freightvision

Freight Transport FORESIGHT 2050

Management Summary I on Policy, Technology & External Factors

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freightvision
Freight Transport FORESIGHT 2050

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TABLE OF CONTENTS

INTRODUCTION

"... the point of establishing the Forum is to get a common understanding about shaping the future..."

"FREIGHTVISION's holistic approach integrates all aspects of the problem..."

"FREIGHTVISION's objective is to develop a long-term vision and robust and adaptive actions plan both for transport and technology policy..."

INTRODUCTION

FREIGHTVISION started half a year ago, with the intention to develop a vision and roadmap for long distance freight transport and technology policy in a forward looking process and at a time horizon of 2050. This first management summary shall introduce the most relevant key drivers and trends for long distance freight transport in Europe from different viewpoints.

The viewpoints are:

- European policy
- National policies
- Key demonstration projects
- Infrastructure technologies & ITS
- Engine technologies
- Logistics technologies
- Socio-graphic and economic trends
- Transport demand and congestion
- Logistics trends
- Emission trends
- Energy trends

For each of these areas a report has been developed, which is available to you as a stakeholder in the FREIGHTVISION Foresight process from our website.

Intention of this management summary

The intention of this management summary is to sum up the main results of the reports provided by the FREIGHTVISION Project Partners, in order to ***serve as a common basis for discussion at the 1st FREIGHTVISION Forum***.

In this summary the results of each report have been reduced to two pages. It addresses the following two questions:

- ***What are the key drivers in an area?***

  "Key drivers" mean the key impact factors, which trigger and shape the development in an area.

- ***What are the trends in this area?***

  "Trends" mean what is the most likely future of important aspects of this area, if we go on like in the past, but take into account the policy measures already defined at present.

Of course on two pages it is not possible to provide deep insights into a specific area, but the two pages can help to give an impulse for the discussion groups to be set up in the Forum.

Goals of the 1st Forum

The 1st Forum aims to achieve a common understanding of drivers and trends in all of the relevant areas and a shared view of the participants on the most important impact factors affecting the freight transport system in Europe over the next 40 years.

INTRODUCTION

This common understanding will be important for the succeeding project phases as they build an input to the preparatory work of the project team for the 2nd Forum and all other further steps in the process.

The second aim of the Forum is to develop a common understanding of the interdependence of the impact factors identified for the different areas taking into account the long term perspective.

To do so, viewpoints will be integrated by combining the identified impact factors to chains of arguments (storylines) that will result in scenarios for the challenges freight transport system will be facing over the next 40 years.

The challenges, for which three(trend, higher than trend & lower than trend) possible futures will be developed are:

- GHG emission
- Dependence on fossil fuels
- Accidents
- Congestion

Your contributions are most appreciated

You are a stakeholder and/or a specialist in one or more of the areas we will be discussing.

We invite you to participate and share your knowledge in a process that intends to address shaping the future of freight transport from the point of view of transport and technology policy.

In the areas you are particularly interested in, your contribution will help to improve the results of the Foresight process.

Your active involvement will also provide legitimacy to a vision and action plan for present day policy making.

We hope that this summary will be a sound basis and starting point for a fruitful work at the Forum.

Looking forward meeting you

Stephan Helmreich
Project Coordinator

EUROPEAN POLICY

EUROPEAN POLICY

"... the chief function of the EU transport policies is to provide a common guidance for national policies for maintaining coherence among the whole EU."

As countries' geological, economic and political structures differ largely, an applicable common transport policy is almost impossible. Additionally, reducing to a common denominator for the whole EU may be quite inefficient. However the chief function of the EU transport policies is to provide a common guidance for national policies in order to maintain coherence among the whole EU.

The EU has recently confirmed its 20-20-20 strategy: to reduce its overall emissions to at least 20% below 1990 levels by 2020, to increase energy efficiency by 20% and to increase the share of renewables in energy use to 20% by 2020. Emissions from sectors not included in the EU Emissions Trading Scheme, including transport, will be cut by 10% from 2005 levels by 2020. This has mostly shaped the EU policies relevant for LDFT. TEN-T infrastructure program and Marco Polo II are the key ones.

"For transport, the efforts have been made especially for modal shift, i.e., moving freight off the road and for the use of alternative fuels."

It must be noted that most of the EU policies have a limited time horizon. Climate change policies' targets go up to 2020, but the rest of the policies' targets are usually set for 2010-2015.

Key Drivers

Increasing openness of the Member states, the ***EU enlargement*** and the ambitious ***Lisbon Strategy*** to be "the most dynamic and competitive knowledge-based economy in the world capable of sustainable economic growth with ... respect for the environment by 2010" can be recognized as the three main drivers of most of the EU policies. Following this, ***environmental sustainability*** and ***efficiency*** have become priorities in the transport sector.

Reducing dependency on road for freight transport is the main driver of the EU policies relevant to LDFT.
Specific drivers that the Project is concerned are:

- The ***costs of accidents amounted to 2.5 of the EU's GDP*** in 2001. At the present rate, road fatalities are likely to stand at 32,500 in 2010.
- By 2020, road freight transport is expected to increase even more. Currently, ***congestion costs around 1.1% of EU GDP /year.***
- *The* ***Energy dependency*** of the EU was 54% in 2006, which is expected to ***reach 70% by 2030***. Transport accounts for 67% of the final demand for oil (nearly all dependent).
- ***Emissions: Transport*** is responsible for more than ***one fifth of greenhouse gas emissions***.

Trends

Due to increasing environmental threats of road transport, the efforts have been made especially for ***modal shift*** in transport, i.e., moving freight off the road and for the use of alternative fuels.

Infrastructure financing is an important trend in European policies relevant for LDFT. The attempts to extend the use of ***road charging to heavy good vehicles***, which are

mainly used for LDFT, is also a key trend to achieve a modal shift in freight transport for sustainability. Furthermore, ***legislations on alternative fuel*** uses are becoming accepted.

The policies are also inclined to achieve ***standardization of vehicles and their emission limits***, the use of ***technology in LDFT communication*** and ***simplifying administrative processes***.

In terms of safety, the emphasis has been on ***road safety measures*** due to increasing road fatalities. However, not much has been done so far.

