



# EU Transport GHG: Routes to 2050?

## Annex to Task III Paper on the EU transport demand: Freight trends and forecasts

Riccardo Enei (ISIS)

January 2010 - DRAFT

Partners



The project is funded by the European Commission's Directorate-General Environment



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Reviewed by Ian Skinner (AEA)

Suggested citation: Enei R (2010) *Freight trends and forecasts* ISIS, paper produced as part of contract ENV.C.3/SER/2008/0053 between European Commission Directorate-General Environment and AEA Technology plc; see [www.eutransportghg2050.eu](http://www.eutransportghg2050.eu)

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# 1 Introduction

This paper is an Annex to the Task III Paper on “EU transport demand: Trends and drivers”, presented to the First Stakeholder Conference on March 27 2009 in Brussels and available on line at the project web site address <http://www.eustransportghg2050.eu/>

The reasons for an additional Annex paper are twofold:

1. the attempt to outline the future development of freight transport from a bottom-up perspective, i.e. providing a view of the likely developments focused by specific transport mode, geographical area, type of goods, etc, rather than analysing in details the factors affecting the future freight demand in general, as done in the main paper
2. the intention to provide a contribution to the Meeting 6 on “Transport Futures; Scenarios and visions”, designed to discuss, by the other things, future visions of long term development in freight transport.

The freight trends and forecasts outlined in this paper derive basically from the most likely continuation of existing trends, relying on the BAU scenarios sketching out by the application of the TRANS-TOOLS model to 2030<sup>1</sup>, projecting to 2050 the main trends under an “other things being equal” assumption. Therefore, the freight forecasts provided in this paper do not take in to account for extreme scenarios in economic development, world trade pace, population growth and other social/political background scenarios, e.g. insurgency or terrorism, lack of security, etc.

The structure of the paper is the following:

- Chapter 2 outlines the background assumptions behind the BAU scenario in the TRANS-TOOLS model and its main results
- Chapter 3 provides an overview of future freight trends by transport mode, on the basis of the background conditions described in the chapter 2
- Chapter 4 draws conclusions

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<sup>1</sup> The TRANS-TOOLS transport forecasts to 2030 have been analysed in the TEN CONNECT study (2009), elaborated and projected to 2050 in the TRANSvision study (2009). The TRANS-TOOLS forecasts have also been used in the FREIGHTVISION project (2009)

## 2 The BAU scenario

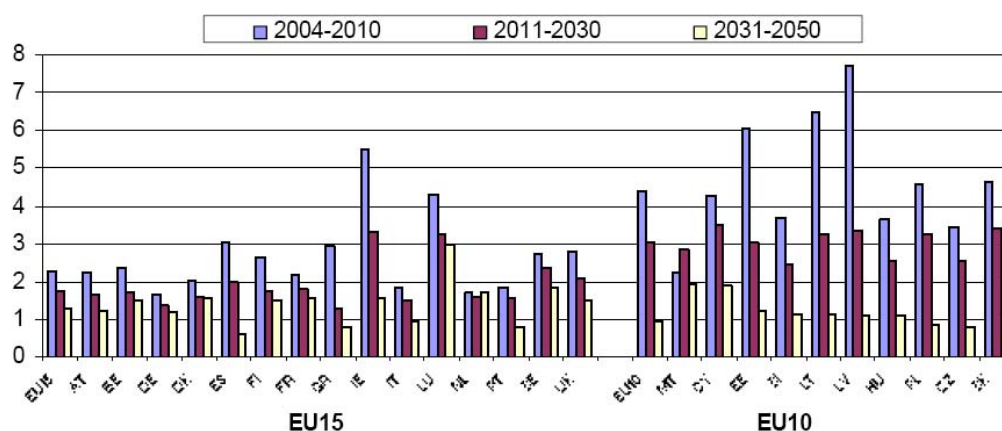
### 2.1 The TRANS-TOOLS assumptions

The review of drivers affecting volume and composition of transport demand carried out in the Task III Paper has identified a wide range of factors belonging to several interlinked domains: economy, energy, technology and society. With reference to the freight transport, the review has stressed that economic growth (including the pace of globalization and the related intensity of global trade), and fuel price, assumed as one of the main component of the transport costs, are important drivers behind freight transport growth.

