INITIATIVES POUR L'AVENIR DES GRANDS FLEUVES
INITIATIVES FOR THE FUTURE OF GREAT RIVERS

Synopsis sheets

Rivers of the World

THE ELBE

Initiatives pour l'Avenir des Grands Fleuves

Elbe

The source of the Elbe lies in the Giant Mountains (Krkonose, Riesenbirge), at an altitude of 1,386 metres, and flows into the North Sea at Hamburg, after a course of 1,094 km. Its watershed covers 148,000 km² and is inhabited by more than 25 million people.

Technical sheet

Countries crossed	Czech Republic (33%), Germany (66%)	Discharge	1 800 m^3/s
Tributaries	Vitava, Ohre, Schwarze Elster, Mulde, Saale, Havel	Length	1,094 km
		Watershed	148,000 km^2

Caracteristics		Length section (km)	Watershed (km2)
Upper Elbe	Source until Hirschstein Castle.	463	54,170
Middle Elbe	From Hirschtein Castle to Geesthacht Weir	489	80,143
Lower Elbe	Geesthacht Weir to its mouth, where the last section is called the "Elbe of the Marshes"	142	13,255

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The Elbe

A river of contrasts

The origins

The name Elbe comes from the Latin word Albis (river).
The Romans attempted to extend their empire beyond the Rhine and reach the Elbe, but failed at the Battle of the Teutoburg Forest in 9 BC. In the Middle Ages, the river formed the eastern border of the Carolingian Empire. Charlemagne granted sovereignty to the Slavic peoples living on the eastern banks of the river in 804. The Saxons invaded the Slav territories when the Emperor died in 814. The region was subjected to successive invasions during the following centuries.

The river fulfilled the role of administrative border and gave its name to certain regions. The department of Bouches-de-l'Elbe was created in 1811 when the region was annexed by France. It lasted three years until the fall of Napoleon, and now corresponds to the territory situated in present day Lower Saxony, Schleswig-Holstein and Hamburg, which was the capital of the French department.

Present day collective memory above all recalls 25 April 1945, which was the day when American and Soviet troops met each other for the first time at Torgau, on the Elbe, northeast of Leipzig. The choice of this place was symbolic and strategic. The aim was to preserve the diplomatic balance decided at Yalta between the Allies to separate the defeated Germany into three zones of occupation. The date is known as "Elbe Day".

The towns located on the banks of the Elbe have long borne the scars of the war. Dresden was the most bombarded city of the Second World War (90% of the old city was destroyed).

During the Cold War, part of the Elbe formed the border between East Germany and West Germany, from Lutkenwisch/Schnackenburg to Boizenburg/Lauenburg (94 km).

Landscapes and urban planning

Less well-known than its neighbouring rivers, the imagination sparked by the Elbe is just as strong in the local culture. More subtle than the Rhine, the warrior river, and the Danube, the river of unity, it is also more contrasted, like the landscapes it crosses: industries and open cast mines on the Czech side, then a country of abundance, hills and vines in "Saxon Switzerland" until Dresden. The Elbe then crosses moors, forests and the small towns that formed the heart of the Lutheran reform of the 16th century.

The Elbe

A river of contrasts

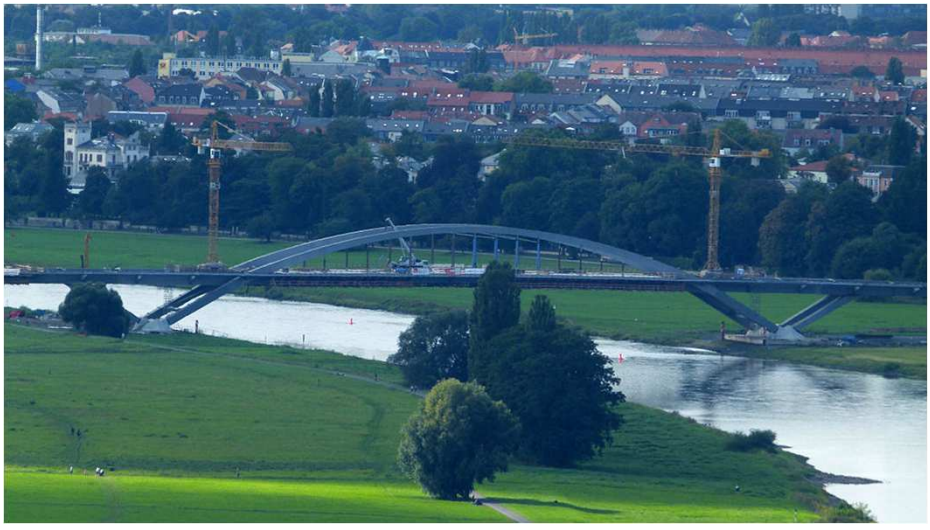
Landscapes and urban planning (cont.)

