission and noise levels by diesel generators and establish technical norms for quay side power in ports
	I9. Develop a set of European-wide benchmarks for services provided at inland ports	Define benchmarks for handling equipment, port charges, opening hours in inland ports across the European waterway network thereby reducing logistics costs and increasing service levels
	I10. Support setup covenants between shippers-shipping industry-government for local waterside access	Demonstrate value of integrated waterfront development incl. logistics development areas, enhance network of possible transhipment interfaces, raise potential for water transport
	I11. Raise awareness for development of logistics sites along European waterways	Demonstrate, disseminate value of integrated waterfront development incl. logistics development areas, enhance network of possible transhipment interfaces, and raise potential for water transport.
	I12. Improve efficiency and capacity of waterside transhipment and pre- and end-haulage operations	Support research and pilots, enhance network of possible transhipment interfaces and last mile trucking, raise potential for water transport
	I13. Develop European toolkit for inland ports development	Develop port toolkits helping local authorities to develop waterside logistics
	I14. Promote and disseminate environmental zoning in ports	Developing a toolkit to help port authorities and municipalities to properly assess the impact of IWT operations on the air quality

**) The measures have been listed in the tables in the various chapters of the Main Report (3 to 7) for each policy field. They are further detailed in Annex 8 under the respective category I = Infrastructure, R = RIS, M = Market etcetera and the consecutive number.*

Measure	*Reference to individual measures in tables chapters 3-7 *)*	*Description*
b) Provide support for improved waterway management and maintenance	I3. Establish international expert groups for waterway maintenance and develop European standards	Establish harmonised standards for maintenance works along waterways by establishing international expert groups, workshops and manuals (know-how exchange)
	I4. Support innovation in waterway management and development	Secure RTD and innovation budget for infrastructure development e.g. through Horizon 2020
	I5. Ensure constant monitoring of fairway conditions at critical sections	Strengthen monitoring mechanisms for strategic bottlenecks, forward topical information and data to waterway users
	I6. Apply standards for sustainable and integrated waterway management	Support expert group on sustainable waterway planning: know how exchange, workshops and dissemination of guidance documents, shorten planning horizons
	I15. Support expert groups on accident investigation, calamity abatement and insurance obligations	Establish a European expert group and develop a common framework for accident investigation, calamity abatement and insurance of inland vessels in order to reduce disruption of services and to increase the overall safety level
	M13. Maintain a RIS-based inland waterway traffic and transport statistics tool	Increase market transparency and improve knowledge basis on IWT for waterway administrations to optimise waterway management and maintenance works

**) The measures have been listed in the tables in the various chapters of the Main Report (3 to 7) for each policy field. They are further detailed in Annex 8 under the respective category I = Infrastructure, R = RIS, M = Market etcetera and the consecutive number.*

Measure	*Reference to individual measures in tables chapters 3-7 *)*	*Description*
c) Prepare for possible impacts of climate change	I16. Support expert groups on climate change	Bundle available know-how by setting-up dedicated expert groups dealing with possible climate change adaptation strategies for the EU inland waterway network
	I17. Develop adaptation strategies for climate change	Prepare robust waterway planning strategies and elaborate concrete and tailored measures for different international rivers (e.g. Rhine, Danube) and river stretches
d) Prepare for internalisation of external costs	M11. Provide standards for externality calculation	Develop knowledge on possible impacts and scenarios regarding the internalisation of external costs in order to identify the possible impact on the modal share of such a measure

**) The measures have been listed in the tables in the various chapters of the Main Report (3 to 7) for each policy field. They are further detailed in Annex 8 under the respective category I = Infrastructure, R = RIS, M = Market etcetera and the consecutive number.*

Table 7 Policy field / sub-group River Information Services: Support and promote harmonised implementation

Measure	*Reference to individual measures in tables chapters 3-7 *)*	*Description*
Support and promote harmonised implementation of RIS	R1. Update and further develop technical specifications for River Information Services (RIS)	Amendment of the RIS Directive and the creation, updating and further developing the technical specifications for RIS.
	R2. Support and promote harmonised implementation and deployment of RIS	Provision of financial and technical support e.g. through Connecting Europe Facility
	R3. Operate and maintain European Position Information Service	Operate, maintain and further develop the European Position Information Server in such a way that all relevant logistical RIS stakeholders are provided with position information on the basis of controlled access.
	R4. Organise compliance and progress monitoring in the field of RIS	Compliance and progress monitoring in the field of RIS
	R5. Operate and maintain Reference Data Management system	Operate, maintain and further develop the ERDMS in such way that all countries providing River Information Services participate.
	R6. Operate and maintain Inland ENC Register and digital parts of the ENC Standard	The data of the Inland ENC Register and the digital parts of the standard is available for all RIS application manufacturers and authorities producing IENCs, being an enabler for administrative and logistics RIS services.
	R7. Support RIS expert groups	Provide support for the RIS Expert Groups. RIS experts from public administrations, application providers and logistics users have the right framework conditions and support to actively participate in RIS standardisation and harmonisation.
	R8.Operate and maintain single RIS portal	Operate, maintain and further develop the RIS Portal in such way that all RIS stakeholders (EC, RIS authorities, RIS providers, RIS users, etc.) can obtain information on RIS (status, specifications, projects, etc). All RIS stakeholders have the relevant information. The central access point provides Notices to Skippers and Inland ENCs of all administrations.
	R9. Operate and maintain European Hull Database	Operate, maintain and further develop the European Hull Database in such way that all countries issuing ENIs participate.

**) The measures have been listed in the tables in the various chapters of the Main Report (3 to 7) for each policy field. They are further detailed in Annex 8 under the respective category I = Infrastructure, R = RIS, M = Market etcetera and the consecutive number.*

Annex 7 List of policy measurement indicators

In order to develop the dashboard for the measurement of future policy of Inland Waterway Transport, the following indicators are recommended. A list of primary indicators is distinguished as well as the secondary (more detailed) indicators.

7.1 Primary indicators

As seen in the objectives trees in chapter 2 of the Main Report, a few main questions can be marked as essential for the starting point for measurement of the policy on IWT and the contribution of IWT to the society:

- What is the contribution to Europe's GDP?
- What are the current external costs of IWT?
- What is the situation (advantage) compared to other modes?

Based on the objectives and the questions above a list of primary indicators was derived that answer these questions. The following five primary indicators were defined (0A – 0E):

Society:

- 0A: Value added contribution to GDP of the European Union both direct and indirect (in euro per year and share in total)
- 0B: External effects of IWT: total external costs of IWT for the EU (in euro per year and share in total transport)

Opportunity costs for society:

- 0C: Modal split of IWT (share in total, differentiated for different types of goods (NSTR))
- 0D: External costs per tonne km and comparison with other modes
- 0E: Internal costs per tonne km and comparison with other modes

It can be seen that the indicators OB, 0C and 0D do logically focus on the main policy objectives (raise modal share, reduce external costs) whereas indicator 0E is one of the main indicators that determines the modal share of IWT.

7.2 Secondary indicators

Market & Awareness

Demand side

- 1A: Tonnes/ tonne kms transported (per type of vessel, market segment, per corridor)
- 1B: Share of transport costs in total production costs for different market segments
- 1C: Share of inland waterway transport cost in transport cost
- 1D: Multiplier value of IWT to GDP for the customers (shippers, industries, ports)

Supply side

- 1G: Cost structure of transport (breakdown: personnel cost, capital cost, fuel, other costs)
- 1H: Companies and employment (size)
- 1I: Organisational structures (e.g. amount of trade associations, brokers, electronic freight markets, freight exchange platforms) (qualitative)
- 1J: Multiplier value of IWT for their suppliers (fuel suppliers, banks, etc.) (qualitative)

Performance indicators (various market segments)

- 1K: Freight prices (time series)
- 1L: Turnover of companies
- 1M: Profitability
- 1N: Number of bankruptcies
- 1O: Capacity utilisation (overcapacity)
- 1P: Average loading rate
- 1Q: Share of empty sailing in total mileage
- 1R: The perception of IWT on price-quality of IWT among clients of IWT (questionnaire)

Intermodality and logistics

- 1S: Modal share in tonnes and tonne kms per NSTR per corridor
- 1T: Modal share in TEU/TEUkms in the container transport market per corridor
- 1U: Number of intermodal shuttle services and TEU’s transported
- 1V: Cost difference between modes of transport on representative origin-destinations
- 1W: Differences in reliability of service

Fleet

Physical fleet characteristics

- 2A: Available number of vessels and total tonnage
- 2B: Required number of vessels and total tonnage
- 2C: Average year of construction
- 2D: Type of engines and their emission characteristics

External effects, climate and energy

- 2E: Size and type of investments and R&D in the fleet (e.g. alternative fuels, fuel savings, retro-fitting technologies)
- 2F: Average external costs per vessel kilometre and tonne kilometre (different vessel types)
  - 2G: Uncovered infrastructure costs
  - 2H: Non-internalised costs of accidents
  - 2I: Number of fatalities, seriously injured people, number of other accidents
  - 2J: Costs of congestion
  - 2K: Costs of noise
  - 2L: Cost of emissions (PM10, NOx, SO2 etc.)
  - 2M: Cost of climate change (CO2 value)
- 2J: Energy consumption
- 2K: Share of fossil fuel consumption
- 2L: External costs and emissions of other modes of transport (road and rail in particular)
- 2N: Tax revenues from inland waterway transport (VAT, port dues, profit tax)
- 2O: Balance between external costs and tax income (internalising external costs)

Employment and Education

- 3A: Available number of workers
- 3B: Required number of workers (e.g. shortages)
- 3C: Salaries of workers and entrepreneurial staff
- 3D Level of education
- 3E: Number of students
- 3F: Average age of workers
- 3G: Indirect employment (in supply markets of IWT (fuel, banks, etc.) and customers of IWT (shippers)
- 3H: Training programmes on logistics and intermodality
- 3I: Training programmes on fuel efficiency

Infrastructure

- 5A: Size of the waterway networks (length, CEMT class, maps)
- 5B: Bottlenecks on waterway networks
- 5C: Share of 24/7 service on infrastructure network (locks, bridges)
- 5D: Availability and reliability of infrastructure (water levels, accidents, construction)
- 5E: Number and characteristics of transhipment locations (ports, terminals)

River information services

- 6A: RIS funding and number of AIS transponders on inland waterway transport vessels
- 6B: size fleet using RIS for transport and logistics applications

ANNEX 8 Catalogue of individual policy measures

MARKETS & AWARENESS					
Provide neutral information and data on available inland waterway transport services					
A. Insufficient visibility, information and knowledge regarding IWT as supply chain partner for potential clients					
Current situation					
In order to attract new customers to the inland waterway transport sector, neutral information and data on available services (transport, transhipment, value added services) need to be provided via dedicated platforms. Neutral directories and databases with contact addresses of service providers and suppliers (together with their service portfolios) exist for many economic branches. For inland waterway transport however information on supply-side services is still often incomplete, scattered over many sources or in the worst case totally intransparent. Setting-up the required information systems and the organisation and maintenenance of such systems is primarily a task of the industry itself and service providers, but some help in initiating these could be offered by the authorities including the EC.					
Policy objectives and targets					
Policy objectives	++	Improve multimodality and logistics integration			
	0	Reduce environment, climate change and safety impacts			
	+	Improve market conditions for efficient IWT operations			
Vision 2040	Information and data on logistics services and transport providers along European waterways are easily accesible and geared towards the needs of potential customers.				
Proposed policy measures IWT 2020					
Description of measure	Increase market transparency by providing information on suppliers and available services in order to increase modal share in the long run.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States		X	Policy
		River Commissions			Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
	X	Promotion offices		X	Danube
Estimated costs [EUR]	1,250,000				
Provisional time planning	2014-2020				
Expected outcome					
Dedicated information portals and branch directories for main European waterways; higher market accessibility and transparency thereby overcoming the lack of a one-stop-shop for IWT					

MARKETS & AWARENESS					
Collect and disseminate successful multimodal modal shift projects					
A. Insufficient visibility, information and knowledge regarding IWT as supply chain partner for potential clients					
Current situation					
The majority of current projects aiming at shifting transport from road to inland waterways take place indepently of each other. An exchange of know-how and expertise would increase the effectiveness of modal shift actions across Europe and could help to avoid making the same mistakes twice. The successes achieved in one country can help to convince potential customers in other countries to follow suite. Successful projects could be presented in regularly published manuals.					
Policy objectives and targets					
Policy objectives	++	Improve multimodality and logistics integration			
	0	Reduce environment, climate change and safety impacts			
	+	Improve market conditions for efficient IWT operations			
Vision 2040	Successful modal shift projects are being implemented across Europe with regular know-how exchange among involved supply chain management experts				
Proposed policy measures IWT 2020					
Description of measure	Collect and disseminate good practices on how to shift cargo onto waterways in order to trigger multiplier effect and common learning.				
Stakeholders involved		EU/EC	**Type of instrument**		Support
		Member States		X	Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
	X	Promotion offices		X	Danube
Estimated costs [EUR]	1,000,000				
Provisional time planning	2014-2020				
Expected outcome					
Easily accessible collection of successful modal shift projects including a regularly published manual; shortened innovation cycles.					