The TRANS-TOOLS Baseline scenario looks at the above key drivers as follows:

**Economic growth.** The baseline scenario of economic development in Europe 27 to 2030 is based on the DG-ECFIN Note 253 of June 2006. The pattern suggests a fastest growth in the eastern part of Europe compared to the western part. There are in fact significant regional differences in the forecasts of GDP growth rates in Europe, to the extent that in the old member states (Germany, the Netherlands, Italy) the growth rates are slower compared to the Eastern European countries. The graph below shows that this pattern is going to continue up to 2050, in which in many countries, potential annual growth rates will have dropped to close to, or below, 1% during the period 2030 to 2050. Only a few small countries (LU, LV, CY, IE, LT, and EE) are projected to benefit of an average growth rate higher than 2.5%.

Figure 1: European GDP growth rate 2005-2050

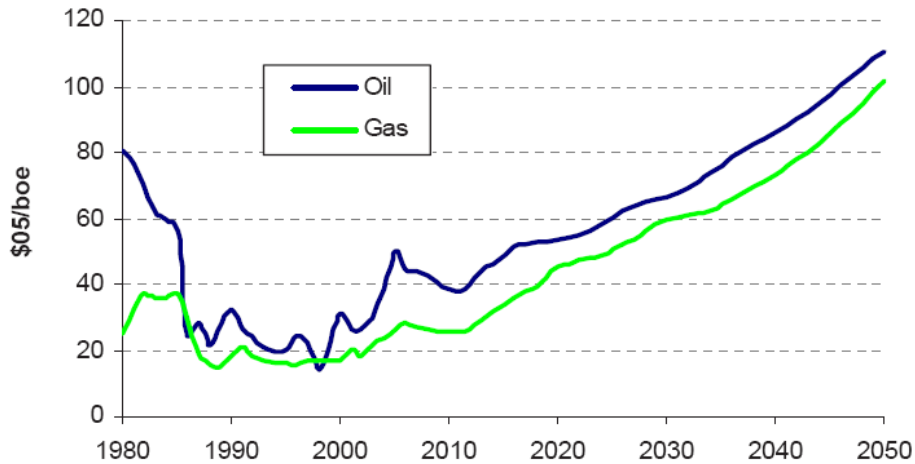


Source: EPC and European Commission (2005a)

Source: Economic Policy Committee and the European Commission (DG ECFIN), 2006

**Oil price.** In the TRANS-TOOLS baseline scenario (2005-2030), the oil price in 2030 is 20% higher than in 2005 in real prices. Price per barrel of oil, expressed in 2006 US\$ per barrel will be about 80€ on average from 2005-2030. However, a peak in oil price after 2025 is expected due to the increasing resource scarcity. In fact, according to the WETO –H2 Reference scenario (2006) , oil price per barrel could reach 110 \$ and 100 \$ per barrel for gas in 2050, as shown in the following picture.

Figure 2: Oil and gas price forecast (2050)



Source: WETO-H2 (2006)

Despite the likely increase of oil price in the long term, the impacts on freight transport costs and the related negative implications for freight transport demand are considered mild. This could happen for several reasons, generally depending on technological development:

