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D3.1 Summary on main policies, funding mechanisms, actors and trends

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Preliminary note

This document summarizes the output of WP 3 on policies, funding mechanisms, actors and trends relating the four thematic groups. Each thematic group examines one goal of the White Paper on Transport, published by the European Commission in 2011. The purpose of this document is to provide input for further work carried out in the project, especially the road-mapping exercises and the strategic outlook carried out in WP 6. The inputs for this document include information from a literature review and direct consultation with stakeholders.

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Extended Summary

TRANSFORuM examines four goals from the White Paper on Transport, published by the European Commission in 2011. The goals are:

- Clean Urban Transport and CO_2 free city logistics (goal 1)
- Shift of road freight to rail and waterborne transport (goal 3)
- Complete and maintain the European high speed rail network (goal 4)
- Create a framework of a European multimodal information, management and payment system until 2020 (goal 8)

Each of these goals is examined in thematic groups throughout the project. TRANSFORuM will develop roadmaps describing pathways on how to achieve these goals (towards 2030) and recommend concrete measures for decision makers at different political levels (i.e. European, national and subnational). A strategic outlook will provide a long-term perspective (from 2030 - 2050) taking into account the increasing uncertainty as the time horizon increases.

As a first step, this document summarizes the findings of the TRANSFORuM project on policies, actors, funding mechanisms and trends for each of the project's four thematic groups (urban mobility, freight, high-speed rail and ITS). The purpose of this document is to provide a basis on which the roadmaps and strategic outlook can be developed in the subsequent work packages (Analysis of challenges and barriers, Best practice cases). The section on policies focuses on current relevant policies that have already been adopted or are planned to be initiated in near future. It also provides a look back at the history of the development of certain policies, thereby indicating necessary time frames for innovative policy development. Awareness of such processes is supposed to contribute to avoid unrealistic time assumptions, when creating new roadmaps (i.e. learning from the past, looking into the future).

TRANSFORuM has created an extensive database of relevant stakeholders in each of the four sectors (urban mobility, freight, high-speed rail and ITS). Such stakeholders include representatives of private operators, consultants, researchers, public authorities, regulators and different interest groups from countries all over Europe. The database is continuously being updated and extended. A trend analysis gives an extensive overview of current and future trends relevant for the four thematic groups. The purpose of the trend analysis is to collect information about relevant developments for the transport sector as a whole and specifically for the white paper goals.

One of the goals of the project is to involve a large number of stakeholders during the life-time of the project and capture their views and recommendations on these issues. Inputs for this document are thus not only derived from literary research but also from direct consultation with stakeholders, mainly collected during workshops at the project's first Forum that took place in Gdansk, Poland 24-25 June 2013. More than 35 external stakeholders in addition to the project partners met to identify and discuss key policies, funding mechanisms and trends.

1 Introduction

Since the late 19th century the global average temperature increased by 0.85°C. In particular, within the 20th century greenhouse gas (GHG) concentration has risen, the ocean as well as the atmosphere have warmed, the quantity of snow and ice have diminished and sea level increased. Carbon dioxide (CO_2) is the greenhouse gas which is produced most by human activities (one of the main sources: combustion of fossil fuels, coal, oil and gas) and accountable for over 60 % of man-made global warming. In 1997 the Kyoto Protocol, an international treaty which sets limitations for six GHG emissions from developed countries, was agreed on. The former EU-15 countries agreed to reduce the GHG emissions by 8 %, in the first period (2008-2012), compared to a base year, in most cases 1990. According to the European Environment Agency, based on comprehensive data until 2011 and estimations for 2012, the EU-15 emissions were (on average) about 12.2 % below the base year level in that first period, thus achieving the target. The goal for 2020 is a reduction of 20 % compared to 1990 levels, which is one of the "20-20-20" targets and part of the Europe 2020 growth strategy. The other "20-20-20" targets aim to raise the share of renewable resources to 20 % (EU energy consumption) and to improve the EU's energy efficiency by 20 %. With regard to the 2050 climate goals, in 2011 the European Commission published the Roadmap for moving to a competitive low carbon economy in 2050, the Energy Roadmap 2050 and the Transport White Paper, which reflect the target of a GHG emission reduction of 80-95 % by 2050 (compared to 1990 levels) (EC, 2013a). The White Paper "Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system" spells out ten goals to be achieved by 2050. The TRANSFORuM project contributes to this transformation process by bringing together key actors from across Europe who are needed to create real and lasting change (industry, policy makers, NGOs, local authorities, research, planning, operations, energy, infrastructure, authorities at all levels) and trying to learn from their knowledge and experience. Moreover the composition of a neutral project team, consisting of transport experts and researchers from across Europe who are well connected nationally and internationally and who have access to a wide range of networks, brings a fresh approach and creative ideas to the project. The focus is in particular on the implementation of the following four key goals of the Transport White Paper (EC, 2011):

- Clean Urban Transport and CO_2 free city logistics (goal 1)
- Shift of road freight to rail and waterborne transport (goal 3)
- Complete and maintain the European high speed rail network (goal 4)
- Create a framework of a European multimodal information, management and payment system until 2020 (goal 8)

The project is divided in seven work packages. WP1 (Project Management) deals with the administrative and financial management as well as the technical coordination and quality control. In WP2 (Network management and meeting logistics) a stakeholder network will be developed, services which facilitate the involvement of the experts and stakeholders in the network are provided and meeting logistics are coordinated. Within WP3 (Overview on main policies, funding mechanisms, actors and trends) an overview about most important policies and funding mechanisms, actors and trends relevant for

implementing the four selected White Paper goals will be established. A state of the art review of challenges and barriers for sustainability transitions in the transport sector will be done in WP4 (Challenges and barriers for implementation of White Paper goals). While WP5 (Selection and analysis of international good practice case studies - "Transformation is possible!"), will create a comprehensive database of good-practice examples, analyse (unsuccessful) examples, categories success factors and provide an answer to: "What effective solutions do we already know?" Building strongly on the previous Work Packages and the different stakeholder consultation activities, in WP6 (Implementation roadmaps, concrete recommendations and a detailed strategic outlook) the three main project results: roadmaps, target group specific recommendations, and a detailed strategic outlook into the future European transport system will be developed. In WP7 (Dissemination and communication), effective dissemination and communication strategy and tools will be developed and the results of the TRANSFORuM project will be promoted.

This document provides an overview on the findings of the TRANSFORuM project on policies, actors, funding mechanisms and trends relevant for implementing the four selected White Paper goals. The aim is to:

- Give an overview of policies already in place and foreseeable for the near future;
- Identify actors and actor groups relevant to promote the different goals;
- Examine the different funding mechanisms in place today on an EU and national/local level;
- Highlight trends which are most relevant for the goals and their achievement.

The structure of the document follows the structure of the project, i.e. each theme is discussed separately. In order to avoid repetition, the approaches applied for each topic and the general themes relevant for all thematic groups are discussed in the following sub-sections. Issues specific for each thematic group are examined in separate section.

The input for this deliverable is derived from desk research, direct discussions with relevant experts and contributions made at the first Forum, which took place in Gdansk on 24th and 25th of June 2013. At this event, more than 35 stakeholders were present. Discussions took place in four parallel workshops, one for each thematic group.

1.1 Policies and funding mechanisms

This section will define the concepts of policies and funding mechanisms and provide expert examples relevant to implemented project goals. A policy is a principle or rule to guide decisions and achieve specific outcomes. Policies are generally adopted by governance bodies within public organizations whereas procedures would be developed and adopted by executive officers. Policies assist in decision making and may apply to government, private sector organizations, groups and individuals. Policies may also refer to the process that lead to organizational decisions, including the identification of different alternatives such as programs or spending priorities and selecting among them on the basis of the impact that they will have. Policies are comprehended here as political, management, financial and administrative mechanisms that are

initiated in order to reach certain targets. Common types of policy measures include: economic instruments, regulations, information and other soft instruments.

The goal of this document is to highlight current and foreseeable policies relevant for the four White Paper goals. At this stage the main focus is on EU policies and agendas. Especially for the TRANSFORuM roadmaps it is relevant to identify what can be done at the EU level and what should be left to the national and regional level to decide. Especially for setting frameworks and agendas, ensuring European-wide standards and highlighting long term priorities, the EU plays an exceptional role.

In order to implement relevant measures and policies, appropriate funding mechanisms are important. Especially in times of limited financial resources, it is important to ensure that financing is appropriate to achieve the expected impacts. Depending on the type policy, funding can take place either on a local, regional, national or European level or a combination of them. Funding can be carried out for different purposes, ranging from instigating research and discussion processes to direct support of concrete implementation projects.

One important aspect is the time line associated to funding mechanisms. On the one hand, in large scale programmes such as HORIZON2020 certain general decisions about what type of initiatives will be financed are made for a long period. This implies that a decision within the field of research and technology will be supported in the coming seven years. This is complemented by other funding mechanisms, such as regional funds, which allow a more regional, often cross-border, concentration of support. National initiatives play an important role in this context, as they can complement these initiatives with a focus on the national needs and priorities.

Each of the White Paper goals examined in TRANSFORuM has different needs in regard to funding. Thematic group 1 (Clean Urban Transport and CO_2 free city logistics) is located primarily at the local and regional level and needs separate solutions which are compatible to the different transport requirements.

Thematic group 2 (Shift of road freight to rail and waterborne transport) requires a combination of both national and transnational approaches, national where the local situation must be considered, transnational where compatibility and accessibility across Europe must be ensured.

The same goes for thematic group 3 (Complete and maintain the European high speed rail network). Here the difference to thematic group 2 lies in the fact, that the high speed rail network represents a separate and newer network.

Thematic group 4 (Create a framework of a European multimodal information, management and payment system until 2020) has a clear European dimension and here it is important to ensure compatibility across Europe and across the different systems. Here the EU can most support by encouraging standardization and cross-country collaboration while the funding of local and regional solutions in each country can be supported by local initiatives.

Implementation of policies can be supported by different funding mechanisms and can be highly relevant for reaching the different White Paper transport goals (see also sections 2.2, 3.2, 4.2, 5.2).

An overview of the most important funding mechanisms which can be geared towards White Paper implementation, justified according to significance and measure, is following:

- **Structural Funds** and Cohesion Fund (see below) make up one of the largest items of the budget of the European Union. They are financial tools set up to implement the regional and structural policy of the EU. These funds aim to reduce regional disparities in terms of income, affluence and feasibility. The Structural Funds are made up mainly of the European Regional Development Fund and the European Social Fund. Together with the Common Agricultural Policy, the Structural Funds and the Cohesion Fund comprise the great bulk of EU funding. The Structural Funds priorities consist of reinforcing competitiveness, employment, human and physical capital (e.g. roads, buildings, airports etc.), innovation, knowledge society, environment and administrative efficiency. To explain the interplay between different political levels – European, national and regional – in determining the priorities for these funds in general, the overarching preferences are set at the EU level and then transformed into national priorities by the member states and regions. At the EU level the overarching priorities are established in the Community Strategic Guidelines which set the framework for all actions that can be taken using the funds. Within this framework each member state develops its own National Strategic Reference Framework which sets out the priorities for the respective member state, taking specific national policies into account. Operational Programmes for each region within the member state are drawn up in accordance with the respective National Strategic Reference Framework, reflecting the needs of individual regions.
- The **Cohesion Fund** is assigned to direct funding of big projects in the field of environment and direct transport development. It applies to member states with a Gross National Income of less than 90 % of the EU average.
- The **European Regional Development Fund** supports programmes addressing regional development, economic change, enhanced competitiveness and territorial co-operation throughout the EU. Funding priorities include modernizing economic structures, creating sustainable jobs and economic growth, research and innovation, environmental protection and risk prevention. Investment in infrastructure also retains an important role, especially in the least-developed regions.
- The **European Social Fund** appertaining to Structural funds focuses on four key areas: increasing the adaptability of workers and enterprises, enhancing access to employment and participation in the labour market, reinforcing social inclusion by combating discrimination and facilitating access to the labour market for disadvantaged people and promoting partnership for reform in the fields of employment and inclusion.
- The **Research Framework Programmes** – Currently **The Seventh Research Framework Programme (FP7)** bundles all research-related EU initiatives and very strong support is shown for European funding of trans-national collaborative research. The broad objectives have been grouped into four categories: Ideas, People, Capacities and Cooperation including theme "Transport". For each type of objective there is a specific programme corresponding to the main areas of EU research policy. All specific programmes work together to promote and encourage the creation of European poles of

excellence. The bulk of EU research funding in FP7 goes to cooperative research, with the objective of establishing excellent research projects and networks able to attract researchers and investments from Europe. This is achieved through a range of funding schemes: Collaborative projects, Networks of Excellence, Coordination/support actions, etc. The specific Cooperation programme is sub-divided into ten distinct themes and supports all types of research activities carried out by different research bodies in trans-national cooperation and aims to gain or consolidate leadership in key scientific and technology areas. The ten identified themes reflect the most important fields of knowledge and technology where research excellence is particularly important to improve Europe´s ability to address its social, economic, public health, environmental and industrial challenges of the future. The Cooperation programme budget is devoted to supporting cooperation between universities, industry, research centres and public authorities throughout the EU.

- **Public Private Partnerships (PPP)** are a government service or private business venture which is funded and operated through a partnership of a government and one or more private sector companies. PPP involve a contract between a public sector authority and a private party, in which the private party provides a public service or project and assumes substantial financial, technical and operational risk in the project. Governments seek to encourage private investment in infrastructure and PPPs provide a perspective on the collaborative and network aspects of public management. Investments in public sector infrastructure are seen as an important means of maintaining economic activity as was highlighted in a European Commission communication on PPPs (EC, 2013b). A key motivation for governments considering public private partnerships is the possibility of bringing in new sources of financing for funding public infrastructure and service needs. It is important to understand the main mechanisms for infrastructure projects, source of finance, the typical project finance structure and key issues arising from developing project financed transaction. A number of key risks need to be taken into consideration as well. These risks need to be allocated and managed to ensure the successful financing of projects.
- **Direct European Investments and Research Grants** are supporting research and innovation, technology development, cooperation etc. The financial support is available through various EU programmes and instruments aimed at assisting Member States in supporting EU policy implementation and initiating associated investments. In an open global economy, competitiveness relies on the capacity of businesses to create high value added goods and services. Research and innovation can offer solutions to overcome the great challenges our continent and the rest of the world are facing, challenges such as energy security, climate change, environmental degradation, the exclusion of vulnerable groups, the ageing population, global health threats and demographic developments.
- **European Economic Area and Norway grants** provide funding to 16 EU countries in central and southern Europe. There are 32 programme areas within different sectors ranging from environmental protection and climate change to civil society and research. All countries have different needs and priorities. Each country agrees on a set of programmes with the donor countries based on needs, priorities and the scope for bilateral cooperation. The goal is to contribute to financing of programs /

projects in priority areas to reinforce the competitive advantage of new member countries. Norway is a part of the Schengen Area and is the EU´s 4th most important import partner and overall program objective is to enhance research cooperation and fund the creation of new scientific knowledge and quality outputs through these bilateral research projects.

- The **European Investment Bank** – is the European Union´s bank, therefore representing the interests of the European Union Member States and working closely with other EU institutions to implement EU policy. The European Investment Bank provides finance and expertise for sound and sustainable investment projects which contribute to furthering EU policy goals. Projects that make a significant contribution to growth, employment, economic and social cohesion and environmental sustainability in Europe are supported. Priorities as defined in the Banks Operational Plan are following:
    - Linking regional and national infrastructure of transport and energy
    - Supporting a competitive and secure energy supply
    - Addressing economic and social imbalances between regions
    - Protection and improving the natural and urban environment
    - Promoting innovation through investment in ICT and human and social capital
    - Supporting the creation of new jobs

  All financed projects comply with strict economic, technical, environmental and social standards. The European Investment Bank cooperates with the European Commission to use EU funds for special programme support and stimulates and catalyses private capital through investment in equity and funds.

- **TEN-T Financing – Trans-European Transport Networks** are a planned set of road, rail, air and water transport networks in Europe. TEN-T funding opportunities are open to all Member States or, with the agreement of the Member States concerned, international organizations, joint undertakings or public/private undertakings or bodies. TEN-T grants can support studies or works which contribute to relevant programme objectives. To allow this funding to ultimately improve the European transport network and increase mobility, there is a specific sequence of activities which need to take place in order to award it. The Trans-European Transport Network Executive Agency TEN-T EA) is responsible for managing the technical and financial implementation of the TEN-T programme. Fundamental priorities are the transport infrastructure support, interoperability, safety control, to facilitate the mobility of persons, goods and services etc. TEN-T planning take place on two levels:
    - Comprehensive network (plans for rail, road, inland waterway, combined transport etc.)
    - Priority projects with cohesion and sustainable development objectives
- The **Europe 2020 Project Bond Initiative** has the objective to support the capital market financing of large infrastructure projects in the sectors of transport (TEN-T), energy (TEN-E) and information

and communication technologies (ICT) by attracting additional private sector financing (e.g. from insurance companies and pension funds). This is supported by the provision of a subordinated debt portion of the project financing from the EIB, which improves the credit quality of the bonds. In general the project company will be a public private partnership (PPP) established to build, finance and operate an infrastructure project and will issue these bonds themselves (not EIB or Member States) (EIB, 2012).

1.2 Actors

Another element in the TRANSFORuM project is to create a broad overview of European actors and stakeholders relevant for the four selected key goals of the European Transport White Paper. The TRANSFORuM project has therefore established an extensive stakeholder database including numerous actors and organisations which play an important role when it comes to:

- Implementing policies and programmes;
- Carrying out impact assessments; and
- Generating public support.

Examples of such actors are; operators, consultants, researchers, NGO's, interest or consumer groups, media, local or regional authorities, public authorities and industry. In addition, where appropriate, information on links to other individuals and organisations are collected in order to allow a better understanding of different networks and connections. Output is an extension of the database which has already been set up in TRANSFORuM and is expanded throughout the project. At the time of writing this database has already more than 500 entries and is continually being expanded to include 1000 entries.[1]

1.3 Trends

The objective of this section is to identify trends that are relevant for the White Paper goals of the thematic groups. Relevancy in this context means that these trends either directly work for or against achieving these goals or that they must be considered as they make up the framework in which policies are implemented. It is not the goal of this study to carry out yet another trend analysis but rather to rely on the data already available. Sources for the analysis are taken from studies, roadmaps and projects carried out in Europe and beyond. In cases where different future scenarios were discussed, we have selected future scenarios with medium impact and probability. For example, wildcards, which are low-likelihood, hard-to predict events that would have a disproportionately large impact if they occur (e.g. energy from fusion power will be standard by 2040), will not be considered as these would not be trends but rather a break which

[1] The stakeholder database is an ongoing process and will be documented in a separate report which contains the database and highlights the relevant actors and organisation for the implementation of the different roadmaps.

cannot be reasonably anticipated at the moment. In case of conflicting results from different studies this will be mentioned, although no demand for completeness can be made.

2010 is the base year of the analyses in this paper, in addition to the prospective year of 2020, 2030 and 2050, although allowances have to be made for data gaps depending on the references. Both quantitative and qualitative data will be considered and discussed for the analysis.

From an analysis point of view we are mainly talking about 'megatrends'. This term was introduced in the 1980s by John Naisbitt (1982) and refers to trends which have a lasting impact, are very difficult if not impossible to reverse and last for at least 20 to 30 years. Examples for such megatrends are climate change and demographic change. Considering the timeframe of the White Paper of 2030/2050 we are already at the border between trend analysis and future research and indeed some might argue that looking further than 10 years in the future cannot be termed trend analysis. From this point of view, a trend is something that develops out of something that already exists and does not allow for any breaks. For our purpose we will have to stretch the term trend in order to cover the time frame of the White Paper and at the same time not to drift too much into the realms of fantasy but provide a solid basis for the subsequent road mapping exercise.

For the following sections different types of trends are considered. First of all we start with general trends which are relevant for all thematic groups (e.g. demographic development) or help describe the general landscape in which the policies are carried out (e.g. stock of natural resources). Thematic group specific trends are examined separately. Trends relevant for only one of the thematic groups are discussed in the appropriate sections. As this should not be a mere repetition of trends which have already been collected in numerous data bases, the focus will be on qualitative discussions on the different trends with a special focus on uncertainties connected to them.

1.3.1 General global trends

Global Demographic and social trends

From the outlook by the United Nations (UN, 2010) it can be seen that the global population is expected to increase until 2050 and continue to do so although a trend break seems to occur around that time (see Figure 1). The largest contribution to this growth will come from Africa and Asia although in Asia growth will have virtually abated by 2050. It can be seen that the increase in population pressure will be strongest in Africa, which might also have a growing impact on Europe, due to migration. Latin America shows very moderate growth as does North America.