R. Jorna, H. Zuiver, D. Bonilla, N. Akyelken

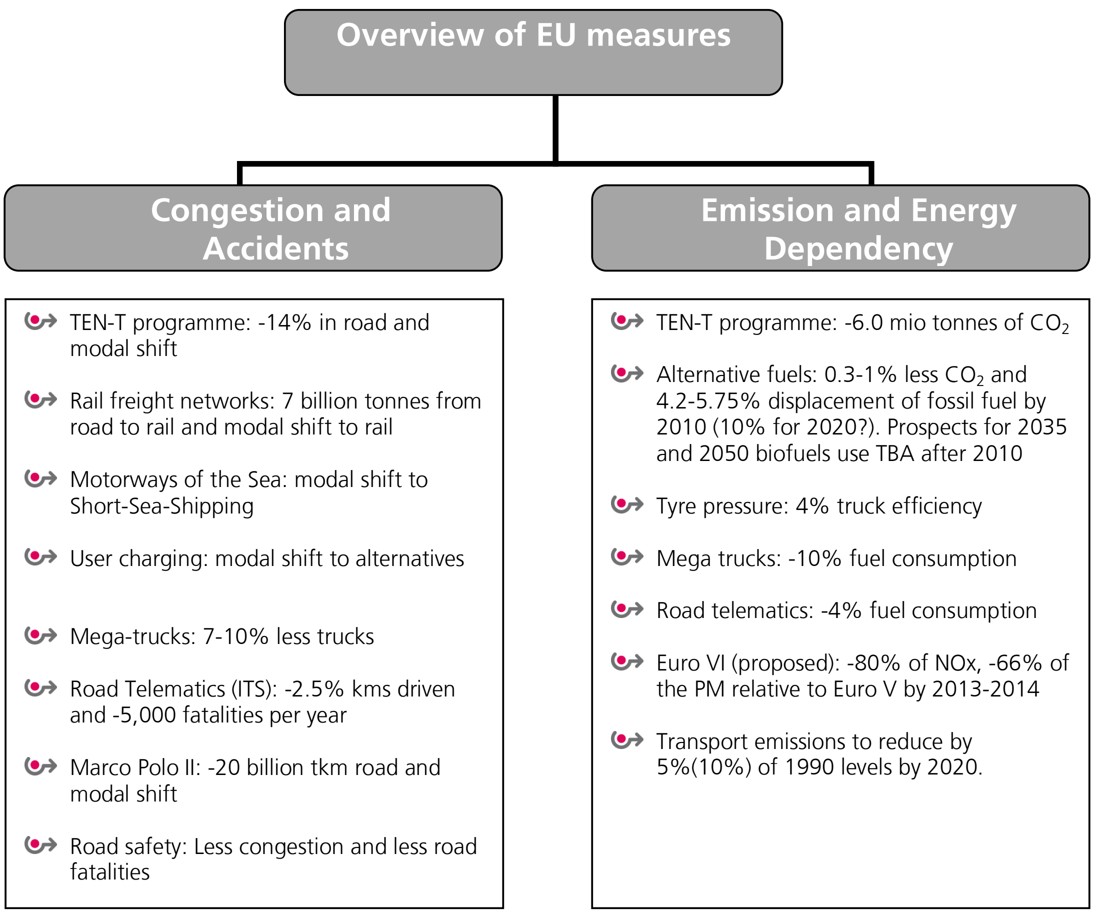


Figure 1: Overview EU measures

> *"The change from forced modal-shift (stimulating alternatives for road transport) to co-modality (using the most efficient transport mode) is widely accepted across Europe."*

> *"Policies influencing long distance freight transport focus on strengthening the competitive position and the national economy of individualal Member States."*

NATIONAL POLICIES

The national transport policies focus on reliable, safe and sustainable freight transport, while maintaining the quality of life.

However due to the different geographic, economic and financial situation, national policies' key drivers and trends differ between Member States. Countries with a high economic dependence on international trade (e.g. Denmark, Netherlands, Italy and Spain) have a different focus than countries in environmentally sensitive areas in the centre of Europe (e.g. Austria).

Old member states with high congestion (e.g. Netherlands, UK, France, and Germany) also have a different focus than new Member States with relatively low congestions (e.g. Slovakia, Romania, Bulgaria). And last but not least, different infrastructure availabilities and financial capabilities have impacts on national policies.

Key Drivers

- ***International competitive situation***: Member Stated strive to strengthen their international competitive position as much as possible. A ***smooth transport system*** and ***accessible mainports*** are considered an indispensable precondition for economic and
- ***Infrastructure financing***: Due to budgetary restrictions Member States have to find new ways for financing their infrastructure.
- ***Emissions***: in order to meet EU directives on air quality – and not risk penalties – Member States must reduce emission levels.

Trends

Probably the most important trend in the Member States is to improve the ***efficiency of every mode***. Every mode of transport is required to handle the expected growth of freight transport in the coming years and to reduce road congestion. National polices therefore focus on ***smooth functioning transport networks, in which road, rail, sea and inland waterways are all included***.

The second strong trend is to ***promote rail and inland navigation as alternatives for road transport***. Investments in rail and inland waterway infrastructure should lead to larger market shares, thereby reducing road congestion and limiting the negatives impacts of transport.

The third trend is ***toll charges***. Many countries already have a form of road pricing for heavy goods vehicles in the form of (electronic) toll collection or a vignette. The reasons behind this measure differ per country (funding of new infrastructure, tackling the negative effects of traffic, improving

social development and accessibility). In The Netherlands, Denmark and the Slovak Republic road pricing will be implemented in the near future, while in other countries this is not the case.

Promotion of sustainable transport is the final trend. While most Member States aim to constitute 5.75% of fuel use for land transport in 2010 and 10% in 2020 (in line with EU policy).

K. Krusina, H.Zuiver, J. Düh

Overview of national measures on LDFT

Congestion and Accidents

- New road link between Denmark and Germany: +1300 trucks per day from 2018
- Introduction road pricing in the Netherlands, Slovakia and Denmark: 4-16+% less private vehicles in NL
- New rail infrastructure: Betuwelijn (NL) 40 million tonnes of cargo per 2012
- New IWT infrastructure: Volume +100% in Austria by 2015, +15% in UK
- Promotion of intermodal traffic across the EU- shift away from road: 100-300 million tonnes in DE. Intermodal traffic Slovakia +400% by 2020
- Less congestion and less road fatalities due to common measures and freight specific measures

Emission and Energy Dependency

- 15-40% less energy consumption and emissions
- Environmental zones: -30% diesel particles in urban areas
- Alternative fuels: 5.75% displacement of fossil fuel by 2010. Ireland 30% by 2015
- Promotion of second generation biofuels in Germany and the Netherlands
- Green house gas emission: financial assistance in Germany for purchasing cleaner and quieter HGV's

Figure 2: Overview of national measures

KEY DEMONSTRATION PROJECTS

"... focus on different equipment and measures for reduction of fuel consumption and the number of accidents..."

"... investments in reduction of different infrastructural and other bottlenecks, international coordination and cooperation between different stakeholders..."

KEY DEMONSTRATION PROJECTS

There are a large number of key demonstration projects on national and regional level that as pilot projects through dissemination, investments and different measures could be implemented also on national, regional or EU-level.
This report selected and described a number of pilot projects for road transport, short sea shipping, inland waterway transport, intermodal and rail transport.

Key Drivers

Key drivers for road are the focus on different equipment and measures for ***reduction of fuel consumption and reduction of the number of accidents*** with trucks involved as well as introduction of ***modular-haulage for optimisation and reduction of the number of trucks*** on the European roads.

Key drivers for short sea shipping and inland waterway transport are shifting from road transport and innovative measures as double-stacking units on-board, innovative and optimised logistics and operational systems.

For intermodal and rail transport the ***shift from road onto rail*** is essential and key drivers are ***investments in reductions of different infrastructural and other bottlenecks, international coordination and cooperation*** between different stakeholders in the intermodal transport chain.

Trends

The measures to reduce energy consumption are

- ***eco-driving*** (10-14%),
- ***aerodynamic adjustments*** of spoilers etc. (10%)
- ***tyre profiles and tyre pressure*** (5-7%), and hereby it is expected to reduce fuel consumption with 10-20% overall within the coming years.

The figures are estimates of maximum output for the specific measures on an individual basis, whereas an overall reduction of some 10% is expected in the coming years.

With ***modular haulage (25,25 m vehicle combinations)*** introduced throughout larger parts of Europe, less vehicles would be needed, the transport work would increase 1%, whereas the vehicle-km are reduced by 12,9% hereby giving positive effects for both safety and emission, and probably also for congestion through the reduced number of trucks.

For short sea shipping (SSS) the Motorways of the Sea (MoS) projects aim at shifting road volumes to ship and innovative measures as for example ***double-stacking 45' units*** will lead to more than 50% reduction of CO_2-emissions and energy consumption by more than 50% on the Zeebrugge-Esbjerg route. Further MoS projects throughout Europe are expected to shift volumes from road to SSS, thereby reducing the number of trucks on the congested European roads and reducing energy consumption.

KEY DEMONSTRATION PROJECTS

The inland waterways also have sufficient capacity for shifting road volumes and through innovative techniques for example some 185,000 truck rides can be avoided through the Waterslag project.