The middle part of the river (in the Lander of Saxe-Anhalt) is listed as a biosphere reserve. But it is also a region that has seen the emergence of German modernity: religious with the Reform Party of Saxe, artistic with the dance of Gret Palucca (in Dresden) and the Bauhaus, a school of architecture and design with international influence located in Dessau in 1925 following the dissolution of the Bauhaus of Weimar by the German far right.

In the post-modern era, the urban planning of the cities along the river demonstrates the attempts at renewal in reaction against the industrial crisis and the fall in demography.

Hamburg is the emblem of this renewed link with the river, but there is also the city of Magdeburg which has been re-imagined as a river port, signalling the entry into the plains of north Germany. This city is now known for its flagship contemporary architectural projects like the Green Citadel by the Austrian architect Friedensreich Hundertwasser (2005), and the Millenium Tower by the Swiss architect Johannes Peter Staub (1999). Other cities such as Dessau, still in the middle section, turn their backs on the river and prefer that of one of its tributaries, the Mulde.

The urban planning of the river has given rise to heated debate. The construction of the Waldschloesschen bridge (below), inaugurated in 2013, led UNESCO to withdraw the Elbe at Dresden from its list of World Heritage Sites.



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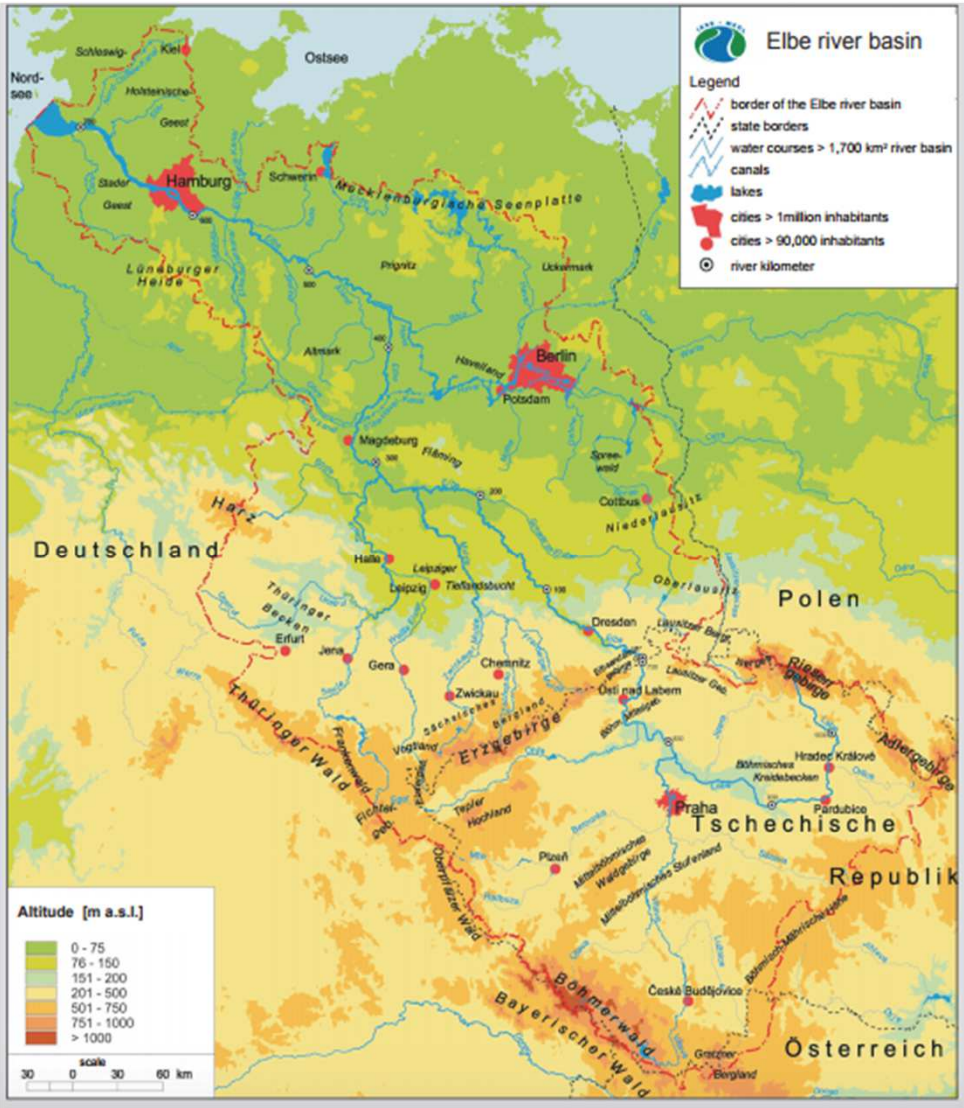
The Elbe

