freightvision

Freight Transport FORESIGHT 2050

Deliverable 5.3
Identification of conflicts between forecasts and preliminary targets

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Executive Summary

Based on the various trend forecasts in Work Package 4 (Deliverables D4.1 to D4.5) a framework was developed to forecast the long-distance freight transport market in the European Union (EU) under business-as-usual (BAU) assumptions (Deliverable D5.2). The results are long-term forecasts (horizon 2050) of EU-wide transport performance and modal split as well as the impacts on the four primary criteria: greenhouse gas emissions (GHG emissions), fossil fuel dependency, congestion and accidents.

Independently from the BAU forecasts, preliminary visions regarding quantitative policy targets for the future development of the above mentioned four criteria have been identified based as far as possible on existing official EU targets and in the absence of such targets on a sustainability concept developed by the FREIGHTVISION team (Deliverable D5.4).

The present Deliverable D5.3 describes which gaps between BAU forecast and preliminary visions can be identified and describes the reasons for these gaps and thus give preliminary hints which areas should be addressed to close the gaps in the future. For a more meaningful discussion, the long-distance freight transport (LDFT) sector is reviewed by mode of transport (road, rail, inland waterway).

In most cases, the gap between what is desirable (regardless whether or not it is achievable) on the one side and the BAU forecasts on the other side, is widening over time. As a consequence, serious conflicts may emerge. Drastic reductions of GHG emissions, fossil fuel dependency, congestion and accidents will be necessary to reach these targets in 2050 and intermediate targets in 2020 and 2035.

The separate comparison of BAU forecast and preliminary visions for long-distance freight transports by mode (road, rail, inland waterways) show furthermore, that there will be different developments concerning the size of the gaps regarding the four primary criteria and the measures that have to be introduced to close these gaps.

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List of Abbreviations

BAU	business as usual
CO_2	carbon dioxide
EC	European Commission
ERTMS	European Rail Traffic Management System
EU	European Union
EU27	all current EU Member States
g	gramme
GDP	gross domestic product
GHG	greenhouse gas
GVW	gross vehicle weight
HGV	heavy goods vehicles
ITS	intelligent transportation systems
IWW	inland waterway transport
km	kilometre
LDFT	long-distance freight transport
SYKE	Finnish Environment Institute
tkm	tonne-kilometre
vkm	vehicle-kilometre
WP	work package

1. Introduction

Based on the various trend forecasts in Work Package 4 (Deliverables D4.1 through D4.5, the FREIGHTVISION team developed a framework to forecast the long-distance freight transport market in the European Union (EU) under business-as-usual (BAU)[1] assumptions. The resulting long-term forecasts (horizon 2050) of transport performance[2] and modal split as well as the impact on the four primary criteria: greenhouse gas emissions (GHG emissions), fossil fuel dependency, congestion and accidents (more precisely fatalities) are documented in Deliverable D5.2[3].

Independently from the BAU forecasts, FREIGHTVISION partners have ventured into the development of preliminary visions regarding quantitative targets for the future development of the above mentioned four criteria, based partly on existing official EU targets and in the absence of such targets on an independent sustainability concept (Deliverable D5.4)[4].

The present Deliverable D5.3 describes which gaps between BAU forecast and preliminary visions the project team identified and describes the reasons for these gaps and thus which areas should be addressed to close the gaps in the future. To better focus the discussion, the long-distance freight transport (LDFT) sector is reviewed by mode of transport (road, rail, inland waterway).

In most cases, the gap between what is desirable (regardless whether or not it is achievable) on the one side and the BAU forecasts on the other side, is widening over time. As a consequence, serious conflicts may emerge. Drastic reductions of GHG emissions, fossil fuel dependency, congestion and accidents will be necessary to reach these targets in 2050 and intermediate targets in 2020 and 2035.

The trend forecast of transport demand (Deliverable D4.1)[5] is driven by forecast of socio-economic variables (population, GDP, foreign trade) based on statistics through

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[1] "Business as usual" means in this connexion that the impact of technologies and policies in place as well as the implementation of current EU and national transport infrastructure investment programmes are taken into account, but further infrastructure investments , technology progress and policy measures are not considered.