MARKETS & AWARENESS					
Creation of IWT multimodal integration kit					
A. Insufficient visibility, information and knowledge regarding IWT as supply chain partner for potential clients					
Current situation					
The majority of current projects aiming at shifting transport from road to inland waterways take place indepently of each other. An exchange of know-how and expertise would increase the effectiveness of modal shift actions across Europe and could help to identify the potentials for modal shift by using the experience gained in another Member State. Developing an IWT multimodal integration kit would provide modal shift promoters with useful arguments and tools to convince shippers and forwarders to choose inland navigation (including for example templates for business plans for existing successful projects, supply chain scanners, etc).					
Policy objectives and targets					
Policy objectives	++	Improve multimodality and logistics integration			
	0	Reduce environment, climate change and safety impacts			
	+	Improve market conditions for efficient IWT operations			
Vision 2040	Know-how and expertise regarding an effective support for modal shift is shared across Europe				
Proposed policy measures IWT 2020					
Description of measure	Demonstrate how most frequent problems in multimodal transport can be overcome and thereby raise share of multimodal transport.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States		X	Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
	X	Promotion offices		X	Danube
Estimated costs [EUR]	500,000				
Provisional time planning	2014-2020				
Expected outcome					
Availability of an IWT multimodal integration kit which supports the implementation of effective modal shift actions across Europe					

<table>
<tr><th colspan="6">MARKETS & AWARENESS</th></tr>
<tr><th colspan="6">Initiate IWT innovator of the year award</th></tr>
<tr><td colspan="6">A. Insufficient visibility, information and knowledge regarding IWT as supply chain partner for potential clients</td></tr>
<tr><th colspan="6">Current situation</th></tr>
<tr><td colspan="6">The efforts of private companies in shifting cargo to inland waterways is currently still underappreciated. Companies who take efforts to gear their supply chains towards the use of more environmentally friendly modes of transport such as inland navigation need to know that their work is appreciated and that it pays off to look for innovative alternatives to transport by truck.</td></tr>
<tr><th colspan="6">Policy objectives and targets</th></tr>
<tr><td rowspan="3">Policy objectives</td><td>+</td><td colspan="4">Improve multimodality and logistics integration</td></tr>
<tr><td>0</td><td colspan="4">Reduce environment, climate change and safety impacts</td></tr>
<tr><td>+</td><td colspan="4">Improve market conditions for efficient IWT operations</td></tr>
<tr><td>Vision 2040</td><td colspan="5">Modal shift efforts of private companies are acknowledged by political stakeholders and the media thereby fostering a favourable environment for the future development of environmentally friendly transport solutions</td></tr>
<tr><th colspan="6">Proposed policy measures IWT 2020</th></tr>
<tr><td>Description of measure</td><td colspan="5">Collect and disseminate good practices, acknowledge efforts of the private sector and trigger multiplier effect.</td></tr>
<tr><td rowspan="7">Stakeholders involved</td><td></td><td>EU/EC</td><td rowspan="3">Type of instrument</td><td></td><td>Support</td></tr>
<tr><td></td><td>Member States</td><td>X</td><td>Policy</td></tr>
<tr><td></td><td>River Commissions</td><td></td><td>Legislation</td></tr>
<tr><td>X</td><td>Industry</td><td rowspan="4">Corridors</td><td>X</td><td>Rhine</td></tr>
<tr><td></td><td>Social partners</td><td>X</td><td>East-West</td></tr>
<tr><td></td><td>Education institutes</td><td>X</td><td>North--South</td></tr>
<tr><td>X</td><td>Promotion offices</td><td>X</td><td>Danube</td></tr>
<tr><td>Estimated costs [EUR]</td><td colspan="5">1,000,000</td></tr>
<tr><td>Provisional time planning</td><td colspan="5">2014-2020</td></tr>
<tr><th colspan="6">Expected outcome</th></tr>
<tr><td colspan="6">Every year one company receives the "IWT user of the year"-award in the framework of a logistics event; attention of media and logistics audience is retained; higher visility of business opportunities of IWT</td></tr>
</table>

MARKETS & AWARENESS					
Support setup of business-to-business conferences					
A. Insufficient visibility, information and knowledge regarding IWT as supply chain partner for potential clients					
Current situation					
The conference scene within the inland navigation sector is still characterised by ad-hoc events with a mainly regional focus. With the Barge-2-Business conference which took place on the 30 November and the 1 December 2010 in Brussels however, a new initiative was ushered for European inland navigation. For the first time a business-2-business event about logistics and supply chain management, focusing especially on inland waterway transport, was organised on the European level. The unique event brought together some of the leading opinion makers in Europe - both on the supply and demand side - to lead more than 30 presentations and panel discussion showcasing all that inland waterway transport has to offer logistics and supply chain managers. The resonance of all participants was overwhelmingly positive and many participants urged for a continuance of this successful event scheme.					
Policy objectives and targets					
Policy objectives	++	Improve multimodality and logistics integration			
	+	Reduce environment, climate change and safety impacts			
	+	Improve market conditions for efficient IWT operations			
Vision 2040	Regular meetings of supply-side and demand-side within the course of a dedicated European IWT event; higher visibility of IWT among audience of logistics decisionmakers and potential customers				
Proposed policy measures IWT 2020					
Description of measure	Raise general awareness, bring together supply-side and demand-side (logistics service providers with potential customers), raise modal share of IWT.				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
		Member States			Policy
		River Commissions			Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
	X	Promotion offices		X	Danube
Estimated costs [EUR]	3,800,000				
Provisional time planning	2014-2020				
Expected outcome					
Organisation of a regular IWT event on European level bringing together logistics service providers and potential customers; higher visibility of business opportunities and innovative character of IWT					

MARKETS & AWARENESS					
Operate and maintain European information portal as general point of entry for information					
A. Insufficient visibility, information and knowledge regarding IWT as supply chain partner for potential clients					
Current situation					
Convincing data and information on the benefits and potentials of inland navigation are important communication instruments and powerful means to promote the sector. The facts that the information targets groups have about inland waterway transport are not always complete, correct or well communicated. That is why the European information portal www.naiades.info was set up within the frame of the PLATINA project (Platform for the Implementation of NAIADES) to provide latest news on inland navigation, announcements of important inland navigation events as well as other up-to-date information relevant for the European inland waterway transport sector. The information portal requires sufficient funding to fulfil its role as first point of entry for interested stakeholders also in future.					
Policy objectives and targets					
Policy objectives	+	Improve multimodality and logistics integration			
	+	Reduce environment, climate change and safety impacts			
	++	Improve market conditions for efficient IWT operations			
Vision 2040	Information and data on latest issues relevant for European IWT are efficiently collected, easily accessible and well communicated				
Proposed policy measures IWT 2020					
Description of measure	Improve knowledge basis on IWT for potential customers, political decision-makers and other interested groups to raise awareness.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
		Member States		X	Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
	X	Promotion offices		X	Danube
Estimated costs [EUR]	1,500,000				
Provisional time planning	2014-2020				
Expected outcome					
A European information portal continues to provide latest news on European inland navigation, announcements of important inland navigation events as well as other up-to-date information relevant for the European inland waterway transport sector and acts as general point of entry on the European level; Policy-related information and European business opportunities can be found on a neutral platform.					

<table>
<tr><th colspan="6">MARKETS & AWARENESS</th></tr>
<tr><th colspan="6">Support networking activities of modal shift experts and logistics advisors</th></tr>
<tr><td colspan="6">A. Insufficient visibility, information and knowledge regarding IWT as supply chain partner for potential clients</td></tr>
<tr><th colspan="6">Current situation</th></tr>
<tr><td colspan="6">Some EU member states have set up support structures which provide expertise and consultant services to potential clients of inland waterway transport services. Dedicated modal shift experts and logistics advisors support private companies in developing taylor-made logistics solutions including inland navigation. An exchange of experience and know-how via a dedicated European network of modal shift experts would increase the effectivity of modal shift actions across Europe and could help to avoid making the same mistakes twice. As transport by inland waterways is mainly taking place in an international context, sharing information and data on services available along waterways (transhipment, transport, logistics services) as well as on available funding opportunities in other countries is essential to effectively promote modal shift.</td></tr>
<tr><th colspan="6">Policy objectives and targets</th></tr>
<tr><td rowspan="3">Policy objectives</td><td>+++</td><td colspan="4">Improve multimodality and logistics integration</td></tr>
<tr><td>+</td><td colspan="4">Reduce environment, climate change and safety impacts</td></tr>
<tr><td>++</td><td colspan="4">Improve market conditions for efficient IWT operations</td></tr>
<tr><td>Vision 2040</td><td colspan="5">Close cooperation of logistics advisors with special know-how on the inland waterway transport sector allows for effective modal shift</td></tr>
<tr><th colspan="6">Proposed policy measures IWT 2020</th></tr>
<tr><td>Description of measure</td><td colspan="5">Bundle know how of modal shift moderators; exchange know-how and implement joint projects and lobbying initiatives with key users of waterways thereby raising the modal share of IWT.</td></tr>
<tr><td rowspan="7">Stakeholders involved</td><td>X</td><td>EU/EC</td><td rowspan="3">Type of instrument</td><td>X</td><td>Support</td></tr>
<tr><td>X</td><td>Member States</td><td></td><td>Policy</td></tr>
<tr><td></td><td>River Commissions</td><td></td><td>Legislation</td></tr>
<tr><td></td><td>Industry</td><td rowspan="4">Corridors</td><td>X</td><td>Rhine</td></tr>
<tr><td></td><td>Social partners</td><td>X</td><td>East-West</td></tr>
<tr><td></td><td>Education institutes</td><td>X</td><td>North--South</td></tr>
<tr><td>X</td><td>Promotion offices</td><td>X</td><td>Danube</td></tr>
<tr><td>Estimated costs [EUR]</td><td colspan="5">5,000,000</td></tr>
<tr><td>Provisional time planning</td><td colspan="5">2014-2020</td></tr>
<tr><th colspan="6">Expected outcome</th></tr>
<tr><td colspan="6">Set-up and support of a network of modal shift experts and logistics advisors including the implementation of joint projects</td></tr>
</table>

MARKETS & AWARENESS					
Explore new markets					
A. Insufficient visibility, information and knowledge regarding IWT as supply chain partner for potential clients					
Current situation					
Technological developments amongst others in transhipment techniques and the organisation in the supply chain on the supply side as well as changend patterns in transport demand offer entirely new opportunities for the Inland Waterways Transport Industry. In order to prepare for exploiting the opportunities some groundbreaking / pioneering work will have to be done for which a contribution of authorities would be very helpful. It is proposed that a project supported by the EC will be carried out which should aim at working out the business cases for the commercial rolling-out of new services of the industry . Possible new markets are 1) Biofuels 2) LNG 3) perishable good 4) waste transport 5) sea-river transport 5) Palletised goods. Also a market investigation to the market for small vessel services could be part of this.					
Policy objectives and targets					
Policy objectives	+++	Improve multimodality and logistics integration			
	0	Reduce environment, climate change and safety impacts			
	+	Improve market conditions for efficient IWT operations			
Vision 2040	Fully developed new markets by means of innovative application of IWT services				
Proposed policy measures IWT 2020					
Description of measure	Support for the industry to develop promising markets which currently either do not exist all or are not served by IWT (e.g. pallets, perishables, waste, automotive, LNG).				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
		Member States			Policy
	X	River Commissions			Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	5,000,000				
Provisional time planning	2014-2020				
Expected outcome					
The envisaged project should be very practical, work out concrete business models and business organisation together with alll the parties in the supply chains and just halt at starting-up commercial activities. So the final result should be a number of real-life business cases ready for implementation.					

MARKETS & AWARENESS					
Support cooperation between IWT and other modes (rail and road operators)					
B. Lack of cooperation among owner-operators and integration with other modes					
Current situation					
One of the main objectives of European transport policy is to promote the usage of each transport mode according to its specific strengths while at the same time reducing the negative effects on the environment to the possible minimum. There are already combined transport solutions in place which contribute to a cost-effective and environmentally friendly European transport system. In some cases waterway blockages due to accidents, lock maintenance works or low water periods have a negative impact on the reliability and competitiveness of IWT. Shippers require the existence of emergency concepts providing back-up transport solutions by railways or roads in case ports are not accessible due to blockages of the used waterways. Deficits exist with respect to the provision of such back-up solutions, e.g due to the large share of small and medium-sized enterprises in the industry. Reliability is particularly important for time-sensitive shipments such as container transport and production critical raw materials. European support is required for cooperation models which tackle these problems in order to facilitate their large scale implementation.					
Policy objectives and targets					
Policy objectives	+++	Improve multimodality and logistics integration			
	+	Reduce environment, climate change and safety impacts			
	+	Improve market conditions for efficient IWT operations			
Vision 2040	Advantages of each mode of transport are used according to its specific strenghts to ensure cost-effective and environmental friendly transport of goods				
Proposed policy measures IWT 2020					
Description of measure	By means of supporting R&D projects and collecting and disseminating good practices on multimodal logistic organisation and transport planning the market is supported to improve cooperation between modes of transport.				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
	X	Member States			Policy
		River Commissions			Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
	X	Promotion offices		X	Danube
Estimated costs [EUR]	1,500,000				
Provisional time planning	2014-2020				
Expected outcome					
Cooperation models are in place to facilitate effective modal shift towards sustainable transport modes such as railways and inland waterway transport. Provision of back-up solutions in case inland waterway transport is blocked.					

MARKETS & AWARENESS					
Support the development of cooperation models between IWT operators					
B. Lack of cooperation among owner-operators and integration with other modes					
Current situation					
The inland waterway transport sector (especially in Western Europe) is characterised by a large number of private vessel owner-operators. Due to their limited financial capacity and a lack of coordination among these small companies market activities are sometimes not as effective as they could be, which results in a loss of the overall competitiveness of inland navigation compared to other modes of transport. Effective cooperation models among these actors and need to be set up and adjusted in order to ensure a good economic base for the small and medium-sized enterprises active in inland waterway transport.					
Policy objectives and targets					
Policy objectives	+++	Improve multimodality and logistics integration			
	+	Reduce environment, climate change and safety impacts			
	++	Improve market conditions for efficient IWT operations			
Vision 2040	The specific strenghts of inland waterway transport are more actively promoted by operational cooperation among supply side actors (especially SMEs)				
Proposed policy measures IWT 2020					
Description of measure	Identify and disseminate good practices in the field of cooperation models. Analyse possible barriers in competition rules, foster cooperation to enhance overall competitiveness.				
Stakeholders involved		EU/EC	**Type of instrument**	X	Support
		Member States			Policy
		River Commissions			Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners			East-West
		Education institutes		X	North--South
	X	Promotion offices			Danube
Estimated costs [EUR]	2,000,000				
Provisional time planning	2014-2020				
Expected outcome					
Effective ooperation models of IWT operators are in place to ensure effecient IWT services on European waterways and to increase the overall competitveness of the sector					

<table>
<tr><th colspan="6">MARKETS & AWARENESS</th></tr>
<tr><th colspan="6">Provide standards for externality calculation</th></tr>
<tr><td colspan="6">C. Lack of generally accepted framework for internalisation of external costs and user charges for IWT</td></tr>
<tr><th colspan="6">Current situation</th></tr>
<tr><td colspan="6">Ongoing initiatives of the European Union to internalise external costs have to be supported by the provision of standards for externality calculation in the inland waterway transport sector. Calculation models and indices developed up to now have to be critically reviewed and integrated in a trend-setting concept for future policy actions. Due to its environmental performance inland navigation will play a prominent role in efforts for the internalisation of external costs. Therefore solid data and information is required to promote modal shift towards IWT.</td></tr>
<tr><th colspan="6">Policy objectives and targets</th></tr>
<tr><td rowspan="3">Policy objectives</td><td>+</td><td colspan="4">Improve multimodality and logistics integration</td></tr>
<tr><td>++</td><td colspan="4">Reduce environment, climate change and safety impacts</td></tr>
<tr><td>+</td><td colspan="4">Improve market conditions for efficient IWT operations</td></tr>
<tr><td>Vision 2040</td><td colspan="5">Successful internalisation of external effects based on solid standards for externality calculation</td></tr>
<tr><th colspan="6">Proposed policy measures IWT 2020</th></tr>
<tr><td>Description of measure</td><td colspan="5">Develop knowledge on possible impacts and scenarios regarding the internalisation of external costs in order to identify the possible impact on the modal share of such a measure.</td></tr>
<tr><td rowspan="7">Stakeholders involved</td><td>X</td><td>EU/EC</td><td rowspan="3">Type of instrument</td><td></td><td>Support</td></tr>
<tr><td></td><td>Member States</td><td>X</td><td>Policy</td></tr>
<tr><td>X</td><td>River Commissions</td><td></td><td>Legislation</td></tr>
<tr><td>X</td><td>Industry</td><td rowspan="4">Corridors</td><td>X</td><td>Rhine</td></tr>
<tr><td></td><td>Social partners</td><td>X</td><td>East-West</td></tr>
<tr><td></td><td>Education institutes</td><td>X</td><td>North--South</td></tr>
<tr><td></td><td>Promotion offices</td><td>X</td><td>Danube</td></tr>
<tr><td>Estimated costs [EUR]</td><td colspan="5">750,000</td></tr>
<tr><td>Provisional time planning</td><td colspan="5">2014-2017</td></tr>
<tr><th colspan="6">Expected outcome</th></tr>
<tr><td colspan="6">Well-founded standards for externality calculation from the perspective of the inland waterway transport sector</td></tr>
</table>

MARKETS & AWARENESS

Provide market information, observation and forecasting

D. Lacking general market information

Current situation

In collaboration with the European inland navigation organisations regular market observation and analysis of the inland waterway transport sector are already carried out by the Central Commission for Navigation on the Rhine (CCNR) on behalf of the European Commission.
Regular (biannual) reports published by the CCNR provide:
- an analysis of the demand for inland waterway transport;
- an analysis of the supplied services on the inland waterway market;
- an overview of navigation conditions on European inland waterways;
- a microeconomic analysis of the sector.