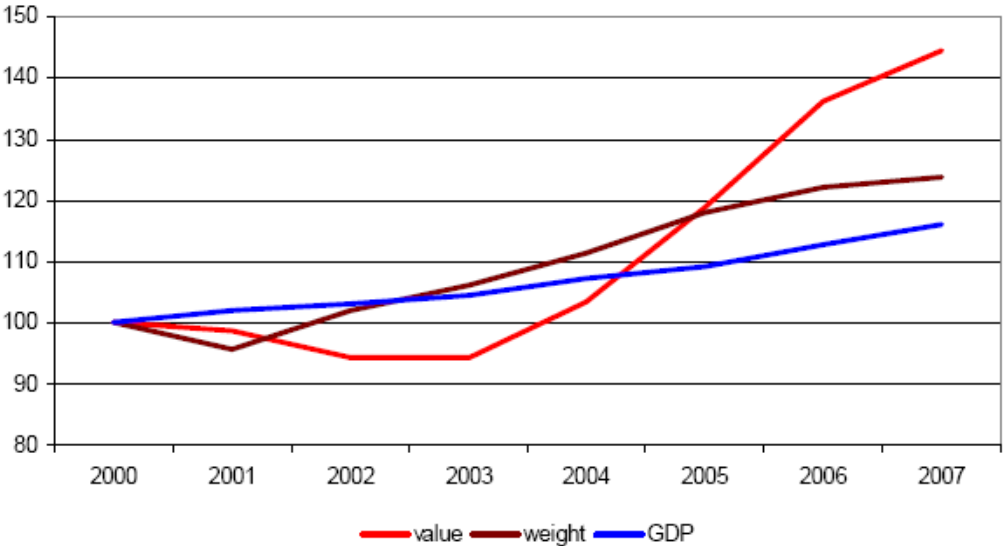
- Concerning **truck**, it should be considered that about 2/3 of the costs are time related and the rest can be considered as distance related. Considering the distance related costs, fuel costs make up about 1/3 to 1/2 of the distance based costs (TEN CONNECT, 2009). Therefore, also assuming an improvement of technological development and improved efficiency both in terms of better utilisation of the trucks and more efficient load planning, it can be concluded that distance costs for trucks increase with 4 % up to 2030 measured in fixed prices and something more up to 2050, due to higher oil prices, but not up to level reducing dramatically freight transport demand by truck.
- The same technological development will act positively for freight transport by **air**. It is expected in fact that efficiency improvements, as well as consolidation of the air transport business and introduction of less fuel consuming aircrafts could result in the same air fares in 2030 as in 2005 measured in real prices.
- Concerning **maritime** transport, not modelled as such in TRANS-TOOLS (freight flow between Europe and the rest of the world are estimated but not allocated to specific transport modes, even if it can be guessed that the vast majority of them is carried by ship), it can be assumed in the long term that maritime transport will be not the most sensitive to energy costs, given that it only uses 5% of the oil consumed by transport sector (ITF, 2009)
- **Inland Waterways** operating costs are considered in the long run to be not heavily affected by fuel prices

**Globalization** and the economic integration have an enormous effect on freight transport. The main paper has provided estimates of how the reduction of international trade due to the present economic downturn may affect freight demand, in particular for maritime transport. **However, the TRANS-TOOLS scenario to 2030 and the projection to 2050 assume that the globalization process in the long term perspective will be not arrested:** the decline in customs duties, containerisation and more reliable transport, the Internet, information and communication technologies will continue to exert their impact toward a general reduction of transport costs. Moreover, the reorganization of the global industrial landscape from the International Division of Labour to the International Division of Production Processes (ITF, 2009) will continue, implying the development of modular products, which can be broken down into independently constructed