[2] In accordance with the Eurostat-UNECE-ITF Glossary of transport statistics, the term "transport" is used here to represent the movement of goods (and passengers) while the term "traffic" is used to represent the movement of means of transport (e.g. heavy goods vehicles (HGV) on the roads, trains on the railways and vessels operated on inland waterways and sea routes). Transport volumes are measured in tonnes and transport performance with is the product of a given transport volume and the distance over which the goods are transported is measured in tonne-kilometres (tkm); similarly, traffic volumes are expressed in number of vehicles (trucks, trains, vessels) and traffic performance is measured in vehicle-kilometres.

[3] Schmiele, Jürgen; Glöckl, Ulrich; Antikainen, Riina; Mattila, Tuomas; Rich, Jeppe; Hansen, Christian O. (2009): Description and modelling of forecasts and primary criteria evaluation. Deliverable 5.2 of FREIGHTVISION – Vision and Actions Plans for European Freight Transport until 2050. Funded by the European Commission 7th RTD Programme. Munich, Germany.

[4] Bonilla, D.; Akyelken, N. (2009): Report on Preliminary Visions. Deliverable 5.4 of FREIGHTVISION – Visions and Actions Plans for European Freight Transport until 2050. Funded by the European Commission 7th RTD Programme. Oxford, UK.

[5] Anders, Natalia; Knaack, Franziska; Rommerskirchen, Stefan (2009): Socio-demographic and economic mega trends in Europe and in the World – Overview over existing forecasts and conclusions for long-term freight transport demand trends in Europe. Deliverable 4.1 of FREIGHTVISION – Visions and Actions Plans for European Freight Transport until 2050. Funded by the European Commission 7th RTD Programme. Basel, Switzerland.

2007 (prior to the economic crisis). All technological and logistics trends are implicitly included insofar as they have influenced transport performance in the past; they cannot be isolated as independent variables. The modal split (in terms of tonne-kilometres (tkm)) is the result of the modelling and forecast procedure.

As specified in D5.2, the indicators for the four criteria are defined as follows:

- *GHG emissions:* Total (including upstream) CO_2-equivalent emissions (measured in tonnes per year) that are caused by road, rail and inland waterway traffic for long-distance freight transport within the EU27 countries.
- Fossil fuel dependency*:* Share of fossil fuel energy input in total energy input for long-distance freight transport by road, rail and inland waterways within the EU27 countries (measured in percent).
- *Congestion:* Difference between total travel time of means of transport under free-flow conditions and under effective traffic conditions (loaded network) by the number of trucks affected.
- *Accidents:* Number of fatalities with an involvement of heavy goods vehicles.

The indicators regarding GHG emissions, fossil fuel dependency, congestion and accidents are related to traffic performance (movement of means of transport: trucks, trains, vessels). The logistics trend to better loading efficiency (higher average load) implies that traffic performance grows at a lower rate than transport performance.

GHG emissions and fossil fuel dependency are related, but complementary. Increased road congestion leads to increased fuel consumption and thus CO_2 emissions, but also external costs including accidents. Conversely accidents create congestion.

As the preliminary vision for GHG emission contains only an overall target for LDFT and does not distinguish between modes, it would be necessary to define an individual target for each mode of transport. For doing this it might be preferable to define targets for specific CO_2 emissions per tonne-kilometre which is the relevant variable in the emission model used for the trend forecasts.

Work on task 5.4 started with the kick-off of WP5 and accompanied activities all along the implementation of this WP. The compatibility of the visions and the forecasts was a challenge all along. In this regard, the team working on task 5.4 provided methodological and factual inputs for all other tasks of WP5. The conflicts identified provide the basis for the focus in WP6 of measures reducing the gaps between trends and visions.

2. Road transport

The long-distance road freight transport sector is not clearly defined in the statistics; therefore, the transport and traffic performance figures are estimates. In the trend forecast 2005 to 2050, transport performance (tkm) is growing by 52%, traffic performance (vkm) by 36%.

Table 1 provides an overview of trend forecasts and preliminary visions for the long-distance road haulage sector in the EU27. The figures for fossil fuel dependency represent levels of the indicator while for the other three criteria the difference from the corresponding base year value 2005 is given in relative terms (percentage).

