

WP 1: Markets & Awareness

D 1.7:

Report on market potential and up-take measures for the Danube Region

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1. BACKGROUND & METHODOLOGY

“PLATINA II – platform for the implementation of NAIADES” is designed to support to the Commission, Member States and third countries in the implementation of the NAIADES action programmes in harmonisation and strengthening inland navigation and fostering synergy between market players.

The PLATINA II sub work package 1.1 “Identification of new markets for inland waterway transport” is an integral part of the WP Markets & Awareness aiming at increasing the modal share of inland navigation and stimulating multimodal supply chain integration. The sub work package deals with detection and attraction of new promising markets for inland waterway transport and pointing out new opportunities for the logistics sector and the industry in the Danube Region.

This report shall summarise the detected unused potential of inland navigation and provide supportive measures for increased usage of inland waterway transport for promising cargo groups by creating financial incentives for investments in cargo-specific handling and storage equipment, investing in maintenance of the waterway and paying a greater attention Danube navigation as an equal partner in the European logistics policy.

The report is based on following examinations conducted in the framework of WP 1:

The first pillar of the report is the determination of factors for the modal choice of logistic decision makers. In order to understand the approach of logistics decision it was not necessary to start from scratch: based on desk research existing modal shift studies were evaluated and used for the development of a **conceptual framework for modal choice**.

The investigation showed that shippers’ modal choice depends on the characteristics of the goods and quality and the dimension while for logistics providers costs (i.e. door-to-door transport costs and inventory costs) and quality of the transport service (reliability, door-to-door transit time, flexibility, safety/security, frequency, network coverage, mass/bundling capability, availability of loading units, information exchange, organisation of the supply chain and complementary logistics services) play an essential role. These factors are particularly defined by the location of shippers, recipients, availability and quality of the transport network infrastructure as well as legal and political framework.

These conclusions in terms of lessons learnt, the identified main drivers and barriers behind modal shifts as well as further common issues are used as basis for further investigations.

After the investigation of modal shift studies, an in-depth analysis of market segments with the highest potential for transport on European inland waterways has been conducted. The groundwork of the study was already set in the “Upgrading of Inland Waterway and Sea Ports (INWAPO)” project, co-financed by the EU’s Central Europe Program. Namely, in 2012 viadonau carried out a national market review analysis, identifying nine market segments with the highest potential for inland waterway transport, mainly focussing on the Austrian market. Based on these results, an extended and updated **market analysis for the Danube corridor** covering the entire Danube Region and including 28 products was executed. The analysis is based on a micro and macro level and provides a bird's-eye view on specific topics and overall given preconditions regarding production and trade

volumes, trade relations, requirements for transport/transshipment/storage and the consequential identification of most promising market segments for Danube navigation.

The data used in this market study originates from heterogeneous sources due to the large scale of study subject and the wide geographical scope covered. Quantitative examinations of cargo groups resp. products are primarily based on official national and international statistical databases such as UN Comtrade, FAOSTAT, Eurostat, etc. The volume of data as well as the accuracy and level of detail degree varies between the countries heavily. While countries on the Upper Danube provide in depth data sets and user friendly statistics tools, Danube countries in South and Eastern Europe do have considerable backlog.

Beside the usage of statistical databases and yearbooks, sectoral reports of national and international associations, selected company reports provided valuable information on the respective product. Occasionally, representatives of interest groups e.g. Chamber of Commerce Serbia, were contacted via phone and information on specific topics which were not available on the internet, were inquired.

viadonau itself has been dedicated to creation, collection and dissemination of knowledge concerning Danube navigation for a long time. Consequently, a wide range of information on inland waterway transports which was available in-house has been used for the purpose of this report. After the theoretical examination market potential, obstacles and cooperation possibilities at business level for the most promising market segments were discussed during **meetings with stakeholders**. The testing of the market transfer conditions was realised on European level during the “Danube Business Talks” in March 2014, focussing on Renewable Resources and High & Heavy goods. A further promising market segment, recycling products, were examined on regional level in April 2015.

The proactive discussions among the players from the business and logistics encouraged mutual learning and will provided solid arguments for a public support for sector-specific modal shift.

Finally, this report summarises the findings of the mentioned tasks in recommendations for fields of action, which target national, regional and European decision makers in order to promote and strengthen the Danube logistics network.

2. REVIEW OF THE MOST PROMISING MARKET SEGMENTS

The review on promising market segments in the Danube Region was results of the market review analysis in the context of the project INWAPO in 2012. Due to the study’s limitation on the Austrian market and the consequent absence of results referring to the Danube Corridor as an entity for inland waterway transports, the follow-up study including all ten Danube countries was conducted in the Platina II Project (as mid-term report for the D1.7 “Report on market transfer conditions”: see separate document).

The “Report on market transfer conditions – Market Analysis Danube Corridor” contains a detailed analysis of seven cargo types and 28 different products. The report in particular focused on production and trade volumes in the Danube riparian countries and the special transport requirements of the selected products.

In addition production and processing sites in the vicinity of the Danube were identified in order to evaluate the potential for a modal shift to inland navigation. A summary of the potential for inland waterway transport was compiled using the "traffic light system" (green / yellow / red).

Following cargo groups were analysed:

1. **Renewable resources**
2. **Vehicle components and cars**
3. **Chemical products**
4. **Mineral resources**
5. **Energy raw material**
6. **Recycling products**
7. **High & Heavy cargo**

2.a. Renewable resources

Renewable resources (RES) are agricultural and forestry products which are intended either for material and/or energetic use but not as food or feedstuffs. The availability of renewable resources is, in comparison to fossil raw materials, not limited but through secure and constant regrowth guaranteed.

The EU "Directive on the promotion of the use of energy from renewable sources", which came into force in 2009, established a European wide framework for production, use and promotion of renewable resources. The goal is to reach a 20% share of energy from renewable sources and a 10 % share of energy from renewable resources in transport in community energy consumption by the year 2020.

Moreover, national mandatory targets have been determined for EU member states as well as for SEE and Black Sea countries, which have signed the Energy Community Treaty. Individual target rates have been determined for each country. So far (until 2010) the rates achieved differ from each other and some countries like Germany, Slovakia, Hungary, Croatia, Serbia and Ukraine will have to make some effort in order to achieve the individual target rate by 2020.

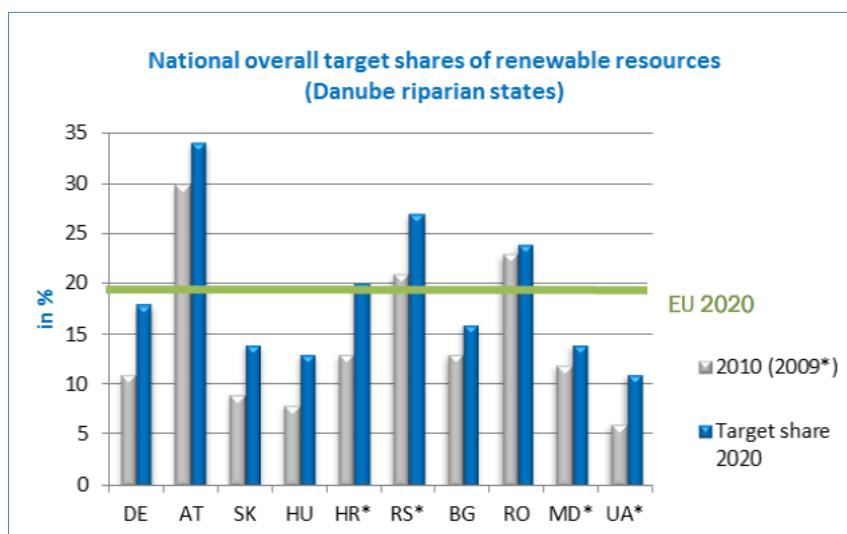


Figure 1: National overall target shares of renewable resources

Agricultural and forestry products make up to 20% of the total volume of goods transported annually on the Danube. Despite of their dependency on weather conditions (precipitation, temperature, days of sunshine per year) and the resulting production fluctuations, agricultural goods were and are one of the most important cargo type for inland navigation for the vast majority of the Danube countries.

There are large growing areas of agricultural and forestry goods and numerous large production, trade and processing companies in the vicinity of the Danube River.



Figure 2: Growing areas of agricultural goods in the Danube Region

Furthermore, agricultural products and forestry can be transhipped in more than 50 Danube ports which have appropriate handling equipment which strengthens the potential of these products for inland navigation.

- **Agricultural products**

Renewable resources are traded in great quantities by Danube countries: Large importers of agricultural goods are Austria and Germany while countries in the Middle and Lower Danube (Hungary, Serbia, Romania, Bulgaria and Ukraine) are predominantly exporting these goods, as evaluated in the market studies.