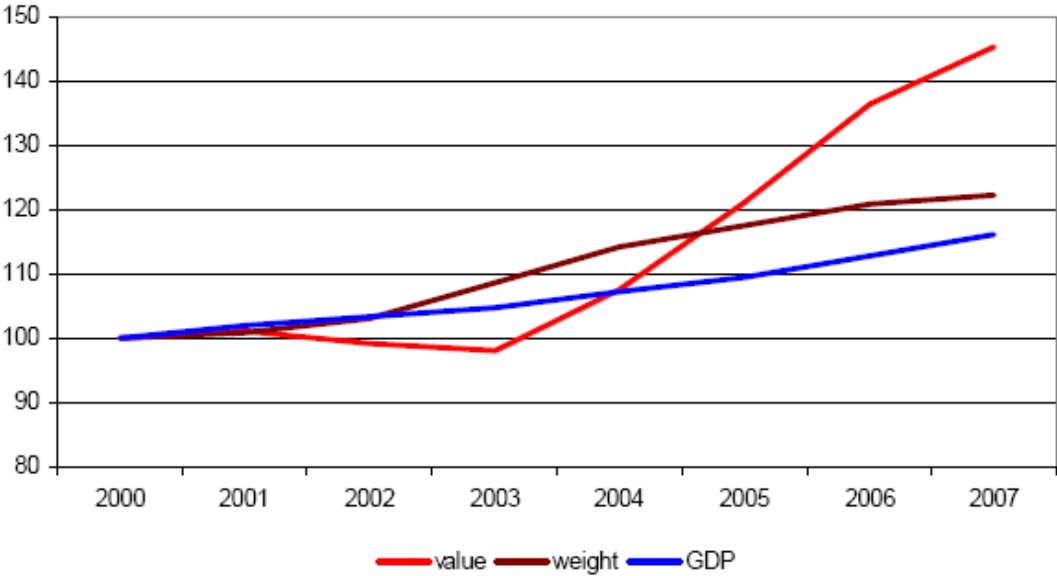
sub-assemblies, paving the way for the reorganisation of production processes on a global scale. This type of division can be assimilated to vertical division.

This process also changes the commodity structure and commodity composition of the European trade. A growing **value-to-weight** ratio and evolution compared to GDP growth in the European import and export external trade has been recorded over the past 10 years, as showed in the figure below (TRANSvisions, 2009):

**Figure 3: Value to weigh evolution of EU 27 Import external trade**



**Figure 4: Value to weigh evolution of EU 27 Export external trade**



Source: TRANSvisions ( 2009)

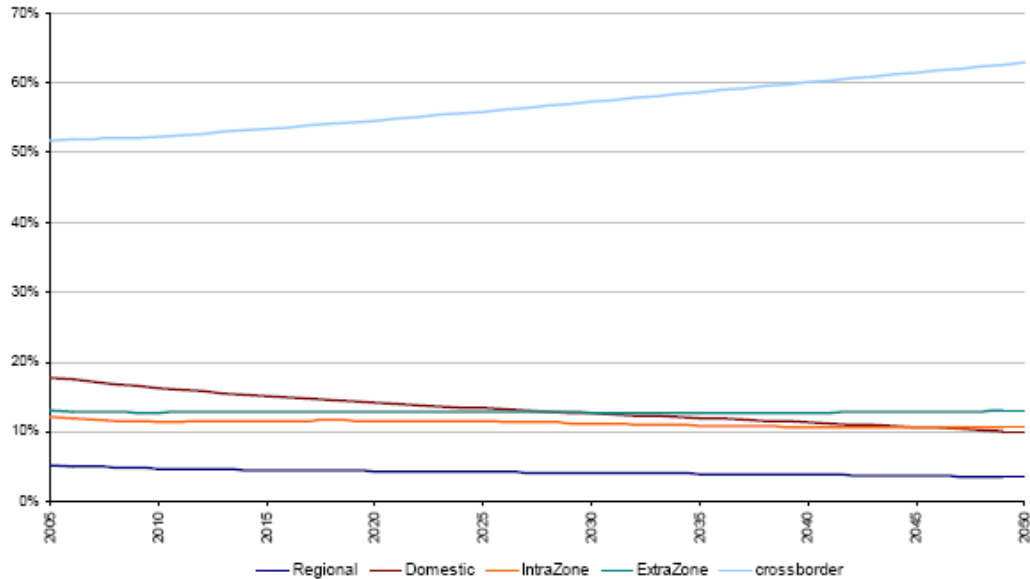
The growing value-to-weight ratio in freight transport leads to the consequence of a reduced importance of transport costs of the delivered price of good (low price elasticity), **leading to increasing switching to air cargo and maritime transport in a long term perspective.**