The hydrological basin



The Elbe region is one of the river regions of Europe with the lowest rates of runoff.

Only 2% of the basin is located at altitudes exceeding 800m above sea level, thereby explaining a considerable fall in runoff during the summer months.

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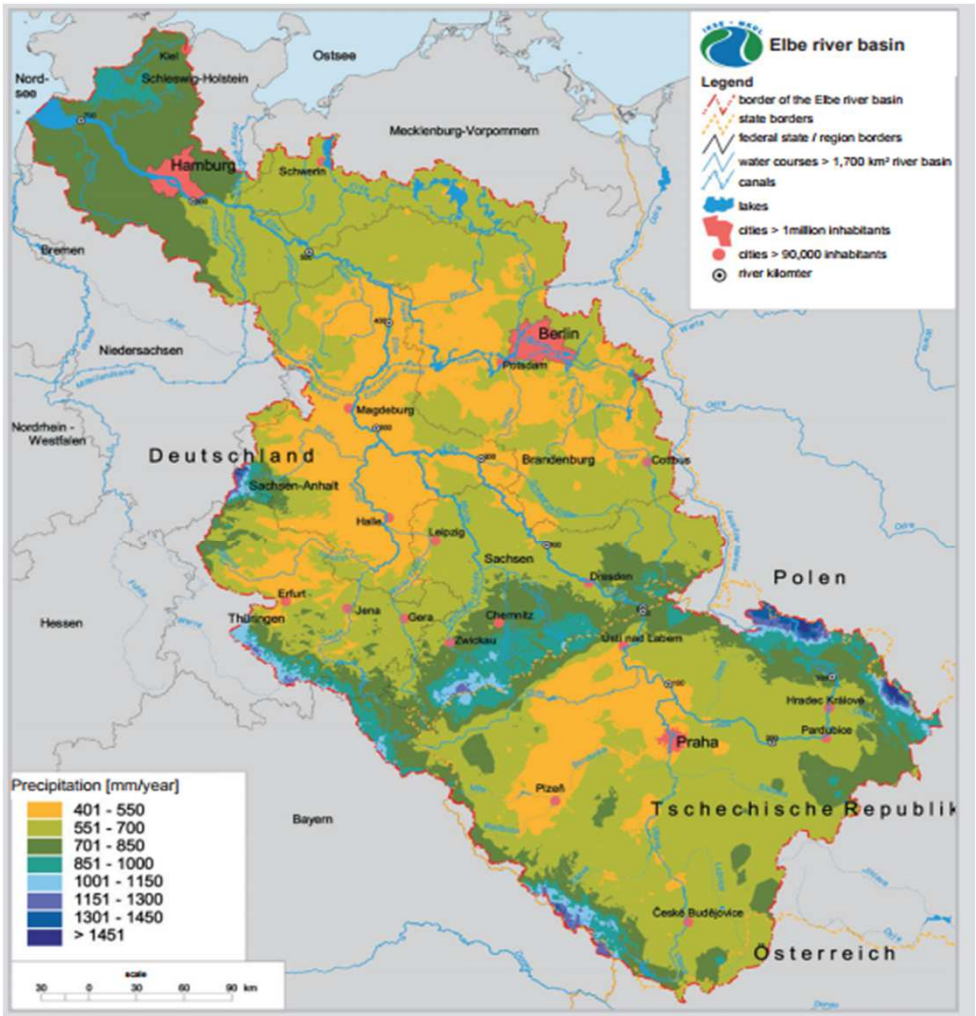
The Elbe