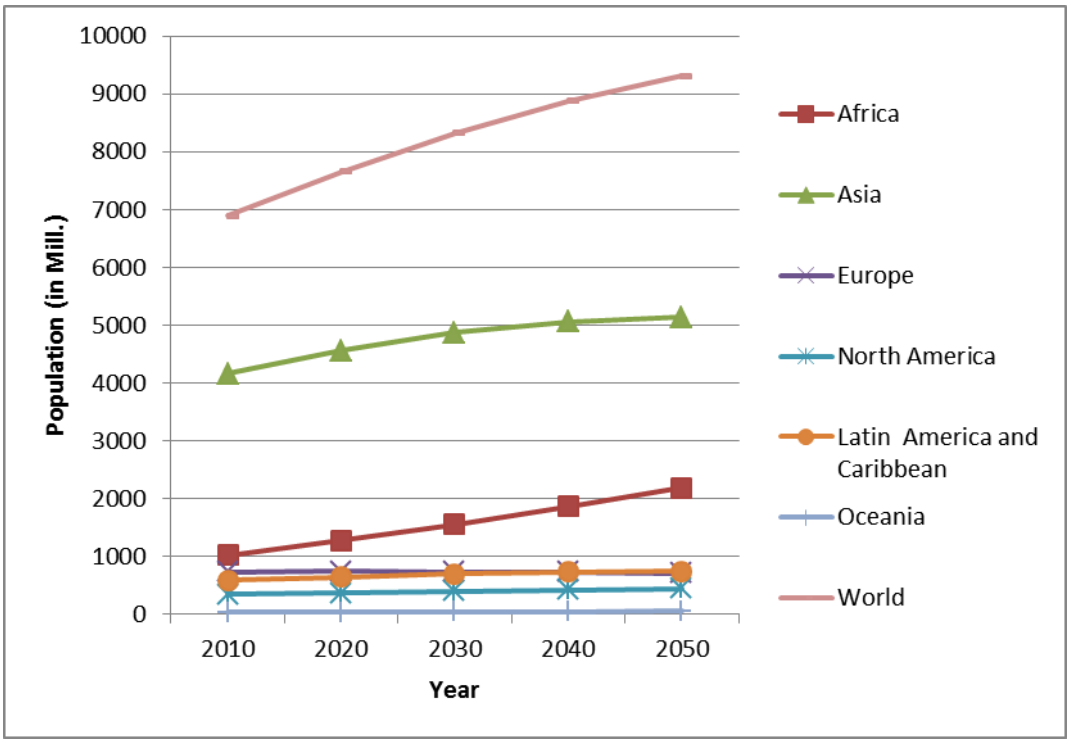


Figure 1: Global population development until 2050, data for medium variant (UN, 2010)

While the life expectancy increases and the population becomes older, the planned increase of pensionable ages in OECD countries is only about 2 years until 2050 (see Figure 2). The average life expectancy at age 65 in OECD countries between 1960 and 2010 increased by around 3.9 years for men and 5.4 years for women. In 2010, for women, the expected life expectancy after pensionable age is about 23.2 years, nearly five years longer than for men. From 2010 to 2050 it is expected to increase about 1.5 years for both, women and men (see Figure 3). The pension age is the most visible indicator for the retirement-income system. Currently, the number of years of people's lives spent in work has decreased. This has several reasons, people spend longer periods in retirement and young people enter later into work. Although the longer time periods of education may result in private and public benefit, it puts further pressure on the pension-system finances. In case this trend continues it can be expected that the overall pension costs will increase in future (OECD, 2010).

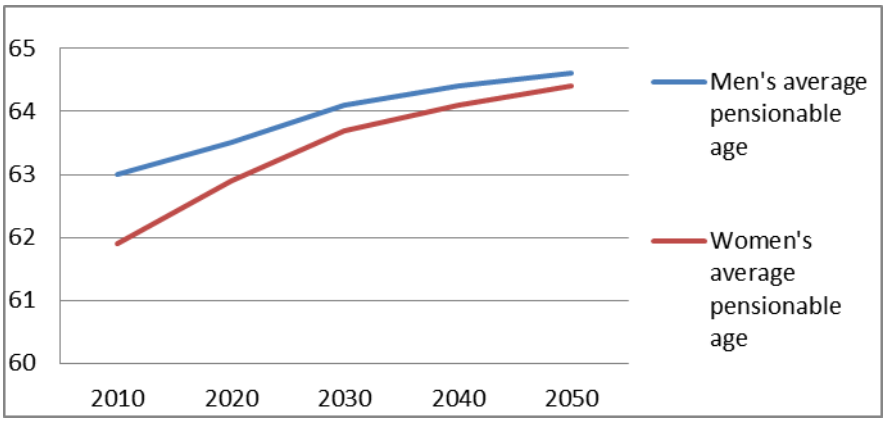


Figure 2: Average pensionable age for men and women in OECD countries 2010-2050 (OECD, 2010, p. 13f)

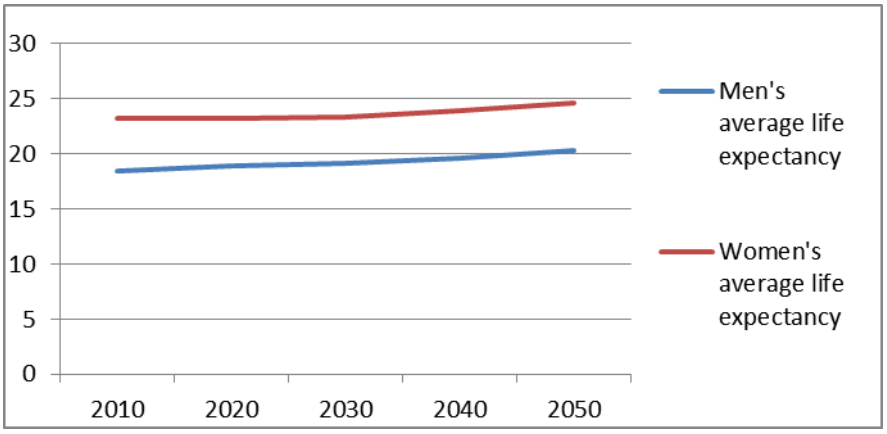


Figure 3: Average life expectancy after pensionable age for men and women in OECD countries 2010-2050 (OCED, 2010, p. 19f)

Urbanization

A look at the global urban development indicates that there is an on-going population shift from rural to urban areas. The World Bank (2013) predicts that more than two-thirds of the world population will live in cities by 2030. Most of this growth is caused in developing countries where each month more than 5 million people move to urban areas. Almost 1 billion people live in slums near to their jobs and opportunities generated by urban growth. This brings new challenges to the cities, which have to ensure access to basic services, infrastructure as well as affordable living spaces, in particular for poor people (World Bank, 2013). 100 years ago only about 20 %, by 1990 less than 40 % of the world population lived in urban areas. In 2010 more than 50 % of the world population lived in cities, while estimates by the WHO (2013) expect that around 60 % will live in a city by 2030 and 70 % in 2050.

Figure 4 presents an overview of the development from 1960 to 2010. From a global perspective, the highest growth took place in the 1950s, with 3 % per year. Nowadays about 60 million people migrate to cities every year. Between 2025 and 2030 an annual growth of 1.5 % is expected. In 2050 the urban

population will reach about 6.4 billion, thus be almost twice as high compared to 2009. When looking at the developing countries between 1995 and 2005, a weekly growth of 1.2 million people living in urban areas was recorded. By 2050 it is expected that the urban population in these countries will more than double compared to 2009 (2.5 billion to 5.2 billion). Annual growth from 2025 to 2050 is estimated to be about 1.55 %, compared to 4 % between 1950 and 1975. In high-income countries the urban population is only expected to grow slowly, where immigration will account for two-thirds of the growth, over the next two decades (from 920 million to 1 billion by 2025) (WHO, 2013).

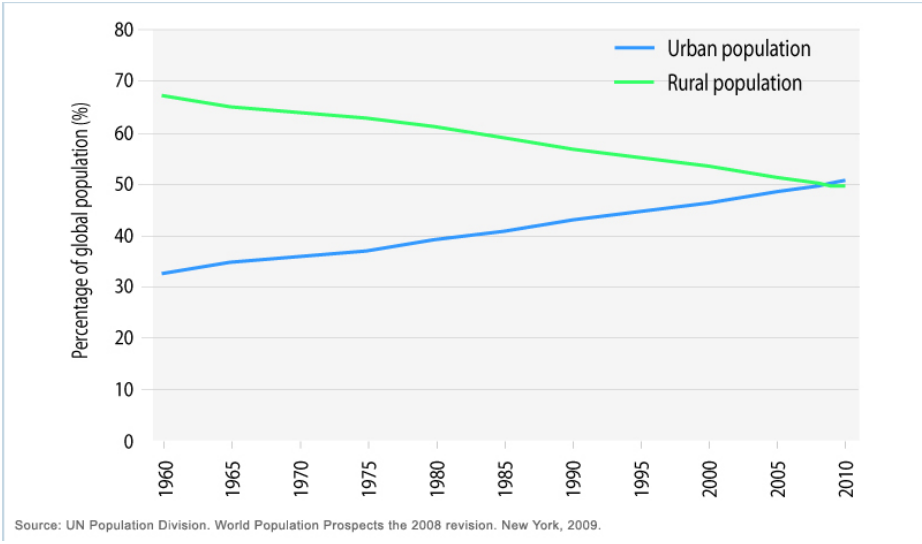
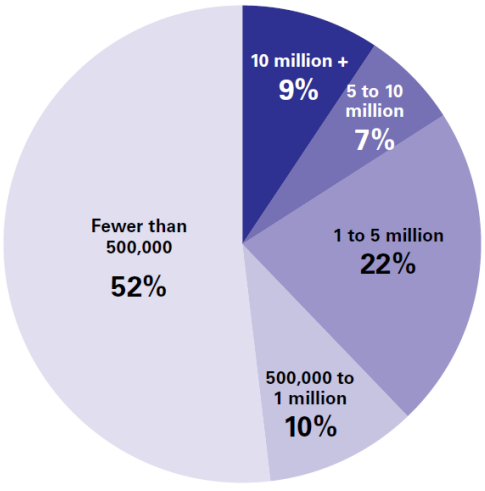


Figure 4: Percentage of total population living in urban/rural areas, 1960-2010 (WHO, 2013)

Half of the world's urban population lives in cities with fewer than 500,000 citizens and only 16 % in cities with more than 5 million inhabitants, highlighting the need for transport solutions addressing the challenges faced by small and medium sized urban areas. Figure 5 gives an overview about the population distribution regarding city sizes (UNICEF, 2012).



Source: Calculations based on UNDESA, *World Urbanization Prospects: The 2009 revision.*

Figure 5: World urban population distribution, by city size, 2009 (UNICEF, 2012)

Household income distribution

In the two decades before the economic crisis in 2008, the real disposable household income in OCED countries increased by an average of 1.7 %, with a faster growing income of the richest 10 % compared to the poorest 10 %, widening the gap between rich and poor households. In OECD countries in 2011 the average income of the richest 10 % was about nine times higher than of the poorest 10 %. This varies widely between the countries, it is lower e.g. in most Nordic countries. In Italy the ratio is about 10 to 1, in Turkey, Israel and the US 14 to 1 and about 27 to 1 in Chile and Mexico. The Gini coefficient gives information about the income inequality (0 when everybody has the same income; 1 when all income goes to one person). While in the mid-1980 the average Gini coefficient was about 0.29 in OECD countries, it climbed until the late 2000s to 0.316. There were significant increases in 17 of the 22 OECD countries (for which long term data was available; see Figure 6). In Finland, Germany, Israel, Luxembourg, New Zealand, Sweden, and the United States it went up by more than 4 %. In Belgium, Hungary and France only little changes occurred, while Turkey and Greece experienced a decrease in inequality. The development of the income inequality differs over time and region. For instance, in the US, the UK and Israel the gap started to increase in the late 1970s. A trend in the late 2000s showed that not only countries where the inequality is already quite high are affected but also traditionally low-inequality countries like Germany, Denmark and Sweden, where the inequality increased more than elsewhere in the 2000s. Compared to that, countries with high levels of inequality (e.g. Chile, Mexico, Greece etc.) reduced it considerably (OECD, 2011).

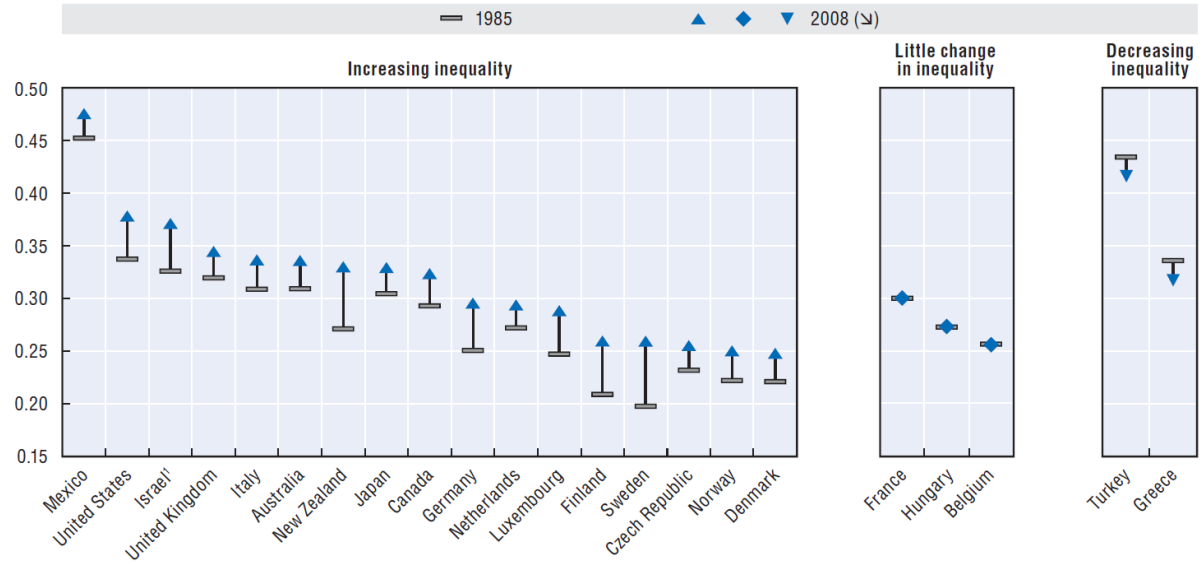


Figure 6: Gini coefficient for different OECD countries (OECD, 2011, p. 22)

Distribution of wages

Changes in the distribution of wages and salaries are the main reason for the increase in household income inequality, since it accounts for ¾ of household incomes among working-age adults. The wages of the 10 % best-paid workers have relatively increased compared to the 10 % lowest-paid. The difference

between the top 10 % and the middle earners grows faster than between the middle and the lowest earners. For instance, in the US, the disparity between the richest and poorest 10 % of full-time workers changed from 3.8 times in 1980 to almost 5 times in 2008. Other examples are Hungary (3.6 in 1992 to 4.6 in 2006) and Poland (2.9 in 1992 and 4.2 in 2004). The increase of the wage inequality, which resulted from income growth at the top and income reduction at the bottom, was higher in the late 1990s and 2000 than in former times. In total, the wage disparity increased in 16 of 23 OECD countries, while only in two countries (France and Spain) a decline was recorded and no considerable changes occurred in five other countries (Korea, Belgium, Finland, Japan and Ireland) (OECD, 2011).

Consumer spending

Figure 7 shows the changes in consumer spending of the middle class. In the European Union the middle class consumption increases slightly until 2025 but then declines towards 2050. In contrast, in India and China average income and spending power increases. In the US, the middle class consumption declines steadily from 2010 till 2050 (EEA, 2011).

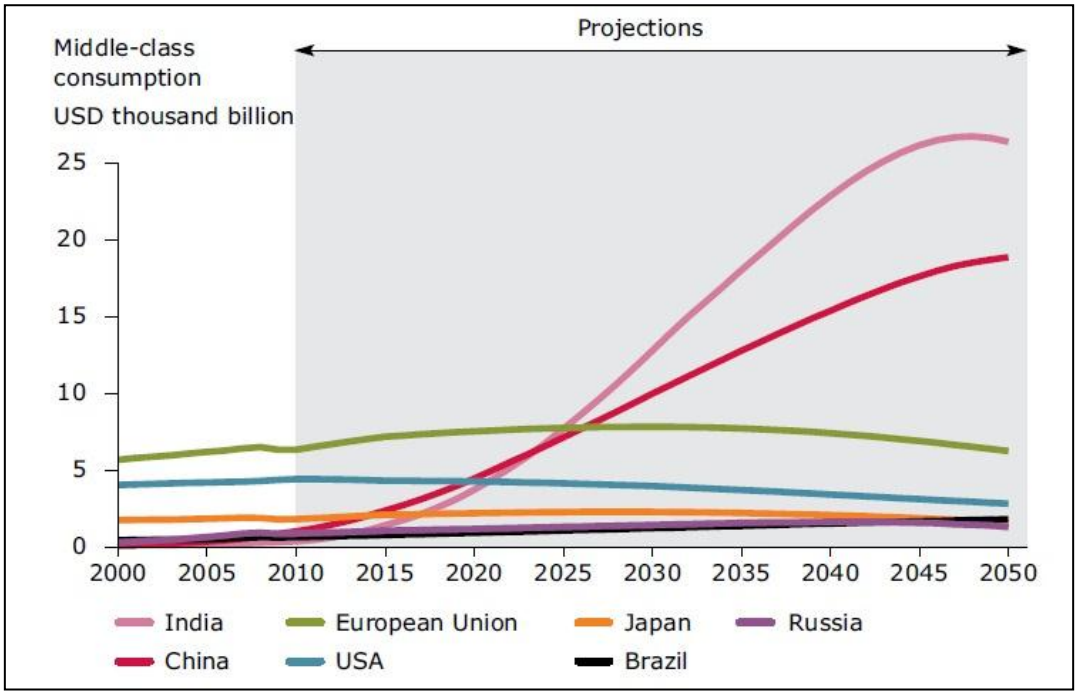


Figure 7: Changing consumer spending of the middle class (EEA, 2011, p. 27)

Car ownership

An improvement of economic conditions also leads to a change in mobility patterns. This is well reflected by the rate of car ownership expected for the future (see Figure 8). China and India are expected to see the biggest increase of car ownership in the future while several OECD countries may already have reached a saturation point or will reach it by 2030 (EEA, 2011). In ITF (2012) various discussions about reduced traffic growth ('peak car/travel') in recent years are summarised. There is a wide range of studies available which state that there was only little growth or even a decline (especially in cities) in car use per

capita, total car traffic, and even total road traffic for some years in advanced economies. Other studies extend this view and show that this might be related to all traffic not just car use. There are a lot of possible explanations for reduced growth and even a decline in car use, like traditional 'economic' factors of prices and incomes; changes to the relative quality and reliability of travel; developments in land use planning; new social/technical patterns and preferences seen as influences on behaviour; new patterns of work, shopping, entertainment and leisure or direct and indirect effects of technologies providing mobile internet access.

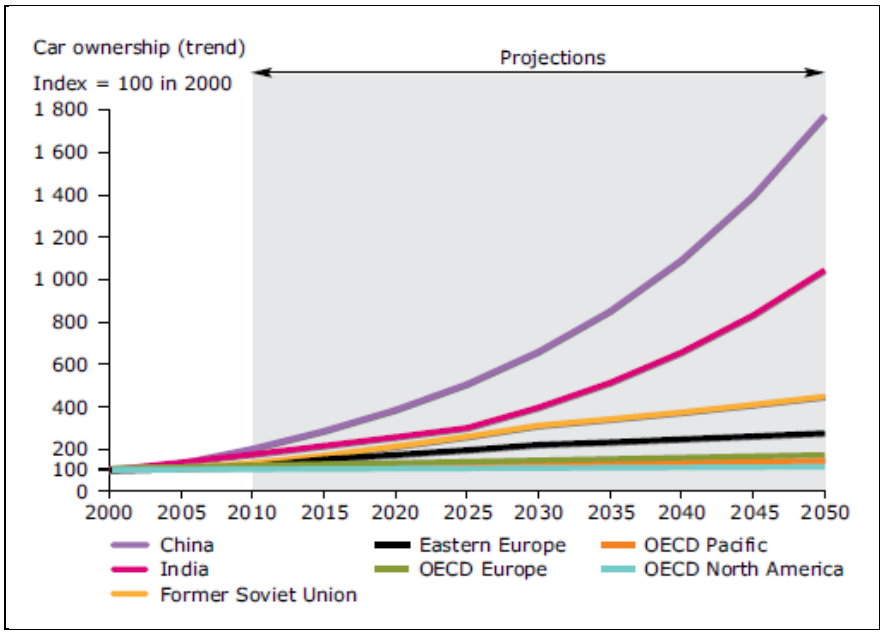


Figure 8: Car ownership rate from 2000 – 2050 (EEA, 2011, p. 28)

Global climate trends

Changes in the environment triggered by climate change are one of the main motivations for the Transport White Paper. While the impact humans have in triggering these changes has not been fully agreed upon, although accepted by most scientists, the existence of global climate change is not in dispute and can already be observed by many indicators (e.g. changes in phenology, changing migration patterns of animals, and so forth).

In 2010, at the UN Framework Convention on Climate Change (UNFCCC) conference in Cancún, the goal of a CO_2 concentration level of 450 ppm was set, to have at least a 50 % chance of stabilizing the climate at 2 degrees (2 °C) global average temperature increase above pre-industrialization levels. The Baseline projection shows that the global average temperature will likely exceed this value by 2050 (see Figure 9), assuming that no actions are taken (OECD, 2012). Currently the fifth assessment report is under development which will be presented in 2014. The summary of working group I (Physical Science Basis) was published on 27th September, 2013 further strengthening the basis for assuming human induced climate change (IPCC WGI AR5, 2013).