Further investigation of economic trends and specific aspects of inland waterway transport (e.g. specific types of cargo, transport sectors) is required to support the further promotion of the sector and allow for a detailed assessment of future development opportunities.

Policy objectives and targets

Policy objectives	+	Improve multimodality and logistics integration
	0	Reduce environment, climate change and safety impacts
	++	Improve market conditions for efficient IWT operations

Vision 2040	Information and data on market segments which were identified as most promising in the market observation and analysis are easily accessible.

Proposed policy measures IWT 2020

Description of measure	By means of funding research a regular investigation is carried out on economic trends and specific aspects of inland waterway transport, improve knowledge basis on IWT for potential customers, IWT operators, banks and policy makers.

Stakeholders involved	X	EU/EC	**Type of instrument**		Support
		Member States		X	Policy
	X	River Commissions			Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
	X	Promotion offices		X	Danube

Estimated costs [EUR]	5,200,000
Provisional time planning	2014-2020

Expected outcome

Regular market observation reports covering main European waterways with valid qualitative and quantitative data for policy and logistics decisionmakers; enabling active monitoring of compliance of market developments with policy objectives

MARKETS & AWARENESS					
Maintain a RIS-based inland waterway traffic and transport statistics tool					
D. Lacking general market information					
Current situation					
Reliable data on the number and types of vessels navigating on European waterways (convoy type, vessel dimensions, etc) and corresponding transport volumes is required to gain insight in market trends and requirements of waterway users regarding waterway infrastructure parameters. This will help waterway administrations to optimise their waterway management and maintenance works and will increase the overall market transparency. River Information Services (RIS) provide an efficient way to electronically collect and process data which can be used for statistical evaluations.					
Policy objectives and targets					
Policy objectives	+	Improve multimodality and logistics integration			
	0	Reduce environment, climate change and safety impacts			
	+	Improve market conditions for efficient IWT operations			
Vision 2040	Reliable data on number and types of vessels as well as on corresponding transport volumes provides useful information to support market transparency and the optimisation of waterway management and maintenance works				
Proposed policy measures IWT 2020					
Description of measure	Increase market transparency and improve knowledge basis on IWT for waterway administrations to optimise waterway management and maintenance works.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States		X	Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	2,500,000				
Provisional time planning	2014-2020				
Expected outcome					
Set-up and operation of a RIS-based inland waterway traffic and transport statistical tool					

MARKETS & AWARENESS

Promote access to capital and funding programmes

E. Difficult access to capital and funding programmes

Current situation

European inland navigation is characterised by a high number of vessel owner-operators. These micro, small and medium-sized enterprises often have problems to finance the modernisation of their vessels as well as investment in new equipment which enables them to open up new markets and increase their overall competitiveness. Information on available funding schemes is often scattered over many different sources. Launched within the frame of the PLATINA project in March 2009, the European Funding Database for Inland Waterway Transport therefore allows for targeted online queries regarding funds and subsidies. Contents of the funding database need to be continuously maintained and updated. In addition financing models for SMEs have to be developed in close cooperation with banks who are interested in developing know-how on the inland navigation sector thereby enlarging their business portfolio.

Policy objectives and targets

Policy objectives	++	Improve multimodality and logistics integration
	+++	Reduce environment, climate change and safety impacts
	++	Improve market conditions for efficient IWT operations
Vision 2040	Sufficient financing and funding means are available and accessible in order to ensure that SMEs active in the IWT sector can invest in the modernisation of their vessels and the purchase of new equipment	

Proposed policy measures IWT 2020

Description of measure	Raise capital within the sector and provide knowledge and awareness of funding opportunities to allow for further market expansion and innovation.

Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States		X	Policy
		River Commissions			Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube

Estimated costs [EUR]	1,000,000
Provisional time planning	2014-2020

Expected outcome

Further operation and updating of the European Funding Database and the development of financing models together with the industry and the banking sector ensure sufficient capital for further market expansion of the IWT sector.

FLEET					
Investigate and implement options to reduce pollutant emissions of existing engines					
A. Slow replacement rate of the existing engines					
Current situation					
The average lifetime of inland navigation engines is so high, that only limiting the emissions of new engines will not lead to satisfactory effects and a signifianct improvement of the position of IWT regarding air pollutants. Moreover a very limited number of engines is replaced each year and as a result of the econonomic crisis and overcapacity there is not much newbuilding of vessels. Therefore, only addressing new vessels and new engines in terms of emission standards is not effective. The following options need to be evaluated: setting standards to existing engines, implement environmental zones, introduce a NOx business fund like was done in Norway, differentiate port dues on the basis of environmental performance. This measure can be complemented with a retrofit subsidy programme (see F2).					
Policy objectives and targets					
Policy objectives	+	Improve multimodality and logistics integration			
	+++	Reduce environment, climate change and safety impacts			
	+	Improve market conditions for efficient IWT operations			
Vision 2040	Inland navigation has significantly cut NOx and PM emissions and the emission levels of the most modern vessels will be clearly lower than those of road freight transport.				
Proposed policy measures IWT 2020					
Description of measure	Study and introduce policy instruments to reduce emissions of existing engines (e.g. setting standards to existing engines, implement environmental zones, introducing a NOx business fund, differentiate port dues).				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States			Policy
	X	River Commissions		X	Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	2,000,000				
Provisional time planning	2014-2020				
Expected outcome					
Faster improvment of air pollution profile of IWT					

FLEET

Implement efficient eco-refit concepts

A. Slow replacement rate of the existing engines

Current situation

Due to very long lifetime of inland vessels it comes to a situation that many ship components, although technically in excellent condition, can not provide performances of the corresponding components of modern vessels being built upon the state-of-the-art knowledge. These components are for instance engines, propeller and rudder arrangements and shapes, deck and especially electronic equipment, but also hull form and hull structure. Moreover, changed market and logistic requirements after 20 or more years of service of an existing ship could set-up new requests for performances like more carrying capacity or more speed, combined with less fuel consumption and emissions. These circumstances impose the need to implement various modernisation measures. In addition within this activity also the setting-up and implemention of retrofit programs for in the industry are included. In particular option like SCR, DFP and the use of LNG propelled engines are to be considered. However, it should be clear that single retrofit programmes are ineffective. They need to be complemented with push measures (see F.1) to provide incentives for investments.

Policy objectives and targets

Policy objectives	0	Improve multimodality and logistics integration
	+++	Reduce environment, climate change and safety impacts
	0	Improve market conditions for efficient IWT operations
Vision 2040	Efficient eco-refit concepts have been fully deployed in Europe; the paradox between the long economic lifetime of vessels and the necessary innovation cycles of vessels has been overcome	

Proposed policy measures IWT 2020

Description of measure	Design and implement approaches to speed up the implementation of technical innovations into the existing vessels (refitting technologies and strategies) by means of funding schemes.			
Stakeholders involved	X	EU/EC	**Type of instrument**	X
	X	Member States		X
		River Commissions		
	X	Industry	**Corridors**	X
		Social partners		X
		Education institutes		X
		Promotion offices		X
Estimated costs [EUR]	75,000,000			
Provisional time planning	2014-2020			

Expected outcome

1) Decision support tools for vessel owners for the ranking of alternative technical measures to upgrade the vessel, thereby considering cost-efficiency of single measures and limited financial means of the sector as well as 2) new/ retrofitted vessel engines for the industry for all IWT countries

FLEET					
Financial incentives from shippers and ports for eco-innovation investments					
A. Slow replacement rate of the existing engines					
Current situation					
As an additional non-legislative measure in order to stimulate eco-innovation, an reward scheme needs to be developed and implemented to provide incentives for investment in clean and efficient techniques. At present such innovation award schemes exist for other sectors. The Dutch Green Award for the inland shipping comes from the Green Award scheme established in 1994 in order to promote quality shipping amongst sea-going vessels. Exploration of the willingness of shippers for providing incentives to ship-owners with Greenaward certificates. For an effective scheme, it needs to be very clear to what extent ship-owners can count on additional rates on the spot market depending on the environmental performance of the ship. It needs to be investigated how this can be organized and of and how this can be done from a legal perspective. Ports can provide reductions on their published tariffs, but with flexible cargo rates, this is different.					
Policy objectives and targets					
Policy objectives	+	Improve multimodality and logistics integration			
	+++	Reduce environment, climate change and safety impacts			
	+	Improve market conditions for efficient IWT operations			
Vision 2040	Business itself prefers and selects clean ships by a European Green Award like kind of incentive scheme				
Proposed policy measures IWT 2020					
Description of measure	Define market driven awards for innovation investments until 2015, roll-out the award at an annual basis.				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
	X	Member States		X	Policy
		River Commissions			Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
	X	Promotion offices		X	Danube
Estimated costs [EUR]	1,000,000				
Provisional time planning	2014-2020				
Expected outcome					
Award for innovation instruments is implemented from 2015 onwards; a continuous awareness and innovation process is being triggered.					

FLEET					
Introduce policy instruments to reduce fuel consumption and co-fund research					
B. Poor focus on decarbonisation of IWT fleet					
Current situation					
In the 2011 Transport White Paper, 60% GHG reduction in 2050 has been identified as a goal for the transport sector. To anticipate on both this goal and the Commission initiative to study obligatory fuel standards for trucks, as a reaction on US truck fuel efficiency standardisation, possible measures and policy instruments will need to be identified and implemented as well for inland shipping to keep a leading position on fuel efficienct transport. Possible instruments are: fuel taxation, implementation of design and operational standard (c.f. IMO). The implementation needs to be co-funded by research programmes.					
Policy objectives and targets					
Policy objectives	0	Improve multimodality and logistics integration			
	++	Reduce environment, climate change and safety impacts			
	+	Improve market conditions for efficient IWT operations			
Vision 2040	IWT remains in a leading position as regards to engine CO2 emissions, concepts for decarbonisation of the IWT fleet have been developed in co-funded research programmes and broadly been deployed in the sector, as a result of policy.				
Proposed policy measures IWT 2020					
Description of measure	The measure to be considered can be a design or operational index, of a fuel tax. Additional research and development shall be supported on technologies and innovations to reduce fuel consumption and CO2 emission.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States			Policy
		River Commissions		X	Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	17,500,000				
Provisional time planning	2014-2020				
Expected outcome					
Significant reduction of fuel consumption. Cost-efficient concepts for the decarbonisation of the IWT fleet have been developed and implemented.					

<table>
<tr><th colspan="6">FLEET</th></tr>
<tr><th colspan="6">Maintain and implement technical requirements for inland vessels and create eco-competitive technical regulations</th></tr>
<tr><th colspan="6">B. Poor focus on decarbonisation of IWT fleet</th></tr>
<tr><th colspan="6">Current situation</th></tr>
<tr><td colspan="6">Certain inland waterways vessels require a technical inspection before being allowed to sail on European inland waterways. Vessel certification authorities and recognized classification societies issue community certificates after technical inspections. The technical requirements for inland waterway vessels are defined in Directive 2006/87/EC as well as in the Rhine Inspection Rules (RheinSchUO). At European level, the Joint Working Group and the Committee for 2006/87/EC are the formal bodies discussing amendments, which are proposed by the EC. The Joint Working Group (JWG) requires administrative support and technical expertise provided by consultants outside of the JWG. While maintaining high safety standards, technical innovation should not be delayed unnecessary by technical regulations.</td></tr>
<tr><th colspan="6">Policy objectives and targets</th></tr>
<tr><td rowspan="3">Policy objectives</td><td>+</td><td colspan="4">Improve multimodality and logistics integration</td></tr>
<tr><td>+</td><td colspan="4">Reduce environment, climate change and safety impacts</td></tr>
<tr><td>++</td><td colspan="4">Improve market conditions for efficient IWT operations</td></tr>
<tr><td>Vision 2040</td><td colspan="5">The technical requirements for inland waterway vessels are published by one body and are binding for the entire European inland waterway network, updates are done in regular intervals.</td></tr>
<tr><th colspan="6">Proposed policy measures IWT 2020</th></tr>
<tr><td>Description of measure</td><td colspan="5">Review of Directive 2006/87/EC on technical prescriptions for inland waterway vessels and NRMM Directive 79/68/EC with a view of reducing implementation barriers for vessel innovations such as application of LNG as alternative fuel.</td></tr>
<tr><td rowspan="7">Stakeholders involved</td><td>X</td><td>EU/EC</td><td rowspan="3">Type of instrument</td><td></td><td>Support</td></tr>
<tr><td>X</td><td>Member States</td><td></td><td>Policy</td></tr>
<tr><td>X</td><td>River Commissions</td><td>X</td><td>Legislation</td></tr>
<tr><td></td><td>Industry</td><td rowspan="4">Corridors</td><td>X</td><td>Rhine</td></tr>
<tr><td></td><td>Social partners</td><td></td><td>East-West</td></tr>
<tr><td></td><td>Education institutes</td><td></td><td>North--South</td></tr>
<tr><td></td><td>Promotion offices</td><td></td><td>Danube</td></tr>
<tr><td>Estimated costs [EUR]</td><td colspan="5">1,200,000</td></tr>
<tr><td>Provisional time planning</td><td colspan="5">2014-2020</td></tr>
<tr><th colspan="6">Expected outcome</th></tr>
<tr><td colspan="6">Technical requirements of inland waterway vessels are state-of-the-art</td></tr>
</table>

FLEET					
Revise engine emission standards beyond introduction of phase-IV					
C. Unclear engine emission standards for new engines					
Current situation					
Emissions to the air are regulated by Regulations of the Central Commission for Navigation on the Rhine (Stage II in force since 1.7.2007) as well as by Directive 2004/26/EC (Stage IIIA (V1:1 –V1:3) since 1.1.2007, other engine categories starting from 1.1.2009). In terms of future emission standards, the European Commission has not yet tabled a phase IV proposal for stricter emission standards which are likely to apply from 2016. In non-road mobile machineries, inland waterway vessels will possibly face emission limits that are similar to the US Environmental Protection Agency's standards which would allow for a bigger market for specific engines. Analysis has shown that to achieve a the pole position, a further strengthening will be needed. From an economic point of view, tightening in co-operation with the US would be preferable.					
Policy objectives and targets					
Policy objectives	0	Improve multimodality and logistics integration			
	+++	Reduce environment, climate change and safety impacts			
	0	Improve market conditions for efficient IWT operations			
Vision 2040	Inland waterway transport retains pole position in terms of emissions to air				
Proposed policy measures IWT 2020					
Description of measure	The relevant legislation for engine emissions are updated beyond the introduction of the phase IV standard (e.g. to Euro-VI truck level).				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States			Policy
	X	River Commissions		X	Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	500,000				
Provisional time planning	2014-2020				
Expected outcome					
Legislation and regulations on engine emissions are kept up-to-date, the European Commission, other international bodies and the sector are supported with complementary expertise (e.g. studies on the technical feasibility, impact, etc.)					