Summing up, the TRANS-TOOLS baseline assumes that freight transport in Europe will be spurred by globalization and new international production patterns (vertical integration and increase of value-to-weight ratios of traded goods), stressing the emergence of a global economy in which in the long run the notion of distance and nation could be not important. In such a context, there will be a European moderate economic growth on average (GDP at 2%), but with higher level in the Eastern countries.

## 2.2 Results

The resulting trends (2005-2050) of freight transport (including short sea shipping) by geographic distribution are the following (all transport modes included):

**Figure 5: Freight geographic distribution EU 27 (2005-2050)**



Source: TRANSvisions (2009)

The geographical distribution allows to identify two type of traffic:

1. **Short distance freight traffic**, classified in a) Domestic freight traffic: trips with origin and destination inside the same country b) the Regional freight traffic occurring inside the NUTS2 area; c) the Intra Intra-Zone freight traffic: trips with origin and destination inside the same macro zone: South (Portugal, Italy, Greece, Spain), North/Centre (rest of the EU-15), East (rest of the EU-27).
2. **Long distance freight traffic**, concerning: a) the ExtraZone traffic, involving trips with origin and destination in different macro zones and b) the Cross-border freight traffic, i.e. Extra-EU: trips with origin or destination outside the EU-27, in one of the neighbouring countries (EFTA, the Balkans, Russia, Byelorussia, Ukraine and Turkey).



The figure shows a growing trend of long distance trips, in particular overseas freight traffic, while the short distance trips, in particular domestic trips show a marked decreasing trend. The next chapter reviews how the different transport modes behave in such a context.

## 3 Freight scenarios by transport modes

### 3.1 Road transport

Road freight traffic by truck will not lose its importance. As shown in the table below, in terms of tonne km, the TRANS-TOOL forecasts to 2030 and the projections to 2050 show a limited reduction in the share of road freight transport at EU 27 level: from 46.5% to 40.3%.

Table 1: Shares by transport mode in billion tonne km (2005-2050) EU 27

	Bill tkm 2005	Bill tkm 2050
Road Intra NUTS	395	465
Road Inter NUTS	1316	2347
Rail	447	1222
Maritime	1525	2949
Total	3683	6983
% Road	46,5%	40,3%
% Rail	12,1%	17,5%
% Maritime	41,4%	42,2%
	100,0%	100,0%

Source: TRANSvisions (2009)

Furthermore, in terms of freight tonne-lifted, the truck mode accounts nowadays for about 73% of all freight transport movements, and despite its decreasing trend (it will be 67% in 2030), it is likely to be expected that road freight transport will be still relevant to 2050. The lifted tonnes, the so called handling factor (McKinnon, 2006), can be considered a crude measure of the number of links in a supply chain. The important role of truck stresses the limited degree of substitution with other modes, also in consideration of the fact that 85% of road transport is less than 150km, with no viable alternative (J.Lacny, 2009).

By type of commodity, mineral and solid fuels will be the most important items carried by road (domestic market). The geographical growth much depends on the GDP forecast. Future developments in tonne-km are in fact strongly correlated with the GDP growth. This explains the higher truck transport growth in the Eastern European countries: Romania, Latvia, Poland, Bulgaria and the Slovak republic. Where the domestic freight transport is projected to fall, as in Denmark and Germany, a reduction in tonne km by road is likely to happen.

In fact, according to the TRANS-TOOLS projections in the European central and northern regions, domestic freight traffic will remain stable, decoupled from economic growth, while traffic originated or having a destination outside the EU-27 is projected to grow faster than the economy.