The combined transports (CT), i.e. rail on the long stretch and road for the local transport have further large potential for shifting road volumes. Through implementing measures proposed in the DIOMIS project as regards making the infrastructure more efficient, more infrastructure investments and international coordination, the ***unaccompanied CT*** will increase in volume by 113% to 268 million tonnes in 2015, (compared to 2005), and hereby reduce the energy consumption by 29% in the whole transport chain for these transports. At the same time the CO_2-emissions are reduced by 55% for these intermodal transport chains.

H. Kyster-Hansen, M. Henriques,
H. Zuiver, H. Rosič, G. Bauer, V. Malinovski

INFRASTRUCTURE TECHNOLOGIES & ITS

"... Technologies help to optimise the transport process."

"... an overall view that takes all transport modes into account is needed to tackle the future problems of freight transport."

INFRASTRUCTURE TECHNOLOGIES & ITS

Main objective of Intelligent transport systems (ITS) and infrastructure technologies is to shape and use infrastructure in a safer, more intelligent and more efficient way. The main infrastructure technologies are
Road:

- Traffic control with VMS and Temporary Hard Shoulder Running
- Pre- and On-trip Information
- Collision Avoidance
- Automated Platooning

Rail (and Road-Rail CT):

- Rail freight corridors
- ETCS/ERTMS
- Integrated Information Platforms
- Reduction of noise emissions

Short-sea shipping & inland navigation:

- River information systems
- X-gate Vessel tracking

Key Drivers

The key drivers for implementation of these systems are

- ***Efficiency***
- ***Accidents***
- ***Congestion***

Trends

Road:

- ***ITS services*** are currently widespread and future dissemination will grow, in the vehicles as well as on ***risky parts*** (congestion/ accidents/ bad weather) ***of motorways***. Up to 2050 the ITS services Traffic Control with VMS and Temporary Hard Shoulder Running are expected to be implemented wherever they are able to improve the road transport problems.

- Also ***Pre- and On-trip Information and Collision Avoidance Systems*** will be diffused to almost maximum levels.

- Merely for the potential launch of ***Automated Platooning*** further efforts and clarifications are needed.

- Also development is required regarding ***standardisation of data and interfaces***, further development of ***data transmission technologies*** (e.g. C2C and C2I) and improvement of ***traffic detection*** and ***weather conditions***.

INFRASTRUCTURE TECHNOLOGIES & ITS

Rail:

- In the Rail sector necessary measures such as the ***upgrade of current existing conventional freight networks***,
- the ***construction of new rail freight corridors***,
- ***the upgrade of infrastructure for longer and heavier trains*** and
- the ***implementation of advanced technologies for interoperability*** (e.g. ETCS/ERTMS) and for noise reduction (e.g. new kinds of brakes).

These trends are also supported by the EC.

Short Sea Shipping & Inland Navigation:

- Short Sea Shipping will be improved by the ***enhancement of ports*** and
- the ***implementation of new technologies for vessels (e.g. RIS) and the management of cargo***.

Road-Rail combined transport:

- Road-Rail Combined Transport (CT) is recognised as being the most dynamic market for freight transport in Europe. A transfer of loading units from road transport or in many cases maritime to road-rail CT diminishes the emission of pollutants and energy consumption. Improvements in this sector are needed regarding the ***implementation of intelligent transport technologies which allow faster, more cost-effective and reliable intermodal services.***
- The use of ***new transshipment techniques on the current infrastructure***,
- ***the upgrade of existing terminals***, or even
- the ***construction of a new generation of terminals*** might be the perspectives in CT

A.-C. Böhmann, E. Feyen, B. Hamisch, C. Heinrich, S. Leonhardt, V. Malinowski, F. Panse

ENGINE TECHNOLOGIES

ENGINE TECHNOLOGIES

The analysis provides an overview of engine and vehicle technologies as well as transport fuels implemented for freight transport and relevant to improve fuel economy and reduce GHG emissions.

The relevance of each mode for freight transport in Europe is shown in the first figure below; road and water ways have the highest share with almost 40% each.

An important aspect regarding different modalities is their relative performance regarding energy efficiency shown in the second figure below; modalities with big capacities are normally also the ones with the highest energy efficiency.

The main findings of the report are:

- ***Deployment of very efficient diesel propulsion systems running partly on biofuels seems to be the most likely development.***
- Use of electric locomotives is supported by ***growing share of electrification in rail network*** (increase from 42 % to 51 % from 1992 to 2007).
- ***Deployment of propulsion systems relying on batteries or fuel cells appears to be unlikely in long-haul freight transport.*** This would be possible only if major obstacles are overcome (e.g. low energy density, infrastructure, low durability).

Key Drivers

The main key drivers for the introduction of alternative technologies are

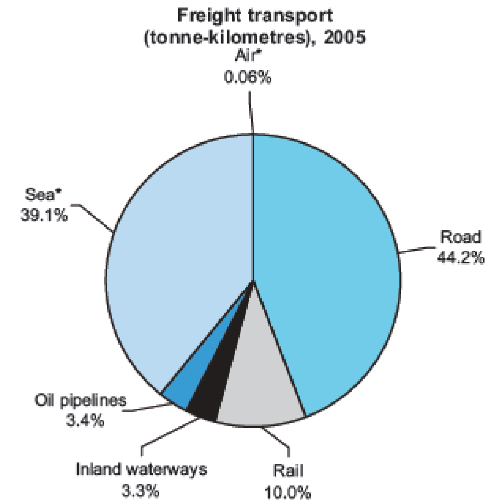
- ***environmental policies*** and
- ***energy costs.***

Trends

- A main trend in every mode of transport is the ***continuous reduction of fuel consumption through improved efficiency***.
- ***Diesel engines for road transport are expected to increase their efficiency by up to 20 % until 2020***.
- ***The current trend of electrification of railway tracks will continue.***
- ***Diesel fuel produced from conventional a+nd unconventional resources will be increasingly implemented in the short-term. Deployment of synthetic diesel fuels from coal and natural gas seems likely in the mid-term. Biofuels used in diesel engines will have a limited share with a possible increase in long-term.***
- ***Use of cleaner fuels especially in inland navigation and short sea shipping.***

M. Dirnwöber, S. Herndler, G. Telias

ENGINE TECHNOLOGIES



*Air and sea: data only include intra-EU traffic and are estimates made by the Commission

Figure 3: Distribution of freight transport in modes for Europe in tkm.
(Eurostat (2007). "Panorama of transport" statistical books, edition 2007.)

Energy factors for road transport, inland shipping and railways, in MJ/tonne-km

Type of transport	Average cargo capacity (tonnes)	Primary energy consumption (MJ/tonne-km)
Bestelauto:		
* Petrol	0.9	11.42
* Diesel	0.9	11.48
* LPG	0.9	10.96
Lorry	7.3	4.06
Lorry + trailer	19.3	1.82
Truck & trailer	25.0	1.40
Inland shipping		
* International	1,250	0.43
* National	700	0.48
Railways		
* Electric traction	1,000	0.59
* Diesel-electric traction	650	0.73
Energy factors per freight process:		
National freight shipping sector	0.49 *)	
National tanking sector	0.32 *)	
Freight process of Railways	0.73 **)	

*) Value is calculated as the total energy consumption for loaded and unloaded kilometres, divided by the tonne-kilometre performance

**) Value is calculated as the total energy consumption by the Netherlands Railways (E traction + DE traction, shunting) divided by the tonne-kilometre performance

Source: CBS, Lehmann

Figure 4: Energy efficiency for different transport modes in MJ/tkm.

(Dutch Inland Shipping Information Agency – BVB (2008/2009). "The power of inland navigation: The future of inland navigation on European scale", Edition 2008/2009.)

LOGISTICS TECHNOLOGIES

"Industrial companies face the challenge to constantly optimize their operations and reduce cost, in order to stay competitive in the market" ... "with APS, logistics cost can be reduced by 15-20%."