<table>
<tr><th colspan="6">FLEET</th></tr>
<tr><th colspan="6">Create innovation roadmap and accompanying innovation deployment plans: integration in EU RTD and funding instruments</th></tr>
<tr><td colspan="6">D. Fragmentation of available sources of information on innovations and lack of coordination and R&D and deployment plans</td></tr>
<tr><th colspan="6">Current situation</th></tr>
<tr><td colspan="6">The NAIADES action programme includes the development of a Strategic Research Agenda (SRA) for Inland Waterway Transport.Against this background the individual fields can only jointly develop their full impact; isolated considerations of just individual aspects are neither effective nor foreseen. The definition and regular update of the Strategic Research Agenda as well as its integration into national and European research and innovation funding programmes shall ensure long term research and the development for IWT to overcome instrinsic SME structure and lack of critical mass. The development of a Strategic Research Agenda (SRA) for the Inland Waterway Transport mode started within the framework of PLATINA. It thereby defines research and development priorities which decisively contribute to the EU transport policy targets by the promotion and strengthening of inland waterway transport. The SRA needs to be developed further and become an innovation roadmap 2050 including accompanying innovation deployment plans.</td></tr>
<tr><th colspan="6">Policy objectives and targets</th></tr>
<tr><td rowspan="3">Policy objectives</td><td>+</td><td colspan="4">Improve multimodality and logistics integration</td></tr>
<tr><td>+</td><td colspan="4">Reduce environment, climate change and safety impacts</td></tr>
<tr><td>0</td><td colspan="4">Improve market conditions for efficient IWT operations</td></tr>
<tr><td>Vision 2040</td><td colspan="5">An Innovation Roadmap 2050 is available in 2015 which is updated regularly in order to match with the technological developments, current legislative and business environment. IWT research has led to cost-efficient and environmental friendly innovations.</td></tr>
<tr><th colspan="6">Proposed policy measures IWT 2020</th></tr>
<tr><td>Description of measure</td><td colspan="5">Prepare an Innovation Roadmap defining intermediate steps until 2015 and update the roadmap on a regular basis, carry out research and innovation funding instruments.</td></tr>
<tr><td rowspan="7">Stakeholders involved</td><td>X</td><td>EU/EC</td><td rowspan="3">Type of instrument</td><td></td><td>Support</td></tr>
<tr><td>X</td><td>Member States</td><td>X</td><td>Policy</td></tr>
<tr><td>X</td><td>River Commissions</td><td></td><td>Legislation</td></tr>
<tr><td>X</td><td>Industry</td><td rowspan="4">Corridors</td><td>X</td><td>Rhine</td></tr>
<tr><td></td><td>Social partners</td><td>X</td><td>East-West</td></tr>
<tr><td></td><td>Education institutes</td><td>X</td><td>North--South</td></tr>
<tr><td></td><td>Promotion offices</td><td>X</td><td>Danube</td></tr>
<tr><td>Estimated costs [EUR]</td><td colspan="5">1,500,000</td></tr>
<tr><td>Provisional time planning</td><td colspan="5">2014-2020</td></tr>
<tr><th colspan="6">Expected outcome</th></tr>
<tr><td colspan="6">An Innovation Roadmap 2050 is available in 2015 and is updated at on a regular basis in order to match with the technological developments, current legislative and business environment. IWT is integrated in national and European research and innovation funding instruments.</td></tr>
</table>

<table>
<tr><th colspan="6">FLEET</th></tr>
<tr><th colspan="6">Support innovation and technology transfer and roll out planning</th></tr>
<tr><td colspan="6">D. Fragmentation of available sources of information on innovations and lack of coordination and R&D and deployment plans</td></tr>
<tr><th colspan="6">Current situation</th></tr>
<tr><td colspan="6">Currently limited dedicated research efforts into inland navigation applications are combined with the relatively low speed at which innovation is spreading across the long tail of small inland navigation operators. Fragmentation is therefore a barrier to innovation and market entry of new technologies. Support for innovation and technology transfer and roll out planning is needed.Critical mass is needed and demand needs to be consolidated. Knowledge on fleet innovations, transhipment equipment and new logistics concepts is dispersed over many different sources.</td></tr>
<tr><th colspan="6">Policy objectives and targets</th></tr>
<tr><td rowspan="3">Policy objectives</td><td>+</td><td colspan="4">Improve multimodality and logistics integration</td></tr>
<tr><td>+</td><td colspan="4">Reduce environment, climate change and safety impacts</td></tr>
<tr><td>0</td><td colspan="4">Improve market conditions for efficient IWT operations</td></tr>
<tr><td>Vision 2040</td><td colspan="5">Knowledge of innovations in the field of inland navigation disseminated and applied broadly with the support of innovation transfer clusters enabling the fleet to be more competitive and sustainable. There is co-ordination in the innovation of the inland navigation, e.g. trough an intensive dialogue on requirements between engine manufacturers and fleet operators.</td></tr>
<tr><th colspan="6">Proposed policy measures IWT 2020</th></tr>
<tr><td>Description of measure</td><td colspan="5">Create critical mass for specific IWT innovations, bundle know how and guide transition from research to implementation, support innovation clusters.</td></tr>
<tr><td rowspan="7">Stakeholders involved</td><td></td><td>EU/EC</td><td rowspan="3">Type of instrument</td><td></td><td>Support</td></tr>
<tr><td>X</td><td>Member States</td><td>X</td><td>Policy</td></tr>
<tr><td></td><td>River Commissions</td><td></td><td>Legislation</td></tr>
<tr><td></td><td>Industry</td><td rowspan="4">Corridors</td><td>X</td><td>Rhine</td></tr>
<tr><td></td><td>Social partners</td><td>X</td><td>East-West</td></tr>
<tr><td></td><td>Education institutes</td><td>X</td><td>North--South</td></tr>
<tr><td>X</td><td>Promotion offices</td><td>X</td><td>Danube</td></tr>
<tr><td colspan="3">Estimated costs [EUR]</td><td colspan="3">5,000,000</td></tr>
<tr><td colspan="3">Provisional time planning</td><td colspan="3">2014-2020</td></tr>
<tr><th colspan="6">Expected outcome</th></tr>
<tr><td colspan="6">The financial strength of inland waterway transport has increased in Europe in comparison with 2010.</td></tr>
</table>

FLEET					
Monitor (over)capacity in market segments					
E. Lack of decision support tools preventing overcapacity in the market					
Current situation					
Overcapacity in certain market segments leads to a malfunction of the market mechanism and threatens profitability of IWT enterprises. In particular the tanker market is affected due to new double hull capacity entering the market and slow phasing-out of one hull vessel. Another market with tendency to overcapacity problems is the segment of large dry vessels. Regular market observation is required to monitor the current economic situation of the sector in the form of an overview of developments. At least the following analyses have to be carried out; specific topics might appear at a case by case basis. 1. Transport demand (Economic growth: development and prospects, Transport demand: development and prospects, transports according to axis, port transhipment, etc.) 2. Transport supply (Evolution of the fleet, etc.) 3. Fairway conditions and operating capacity The market observation will provide for scientific ground for political measures (e.g. measures to temporarily reduce overcapacity, call for severe market disturbance, additional state aid due to economic crisis, etc.) as well as information for companies to make decisions on investments in the fleet and innovations					
Policy objectives and targets					
Policy objectives	0	Improve multimodality and logistics integration			
	0	Reduce environment, climate change and safety impacts			
	++	Improve market conditions for efficient IWT operations			
Vision 2040	Quantitative indicators on the IWT fleet are available and known in the sector and used to balance supply and demand regarding fleet capacity				
Proposed policy measures IWT 2020					
Description of measure	Simplify legal framework with regard to market disturbance (Directives 96/75/EC, Regulation EC 718/1999, and survey quantitative indicators regarding the IWT fleet as a basis for (over)capacity measures in specific market segments.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States		X	Policy
	X	River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	1,500,000				
Provisional time planning	2014-2020				
Expected outcome					
Removal of overcapacity with respect to tanker fleet. Regular monitoring of capacity development and adjustment of regulation including more concrete criteria to allow fast public intervention if market forces fail. Extension of available long-term information on market development and cooperation among shipping lines and vessel owners lead to more rational capacity decision. Quantitative indicators on the IWT fleet are available forming the basis for (over)capacity measures in specific market segments and decisions on business level.					

FLEET						
Analyse waste disposal practice in inland navigation (ship waste)						
F. Poor shipping waste arrangements to operating areas outside the Rhine, in particular along the Danube						
Current situation						
Rivers are a unique ecosystem with a high biodiversity, an important water reservoir and an international waterway with high potential for inland navigation. Along with the increase of transport growth, waste from IWT is going to increase as well. On the river Rhine, shipping waste arrangements for the Rhine and inland waterways are set out under the terms of the CDNI Shipping Waste Treaty. In other regimes, such measures are still under development. In order to account for this, the establishment of a sustainable, environmentally sound and translational coordinated approach in ship waste management along European rivers will need to be studied and possibly implemented: 1. Elaborating national ship waste management concepts, 2. Implementing pilot actions and 3. Developing a financing model for the operating system based on the polluter-pays principle.						
Policy objectives and targets						
Policy objectives	0	Improve multimodality and logistics integration				
	+	Reduce environment, climate change and safety impacts				
	+	Improve market conditions for efficient IWT operations				
Vision 2040	Sustainable and environmentally friendly approaches have been implemented throughout Europe by 2020; a function ship waste collection system has been set up and in operation, leading to zero harmful impacts on the environment and water quality.					
Proposed policy measures IWT 2020						
Description of measure	Carry out pilot projects and define sustainable and environmentally friendly approaches for ship waste disposal.					
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support	
	X	Member States			Policy	
	X	River Commissions		X	Legislation	
		Industry	**Corridors**		Rhine	
		Social partners		X	East-West	
		Education institutes		X	North--South	
		Promotion offices		X	Danube	
Estimated costs [EUR]	1,500,000					
Provisional time planning	2014-2017					
Expected outcome						
Sustainable and environmentally friendly approaches have been implemented throughout Europe by 2020.						

EMPLOYMENT & EDUCATION					
Support European and national recruitment campaigns					
A.Lack of qualified staff					
Current situation					
Staff and entrepreneurial shortage has become a major problem in IWT. Although the European inland navigation sector offers secure job perspectives, it is not a very popular employer for young people and job seekers. Within PLATINA a general recruitment strategy (incl. a toolbox for European and national implementation) was elaborated.					
Policy objectives and targets					
Policy objectives	0	Improve multimodality and logistics integration			
	0	Reduce environment, climate change and safety impacts			
	++	Improve market conditions for efficient IWT operations			
Vision 2040	Inland navigation has managed to position itself as an attractive employer and has overcome its shortage of personnel				
Proposed policy measures IWT 2020					
Description of measure	Raise awareness on IWT careers and widen potential pool of newcomers to the IWT sector by supporting European and national recruiting campaigns aimed at young people and job seekers.				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
	X	Member States			Policy
		River Commissions			Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
	X	Promotion offices		X	Danube
Estimated costs [EUR]	6,000,000				
Provisional time planning	2014-2017				
Expected outcome					
Attract qualified young people and career changers to jobs in inland navigation					

EMPLOYMENT & EDUCATION					
Develop career changers programmes					
A.Lack of qualified staff					
Current situation					
The European IWT market suffers from a shortage of qualified nautical personnel. People and students from e.g. technical or other transport professions or education systems could be one possibility to solve this problem. Some European countries are already exploiting this potential by offering tailor-made and efficient programmes for different groups of career changers to join IWT.					
Policy objectives and targets					
Policy objectives	0	Improve multimodality and logistics integration			
	0	Reduce environment, climate change and safety impacts			
	++	Improve market conditions for efficient IWT operations			
Vision 2040	Access to IWT labour market is eased through wide application of career changers programmes.				
Proposed policy measures IWT 2020					
Description of measure	Facilitate access to the IWT labour market for career changers by recognition of equivalent qualifications and offering tailor-made training programmes.				
Stakeholders involved		EU/EC	**Type of instrument**		Support
	X	Member States		X	Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
	X	Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	1,500,000				
Provisional time planning	2014-2017				
Expected outcome					
Activated pool of career changers as potential newcomers to the IWT sector					

EMPLOYMENT & EDUCATION					
Support Joint Working Group on Professional Competencies					
A.Lack of qualified staff					
Current situation					
Within the PLATINA project a joint working group (JWG) on professional competencies was initiated. This JWG consists of representatives of the CCNR, EDINNA, European Transport Workers' Federation, European Barge Union, European Skippers Organisation, Danube Commission and the Sava Commission. The JWG elaborated a consolidated draft of professional competencies for inland navigation personnel and thus created the basis for the development of European Standards of Training and Certification in Inland Navigation (STCIN).					
Policy objectives and targets					
Policy objectives	+	Improve multimodality and logistics integration			
	+	Reduce environment, climate change and safety impacts			
	+	Improve market conditions for efficient IWT operations			
Vision 2040	European Standards of training and certification are in force in the whole of Europe. The JWG supports regular updating of the regulations.				
Proposed policy measures IWT 2020					
Description of measure	Create standards on professional competencies and thereby raise mobility on the labour market.				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
	X	Member States			Policy
	X	River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
	X	Social partners		X	East-West
	X	Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	725,000				
Provisional time planning	2014-2017				
Expected outcome					
Enable a smooth implementation of STCIN in all European inland navigation countries					

EMPLOYMENT & EDUCATION

Optimise and harmonise manning requirements

A.Lack of qualified staff

Current situation

Given the current and expected future shortage of statf, ways how to reduce and optimise manning requirements will become crucial for the Industry.In the most extreme case one could think of the future use of (almost) fully automatic vessels for which no or only a single (supervising) person will be on-board. Less radically current manning requirements could also be investigated to look for further redcution possibilities.An exploratory study will be needed to investigate the technologies and extent to which staff reduction will be possible without of course impairing safety ofoperations.

Policy objectives and targets

Policy objectives	++	Improve multimodality and logistics integration
	0	Reduce environment, climate change and safety impacts
	+	Improve market conditions for efficient IWT operations

Vision 2040	Reduction of staff shortages and strong reduction of human input

Proposed policy measures IWT 2020

Description of measure	Analyse and harmonise crew composition regarding number and qualifications of crew members and possibilities for automation of functions.