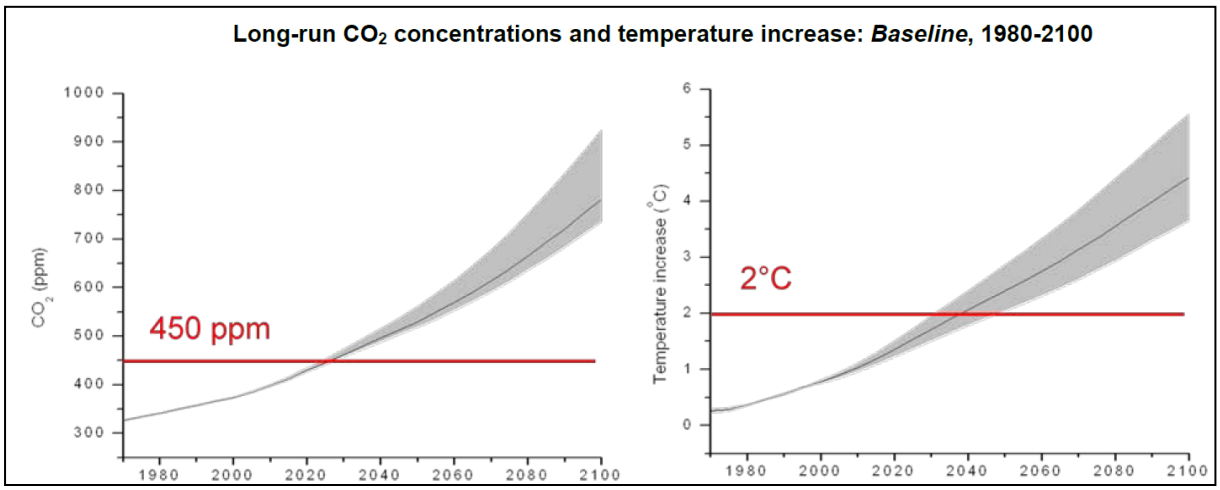


Figure 9: Long-run CO_2 concentration and temperature increase, Baseline 1980-2100 (OECD, 2012, p. 2)

One direct consequence of this temperature increase is the rise in sea levels. This will affect all low lying regions along the shores. The consequences are enormous, not only in monetary terms, and will need large scale adaption as well as mitigation efforts (e.g. Brown et al., 2011). Globally this will increase the population pressure as low lying areas are normally those which are most suitable for habitation and used most extensively for agriculture.

A Loss of forested areas also has direct impact on the CO_2 concentration, as well as on rain patterns, run offs and other parameters. In 2005, 30 % of the world's land area was covered by forest, i.e. 3,952 million ha. Scenarios from the Millennium Ecosystem Assessment predict that the forest area in developing regions will decrease between 2000 and 2050 by about 200 to 490 million ha, while in industrialized regions it will increase by about 60 to 230 million ha, which would lead to an overall decrease of 3-7 % from 2000-2050 (Nabuurs, et al. 2007).

Both, changes in regional biodiversity and the loss of biodiversity can have effects on the Earth System functioning by increasing the vulnerability of terrestrial and aquatic ecosystems to changes in climate and ocean acidity. All species have different roles in the ecosystem influencing various ecosystem processes and a loss can affect their functioning as well as their potential to respond and adapt to changes in conditions from undesired states. At the moment the global extinction rate is much higher than the rate of speciation, thus loss of species is the primary driver of changes in global biodiversity (Rockström et al., 2009).

Chemical pollution, like radioactive compounds, heavy metals, and a wide range of organic compounds of human origin, has a negative effect on the Earth System functioning as well as on humans. This was mainly observed at local or regional level but is nowadays also apparent at global scale. The physiological development and demography of humans and other organisms is influenced which might lead to further impacts on the ecosystem functioning and structure. Moreover impacts on other areas like biodiversity (e.g. through reducing the abundance of species) might potentially increase organisms' vulnerability to other stresses such as e.g. climate change (Rockström et al., 2009).

Global energy resources

Oil

The confirmed oil reserves are shown in Table 1. The Middle East, with almost 50 % has the most confirmed oil reserves, followed by South and Central America. When looking at single countries, Venezuela (297.6 thousand million barrels; share of total: 17.8 %), Saudi Arabia (265.9; 15.9 %) and Canada (173.9; 10.4 %) have the most confirmed oil reserves (BP, 2013).

Table 1: Confirmed oil reserves in Thousand million barrels according to (BP, 2013)

		At end 2011	At end 2012	Share of total
Total North America		221.0	220.2	13.2 %
Total S. & Cent. America		326.9	328.4	19.7 %
Total Europe & Eurasia		140.3	140.8	8.4 %
Total Middle East		797.9	807.7	48.4 %
Total Africa		126.6	130.3	7.8 %
Total Asia Pacific		41.4	41.5	2.5 %
Total World		**1654.1**	**1668.9**	**100 %**
of which:	OECD	238.5	238.3	14.3 %
	Non-OECD	1415.6	1430.7	85.7 %
	OPEC	1199.0	1211.9	72.6 %
	Non-OPEC[2]	329.4	331.0	19.8 %
	European Union	6.9	6.8	0.4 %
	Former Soviet Union	125.8	126.0	7.5 %

Coal

Table 2 shows an overview of confirmed coal reserves in 2012. Here, Europe and Eurasia (35.4 %), Asia Pacific (30.9 %) and North America (28.5 %) have the most resources. On country level, the US has the highest share (27.6 %), followed by the Russian Federation (18.2 %) and China (13.3 %) (BP, 2013).

Table 2: Confirmed coal reserves in million tonnes according to (BP, 2013)

		At the end of 2012	Share of total
Total North America		245,088	28.5 %
Total S. & Cent. America		12,508	1.5 %
Total Europe & Eurasia		304,604	35.4 %
Total Middle East & Africa		32,895	3.8 %
Total Asia Pacific		265,843	30.9 %
Total World		**860,938**	**100 %**
of which:	OECD	378,529	44.0 %
	Non-OECD	482,409	56.0 %
	European Union	56,148	6.5 %
	Former Soviet Union	228,034	26.5 %

[2] Excludes Former Soviet Union

Shale oil and gas

The U.S. Energy Information Administration (EIA) released in June 2013 a study about the shale gas and shale oil resources. The analysed resources in 42 countries represent 32 % of the world's natural gas and 10 % of the world's crude oil technically recoverable resources. As Figure 10 shows Russia, U.S., China and Argentina have the most shale oil resources. When comparing shale gas, China, Argentina, Algeria and U.S. have the largest deposits of the 42 assessed countries.

Rank	Country	Shale oil (billion barrels)	
1	Russia	75	
2	U.S.[1]	58	(48)
3	China	32	
4	Argentina	27	
5	Libya	26	
6	Australia	18	
7	Venezuela	13	
8	Mexico	13	
9	Pakistan	9	
10	Canada	9	
	World Total	**345**	**(335)**

[1] EIA estimates used for ranking order. ARI estimates in parentheses.

Rank	Country	Shale gas (trillion cubic feet)	
1	China	1,115	
2	Argentina	802	
3	Algeria	707	
4	U.S.[1]	665	(1,161)
5	Canada	573	
6	Mexico	545	
7	Australia	437	
8	South Africa	390	
9	Russia	285	
10	Brazil	245	
	World Total	**7,299**	**(7,795)**

[1] EIA estimates used for ranking order. ARI estimates in parentheses.

Figure 10: Top 10 countries with technically recoverable shale oil/gas resources (EIA, 2013)

EIA's study does not consider many potential shale formations e.g. located in the Middle East and the Caspian region. At the moment only the US and Canada are producing shale gas and oil in commercial quantities. It has to be stated that the estimates are highly uncertain until accurate testing of shale formations is done. Several nations like Argentina, Australia, China, England, Mexico, Russia, Saudi Arabia, and Turkey have started with the exploration or at least expressed interest in their shale formations (EIA, 2013).

Global energy consumption

Figure 11 illustrates the world energy consumption for the OECD and non-OECD countries from 1990 to 2040. The world energy consumption is assumed to increase by 56 % over the next 30 years (from 630 quadrillion Btu in 2010 to about 820 quadrillion Btu in 2040). This high increase is driven by the developing countries outside the OECD, due to their strong economic growth and increasing population. However, there are quite a lot of uncertainties regarding a long-term prognosis or the world energy market. At the moment there is a wide variation in the economic performance, the pace of the emerging economies of non-OECD countries is fast compared to OCED countries. India and China have been among the world's fastest growing economies over the last 20 years (from 1990 to 2010 China grew by an average of 10.4 % per year; India 6.4 % per year). Although the economic growth of the two countries slowed down a little through global

recession, both are expected to continue to lead world economic growth and energy demand growth (EIA, 2013).

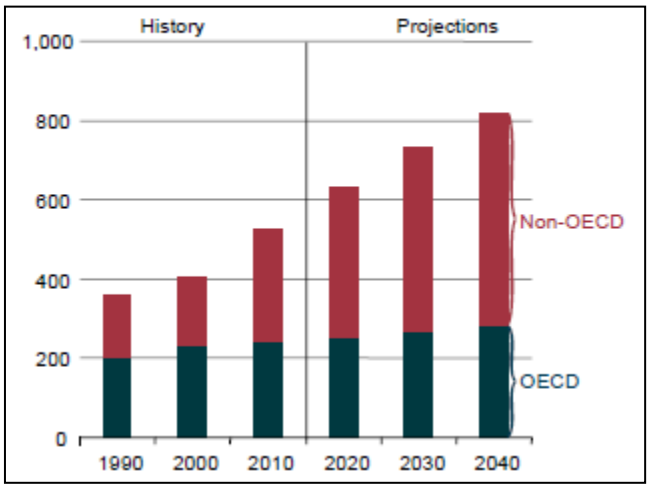


Figure 11: World total energy consumption, 1990-2040 (EIA, 2013, p.9)

Oil consumption

The demand for energy is one of the main drivers in the world today and its impact on the world depends very much on the origin/source and how as well as where it is used. The large and increasing dependency on imported fossil fuels (raised from 45 % in 1997 to 55 % in 2008) makes the EU highly vulnerable to any disturbance in supply (EREC, 2010). Renewable energy sources can help to diversify the fuel consumption within Europe and thereby decrease the fossil fuel dependency and vulnerability of the EU.

If the world agrees on the limitation of global warming at 2 °C (450 Scenario) there will be a significant reduction in oil demand (see Figure 12). The EU already tries to reduce its oil demand; by 2035 it would reach a reduction of about 12 % and thus reduce its dependency on oil imports (IEA, 2010).

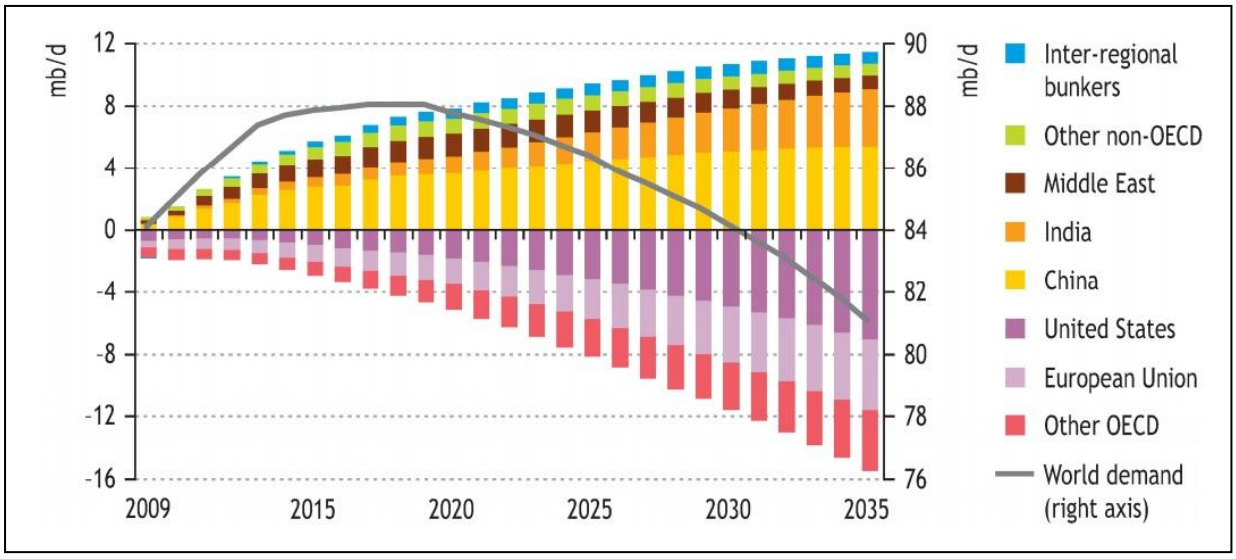


Figure 12: Change in oil demand by region in the 450 Scenario compared with 2008 (IEA, 2010, p.10)

Coal consumption

The world coal consumption is expected to increase from 147 quadrillion Btu in 2010 to 180 quadrillion Btu in 2020 and 220 quadrillion Btu in 2040. Figure 13 shows that the growth rates of coal consumption of OECD and non-OECD until 2040 differ significantly. The short-term increase reflects the high increases of coal consumption by China, India and other non-OECD countries. In the long term the growth rates decrease a little due to policies and regulations that promote the use of clean energy sources and natural gas becoming more competitive. The leading consumer countries are China (47 %), the United States (14 %) and India (9 %) and their total share is expected to increase until 2040 to 75 %. In the OECD countries the coal use is expected to decline by 0.2 % on average per year, while in non-OECD countries an annual increase of 1.8 % is projected. The large amount of coal reserves in India and China as well as their high economic growth result in a significant increase of their use of coal for industrial processes and electric power generation (EIA, 2013).

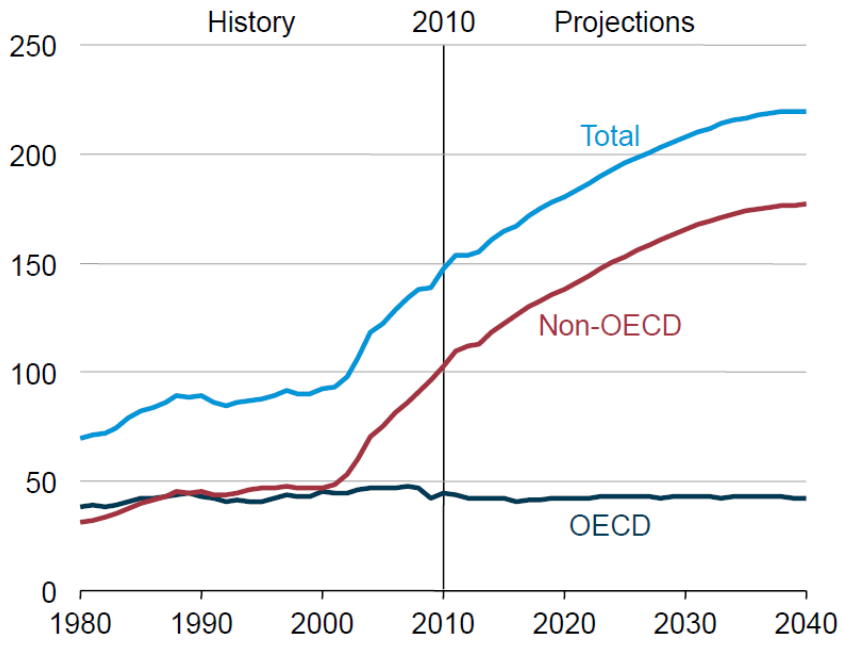


Figure 13: World coal consumption by region (quadrillion Btu) (EIA, 2013, p.67)

Renewable energy

In 2011, the EU-27 average share of energy from renewable sources increased, from 12.1 % (2010), to 13 % (target 20 % by 2020), almost all member states increased their share within this year. The highest shares in 2011 were recorded in Sweden (46.8% of renewable energy sources in total consumption), followed by Latvia (33.1 %), Finland (31.8 %) and Austria (30.9 %). In contrast, Malta (0.4 %) and Luxembourg (2.9 %) had the lowest shares in 2011. Estonia was the member state to reach the Europe 2020 goal (Eurostat, 2013a). The European Renewable Energy Council predicts for the potential of renewable energy sources, that by 2020, the European Union could decrease its annual fossil fuel demand by more than 290 Mtoe, reaching almost 500 Mtoe by 2030 and over 1,000 Mtoe by 2050 (EREC, 2010).

With regard to biofuels, according to (EREC, 2010) the biofuels Consumption will increase from 2007 (7.88 Mtoe) continuously until 2020 (34 Mtoe), 2030 (44.5 Mtoe) and 2050 (102 Mtoe). Therefore in 2020 about 9 % of the total transport fuel demand could be met by biofuels and thus exceeding the target set in the Renewable Energy Directive (which is based on the demand for diesel and gasoline) with about 11 % in 2020. The scenarios predict that about 12 % in 2030 and 67 to 98 % in 2050 of the total transport fuel demand could be covered. This is expected due to a sharp decrease of the transport fuel demand between 2030 and 2050 because of modal shift (passenger and freight) to less energy intensive modes as well as electrification of the road sector (EREC, 2010).

Global Economic trends

Production

To reflect the changes expected in the future regarding production patterns, Figure 14 presents a prognosis how the shares of production of electronic products will develop until 2050. The trend of outsourcing the production of electronic equipment to China is expected to continue. The share of China by 2050 will be more than twice as high as today, which might be a result of specialization in industrial sectors where China has advantages as well as the result of the increasing home market size. In this sector India is not an important actor, since it has its advantages primarily in the software sector (EC, 2012).

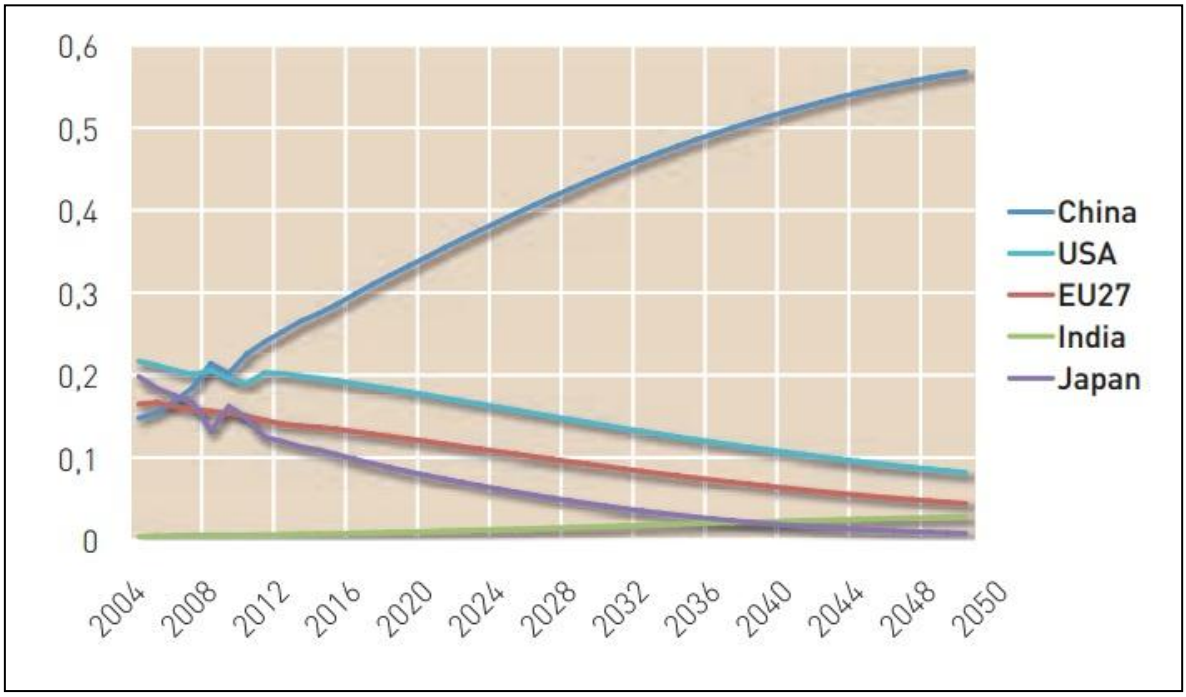


Figure 14: Regional shares in the world production of electronic products (EC, 2012, p. 56)

Gross Domestic Product (GDP)

According to The Conference Board (2014), in mature economies an average GDP growth of 2.2 % is expected in 2014 (1.3 % in 2013). This is mainly due to the United States, where a growth increase from 1.9 % (2013) to 3 % (2014) is projected. Furthermore, the Euro region recovers from the negative growth in

2013 (-0.3 %) to 1 % in 2014. In emerging markets and developing economics only a slight increase of 0.3 % to 4.8 % in 2014 is expected, mainly due to the slowdown of China's growth (7.5 % in 2013, 7.0 % in 2014). In other emerging markets like India, Latin America and other developing Asia a slight growth improvement for 2014 from a weak growth performance in 2013 is expected. In the medium-term outlook (2014-2019), an annual growth of 1.2 % of the Euro region is projected, this trend is expected to continue until 2025. The projected annual growth for the United States and other mature economies (Australia, Canada etc.) is 2.4 % in 2014-2019 and declining for the period 2020-2025 to 1.7 %. Japan's annual growth slows down to 1.0 % from 2014-2019 and 0.6 % from 2020-2025. The slowdown of the emerging markets and developing economies is more significant, since several countries (China, India, Brazil etc.) change to a more balanced growth model (compared to rapid, investment-intensive 'catch-up' growth in former years), this results in a projected annual growth of 4.3 % for 2014-2019 and 3.2 % from 2020-2025 (see Figure 15). Figure 16 shows the change in distribution of World GDP for 2000, 2012 and 2025 (trend).