"In 2007, the revenues of the APS market amounted to nearly 6 billion US$" ... "is estimated to grow by 7% annually until 2012."

"The integration of GNSS and RFID will be one of the challenges in the coming years."

LOGISTICS TECHNOLOGIES

Logistics technologies can be divided into logistics software and hardware technologies.

Software technologies are so-called Advanced Planning Systems (APS) which are software packages that support decision-making in a supply chain context, such as decisions about the location of production or distribution sites, distribution plans, the choice of a certain mode etc.

Concerning hardware technologies, Global Navigation Satellite Systems (GNSS) and Radio Frequency Identification (RFID) are covered. With a GNSS receiver the current position of an object. (e.g. vehicle, container,...) can be identified. In freight transport the main fields of applications of GNSS are the optimisation of route planning, improved reaction to unforeseen events and better use of available cargo space.

With RFID it is possible to send data contactless and without line-of-sight. RFID technology is already used to some extent in logistics processes, e.g. in warehousing for the quicker identification of objects or for the backtracking of products.

Key Drivers

Industrial companies face the challenge to constantly optimize their operations and reduce cost in order to stay competitive in the market. Furthermore, they have to cope with an increasing complexity of supply chains due to globalization. APS help to ***manage these complex supply chains and to reduce the total cost***. Recent studies have shown that with the help of APS,

- ***average freight distance can be shortened by 20%*** and more,
- ***the number of trips can be optimized*** and
- ***the utilization of vehicles can be increased***.
- Therefore, on average, ***logistics cost can be reduced by 15-20%***.

The ***need to have up-to date information as to where vehicles and even individual products are located continuously grows***.

Besides, information concerning the ***state of a product*** (e.g. temperature) is very important. Logistics technologies such as GNSS and RFID help to provide this information.

Trends

- In 2002, a survey showed that ***APS have been implemented by less than 50% of the companies interviewed***.
- In 2007, the ***revenues*** of the total APS market amounted to nearly 6 billion US$ which represented an increase of ***17% compared to 2006***.
- The ***market is estimated to grow by 7% annually until 2012***, therefore reaching a much higher degree of diffusion than today.

LOGISTICS TECHNOLOGIES

- But, as long as the costs of implementation remain high, ***small and medium-sized companies will not be able to afford APS.***

- It can be expected that in the ***medium-term future, satellite navigation information will be considered an essential part of the infrastructure.*** It is assumed that until 2020 GNSS will be an integral part of our daily lives.

- Besides its use for navigational purposes, ***GNSS will be used in other applications in the freight sector, most notably in connection with intelligent containers***.

- ***RFID will follow the same development although at a slower pace.***

- The next step is the ***integration all the different types of information in an APS for optimal planning, control and management of logistics networks.***

W. Jammernegg, F. Kressler, H. Rosič

Company name	2007 revenue (in million US$)	2007 market share (%)	growth 2006-2007 (%)
SAP	1.334,40	22,4	31,9
Oracle	955,2	16	26,1
JDA Software	229,6	3,9	67,4
Ariba	160,3	2,7	6,3
Manhattan Associates	152,2	2,6	13
Others	3.313,50	52,5	8,8
Total	5.963,20	100	17,6

Table 1: Revenue and Market Share 2007 of selected APS vendors
(Gartner Inc. 2008)

SOCIO-ECONOMIC MEGATRENDS AND CONCLUSIONS FOR FREIGHT TRANSPORT DEMAND

"Labour division as well as foreign trade will continue to globalize."

"The annual growth rates of all mode freight transport decrease up to the year 2050."

"The development of the modal share depends on the mode of transport and on the individual countries."

SOCIO-ECONOMIC MEGA-TRENDS AND FREIGHT TRANSPORT DEMAND

The objective is to elaborate long-term quantitative trends of freight transport performance for 30 European countries (EU 15, EU 12, Switzerland, Norway, Croatia), based on socio-economic trends (population, GDP, foreign trade etc.).

Key Drivers and their impact on freight transport demand

The future development of population in EU countries is very different. ***Eastern Europe has to expect significant losses, whilst some of the old member states will have an increasing population.*** A certain shift of transport demand from Eastern to Western Europe is therefore to be expected for general demographic reasons.

The drivers of freight transport demand have always been the ***progressing spatial division of production***. This will remain true, but ***change with regard to transport distances.***

While in the past division of labour was a local or national trend mainly, since about 20 years it becomes more and more a European and even global phenomenon with respective foreign trade developments. For the future is expected, that labour division as well as the foreign trade, will continue to ***"globalize".***

The analyses of the origin of GDP by industry show the current and continuing ***great importance of the manufacturing industry***, but also a ***big and increasing role of the service sector*** as a whole.

Comprehensive analyses show, that ***intra European trade is of much more importance today than intercontinental trade***.

Foreign trade is growing at a significantly higher level than GDP, so that GDP growth does not show the big dynamics of foreign trade development.

Trends

- Generally, the annual ***growth rates of all mode freight transport performance in all study countries decrease up to 2050***, but they will not be negative for the most countries.

- The ***biggest increase of all mode transport performance as percentage change will take place in Croatia, Austria, Slovenia and Romania***.

- In ***absolute figures, the biggest increase will occur in Germany, Spain and France***, in particular due to the country size and also due to the countries location (especially Germany and France).

SOCIO-ECONOMIC MEGATRENDS AND CONCLUSIONS FOR FREIGHT TRANSPORT DEMAND

- Roughly ***one third of the total transport performance in the Western European countries is produced on German territory, where the growth is expected to be 89% from 2005 up to 2050. France follows with a share of 21%, Italy and Spain of 13% in 2005 with an increasing trend.***

- Because of ***stronger economical development in the next years a substantial increase in total transport performance can be expected up to 2020. Poland has the largest weight of all 12 new EU member states (including candidate country Croatia) with a share of 25%.***

- Generally the ***growth in all 30 countries is much higher in international transport (export, import, transit) than in national transport.***

- The modal share for road transport in the past is quite important in the EU 15, Switzerland and Norway. ***For 2050 is estimated for almost all countries a decreasing road transport share***.

- The ***modal share for rail transport is quite important and will be important in 2050 for Switzerland and Baltic countries. Overall countries an increase of 3% is estimated for 2050.***

- Inland waterway transport plays currently an important role in the Benelux countries and Germany. ***Up to 2050 inland waterways will not increase their market shares significantly as a trend.***

N. Anders, F. Knaack, S. Rommerskirchen

Related tables can be found in Appendix A

TRANSPORT DEMAND & CONGESTION

> *"The GDP is the single most important driver of freight transport. The expected average annual growth per country within EU27 from 2005 to 2030 is 2.7%."*

> *"A strong increase in the market share for rail is anticipated"*

TRANSPORT DEMAND & CONGESTION

The overall objective is to assign transport demand to the existing and planned transport network to estimate congestion and other network effects. Congestion is a major obstacle for economic growth, efficient trade, and competitive economies

The reference scenarios measures the most likely development given the assumptions put forward. Reference scenarios have been developed on the basis of the TRANSTOOLS model developed in the TEN-CONNECT study.

Key drivers

The key drivers influencing transport demand and thus congestion in the TRANS-TOOLS model are:

- ***GDP growth:*** For numbers on GDP growth please refers to summary "socio-economic trends and transport demand".
- ***Infrastructure development:*** Rail and road infrastructure is updated according to projects that are already planned or decided.
- ***Transport costs estimates rail:*** For rail, a decrease of 10% in the average transport costs is anticipated. The decrease is due to more efficient planning and improved interoperability.
- ***Transport cost estimates road:*** Transport operating cost for trucks is expected to increase by 4% in 2020/2030 compared to 2005 in fixed prices. This includes a general cost increase of 20% which is partly offset by. Improved logistical operations. Toll costs are added and follow the Vignette directive of 6.7 Euro Cent / KM in rural areas and 15 Euro Cent in Urban areas.