Table 1: Trend forecasts and preliminary targets for road freight transport

	Trend Forecast				*Preliminary Vision*			
	2005	*2020*	*2035*	*2050*	*2005*	*2020*	*2035*	*2050*
GHG emissions	/	-6%	-31%	-36%	/	-40%*	-70%	-80%
Fossil fuel dependency	96%	85%	75%	70%	96%**	92%	83%	50%
Congestion	/	+58%	+125%	+215%	/	-17%	-33%	-50%
Fatalities	/	+7%	-11%	-26%	/	-40%	-64%	-78%

*Since the 20% reduction committed by the EU (see D5.4) relates to 1990 and the actual emission level has increased by some 30% between 1990 and 2005, the reduction target for 2020 is around 40% compared to 2005.

** In the D5.4 “Report on Preliminary Visions” a figure of 100% is documented for 2005. It does not take account of biofuels being added to fossil diesel.

Greenhouse gas emissions

Road freight is the main GHG emitter amongst all freight transport modes and hence the focus of reduction potential in the freight sector reduction is on this mode.

CO_2 emissions are forecast to be reduced in the projection period by 36% with the share of biodiesel increasing from 2% to 20% as well as increased engine efficiency and the reduction of resistances. The specific (direct and upstream) CO_2 emission level was about 109 g/tkm in 2005 and is forecast to be reduced by 58% in 2050 to 46 g/tkm.

The main challenges are:

1. Improvement of engine fuel efficiency
2. Reduction of congestion (traffic management, infrastructure)
3. Improvement of logistics efficiency (higher average load, shorter distances)
4. Modal shift to transport modes emitting less GHG

The GHG reduction policy of the EU is pursued in several directions:

1. Global targets are negotiated at the international level. So far the European Commission envisages a unilateral reduction target of 20% compared to the 1990 level and a 30% reduction if agreed by developed nations. No target has been officially announced for the time after 2020 but the Commission seems to subscribe to the idea of a world-wide reduction by 50% in 2050 compared to 2005 which would require the EU as part of the industrialised world to reduce GHG emissions by 80-90% by 2050.
   No specific targets are set by the EU for individual sectors. Member State governments are expected to define their own targets. This also relates to the transport sector which has a major share in present GHG emissions and which continues to rely heavily on fossil fuels.
2. Another policy tool directly affecting the transport sector is to define average emission levels for manufacturers like the existing one for the car manufacturing sector (the target for 2014 is 120g per 100 kilometres. Light goods vehicles are to follow shortly and it can be anticipated that a similar scheme will also follow for heavy goods vehicles.

In the preliminary vision, the target of 80% reduction of GHG by 2050 compared to 2005 has been retained also for long-distance freight transport as a whole and also for long-distance road haulage.

Keeping the focus at 2050, the trend forecast suggests that a reduction of GHG emissions in the EU by 36% is likely under prevailing conditions. This is achievable in spite of an increase of transport demand (tkm) by 52% and, with improved logistics, an increase of traffic performance (vkm) of 36%. Improvements of fuel efficiency of engines and of the vehicles (rolling and aerodynamic resistance) and in addition the replacement of fossil fuels by biofuels contribute most to the over 50% improvement in energy efficiency of heavy goods vehicles.

But all this will not be sufficient to reach the GHG reduction target of 80% by 2050. Much more needs to be done if one wants to reach the target. Measures to improve the energy efficiency of road haulage will be assessed in WP6. And unless all measures combined will be sufficient to meet the reduction target, road freight transport would have to be included in the EU emission trading scheme or in a scheme to ultimately reach carbon neutral transport.

Fossil fuel dependency

All road freight vehicles for long-distance transport today are powered by diesel engines. In 2005, fossil fuel dependency of the LDFT by road was 96% with some biodiesel used; this share is forecast to be reduced to 70% in 2050. In contrast, the preliminary vision puts a target of a dependency ratio of 40% in 2050. This target is not an official EU target but has been defined by the FREIGHTVISION team as “commonly agreed”.

The only ways to reduce the fossil fuel dependency are:

1. replacement of fossil fuels by non-fossil fuels (biofuels), and
2. alternative propulsion systems (e.g. electric, hydrogen).