Stakeholders involved	X	EU/EC	**Type of instrument**		Support
		Member States		X	Policy
	X	River Commissions		X	Legislation
	X	Industry	**Corridors**	X	Rhine
	X	Social partners		X	East-West
	X	Education institutes		X	North--South
		Promotion offices		X	Danube

Estimated costs [EUR]	500,000
Provisional time planning	2017-2020

Expected outcome

Overview of new technical possibilities to further reduce the crew size on-board of IWT vessels

<table>
<tr><th colspan="6">EMPLOYMENT & EDUCATION</th></tr>
<tr><th colspan="6">Harmonise and implement education and training standards (STCIN)</th></tr>
<tr><td colspan="6">B.Lack of standards for education, training and certification</td></tr>
<tr><th colspan="6">Current situation</th></tr>
<tr><td colspan="6">Education and training for inland navigation personnel is organised at national level and differs quite strongly from country to country (ranging from learning-by-doing-approaches to education at university level). There are no European minimum standards for IWT education defined. Thus mutual recognition of nautical certificates (regulated e.g. by the European Commission (96/50/EC), the UNECE (Resolution No. 31, revised) or the CCNR) is difficult. Furthermore the absence of minimum education standards leads to safety risks and hinders labour market mobility.</td></tr>
<tr><th colspan="6">Policy objectives and targets</th></tr>
<tr><td rowspan="3">Policy objectives</td><td>0</td><td colspan="4">Improve multimodality and logistics integration</td></tr>
<tr><td>+</td><td colspan="4">Reduce environment, climate change and safety impacts</td></tr>
<tr><td>++</td><td colspan="4">Improve market conditions for efficient IWT operations</td></tr>
<tr><td>Vision 2040</td><td colspan="5">Harmonised standards of training and certification in inland navigation are implemented in all European inland navigation countries; labour mobility and mutual recognition of educational standards has become obvious.</td></tr>
<tr><th colspan="6">Proposed policy measures IWT 2020</th></tr>
<tr><td>Description of measure</td><td colspan="5">Develop and implement EU-wide Standards of Training and Certification in Inland Navigation (STCIN).</td></tr>
<tr><td rowspan="7">Stakeholders involved</td><td>X</td><td>EU/EC</td><td rowspan="3">Type of instrument</td><td>X</td><td>Support</td></tr>
<tr><td>X</td><td>Member States</td><td>X</td><td>Policy</td></tr>
<tr><td>X</td><td>River Commissions</td><td>X</td><td>Legislation</td></tr>
<tr><td></td><td>Industry</td><td rowspan="4">Corridors</td><td>X</td><td>Rhine</td></tr>
<tr><td>X</td><td>Social partners</td><td>X</td><td>East-West</td></tr>
<tr><td>X</td><td>Education institutes</td><td>X</td><td>North--South</td></tr>
<tr><td></td><td>Promotion offices</td><td>X</td><td>Danube</td></tr>
<tr><td>Estimated costs [EUR]</td><td colspan="5">3,500,000</td></tr>
<tr><td>Provisional time planning</td><td colspan="5">2014-2020</td></tr>
<tr><th colspan="6">Expected outcome</th></tr>
<tr><td colspan="6">European standards of training and certification in inland navigation ensure high safety standards and labour market mobility in inland navigation.</td></tr>
</table>

EMPLOYMENT & EDUCATION					
Support standardisation and certification of simulators					
B.Lack of standards for education, training and certification					
Current situation					
Simulators gain importance in the field of education and training, take for example aircraft training. Also in IWT simulators are used to gain and train skills in the field of navigation (e.g. navigation, radar, motor or VHF simulators), logistics (e.g. transport chain simulators) or port operation (e.g. crane simulators). The use and quality of simulators differs strongly across Europe. EDINNA collected information on different existing simulators as a basis for future standardisation and certification of simulators used in training and examination.					
Policy objectives and targets					
Policy objectives	+	Improve multimodality and logistics integration			
	+	Reduce environment, climate change and safety impacts			
	+	Improve market conditions for efficient IWT operations			
Vision 2040	State-of-the-art simulators are fully part of IWT education in Europe have contributed to modern and efficient IWT education.				
Proposed policy measures IWT 2020					
Description of measure	Develop standards for different kinds of simulators used in IWT education and training in order to facilitate mutual recognition of education programmes and reduce education time.				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
	X	Member States			Policy
	X	River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
	X	Social partners		X	East-West
	X	Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	3,300,000				
Provisional time planning	2014-2017				
Expected outcome					
Along with STCIN standardisation of IWT simulators lead to harmonised and modernised European IWT education and training; higher mobility and transparency on the European labour market for IWT.					

<table>
<tr><th colspan="7">EMPLOYMENT & EDUCATION</th></tr>
<tr><th colspan="7">Support education and training networks and school exchanges</th></tr>
<tr><td colspan="7">B.Lack of standards for education, training and certification</td></tr>
<tr><td colspan="7">Current situation</td></tr>
<tr><td colspan="7">In 2009 EDINNA the educational network of inland waterway navigation schools and training institutes with currently over 20 members was founded. The foundation of EDINNA was strongly supported by PLATINA. With an innovative bottom-up approach they have the goal to establish harmonised education, training and certification system for inland waterway personnel. NELI, a project-based IWT education and training network in the Danube region, was set up to foster school exchanges and cooperation between nautical and logistics education institutions and IWT information and training centres.</td></tr>
<tr><td colspan="7">Policy objectives and targets</td></tr>
<tr><td rowspan="3">Policy objectives</td><td>0</td><td colspan="5">Improve multimodality and logistics integration</td></tr>
<tr><td>+</td><td colspan="5">Reduce environment, climate change and safety impacts</td></tr>
<tr><td>++</td><td colspan="5">Improve market conditions for efficient IWT operations</td></tr>
<tr><td>Vision 2040</td><td colspan="6">Cooperation, exchange and harmonisation in European IWT education and training have lead to high quality standards of nautical personnel</td></tr>
<tr><td colspan="7">Proposed policy measures IWT 2020</td></tr>
<tr><td>Description of measure</td><td colspan="6">Support the bottom-up approach of existing school networks to harmonise and modernise IWT education and training.</td></tr>
<tr><td rowspan="7">Stakeholders involved</td><td>X</td><td>EU/EC</td><td rowspan="3">Type of instrument</td><td>X</td><td colspan="2">Support</td></tr>
<tr><td></td><td>Member States</td><td></td><td colspan="2">Policy</td></tr>
<tr><td></td><td>River Commissions</td><td></td><td colspan="2">Legislation</td></tr>
<tr><td></td><td>Industry</td><td rowspan="4">Corridors</td><td>X</td><td colspan="2">Rhine</td></tr>
<tr><td></td><td>Social partners</td><td>X</td><td colspan="2">East-West</td></tr>
<tr><td>X</td><td>Education institutes</td><td>X</td><td colspan="2">North--South</td></tr>
<tr><td></td><td>Promotion offices</td><td>X</td><td colspan="2">Danube</td></tr>
<tr><td>Estimated costs [EUR]</td><td colspan="6">2,200,000</td></tr>
<tr><td>Provisional time planning</td><td colspan="6">2014-2020</td></tr>
<tr><td colspan="7">Expected outcome</td></tr>
<tr><td colspan="7">Raise efficiency of education system and arrive at harmonised education standards</td></tr>
</table>

EMPLOYMENT & EDUCATION					
Harmonise working time regulations					
C.Weak social security and working conditions framework					
Current situation					
Working time periods in inland navigation are specific, therefore the general EU's Working Time Directive (2003/88/EC, currently in reviewing process) is not adequate. Social partners of other (transport) sectors already worked out and agreed on specific arrangements. In the Sectoral Social Dialogue Committee for inland waterway transport, the social partners started negotiations in January 2008 on specific working time arrangements in the inland waterway transport sector. The provisions shall take account of the specific needs of the sector. A social partners' agreement is likely to be concluded.					
Policy objectives and targets					
Policy objectives	0	Improve multimodality and logistics integration			
	+	Reduce environment, climate change and safety impacts			
	++	Improve market conditions for efficient IWT operations			
Vision 2040	Adequate EU-wide working time arrangements for nautical personnel are in force and implemented on national level.				
Proposed policy measures IWT 2020					
Description of measure	Improve working conditions, raise safety levels and facilitate efficient enforcement by implementing new tailor made working time arrangements that are currently negotiated by the social partners .				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States			Policy
		River Commissions		X	Legislation
		Industry	**Corridors**	X	Rhine
	X	Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	500,000				
Provisional time planning	2014-2017				
Expected outcome					
Adequate, harmonised and clear working time regulations for onboard personnel, which raise attractiveness of IWT on labour market					

EMPLOYMENT & EDUCATION					
Harmonise and establish social security rules in European IWT labour market					
C.Weak social security and working conditions framework					
Current situation					
Whereas European IWT mainly is an international business, social security rules mainly are a national responsibility. This makes human resources management complex, difficult to control and often leads to abuse of the system to the detriment of employees - especially for third country citizens. This fact harms the attractiveness of nautical jobs. The European regulation 883/2004 aims at the coordination of social security systems, though some problems in implementation have to be solved.					
Policy objectives and targets					
Policy objectives	0	Improve multimodality and logistics integration			
	0	Reduce environment, climate change and safety impacts			
	++	Improve market conditions for efficient IWT operations			
Vision 2040	Clear, fair and harmonised legal framework concerning social security systems for employees in the European inland navigation sector				
Proposed policy measures IWT 2020					
Description of measure	Solve implementation problems regarding EC regulation on the coordination of social security systems.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States			Policy
		River Commissions		X	Legislation
		Industry	**Corridors**	X	Rhine
	X	Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	750,000				
Provisional time planning	2014-2020				
Expected outcome					
Making the profession of on-board personnel more attractive by raising social security levels in IWT					

<table>
<tr><th colspan="6">EMPLOYMENT & EDUCATION</th></tr>
<tr><th colspan="6">Strengthening safety culture of IWT staff</th></tr>
<tr><td colspan="6">D.Low internal safety, lack of safety culture</td></tr>
<tr><th colspan="6">Current situation</th></tr>
<tr><td colspan="6">A generally high safety level is one of the major strengths of inland waterway transport. However, recent incidents show that there is room for improvements. With respect to loading, the stability of vessels is a growing concern, in particular with respect to container and steel transports. Moreover, the variety of dangerous goods with different handling restrictions in chemical supply chains increases. This implies additional requirements regarding the skills of personnel. In addition language barriers on waterways and in ports during loading and discharging of goods are another problem threatening safety.</td></tr>
<tr><th colspan="6">Policy objectives and targets</th></tr>
<tr><td rowspan="3">Policy objectives</td><td>0</td><td colspan="4">Improve multimodality and logistics integration</td></tr>
<tr><td>++</td><td colspan="4">Reduce environment, climate change and safety impacts</td></tr>
<tr><td>+</td><td colspan="4">Improve market conditions for efficient IWT operations</td></tr>
<tr><td>Vision 2040</td><td colspan="5">Well-trained staff contributes to inland waterway transport with hardly any accidents</td></tr>
<tr><th colspan="6">Proposed policy measures IWT 2020</th></tr>
<tr><td>Description of measure</td><td colspan="5">Contents of education and training in inland navigation will be geared towards achieving higher safety standards. Education will focus more on dangers related to specific goods (e.g. chemicals, containers).</td></tr>
<tr><td rowspan="7">Stakeholders involved</td><td>X</td><td>EU/EC</td><td rowspan="3">Type of instrument</td><td>X</td><td>Support</td></tr>
<tr><td></td><td>Member States</td><td>X</td><td>Policy</td></tr>
<tr><td></td><td>River Commissions</td><td></td><td>Legislation</td></tr>
<tr><td></td><td>Industry</td><td rowspan="4">Corridors</td><td>X</td><td>Rhine</td></tr>
<tr><td></td><td>Social partners</td><td>X</td><td>East-West</td></tr>
<tr><td>X</td><td>Education institutes</td><td>X</td><td>North--South</td></tr>
<tr><td></td><td>Promotion offices</td><td>X</td><td>Danube</td></tr>
<tr><td>Estimated costs [EUR]</td><td colspan="5">2,200,000</td></tr>
<tr><td>Provisional time planning</td><td colspan="5">2014-2020</td></tr>
<tr><th colspan="6">Expected outcome</th></tr>
<tr><td colspan="6">Adjustment of training ensures safety-relevant know-how on European inland vessels.</td></tr>
</table>

EMPLOYMENT & EDUCATION					
Integrate IWT knowledge in transport logistics education					
E.Lack of logistics know-how among IWT training and Lack of attention to IWT in education programmes focussing on logistics					
Current situation					
Surveys and expert interviews undertaken within PLATINA, NELI and previous research projects have shown a clear underrepresentation of IWT knowledge in transport logistics education. Future transport chain decision makers have no or little knowledge on IWT logistics and thus the potentials of this mode of transport are not fully used. Taking this in consideration a "Strategy for the integration of IWT knowledge in general logistics education" has been elaborated by the PLATINA consortium.					
Policy objectives and targets					
Policy objectives	++	Improve multimodality and logistics integration			
	0	Reduce environment, climate change and safety impacts			
	+	Improve market conditions for efficient IWT operations			
Vision 2040	IWT knowledge is integrated part in education and training of transport logistics				
Proposed policy measures IWT 2020					
Description of measure	Implement a European strategy for the integration of IWT knowledge in general logistics education.				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
	X	Member States			Policy
		River Commissions			Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
	X	Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]			1,500,000		
Provisional time planning			2014-2020		
Expected outcome					
Intermodal transport experts and a new generation of logistics dispatchers will have profound IWT knowledge which leads to a better integration of IWT in transport chains					

EMPLOYMENT & EDUCATION					
Incorporate better and more extensive logistics knowledge in IWT training courses and education					
E.Lack of logistics know-how among IWT training and Lack of attention to IWT in education programmes focussing on logistics					
Current situation					
In current curricula of IWT training courses supply chain expertise is often still lacking. Better Skills and more knowledge in this field are required in order for IWT to expand to other markets and improve the customer service in the existing markets. In particular at a higher professional level such expertise is required to be of real service to supply chain managers and to enter open up new markets for IWT.					
Policy objectives and targets					
Policy objectives	++	Improve multimodality and logistics integration			
	0	Reduce environment, climate change and safety impacts			
	+	Improve market conditions for efficient IWT operations			
Vision 2040	IWT will have expanded activities in many non-traditional supply chains and IWT staff is seen by customers as partners that provide services at the same level as operators in other transport modes and are flexible as those operators..				
Proposed policy measures IWT 2020					
Description of measure	Stimulate that integral practical supply chain knowledge and understanding of supply chain organisation in particular is more extensively included in curricula of IWT education and training programmes is included.				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
	X	Member States			Policy
		River Commissions			Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
	X	Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]			1,500,000		
Provisional time planning			2014-2020		
Expected outcome					
The benchmark is to achieve comparable levels of expertise as in road freight transport where at present in companies the average level of logistics expertise is significantly higher than in IWT The industry will have to catch-up to be able to communicate and think with potential new customers.					