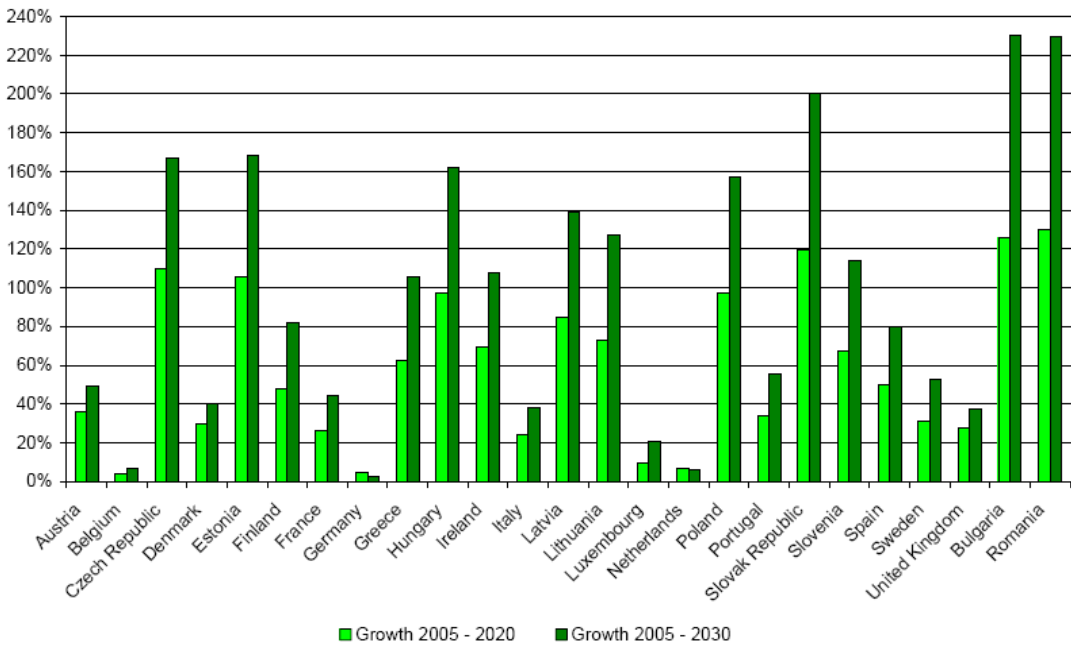
### 3.2 Rail transport

The TRANS-TOOLS projections for rail freight transport are positive. Rail freight transport in fact increases its share from 12% in 2005 to 14% in 2030 to 17% in 2050. The growth in long distance transport is the key factor behind the good performance of rail freight.

The TRANS-TOOLS projections points out that in the long term, rail freight may grow because of the high growth of goods imported and exported overseas. Rail is in fact expected to be competitive for overseas traffic moving from/to large ports and main consumption centres.

In terms of geographical distribution, Bulgaria and Romania are estimated to show an increase more than 200% in 2030.

Figure 6: Growth in tonne km by rail (2005-2020 and 2020-2030)



Source: TEN CONNECT (2009)

By type of commodity, bulk products, building material, chemicals and metal product will be the type of goods showing the higher increase by rail. Furthermore, in 2030 the rail freight transport to and from Russia is expected to growth by 135%. Similar high growth rates are expected in the Baltic countries.

### 3.3 Maritime transport

Maritime and Short Sea Shipping freight transport are projected to grow at high rates in Europe. The TRANS-TOOLS forecasts to 2030 and the projections to 2050 show a growth rate in billion tonne km by about 100% for SSS (compared to the 2005 level) and about 150% for overseas transport, as shown in the table below.