The ranges of application of renewable resources are diversified and consequently a wide range of industries are targeted by these products:

Starchy agricultural products such as wheat and maize are not only processed in the food and fodder industry but are predominantly used in the paper and pulp industry, chemical and textile industry as well as in the pharmaceutical industry. The second important field of application for starch-based goods is bioethanol production while bioethanol itself is utilized as biofuel but also in the chemical and food sector.

In the Danube Region there are eight bioethanol plants in the vicinity of the Danube River (90 minutes truck drive) with a total production capacity of round 1 million m³. Inland navigation does not only have the potential to become the an important transport mode for raw material delivery but also for transport of final products and valuable by-products such as high in protein fodder (D.D.S.G), which is suitable for inland waterway transports due to its .

Oilseeds such as sunflower, soya and rape are, as starchy products, used in various industries: chemical, bio-based synthetic materials, lubricants, pharmaceutical and biofuel industry. The demand for soybeans in particular has experienced a high global, European and national increase in the last years and has become indispensable for the food and fodder industry.

In order to counteract the increased imports of GMO soya from North and South Amerika, the Austrian association “Danube Soya” (<http://www.donausoja.org/en-en/>) was established. The main goal of this non-profit organization is to promote sustainable, local production of GMO free soya production in the Danube Region which will surely have positive impact on inland navigation.

Rape and sunflower are the base products of biodiesel with press cake or seed meal as important by-products which can be used as feed, the catalyser as fertilizer and the glycerol can be used as an important substance in the pharmaceutical industry. The production of biodiesel in all Danube countries accounted for than 3 million tons in 2012 and the transport of the oilseeds as well as biodiesel and by-products can be easily facilitated by inland navigation.

Having in mind, the target of 10% share of renewable resources in transport according to the EU “Directive on the promotion of the use of energy from renewable sources” but also the diversified utilization possibilities of esp. bioethanol, biofuels production companies will become increasingly important in the future.

- Forestry products

Forestry products are used for material (wood-based panels, plywood, construction material and furniture) as well as for energy production (pellets, pellets, fuel wood and chips). Since 1990 forestry areas increased between 13% and 20% (or stayed stable) in the Danube Region and there are three important forest areas which are located near the Danube River: Austria, Bavaria, Serbian/Bulgarian/Romanian border area and in Bulgaria, in the south of the river.

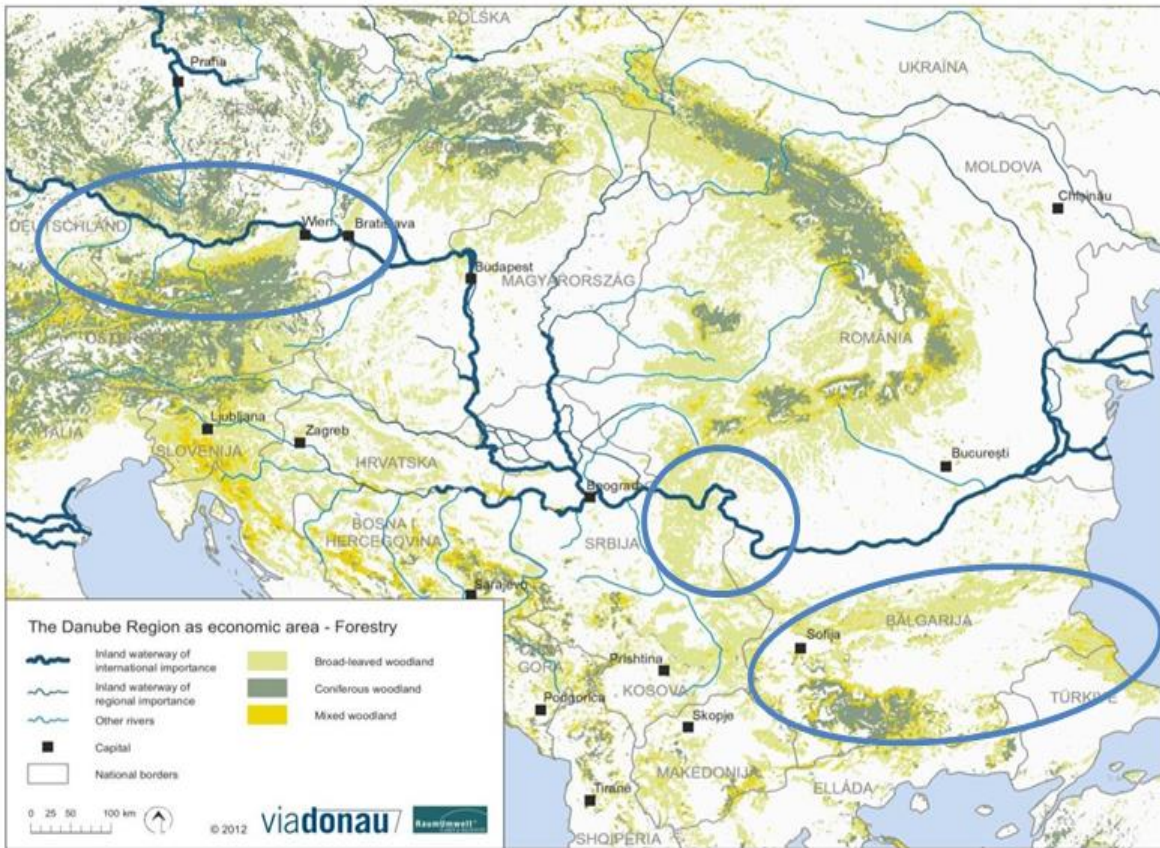


Figure 3: Forest areas in Danube region

Wood based products for material and for energetic use are traded in large volumes in the Danube Region. The basic wood product is **round wood** which is used as raw material for the sawn industry, industrial wood and for energy purposes. Round wood production in the Danube countries accounted for more than 140 million tons in 2012. Analysis showed that the biggest producers – Germany, Austria, Romania - have the largest demands and consequently are the largest importers of this product. Germany covers its demand mainly from Austria, while Austria’s imports are originate from all over the Danube Region.

The Austrian company “Bluewave” proved that inland waterway transports of round wood can be a successful business model in the Danube Region. This company transported approx. 335 ships/barges of round rood from

the Romanian/Serbian border region and Bulgaria to Austria. This amount corresponds to 370.000 tons or more than 15.000 trucks which were shifted on the waterway. The successful participation at the EU Marco Polo II Call supported this activity and will surely have further positive impact on the usage of inland navigation.

Besides wood based products for material use such as sawn wood or wood based panels, wood for energetic use such as **pellets** play also an important role when evaluating the potential of IWT.

Having in mind the EU2020 goals towards increased use of renewable resources elaborated in the introduction of the chapter, advantages of pellets as energy source should be emphasized at this point:

- Pellets can save up to 50% of energy costs from fuel oil and natural gas
- Pellets are bundled energy: 1 kg pellets equal 4.9 kW → 2 tons pellets equal 1,000 liters fuel oil
- With efficient heating boilers 90% of the pellet energy be processed to heat
- CO2 emission during the burning process equal the absorption of CO2 during the wood growth period
- Pellets origin from renewable resources – wood

There are more than 300 pellets producers in the Danube country with a total capacity of more than 8 million tons per year. The capacity is however not exploited since the actual production accounted for 4 million tons in 2012. The greatest demand for pellets is given in Germany (esp. Bavaria) and Austria. The reason for that might be the large imports to Europe from the US, which are transported to Central European countries via ARA ports. Nevertheless, there is a great unused potential in the sector due to existing forest areas in the vicinity of the Danube, the great number of producers and growing demand in the European Union.

There are 50 Danube ports and sites which provide transshipment services for renewable resources. The majority of the renewable resources handling locations is located in the upper and middle Danube, as shown in the map below.



Figure 4: Danube ports and transshipment sites for renewable resources

It is notable that transshipment locations along the Danube correspond to the areas of cultivation illustrated in this study above.

Agricultural products are mainly transported as bulk and are transhipped with grabbers and/or suction equipment. Forestry products such as round wood, wood-based panels and sawn wood are defined as break bulk and require grabbers, hooks for palettes, etc. Renewable resources are in general sensitive to moisture and mechanical damages which can be caused by inappropriate handling.

In order to ensure a high level of service level, ports' handling equipment and storage equipment must be available is plays an important role in the achievement of a modal shift towards inland waterway transport.

2.b. Vehicle components and cars

Vehicle production in all Danube countries accounted for more than 7.6 million vehicles in 2013, dominated by Germany's strong position in this sector however, especially Slovakia and Romania became important producers since 2008 by doubling their outputs to 1 million respectively 400.000 vehicles per year.