Congestion

Congestion is the result of traffic exceeding road capacity. Where congestion occurs, in the morning and afternoon peaks in urban and suburban areas of agglomerations, during weekends and summer vacation seasons or due to accidents, it is temporary. HGVs are either delayed in congestion or prohibited from driving (weekends and public holidays). Whenever suitable, they drive at night to avoid congestion (compare

Figure 1 and Figure 2, page 7).

Interest groups argue that 80% of congestion is due to passenger cars. The argument is probably based on the vehicle mix in traffic jams on motorways. Passenger cars usually have higher daily peaks than HGVs, in particular in the morning and the afternoon due to commuter traffic and on weekends due to leisure traffic. The question who causes congestion does however not lead anywhere. The challenge is to reduce congestion by traffic management and road pricing and in addition to increase infra-structure capacity where other measures are not effective enough.

Figure 1: Daily traffic variation curve German motorway A5 automatic counting point Achern (Thursday, 28 August 2006)[6]

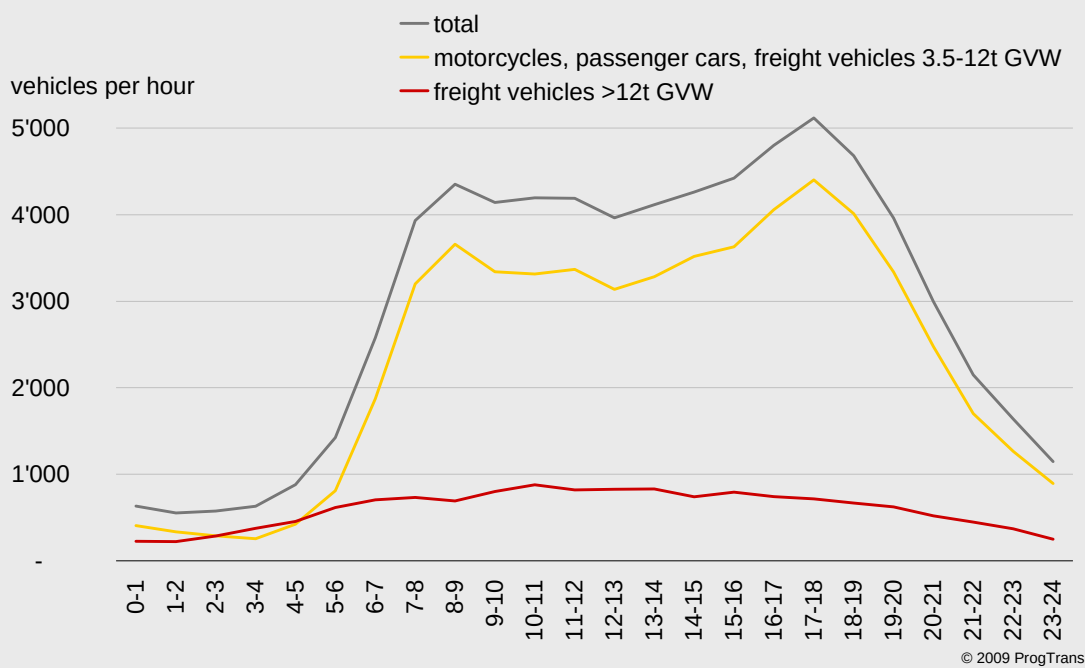
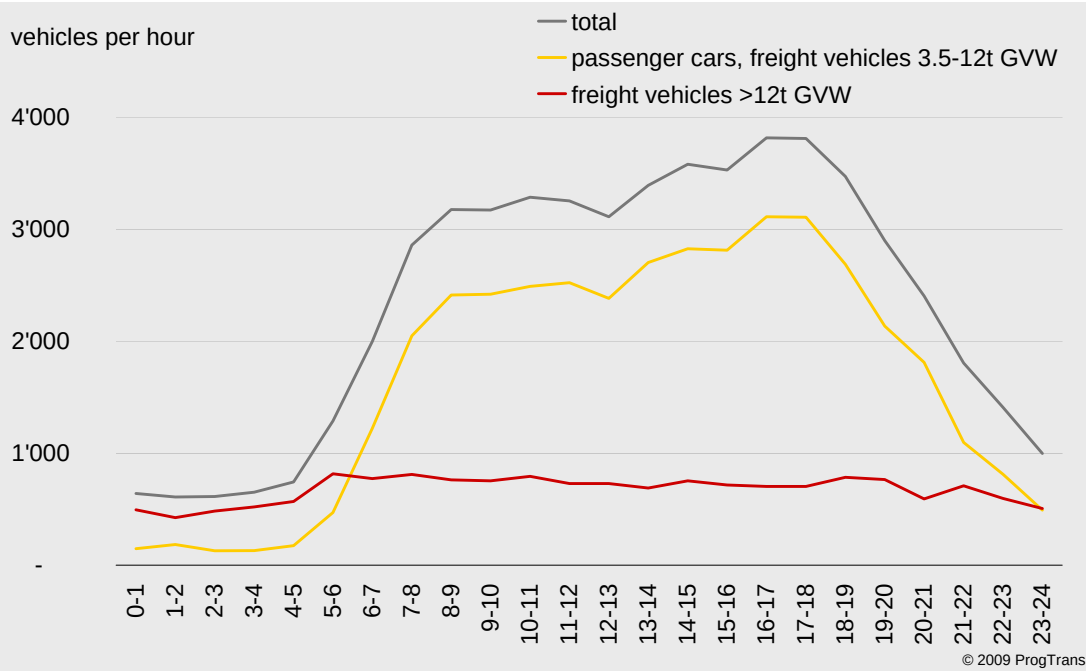