	Actual Growth 2010-2012	Forecast Growth 2013	Forecast Growth 2014	Projected Growth 2014-2019	Trend Growth 2020-2025
United States	2.4	1.9	3.0	2.4	1.7
Europe*	1.1	0.2	1.4	1.4	1.3
of which: Euro Area	0.9	-0.3	1.0	1.2	1.2
Japan	2.0	1.8	1.5	1.0	0.6
Other mature**	3.7	2.5	3.0	2.4	1.7
Mature Economies	**2.0**	**1.3**	**2.2**	**1.9**	**1.4**
China	9.2	7.5	7.0	5.9	3.5
India	6.8	4.2	4.4	4.8	3.6
Other developing Asia	5.6	4.3	4.9	4.8	4.2
Latin America	4.3	2.1	2.8	2.9	2.9
of which: Brazil	3.5	2.0	2.3	2.9	2.8
of which: Mexico	4.4	1.5	3.1	2.9	3.1
Middle East & North Africa	4.0	1.8	3.0	2.9	2.9
Sub-Saharan Africa	4.8	4.4	5.0	3.9	3.9
Russia, Central Asia and Southeast Europe***	4.6	1.9	2.7	1.8	1.3
Emerging Market and Developing Economies	**6.4**	**4.5**	**4.8**	**4.3**	**3.2**
World Total	**4.0**	**2.8**	**3.5**	**3.1**	**2.4**

Note: projections are based on trend growth estiamtes, which – for the period 2014-19 – are adjusted for adjustments from remaining output gaps
* Europe includes 27 members of the European Union (excluding Croatia) as well as Switzerland and Norway.
** Other advanced economies are Australia, Canada, Iceland, Israel, Hong Kong, South Korea, New Zealand, Singapore, and Taiwan Province of China.
*** Southeast Europe includes Albania, Bosnia and Herzegovina, Croatia, Macedonia, Serbia and Montenegro, and Turkey.
Source: The Conference Board Global Economic Outlook 2014, February 2014 update
https://www.conference-board.org/data/globaloutlook.cfm

Figure 15: Global Outlook for Growth of Gross Domestic Product, 2013-2025 (The Conference Board, 2014)

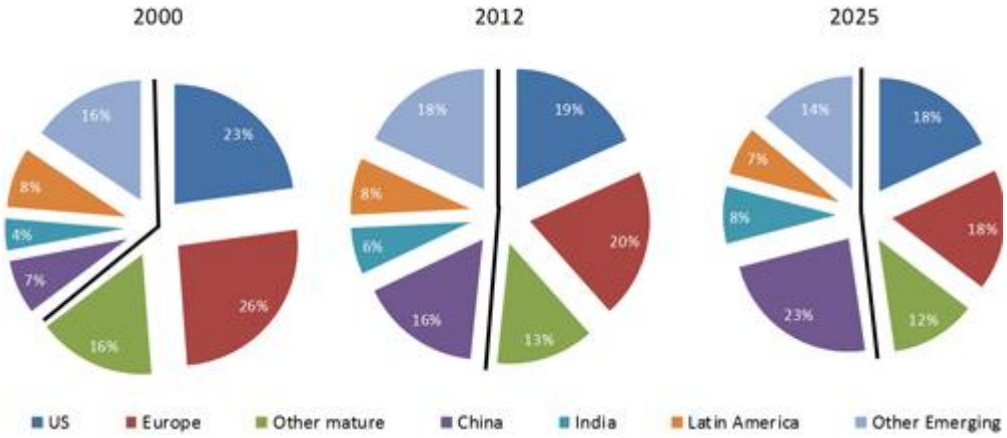


Figure 16: Distribution of World GDP in 2000, 2012 and 2025 (The Conference Board, 2014)

Public austerity

Ortiz and Cummins (2013) discuss public austerity, analysing government spending projections from 181 countries from 2005 to 2015. In the beginning of the crisis (2008-2009), 80 % of the countries enhanced their public spending, on average by 3.9 % of GDP as a countermeasure to the impacts of the global crisis. In the period from 2010 to 2012 40 % of countries (73) cut the total spending on average by 2.3 % of GDP. For the timeframe 2013-2015, the IMF forecasts predict that worldwide more than 50 % of the countries (94 in total) will cut their budgets on average by 3.3 % of GDP. Austerity will affect more than 80 % of the global population (i.e. 5.8 billion persons) in 2013 and this trend is expected to continue to over 90 % worldwide (6.3 billion people) in 2015.

1.3.2 General trends in Europe and the EU

Demographic and Social trends in Europe

Aging population is one of the biggest challenges in the future. As Figure 17 shows, the number of people above 65 will rise by about 70 % (compared to 2010) until 2050 in the EU-27 (from 87 to 148 million). In contrast, the share of people between 15 and 64 will drop by about 12 %. The development for some countries, e.g. in Austria, Germany, Poland and Great Britain, differs significantly from the EU-average. In the UK the number of people in the age class between 15 and 64 is expected to increase, while in Germany and Poland it tends to decrease and in Austria will remain stable (Wöss and Türk, 2011).

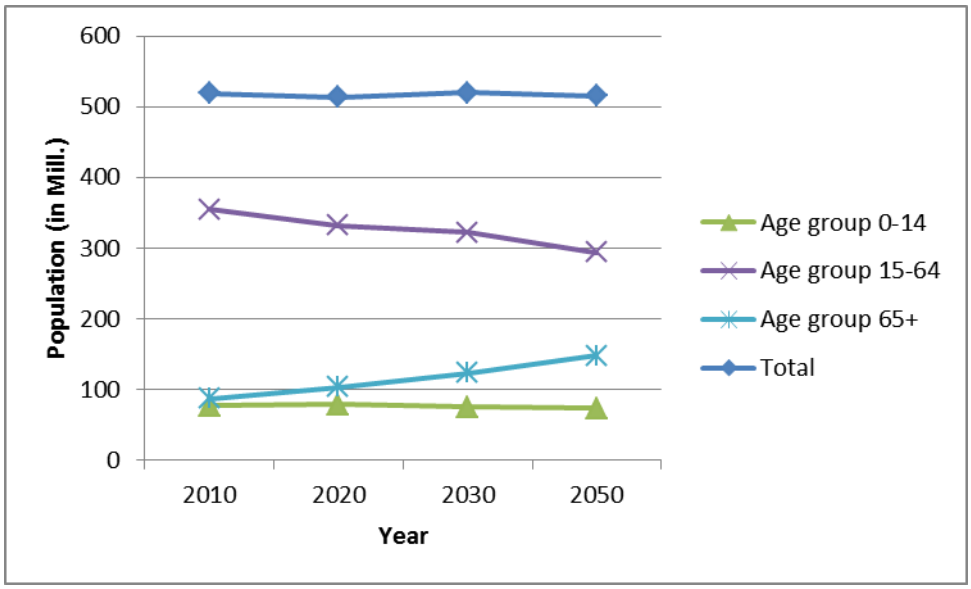


Figure 17: Population projections 2010-2050 (EU-27) (Wöss and Türk, 2011, p. 2)

The population of the EU is currently increasing slowly. In 2011 the increase was 0.3 % for the entire EU-27 (EC, 2012a). It is forecasted that the population will stagnate and possibly decrease slightly during the coming decades. Simultaneously the population will become older (see Figure 18) and the share of retired people may be above 30 % in 2050. This development has several important impacts for transport. The working share of the population will continue to diminish as long as retirement age is not linked to the high life expectancy, which in turn will reduce public revenues. At the same time spending needs increase, e.g. in the form of medical treatments and care for elderly people. This means that (ceteris paribus) it will become more difficult to get public funding for transport infrastructure. A general assumption is thus that the ageing population will tend to weaken pull measures (infrastructure investment in cleaner modes) and strengthen push measures like carbon taxes, energy taxes and congestion charges.

It is also plausible that an ageing population in Europe may shift their consumption somewhat from material commodities to more services, not least health services. This tends to decrease the need for freight transport. Another factor that works in the same direction is that when the population stagnates the need for investment in housing (and to some extent infrastructure) may decrease substantially. Although the direction of these trends - given an ageing population - are rather clear, the magnitude of the trends is uncertain. A potential counter-trend to the ageing population could be an increased immigration of young people to the EU. At present the tendency is to tighten migration control, although if the demand for labour increase this might have to change.

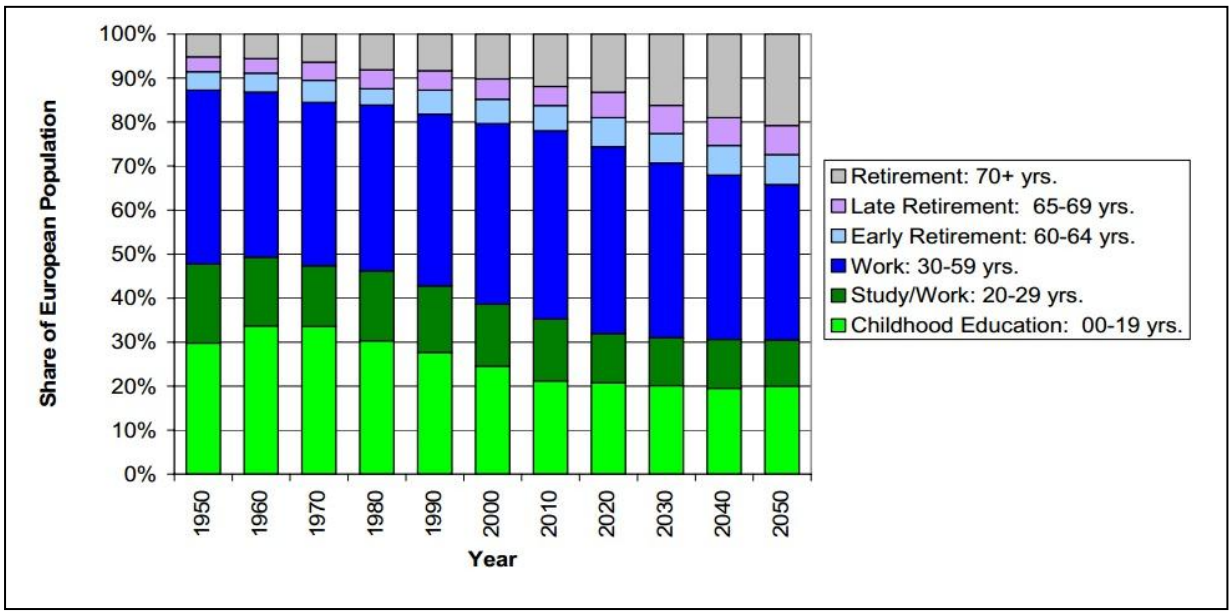


Figure 18: Share of European Population by Age Range and "Biographic Stage" from 1950 – 2050 (EFP, 2011, p.7)

Environmental trends in Europe

GHG emissions

Figure 19 presents the development of the total GHG emissions in the EU in the past and projections until 2030. Estimates for the 2011 GHG emissions indicate that there was a decrease of about 2.5 % from 2010 levels, which are about 17.6 % below the 1990 level and therefore at the lowest emission level observed in the EU until now. The reasons were, on the one hand, the mild winter in many parts of Europe and corresponding lower heating / natural gas demands. On the other hand, renewable energy continued to increase. Also the transport sector played a role, contributing to emission reductions for four years in a row. However it remains to be one of the largest contributors to GHG emissions and only limited reductions have taken place when compared to the emissions from energy industry and use (see Figure 20). A continuous reduction of the EU GHG emissions with already existing policy measures until 2030 is expected. Until 2020 a reduction of around 19 % compared to 1990 is assumed, but given the assumption that the emissions from international aviation will not decrease more strongly until 2020, about 1 % will be missing to reach the 2020 target, unless additional measures and initiatives will be undertaken. When including the impact of additional policies and measures, which are at planning stage at the moment, in 2020 a reduction of GHG emissions of about 25 %, compared to 1990 can be reached. Therefore if the member states increase their current effort, it might be possible to reduce the GHG emissions even 5 % below the target. Since after the implementation of mitigation policies, it takes a while until they reach their full impact (EEA, 2012a).

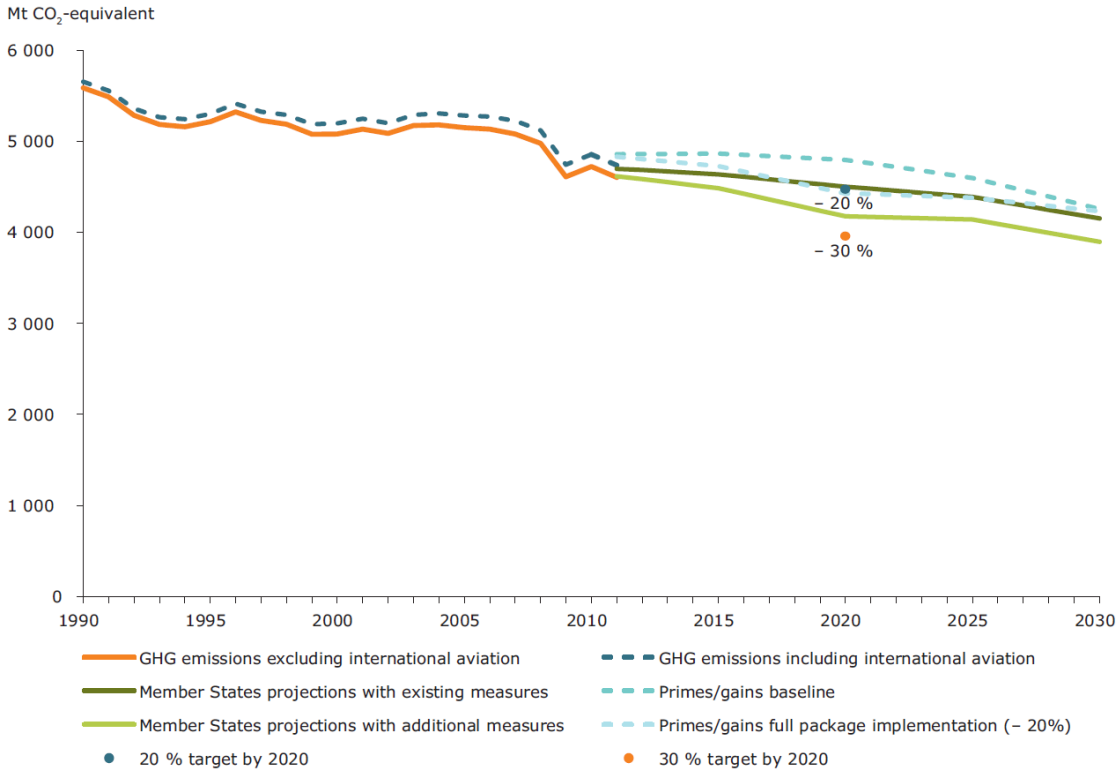
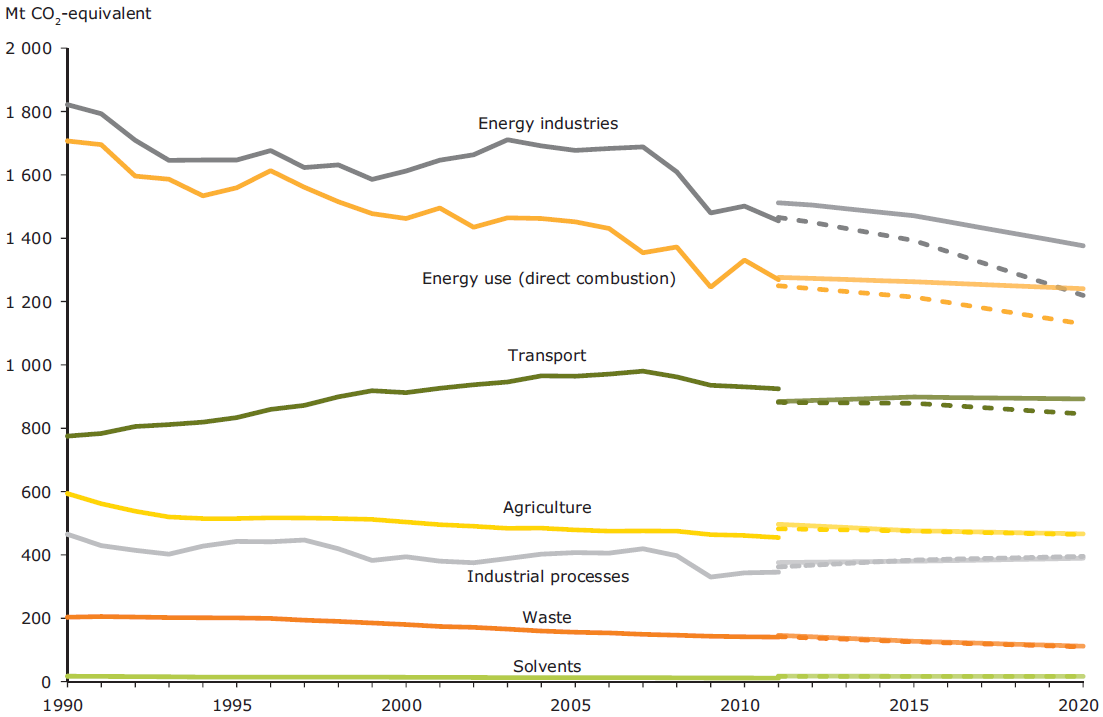


Figure 19: Trends and projections of EU total GHG emissions (EEA, 2012a, p. 61)



Note: Solid lines represent historic emissions up to 2011 and WEM projections from 2011 onwards. Dashed lines represent WAM projections.

The gaps observed between the end of historic trends and the start of projected trends are due to the fact that absolute projection data were not calibrated on the latest 2011 GHG proxy inventory data.

Figure 20: Sectorial trends and projections of EU GHG emissions (EEA, 2012a, p. 62)

Figure 21 shows the progress in technology of new cars on emitted CO_2 emissions per kilometre until 2011 with the corresponding EU targets for 2015 and 2020. A continuous decrease can be seen. In 2011, the average CO_2 emissions from new passenger cars were 135.7 gCO_2/km, compared to 140.3 gCO_2/km in 2010.

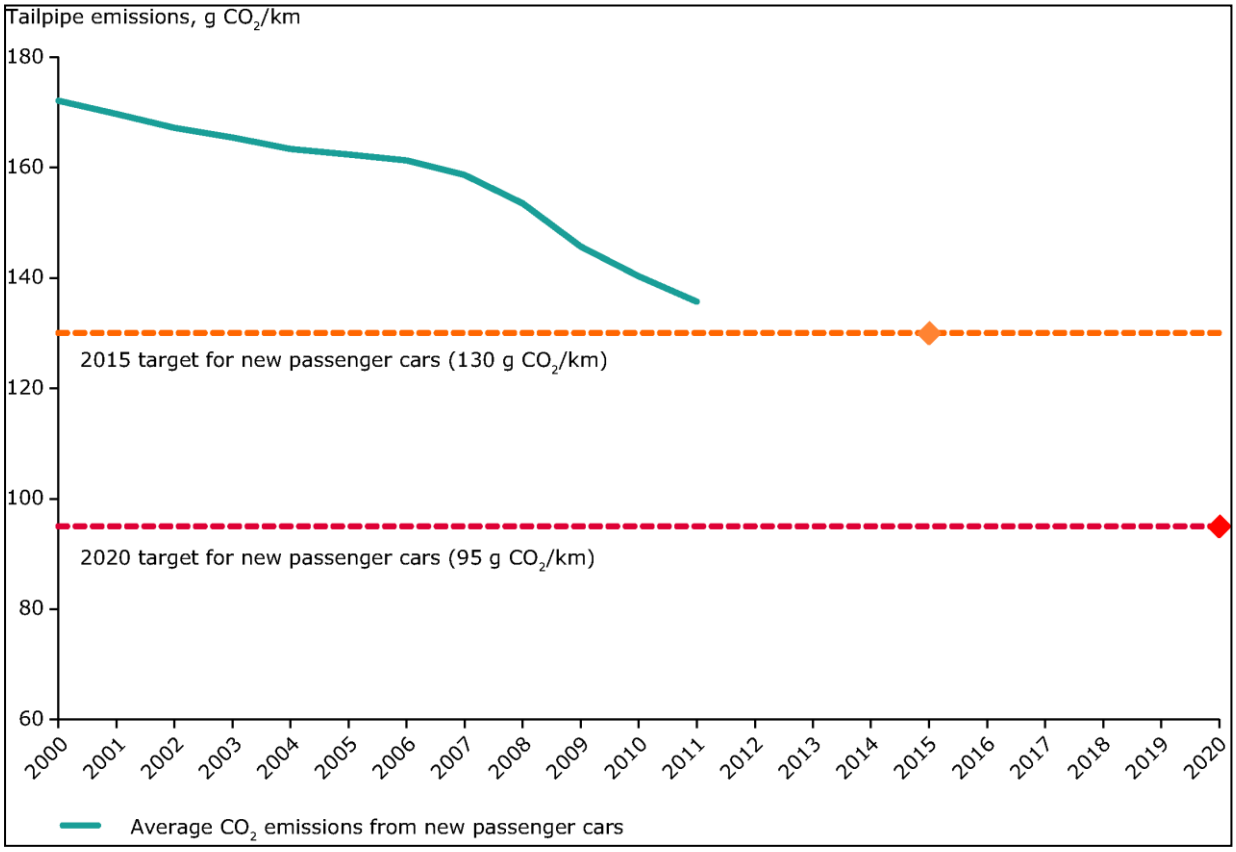


Figure 21: progression of average emissions for new cars versus 2015 and 2020 targets (EEA, 2013a)

Natural resources in Europe

The importance of various materials, like e.g. platinum, is increasing, since on the one hand they are essential to the production of electronic equipment (e.g. cell phones, batteries) and, on the other hand, vital for some 'green technologies' like construction of wind turbines and hybrid cars. In case of platinum, about 88 % of the world's platinum production (about 200 tonnes per year) comes from South Africa (two mines) and Russia (one mine). If this amount would be used to increase the number of cars powered by fuel cells, until 2030 this would only be enough to manufacture about 2 million such vehicles, which is only about 5 % of the world's current car fleet (EC, 2012c).