For Germany, Danube countries do not play a significant role as target markets. Despite of the low share in total exports of 4.6% (360.000 tons) in 2013, Danube navigation does play a role as the company BLG Logistics runs a regular service for the transport of new cars from Kelheim to Budapest. Mitsubishi, Ford and Renault vehicles are transported from Germany to Hungary while Suzuki cars from Hungary are transported upstream to Germany. Empty runs are in that way avoided and cost-efficiency achieved.

Round ¼ (round 220.000) of the total Slovak vehicle exports are aimed at Danube countries. For Slovak vehicles there is a large potential for inland navigation, considering that Germany is the most important target market and that the connection to the heartland is provided by the Danube-Main-Rhine axis.

Vehicles can either be loaded conventionally by lifting them with cranes – so called LoLo (lift on/ lift off) or via ramps using their own wheels – RoRo (Roll on /roll off), which is the more convenient transshipment method for new cars due to lower risk of damage.

There are 20 RoRo, ports in the Danube Region as illustrated below, one ramp is under construction in the Port of Giurgiulesti and will be finished by end of 2015. The absence of a RoRo port in Serbia has surely negative impact on inland waterway transports of vehicles but also other goods which depend on ramps for transshipment (such as High & Heavy goods) to and from this country. A further argument that has been mentioned for the relatively low usage of IWT for this product group is that vehicles are increasingly custom-made and are directly delivered to the clients who are not willing to take into account longer delivery times by inland waterway transports, but require shipment in the shortest possible time. This circumstance results in the diminished need for in-stock shipment of vehicles. This circumstance can be used for the conception of scheduled services with focus on vehicles aimed for storage or even used vehicle from the Western European countries towards SEE.

2.c. Chemical products

Europe has a strong chemical industry worth almost 700 billion Euros and this industry plays a major role for countless other industries such as construction, health and agriculture. Europe is also the largest exporter and importer of chemicals, with a record 49.1 billion Euros trade surplus in 2012.

Chemical industry comprises a variety of different products in all states of aggregation. Chemical products which can be transported as bulk are suitable for IWT, this refers especially to fertilizers such as urea and raw materials for the plastics industry such as polymers. Having in mind, that the increase of productivity in the agro business plays and will play a major role in future, especially in South East Europe, sustainable transport concepts should be developed including inland navigation into a greater proportion.

Large chemical plants are not located in the vicinity of the Danube River to a large extent; however, according to the European Chemical Industry Council (CEFIC) there is much unused potential for inland navigation for this cargo group. Namely, CEFIC¹ conducted a survey among 13 large chemical companies and 15 logistics service providers with the goal to identify main chemical transport corridors and volumes, as well as bottlenecks and barriers in terms of intermodal transport.

The results of the survey show that the most used intermodal transport combination is “road-rail” (72 %). Short-sea-shipping represents 27%, mainly related to transport from/to the clusters in Great Britain and Iberia. Intermodal inland waterway transport is currently used to a very limited extent namely 1%. The participants of the survey identified new potential corridors for intermodal transports that are not in use today but may be interesting for intermodal shifts in the future. The chemical industry sees potential for volumes to be shifted to and from France and to and from the CEE countries, especially Russia and the South-East of Europe since there are no intermodal concepts that are currently offered on the market for these connection and can only be performed by road. According to the survey about 1.4 million tons may be shifted towards intermodal transport solutions, if the requirements would be met. In terms of Danube navigation the identified intermodal flows of more than 200,000 tons per year towards Turkey and Russia are relevant and should be considered as a great opportunity for all parties included in this industry but also the European Union which aims at shifting 30% of road freight over 300km to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050.

¹<http://www.cefic.org/Documents/IndustrySupport/Transport-and-Logistics/Intermodal-Transport-Report-June%202014.pdf>

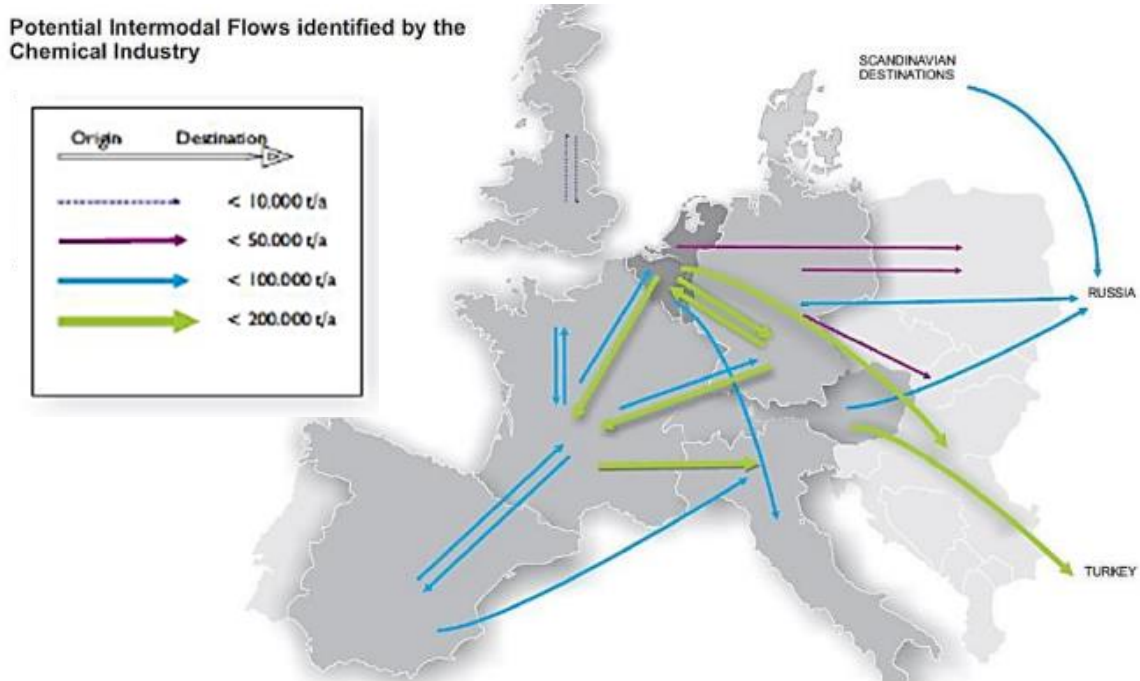


Figure 6: Potential for modal shift in the chemical industry

2.d. Mineral resources and mineral oil products

This group covers a wide range of different products which are applicable in a wide range in business sectors.

- Non-metallic mineral resources

Non-metallic mineral resources such as aggregates (sand, sandstone, limestone, etc.) but also derived products such as cement are mainly used in the building industry for foundations, roads, drainage, asphalt, etc. Despite of regular construction booms and construction crises in Europe and the world, the building industry in the Danube Region is characterized by stable production volumes, as illustrated below. It is expected that construction activities in Central and South East Europe will increase which will lead to higher demand for construction materials in the region.

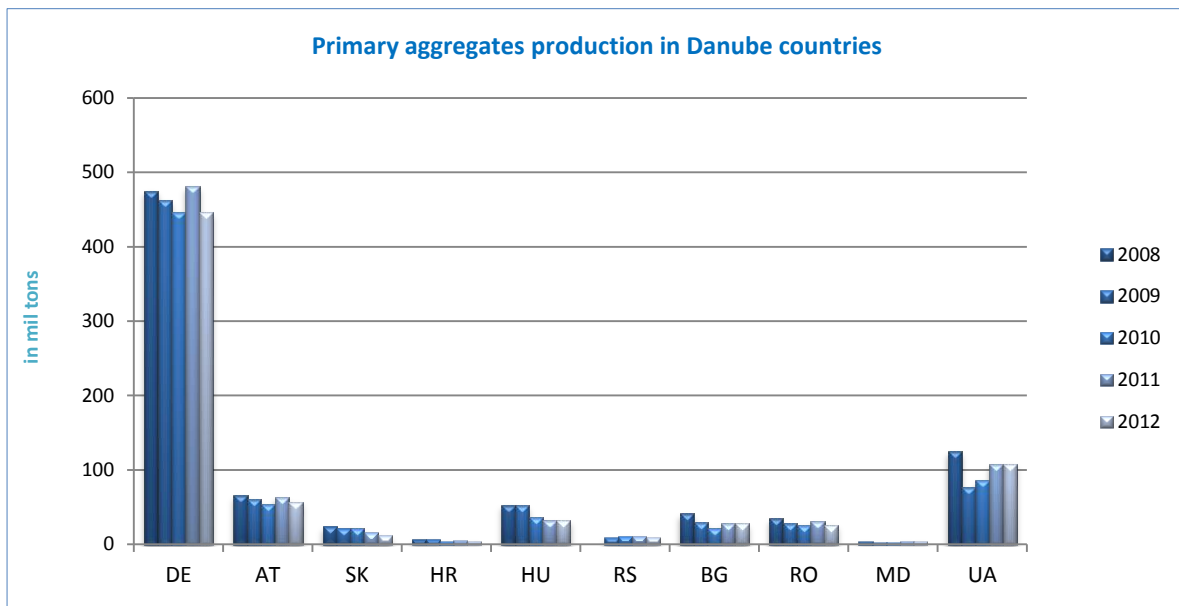


Figure 7: Production of aggregates in the Danube Region

Germany’s production of more than 400.000 million tons of aggregates covered nearly 1/3 of the total output in the entire region, followed by Ukraine with 100.000 million tons in 2012. Germany is not only the dominating producer but also the largest importer and exporter of aggregates with 25 resp. 12 million tons. Ukraine, on the other hand, focussed mainly on exports of these goods which accounted for 15 million tons.