EMPLOYMENT & EDUCATION					
Develop strategy to overcome language barriers in IWT					
F. Language problems causing lack of efficiencies and safety risks					
Current situation					
With an increasing mobility on IWT labour market language barriers start to unveil and endanger safety and efficiency in inland navigation. Different from maritime sector, where English is the common language (IMO Standard Marine Communication Phrases) no such common language exists in IWT. EDINNA has set up a working group to develop "River speak" - fixed phrases in English for different communication situations in IWT based on existing IWT lexica and maritime standards. The future implementation of River speak shall start in IWT education and have adequate transition periods before becoming obligatory.					
Policy objectives and targets					
Policy objectives	0	Improve multimodality and logistics integration			
	++	Reduce environment, climate change and safety impacts			
	+	Improve market conditions for efficient IWT operations			
Vision 2040	Common "River Speak" leads to higher efficiency and safety levels and to easier mobility on labour market				
Proposed policy measures IWT 2020					
Description of measure	Support implementation of "River speak" on European waterways.				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
	X	Member States		X	Policy
	X	River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
	X	Social partners		X	East-West
	X	Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	1,000,000				
Provisional time planning	2014-2020				
Expected outcome					
River speak is the lingua franca on European waterways					

EMPLOYMENT & EDUCATION					
Provide smart steaming courses and support decision support applications					
G.Lack of awareness and information on fuel consumption and carbon footprint					
Current situation					
Applied research (e.g. CREATING project) and smart steaming competitions like in the Netherlands have shown that smart steaming on inland waterways substantially saves fuel. Supported by smart steaming courses and decision support applications like speed control, river information services and energy consumption registration this potential of energy saving can be realised.					
Policy objectives and targets					
Policy objectives	0	Improve multimodality and logistics integration			
	+++	Reduce environment, climate change and safety impacts			
	0	Improve market conditions for efficient IWT operations			
Vision 2040	Reduction of energy consumption by a minimum of 10% with the help of smart steaming on inland waterways				
Proposed policy measures IWT 2020					
Description of measure	Support applications and education and training measures to improve sailing behaviour.				
Stakeholders involved		EU/EC	**Type of instrument**	X	Support
	X	Member States			Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
	X	Education institutes		X	North--South
	X	Promotion offices		X	Danube
Estimated costs [EUR]	10,000,000				
Provisional time planning	2014-2017				
Expected outcome					
All ships are equipped with navigation support applications and boatmen are well trained in smart steaming; together with technical progress and innovation this measure will help IWT retain ist pole position in terms of emissions to air					

INFRASTRUCTURE

Support the elimination of bottlenecks and missing links

A. Physical bottlenecks and missing links

Current situation

The Trans-European Transport Network (TEN-T) defines two priority projects of highest importance for developing waterway infrastructure in Europe: the Seine-Nord-Canal and the river Danube. The Seine-Nord Canal is under construction and is planned to be finished in 2017. There are ongoing/planned projects along the Danube in Germany, Austria, Hungary, Romania and Bulgaria. Still the current situation on the Danube is that the recommendations by the Danube Commission and by the UNECE (AGN, Blue Book) on fairway parameters - basically fairway depths of 2.5 metres at low navigable water level - are not met on several stretches of the Danube. European attention and funding is required to speed up the implementation of strategic waterway projects.

Policy objectives and targets

Policy objectives	+++	Improve multimodality and logistics integration
	++	Reduce environment, climate change and safety impacts
	+	Improve market conditions for efficient IWT operations

Vision 2040	Improved waterway infrastructure leads to higher reliability, reduced transport prices and modal shift from road to waterway.

Proposed policy measures IWT 2020

Description of measure	Improve fairway conditions and thereby facilitate better vessel utilisation, more efficient operations and more competitive market prices.

Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
	X	Member States			Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube

Estimated costs [EUR]	NA: see official reporting from MS
Provisional time planning	2014-2020

Expected outcome

A seamless waterway infrastructure network with common minimum fairway parameters for international waterways.

INFRASTRUCTURE					
Coordinate development of European core network					
A. Physical bottlenecks and missing links					
Current situation					
With inland waterway transport, the available fairway depths determine the draught loaded of a vessel and hence the possible loading quantity. A chain is only as strong as its weakest link. This principle also applies to international inland navigation. Due to different responsibilities (EU, national, regional), policies and financial means of waterway administrations the European waterway network is still fragmented with different infrastructure quality standards and fairway conditions. Existing coordination activities (PLATINA, corridor coordinators, NEWADA - cooperation of Danube waterway administrations) have to be enforced and extended to ensure a seamless high-quality waterway infrastructure network.					
Policy objectives and targets					
Policy objectives	+++	Improve multimodality and logistics integration			
	+	Reduce environment, climate change and safety impacts			
	++	Improve market conditions for efficient IWT operations			
Vision 2040	Improved waterway maintenance leads to higher reliability, reduced transport prices and modal shift from road to waterway.				
Proposed policy measures IWT 2020					
Description of measure	Coordinate development of core waterway network and keep IWT projects high on the agenda by means of an active role in the Connecting Europe Facility (e.g. providing input for Corridor Development Plans).				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
		Member States		X	Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	2,500,000				
Provisional time planning	2014-2020				
Expected outcome					
European core IWT network with harmonised quality standards					

INFRASTRUCTURE					
Establish international expert groups for waterway maintenance and develop European standards					
B. Lack of maintenance and lack of reliable fairway conditions according to international standards					
Current situation					
Different maintenance standards and especially different implementation quality of maintenance works by national waterway administrations leads to uneven framework conditions for transport on inland waterways. This is especially a problem along the Danube river, where waterway administrations of the ten adjacent countries pursue different strategies and financial resources for waterway maintenance (measuring, dredging, etc) are rather limited. Mutual know-how exchange and dedicated expert groups for waterway management could help to raise the political sense of urgency and priority for these issues.					
Policy objectives and targets					
Policy objectives	++	Improve multimodality and logistics integration			
	+	Reduce environment, climate change and safety impacts			
	++	Improve market conditions for efficient IWT operations			
Vision 2040	Improved waterway infrastructure leads to higher reliability, reduced transport prices and modal shift from road to waterway.				
Proposed policy measures IWT 2020					
Description of measure	Establish harmonised standards for maintenance works along waterways by establishing international expert groups, workshops and manuals (know-how exchange).				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States		X	Policy
	X	River Commissions		X	Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	1,500,000				
Provisional time planning	2014-2020				
Expected outcome					
European minimum standards developed by international expert groups for waterway maintenance allow for competitive inland waterway transport on main European waterways					

INFRASTRUCTURE					
Support innovation in waterway management and development					
B. Lack of maintenance and lack of reliable fairway conditions according to international standards					
Current situation					
Inland waterways are complex systems with multiple functions, especially the potential conflict between the ecological function (ecoystem) and the transport infrastructure function require a cautious approach towards waterway management and development. Innovative methods to consolidate these functions in the development and the continuous management (maintenance) of the inland waterway system are necessary. Dedicated funding for applied research projects could speed up the introduction of innovations. In addition expert exchanges, manuals and guidelines as well as the definition of best practices could help to achieve fundamental improvements.					
Policy objectives and targets					
Policy objectives	+	Improve multimodality and logistics integration			
	++	Reduce environment, climate change and safety impacts			
	++	Improve market conditions for efficient IWT operations			
Vision 2040	Optimised, harmonised and holistic development and management of inland waterways taking into account and respecting their different functions.				
Proposed policy measures IWT 2020					
Description of measure	Secure RTD and innovation budget for infrastructure development e.g. through Horizon 2020.				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
	X	Member States			Policy
	X	River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	1,000,000				
Provisional time planning	2014-2020				
Expected outcome					
Support for innovation in waterway management and development to improve river ecoystems and inland waterway transport at the same time through a holistic approach					

INFRASTRUCTURE					
Ensure constant monitoring of fairway conditions at critical sections					
B. Lack of maintenance and lack of reliable fairway conditions according to international standards					
Current situation					
The constant monitoring of critical fairway sections is a prerequisite for well maintained inland waterways. Especially for inland waterways of international importance (e.g. Rhine, Danube) a European coordination of these activities is of utmost importance. On the most international river of the world, the Danube, 10 riparian states with different socio-economic and political framework conditions should establish a common approach. The information and data gained through the thorough and constant monitoring of fairway conditions at critical sections has to be provided to waterway users (especially captains) in order to allow for additional tonnage to be transported on waterways thereby increasing the overall competitiveness and efficiency of inland navigation. Modern IT solutions can be used to ensure seamless communication chains between waterway administrations and skippers.					
Policy objectives and targets					
Policy objectives	++	Improve multimodality and logistics integration			
	++	Reduce environment, climate change and safety impacts			
	0	Improve market conditions for efficient IWT operations			
Vision 2040	Improved waterway infrastructure leads to higher reliability, reduced transport prices and modal shift from road to waterway.				
Proposed policy measures IWT 2020					
Description of measure	Strengthen monitoring mechanisms for strategic bottlenecks, forward topical information and data to waterway users.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States		X	Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	2,500,000				
Provisional time planning	2014-2020				
Expected outcome					
Seamless and harmonised monitoring system for international European inland waterways					

INFRASTRUCTURE					
Apply standards for sustainable and integrated waterway management					
B. Lack of maintenance and lack of reliable fairway conditions according to international standards					
Current situation					
PLATINA has launched an innovative manual presenting good practises in sustainable waterway planning. The document provides guidelines for planning waterway development projects that are compatible with environmental protection requirements, creating a win-win harmony. It offers general advice for waterway infrastructure projects and addresses both technical planners and other interested stakeholders who want to be involved in a waterway development planning process. The integrated approach of the manual should now be extended to all activities of waterway administrations including the maintenance of the fairway (surveying, planning, dredging, information to customers) and all other river engineering works. International expert groups developing European standards can help to enhance and smoothen communication between the transport and environment sectors.					
Policy objectives and targets					
Policy objectives	0	Improve multimodality and logistics integration			
	++	Reduce environment, climate change and safety impacts			
	0	Improve market conditions for efficient IWT operations			
Vision 2040	Achievement of win-win solutions for environment, transport and other river uses				
Proposed policy measures IWT 2020					
Description of measure	Support expert group on sustainable waterway planning: know how exchange, workshops and dissemination of guidance documents, shorten planning horizons.				
Stakeholders involved		EU/EC	**Type of instrument**		Support
	X	Member States		X	Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	1,000,000				
Provisional time planning	2014-2020				
Expected outcome					
Set up of internationally agreed practical standards for sustainable and integrated waterway management (e.g. for river regimes as the Rhine, Danube)					

INFRASTRUCTURE					
Extend and promote network of quay side power in ports					
C. Inland ports: pressure, poor quality and missing transhipment locations					
Current situation					
Currently most ships still generate electricity with their own engines while mooring in a port, emitting air pollutants and noise. If a port is situated near densely populated areas this can contribute significantly to environment and health problems. To tackle this problem landside power supply systems can be introduced. More and more port administrations therefore equip their berths with the required facilities. To extend and promote this environmentally friendly and noise-reduced electricity supply will be the challenge of the next years.					
Policy objectives and targets					
Policy objectives	+	Improve multimodality and logistics integration			
	++	Reduce environment, climate change and safety impacts			
	0	Improve market conditions for efficient IWT operations			
Vision 2040	All inland vessels mooring in European ports are supplied with energy and water by modern landside facilities providing an easy-to-use payment device				
Proposed policy measures IWT 2020					
Description of measure	Offer landside power supply to reduce local emission and noise levels by diesel generators and establish technical norms for quay side power in ports.				
Stakeholders involved		EU/EC	**Type of instrument**	X	Support
	X	Member States			Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	500,000,000				
Provisional time planning	2014-2020				
Expected outcome					
Foster the use of landside power supply and ensure harmonisation of standards by a set of technical norms					

INFRASTRUCTURE					
Provide funding for the equipment of ports and transhipment sites					
C. Inland ports: pressure, poor quality and missing transhipment locations					
Current situation					
The development of inland ports - in their function as multimodal logistics nodes - plays an important role in increasing the competitiveness of inland waterway transport and in promoting intermodality and modal shift. To ensure efficient handling of goods according to the needs of their customers, ports require modern handling equipment for different types of cargo (e.g. containers, project cargo, liquid cargo, etc) supported by up-to-date IT services. As investements in handling equipment and port infrastructure are very cost-intensive, financial support is required from the side of the Member States as well as from the European Union as far as inland ports can be regarded as multimodal platforms of European importance (Trans-European Transport Networks).					
Policy objectives and targets					
Policy objectives	++	Improve multimodality and logistics integration			
	+	Reduce environment, climate change and safety impacts			
	+	Improve market conditions for efficient IWT operations			
Vision 2040	A well-equipped and efficient network of inland ports functioning as multimodal platforms along main European waterways				
Proposed policy measures IWT 2020					
Description of measure	Establish efficient handling facilities and infrastructure and thereby reduce logistics costs and facilitate modal shift.				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
	X	Member States			Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	250,000,000				
Provisional time planning	2014-2020				
Expected outcome					
Sufficient funding on national and European level to support the further development of inland ports in order to reduce logistics costs and facilitate modal shift					

INFRASTRUCTURE					
Develop a set of European-wide benchmarks for services provided at inland ports					
C. Inland ports: pressure, poor quality and missing transhipment locations					
Current situation					
The quality of handling equipment and the level of services provided in European inland ports vary to a large extent depending mainly on available financial means, the development level of the waterway infrastructure and the general port management strategy. A European-wide benchmark study could support mutual learning among ports and will provide good practices regarding services (flexible opening hours, value-added services, port dues, etc) and transhipment (handling capacity, innovation in handling equipment, etc). Inland ports with extraordinary innovative services could be presented in more detail in publications and dedicated websites.					
Policy objectives and targets					
Policy objectives	++	Improve multimodality and logistics integration			
	+	Reduce environment, climate change and safety impacts			
	0	Improve market conditions for efficient IWT operations			
Vision 2040	A well-equipped and efficient network of inland ports functioning as multimodal platforms along main European waterways				
Proposed policy measures IWT 2020					
Description of measure	Define benchmarks for handling equipment, port charges, opening hours in inland ports across the European waterway network thereby reducing logistics costs and increasing service levels.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
		Member States		X	Policy
		River Commissions			Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	500,000				
Provisional time planning	2014-2017				
Expected outcome					
Benchmarks and good practices regarding the quality of handling equipment and the level of services provided in inland ports					

INFRASTRUCTURE

Support setup covenants between shippers-shipping industry-local / regional government for local waterside access

C. Inland ports: pressure, poor quality and missing transhipment locations

Current situation

Business and logistics sites along waterways increase the competitiveness of inland waterway transport as costs for pre- and post-haulage can be minimised and all transport modes can be used according to their strengths and the specific needs of the relevant supply chains. Inland ports and transhipment sites provide direct access to inland waterways and enable companies to make use of environmentally friendly and cost-efficient inland navigation. In order to foster the development of transhipment facilities along waterways, some EU Member States have introduced targeted funding programmes.
The Flemish regional government for example is supporting the construction of quays along inland waterways, the so called "Kaaimuur programma" (quay wall construction programme). Private companies contribute 20% to the construction costs; the remainder is paid by the government. The quay wall remains under the ownership of the government, who is contributing to the investment under the condition that the company guarantees certain volumes of cargo for a period of 10 years. If these guarantees are not met, the company pays a fine.
Similiar covenants could be implemented in other Member States in order to promote the use of inland waterway transport among shippers and logistics companies.