Figure 2: Daily traffic variation curve German motorway A1 automatic counting point Bockel (Wednesday, 25 October 2006)[7]



[6] ProgTrans AG (2008b): Traffic Study, BAB A5 Malsch – Offenburg, Final Report; Basel, Switzerland.
[7] ProgTrans AG (2008a): Traffic Study, BAB A1 Hamburg – Bremen, Final Report; Basel, Switzerland.

In the FREIGHTVISION project the TRANS-TOOLS model – developed for the European Commission and used for strategic analyses and forecasts – was used to measure congestion as the difference of vehicle hours effectively spent in traffic including during periods of congestion and hypothetically spent in free-flow traffic. The TRANS-TOOLS simulations suggest a tripling of congestion by 2050 compared to 2005. This result reflects however the assumption that no new infrastructure projects except those which are already firmly committed and should all be implemented by 2025 at the latest are considered. This assumption is of course problematic and must be taken up and adjusted in the course of the FREIGHTVISION process.

There are significant differences in congestion levels among countries. The UK has the most serious congestion problem (26% of all lost truck-hours in 2005 with an increasing share) while Germany has today a slightly lower share (24%) with a comparably modest growth (the congestion level is “only” doubling between 2005 and 2050). Highest growth of congestion levels is in the new Member States, e.g. 6 times in Poland, 30 times in Romania, signalling a situation of inadequate infrastructure before the background of fast growing motorisation and traffic density after joining the European Union.

In contrast to the dramatic increase of congestion in the trend forecast, the preliminary target is set at a 50% reduction by 2050, a major conflict area. The main challenges for future years are:

- the better usage of existing road infrastructure with
  - improved traffic management
  - improved logistics efficiency
  - congestion charging
- modal shift from road to other modes of transport
- elimination of bottlenecks in road infrastructure, and possibly
- new concepts for road infrastructure usage (e.g. dedicated truck lanes)

Accidents

The reduction of road traffic accidents and in particular of fatalities is high on the EU agenda of transport policy. The EU objective for the present decade (2000 to 2010) is the reduction of fatalities by 50%. This objective was fixed prior to the enlargements in 2004 and 2007. The reduction target is a particular challenge for new EU Member States with fast growing motorisation and traffic on inadequate road infrastructure. All 27 EU Member States taken together, the number of fatalities was 56,000 in the year 2000. The reduction target to 28,000 fatalities in 2010 will not be achieved. It is anticipated that a reduction of around 30% will be met by 2010.