Although transport of aggregates via inland waterways is nowadays common practise, having in mind the large trade volumes of this cargo group, there is still great potential. Road transport still plays a predominant role for this cargo while benefits in terms of costs deriving from the bulk capacity of inland vessels offer unused possibilities.

Cement is a mineral-based product which is mainly used in the production of mortar and concrete. The total production of cement, clinker as well as finished cement, accounted for 91 mil tons in 2012. High volumes are not only represented in production but also in trade. Germany, Slovakia and Croatia export cement while high imports are allocated to all Danube countries, except Serbia and Moldova.

Numerous production sites are located in the vicinity of the Danube River which provides free transport capacities. Cement is shipped either as bulk, in 50 kg paper sacks or one to two ton polypropylene bags whereas bulk transports are not practiced often due to special requirements of the respective vessels.

- **Metallic mineral resources**

The analysis of this group of products includes metallic raw material, iron ore (rocks and minerals from which metallic iron can be extracted), as well the semi-finished steel products such as blooms, ingots, blooms and billets. Iron ore is predominantly used for steel production. Approximately 98% of the mined iron ore is processed

in blast furnaces, together with scrap metal, limestone and coal. However, iron ore is also used in the construction and transport industry e.g. automobiles, trucks, trains.

Iron ore deposits in the Danube Region are centred in Ukraine. This country has increased its production steadily since 2009, reaching an output of 84 million tons in 2013, which positions Ukraine as the leading European iron ore producer and a major player on the global scale (Ukraine holds 4% in the total world production and is the sixth largest iron ore conveyer). Furthermore, Ukraine has about 30 billion tons of iron ore deposits which represent the largest extraction potential worldwide.

World iron ore reserves in 2009

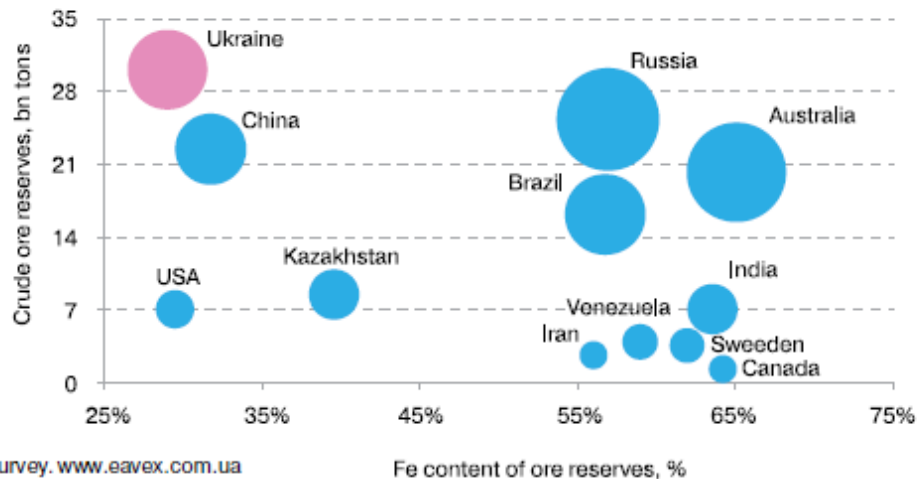


Figure 8: Iron ore reserves

Ukraine exported round 35 million tons iron or in total of which 9 million tons were shipped to Danube countries. The most relevant target markets were Austria and Slovakia with a share of 70%. The Austrian market decreased since 2010, however exports to Slovakia rose and accounted in 2012 3.4 mil tons.

The largest Austrian steel producer “voestalpine” received iron ore from Ukraine via inland navigation to a large amount until 2012. However, the political crises in Ukraine resulted in strong negative impacts on inland waterway transports of iron ore to Austria: Since 2012 iron ore exports decreased heavily from 1.2 million tons to only 71.000 tons in 2014. In order to counteract this trend and ensure sufficient raw material supply for the steel making plants, Austria obtained increased iron ore from Romania via inland waterways.

Serbia was the third important market for Ukraine until 2011, however, in 2012 iron ore exports sharply declined due to operation difficulties of the largest steel producer in Serbia “Zelezara Smederevo”, in the city of Smederevo, which is located at the Danube. In regard to the newest developments of “Zelezara Smederevo” by reorganizing the company and setting up a new management team, increased production and increased iron ore demand may be expected. The importance of inland navigation for this company can be raised in that way.

- **Steel products**

In terms of steel cargo, especially semi-finished products, such as blooms, ingots, blooms, billets and coils which are destined for further processing are suitable for inland waterway transport.

The largest crude steel producers were Germany, Ukraine and Austria. The steel semi-products export activity in the Danube Region is not diversified but focused on Ukraine as the most important exporter with a share of 80%.

Imports are mainly realized through Germany with 1.8 million tons in 2012 while the remaining Danube countries imported between up to 800.000 tons per year.

Inland waterway transport provides an ideal solution for steel-based products, which are critical to weight meaning that this cargo reaches high weight load with low volumes, which might lead to nearly empty trucks reaching the maximum weight. A single convoy with four lighters for example can move 7,000 tons of cargo which corresponds to a load of 175 railway wagons each containing 40 net tons or 280 trucks each containing 25 net tons.

2.e. Energy raw materials

Energy raw materials cover products of fossil origin – crude oil as raw material, diesel and gasoline as finished products, liquefied natural gas (LNG) as well as coal.

- **Crude oil**

Crude oil supply of refineries in the Danube countries is facilitated through a wide network of pipelines and through tankers which transport crude oil over long distances from oil Russia and (North) African countries as well as The Netherlands (via ARA ports), Great Britain and Poland.

Despite of the fact that crude oil imports are declining in the Danube region and Germany is the only country which exports crude oil, however, mainly to UK and Norway, inland waterway transport should be considered as a suitable alternative means of transport for crude oil. Especially for upstream routes from the Black Sea towards Germany it is worth to take a closer look at inland waterway transport opportunities.

All refineries in the Danube countries are located in the close vicinity of the Danube River with the exception of Romania.

Petroleum products are transported in tankers which have to fulfil certain requirements. According to the UNECE “European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways” (ADN), crude oil as well as diesel, fuel oil and gasoline are classified as dangerous. Consequently, special transport conditions are required for this product. Furthermore, ADN requires double hull transport vessels, which should prevent leakage of petroleum products into the water in case of ship damages.

- Diesel and gasoline

The total output in the region accounted for 60 million tons in 2012, while 43 million tons of diesel were produced in Germany. Production in the remaining markets did not exceed 4 million tons in the same year. The

Analysis showed that diesel and gasoline are traded in respectable quantities between the Danube countries. Petroleum products which is intended for export or imported are mostly stored in tank farms for some time after being distributed via pipeline or trucks to gas stations or industrial plants. Only in Germany there are 40 tank farms which are located in the vicinity of a waterway (Danube, Rhine, Main), numerous tank farms are also situated at a favourable location for IWT in other Danube countries.

Even though inland navigation is an integral part for petroleum products in some countries e.g. Austria, there is still space for improvement and intensification of the usage.

- Liquefied natural gas

Liquefied natural gas (LNG) is natural gas which is transformed in liquid through cooling to $-162\text{ }^{\circ}\text{C}$. The purpose of the transformation is the decrease in volume of the products for more than 600 times than in gaseous state. Consequently, transport and storage can be facilitated more efficient with cost savings regarding required space.

Natural gas has is the third important primary energy resource on global scale with a share of 24% and is mainly used in industry for electricity and heating production however, usage in mobility is becoming more important.

Even though the European continent has good connections to a large proportion of the global gas reserves via pipelines and LNG terminal, the Danube Region is unfortunately excluded from the connection. This circumstance was the basis for the European project "The LNG Masterplan - Liquefied Natural Gas Fuel and Cargo for Inland Navigation 2013-2015" is one of the largest TEN-T projects with a budget of 80.5 mil € which aims at developing the infrastructure for LNG as cargo for inland navigation as well as fuel for inland navigation vessels.