The European Union covers about 48 % of its energy needs with domestic production. In 2009, the energy gross inland consumption was about 1.703 Mtoe - 818 Mtoe from EU energy production and 944 Mtoe as net energy imports. Figure 22 presents the import dependency of the EU-27 in 2009 in comparison to 1990. It shows that the EU dependency on imports is increasing for all fossil fuels, 83.5 % for oil and 64.2 % for gas.

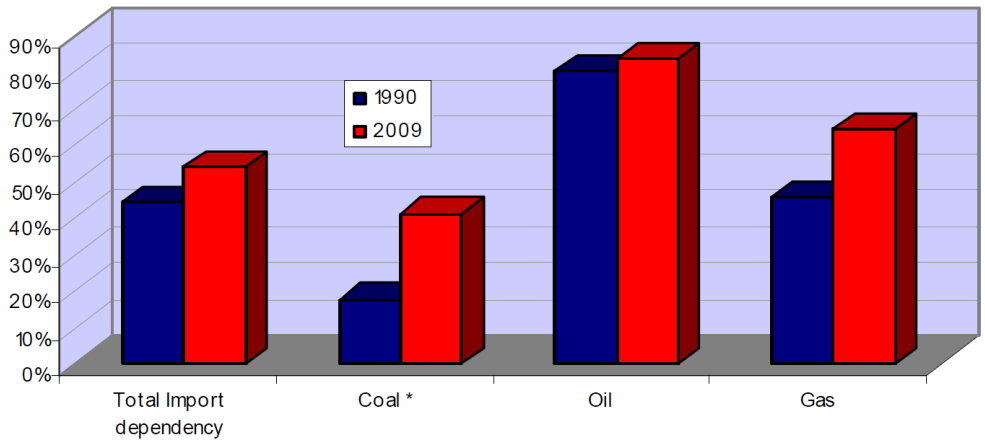


Figure 22: EU-27 Energy import dependency (DG Energy, 2011)

As Figure 23 indicates the EU depends on a few suppliers for its gas and oil imports. One of the strategic priorities of the European Union is the diversification of supply (routes and sources).

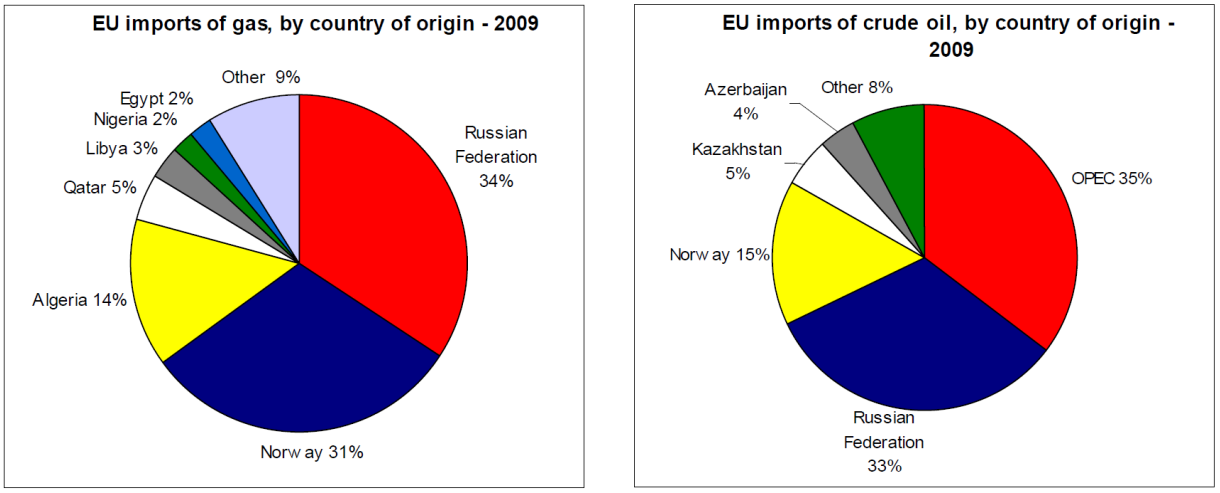


Figure 23: EU imports of gas and oil by origin, 2009 (DG Energy, 2011)

Figure 24 shows the energy import dependency of the EU-27. It can be seen that it significantly varies among the Member States. Malta depends completely on energy imports, while only Denmark has net energy exports.

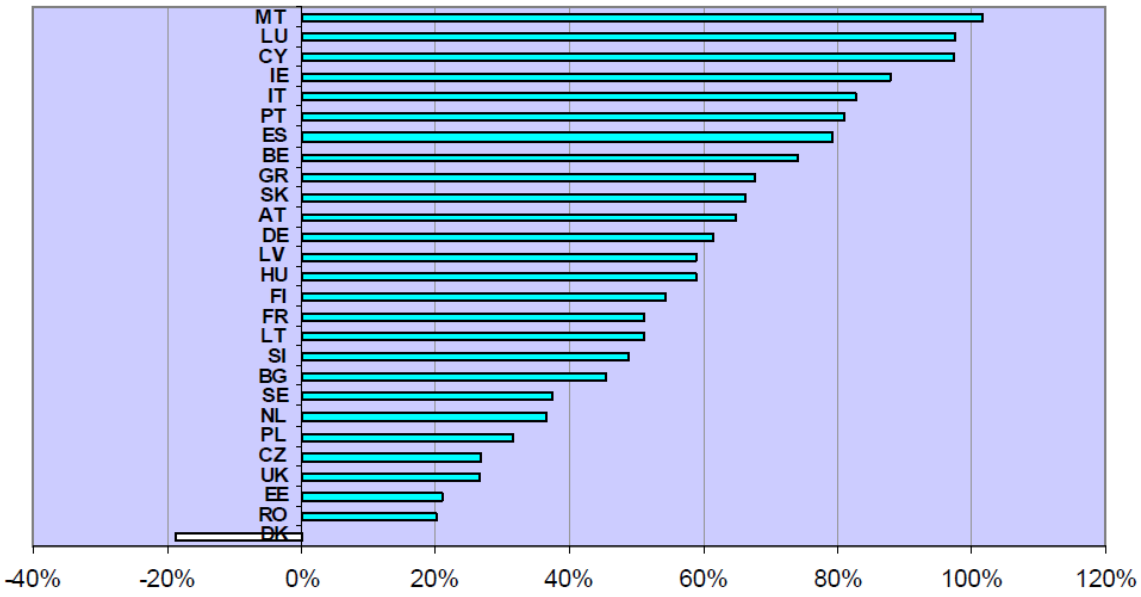


Figure 24: Energy Import dependency in Member States in 2009 (DG Energy, 2011)[3]

Figure 25 and Figure 26 present detailed overviews about each EU-27 country and its dependency on gas and oil imports. The snapshot of the year 2011 shows that Denmark was the only net oil exporter, while the UK had with 8.6 % the lowest dependency. In case of gas, Denmark as well as the Netherlands were the only gas exporters in 2011, Romania had the lowest dependency among the other countries within this year.

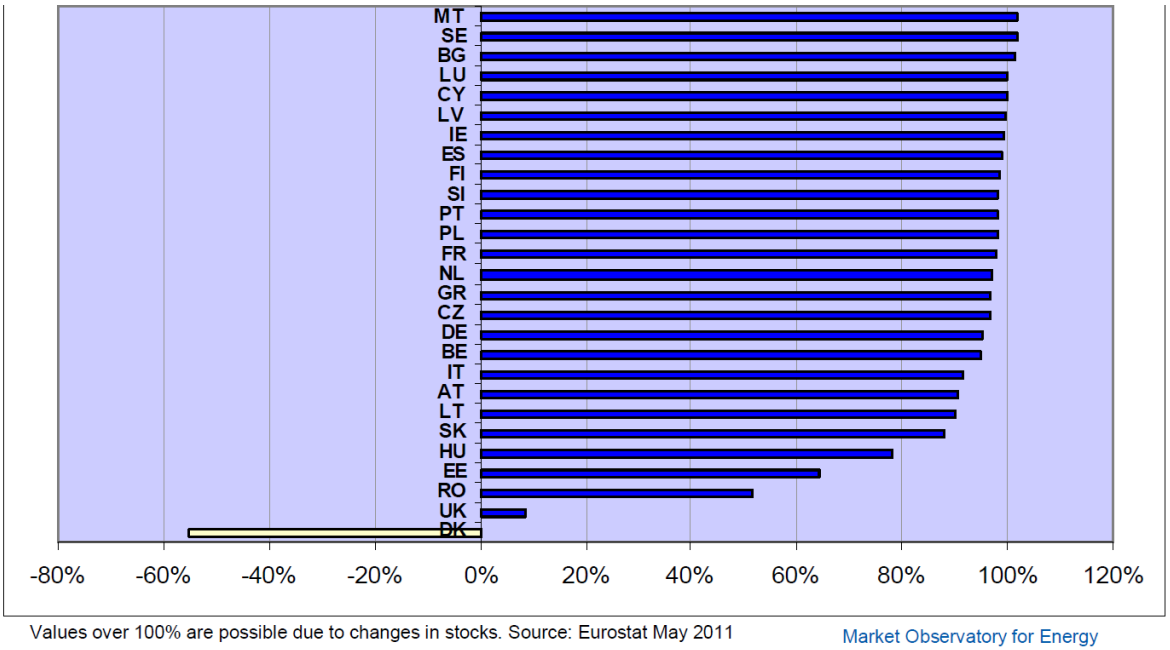
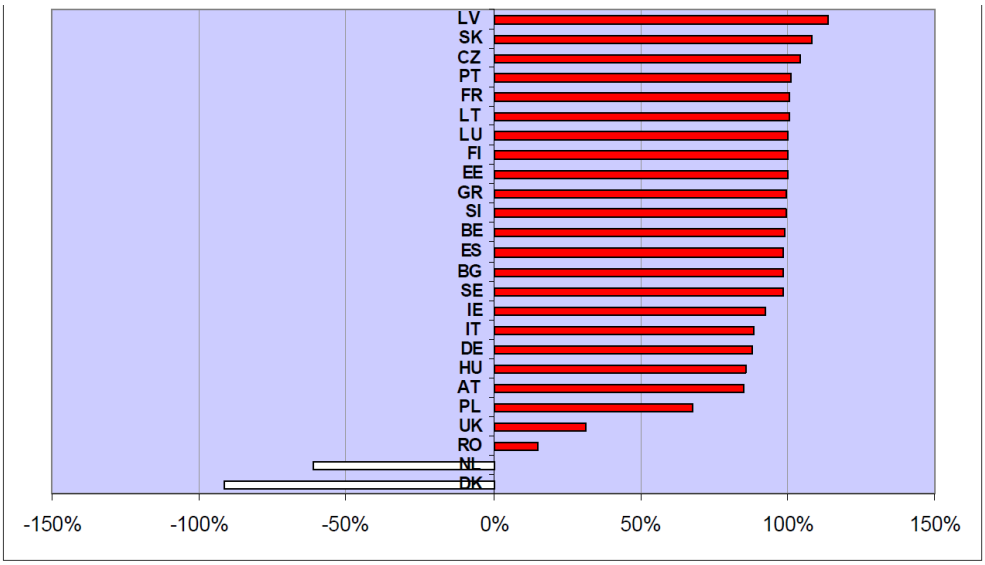


Figure 25: Oil dependency in Member States in 2009 (DG Energy, 2011)[3]

[3] AT...Austria; BE...Belgium; BG...Bulgaria; CY...Cyprus; CZ...Czech Republic; DE...Germany; DK...Denmark; EE...Estonia; EL...Greece; ES...Spain; FI...Finland; FR...France; HU...Hungary; IE...Ireland; IT...Italy; LT...Lithuania; LU...Luxembourg; LV...Latvia; MT...Malta; NL...Netherlands; PL...Poland; PT...Portugal; RO...Romania; SE...Sweden; SI...Slovenia; SK...Slovakia; UK...United Kingdom



Values over 100% are possible due to changes in stocks. Source: Eurostat May 2011

Market Observatory for Energy

Figure 26: Gas import dependency in Member States in 2009 (DG Energy, 2011)[3]

Energy consumption in Europe

The speed of development towards more sustainable energy varies within Europe, but every country in the EU plans to extend its renewable energy share (EWEA, 2011). Figure 27 shows the renewables' share in Member States consumption of electricity in 2020 according to the National Renewable Energy Action Plans (NREAPS).

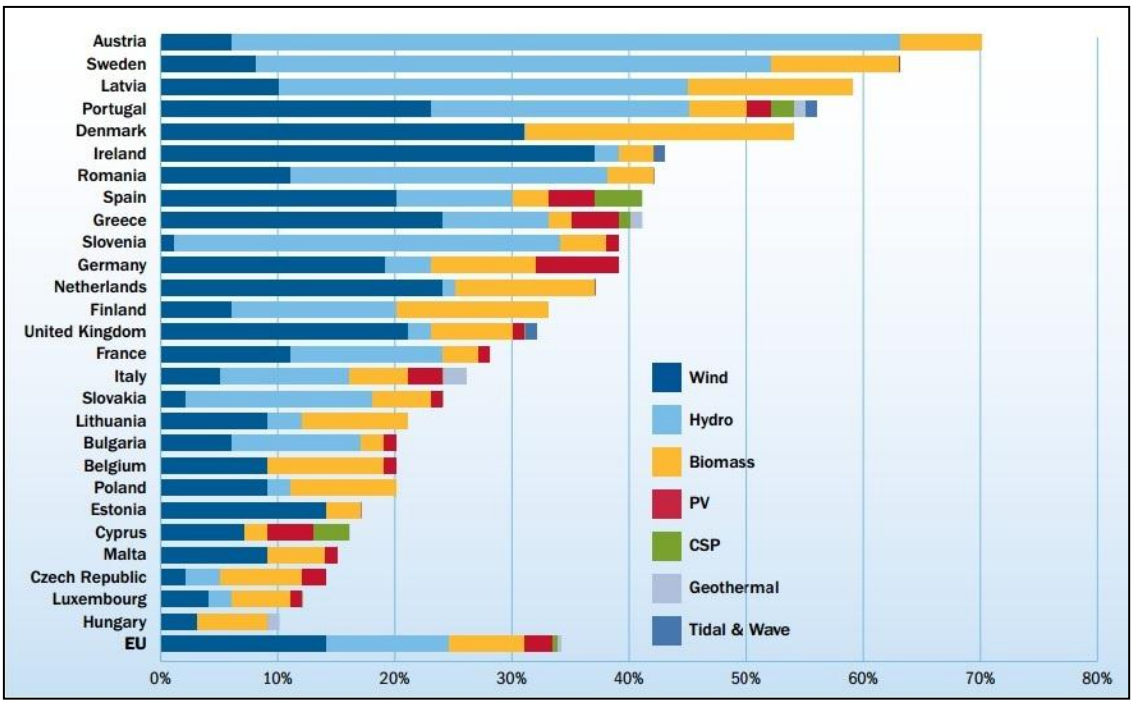


Figure 27: Renewables' share of electricity consumption per Member State (%) in 2020 according to the NREAPs (EWEA, 2011, p.20)[4]

[4] PV… Photovoltaic; CSP… Concentrated Solar Power

2 Clean Urban Transport and CO_2-free city logistics

2.1 Introduction

Goal 1 of the European Transport White Paper: "Halve the use of 'conventionally-fuelled' cars in urban transport by 2030; phase them out in cities by 2050; achieve essentially CO_2-free city logistics in major urban centres by 2030."

Cities are hugely important for innovation, economic growth, and quality of life. According to European Commission estimates urban areas generate 85 % of the EU GDP. Cities are however also major consumers of energy and emitters of CO_2. In this regard it has previously been estimated that urban transport accounts for around 70 % of pollutants and 40 % of greenhouse gas emissions from European road transport (EC, 2007).

Urban transport development is a highly complex phenomenon. Demand for and supply of urban passenger and freight transport are driven, influenced and balanced by a wide range of interacting factors. Like transport in general it is influenced by economic activity, organisation and prices, socio-demographic and cultural factors, technology changes, as well as institutions and policies. At the urban level, adequate transport governance is particularly crucial but steering and coordination processes are confusing and fragmented in many European cities, with a variety of authorities existing at many different levels and a large and diverse range of stakeholders present. These features make it difficult to establish effective policy making to handle the urban transport goal (Sorensen & Gudmundsson, 2010).

The goal becomes even more ambitious when viewed with the statement in the White Paper that, 'curbing mobility is not an option'. The goal must also be interpreted in the context of the European Action Plan on Urban Mobility (2009), i.e. making urban transport sustainable in environmental terms (CO_2, air pollution, noise), making it competitive (tackling congestion), while at the same time addressing social matters (such as health problems, demographic trends) and fostering economic and social cohesion to take into account the needs of persons with reduced mobility, families and children.

Most scenario studies predict that overall transport demand in Europe will increase in the future (Rijkee and van Essen, 2010) while a recent forecast by the International Energy Agency assumes a general stabilization and possible decline in *urban* transport in Europe over the coming decades (see Figure 28). However, due to strong variation in local circumstances neither growth, stability nor decline will necessarily apply in the same way to all cities in the north, south, east and west of Europe or within each urban area at the same time.

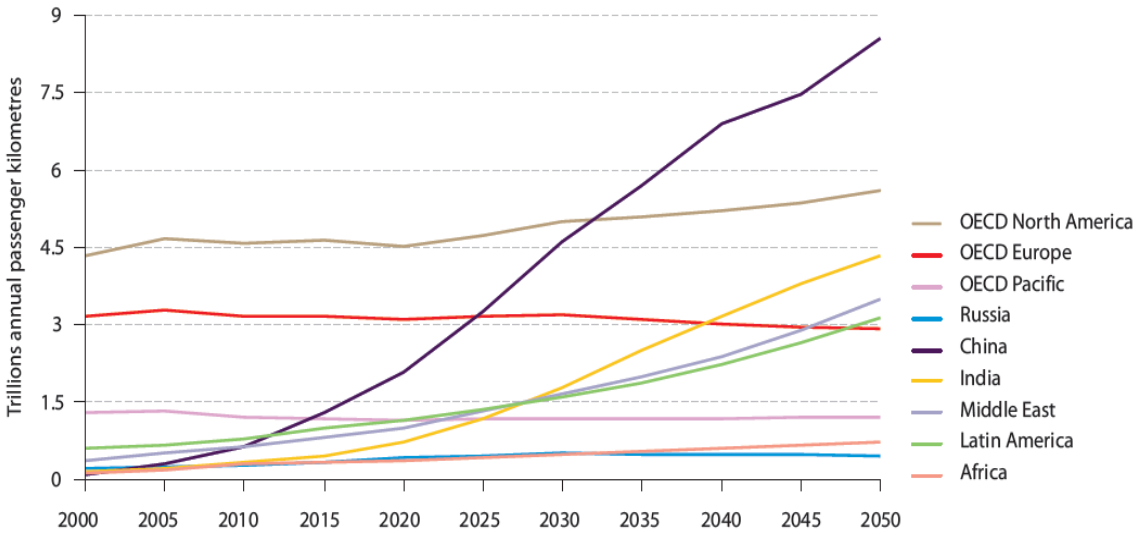


Figure 28: Projection of urban transport growth (IEA, 2013)

Changes in urban transport due to the combined effects of all trends may be hard to predict. On the one hand cities are large, fairly stable, rooted entities with many fixed assets and features that can be difficult to change. On the other hand, they are also smart and flexible engines of ingenuity, where adaptations of new technologies, lifestyles, and business concepts are quick to emerge and disseminate. Some cities and urban agglomerations are undergoing substantial growth and may therefore experience the pressure of trends as well as conflicts between them stronger than others. The balance between stabilizing and transformative mechanisms in view of overall trends can be difficult to foresee. First and foremost European cities are different in terms of size, structure, location, natural conditions, history, culture, and role in the overall economic systems.

Towards 2030 and 2050, technological developments will be pivotal for reaching the urban transport goal. Known technologies which are not yet ready for the market or for political implementation will become more viable, and new emergent technologies, which we are not yet aware of, will be developed (Copenhagen Research Forum, 2012). With respect to electric vehicles, various technology-related challenges will have to be considered (important for both individual passenger transport as well as for urban freight), including: public charging infrastructure, optimization of the electrical grid, and scheduling of EV-based energy consumption to off-peak intervals. Importantly, with regards to the White Paper goal, the advantage of electric vehicles depends on the energy sources that power them, i.e. renewable energy sources and smart grids.