Trends

Road congestion:
The current European road and congestion profile can be characterised by

- ***Eastern Europe, Balkan, Turkey: Low congestion***
- ***South and Northern Europe: Medium congestion***
- ***Central Europe and UK: High congestion***

As can be verified from figure 11, there is a non-linear relationship between travel time and flow, which implies that high congestion regimes are relatively more sensitive to traffic growth. It means that ***even relative small increases in traffic volumes in central parts of Europe and UK may have significant congestion effects***.

TRANSPORT DEMAND & CONGESTION

- The transport growth in Europe for road transport projects a ***moderate increase in central Europe whereas a more aggressive growth is expected in Eastern Europe, Balkan, the Baltic countries, and Turkey.***

- At the overall European level, congestion is expected to rise through 2020 and 2030 from its current level. ***The increase will be highest in Central Europe in that the present high level of congestion will cause the moderate increase in traffic to have relative large impact. For Eastern Europe, where we have a low present congestion level but expects a relative high traffic growth, a more modest increase in congestion is expected. In other words, the increase in traffic is largely absorbed by free capacity.***

- Road ***bottlenecks are primarily located around the large cities (figure 12)***. In particular the London-Manchester-Birmingham triangle, the Ruhr district and Northern Italy (Milano). France, Spain, Scandinavia, and Eastern Europe will experience a slower increase in congestion.

Rail congestion:
It is expected that rail transport measured in ton-km will increase relative to road transport and represent a 23.3% share in 2030 compared to 19.5% in 2005. More specifically, we anticipate;

- ***Longer trips due to market specialisation***
- ***A move from national to international transports***
- ***Growth in specific bulk-corridors to Russia***

The impact in terms of congestion cannot be explicitly represented in the TRANSTOOL. However ***it is expected that;***

- ***Due to longer trips, rail transport will be more sensitive to regional bottlenecks***
- The general increase in rail demand (for passengers and freight) will put pressure, not only on the network but also ***on terminals and re-loading centres which may increase waiting times***.

Inland Waterways:
Inland waterways are not expected to be affected by congestion and the transport growth is assumed to be absorbed by free capacity.

J. Rich, C. O. Hansen
Related figures and tables can be found in Appendix E.

LOGISTICS TRENDS

> *"Traditionally, the design of a logistics network is based on financial objectives..."*

> *"Prevalent logistics trends are outsourcing, offshoring and centralization."*

> *"... from an integrated perspective, including costs, risks and environment, new logistics trends become more important."*

LOGISTICS TRENDS

Logistics trends existing within international networks of production companies have a huge impact on transport demand. In logistics networks, besides transportation other activities such as sourcing, production and warehousing are necessary in order to fulfil the requirements of final customers.

Key Drivers

Traditionally, the design of a logistics network is based on ***financial objectives***, i.e. minimizing total logistics costs which consist of

- ***facility,***
- ***inventory and***
- ***transportation costs.***

There is a basic trade-off between

- ***economies of scale*** and
- ***responsiveness by being close to the market***.

In addition to the financial objectives, a wide variety of other factors influence the network design and therewith the location of facilities.

Concerning the facility location also

- ***macroeconomic factors***,
- the ***quality*** and ***cost of workers***,
- ***availability of infrastructure*** *and* ***manufacturing*** and
- ***logistics technology***

have to be considered.

Trends

Prevalent logistics trends are

- ***outsourcing*** (to subcontract a process to a third-party which can gain economies of scale),
- ***offshoring*** (dislocation of a production activity to a far-distant country in order to lower operational costs) and
- ***centralization*** (to reduce the number of production, procurement or distribution site, to pool risk, reduce inventory and exploit economies of scale).

The resulting design of the logistics network is mainly based on a cost perspective. For instance, ***offshoring leads to a reduction of total logistics costs by 25-40%***. ***But important "soft" factors, like delivery time, flexibility and risks of a logistics network can lead to a considerable reduction of this cost advantage***.

Furthermore, ***stricter regulations*** and ***increased awareness of customers with respect to the environment*** support a reconsideration of a company's strategy.

All prevalent logistics trends usually result in increased transportation distances. In this respect, resulting ***risks (accidents, congestion)*** as well as ***environmental aspects (dependence on fossil fuels, CO_2-emissions)*** should be considered.

LOGISTICS TRENDS

Thus, from an integrated perspective, including costs, risks and environment, ***new logistics trends*** become more important. By moving production activities closer to the market through

- ***nearshoring***,
- ***onshoring*** or
- ***decentralization***,

the transportation distances can be reduced and therefore network redesign can have a positive impact on the key indicators, especially on CO_2-emissions.

By using a ***flexible supply base*** a company can benefit from low costs in an offshore facility and simultaneously be able to respond quickly to demand fluctuations by serving the market also from an onshore site.

In this way, the amount of long-distant freight transport can be reduced, therefore mitigating transportation disruptions, such as accidents and congestion.

Furthermore, ***flexible transportation*** helps to improve the performance of a logistics network with respect to the key indicators by a change of transport mode, multi-modal transportation or the use of multiple routes.

Improvements in ***transportation efficiency***, such as better vehicle utilization and reduction of empty trips, again leads to a reduction of the number of transports. Thus costs, CO_2-emissions and fossil fuel consumption can be reduced significantly.

H. Rosič, G. Bauer, W. Jammernegg

Related tables can be found in Appendix B.

TRANSPORT RELATED EMISSION TRENDS 2000-2050

> *"... no significant improvement in terms of GHG emissions, energy consumption or dependency on oil in transport as a whole or freight transport is expected."*

> *"... Abatement measures to reduce other atmospheric emissions have been more successful than in the control of GHGs..."*

> *"... Transportation has been identified as the largest single factor spreading invasive species in Europe..."*

EMISSION TRENDS

Transport has been identified to be one of the main causes of different environmental problems.

- ***Climate change*** is most likely the most important of these needing urgent mitigation measures, and therefore, the main emphasis has to be given on this aspect.

- ***Atmospheric emissions*** causing acidification and tropospheric ozone formation are other aspects needing attention.

- Additionally, transport may cause significant health impacts especially in densely populated areas due to ***particulate matter emissions*** and ***environmental noise***.

- ***Exhaustion of natural resources, such as fossil fuels and soil***, is another challenge transport sector faces.

- ***Loss of biodiversity*** due to habitat loss, degradation and fragmentation and introduction of foreign species may significantly reduce ecosystems' capacity to resist pressure.

Relatively little information is available directly relating to the freight transport's environmental problems, and therefore when data was not available, a wider perspective on transport as a whole is taken.

Key Drivers

Key transport related drivers affecting the environmental aspects include

- ***transport volume***,
- ***modal split***,
- ***technology type and development state***,
- ***fuel type*** and
- ***fuel consumption or energy efficiency***.

Trends

The energy use and the associated carbon dioxide emissions from freight transport grew faster than in almost any other sector between 1995 and 2005.

According to EU statistics (EC 2006), inland freight transport performance (road, rail and inland waterways) in EEA member countries increased by 30% (2.6% per annum) during this time period. Despite the decline in overall energy intensity of freight transport, it is estimated that in ***OECD countries, the energy consumption by freight transport will continue to grow (by 1.1 %/a, on average) between 2005 and 2030 (EIA 2008)***.

The oil dependency of transport sector in relative terms is expected to some extent to be moderated by the ***penetration of bio- and other alternative fuels in road transport***. ***However, in absolute terms, the total consumption of oil products in road transportation is projected to continue to grow at least up to the year 2030 in the EU***.