LNG Supply & Distribution in Europe

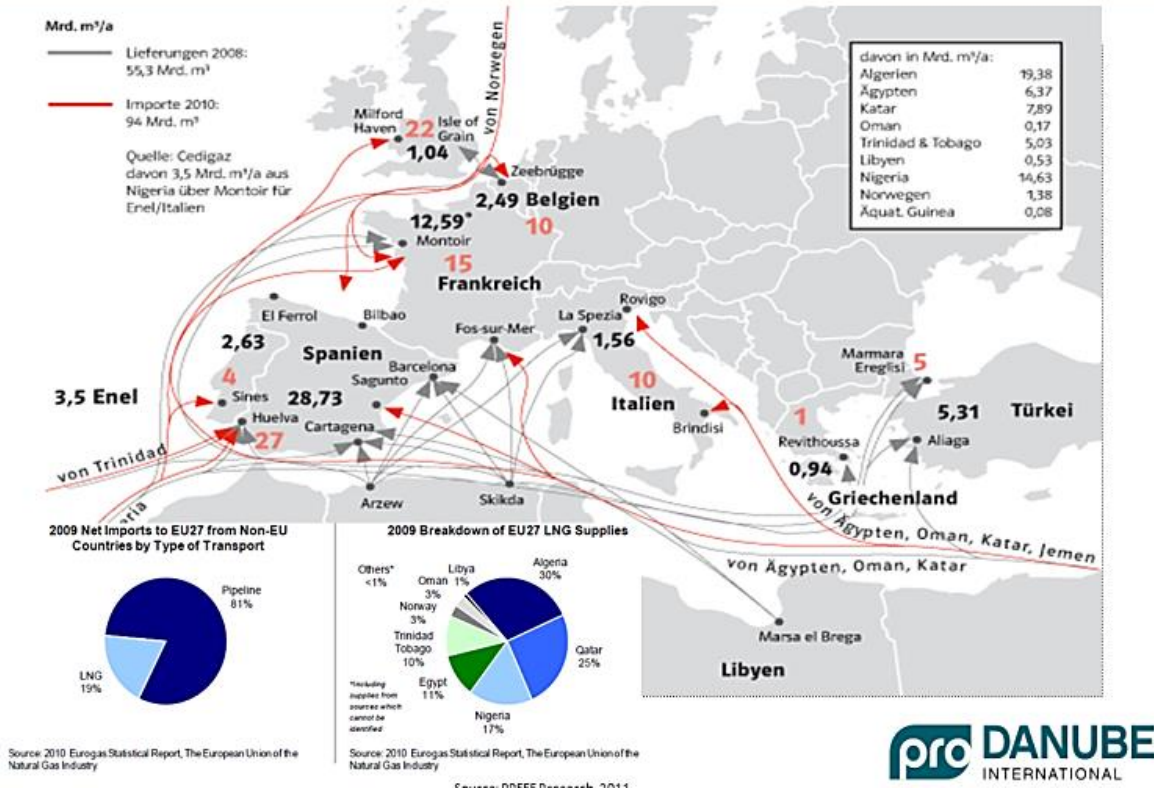


Figure 9: LNG supply & distribution

One of the main goals of the LNG Masterplan is that the inland ports on the Rhine-Main-Danube axis become key

distribution centres for LNG to liberalise the gas market and relativize Europe's current dependence on gas from Russia and Norway.

The Masterplan evaluate the LNG distribution potential in selected Danube ports as basis for further development of this segment in the Danube region. Furthermore, a pilot LNG terminal in Rouse is foreseen with waterfront storage unit of minimum 1,000 m³ including fuelling for vessels and trucks with calculated hinterland demand/base load in the first year approx. 40,000 m³. The second pilot will be a bunker station in Antwerp, NL as the other end of the axis between the North and the Black Sea.

The current lack of sufficient infrastructure for inland waterway transports and corresponding transshipment and storage of LNG along the Danube leads to circumstances that analysis of resource and targets markets of gas for Danube countries is redundant at this point. Nevertheless, one can expect major changes in the market resulting for increased opportunities for inland navigation for this product.

- **Coal**

Coal is important fossil energy source accounting for 30% of the EU28 electricity production. Danube countries having divergent coal consumption rates: Austria has relatively low coal-based power production with 6% in 2012, while in countries such as Germany and Bulgaria, over 40% of the electricity production was depended on coal.

The total output of Danube coal (coal and lignite) accounted for 350 million tons in 2013 with a decrease of 13% compared to 2012. The largest producers are Germany and Ukraine followed by Serbia and Romania.

Numerous are located in the vicinity of to waterways: in Germany these can be found especially in the west of the country near by the Rhine River, in Serbia two mining locations are located in close proximity to the Danube.

It is undisputable that coal will remain an important energy raw material in the future however, it is important to bear in mind that the EU and the global policy tend to limit and decrease coal consumption because of high CO₂ production in coal power station and the resulting global warming. In the meantime environmentally friendly transport modes should be applied for this cargo: Coal is an important cargo for inland navigation and is already transported to a certain extent via waterways. There is however, still space for shifting the product especially because of the IWT advantages mentioned above.

2.f. Recycling products

Recycling means the extraction of raw materials from waste, their return to the economic cycle and usage in new products. Products suitable for recycling are in particular glass, paper, paperboard, cardboard, iron, non-ferrous metals and plastics which accrue in households and in production and processing sites.

Having in mind, that raw materials will be increasingly obtained by recycling are in future due to rising global resource scarcity special attention should be paid on this cargo group. Furthermore, European Policy Waste

Policy has focused on boosting recycling in order to achieve secure access to raw materials and create jobs and economic growth. For that reason the EC proposed the increase of recycling rates for paper, plastics, wood, and scrap metal and to review recycling and other waste-related targets in the EU Waste Framework Directive 2008/98/EC, the Landfill Directive 1999/31/EC and the Packaging and Packaging Waste Directive 94/62/EC.

According to the EC legislative proposal recycling rates should reach 90 % for paper by 2025 and 60% for plastics, 80% for wood, 90% of ferrous metal, aluminium and glass by the end of 2030.

There are several reasons for inland navigation to be considered as a suitable means of transport for these goods:

- Growing demand for secondary raw materials
- Recycling products are globally traded goods
- High cost sensitivity of recycling products and little time-sensitive transportation
- Ability to convey large quantities of goods per unit
- Environmental performance of inland navigation

- **Scrap metal**

Scrap metal is an important raw material for the steel producing industry and there are numerous steel producing plants in the vicinity of the Danube River. Scrap metal arises in steel processing businesses, households, scrapping of old cars, in-house waste from steelworks and foundries. The Danube region is a net exporter of metal scrap whereas the relation between exports and imports accounted for 2:1 in 2012.

Round 15 million tons of scrap metal were exported from Danube countries in total in 2012 while imports reached amounted 7.2 million tons. These quantities prove that inland navigation does have large potential especially in regard to its characteristics and its suitability for inland waterway transports. It has to be mentioned that the scrap metal market is volatile and that supply and demand are vulnerable to frequent changes nevertheless, this does not minimize the possibilities which are offered for inland navigation for this sector. An interesting target market for scrap metal is Turkey, the largest worldwide importer with 19 million tons in 2014. More than 3 million tons were exported to Turkey from the Danube countries in 2014, however inland navigation is not used in a satisfactory amount for these transports. The main reason might be the difficult bundling possibilities of small amounts in order to achieve the adequate quantity for inland waterway transports. Scrap is mainly collected regionally all over the countries where without achieving sufficient volumes for IWT. For that reason information and knowledge transfer and cooperation between the players in this sector is essential.