The European Commission has identified four main root causes that prevent the development of the EU transport system from becoming genuinely sustainable: inefficient pricing, inadequate research policy, inefficiency of transport services, and lack of integrated transport planning (White Paper Impact Assessment, p. 10-11, paragraph 33). These causes are also relevant for the urban transport goal, with adequate political guidance through governance institutions and cross-sectoral cooperation being key elements.

2.2 Policies and Funding Mechanisms

At EU level it was recognized that there is a need for more common standards. EU level strategies and guidelines should be flexible enough to be interpreted at local level. The national level was seen to play a coordination role across the other levels but also between different national levels. Collaboration with business was seen as important. Table 3 gives an overview of policies and funding mechanisms identified for thematic group 1. The particular policies were analysed in the term of relevant measures and expected impacts and are organized according to time scope and withal according to significance towards the White Paper goal. Figure 29 shows the timeline when the different policies were introduced. Following the policy documents summary was identified and selected on the base of internet literature study and in cooperation with the thematic group expert leader who verified the relevance and completeness of the chosen existing policies for the White Paper goal.

Table 3: Policies and funding mechanisms identified for thematic group 1

Policy actions, initiatives and programs	**Scope**	**Expected impact and intervention capacity (*multilevel perspective*)**	**Expected coordination with other policy initiatives**
1) Environmental Technologies Action Plan (ETAP)/ Eco-Innovation Action Plan (ECO-AP)	Using environmental policy and legislation as a driver to promote eco-innovation Supporting demonstration projects and partnering to bring technologies to the market Developing new standards boosting eco-innovation Mobilizing financial instruments and support services for SMEs Promoting international cooperation Supporting the development of emerging skills and jobs	Significant and demonstrable progress towards the goal of sustainable development, Reducing impacts on the environment, enhancing resilience to environmental pressures, Achieving a more efficient and responsible use of natural resources	Europe 2020 Flagship Initiative: Innovation Union Other Flagship initiatives in 2020 strategy Agenda for skills and jobs Horizon 2020 Infrastructure standards Member States' plans
2) European Strategy on Clean and Energy Efficient Vehicles	Electric vehicles Reducing of emissions of vehicles Supporting research + innovation in green technologies Standardization Market uptake + consumer information Global issues (inter. standardization) Vehicle taxation Car Labelling	Competitiveness of E. automotive industry Green corridors Timely coordination of public and private, innovation, deployment programs	KIC Knowledge Innovation Community – focusing on performance testing and impact assessment

	UNECE regulation ITS Impacts of fossil fuel Renewable sources (to reduce local emission) Electrification of Road Transport Technology development Measures for electric and other low CO_2 vehicles Internal combustion engine Charging infrastructure for electric vehicles Power distribution Plug standards Billing process Collaboration in logistics		
3A) European Green Cars Initiative	Revision of test cycle to measure emissions Measures on CO_2 and pollution emissions from road transport Noise emissions Available alternative fuels Sustainability criteria for biofuels Heavy Duty Vehicles	More resource efficient Greener and more competitive economy Environmental benefits of integrated approach	Industrial Advisory group;
3B) European Green Vehicles Initiative	Energy efficiency Alternative powertrains Passenger cars Trucks Buses Two-wheelers	Delivering green vehicles and mobility system solutions Decarbonisation Reliability Safety	ERTRAC HORIZON 2020 Automotive industry, and suppliers Smart systems and Smart grid industries
3C) Clean Vehicle Portal	New web dB Access to Europe´s largest vehicle dB Interactive joint-procurement EU-wide information about	Clean and energy-efficient road transport vehicles	Lifetime-cost-calculation according to Clean Vehicle Directive (2009/33/EC)

	existing procurement rules and incentive schemes for clean vehicle EU-wide information about market-shares of clean vehicles Powerful and easy-to use web application Individual data-output and calculations for each EU country		
4A) ERTRAC: Research and Innovation Roadmaps (not official policy document)	Integration of urban mobility system Energy efficiency Payment and pricing Network management Urban freight Informedness	Energy efficiency High level accessibility New mobility services Integration of public and private modes of transport	-
4B) ERTRAC/ EPOSS: Roadmap Electrification of Road Transport	Aim : quantifying the differences between conventional and new technologies (energy, resource, security, climate change, public health, freedom of mobility, economic growth)	Primary energy savings Cut of GHG emissions Reduction of noxious emissions Range and speed Cost of technology and constrains on raw materials	EPoSS, SmartGrids platforms
5) Clean Power for Transport Package	Alternative fuels strategy Europe-wide coordination of alternative fuel internal markets Alternative fuel infrastructure problems Consumer acceptance Technological development Common technical specifications	Replace oil with alternative fuels Build up necessary infrastructure Support market development of alternative fuels Decarbonisation of transport	Commission to support Member States, necessary technological changes and market developments
6) European Action Plan on Urban Mobility	Sustainable transport (CO_2, noise, pollution) Competitive advantage Overloading Social issues Health problems	Development Planning Regulation Interoperability Adjustment Policy integration	Expected coordination with structural and cohesion funding Support of integrated policies Focused on citizens

	Demographic trends Economic situation Disabled people mobility Family + children Freight urban transport Parking Trolley transport	Relations solution Standards Sustainability Better life quality	Ecological measures
7) Urban Mobility Package (UMP)	Urban logistics Urban vehicle access regulations Intelligent transport systems for EU cities Urban road safety Sustainable urban mobility plans Support of local authorities to develop and implement SUMP European funding instruments Non-binding guidance	Reduced congestion Modal shift away from motorized transport Competitiveness of EU industry increased Road safety improved Health improvement Air quality improved Reduced energy/ GHG Reduced noise Moderate increase in the uptake of full SUMPs	European Structural and Investment Funds SUMPs presuppose coordination across policy areas and different levels of government

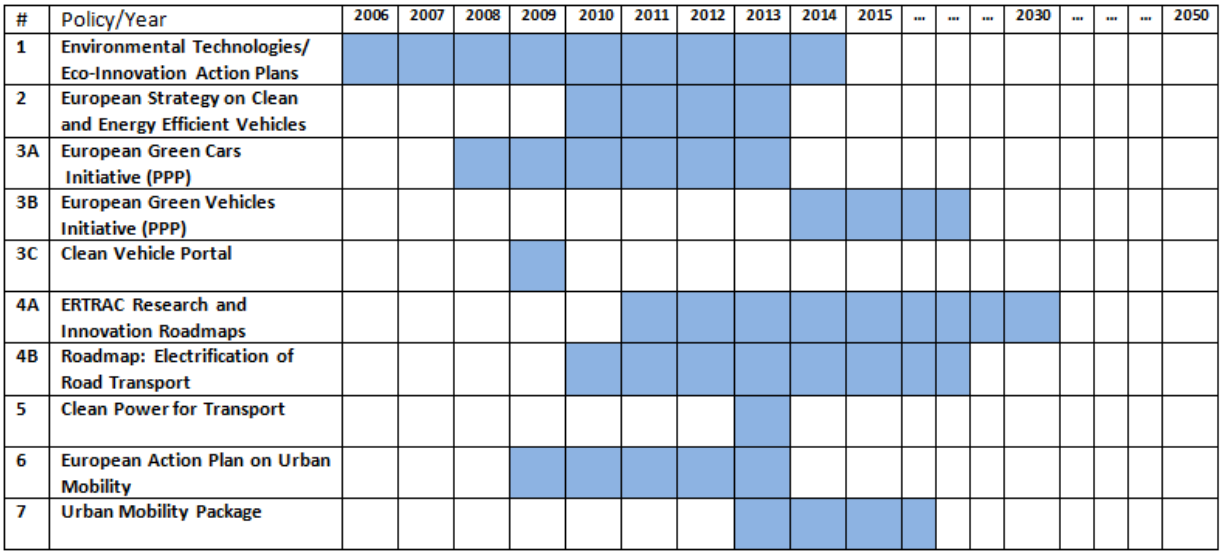


Figure 29: Timeline of policies for thematic group 1

Resource citation links:

1) http://ec.europa.eu/environment/ecoap/index_en.htm
2) http://ec.europa.eu/enterprise/sectors/automotive/competitiveness-cars21/energy-efficient/index_en.htm
3A) http://ec.europa.eu/research/transport/road/green_cars/index_en.htm, http://www.green-cars-initiative.eu/public/
3B) http://www.egvi.eu/
3C) http://www.cleanvehicle.eu/
4A) http://www.ertrac.org/pictures/downloadmanager/6/50/ertrac-researchinnovation-roadmaps_60.pdf

4B) http://www.ertrac.org/pictures/downloadmanager/1/52/electrification_roadmap_june2012_62.pdf
5) http://ec.europa.eu/transport/themes/urban/cpt/index_en.htm
6) http://ec.europa.eu/transport/themes/urban/urban_mobility/action_plan_en.htm
7) http://ec.europa.eu/transport/themes/urban/ump_en.htm

2.3 Trends

An important question for TRANSFORuM is how trends will affect the chances and opportunities to fulfil the White Paper goals for clean urban transport (see 2.1). Some trends may be directly conducive for the goal to halve and eventually eliminate the use of conventionally fuelled vehicles for passenger and freight transport while others may hamper them. For example, economies of scale in the production of electric vehicles could help make transition to renewable energy sources faster, while a combination of aging population and lower income growth could slow down fleet turnover and system transitions. Consolidation of goods consignment in city distribution could facilitate the introduction of electric freight vehicles, while increased competition from low cost hauliers using diesel trucks could undermine it. However urban transport trends and challenges need also to be considered in a wider context of aims and goals for urban transport, mobility and development formulated at local, national, as well as European levels. This means that the same megatrends may raise partly different challenges and require different sets of strategic responses in various cities or parts of Europe to fulfil the same overall goals. With these words of caution some trends that may be especially important for urban transport are presented in the following.

Urbanization, suburbanization and urban sprawl

Obviously the growth of cities in terms of population and jobs are important for the demand for urban transport. According to United Nations forecasts (see also section 1.3.1), by 2050 nearly 70 % of the global population will live in cities, up from around 50 % today. The figure for Europe is higher still. Already today nearly 80 % live in urban areas and 83 % of the population – nearly 557 million – are expected to live in cities by 2050 (EC, 2010). The patterns are not equal across Europe. Slovakia and Romania have the lowest shares of their population living in a city or its commuting zone, while Germany, the UK and the Netherlands have the highest shares (EC, 2013c). But large cities in countries with already high share of urban population may still continue to attract growth.

Negative companions to urbanization are suburbanization, de-urbanization and potentially urban sprawl. The European Environment Agency has described sprawl as the physical pattern of low-density expansion of large urban areas. Sprawl is for example seen along some already populated coastal strips such as along the Mediterranean Sea. Compared with more compact urban development sprawl can lead to longer commutes, inefficient and costly transport services, higher environmental impacts and reduce accessibility to green spaces at the edge of cities. A correlation between energy consumption and urban density is often found. The spatial distribution and dispersion can also affect the economy of alternative fuel and charging infrastructures as high urban density makes investments more economical feasible.

Multiple trends, such as de-urbanization and re-urbanization may exist side-by-side. The PACT research project has identified four different possible development pattern types for urban areas in Europe.

The patterns are distinguished with regard to 'speed' (fast or slow), and 'density' (alone or together) as shown in Figure 30. Generally the patterns of 'city networks' are seen as favourable for developing efficient public transport while 'small compact cities' are favourable for shorter distances with walking and cycling. The more typical pattern is the fast dynamic model with sprawl around major core cities, which however generate high volumes of car-dependent transport, and conditions of congestion during rush hours. Potentially these core city areas can be strong markets for alternative fuelled vehicles. The slower rural /dispersed pattern also faces the risk of car dependency with the risk of bottlenecks and congestion; while local air pollution may be less severe. This could possibly be mitigated somewhat by enhanced ICT services replacing some travel. Hence each type may have its strengths and weaknesses with regards to reducing the number of (conventionally fuelled) cars and contributing to low carbon freight distribution.

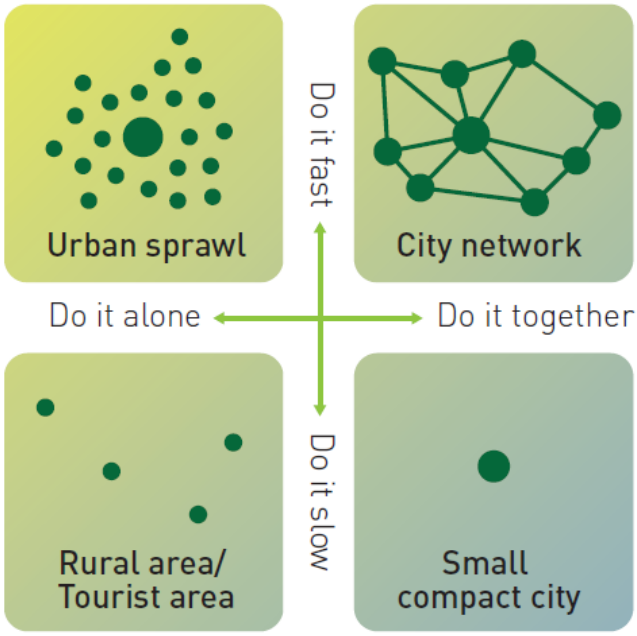


Figure 30: Four different urbanization patterns (EC, 2010b)

Economic growth, demand, and 'peak travel'

Rising income is traditionally a fundamental driver of increases in car ownership and travel demand. Choices between different locations of dwellings and businesses are driven by costs as is the competition between different propulsion system and modes of transport. A continuous trend over the last several decades of growing average income supporting increases in travel demand as well as an increase in demand for consumer goods. These trends may have been broken as indicated by the decoupling of both the passenger and the freight transport from general economic growth (see Figure 31). To what extent this is simply a temporary effect of the 2008 onwards financial crisis is being debated. Some predict that with resumed economic activity demand for transport will start to rise again. Others suggest that car traffic may have 'peaked' in some countries, meaning a saturation and possible decline in the growth of car traffic. This could be due to for example re-urbanization processes, increases in fuel prices, and possibly lifestyle changes (see below).

Income is generally not rising for everyone; some lower income groups even see a decline, which may cool the demand for cars more than a further increase among higher incomes will fuel it. Further income differentiation could be contributing to the possible peaking effect in car traffic in general as more and more people have to use public transport.

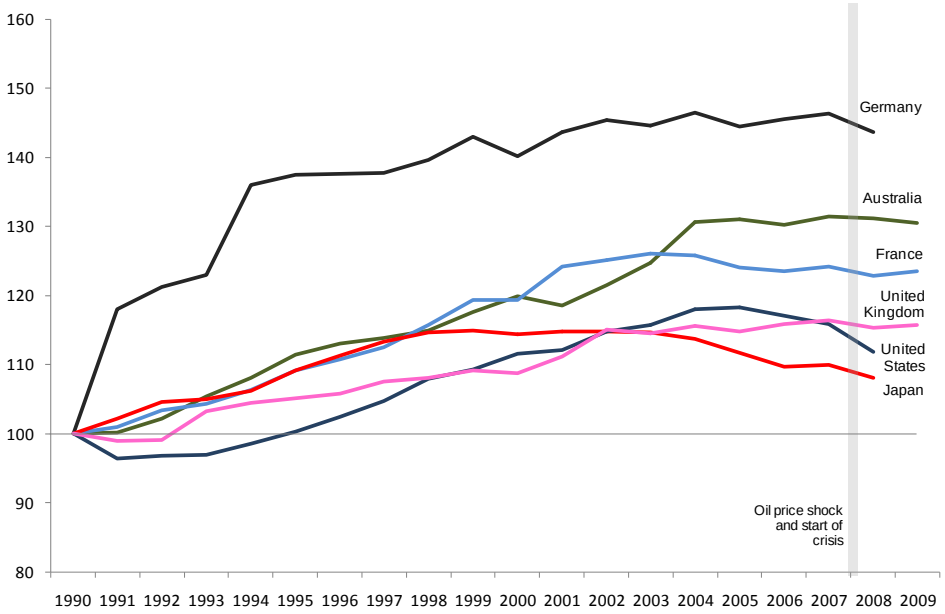


Figure 31: Peak Travel Passenger-kilometres by private cars and light trucks, 1970 – 2009 (Perkins, 2012a)

In freight transport the temporary downturn during the economic recession has been even more significant. It may turn upwards again with renewed growth (even if less intense globally now) since globalization of production systems and markets is likely to continue. How this is affecting transport flows within and across urban areas is more complex.

A possible counter trend to income driven growth in transport demand could be a general de-materialization of consumption patterns. While some studies have indeed indicated a gradually slowing in material consumption relative to economic output in some developed nations over the last decades, a recent detailed analysis of the so-called Material Footprint of nations suggest this not to be the case, at least not if one takes into account the sourcing and trade of material flows from exporting countries as well as the large parts of material extraction that is not included in the traded products (Wiedmann et al., 2013). Still this would not exclude that a de facto dematerialization could occur in terms of the 'last mile' deliveries in European urban areas, but a general trend of this kind cannot be clearly distinguished (we return to trends in urban freight and logistics later).

Demographic changes and lifestyles

Travel and consumption patterns vary across socio-economic groups and household types, and they also tend to change during the course of life, from young, to active working life, to retirement. A general trend so far is that households are decreasing in size but each has more vehicles at their service. While some

of those patterns have been considered stable and relatively predictable, some possible trend changes in behaviours of especially groups of young and older cohorts are now calling the attention (Frändberg & Vilhelmson, 2014).

One of the most noted changes on the demographic side is the longer life span and the resulting aging populations with increasing shares of above 65 year olds as seen in many especially Western European countries. A question is if an aging population will lead to more or less use of cars in cities and make it easier or more difficult to fulfil urban transport goals. One study has indicated that in developed countries an aging population contributes to increase car travel and emissions until their share of population is above 16%, after which it declines, due to fewer and shorter trips and less car ownership among the elderly compared to younger generations (Okada, 2012).

A key question is to what extent for example the post war 'baby boom' generations will imitate previous generations and 'slow down' when they retire or to what extent they will maintain their acquired active mobile lifestyles including the license to, and ownership of cars.

Figure 32 shows that men still possess licenses more frequently than women, but the gap is closing. Will 'everyone' in the future retain a license when they are 80 years old? Will women in the future obtain and keep licenses to the same level as men?

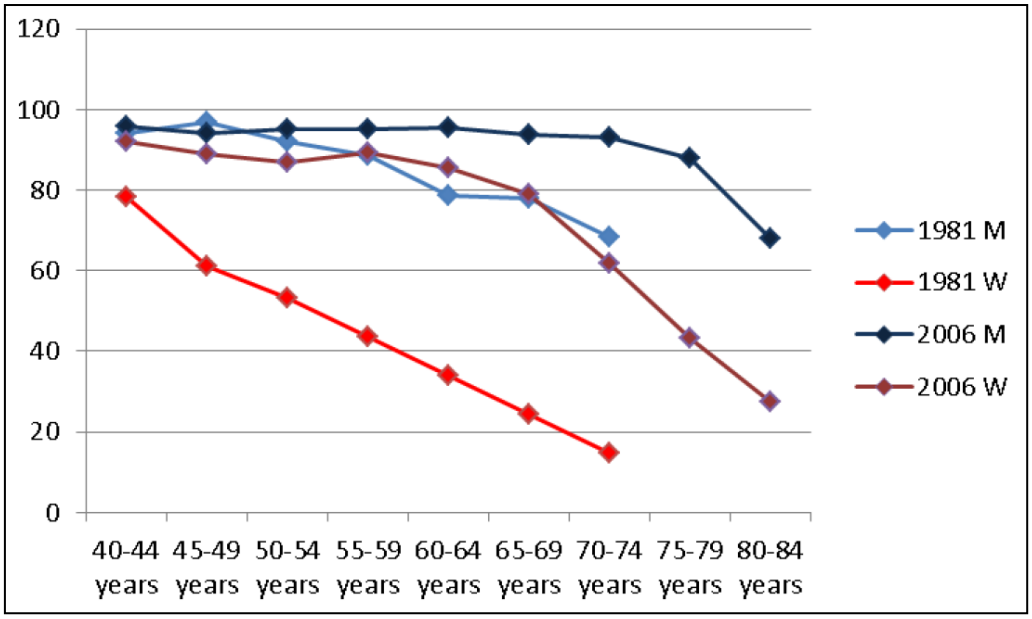


Figure 32: Driver's license for age cohorts and gender in Denmark 1981 and 2006 (Siren and Haustein, 2011).

Another group whose future behaviour is very interesting for urban transport and the environment are the young generations that are about to enter or already are active in the housing, jobs and transport markets (Gärling & Frändberg, 2014; Line et al., 2010). In several countries it is found that younger males in urban areas typically use the car less than the same age group about 10 years ago (Kuhnimhof et al., 2012). Studies have shown that there may be a growing group of younger people with rather pragmatic attitudes towards car ownership and transport (Schippl, 2013). This trend is supported by new technologies that to

some extent can replace travel or which provide real time public transport information (see following section below.). The trend – if it is a trend and not just a fashion or a slight delay before a car lifestyle is assumed - does not seem to be driven by particularly green attitudes (Line et al 2010). Figure 33 shows the tendency where 18-29 year olds constitute a declining share of car owners.