The hydrological basin



Average annual precipitation in the Elbe river basin for the 1961 – 1990 series (Source: BfG, ČHMÚ, ICPER)

Precipitation	628 mm (annual average value of the 1961 – 1990 series)
Evaporation	445 mm (annual average value of the 1961 – 1990 series)
Runoff rate at Neu Darchau gauge*)	5.4 l/s/km^2 (annual average value of the 1961 – 2005 series)
Large cities (>approx. 90,000 inhabitants, sorted according to size)	Berlin, Hamburg, Prague, Leipzig, Dresden, Chemnitz, Halle, Magdeburg, Erfurt, Plzeň, Potsdam, Jena, Cottbus, Gera, Ústí nad Labem, České Budějovice, Hradec Králové, Zwickau, Schwerin, Pardubice

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The Elbe

One main use: navigation

Navigation

The Elbe has played a major role as a waterway and trade corridor, especially during the expansion of the Hanseatic League and up to the 19th century. During the first half of the 19th century the Hamburg-Berlin-Dresden-Usti and Labern-Prague rail corridor competed with the river. However, over the past few decades the German and Czech governments have deployed national strategies to revive river transport as a tool for international development.

Irrigation

The Elbe basin comprises about 312 dams divided between Germany (175) and the Czech Republic (137). The total volume stored in the reservoirs is about 4.12 billion m³. 37.9% of the surface area of the watershed is used for agriculture (figures for 2012), while forest covers 30.8% of the territory. 22.1% of the forest is composed of conifers.

Drinking water and leisure

Before 1990, the Elbe was one of the Europe's most polluted rivers, but the quality of its water has been greatly improved since the reunification, thanks to the closure of a large number of pollutant industrial activities, environmental laws, and to the construction of wastewater treatment plants. However, much remains to be done to reach the targets of the EU's framework directives on water by 2027.
Civil associations have played a role in raising public awareness (for example, the Save the Elbe association in Hamburg).

NB: The headquarters of the Federal Office of the Environment has been located in Dessau since in 2005.

Industries

The industrial activities that predominate in the Elbe basin are chemicals, paper and metal treatment.

The Elbe

Governance

Waterway management

The WSA: waterway management is a federal competence in Germany held by the WSA (Wasserstraßen – und Schifffahrtsamt) / **WSV (Federal Waterways and Shipping Administration)** which is an executive agency of the Ministry of Transport and Digital Infrastructure.
Its missions are:
- Maintenance
- Operational management
- The modernisation and construction of new waterway infrastructures.

International agencies and the basin commission

ICPER:

Czech and German industrial activities and agriculture, through the pesticides discharged into it, made the Elbe one of Europe's most polluted rivers during the 20th century, up to the end of the 1980s.

The Elbe was the real winner of reunification, when the **International Commission for the Protection of the Elbe River (ICPER)** was set up in October 1990 and a major ecological action programme launched.

The objectives of this international commission that brings together the Czech Republic and Germany and observer organisations (including the European Union) are to:
- Render the water usable (treatment of drinking water and irrigation of farmland),
- Achieve a natural ecosystem capable of ensuring the development of the fauna and flora,
- Reduce the impact of the Elbe basin on the North Sea.

The Elbe

Governance

It works on:

- **water quality:** the quantity of chemical products discharged into the river has been reduced from 846,000 tons a year in 1989 to 37,000 tons today. Since 1989, no less than 123 wastewater treatment plants have been built and 114 expanded along the river, in the Czech Republic and Germany. Above all, the river has benefited from the bankruptcy of most of the pollutant factories of the former German Democratic Republic. Once vanished fish species have been reintroduced, especially salmon. 94% of the Elbe's course on the German side has been placed under ecological protection.

- flood protection: The Elbe Flood Protection Action Plan was drafted and approved in 2003. In particular it took into account the major flood of the Elbe in August 2002.

- pollution: a framework document: the International Warning and Alarm Plan Elbe (IWAPE) was adopted as early as 1991 to set up an information system for the neighbouring population in the case of an accident.

The Flussgebietsgemeinschaft Elbe (FGG Elbe): River Basin Commission (only Germany).