Figure 10: Primary steel making locations

- Waste paper

Europe has made great progress in the past 25 years **paper recycling** and has become the global leader recycling rates of 72% in 2013 while in 1991 only 40% of the consumed paper and paperboard in Europe originated from recovered resources:

- 90% of newspapers are printed on recycled paper
- 90% of corrugated boxes are made of recycled fibre
- 70 % of consumed paper is sent for recycling
- 54% of the fibres used in new paper and board are sourced from recovered paper

EUROPEAN PAPER RECYCLING 1991 - 2013

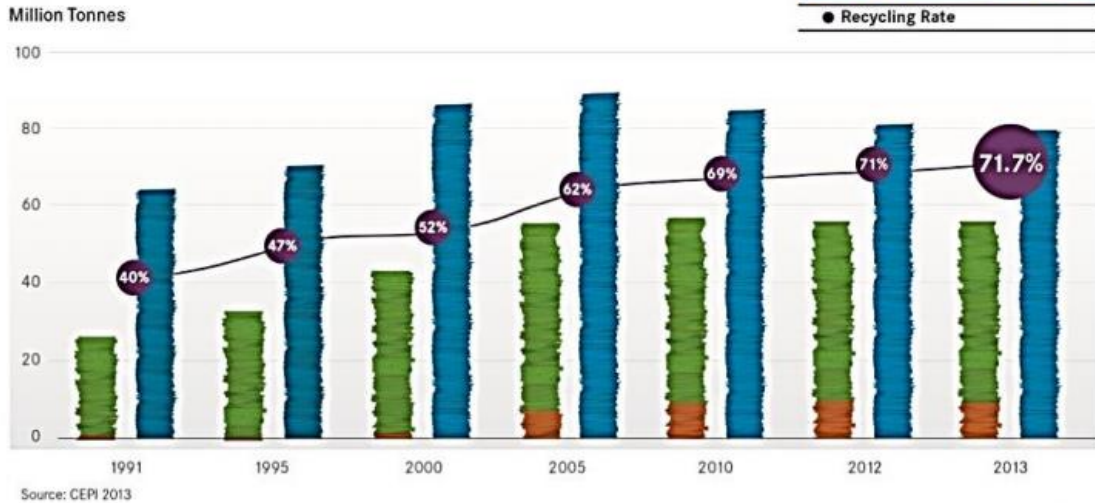


Figure 11: Paper recycling rates in Europe

As for all recycling products, not only collection but also delivery of the cargo to the processing sites should be cost-effective. Waste paper has become an attractive trade commodity for that reason IWT especially in the Danube region can play a more important role.

Germany and Austria are the dominating traders of this commodity in the region with shares up to 70% of the total trade volume (4 million tons of exports and 6 million tons of imports). These two countries are the most relevant trading partners for each other among all Danube countries, however despite of the high volumes, IWT does not have the relevance as one might assume.

The reason for this circumstance can be surely compared to scrap metal and other recycling products namely, the missing bundling possibilities due to regional/local collection across the entire countries. Cooperation platforms for the recycling business should be established in order to demonstrate potential and provide platforms for positioning of inland navigation.

2.g. High & Heavy cargo

High & Heavy (H&H) cargo is not allocated to a specific economic sector but refers to the specific characteristics of the product and the transport. High & Heavy goods can be defined as cargo which cannot be transported as regular load, but requires special measures resulting from its weight and /or big dimensions. Examples of such cargo are power transformers, building machines and engines, tanks, etc.

The advantages of IWT of High & Heavy cargo compared to rail and road are:

- In terms of space, there are almost no limitations. A typically used pushed lighter on the Danube is 76.5 meters long, 11 meter wide and has a load capacity of 1,700 tons. The dimensions of the cargo hold of a typical motor vessel varies, depending on the type, from 67 to 87 meters length, 8.2 to 8.7 meters width with loading capacities up of 2,400 tons and more.
- Inland waterways transports of H&H do not require special cost-intensive transit permissions are as for road transports.
- There are no obstructions through traffic lights, signs, tunnels and bridge passages.
- No detailed routing needed compared to road transport
- Little transport restrictions compared to road (e.g. weekend bans)

Inland navigation is becoming increasingly important the High & Heavy sector nevertheless, there is still a great potential for shifting products from road to inland navigation.



Figure 12: H&H transshipment

In the future the growing markets in South East Europe and the Black Sea Region will bring a big increase of H&H transports especially for the construction industry (e.g. bridges) and energy supply (e.g. wind energy). Furthermore there is a trend towards ever larger cargo. At the same time the maximum sizes allowed on roads and motorways could be potentially reduced to improve the safety on the road. This could lead to an additional shift of oversized and heavy cargo to inland navigation.

The transshipment from road to rail or inland navigation needs special equipment. Some special ports exist along the Danube and the Rhine which offer stationary equipment for more than 100 tons.

In addition mobile cranes and Ro-Ro transshipment technology also offer reasonable possibilities for the transshipment of High & Heavy cargo.

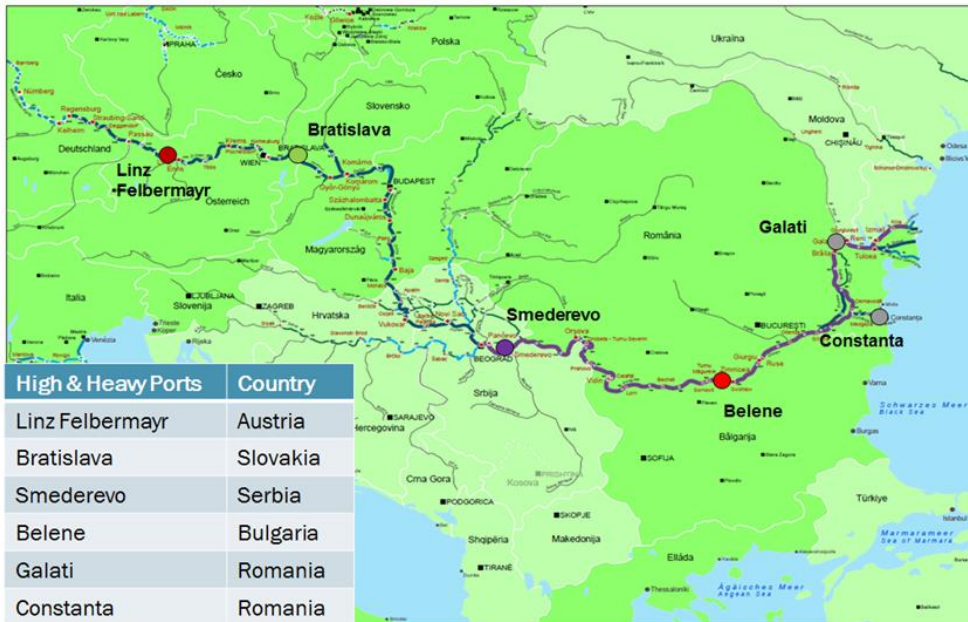


Figure 13: High & Heavy ports

2.h. Summary market review

The aim of the market analysis was to give a comprehensive overview of current potential for modal shift towards inland navigation in the Danube corridor.

The potential for promising market segments was summarized in the table below taking into account production, trade volumes, production and processing site as well as feedback received from the industry and logistics sector.

The use of a “traffic light system” clearly illustrated the identified potential for modal shift towards inland navigation.

- Green = great potential → IWT should be considered
- Yellow = moderate potential → IWT suitability should be checked on a case-to-case basis
- Red = low potential

Cargo	Main points of origin	Main points of destination	Potential
Round wood	DE, AT, HU, BG, UA	DE, AT, RO	Green
Sawn wood	DE, AT, BG, RO, UA,	DE, AT, HU	Yellow
Wood-based Panels	DE, AT, RO	All (except MD)	Yellow
Pellets	DE, AT, RO	DE, AT	Yellow
Wheat	DE, AT, HU, RS, BG, RO, UA,	DE, AT	Green
Maize	HU, RS, BG, RO, UA	DE, AT	Green
Bioethanol	Domestic		Yellow
Soybean	AT, HR, RS, RO, MD, UA	DE	Green
Rape	AT, HU	DE, AT	Yellow
Sunflower seeds	HU, BG, RO, UA	DE, AT, RO	Yellow
Biodiesel	DE, AT, BG, RO, UA	DE, AT, RO	Yellow
Sugar beet	Regional		Red
Cars	DE, SK, RO	DE, AT, HU, UA	Yellow
Chemical products	DE, AT, SK, HU	DE, AT, SK, HU, RO	Green
Cement	DE, SK, HR	DE, AT, HU, UA	Green
Salt	DE, AT, RO, UA	DE, HU	Yellow
Iron ore	UA	AT, SK, (RS), RO	Green
Steel	DE, UA	DE	Yellow
Crude oil	NON-EU	ALL	Yellow
Diesel & gas fuel	DE, SK, HU	SK, HU	Green
Gasoline	DE, AT, SK, HU, HR, BG, MD, UA	DE, AT, SK, HR, BG, MD, UA	Green
LNG	Non-EU		Yellow
Coal	DE, AT, HU,	AT, SK, HU, RO	Green
Metal scrap	DE, AT, RO	DE, AT	Green
Waste paper	DE, AT, HU	DE, AT	Green
Used glass	DE, AT	AT, DE	Green
High & Heavy	All	all	Green

Figure 14: Summary of IWT potential assessment

3. REVIEW OF STAKEHOLDER MEETINGS

The findings of the review of most promising market segments were tested on a small-scale market focussing on particular segment and commodity groups. Based on the market review results and on feedback received from the logistics and business sector **high & heavy cargo, renewable resources and recycling products** were selected as focus segments for meetings with stakeholders. Representatives of the industry, shipping and forwarding companies, Danube ports and transshipment operators were invited to discuss market transfer conditions and identify possibilities for shifting the modal split towards inland navigation.