TRANSPORT RELATED EMISSION TRENDS 2000-2050

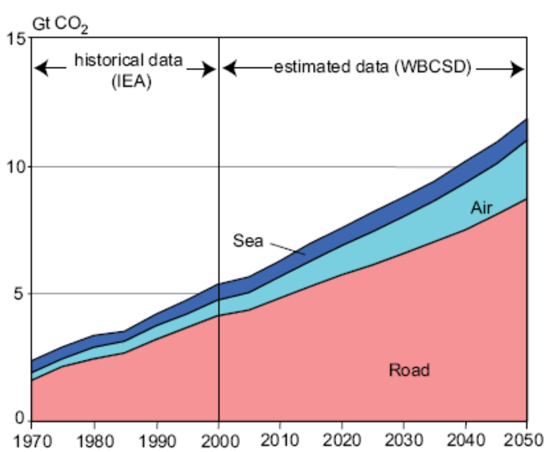
Worldwide growth in use and dependence on petroleum fuels is expected to continue beyond 2050.

Transport emits also other atmospheric pollutants than greenhouse gases, most importantly SO_2, NO_x, NMVOCs, CO and particulate matter. Abatement measures to reduce these emissions have been more successful than in the control of GHGs, and transport induced emissions of these substances have decreased by about 30-60% since 1990.

However, there is still need to further reductions in order to meet the 2010 targets of the National Emission Ceilings Directive and the urban air quality guidelines. For SO_2 emissions, maritime transport is critical. Little information on the role of freight transport in the trends environmental noise, use of soil as a resource and biodiversity losses is readily available. In any case, it is well acknowledged that transport, and especially road transport has a significant negative impact on them and therefore it is expectable that as a consequence of growing transport volumes, a negative trend in these aspects is to be witnessed.

R. Antikainen, A. Holma, F. Panse

Related tables can be found in Appendix C.



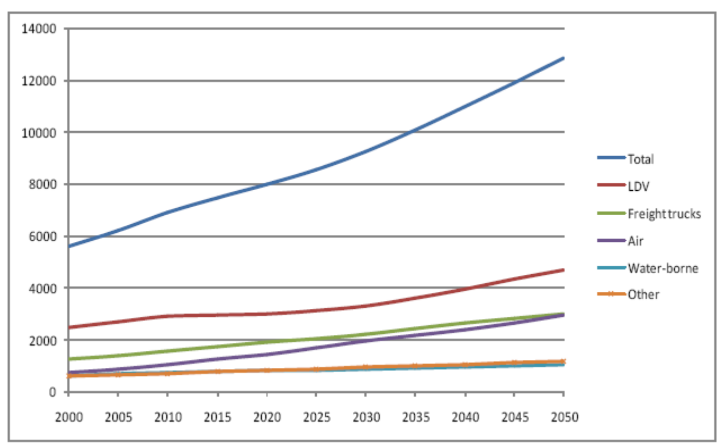


Figure 5: On left panel: Historical and projected CO_2-emission from transport by modes, 1970–2050. (Ribeiro et al. 2007).

Figure 6: On right panel: World tank to wheel CO_2-emissions, BAU, 2000–2050, Mt of CO_2-equivalent (OECD/ITF 2008).

TRANSPORT RELATED ENERGY DEVELOPMENT

"... the analysis under a variety of hypotheses indicates a high likelihood of a tight oil market situation in the horizon to 2050.

"... an alternative pattern of mobility to the horizon of 2050 is very unlikely..."

ENERGY DEVELOPMENT

The aim of this task is to examine key trends in the broader energy system, with particular emphasis on these factors within it that are likely to influence energy demand for freight transport. The methodology for the analysis has concentrated on quantitative aspects, using two large scale models developed and maintained by E3M-Lab of ICCS/NTUA: the PRIMES energy model for Europe and the PROMETHEUS stochastic energy model for analysing alternative prospects at the World level.

Key Drivers

Future energy demand in the freight sector of the EU will be primarily driven by the following factors:

- The ***evolution of overall freight transport activity*** which is itself dependent on the pace and composition of economic growth
- ***Intermodal shifts*** that can influence the type of fuel used and overall energy efficiency
- ***Technological improvements*** including the development and diffusion of radically different technological options
- ***Policy interventions such as taxation***, ***fiscal incentives*** and the ***development of different types of infrastructure*** in an effort to promote sustainability in freight transport

The drivers above primarily depend on developments and actions within the frontiers of the European Union.

- Another key driver is ***the future course of fuel prices***, in particular ***oil prices*** since petroleum currently overwhelmingly dominates transport energy

Trends

- Despite lower growth in both advanced and emerging economies the median growth of the world economy to 2050 will be very close to that experienced in the last four decades, as a result of ***the increasing weight of emerging economies. Under such conditions median oil prices in 2050 will be close to 2008 averages***.
- ***If the developing World grew on average close to historical rates the probability of exceeding 2008 levels increases to more than two thirds.***
- ***Under current geological assessments the probability of obtaining such high prices is around 75%.***
- ***According to the Baseline projection there is a 40% probability that World conventional oil production will peak before 2020***.

TRANSPORT RELATED ENERGY DEVELOPMENT

- On the other hand ***non-conventional petroleum is very likely to compensate substantially: by 2050 there is a 40% probability that tar sands, extra-heavy oil and schists will satisfy more than 50 % of World demand.***

- An alternative pattern of mobility to the horizon of 2050 is very unlikely. Currently the ***transport sector absorbs*** around 50% of total world oil demand. According to the Baseline there is ***78% probability that this share will exceed 60% by 2050***.

- ***Important savings (more than 10%) in oil demand could be achieved assuming a concerted R&D effort on alternative road transport technologies and fiscal supports to promote them. However in such a case most of the impacts would be felt beyond 2040.***

- Freight activity (excl. air freight) which is currently growing at rates close to economic growth is ***projected to decelerate faster than the latter especially in the longer term.*** Even by 2050 it will however be still dominated by trucks. ***Specific energy demand for freight transport will decline by more than 30% between 2005 and 2050 due to technological demand.***

- High or very high oil prices could provide a necessary stimulus for the transformation of the transport energy scene. ***Oil prices are however volatile and surrounded by considerable uncertainty in the short as well as the longer term***.

- ***Improvements will be less pronounced for road freight and particularly dramatic for rail freight due to the projected completion of the electrification process already by 2030.***

- Transformation of the road transport sector towards ***hydrogen use is deemed to be extremely unlikely in the projection horizon***. However assuming a massive R&D, infrastructure development and fiscal supports significant inroads could be achieved beyond 2040.

- ***There are likely to be sufficient low carbon or carbon-free options for producing the hydrogen and they could dominate supply even in the context of a moderate abatement policy***.

N. Kouvaritakis, L. Mantzos, V. Panos, N. Tzelepi

Related tables can be found in Appendix D.