Turning to road accidents caused by HGVs outside urban areas which are the focus of our analysis, there is insufficient analysis and research to provide robust figures. The responsibility for an accident is not always clearly established if two or more parties are involved. According to a recent estimate, 13% of fatalities as a result of road accidents are "attributable" to HGVs; this ratio has not changed significantly over the past decade during which the impact of safer vehicles and safer driving was neutralised by an increase of traffic performance [8]. 70% of all traffic fatalities involving trucks occur in non urban areas. [9]

The trend forecast is based on an estimated number of 5,870 fatalities (2005) from HGV-caused accidents for all road types inside and outside urban areas, corresponding to some 35 fatalities per 1 billion HGV-km. This ratio is forecast to decline to just below 20 in 2050, a reduction of some 45% during the 45 year period. The impact would partly be offset by increased traffic performance. The forecast for 2050 is thus 4,370 fatalities outside and inside urban areas, a pure 25% reduction. In contrast, the target in the preliminary vision is 1,267 fatalities as "socially acceptable". This target is less ambitious than a 50% reduction every decade which the European Union is struggling to achieve during the current decade. It is however less than one third of the trend forecast. This also represents a major conflict and a challenge for the years to come.

Road traffic is not based on a zero-accident concept as is, for example, rail traffic. The system leaves to the driver a range of freedoms to trespass legal or recommended limits such as speed, distance between vehicles, fatigue, alcohol and drugs, which particularly in combination with adverse weather conditions cause a major part of serious accidents. Even professional truck drivers stressed by productivity targets and delivery time limits are not exceptions although more responsible driving is high on the agenda of road haulage operators for cost considerations (fuel consumption, safety).

HGV accident prevention is focused on:

- In-vehicle safety ("safe truck")
- ITS based traffic management
- Safer roads
- Safer driving

The impact of road safety improvement measures need to be assessed in the further course of the FREIGHTVISION process in order to verify whether the forecast of fatalities attributed to HGV traffic is realistic or – hopefully – too conservative.

[8] CE Delft (2009): Are trucks taking their toll? – The environmental, safety and congestion impacts of lorries in the EU. Online available at http://www.ce.nl/art/uploads/file/09_4846_01.pdf, last access July 18th 2009, page 30.
[9] CE Delft (2009): Are trucks taking their toll? – The environmental, safety and congestions impacts of lorries in the EU. Online available at http://www.ce.nl/art/uploads/file/09_4846_01.pdf, last access July 18th 2009, page 30.

3. Rail transport

Rail freight is generally long-distance freight. The trend of diminishing shares of rail freight in total freight transport performance is reversing due to a forceful EU policy of market opening and liberalisation and a more dynamic and commercially oriented rail freight transport industry. The trend forecast of rail freight transport performance suggests an increase from 413 to 788 billion tonne-kilometres, i.e. 91% between 2005 and 2050 compared to a growth of 60% of the overall freight market.

Table 2 provides an overview of trend forecasts and preliminary visions for the long-distance freight transport on railways in the EU27.

Table 2: Trend forecasts and preliminary targets for rail freight transport

	Trend Forecast				*Preliminary Vision*			
	2005	*2020*	*2035*	*2050*	*2005*	*2020*	*2035*	*2050*
GHG emissions	/	+22%	+24%	+20%	targets to be defined in terms of specific GHG emissions (g/tonne-km or kg/train-km)			
Fossil fuel dependency	69%	69%	65%	60%	69%	69%	54%	42%
Congestion	congestion on railway infrastructure cannot be modelled in TRANS-TOOLS; no target has hence been defined.							
Fatalities	fatalities cannot be related to freight transport performance				zero-fatality target			

GHG emissions

Rail is the only mode of freight transport which uses electricity as an energy source. The degree of electrification of the network varies from country to country. Diesel traction is still very common; it is even used on electrified lines.

According to the trend forecast, GHG emissions from rail freight transport will increase from 9.5 million tonnes of CO_2-eq. in 2005 to 11.3 million tonnes in 2050, an increase of almost 20%, mainly due to the strong growth of rail freight demand. During that period, the share of electric traction is expected to increase from 64% to 70%. The

energy mix of electricity production is assumed to move away from fossil coal, oil and natural gas to nuclear and renewables. The mix is identical for 2035 and 2050.

The share of rail freight CO_2 emissions in total CO_2 emissions from LDFT activities are expected to double from 5% in 2005 to 10% in 2050.