The FGG was set up in 2004 between the Lander located on the Elbe watershed, in view to responding to the European Commission's Framework Directive on Water. Its role is to coordinate the implementation of this directive as well as that on floods.

The Elbe

The Port of Hamburg

History

Birth and development of port activity

The development of the city of Hamburg is intrinsically linked to the evolution of its port activity. Maritime trade became more structured in the 12th century with the formation of the Hanseatic League, with the alliance of the trading cities of Northern Europe organised around the cities of Hamburg and Lubeck in particular.
Currently **Europe's 3rd largest port**, integrated in the Northern range, and ranked 26th in the world for its size and traffic, it nonetheless comes in 14th place when considering only its container traffic. Its development has been rapid in recent years.
In particular, the port manages from 35 to 80% of the goods bound for or received from Poland, the Czech Republic, Hungary, Austria, Germany and Denmark. It has also become Europe's 2nd port of entry for containers from China (nearly 1.4 million containers), after Rotterdam.

Governance

The Hamburg Port Authority

In addition to the computerised management of maritime traffic, HPA is responsible for building and renovating bridges, maritime beacons, radar stations, etc. It performs regular maritime soundings to locate dangerous areas of coastal water. The port authority is also responsible for taking protective measures against floods in the port area. HPA develops protective measures for the waterfront and has a storm warning department and a fleet of ice-breakers.

It is also in the process of developing a concept of Port Road Management to ensure efficient circulation, that involves the maintenance and extension of port roads and property development in the port area. Furthermore, HPA is responsible for coordinating goods transport, and monitoring the activity of the St Pauli Elbe tunnel.
Although placed under the control of the municipality, it enjoys a great deal of autonomy in its role as port management body.

The Elbe

The Port of Hamburg

Other bodies of governance

Various public actors are working on issues linked to the port's activities, especially regarding the treatment and management of the port's sediments. This environmental issue concerns all the Federal States along the Elbe. Several ad hoc commissions have been set up:
The **Flussgebietsgemeinschaft Elbe (FGG Elbe)** the river basin commission;
International Commission to protect the River Elbe (IKSE)
The Hamburg Senate (represented by the HPA) and the Minister of Urban Development and the Environment are also active in this project named ELSA (Elbe sediment pollutant remediation).

Port activity

Traffic: the importance of container activity

Every year about 10,000 ships arrive at the port which is equipped with 43 km of dedicated wharves. The port handled 138.2 million tons of goods in 2016 of which 91 million tons by container (Hamburg is Europe's 3rd largest port and the 18th largest for container traffic).

Hamburg has 4 ultra-modern terminals and 15 cranes, making it highly efficient: 100 containers can be unloaded simultaneously per hour.

Asia (with China) is Hamburg's main trading partner for containers, along with Russia.

The EUROGATE project is a project to extend the port westwards to develop its container storage capacity and to receive the increasing number of very large ships (330 m long and 45 m wide).

Localisation	130 km du littoral de la mer du Nord, en aval du centre-ville
Superficie du port	74 km2- 10% surface totale de la ville
Fret	137,8 millions de tonnes (2015)
Conteneurs	8,9 millions EVP (2016)
Emploi	150 000 emplois directs
Revenus pour la ville	750 millions d'euros
Rang	3e européen, 18e mondial (pour le trafic de conteneurs)

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The Port of Hamburg

A point of distribution for the entire region

Hamburg is a point of distribution for the whole of Eastern Europe. The **Kiel canal (Nord-Ostsee-Kanal),** 98 km long, links Brunsbuttel / North Sea to Kiel / Baltic Sea and makes Hamburg the most westerly port of the Baltic Sea. This gives it a considerable competitive advantage as it reduces the sailing distance of ships by 519 km. With an average of 120 ships a day, it is one of the busiest artificial waterways in the world. An infrastructure project is underway to modernise it and maintain the traffic.

Hamburg also serves Germany: 1/3 of the goods handled are intended for an area within 150 km of Hamburg. Lastly it serves to export goods made in Germany and its neighbouring countries.

Multimodality: links by rail, ship and truck to serve the hinterland

The network with the interior of the country and the other European countries is highly developed, with a large volume being transported by **rail (45% of the goods transported) followed by road transport (43%) and the river (12%).** The Port of Hamburg manages 300km of railway line and three goods marshalling yards.