**Table 2: Maritime and SSS growth rate 2005-2020-2030-2050 EU 27 (Bil tonn km)**

	2005	2020	2030	2050
Sea freight including SSS	1525	2223	2645	2949
% var.	100	45,8%	73,4%	93,4%
Sea freight outside Europe	52022	75309	91820	129104
% var	100	44,8%	76,5%	148,2%

Source: *TRANSvisions (2009)*

The reasons behind the high growth rates are manifold:

- technological reasons: it is supposed that short-sea shipping and feederling will be increasingly efficient as inland transport becomes more congested, or there is no alternative dedicated rail service available
- economic reasons: as stressed by Hummels (2009), the growth of the ratio value-to-weight of the goods transport, i.e. the unit of the value of the goods transport is increasing, makes the transportation costs by maritime (and air) less important in terms of impacts on the final good delivered to the consumers
- globalization trends, which rely essentially on maritime transport and that, in particular for the Centre-North Europe, will determine the increase of the average distance against the domestic traffic (the opposite will happen in the European South –East countries), meaning an increase in overseas imports and exports.

Furthermore, the projected growth rates are going to be supplied by massive infrastructure investments, as stressed in the TEN CONNECT (2009), for which “massive container terminal extension plans will add additional capacity of 43 million TEU in the North Range, 31 million TEU in the Mediterranean and the Black Sea and another 9 million TEU in the UK until 2020”. This will make the capacity of the EU containers Ports sufficient to meet the demand.

### 3.4 Air transport

Air freight transport demand at world level has been growing at an average annual rate by 5.8% since 1978 (Boeing, 2008). In a future scenario characterised by a moderate economic growth and the continuation of the current globalization trends, a 5.4 percent average annual growth in air cargo traffic may be estimated in the long term. This would imply that air traffic will double in 15 years, and more than triple in 25 years (Tae Hoon OUM, et al, 2009).

In Europe, the analysis carried out by Hummels (2009) based on past trends over the 2000-2007 period of the shows that in 2007, airborne EU 27 imports from other countries non EU (in value) were 18.1 percent of the total, compared to 25.1 percent in 2000. In contrast, seaborne imports were 50.3 percent of the import value, with a growing trend compared to 2000 (41.5). This means that in this period airborne imports rose only slightly while seaborne import values rose 75 percent. Data show that there is a great variance across countries in their reliance on air-borne v. ocean-borne shipments, for example, as landlocked countries heavily use airborne shipments.

A similar trend is shown for export value. Exports are less likely to use air (25.1 percent in 2007; against 31 percent in 2000).

However, data show that airborne exports are especially important for the UK and Ireland. This likely reflects commodity composition (e.g. the prevalence of electronics and pharmaceuticals in Irish exports). This can lead to the interesting conclusion that richer countries are also more likely to use airborne shipments.

The future growth of air freight transport will be determined by:

- Positively: economic growth rate and growing globalization rates (the reduction in weight/value ratio make convenient to shift to air shipping)
- Negatively: Oil rising prices (past trends show that the elasticity of transportation costs to rising oil price is higher for air than for maritime shipping)

### **3.5 Inland waterways transport**

The TRANS-TOOLS growth rates of inland waterways are slightly below the truck growth rates (in tonn km): 27% between 2005 and 2020 and 39% between 2005 and 2030, corresponding to an annual growth rate of 1.5%.

Belgium, France, Germany and the Netherlands show continuous grow rates, following the general increase of freight transport.

The type of commodity involved are metal product and solid fuels (domestic market) and metal product and manufactured articles (international trade).

## 4 Conclusions

The long term trends shaping the TRANS-TOOLS forecasts and projections to 2050 at EU 27 level are the following:

**Moderate economic growth:** The average annual GDP growth rate by 2% at EU 27 level is assumed. However, significant differences at regional and national level are expected, with relative higher growth rates in Eastern and Baltic countries. Due to the strong relationships between GDP growth and road freight transport, a corresponding higher growth rates in these countries is to be expected.