Given the fact that CO_2 emission from rail freight transport is roughly one quarter of that of road haulage, the increase in the modal share of rail is a positive development. This forecast, however, does not relate transport performance (tonne-kilometres) to traffic performance (train-kilometres). Productivity gains, e.g. with longer trains are only implicitly taken care of.

Specific (direct and upstream) CO_2 emissions are forecast to fall from the 2005 level of 23 g/tkm by 37% until 2050 to 14 g/tkm. This reduction is more than offset by increased transport performance.

Fossil fuel dependency

In the rail freight sector, the reduction of fossil fuel dependency can be achieved by shifting from diesel to electric traction and in addition by increasing the share of renewable energy sources including biomass. However, fossil fuel dependency is not expected to decrease drastically in the trend forecast (from 69% to 60%), as the replacement of fossil fuel energy sources is penetrating only very slowly the electricity production market. Carbon-based electricity production is replaced by natural gas with less CO_2 emissions. But the breakthrough on the side of renewable energy does not materialise in the foreseeable future. The upstream GHG emissions have also to be taken into account.

Congestion

Rail freight transport suffers very much from a limited infrastructure capacity in combination with the priority of scheduled passenger trains on the network. Punctuality statistics are not kept for freight trains. The only way to measure congestion of rail freight traffic is to measure commercial speed of trains from the start to the end of the train trip or of the goods from loading to unloading point. Recent results of a yet unpublished TRANS-TOOLS modelling exercise for a major European network (FERR-MED) suggests that the average commercial speed of rail freight transport is 20 km/h in contrast to road freight transport of 50 km/h. Restricted flexibility (train schedules) in combination with insufficient reliability (predictability) is the main problem shippers are facing with regard.

The main bottlenecks in railway operations are more often nodal points rather than open lines. Bypasses are often suitable solutions but the investment costs mainly in agglomerations are exorbitant.

Congestion in the network can be measured by comparing actual travel times with "free-flow" times using transport modelling capabilities. Such a facility is, however, not implemented in the TRANS-TOOLS model for estimating rail congestion in the FREIGHTVISION project. Given this background, it does not make sense to define quantitative targets for railway congestion.

Accidents

Rail traffic operations are governed by safety systems which do not allow more than one train on a given section (block). Nevertheless, human errors as well as technical problems (e.g. signalling, obsolete infrastructure) are causing sporadically train accidents (derailments, train collisions, collisions at level crossings etc.) affecting also freight operations. New technologies (e.g. ERTMS) and devices continuously reduce the still existing risks.

It must be noted that rail accidents tend to be more frequent in the new Member States. But it is assumed that by setting the same safety standards like in the old Member States this situation will improve progressively.

Railway accident statistics do normally not make a distinction between fatalities caused by freight trains and by passenger trains. Although human error and sometimes also failures of equipment cannot be completely excluded, nonetheless the zero-accident target defined in the preliminary visions is not unrealistic.

4. Inland waterway transport

Inland waterway (IWW) transport is generally long-distance freight. There are examples of short-distance shipping (e.g. construction materials) but in terms of transport performance, these are of little significance.

Table 3 provides an overview of trend forecasts and preliminary visions for the long-distance transport on inland waterways in the EU27

Table 3: Trend forecasts and preliminary targets for IWW transport

	Trend Forecast				*Preliminary Vision*			
	2005	*2020*	*2035*	*2050*	*2005*	*2020*	*2035*	*2050*
GHG emissions	/	+8%	+15%	+25%	targets to be defined in terms of specific GHG emissions (g/tonne-km or kg/vessel-km)			
Fossil fuel dependency	100%	100%	100%	100%	100%	100%	100%	100%
Congestion	congestion on inland waterway infrastructure cannot be modelled in TRANS-TOOLS; no target has hence been defined.							
Fatalities	fatalities cannot be related to freight transport performance				zero-fatality target			

During the past decade, IWW transport performance has increased albeit with ups and downs likely due to variations in weather conditions (high or low water levels) and economic fluctuations. Nevertheless, the modal share has decreased from about 4% in 1995 to slightly more than 3% in 2006 since the goods transported are primarily bulk with a much lower market growth than consumer and investment goods which are transported by IWW only under exceptional conditions. The market for containerised IWW transport is developing dynamically but its share in total IWW shipping volume is still below 10%.