Hamburg has invested heavily in rail transport to serve the hinterland and is now Europe's largest freight station. What is more, HPA has endowed itself with a management dedicated exclusively to rail transport, the Hafenbahn.The port introduced a new billing procedure for its network in 2008, to reduce the time trains are present on the tracks of the network giving access to the port.

<u>Projects in progress</u>
At present, the main transport projects are the following:
- The extension of links with the main roads to Berlin and Hanover to improve access to Central and Eastern Europe;
- Reducing the congestion of the Elbtunnel, notably with the construction of a new motorway;
- The extension of the road network for heavy goods vehicles;
- The New Kattwyk Railway bridge (NBK) project: a project to build a new railway bridge to sustain the growth of the port and preserve the Kattwyk bridge, built in 1973 and a feature of the landscape. It is unable to take any more traffic.

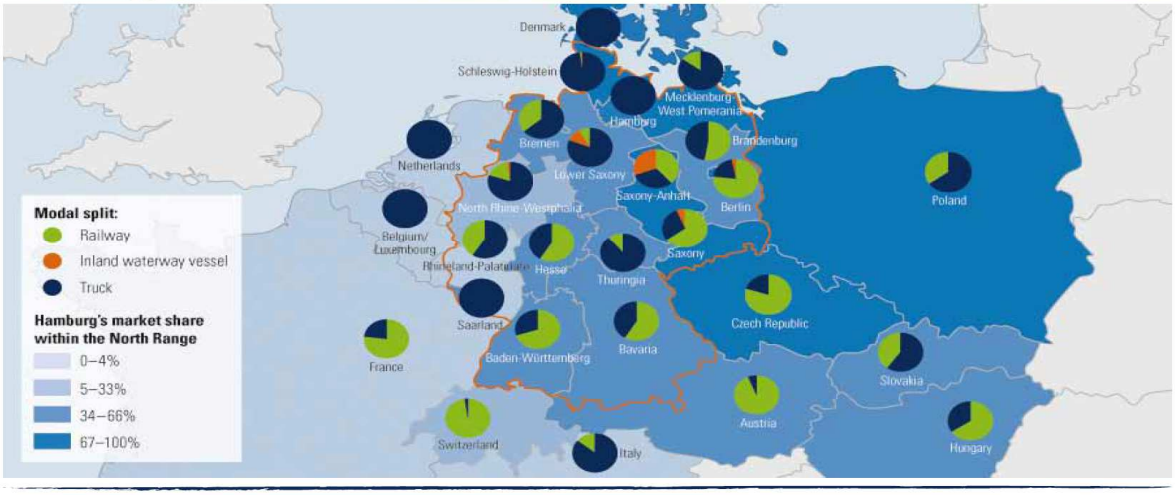
The Elbe

The Port of Hamburg

The inland waterways are under-exploited compared to the railway and the road: in 2014, it recorded 10,000 ships on the inland waterway with 11.6 million tons of goods. They served the other ports of the Elbe up to Dresden as well as to the Czech Republic. They can also take the link with the Rhine. The inland ports on the Elbe are mostly tri-modal (river, rail, road). Inland waterways link the highly developed industrial regions of Hanover / Braunschweig / Salzgitter / Wolfsburg, the ports of the Elbe basin and the ports of the Germany's largest industrial region, the Ruhrgebiet.

Road is much more attractive for short distances, whereas 90% of transport to Austria and Switzerland, for example, is ensured by rail.

Figure 11: Market share of the Port of Hamburg and modal split by hinterland region in 2010



Source: ISL (2011)

The Elbe

The Port of Hamburg

Port activity: cruising

The number of passenger cruisers is growing at Hamburg with 156 cruise liners in operation, carrying more than 520,000 passengers in 2014, with three specific terminals. This activity generates more than €230 M/year.

Towards a cluster of new shipbuilding, logistics and hydrological technologies

The port authority is implementing a development plan known as Hamburg 2025, centred around two main objectives: the increase of maritime traffic and setting up exemplary port management in its conformity with environmental standards. These ambitions are illustrated by the emphasis placed on the quality of the infrastructures, in view to making Hamburg the world's first "smart port". The principle is to create a system that uses NICTs to manage all the port's traffic, including land and rail traffic, the raising of bridges, modelling tides and high water.