In cooperation with the NAIADES Dialogue a meeting on “High & Heavy transports” in the scope of Danube Business Talks 2014, with more than 140 participants from 100 companies and organizations in 16 countries, was designed to provide a platform for knowledge transfer through experts presentations as well as discussions between the participants regarding possibilities and challenges for IWT of high & heavy cargo.



Figure 15: NAIADES Dialogue meeting on “High & Heavy cargo”

The experts agreed that there are several strong arguments which undermine the suitability of inland waterway transports for high & heavy cargo. The advantages of IWT refer especially to challenges in terms of cargo dimensions and challenges in transport planning and realisation:

- Inland waterway vessels have large loading capacity
- Compared to road and rail transports inland vessels are barely limited in weight and dimensions
- No time restrictions during transport (no weekend driving ban, traffic jams, accidents , ..)
- No costly transit permits in international transport
- No complex route planning
- Almost no obstacles by traffic lights, tunnels, bridges
- Unique status in terms of cost efficiency boosts inland vessels potential for multi-modal concepts

On the other hand, experts from the high & heavy business pointed out that transport of high & heavy cargo was confronted with various challenges and that there are requirements which have to be met in order to strengthen

inland navigation in this business sector: In particular, improving and modernizing existing infrastructure along the entire Danube River (e.g. ramps in Serbia, storage areas for high & heavy products in ports, increased number of stationary equipment for transshipment of high & heavy) and creating a higher degree of predictability in planning for forwarding companies as well as for clients.

Besides the identified space of improvement in waterway transports, the participants agreed that this cargo faces various challenges in general:

- Degrading quality of infrastructure hampers the transport of high and heavy cargo by road or even by rail
- Especially road transport is dealing with permanent reduced loading weights and simultaneously higher costs for equipment, etc.
- Unpredictable costs for road examinations, bridge evaluations, transport escort, etc.
- Transport sector faces new challenges, because the size and weight of the transported goods are permanently increasing

The participants pointed out that the driving force was the high & heavy sector itself by creating demand in terms of tons transported. This would result in increased investments and degree of priority of infrastructure of local and regional decision-makers in the Member States. National as well as international investments projects were needed which would ensure steady and adequate modernisation and development of needed infrastructure.

The NAIADES Dialogue meeting on “**Transport of Renewable Resources and Biomass**” in the scope of Danube Business Talks gathered experts from the biomass and logistics sector at one spot in order to discuss and examine potential and challenges for a modal shift towards inland waterway transports of renewable resources.

The presenting specialists at the event elaborated the increasing importance of resources and biomass as well as requirements and obstacles for the intensified use of inland navigation. The rise in production and volumes of soybeans, wheat, maize as well as wood based products on global and regional scale imply efficient logistics infrastructure covering transport, transshipment and storage facilities. They highlighted that countries in the Middle and Lower Danube were particularly attractive as resource markets while target markets were located in Central and Western Europe.



Figure 16: NAIADES Dialogue meeting on “Transport of Renewable Resources and Biomass”

In order to facilitate competitive transports via waterway, it is important to ensure sufficient product quantities for particular transports. This can be ensured through bundling carried out by wholesalers or cooperation platforms.

Port facilities are essential in terms of adequate transshipment equipment for agricultural and forestry products like grabbers, clamps and pneumatic systems. Attention has to be paid to particular products which are at risk of being damaged during transshipment such as pellets: “Every handling of wood pellets degrades quality (fines, bulk density)”. For that reason efficient and careful handling and storage in ports including screening, large grabs, control of drop height is required. Despite of the dense transshipment network along the Danube, countries in the lower Danube show a need to expand the current conditions. Furthermore, storage capacities in ports and silos should be expanded.

Finally, the participants agreed that there are large volumes available to be shifted onto the Danube waterway, room for improvement was however identified in the field of infrastructure respectively waterway maintenance. In order to achieve IWT friendly fairway conditions national agencies e.g. waterway management companies, have to take action, prepare good projects and ensure co-financing. No country can depend on activities and financial aid from the European Commission without having in mind the limited funds of the EC and the principles of self-initiation.

The results of the report with a thematic focus on recycling products were also discussed at a regional meeting with 36 representatives recycling industry, shipping and forwarding companies, Danube ports and transshipment

operators came together in the Port of Enns (Austria) to discuss the potential of Danube navigation as adapted transport mode for recycling products.

The topic “**recycling products on inland waterways**” highly welcomed by the participants brought a high turnout. The event offered a neutral platform for knowledge and information exchange between the Danube logistics sector and the recycling business.



Figure 17: Meeting with stakeholder on „Recycling products“

The participants confirmed that the market segment was becoming increasingly important due to several reasons:

- Increasing global lack of resources and demand for secondary raw materials
- The high cost sensitivity of recycling products has led to an increase in pressure for the more cost-efficient planning and implementation of transportation
- Inland navigation, with its bulk transport capacity and consequently low costs, represents a suitable transport solution for the recycling sector.

These facts combined with the rising volume of secondary raw materials in the Danube riparian states, represent an important argument for transportation on inland waterway.

Experts, running companies in the recycling sector explained in their presentations that the connection to the Danube waterway was one of the decisive reasons for their companies settling their business locations in the close proximity of the Danube waterway and that there is still a lot of potential that should be used.

Following challenges for inland waterway transports of the recycling products scrap metal were identified by the experts:

- IWT are suitable mainly for iron scrap. Other high-valuable scrap metal types are faced with long collection periods for reaching an economic reasonable lot size.
- Shrinkage leads to difference in weight and consequently to financial disadvantages.
- The problematic short-term availability of barges hinders quick reactions to the market and presents concrete challenges for logistic providers

The participants explained that inland navigation should be strengthened as a transport mode for recycling products and that there are requirements which can be fulfilled through improvement of infrastructure and services.

- Increase storage capacities in ports
- Availability of suitable handling equipment
- Flexibility (availability of barges)
- Simplification of administration
- Introduction of “one-stop-shops”, which provide all relevant services from one source

This meeting offered the possibility to discuss identified challenges together, initiate approaches to solve existing obstacles and establish B2B contacts in this new and promising business segment.

4. RECOMMENDATIONS

Based on the results from the investigations conducted in SWP 1.1. recommendations for the increased promotion and usage of inland waterway transports on national, regional and EU level can be derived. The recommendations target inland waterway infrastructure as the absolute precondition for further development of inland waterway transports as well market related activities.

1. General requirements, barriers & preconditions

a. Ensure good navigation status and remove bottlenecks

The fulfilment of internationally defined parameters of the Danube fairway should be understood as a primary goal to be reached in every Danube country. The recommended minimum fairway parameters for the Danube are listed in the European Agreement on Main Inland Waterways of International Importance (AGN) of the United Nations Economic Commission for Europe. With regard to the fairway depths to be provided by waterway administrations, the AGN makes the following provisions: On waterways with fluctuating water levels the value of 2.5 meters minimum draught loaded of vessels should be reached or exceeded on 240 days on average per year. However, for upstream sections of natural rivers characterized by frequently fluctuating water levels due to weather conditions (e.g. on the Upper Danube), it is recommended to refer to a period of at least 300 days on average per year. Currently minimum fairway conditions cannot be guaranteed on some sections of Danube resulting partly from poor planning, partly from the lack of adequate maintenance equipment and finally from a lack of financial resources.

In the past years targeted initiatives have been launched in order to ensure sufficient fairway depth along the entire river, to coordinate maintenance activities and to receive commitment from national decision makers.

An essential step towards joint Danube infrastructure has been realized through the **Fairway Rehabilitation and Maintenance Master Plan** for the Danube and its navigable tributaries which has been developed in the framework of the EU Strategy for the Danube Region (EUSDR). It tackles all critical locations and the required short-term measures to ensure proper fairway rehabilitation and maintenance.

The Masterplan was accepted by the Ministers of Transports of Danube countries in December 2014 and contains concrete national measures to improve waterway maintenance in the management areas of monitoring, planning, implementation and provision of information. The aim is to achieve a common level of service for a variety of maintenance tasks. The measures will be implemented through specific roadmaps that are currently being worked out by the Danube states.

In order to translate the defined Masterplan steps, the EU financed project “**FAIRway**” was developed. The project ensures and provides assistance in the implementation of the national roadmaps through e.g. coordinated purchase of advanced equipment for hydrological services (gauging stations, surveying vessels etc.), realisation and evaluation of pilot activities in the field of coherent monitoring scheme for the navigation status, harmonised water level forecasts, etc.