Policy objectives and targets

Policy objectives	++	Improve multimodality and logistics integration
	+	Reduce environment, climate change and safety impacts
	0	Improve market conditions for efficient IWT operations

Vision 2040	Well developed network of inland ports and transhipment sites along main European waterways facilitates competitive inland waterway transport

Proposed policy measures IWT 2020

Description of measure	Demonstrate value of integrated waterfront development incl. logistics development areas, enhance network of possible transhipment interfaces, raise potential for water transport.

Stakeholders involved		EU/EC	**Type of instrument**	X	Support
	X	Member States			Policy
		River Commissions			Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube

Estimated costs [EUR]	100,000
Provisional time planning	2014-2020

Expected outcome

Member States support dedicated covenants and funding programmes for waterside logistics sites

<table>
<tr><th colspan="5">INFRASTRUCTURE</th></tr>
<tr><th colspan="5">Raise awareness for development of logistics sites along European waterways</th></tr>
<tr><td colspan="5">C. Inland ports: pressure, poor quality and missing transhipment locations</td></tr>
<tr><th colspan="5">Current situation</th></tr>
<tr><td colspan="5">Business and logistics sites along waterways increase the competitiveness of inland waterway transport as costs for pre- and post-haulage can be minimised and all transport modes can be used according to their strengths and the specific needs of the relevant supply chains. Inland ports and transhipment sites provide direct access to inland waterways and enable companies to make use of environmentally friendly and cost-efficient inland navigation.

Joint strategies of IWT promotion offices, business development agencies, inland ports and logistics service providers are required to develop business and logistics locations along waterways. Some Member States already have experience in that field and can provide guidance and good practice examples to other ones thereby initiating mutual know-how exchange and good practices. In this respect the situation around the new port exentension of Rotterdam merits attention. As part of the environmental impact reduction a modal split agreement was made by the port autorities for future years which will imply a substantial increase in the use of IWT in container transport. Such approaches could perhaps be extended to other areas.</td></tr>
<tr><th colspan="5">Policy objectives and targets.</th></tr>
<tr><td rowspan="3">Policy objectives</td><td>++</td><td colspan="3">Improve multimodality and logistics integration</td></tr>
<tr><td>+</td><td colspan="3">Reduce environment, climate change and safety impacts</td></tr>
<tr><td>0</td><td colspan="3">Improve market conditions for efficient IWT operations</td></tr>
<tr><td>Vision 2040</td><td colspan="4">Well developed network of inland ports and transhipment sites along main European waterways facilitates competitive inland waterway transport</td></tr>
<tr><th colspan="5">Proposed policy measures IWT 2020</th></tr>
<tr><td>Description of measure</td><td colspan="4">Demonstrate, disseminate value of integrated waterfront development incl. logistics development areas, enhance network of possible transhipment interfaces, raise potential for water transport.</td></tr>
<tr><td rowspan="7">Stakeholders involved</td><td>X</td><td>EU/EC</td><td rowspan="3">Type of instrument</td><td>Support</td></tr>
<tr><td>X</td><td>Member States</td><td>X Policy</td></tr>
<tr><td></td><td>River Commissions</td><td>Legislation</td></tr>
<tr><td>X</td><td>Industry</td><td rowspan="4">Corridors</td><td>X Rhine</td></tr>
<tr><td></td><td>Social partners</td><td>X East-West</td></tr>
<tr><td></td><td>Education institutes</td><td>X North--South</td></tr>
<tr><td>X</td><td>Promotion offices</td><td>X Danube</td></tr>
<tr><td>Estimated costs [EUR]</td><td colspan="4">750,000</td></tr>
<tr><td>Provisional time planning</td><td colspan="4">2014-2017</td></tr>
<tr><th colspan="5">Expected outcome</th></tr>
<tr><td colspan="5">"how to" guidance document on development of logistics sites along European waterways based on the experience gained in Member States resulting in a denser network of transhipment sites along waterways</td></tr>
</table>

INFRASTRUCTURE					
Improve efficiency and capacity of waterside transhipment and pre- end haulage operations					
C. Inland ports: pressure, poor quality and missing transhipment locations					
Current situation					
A further integration of inland waterway transport into logistics chains is considered as a precondition in order to open up new markets for this mode of transport. Efficient and high-capacity waterside handling equipment and ports infrastructure is required to facilitate the modernisation of the inland waterway transport sector. Transport and transhipment solutions have to be economically attractive, flexible, reliable and safe in order to be competitive with the existing services provided by land-based modes. Research actitivities and pilots are required to raise the level of service offered by waterside logistics providers and to fulfill the requirements of individual types of cargo (e.g. containers, general cargo, etc).					
Policy objectives and targets					
Policy objectives	++	Improve multimodality and logistics integration			
	+	Reduce environment, climate change and safety impacts			
	0	Improve market conditions for efficient IWT operations			
Vision 2040	Efficient and high-capacity waterside logistics facilitate the promotion of multimodal transport solutions				
Proposed policy measures IWT 2020					
Description of measure	Support research and pilots, enhance network of possible transhipment interfaces and last mile trucking, raise potential for water transport.				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
	X	Member States			Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	1,500,000				
Provisional time planning	2014-2020				
Expected outcome					
Dedicated research programmes for waterside transhipment solutions including pilot actions implemented along main European waterways					

INFRASTRUCTURE					
Develop European toolkit for inland ports development					
C. Inland ports: pressure, poor quality and missing transhipment locations					
Current situation					
Instead of developing inland ports and logistics centres, local authorities are under pressure to develop inland waterways for housing and recreation. In the Netherlands there is an initiative ongoing to tackle this problem. A toolkit developed by NEA Transport Research and Training, aims at helping local authorities make balanced decisions As the European transport system comes under ever-increasing pressure, it is becoming more and more important for all available transport modes to be used in the most efficient way. Studies done on the European Transport Network makes it clear that a co-modal network approach is essential in order to distribute the goods flows in the most effective and efficient way. Inland ports are, of course, an essential part of the waterways transport chain using, so the capacity for transhipment needs to be available. These ports provide space for important industrial and logistics activities, thus creating jobs, turnover, profits and welfare.					
Policy objectives and targets					
Policy objectives	++	Improve multimodality and logistics integration			
	+	Reduce environment, climate change and safety impacts			
	0	Improve market conditions for efficient IWT operations			
Vision 2040	A well-equipped and efficient network of inland ports functioning as multimodal platforms along main European waterways				
Proposed policy measures IWT 2020					
Description of measure	Develop port toolkits helping local authorities to develop waterside logistics.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States		X	Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
	X	Promotion offices		X	Danube
Estimated costs [EUR]	750,000				
Provisional time planning	2014-2017				
Expected outcome					
Port toolkits tailored to the needs of Member States to support their local authorities in developing waterside logistics					

INFRASTRUCTURE					
Promote and disseminate environmental zoning in ports					
C. Inland ports: pressure, poor quality and missing transhipment locations					
Current situation					
An alternative to the application of mandatory emission standards for all existing ships, is the designation of environmental sensitive zones, from an air quality perspective. In Rotterdam, inland barge engines will have to meet CCR-II regulation from 2025 on. The decision was made in the context of the expansion of the Maasvlakte area. The measure was needed to ensure that air quality Directive 2008/51 will be met in the distant future. Potentially, environmental zoning can be as effective as standardization since off ships need to load and unload goods. However, the willingness for environmental zoning from the port point of view might limit the effectiveness. The environmental criteria set in Rotterdam will be limitedly effective in the period until 2020. Furthermore, it is questionable if inland ports are willing to introduce such a scheme, since it may reduce their attractiveness for industry to settle and hence the number of port calls. From a theoretical point of view, inland ports could join the Rotterdam scheme in a coordinated way, in particular if there can be related to air quality Directive 2008/51.					
Policy objectives and targets					
Policy objectives	0	Improve multimodality and logistics integration			
	++	Reduce environment, climate change and safety impacts			
	0	Improve market conditions for efficient IWT operations			
Vision 2040	Properly monitored and guided IWT operations in environmental zones in all the major inland ports in the EU				
Proposed policy measures IWT 2020					
Description of measure	Developing a toolkit to help port authorities and municipalities to properly assess the impact of IWT operations on the air quality.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States		X	Policy
		River Commissions			Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	500,000				
Provisional time planning	2014-2017				
Expected outcome					
A set of practical rules and a toolbox to assess and judge the local impact of emissions of IWT operations and port activities and suggestion how to limit these.					

INFRASTRUCTURE					
Support expert groups on accident investigation, calamity abatement and insurance obligations					
D. Reduced reliability due to accidents					
Current situation					
Safety is a top priority of the inland waterway transport sector and one of the most important advantages of this mode of transport. After the accident of the tanker vessel Waldhof at the river Rhine inland navigation experts and shipping companies agreed that the accident should be scrutinised in full detail to draw conclusions regarding future calamity abatement measures and to develop a detailed strategy to prevent similiar accidents in future. Surveys carried out within the PLATINA project showed that insurance obligations within the inland waterway transport sector vary to a great extent in the EU Member States. The harmonisation of regulations in the field of accident investigation, calamity abatement and insurance obligations is one of the main objectives in order to further increase the safety level in inland navigation. River Information Services (RIS) will play a major role in this endeavour.					
Policy objectives and targets					
Policy objectives	+	Improve multimodality and logistics integration			
	++	Reduce environment, climate change and safety impacts			
	0	Improve market conditions for efficient IWT operations			
Vision 2040	Harmonised framework for accident investigation, calamity abatement and insurance obligation (minimum standards)				
Proposed policy measures IWT 2020					
Description of measure	Establish a European expert group and develop a common framework for accident investigation, calamity abatement and insurance of inland vessels in order to reduce disruption of services and to increase the overall safety level.				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
	X	Member States			Policy
	X	River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	1,500,000				
Provisional time planning	2014-2020				
Expected outcome					
Set up of a dedicated European expert group and development of common standards across Europe					

INFRASTRUCTURE					
Support expert groups on climate change					
E. Uncertainty about possible impact of climate change					
Current situation					
Climate change is a critical issue for EU transport infrastructure. Potential effects of climate change on water regimes of important EU IWT transport infrastructure have to be analysed carefully and unprejudiced by bundling the available know-how. In a next step possible climate change adaptation strategies have to be elaborated and implemented by dedicated expert groups. Funded by the European Commission, the project "Effects of climate change on the inland waterway networks" (ECCONET) analyses the effects of climate change on inland waterway transport and related sectors.					
Policy objectives and targets					
Policy objectives	+	Improve multimodality and logistics integration			
	++	Reduce environment, climate change and safety impacts			
	0	Improve market conditions for efficient IWT operations			
Vision 2040	Climate change adaptation strategies for EU IWT network fully developed and implemented via responsible national waterway administrations				
Proposed policy measures IWT 2020					
Description of measure	Bundle available know-how by setting-up dedicated expert groups dealing with possible climate change adaptation strategies for the EU inland waterway network.				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
	X	Member States			Policy
	X	River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	1,500,000				
Provisional time planning	2014-2020				
Expected outcome					
Dedicated expert groups dealing with possible climate change adaptation strategies for the EU inland waterway network					

INFRASTRUCTURE					
Develop adaptation strategies for climate change					
E. Uncertainty about possible impact of climate change					
Current situation					
Climate change adaptation strategies have to be elaborated and implemented by dedicated expert groups. Funded by the European Commission, the project "Effects of climate change on the inland waterway networks" (ECCONET) analyses the effects of climate change on inland waterway transport and related sectors. It also surveys adaptation strategies and their impacts and develops recommendations for decision-makers and future research. Based on the findings of this projects follow-up measures can be defined and implemented.					
Policy objectives and targets					
Policy objectives	+	Improve multimodality and logistics integration			
	++	Reduce environment, climate change and safety impacts			
	0	Improve market conditions for efficient IWT operations			
Vision 2040	Climate change adaptation strategies for EU IWT network fully developed and implemented via responsible national waterway administrations				
Proposed policy measures IWT 2020					
Description of measure	Prepare robust waterway planning strategies and elaborate concrete and tailored measures for different international rivers (e.g. Rhine, Danube) and river stretches.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States		X	Policy
	X	River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	500,000				
Provisional time planning	2014-2020				
Expected outcome					
Concrete set of adaptation measures for waterway administrations					

RIVER INFORMATION SERVICES
Update and further develop technical specifications for River Information Services (RIS)
A. Unfinished technical regulations
Current situation
The current legal framework for River Information Services is based upon Directive 2005/44/EC, which defines binding rules for data communication as well as the minimum level of RIS Services for future RIS implementations. The Directive provides a Europe-wide framework for the harmonised implementation of RIS and the compatibility and interoperability of current and new RIS systems across Europe. The RIS Guidelines describe the principles and general requirements for planning, implementing and the operational use of RIS and related systems. Three Commission Regulations define the technical specifications for the RIS key technologies. A fourth one is about to be finalised. Experts from public administrations, RIS application providers and logistics users contribute to the RIS Expert Groups, which are assisting the European Commission in the preparation and maintenance of the technical specifications.

Policy objectives and targets

Policy objectives	+	Improve multimodality and logistics integration
	+	Reduce environment, climate change and safety impacts
	0	Improve market conditions for efficient IWT operations
Vision 2040	The technical specifications for River Information Services are published by one body and are binding for the entire European inland waterway network, updates are done in regular intervals.	

Proposed policy measures IWT 2020

Description of measure	Amendment of the RIS Directive and the creation, updating and further developing the technical specifications for RIS.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States		X	Policy
	X	River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	1,700,000				
Provisional time planning	2014-2020				

Expected outcome

Legislative stimuli to facilitate RIS deployment are set by means of an amended RIS Directive, technical specifications are kept up-to-date.