To achieve this HPA has launched an original programme: **PRISE,** the Port River Information System Elbe, coordinated by the HPA, DAKOSY (a local software house), Hamburger Hafen und Logistik AG (HHLA, the leading logistics company of Hamburg), EUROGATE, Elbe Pilots Association, and Port of Hamburg Pilots Association.

The port also aims to make investments to ensure it becomes energy independent, through the use of wind turbines, and solar and geothermal energy. The port already accommodates twelve wind turbines (the largest are on land) at the sites of Cuxhaven and Brundbüttel.

It should be emphasised that the city already has a strong energy policy since part of the electricity supply (about 12% of the population) has been managed since 2007 by a public body, Hamburg Energy, that provides 100% renewable and local energy generated by wind and solar power in particular.

The Elbe

The Port of Hamburg

The port and the city

The port of Hamburg is a major component of the urban landscape: the cranes of the container terminals work ceaselessly night and day, loading and unloading the cargos of the huge container ships.

During the 20th century, the port moved downstream from the city centre, leaving a new district covering 157 hectares, HafenCity, free for urban experiments.

With the development of **HafenCity**, Hamburg has defined new criteria for urban planning at the European scale: a new thriving district has sprung up in the city centre, on the former port site of 157 hectares, offering a subtle blend of residential buildings, offices, leisure spaces, shops and cultural facilities. The first series of buildings was completed in 2008.
The project will continue until 2025, with 7,000 dwellings intended to house around 14,000 inhabitants, and buildings for the service sector for 45,000 employees. The Elbphilharmonie, the new concert hall completed in 2016, is one of the flagship buildings of this new district.

This project not only allows the expansion of the city up to the banks of the Elbe, it also provides a new quality of urban life and a new relationship with water in the city centre.

The design of the constructions of this new district take into account the increasingly prevalent **flood risks**. The rising sea level and thus that of the river is one of the consequences of climate change. The level of the river could rise by 50 cm from now to 2100. The HafenCity district, built next to the water, outside the dikes that protect the rest of the city, has been built on foundations that raise it more than 8 metres above the normal level of the river.

The City of Hamburg is also raising the height of its main dike by 1.4 metre.

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The Elbe

What river for tomorrow?

Vulnerability and the impacts of climate change

The Elbe has already been subject to historic floods. In February 1962, the flooding of Hamburg was notorious for the number of victims (more than 300). More recently, the floods of 2002 and 2005 caused 20 deaths and cost more than €9 billion (on the German side, source 2006), while those of 2013 affected the main cities of the middle section of the Elbe and its tributaries (Grimma, Dresden, Magdeburg, region of Leipzig etc.). The latest flood hit Hamburg again in October 2017, claiming six lives.

As in many other parts of the world, the impacts of climate change are difficult to predict. On the scale of Germany, most scenarios nonetheless predict increasingly severe floods for the period 2061-2100 (in comparison to 1961-2000). These forecasts could be mitigated by the reduction of snow melt with the accumulation of less snow in the Alps. In addition, the thawing of the Elbe was one of the aggravating factors of previous floods, though rising temperatures could reduce the frequency at which the river freezes. On the other hand, **the increase in the number of extreme rainfall episodes** may lead to a higher number of floods at the local level.

According to an economic study, the annual cost of floods will double in the period 2071-2100 in comparison to the reference period 1961-2000 (to rise from €500 million a year to €1 billion a year). It should be borne in mind that this study took account only of damage to companies and buildings.

1962, Hamburg
(300 deaths, the water level rose by more than 4 metres)

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The Elbe

What river for tomorrow?

The impact of climate change in the Elbe basin

A programme was launched to assess the economic and social impacts of hydric stress in the watershed of the Elbe (by 2052): the GLOWA-Elbe project. The project has three objectives:

- Identify the conflicts of use,
- Evaluate the accessibility of water in the watershed,
- Develop suitable adaptation strategies,
- Evaluate the efficiency of these strategies from the economic standpoint.

Main results:

- The functions most impacted are irrigation, the supply of water to wetlands, river transport and tourism, and hydroelectricity production.
- The supply of water for consumption, industry and other power plants is inly slightly affected by hydric stress due to the lower water needs of these sectors, thanks to technological progress.
- Water will not be lacking over the entire watershed but will be felt by users (notably river transport)and areas already severely affected during the current spate of summer droughts.
- The adaptation strategies identified concern the management of reservoirs, wetlands, drinking water and drainage.

The Elbe

What river for tomorrow?