**Oil price will continue to rise:** However, the growing trend of oil prices, in particular over the 2030-2050 period is not going to reduce significantly the freight transport growth. This is due mainly to technological improvements: the energy consumption by road oil-based transport will drop by 19% to 2050, in addition to load factors improvements due to the application of new technologies in freight logistic, allowing the reduction of the impacts of higher oil prices on transport costs. Maritime transport has shown a low elasticity of traffic growth to higher oil prices, while rising fuel prices could undermine the relative price of air cargo.

**Globalization and international trade will not be subjected to radical changes.** It is likely to be expected that China will rely less on export-led growth patterns, while, at the same time, US trade deficits could be adjusted in the long term. However, the integration of the world economy should not be undermined and the European international trade should continue to grow at higher rates compared to the intra European transport.

The implications of these trends in terms of where freight transport will be directed, what type of goods will be involved and how they will be carried, are the following:

### Where

The evolution of freight demand will be different geographically. In the EU central and northern regions, domestic freight traffic will remain stable, decoupled from economic growth, while traffic originating or having a destination outside the EU-27 will grow faster than the economy. Besides, if measured in value instead of weight, foreign trade is increasing in terms of value, and the proportion of international traffic will be higher in the European North/Centre zones.

To 2030, the European Eastern countries are expected to have the biggest increase of freight transport (4.3% ton-km per year), while the South will grow less (1.58% per year) and the North/Centre even loses some traffic, -0.3% per year. Freight transport between the zones increases most from/to the eastern countries to the rest, with the East-South exchanges growing at 4.1% per year and East-North/Centre growing at 3.3% per year. The South-North/Centre relation grows at a more modest rate of 1.1% per year. Freight traffic with neighbouring countries grows most in the eastern countries at a rate of 4.1% per year. In the South this rate is 2.7% and in the North/Centre 2.3%. To 2050, the projections of the above trends should continue, even if with higher uncertainties.

### What

While freight transport for shorter distances will be dominated by minerals and building material, for longer distances, it will be more mixed with machinery and other manufacturing, especially for the more industrialised zones. Crude oil, oil derivatives and to a lesser extent solid mineral fuels will be also important in the long distances.

Total motorised freight transport with origin or destination in the EU-27 (measured in ton-kilometres) will keep growing, following previous patterns, but the elasticity to GDP will change

largely in relation to the type of products and the type of movement considered. When only considering freight with origin and destination within EU-27 territory, the growth rate could be very low in average for all products, less than 1.2% per year. The addition of freight with origin or destination in EU-27 neighbouring countries (except northern Africa) increases the growth rate to 2.25% per year, mainly due to the great amount of oil, coal and other fuels moved by sea mode coming from Norway and Russia.

## How

The following table summarises the long term projections by transport mode:

**Table 3: Projections of freight transport annual variation growth rates by mode (2005-2050)**

	2005	2020	2030	2050
P.a % Freight traffic	-	2,0%	1,9%	1,4%
P.a % Road Freight traffic IntraNUTS2	-	0,2%	0,6%	0,4%
P.a % Road Freight traffic InterNUTS2	-	1,5%	1,7%	1,3%
P.a % Rail Freight traffic InterNUTS2	-	2,5%	2,3%	2,3%
P.a % Maritime Freight traffic EU 27	-	2,5%	2,2%	1,5%
P.a % Maritime Freight traffic overseas	-	2,5%	2,2%	2,0%
Freight rail share long distance	25,3%	28,0%	28,6%	34,2%

Source: *TRANSvisions (2009)*

The table shows that in the long term, rail freight and maritime transport are expected to grow at higher rates than road transport, due to the high growth of goods imported and exported overseas and among the European Inter zones traffic. External trade is expected to increase significantly, so there is a good chance for rail as the loads will tend to concentrate in ever fewer points, such as main ports, to gain share by connecting these freight terminals. In congested corridors linked to large industrial centres and ports, freight train services will also tend to be provided through dedicated lines in the long term.

The picture should be completed with airborne cargo forecasts, projected to grow but at the same time the one with the fastest increase in volume.

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