The trend forecast of IWW transport performance suggests nevertheless an increase from 136 to 214 billion tonne-kilometres (+58%) between 2005 and 2050, similar to the forecast growth of 60% of the overall freight market. If this growth materialises, the modal share of IWW transport would not drop further.

GHG emissions

IWW transport uses marine fuel but will be obliged to use cleaner fuels in the future. This shift has little impact on GHG emissions.

According to the trend forecast, GHG emissions from IWW transport will increase from 3.8 million tonnes of CO_2-eq. in 2005 to 4.8 million tonnes in 2050, an increase of 25%.

Specific (direct and upstream) CO_2 emissions are forecasted to fall from the 2005 level of 28.3 g/tkm to 22.5 g/tkm in 2050, a reduction of 20% (this will not be sufficient to offset the growth of transport performance).

The focus for future GHG emission reduction is directed to engine efficiency and also to electric energy for the operation of on-board systems if battery technology allows quick loading during port calls. In the GHG emission forecasts, however, no shift to electric energy has been anticipated.

Fossil fuel dependency

In the IWW transport sector, fossil fuel dependency will remain until 2050 at 100%. This is the view reflected in both the trend forecast and the preliminary vision.

Congestion

Congestion in the IWW transport sector is related sometimes to the capacity of locks but this is not considered to be a major issue. Capacity of individual ports (berths and cargo handling facilities) is occasionally a serious problem to be resolved by appropriate measures to improve management and invest in handling facilities and infrastructure.

Accidents

Safety risks are rather low with only sporadic accidents. The main risk is linked to the transport of dangerous goods. Even in case of serious accidents, there are usually no or few fatalities involved. Based on these facts a zero-fatality target is a realistic vision.

5. Conclusions

The present analysis showed which gaps between BAU forecast and preliminary visions the project team could identify for the future development of the four criteria greenhouse gas emission, fossil fuel dependency, congestion and accidents (fatalities). The separate comparison of BAU forecast and preliminary visions for long-distance freight transports by mode (road, rail, inland waterways) showed furthermore, that there will be different developments concerning the importance of the gaps regarding the four primary criteria and the measures that have to be introduced to close these gaps.

Due to the enormous growth of long-distance road freight transport and despite a reduction of the specific CO_2 emission level, a significant satisfactory reduction of greenhouse gas emissions will be a serious challenge for the upcoming decades. Also to achieve the reduction of the preliminary visions of fossil fuel dependency more attention has to be directed to a replacement of fossil fuel by non fossil fuels and the development of alternative propulsion systems. The analysis also showed that one of the main conflict areas will be road congestion. A lot of challenges have to be focused to solve the problem of congestion and to avoid an undercutting the achievements of reducing CO_2 emissions, fossil fuel dependency and accidents. To continue and to upgrade the efforts of reducing fatalities caused by LDFT the initial stages of development have to be continued and intensified.

The forecast trend of long-distance freight transport is determined by a modal shift towards railway transport. Due to a fast growing rail freight transport demand and despite of reduced specific CO_2 emission levels greenhouse gas emissions will increase significantly. For railway transport targets of specific emissions levels until 2050 are lacking. In case of fossil fuel dependency changes are anticipated but not on a socially acceptable level. The efforts already taken have to be continued. As regards rail freight congestion, no reliable figures are available. Nevertheless, congestion is a problem, in particular at major nodes and where passenger trains are given priority before freight trains. Hence, before setting goals for a future development of congestion, a robust database to quantify congestion today should be established. In case of fatalities caused by long-distance rail freight transport for which we also lack reliable data, a target of zero is realistic even if it is impossible to eliminate all risks.

Also long-distance freight transport on inland waterways will grow up to 2050. And like for goods transport on railways there will be despite reductions of specific CO_2 emissions increasing greenhouse gas emissions. Hence the EU should set targets for the levels of specific CO_2 emissions. The BAU forecast as well as the preliminary visions could not identify a target for reduced fossil fuel dependency. Perhaps in future new developments which are not foreseeable today will appear. Also for IWW freight transport no reliable figures for congestion and fatalities are available. This gap should be closed. A vision of zero fatalities is realistic.

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