RIVER INFORMATION SERVICES					
Support and promote harmonised implementation and deployment of RIS					
B. Unfinished implementation and co-ordniation of RIS in Europe					
Current situation					
The harmonised deployment of River Information has the following benefits at European level: Preparation of the fulfilment of European transport policy objectives as defined in the White Paper on European Transport Policy. At national level it provides assistance to the national RIS authorities in translating the RIS Directive into national policy and deploying the national systems in a coordinated way - interacting also with the relevant European Services (e.g. European Hull Database). A status overview executed within the framework of PLATINA demonstrated the achievements in RIS deployment, but showed also gaps (e.g. vessels are obliged to report cargo and voyage data of container transport only on rivers in the Rhine corridor). In order to support a harmonised RIS deployment at European level, legislative stimuli (e.g. amendment of the RIS Directive), financial stimuli (e.g. EU co-financing for on-board equipment) and technical support (e.g. regular surveys on the state of play) need to be provided.					
Policy objectives and targets					
Policy objectives	++	Improve multimodality and logistics integration			
	++	Reduce environment, climate change and safety impacts			
	0	Improve market conditions for efficient IWT operations			
Vision 2040	RIS is fully deployed in a harmonised way on the TEN-T core and comprehensive network.				
Proposed policy measures IWT 2020					
Description of measure	Provision of financial and technical support e.g. through Connecting Europe Facility.				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
	X	Member States			Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	1,500,000				
Provisional time planning	2014-2020				
Expected outcome					
The European Commission and the national RIS authorities are supported in such way, that RIS deployment on the TEN-T core network can be finalised.					

RIVER INFORMATION SERVICES					
Operate and maintain European Position Information Service					
B. Unfinished implementation and co-ordniation of RIS in Europe					
Current situation					
The European position information service will enable RIS Providers to provide their RIS users with position information, the vessel identification(s) and country in which the vessel is currently sailing. The enabling element, the European server, has been conceptually designed within PLATINA, a pilot system is set up and being tested also within PLATINA.					
Policy objectives and targets					
Policy objectives	++	Improve multimodality and logistics integration			
	0	Reduce environment, climate change and safety impacts			
	0	Improve market conditions for efficient IWT operations			
Vision 2040	The European Position Information Server (EPIS) has been operated under supervision of the EC, the RIS authorities and relevant logistical RIS users.				
Proposed policy measures IWT 2020					
Description of measure	Operate, maintain and further develop the European Position Information Server in such a way that all relevant logistical RIS stakeholders are provided with position information on the basis of controlled access.				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
		Member States		X	Policy
		River Commissions			Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	3,700,000				
Provisional time planning	2014-2020				
Expected outcome					
Position Information Services are available for all relevant and authorised logistical RIS stakeholders.					

RIVER INFORMATION SERVICES					
Organise compliance and progress monitoring in the field of RIS					
B. Unfinished implementation and co-ordniation of RIS in Europe					
Current situation					
River Information Services are defined as a concept of harmonised information services to support traffic and transport management in inland navigation, including interfaces to other modes of transport. RIS are regulated through Directive 2005/44/EC, which defines binding rules for data communication and RIS equipment as well as the minimum level of RIS services for future RIS implementations. The Directive provides a Europe-wide framework for the harmonised implementation of the RIS concept and the compatibility and interoperability of current and new RIS systems across Europe. The implementation of RIS will not only improve safety and efficiency in inland waterway traffic but enhance the environmental friendliness of transport operations in general. Experience from the first decade of RIS deployment has shown, that interoperability problems require a quite long time to be solved. According to the RIS Directive, the European Commission will monitor interoperability.					
Policy objectives and targets					
Policy objectives	+	Improve multimodality and logistics integration			
	0	Reduce environment, climate change and safety impacts			
	++	Improve market conditions for efficient IWT operations			
Vision 2040	RIS users have information on RIS-applications, which are "ready to use".				
Proposed policy measures IWT 2020					
Description of measure	Compliance and progress monitoring in the field of RIS .				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States		X	Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	750,000				
Provisional time planning	2014-2020				
Expected outcome					
The European Commission, national RIS authorities/providers and RIS application manufacturers are supported in rapid system development, the measures such as the "RIS-ready logo" are operational and widely accepted as from 2015 onwards.					

RIVER INFORMATION SERVICES					
Operate and maintain Reference Data Management system					
B. Unfinished implementation and co-ordniation of RIS in Europe					
Current situation					
RIS reference data represents the basic element of all RIS applications. This data includes data of the entire inland waterway network, for instance the location of locks, bridges and ports. This data is generated by national authorities. Skippers need the data in RIS applications. Therefore, this data needs to be consolidated and maintained on a structural basis, in order to avoid the use of different data versions in on-board applications. In cooperation with national authorities, PLATINA defined data management procedures and implemented a reference management tool, the European RIS Reference Data Management System (ERDMS). This facilitates the harmonised generation of reference data. Application manufacturers and RIS users can download this data at one central point. After PLATINA, the RIS data reference management system needs to be further developed and maintained.					
Policy objectives and targets					
Policy objectives	0	Improve multimodality and logistics integration			
	+	Reduce environment, climate change and safety impacts			
	++	Improve market conditions for efficient IWT operations			
Vision 2040	The ERDMS has been operated together with other "European RIS Services" by the EC and/or (an) international organisation(s). All European countries providing RIS use the tool for the data exchange.				
Proposed policy measures IWT 2020					
Description of measure	Operate, maintain and further develop the ERDMS in such way that all countries providing River Information Services participate.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States		X	Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	2,200,000				
Provisional time planning	2014-2020				
Expected outcome					
RIS Reference Data of all countries, which provide RIS is available for users and application providers.					

RIVER INFORMATION SERVICES

Operate and maintain Inland ENC Register and digital parts of the ENC Standard

B. Unfinished implementation and co-ordniation of RIS in Europe

Current situation

The first version of the Inland Electronic Chart Display and Information System (Inland ECDIS) standard was mostly a 'paper' version. Very soon however it became apparent that manufacturers required parts of the standard to be machine-readable. Also the 'paper' version was not suited to the continuing improvement of part of the standard that deals with the data, the ENCs. The digital part of the Inland ECDIS Standard is based on the S-57 Standard of the International Hydrographic Organisation (IHO). IHO however is in the process to move to a next generation of the standard, which will be called S-100. The S-100 provides recognition for the Inland ENC Standard. A part of the S-100 developments with the S-100 Registry, which includes the Inland ENC Register. During the lifetime of PLATINA, the operation of the Inland ENC register and the maintenance of the digital parts of the Inland ECDIS Standard is ongoing. After PLATINA, this maintenance work needs to be continued.

Policy objectives and targets

Policy objectives	0	Improve multimodality and logistics integration
	+	Reduce environment, climate change and safety impacts
	++	Improve market conditions for efficient IWT operations
Vision 2040	The Inland ENC Register and the digital parts of the ENC Standard have been operated under supervision of the EC and the Inland ECDIS Expert Group.	

Proposed policy measures IWT 2020

Description of measure	The data of the Inland ENC Register and the digital parts of the standard is available for all RIS application manufacturers and authorities producing IENCs, being an enabler for administrative and logistics RIS services.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
		Member States		X	Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	1,300,000				
Provisional time planning	2014-2020				

Expected outcome

The data of the Inland ENC Register and the digital parts of the standard is available for all RIS application manufacturers and authorities producing IENCs, being an enabler for administrative and logistics RIS services.

RIVER INFORMATION SERVICES					
Support RIS expert groups					
B. Unfinished implementation and co-ordniation of RIS in Europe					
Current situation					
Experts from public administrations, RIS application providers and logistics users contribute to the RIS Expert Groups, which are assisting the European Commission, the river commissions and the United Nations Economics Commission for Europe (UNECE) in the preparation and maintenance of the technical specifications. 4 expert groups are working on the development and maintenance of the standard of the RIS key technologies, the Inland ECDIS Expert Group, the Notices to Skippers Expert Group, the Expert Group Electronic Reporting International and the Vessel Tracking and Tracing Expert Group. Within PLATINA, a secretariat is supporting the work of the RIS Expert Group.					
Policy objectives and targets					
Policy objectives	+	Improve multimodality and logistics integration			
	+	Reduce environment, climate change and safety impacts			
	++	Improve market conditions for efficient IWT operations			
Vision 2040	RIS Expert Groups work efficiently on the development and maintenance of the standard of the RIS key technologies				
Proposed policy measures IWT 2020					
Description of measure	Provide support for the RIS Expert Groups. RIS experts from public administrations, application providers and logistics users have the right framework conditions and support to actively participate in RIS standardisation and harmonisation.				
Stakeholders involved	X	EU/EC	**Type of instrument**	X	Support
		Member States			Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	2,600,000				
Provisional time planning	2014-2020				
Expected outcome					
RIS experts from public administrations, application providers and logistics users have the right framework conditions and support to actively participate in RIS standardisation and harmonisation.					

RIVER INFORMATION SERVICES					
Operate and maintain single RIS portal					
B. Unfinished implementation and co-ordniation of RIS in Europe					
Current situation					
A benchmark and inventory to determine the best approach for a one-stop RIS portal was undertaken in cooperation with the RIS Expert Groups, also taking national activities into account. Technical specifications for the RIS portal were approved by the Expert Groups in April 2009. Based on these technical specifications the web application – RIS portal (www.ris.eu) – has been built and was successfully launched during the RIS Expert Groups meetings in November 2009 in Vienna. The current RIS portal provides the following information to the general public: news, calender, RIS deployment projects. Members of the RIS expert groups are provided information on technical specification, standards and (status of) change requests, RIS expert group meetings. In addition, first steps towards central access points for Notices to Skippers and Inland ENCs, i.e. Notices and Inland ENCs of all administrations are available at the RIS portal.					
Policy objectives and targets					
Policy objectives	+	Improve multimodality and logistics integration			
	0	Reduce environment, climate change and safety impacts			
	++	Improve market conditions for efficient IWT operations			
Vision 2040	The RIS Portal has been operated under supervision of the EC, the RIS Expert Groups and the RIS authorities.				
Proposed policy measures IWT 2020					
Description of measure	Operate, maintain and further develop the RIS Portal in such way that all RIS stakeholders (EC, RIS authorities, RIS providers, RIS users, etc.) can obtain information on RIS (status, specifications, projects, etc). All RIS stakeholders have the relevant information; the central access point provides Notices to Skippers and Inland ENCs of all administrations.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
		Member States		X	Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	1,600,000				
Provisional time planning	2014-2020				
Expected outcome					
All RIS stakeholders have the relevant information, the central access point provides Notices to Skippers and Inland ENCs of all administrations.					

RIVER INFORMATION SERVICES					
Operate and maintain European Hull Database					
B. Unfinished implementation and co-ordniation of RIS in Europe					
Current situation					
Inland waterway vessels require a technical inspection before being allowed to sail on European inland waterways. Vessel certification authorities issue community certificates after technical inspections. A subset of the data of community certificates, the so-called minimum set of hull data, includes the 'Unique European Vessel Identification Number' (ENI), the name of vessel, length, breadth. The minimum set of hull data needs to be exchanged among vessel certification authorities and with RIS authorities. PLATINA facilitates the implementation of the European Hull Database (EHDB), which eases this data exchange. At the time of creation of this expert paper, about 9350 vessels are available in the database, which represents around 75% of the European Fleet. After PLATINA, the operation of the European Hull Database needs to be continued in a pan-European way, i.e. all countries issuing Unique European Vessel Identification Numbers shall be able to participate.					
Policy objectives and targets					
Policy objectives	0	Improve multimodality and logistics integration			
	+	Reduce environment, climate change and safety impacts			
	++	Improve market conditions for efficient IWT operations			
Vision 2040	The EHDB has been operated together with other "European RIS Services" by the EC and/or (an) international organisation(s). All countries issuing ENIs use the EHDB for the data exchange.				
Proposed policy measures IWT 2020					
Description of measure	Operate, maintain and further develop the European Hull Database in such way that all countries issuing ENIs participate.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
		Member States		X	Policy
		River Commissions			Legislation
		Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	2,500,000				
Provisional time planning	2014-2020				
Expected outcome					
The minimum set of hull data of all vessels, which sail on European waterways are available for all vessel certification authorities, RIS authorities and governmental RIS users.					

RIVER INFORMATION SERVICES					
Stimulate the commercial and logistics use of RIS					
C. Unused potential RIS for logistics					
Current situation					
The application of intelligent information systems is a pre-condition for seamless multi-modal logistics chains. To date, River Information Services (RIS) have been primarily implemented in order to support traffic management and to improve the safety of navigation. The next step would be to create and integrate successful applications for seamless cost-efficient multi-modal logistics. On the one hand this needs further technological development towards the direction of e-Freight ("Internet for Cargo", see also related measure). On the other hand, this would need practical measures to stimulate the commercial and logistics use of RIS. At present, skippers are very well aware of the advantages of RIS. A survey among logistics decision-makers carried out by the IRIS Europe II logistics task force indicated that shippers, terminal operators and other RIS users however are not adequately informed about the possibilities that RIS offers for supply chain management and logistics planning. There is therefore a need to raise awareness among the relevant logistical RIS users, but also measures which reduce the entry barrier similar to Inland AIS support programmes need to be established.					
Policy objectives and targets					
Policy objectives	+++	Improve multimodality and logistics integration			
	0	Reduce environment, climate change and safety impacts			
	0	Improve market conditions for efficient IWT operations			
Vision 2040	e-Freight, the vision of "Internet for Cargo", has become reality since 2020.				
Proposed policy measures IWT 2020					
Description of measure	Create awareness among relevant logistical RIS users, definition and implementation of support programmes, which reduce the entry barrier for such users.				
Stakeholders involved	X	EU/EC	**Type of instrument**		Support
	X	Member States		X	Policy
		River Commissions			Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	2,200,000				
Provisional time planning	2014-2020				
Expected outcome					
Logistical RIS users are using RIS for their logistics planning applications, support programmes have been successfully implemented.					

RIVER INFORMATION SERVICES					
Support creation of eFreight and seamless handling formalities					
C. Unused potential RIS for logistics					
Current situation					
The application of intelligent information systems is a pre-condition for seamless multi-modal logistics chains. To date, River Information Services (RIS) have been primarily implemented in order to support traffic management and to improve the safety of navigation. The next step would be to create and integrate successful applications for seamless cost-efficient multi-modal logistics. The integration of information based on River Information Services in multimodal logistics planning procedures still is technically possible to a limited extent and consequently has been realised only on a limited scale. Within the Freight Transport Logistics Action Plan, the European Commission has outlined the concept of e-Freight. This concept is a vision of a paper-free, electronic flow of information associating the physical flow of goods with a paperless trail built by Information and Communication Technologies. River Information Services form an important element of e-Freight. Also the connection to the eMaritime Single Window concept should be integrated.					
Policy objectives and targets					
Policy objectives	+++	Improve multimodality and logistics integration			
	0	Reduce environment, climate change and safety impacts			
	+	Improve market conditions for efficient IWT operations			
Vision 2040	e-Freight, the vision of "Internet for Cargo", has become reality since 2020.				
Proposed policy measures IWT 2020					
Description of measure	Develop RIS further - and integrate it with other modes through eFreight; moving towards paperless transport for inland waterways consistent with the eMaritime Single Window concept.				
Stakeholders involved		EU/EC	**Type of instrument**	X	Support
	X	Member States			Policy
		River Commissions			Legislation
	X	Industry	**Corridors**	X	Rhine
		Social partners		X	East-West
		Education institutes		X	North--South
		Promotion offices		X	Danube
Estimated costs [EUR]	1,500,000				
Provisional time planning	2014-2020				
Expected outcome					
e-Freight, the vision of "Internet for Cargo", is reality in 202; seamless multimodal information chains lead to a higher share of IWT in multimodal transport					