The common understanding of the need for joint working programmes in the entire Danube Region led to the identification of bottlenecks and fields of action. Based on the results, correspondent steps were defined and a suitable instrument respect. project was developed in order to ensure financial and organisational assistance in their implementation. This approach which should be taken as standard for future activities ensures the sustainability of action plans, fulfilment of tasks through monitoring systems and an overall increased responsibility for Danube navigation.

b. Simplification and harmonisation of administrative processes for inland waterway transports

Shipping and Danube logistics companies emphasized that inflexible administrative processes and paperwork represent a crucial financial and time-consuming factor, causing significant competitive disadvantages for inland navigation and handicap the modal shift towards inland waterway transports.

The administrative bottlenecks can be summarized into three main areas: administrative bottlenecks related to customs clearance, controls of the border police and navigation surveillance. External EU-borders along the Danube are identified as the most challenging points regarding administrative procedures which were found to take long and consequently cause additional costs for operators.

In order to solve some administrative barriers for Danube navigation and to support modal shift more effectively, control authorities and shipping companies should enter a more intensive dialogue how control procedures can be implemented in a flexible and at the same effective way. In particular solutions in terms of quantity of required documents in different languages, non-transparent and time-consuming border revision procedures led to the

conclusion that steps towards simplification and harmonisation of national administrative processes have to be made.

It will be necessary to

- harmonize documents by finding a common understanding of required data
- create single multilingual documents
- introduce digital documents
- provide internet – based documents transmission options

A joint approach and understanding among control authorities for the necessity of modernisation and user friendliness has to be established in order to improve and design border revision forms which will no longer impede control procedures but will disburden inland navigation.

A harmonization of administrative procedures in all Danube countries should also be a mid-term objective in order to ensure seamless transport chains and a higher competitiveness compared to road and rail transport.

2. Targeted measures to facilitate market transfer

a. Neutral platforms for cooperation between Danube ports, shipping companies, forwarders and industry

Neutral platforms focusing on specific and promising market segments turned out very stimulative for inland navigation and are highly appreciated by the sector. Offering a framework for the development of cooperation possibilities, information and knowledge exchange for all players in Danube logistics is crucial for enhanced usage of waterways. Especially companies which produce, process and trade products suitable for inland waterway transports such as renewable resources, recycling products, etc. value the presentation of the possibilities, chances and strengths of inland navigation which they did not consider in the past, due to lack of beneficial information.

Existing players in Danube logistics use cooperation events for identifying synergies in business such as bundling of cargo to achieve optimum capacity utilization and reduce costs.

Cooperation platforms on national but also on international basis with thematic focus should be fostered for the promotion, positioning and raise of awareness of inland navigation.

b. Create and publish freely accessible information about inland navigation

Lack of information regarding Danube logistics are one of the mayor restraints for this mode of transports. Information regarding existing shipping and forwarding companies, ports services in terms of handling equipment, storage capacities, contacts, etc. should be published in a user friendly way and updated regularly. A unique platform with all relevant data for (potential) users of waterways at one spot should ensure a high qualitative and

transparent collection of information. In particular, this information is essential for the industry when searching and identifying transportation providers.

Furthermore, the up-to-date market information should be available for the Danube logistics sector. In that way, market trends can be used for the identification of new promising field of action for inland navigation. Market analysis for the Danube Region should be conducted on regular basis and attention should be drawn on new opportunities in the framework of targeted events with chosen participants. Cooperation and increase of inland waterway transports are the final goal and result of these activities.

c. Improvement of facilities in ports and transshipment sites along the Danube

Port infrastructure regarding transshipment equipment and storage capacities are identified as essential for the Danube logistics network. From the point of view of the shipping industry, Danube ports and transshipment sites shall be equipped with efficient infra- and superstructure. A ports' infrastructure is formed by quay walls, rail tracks and roads as well as other paved surfaces while the superstructure is built on the infrastructure and includes e.g. cranes, warehouses and office buildings.

The availability of adequate, cargo-specific handling and storage equipment at a certain location is therefore – in combination with the overall service quality provided in ports (opening hours, flexibility, etc.) - a crucial factor for the achievement of a modal shift towards inland waterway transport.

Missing port infrastructure/superstructure endangers the entire logistics chain as ports of origin or ports of destination become obsolete due to inadequate facilities such as loading hoppers, insufficient storage space, ramps, etc. but also missing connections to other modes of transport such as rail.

For that reason, port operators as well as national authorities are asked to improve port facilities and provide a satisfying and demand oriented service portfolio to inland navigation users.

In order to assist financially weak port operators and owners it is essential to offer co-financed project models. Particularly, downstream Danube ports face financial and structural difficulties with missing investments in infrastructure as a result.

In that sense, extension of national and international funding opportunities for port development should be fostered and improved.

d. Promoting the industrial locations in the vicinity of ports and terminals

The efficiency of inland navigation is faced with limitations if costs for pre- and end-haulage to the waterway are high. Experience shows that the actual distance to Danube ports is often a decisive factor for considering inland waterway transports or not. Consequently, stimulative measures should be defined in order to promote industrial locations in the vicinity of the Danube.

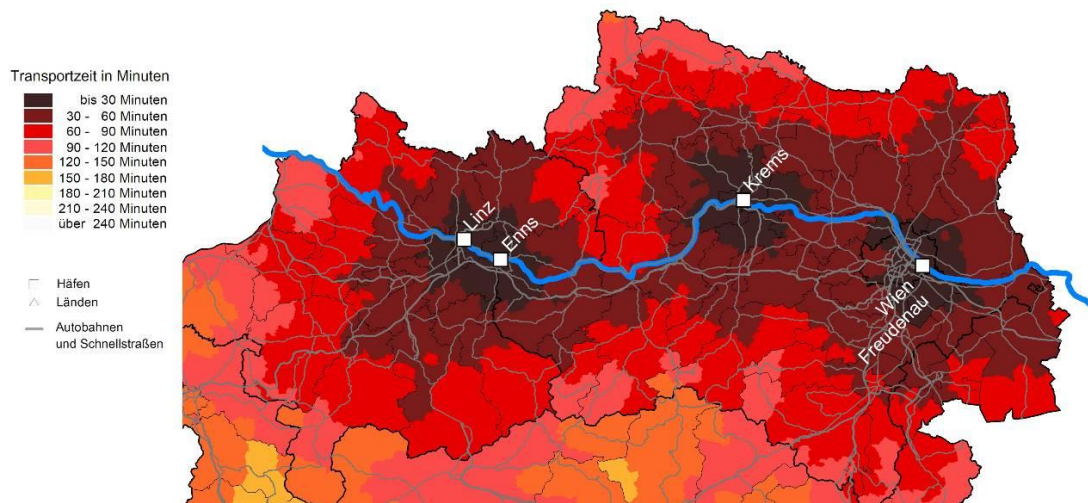
The identification of existing companies within the catchment area of the Danube ports and transshipment sites is essential as a first step for the identification of possible users of the Danube River. Not only existing business locations should be examined, monitored and directly approached, but current projects for establishments of new business locations in terms of production, processing and storage of cargo have to be integrated in the IWT promotion activities.

A qualified network of Danube logistics promotion centres, as “one-stop-shops” in Danube countries are requested to provide consulting and assistance to the industry from the initial planning phase of business locations followed by regular contact regarding Danube navigation. The adequate consulting provided by promotion centres postulates knowledge and customer orientation towards Danube navigation, which should be ensured through capacity building projects and knowledge transfer meetings among experienced Danube logistics promotion centres and new and/or less developed promotion centres.

Previous examinations of companies in the vicinity of the Danube River in Austria, as conducted within the INWAPO project, showed that the analysis and evaluation of business directories and other branch overviews is a complex work which requires a lot of time and external expertise due to the complexity of the field of investigation and in order to ensure high quality of the study.

Following steps should be considered in future studies:

- Determine the catchment area of the respective ports/transshipment sites by calculating the average transport time of trucks. The output should be illustrated on a map as shown in figure below (Accessibility of Public Danube Ports in Austria).



- The selection of a set of branches should be carried out on the basis of pre-defined criteria such as the characteristics of transported goods (size, volumes, etc.), the used types of transport (bulk, containers, RoRo, etc.) and the general affinity towards Danube navigation.

- If no data on the specific location of business and logistics sites is available, assign data on the employees in the industrial sector (labour force assigned to the place of work) according to the population census to the catchment areas. By processing this data a good overview of the industry structure in the catchment areas can be gained.
- By using professional business directories (yellow pages) and other market observation reports the employment data can be traced back to single companies including contact data and additional information on the companies' business portfolio.