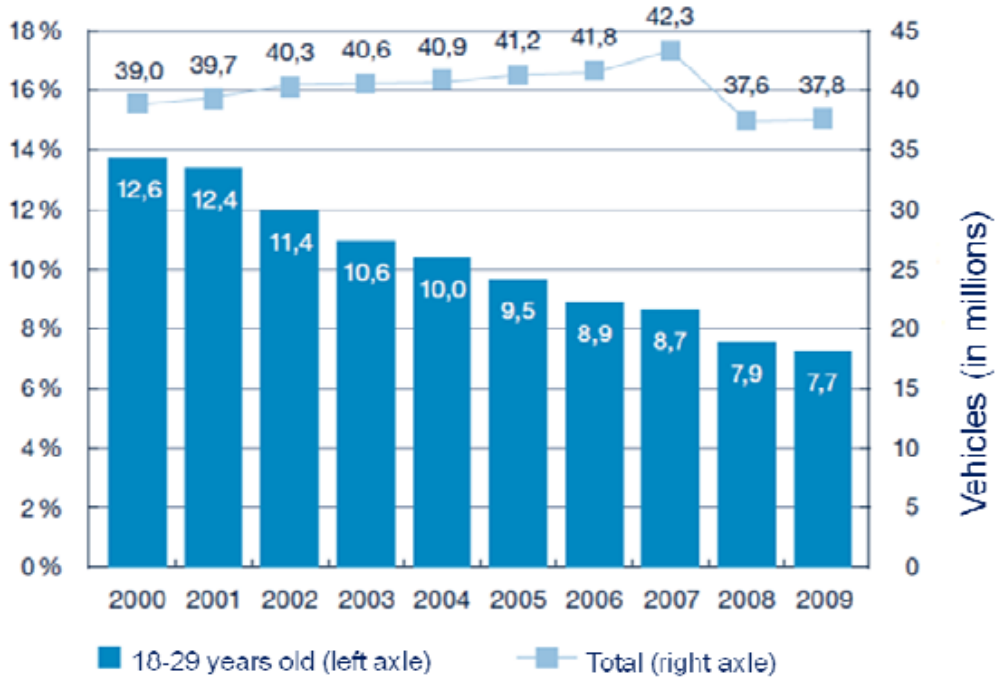


Figure 33: Declining share of 18-29 year olds among car owners in Germany (Frauenhofer IAO & Pricewaterhouse, 2010), here from (Schippl and Puhe, 2012)

These demographic and cultural trends will likely manifest themselves differently across the various types of urban areas in Europe like the four types described in the section about *Urbanization, suburbanization and urban sprawl*. It is for example conceivable that car ownership may stagnate or decline among the young in some networked and compacted cities if these provide good quality public transport solutions, while it may increase among the elderly in sprawling and rural suburbs.

Another important lifestyle related trend is sharing, especially *car sharing* in voluntary format or through commercial car clubs. Car sharing is continuously growing in several European countries (see Figure 34). Many see car sharing as a way towards a more sustainable mobility, since a shared car can eliminate the need for several individual cars. Some also see it as one of the best ways to introduce alternative fuel vehicles to a wider audience. Some car sharing clubs and companies - include EVs or are - like Autolib in Paris - fully focused on e-mobility. It is likely that car sharing under some forms will increase.

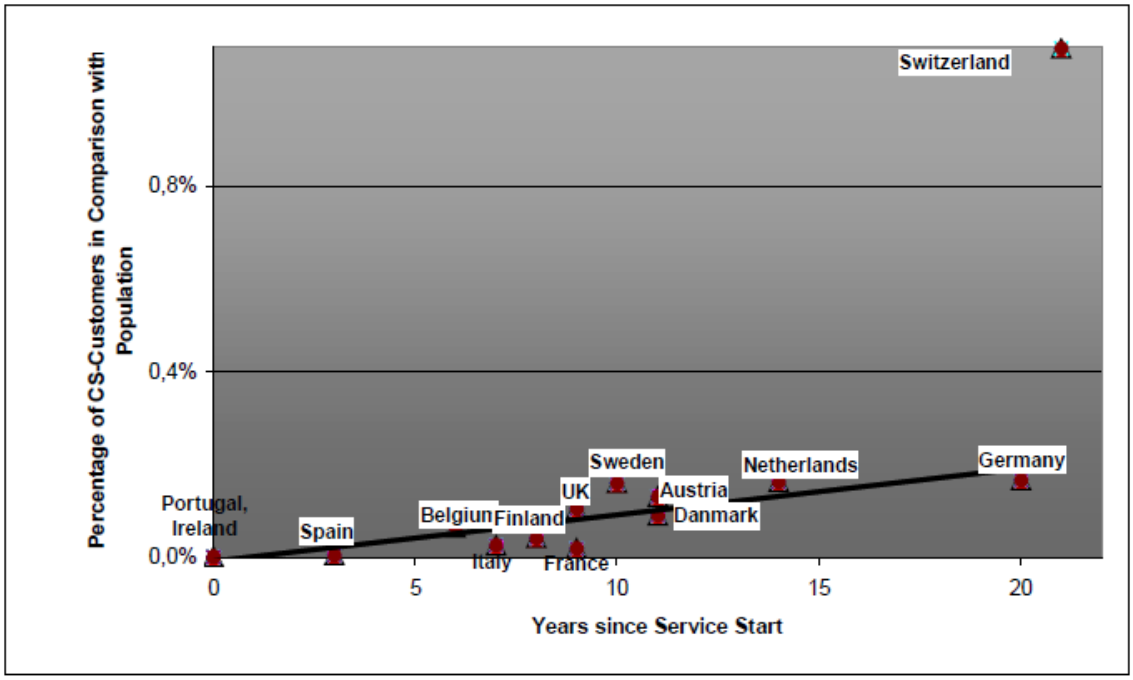


Figure 34: Trends in the share of members in Car-Sharing Clubs in selected European countries, membership set against years of existence of clubs (MOMO project, 2009)

Modal split

In cities a wide variety of transport modes are used, often in combinations, including automobile, bus, trolleybus, commuter train, subway, tram, bicycle, walk, ferry, boat and several others. Generally the car is less used in cities than outside (EEA, 2013). Cities in Europe vary greatly in how their modal split is composed. For example some southern European cities like Turin are for historical reasons rather car dominated, while some northern cities like Amsterdam have a strong tradition for the use of bicycles.

Many factors influence the modal composition, including geography, history, economy and city size. Where for example large metropolises like London and Paris tend to provide conditions for high density and frequency public transport, which is necessary for these cities to function without suffocating, smaller cities are to some degree typically easier to serve with individual modes, be they motorized or non- motorized (MVV consulting, 2007).

Cities in Europe and other industrialized parts of the world have displayed some similarities in their historical development paths (Batty et al., 2003). Parts of the 19th and 20th century saw for example massive urbanization and expansion of cities, first served by public transport and later suburbanization accompanied by automobilization. Some central and eastern European cities have after the fall of the iron curtain 1989 rapidly adopted a western European mobility style with relatively high motorization, partly because of increased wealth, partly because of lacking modernization of public transport systems (MVV Consulting, 2007). However, generally cities do not follow necessarily the same patters as they respond in different ways to social and economic challenges based in widely different starting conditions. Arguably "…urban transport is best regarded as a technology fully embedded in a constellation of social factors, being

both formed by social context and capable of acting back on it" (Divall and Schmucki, 2003, p 1). Hence the modal split of urban transport is not so much a 'trend' in itself as it is the result of multiple trends influencing the design and development of cities on the one side, and the opportunities, preferences and choices of urban dwellers on the other. Figure 35 shows the modal split in 11 European cities and short term changes. Apart from the significant differences, it is hard to observe a clear pattern. In some cities car travel is on the rise, possibly due to increasing incomes, while in others the opposite is the case, possibly due to economic decline, deliberate policies to encourage shift to other modes or new behavioural trends among the citizens. Over a longer time cities may observe much larger variations, as seen for example in the case of bicycle use in Berlin starting form a high level in the 1950'es to near zero 20 years later, followed again by a remarkable increase up until today in part due to deliberate plans and measures to make cycling more convenient and safe (EEA, 2013).

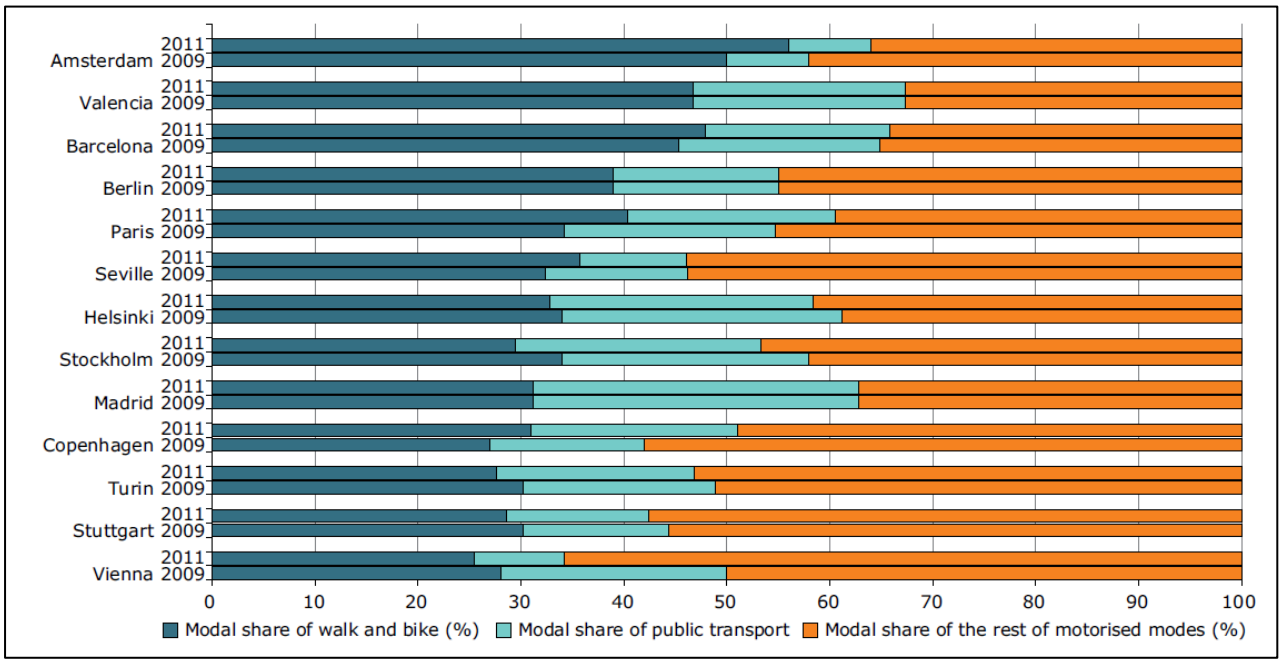


Figure 35: Modal share in 13 selected European cities in 2009 and 2011 (EEA, 2013b)

Many cities are making efforts these years to promote the development of sustainable transport. This is done by combining measures that limit the need to travel. These range from adopting appropriate land use planning policies, support shift of transport from car to other modes by prioritizing investments and enforcing restrictions. This is further supported by improving the efficiency and environmental performance of traffic systems and vehicles with the help of traffic management systems and promoting the use of cleaner technologies. Many cities strive towards a more equal balance between car, public transport and non-motorized modes as part of such efforts, but often face challenges in achieving the necessary behavioural changes (Banister, 2011).

Alternative fuel and vehicle technologies

Nearly all cars in Europe are fuelled by gasoline or diesel. Even among new registrations, alternative technologies such as hybrids, electrics, natural gas and ethanol-fuel make up only 1 % (ICCT, 2012). A very broad range of technology trends and new options are however likely to influence urban transport over the coming decades. All components within the transport system will likely be affected, including vehicles, fuels, infrastructure, and services for passengers and freight transport. It is not easy to identify clearly 'winning' technologies or trends. Each system has its advantages and drawbacks as pointed out in many studies, but new innovations are continuously challenging existing assumptions and outlooks.

Electrification

A key emerging technological trend is the partial or full electrification of vehicles (EVs, VEVs, HEVs, PHEVs etc.) with associated charging infrastructures and power grids. Electrification involves so far mostly passenger cars but is also part of some city logistics schemes. While electric cars are still a very small niche in most places, some countries and cities currently see a rapid rise in the share of EVs in the new car fleet, e.g. in Norway as shown in Figure 36.

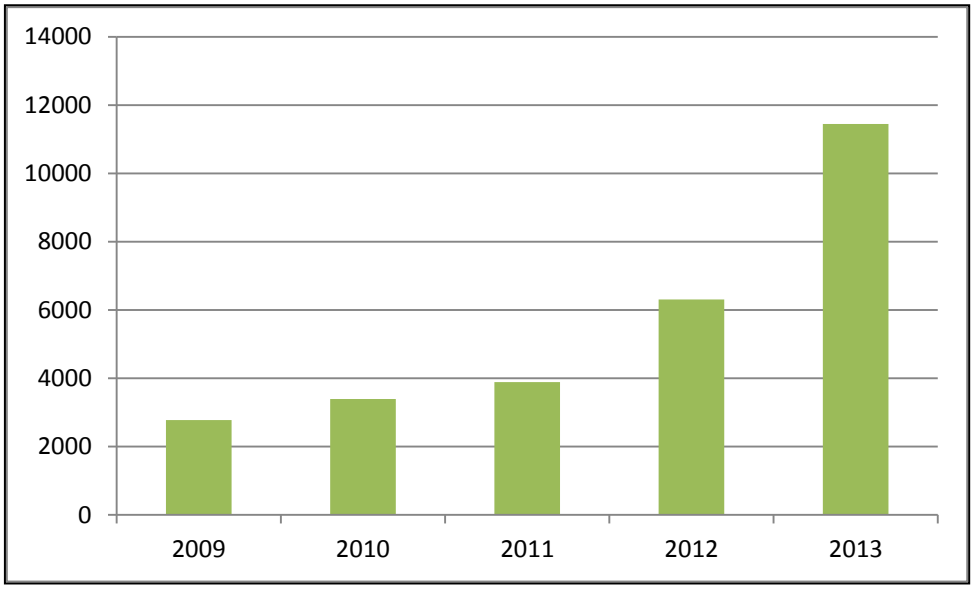


Figure 36: Electric vehicles in Norway up to October 2013 (www.gronnbil.no)

The high costs for owning and using (or leasing) EVs, relative to conventional cars is a key factor limiting acceptance (see Figure 37). Continued research and development is expected to significantly improve battery performance and lower costs over time which will help to overcome barriers. The low driving range of EVs is also still perceived by many as a barrier, although potentially less so in urban transport, where parking and charging is another significant issue.

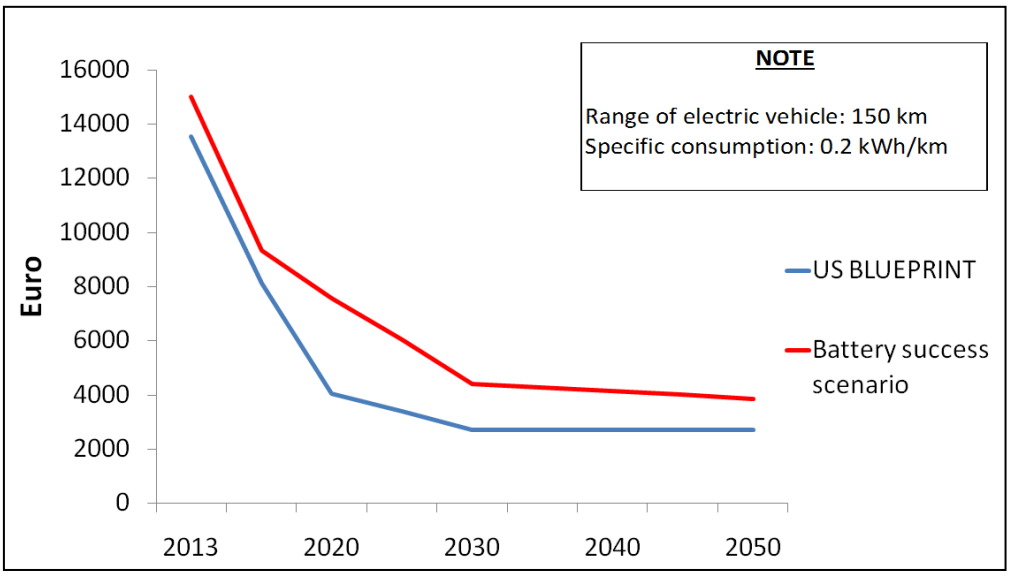


Figure 37: Costs of typical EV battery - projections up to 2050 in an EU and US study (Exergia, 2011)

Many cities and private operators are taking steps to provide charging options and other facilitating measures. The European Commission has proposed a strategy that will direct member states to more systematically roll out enabling infrastructure. The diffusion and integration of EVs as a positive element in the national electric 'ecosystem' may be accelerated through the establishment of so-called smart grids that would allow dynamic and intelligent charging as well as storage and resale of electricity to the grid. The positive effect of EVs on CO_2 emissions will of course depend on the fuel mix of the power systems.

Hybridization

Hybridization is the trend to equip gasoline or diesel driven cars with electric engines for support or directly allow alternation between fossil and electric drive (see Figure 38). Hybridization can improve energy efficiency and some hybrids are currently among the least CO_2 emitting models on the market. Hybridization represents a much less radical shift for the consumer than full EVs. Deployment of hybrids that can be plugged into the electric grid like an EV are by some seen as the most promising trend in the switch away from conventional fuels. While the adoption of hybrids is a strong trend in countries like Japan, in Europe it so far remains a small niche, with a 3.7 % share of new cars sales in the Netherlands as the highest so far and supported by subsidies (ICCR, 2012). The International Energy Agency expects that a large share of cars will be based on hybrid systems by 2030.

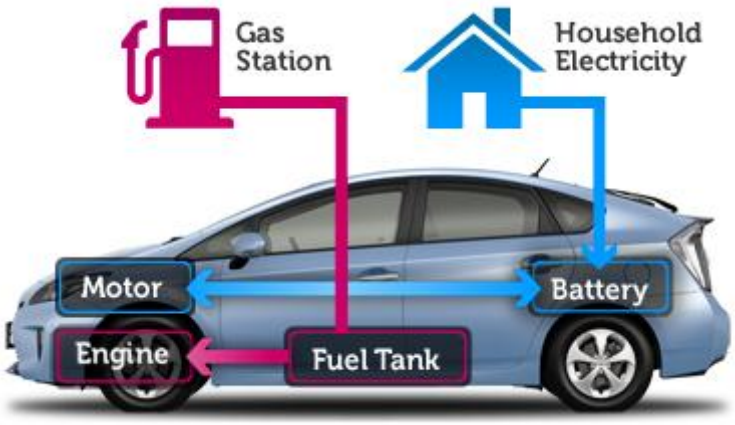


Figure 38: Plug-in hybrid. (http://www.toyota-global.com/innovation/environmental_technology/plugin_hybrid/)

Other alternative fuels

There are several other alternative fuel options being explored or already deployed as part of a more general diversification from conventional fossil fuels, including biofuels like ethanol and biodiesels as well as hydrogen and fuel-cell technologies. Biofuels in lower blends can be used in conventional engines, while high blends require modifications such as for example in flex-fuel vehicles. Hydrogen on the other hand, involves a radical shift that will require fundamental changes to vehicles and infrastructure and it is not possible to talk of a 'trend' in this direction. Spikes in the sales of ethanol and gas powered vehicles respectively can serve to illustrate that it is also difficult to discern clear trends for more 'traditional' alternative fuel vehicles. This sharp increase in sales followed by equally sharp decline seen in Italy and Sweden respectively is the result of national subsidy programs that were terminated to avoid excessive distortions (see Figure 39). Some types become popular in certain countries, but interest can quickly dwindle when government subsidies to support the purchase of alternative fuelled vehicles are withdrawn.

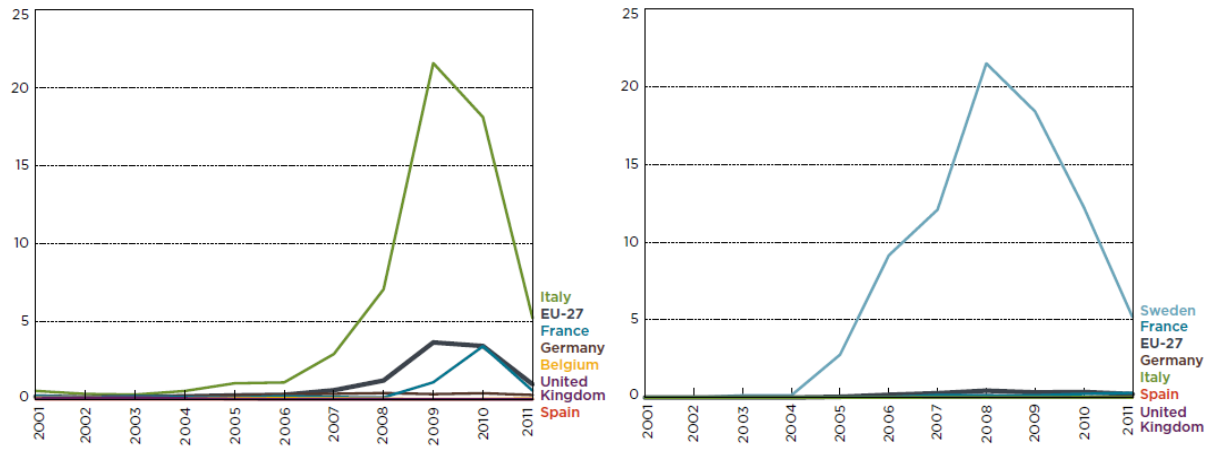


Figure 39: Sales (market shares) of natural gas powered (left) and flex-fuel ethanol cars (right) in selected European countries (ICCT, 2012)

Smart mobility services

Navigating and moving around in urban areas using multiple modes is becoming much easier due to the proliferation of a broad range of ICT-based systems (examples see Figure 40). 'Seamless' passenger travel in urban areas, as it has been put, was previously the domain of the automobile (private, rental, or taxi) but is now challenged by visions of near-seamless, multi-modal passenger mobility services involving options such a public transport, shared bikes and shared cars.