APPENDIX A

Countries	2005 in billion tkm	05-20 in %	05-35 in %	05-50 in %	05-20 in p.p.a.	20-35 in p.p.a.	35-50 in p.p.a.
Growth rates of national transport performance							
EU27	1.494,6	27	38	42	1,60	0,55	0,19
EU15+CH, NO	1.324,3	26	38	43	1,55	0,60	0,23
EU12+HR	206,3	33	38	36	1,91	0,23	-0,05
All 30 countries	1.530,5	27	38	42	1,60	0,55	0,19
Growth rates of international transport performance							
EU27	820,0	46	71	88	2,57	1,06	0,63
EU15+CH, NO	710,5	42	66	82	2,38	1,03	0,62
EU12+HR	128,5	71	105	126	3,65	1,20	0,65
All 30 countries	839,0	47	72	89	2,59	1,06	0,63
Growth rates of total transport performance							
EU27	2.314,5	34	50	58	1,95	0,75	0,37
EU15+CH, NO	2.005,9	32	48	57	1,86	0,77	0,38
EU12+HR	334,7	48	63	71	2,63	0,68	0,30
All 30 countries	2.340,6	34	50	59	1,98	0,75	0,37

Table 2: Growth rates of land transport performance (national, international, total)

Countries	1995	2000	2005	2007	2020	2035	2050
Modal shares of road transport performance (in %)							
EU27	79.7	82.4	83,8	83,8	84,5	82,7	80,4
EU15+CH, NO	85,2	85,8	86,8	86,5	86,7	85	82,9
EU12+HR	49,3	59,6	64,8	66,7	71,6	68,2	63,9
All 30 countries	79,7	82,4	83,8	83,8	84,5	82,8	80,4
Modal shares of rail transport performance (in %)							
EU27	17,8	15,2	13,9	14,1	13,3	15	17,1
EU15+CH, NO	12	11,7	10,9	11,3	11,1	12,6	14,6
EU12+HR	49,5	39	33,8	32,2	27,2	30,2	34,2
All 30 countries	17,8	15,3	14	14,2	13,3	15	17,1
Modal shares of inland waterway transport performance (in %)							
EU27	2.6	2,4	2,2	2,1	2,2	2,3	2,5
EU15+CH, NO	2,8	2,5	2,3	2,2	2,3	2,4	2,6
EU12+HR	1,2	1,4	1,4	1,1	1,2	1,5	1,9
All 30 countries	2,5	2,4	2,2	2,1	2,1	2,2	2,5

Table 3: Modal share trends for transport performance (road, rail, inland waterway)

APPENDIX B

New logistics trends – Integrated perspective	Characteristics	Relevance for key indicators	Case study
Network redesign	Nearshoring, onshoring and decentralization	Reduced transportation distances and number of transports	Using regional distribution centres, a company from the metal manufacturing industry was able to reduce the average distance to the customer by 46%. In the apparel industry, the decision to produce at an onshore facility reduced CO_2-emissions by 25%.
Flexible supply base	Using multiple supply sources (offshore and onshore)	Reduced number of long-distant transports and mitigation of transportation risks (accidents and congestion)	Hewlett Packard uses an offshore facility to produce the base volume and employs also an onshore facility to quickly react to disruptions and demand fluctuations.
Flexible transportation	Change of transport mode Multi-modal transportation Multiple routes	Reduced CO_2-emissions and dependence on fossil fuels Reaction to occurrence of risk events (accidents and congestion)	LKW Walter saved 1,211 km per shipment by changing the mode (1,523 km on the road vs. 312 km short sea/trucking), in total over 1.2 million km per year.
Transportation efficiency	Vehicle routing and loading	Reduced number of empty trips	By maximizing full truck load, PepsiCo, on average, saved 1.5 million km and 1,200 tonnes of CO_2-emissions.
	Consolidated shipments	Improved vehicle utilization	A manufacturer of household and personal-care products cut fuel use by 630,000 litres by combining multiple customer orders.

Table 4: Overview Logistics Trends

APPENDIX C

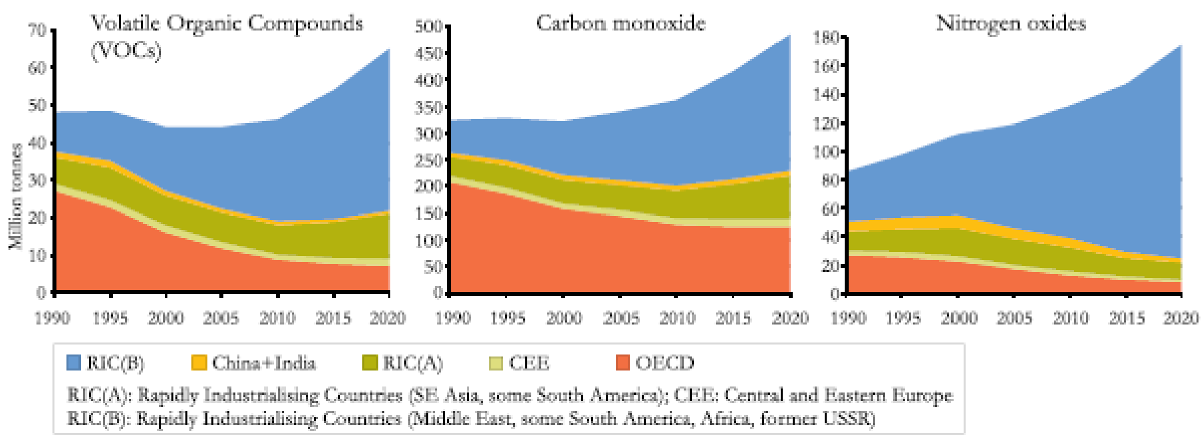
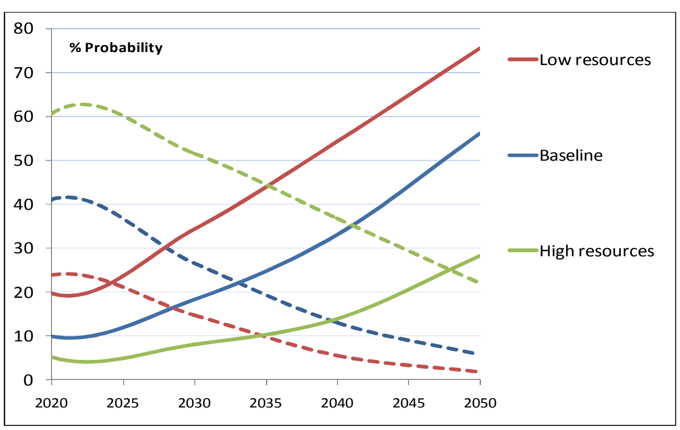


Figure 7: Global motor vehicle emissions by region, 1990–2020, in millions of tonnes (OECD 2000).

APPENDIX D



For three alternative geological probability assessments of undiscovered hydrocarbon resources, the graph shows the probability that:

- oil price exceeds September 2008 level of 100 \$05/bl (solid lines)
- oil price is lower than 2005 level of 55 \$05/bl (dotted lines)

Figure 8: Impact of resources on oil prices

APPENDIX D

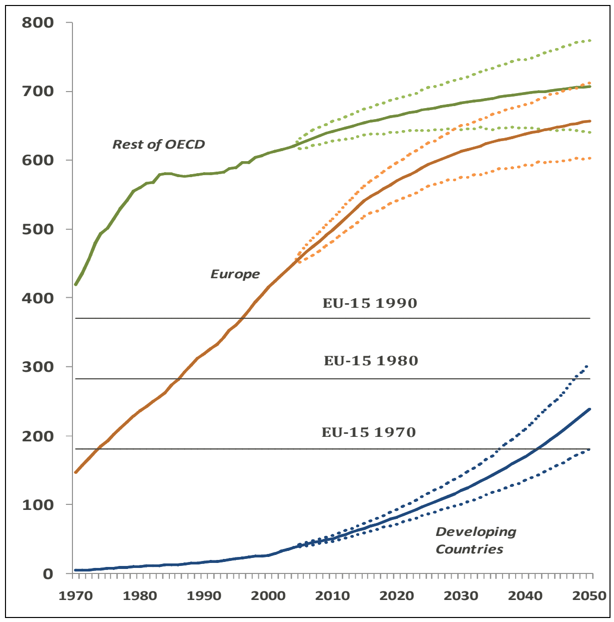


Figure 9: Number of vehicles per thousand inhabitants (dotted lines represent five percentiles)