Developing the competitiveness of river transport

International competition

River transport has lagged due to the lack of infrastructures and multimodal links. The gauges limit the capacities for transport upstream (48 TEU to Dresden). It is above all affected by competition from the very efficient rail service.

The competitiveness of the waterway

The share of transport via inland waterways is still low in comparison to road and rail transport: it represents 2% of shipments to inland Germany, versus 69% and 29% for road and rail transport respectively. The Elbe and its lateral canal are the main waterways for shipping goods to and from Hamburg. Shipments by waterway are almost exclusively dedicated to inland transport in Germany (95%), while the other modes are chosen for international transport.

Modal distribution of inland transport of Europe's main ports (2015) :

Ports	Route	Rail	Barge
Hambourg	69	29	2
Bremerhaver	40	56	4
Rotterdam	60	9	31
Anvers	60	8	32
Zeebrugge	61	38	1
Le Havre	87	5	8

Sources : données des AP et Schiffahrt Bahn & Trechnik

Increasing the modal share of river transport in serving inland Germany is still handicapped by various factors: insufficient river depth, the small size of lock chambers, etc.

The transport master plan defines the orientations for renewing river infrastructures.

The Elbe

Appendices

The largest ports of Europe in 2015 (in millions of tons)

	2015	2014	Évol. %
1 - Rotterdam (Pays-Bas)	466,4	44,7	+4,9%
2 - Anvers (Belgique)	208,4	199,0	+4,7%
3 - Hambourg (Allemagne)	137,8	145,7	-5,4%
4 - Novorossiysk (Russie)	128,4	122,3	+5,0%
5 - Amsterdam (Pays-Bas)	96,5	97,8	-1,3%
6 - Algésiras (Espagne)	91,9	88,1	+4,3%
7 - Ust-Luga (Russie)	87,9	75,7	+16,1%
8 - Marseille (France)	81,7	78,5	+4,1%
9 - Bremerhaven (Allemagne)	73,4	78,3	-6,3%
10 - Valence (Espagne)	70,1	67,5	+3,9%
11 - Le Havre (France)	68,3	66,9	+2,1%
12 - Primorsk (Russie)	59,6	53,7	+11,0%
13 - Grimsby / Immingham (R.U)	58,3	59,4	-1,9%
14 - Trieste (Italie)	57,2	57,1	+0,2%
15 - Constanta (Roumanie)	56,3	55,6	+1,3%
16 - Saint-Pétersbourg (Russie)	51,5	61,2	-15,8%
17 - Gênes (Italie)	50,2	51,0	-1,6%
18 - Dunkerque (France)	46,6	47,1	-1,1%
19 - Barcelone (Espagne)	45,9	45,3	+1,3%
20 - Londres (R.U)	45,4	44,5	+2,0%

The largest European container ports in 2016 (in millions of TEU)

	2016	2015	Évol. %
1 - Rotterdam (Pays-Bas)	12,4	12,2	+1,2%
2 - Anvers (Belgique)	10,0	9,7	+4,0%
3 - Hambourg (Allemagne)	8,9	8,9	0,9%
4 - Bremerhaven (Allemagne)	5,5	5,5	-1,0%
5 - Algésiras (Espagne)	4,8	4,5	+5,4%
6 - Valence (Espagne)	4,7	4,6	+1,6%
7 - Felixstowe (R.U)	3,7	4,0	-8,5%
8 - Le Pirée (Grèce)	3,7	3,3	+10,4%
9 - Marsaxlokk (Malte)	3,08	3,60	-14,4%
10 - Gioia Tauro (Italie)	2,8	2,5	+9,8%
11 - Ambarli / Istanbul (Turquie)	2,8	3,1	-9,2%
12 - Le Havre (France)	2,5	2,6	-1,6%
13 - Carthagène (Espagne)	2,55	2,97	-14,1%
14 - Gênes (Italie)	2,3	2,2	+2,5%
15 - Barcelone (Espagne)	2,2	2,0	+14,5%
16 - Southampton (R.U)	2,0	2,0	0,0%
17 - Saint-Pétersbourg (Russie)	1,7	1,7	-0,2%
18 - Sines (Portugal)	1,5	1,3	+13,6%
19 - Mersin (Turquie)	1,57	2,05	-23,4%
20 - Zeebruges (Belgique)	1,4	1,4	-1,6%