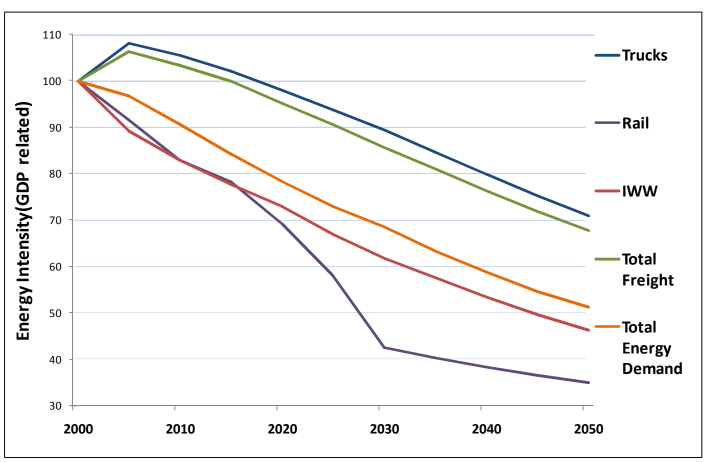


Figure 10: Transport mode energy intensity (2000 = 100, based on toe/M€05)

APPENDIX E

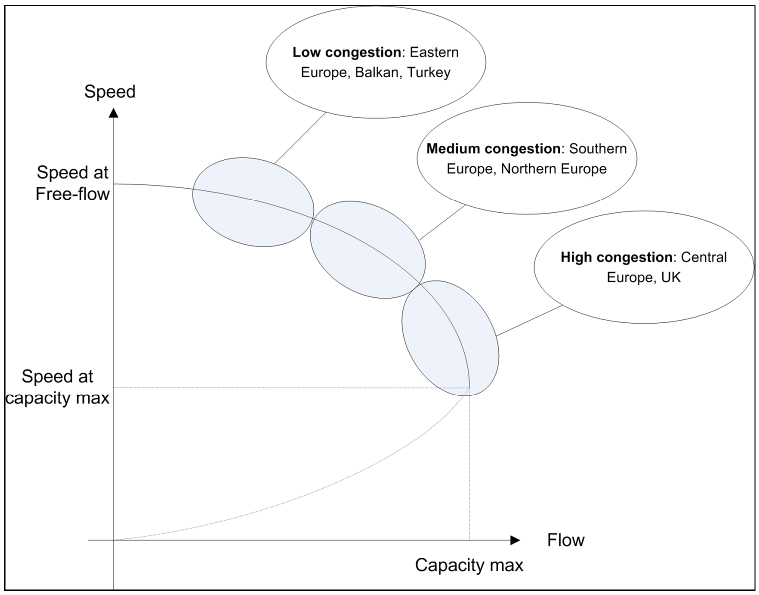


Figure 11: Congestion profile for European regions

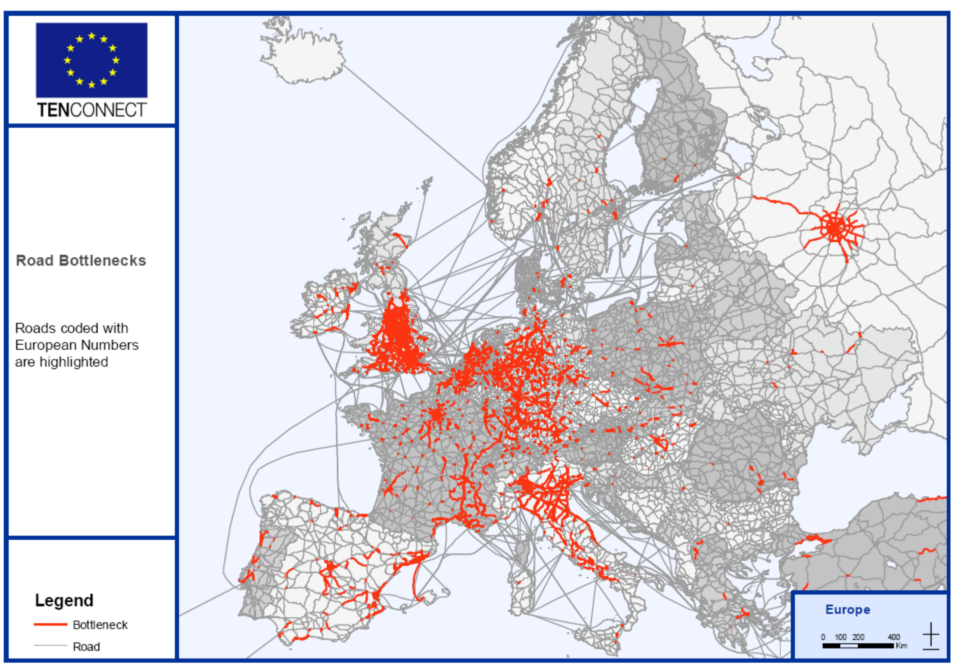


Figure 12: Overview of European road bottlenecks

PROJECT PARTNERS

Coordinator:

AustriaTech – Federal Agency for Technological Measures Ltd.

Partners:

Czech Technical University – Faculty of Transportation Sciences (CVUT)	Diepens en Okkema Groep BV (Mobycon)
Technical University Denmark (DTU)	ProgTrans AG
EGIS Mobilité – Innovative Transport Solutions	Suomen Ympäristökeskus (SYKE)
TSB Technologiestiftung Inov. Berlin GmbH/ Forschungs- und Anwendungsverb und Verkehrssystemtechnik Berlin (FAV)	TetraPlan A/S
Institute Communication and Computer Systems (ICCS)	Transver GmbH
The Chancellor, Masters and Scholars of the University of Oxford (UOXF.JQ)	University of Economics and Business Administration (WUW)

Subcontractor:

International Union of combined Road-Rail transport companies	Austrian Research Centers GmbH

DOCUMENTS

This management summary is based on the following FREIGHTVISION reports:

- R. Jorna, H. Zuiver, D. Bonilla, N. Akyelken (2008) – Relevance of European Policy on long distance freight transport in Europe, Internal Report 2.1
- K. Krusina, H.Zuiver, J. Düh (2009): Relevance of national policies on long distance freight transport in Europe, Internal Report 2.2
- H. Kyster-Hansen, M. Henriques, H. Zuiver, H. Rosič, G. Bauer, V. Malinovski (2009) – Inventory of key demonstration projects for long distance freight transport in Europe, Internal Report 2.3
- A.-C. Böhmann, E. Feyen, B. Hamisch, C. Heinrich, S. Leonhardt, V. Malinowski, F. Panse (2009) – Infrastructure technologies and Intelligent transport of the modes road, rail and short-sea shipping, Internal Report 3.1
- M. Dirnwöber, S. Herndler, G. Telias (2009) – Engine Technologies, Internal Report 3.2
- H. Rosič, F. Kressler (2009) – Logistics Technologies, Internal Report 3.3
- N. Anders, F. Knaack, S. Rommerskirchen (2009) – Socio-graphic and economic mega-trends in Europe and the World – overview of existing forecasts and conclusions for long-term freight transport demand trends in Europe, Deliverable 4.1
- H. Rosič, G. Bauer, W. Jammernegg (2009) – Logistics trends, Deliverable 4.2
- J. Rich, C. Overgaard Hansen (2009) – Freight transport trends through 2020, 2030 & 2050, Deliverable 4.3
- R. Antikainen, A. Holma, F. Panse (2008) – Report in transport related emission trends 2000-2050, Deliverable 4.4
- N. Kouvaritakis, L. Mantzos, V. Panos, N. Tzelepi (2009) – Report on transport related energy development, Deliverable 4.5

freightvision
Freight Transport FORESIGHT 2050

Freight Transport FORESIGHT 2050

FREIGHTVISION is a project funded by the European Commission – DG Energy and Transport – in the 7th Framework Programme.
FREIGHTVISION seeks to develop a long-term vision and a robust and adaptive action plan for sustainable long-distance freight transport in Europe. The methodology used is FORESIGHT.

For further information please contact Stephan Helmreich, project coordinator, AustriaTech (helmreich@austriatech.org) or John Berry, project officer, European Commission.

http://www.freightvision.eu