Key elements include the integration of information and payment systems for public and other transport services using for example smart cards and the increasing availability of a multitude of mobile applications related to mobility and access. The unprecedented rapid diffusion of smartphones is one of the key trends behind these developments.

Figure 40: Example of IT based systems supporting more seamless travel using multiple modes in cities (http://www.citygoround.org; http://www.transportdirect.info; http://senseable.mit.edu/eyestop)

New ICT technologies can support 'infomobility' and contribute to the creation of 'Smart Cities' that improve people's quality of life by making valuable information available to citizens, while reducing unnecessary traffic and supporting environmental sustainability (Albert, 2011). Real-time travel information can for example help minimize the inconvenience of using public transport. By making travelling in cities easier and more 'fun' IT and mobile technologies may however also contribute to stimulate mobility and thereby potentially add to congestion. The technological opportunities provided can thus influence transport demand in several directions (Sessa and Enei, 2011). The long term outcome for urban transport is hard to predict. Chapter 5 on Multimodal Information, Management and Payment Systems provides details of these trends.

Urban logistics and freight transport

Freight and delivery services are significant parts of urban transport; they comprise typically between 20 - 30 % of urban traffic, but have traditionally not been as much in the focus of planning and policy as passenger transport. Freight has mostly been addressed reactively as a cause of negative environmental impacts creating a need for regulations and restrictions. There is now a growing attention to city logistics as part of the urban transport system (Gonzalez-Feliu J., et al., 2013). The key components of city logistics are illustrated in Figure 41.

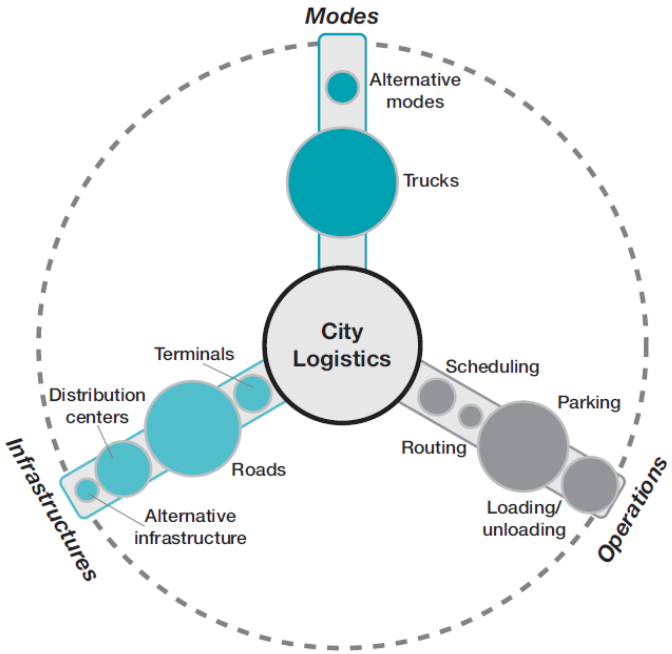


Figure 41: Key components of city logistics (UN Habitat, 2013)

Generally there is little data available to describe trends in urban freight transport especially at a European wide level and the understanding of this complex area is comparably low. A multitude of actors are involved in urban freight, from senders and receivers of goods, to logistics providers, to consumers, city residents, property owners, local authorities etc. For example, 85 % of European short distance truck

companies have less than five employees. This makes it a difficult area to manage from a comprehensive point of view (Browne, 2013).

Urban freight distribution is today entirely dominated by road transport (trucks and vans), distribution via water or rail is typically below 10 %. Trucks used for distribution in urban areas are on average smaller than long haul trucks. Diesel driven light delivery vans and trucks are the most frequently used vehicles. A general problem is inefficient logistics, with around ¼ of trucks running empty in Europe. Data for the UK suggest that load factors of trucks are even lower for trips within urban areas compared to trips in an out, most likely due to the pressure for frequent delivery and limited storage space in cities (Allen, 2010).

Urban freight traffic is largely driven by demand in the sectors that it services. Key sectors involved include retail, express delivery (courier and post), hotel/catering, construction, and waste (MDS Transmodal, 2012). These activities are highly dispersed across urban areas, and each represents a different set of challenges for providing efficient city logistics (Gonzalez-Feliu J., et al., 2012).

In several European cities initiatives have been taken to develop more sustainable logistics solutions (Dablanc, 2011). Some are driven by city administrations in order to manage and regulate urban freight, while others are driven by private companies or partnerships with a commercial perspective. Well known examples include London and Paris, and the Dutch concepts of Binnenstadt and Cargohopper. Figure 42 shows an example of an electric parcel delivery service in Gothenburg, Sweden. Generally the initiatives taken aim to influence the flow of goods, the type of vehicles used, the timing of deliveries, or the spatial aspects. Types of measures to improve city logistics include the following (Dablanc, 2011):

- Urban consolidation centres
- Clean vehicles (e.g. low emission trucks, electric delivery vans)
- Regulations on traffic and parking, access restrictions, environmental standards and permits
- Urban freight transport management systems using ITS
- Land use planning
- Governance initiatives, e.g. freight partnerships

Figure 42: Electric parcel delivery service, Gothenburg

Urban Consolidation Centres (UCC's) in particular are important facilities to enable the concentration of multiple deliveries of goods and parcels into more consolidated flows, and thereby limit the traffic and environment pressure in cities (MDS Transmodal, 2012). At UCC's streams of goods from multiple sources and consignors are unloaded, consolidated and distributed to urban destinations (retailers, construction sites, offices etc.). The consolidation allows reducing the number of vehicles entering the streets and the number of deliveries each destination must handle. Often less polluting and intrusive vehicle types can be used for the distribution rounds, for example EVs or cargo bikes. UCC's have been set up in an increasing number of cities in Europe mostly with support from public authorities. Morena et al. (2014) count 75 UCC initiatives in European cites, of which 30 were operational in 2010.

It is notable that many city logistics initiatives have disappeared again or never made it beyond the experimental stage once subsidies are withdrawn. It is also interesting that innovative green solutions may attract significant attention, while more general trends like 'logistic sprawl' that may outweigh the positive effects for CO_2 by orders of magnitude go unnoticed. (Dablanc, 2010) demonstrated this for the field of parcel delivery in Paris (see Figure 43).

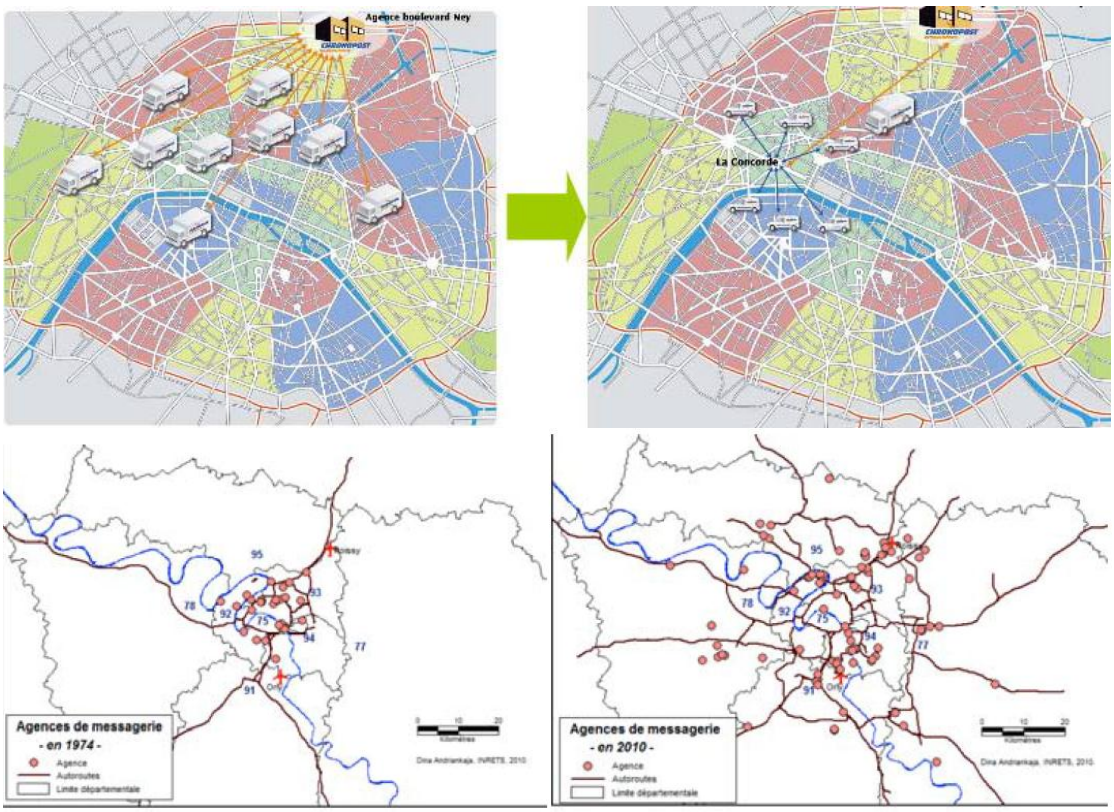


Figure 43: Upper part illustrates the Paris Chronopost 'last mile' delivery in the city centre contributing to reduce driving and emissions. Lower part shows 'sprawling' development of other parcel delivery centres around Paris in the period 1974-2010 leading to net increases in distances travelled and CO_2 emissions. (Dablanc, 2011)

E-commerce

A strong trend of more recent origin is the increased tendency to purchase goods and access services like banking over the internet (e-commerce, see Figure 44). E-purchase often involves direct delivery to the consumers by van, rather than the customer visiting a store. This involves potentially more frequent trips with lower vehicle utilization than conventional retailing. Internet trade is one of the fastest growing areas in retail, although it is still small compared to the traditional form (MDS Transmodal, 2012). The proliferation of internet retailing is very uneven across Europe, but a uniform rapid increase appears to occur. So far internet retailing is predominantly domestic, while cross border retailing is expected to emerge stronger in the coming years.

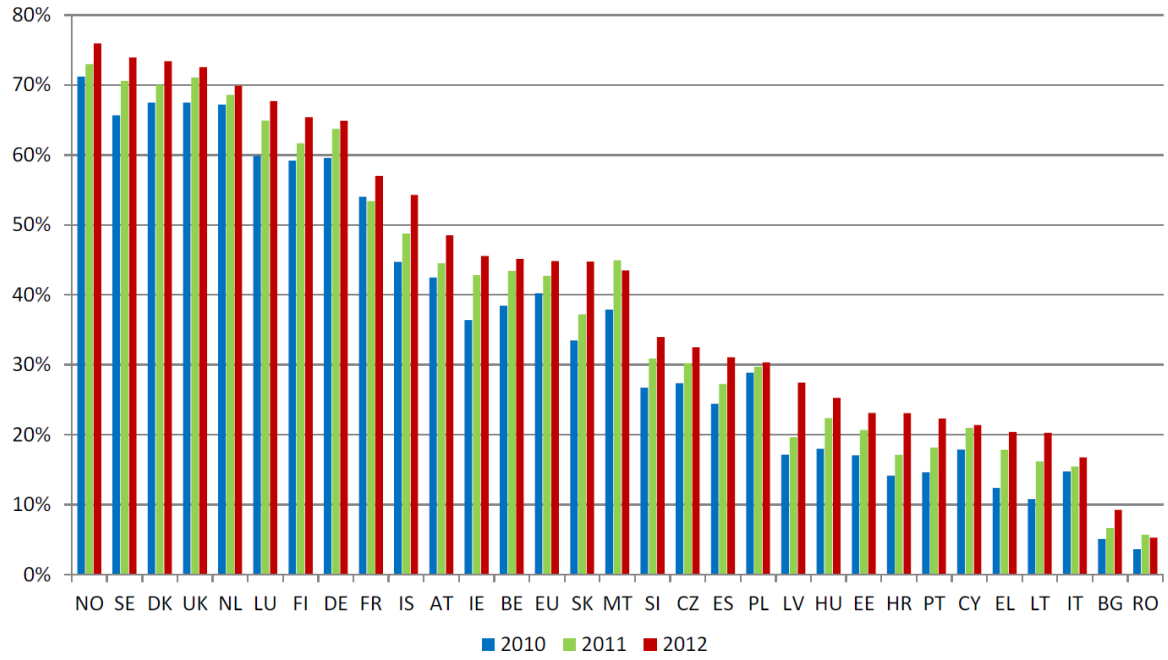


Figure 44: E-commerce usage by citizens in in EU/EEA member states: Percentage of respondents who have made an online purchase during the last 12 months (EC, 2013d)

There are a number of operational issues associated with home delivery of e-purchased products, which affects both the economic viability of the service model, and the amount of transport generated. Delivery may for example fail leading to a need for additional drops, or there may be need for extra trips to return purchased goods. Many parcel delivery models are currently being tested and applied, including delivery to local collection centres or in-home boxes, which allow the logistics operator to optimize fleet and delivery management, but may for example generate additional trips for consumers. According to the Commission's Study on Urban Freight the net effect of e-commerce on urban freight is still unclear, although it may support a fragmentation of retail purchases and increase the number of deliveries to residential areas.

Drivers and trends

While urban transport and mobility is likely to be influenced by a broad range of factors, it may be difficult to establish clear trends on how these factors will precisely affect for example volumes of transport, modal split or shift to cleaner vehicles and fuels in a particular way in the future. The combined outcome across several areas may be even harder to predict, especially when taking into account the diversity of urban areas across Europe.

At its first meeting in Gdansk, Poland (24-25 June 2013), the TRANSFORuM project invited a group of urban transport stakeholders to identify and discuss these and other possible trends in terms of their significance for reaching the urban transport goal. The stakeholders were first asked to bring their individual statements on trends forward from their perspective and were then invited to discuss and review the suggested trends in order to approach a common perspective.

Table 4: Drivers and Trends, examples

Examples of positive contributions	Drivers & trends	Examples of negative contributions
Better potential for Public transport and active transport	**Urbanization**	Increased demand for transport; sprawl
Increasing oil prices make alternatives competitive	**Energy prices**	Continued fluctuations make investments uncertain
On average less car use, better supply of PT	**Ageing population**	Higher car use among modern elderly than before
May avoid cars because of ICT solutions and alt. mobility	**Young people's lifestyles**	Cars remain status; young may catch up with 'delay' later
Leading to reduced emissions etc.	**More efficient engines**	Rebound effects
Economies of scale for EVs/alt. fuel vehicles	**Alternative fuel system investments**	Batteries, EVs remain expensive
Less travel for shopping	**Internet based shopping**	Increasing number of home delivery by vans
Consolidation and promotion of e.g. electric trucks	**Freight and logistics**	Restrictions on inner city logistics lead to longer trips
Citizens become engaged in sustainable mobility plans	**Urban transport planning**	Planning remain poorly coordinated
Modernization and priority to PT services	**Public transport development**	Insufficient funding/priority leads to decline
Cheaper access offer alternatives to travelling and support alternative modes	**ITC deployment**	ITC used to stimulate mobility and throughput of vehicles

The session generally confirmed that a broad range of factors may indeed be expected to play a role for reaching the urban transport goal, actually involving an even wider set of possible trends across fields such as of economy, demography, behaviour, technology, and also policy and governance. What emerged during this dialogue and the interpretation was not so much a consensus on a few key trends, or the elimination of certain others from consideration but more like a dual structure around a set of core driving

forces. Each driving force will be able to influence European urban transport and the realization of the urban goal in an enabling (positive) as well as in a constraining (negative) way, depending on general and context specific circumstances.

Table 4 represents an edited summary of the drivers and effects identified by the stakeholders, emphasizing this dual structure of the feedback. A conclusion would be that the urban goal may not be easy to reach considering the possibility of several negative contributions, and that an eventual roadmap may need to be prepared for the dual reality where drivers may change colour and revert positive trends to negative and vice versa.

3 Shift of road freight to rail and waterborne transport

3.1 Introduction

Goal 3 of the European Transport White Paper: "30 % of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030, and more than 50 % by 2050, facilitated by efficient and green freight corridors. To meet this goal will also require appropriate infrastructure to be developed."

In 2010 road transport over 300 km amounted to 965 billion tkm. Assuming road transport in a business as usual scenario would continue to increase by 2 % annually (average 1995-2009) this would mean that in 2030, according to the 30 % target, 430 billion tkm must be shifted from road to rail and waterborne transport. By 2050 this would increase to more than 800 billion tkm. In comparison, total rail freight in the EU-27 in 2010 amounted to 390 billion tkm while inland waterway amounted to 147 billion tkm.

A number of initiatives are already suggested in the White Paper in order to achieve a shift to rail transport. The organisation of the freight transport market needs to be harmonised through a true internal market for rail services (Initiative 1 of the White Paper). This requires simplified administrative processes (e.g. single transport document, single vehicle type authorization), harmonized signal systems, internalization of costs, non-discriminatory access to rail infrastructure etc. It is also imperative that appropriate physical infrastructure, e.g. trans-European networks and intermodal hubs, will be realized without unnecessary delay.

A considerably increased volume of waterborne transport calls for both a European maritime transport space (Initiative 4 of the White Paper) facilitating maritime movements and an internal market for inland waterway transport with optimized rules and reduced (administrative and physical) barriers (Initiative 5 of the White Paper, NAIADES-The EU Action Program on the Promotion of Inland Waterway Transport). Efficient waterborne transport necessitates intermodal hubs that not only handle container movements between rail and truck, but also handle movements between ship, rail and truck.

All transport infrastructures and modes need considerable support from smart/ITS-enabled freight solutions (Initiatives 7 and 25 of the White Paper) (e.g. e-Freight, one-stop-shopping, single transport document, tracking, tracing and flow management technologies) in order to assure a better exploitation of available infrastructure and to avoid empty vessel movements. Intelligent transport approaches as well as an efficient system of data monitoring, recording and managing are key prerequisites for an efficient integration of rail and waterborne transport into intermodal transport chains.

Efficient and green freight corridors (Initiatives 34 and 35 of the White Paper) concern questions of energy efficiency of freight transport (reduction of CO_2 emissions), alternative fuels (biofuel, full electrification of rail transport), less polluting cargo ships (using, for example, fuel cells and new engine types - even if waterborne transport already shows a favourable energy efficiency and is perceived as an environmentally sound and sustainable transport mode). Green freight corridors also need to respect the living environments of the population (e.g. silent rail rolling stock). The population's acceptance of more rail transport (e.g. in the Rhine valley) is a key element for the achievement of Goal 3.

A key issue is to achieve efficient cross-border freight corridors without technical or administrative obstacles, i.e. to realise a truly integrated rail network within Europe. Both the capacity and the quality of rail transport need to be improved. Rail freight is already often cheaper than road freight but is still often dismissed due to poor punctuality and/or service quality and reliability.

Financing of investments in railway (and to some extent port) infrastructure will be a limiting factor, especially considering that the high-speed rail network should simultaneously increase rapidly. To have a fair chance of achieving this White Paper goal, a decrease in road infrastructure investments is most likely necessary. Such a shift in investment strategy might face rather strong opposition from parties with interests in road transport. With respect to waterborne transport, the performance of inland waterway transport (IWT) depends to a large extent on the availability and the quality of waterway infrastructure. According to the PLATINA report on bottlenecks and missing links, national governments have committed themselves (to different extents) to improve the infrastructure by 2025. However, internationally relevant long-term projects are not yet approved or fixed – due to scarce public money or a lack of awareness and/or missing political willingness to improve the infrastructure.

Better quality and service may under particular circumstances be accomplished through deregulation (Crozet et al., 2013; Guihery & Laroche, 2013). However, it is important that this process is carried out at a similar pace across different member states. Otherwise rail companies in countries that are lagging behind in deregulation may get a competitive advantage since they will be able to compete successfully in foreign markets, while not being forced to meet substantial competition in their own domestic market. An increased number of railway service providers may also imply a less efficient use of track capacity. If fees are not paid for track slots, an increasing number of service providers tend to imply shorter trains on average.

In order to realize a seamless freight transport system, interchanges between road, rail and waterborne transport are a critical issue. Developing inter-modal road-rail hubs with automatic terminal handling is an important part of this, as is efficient rail-port-connections. Achieving successful intermodal hubs will necessitate joint actions involving various actors, e.g. transport agencies, infrastructure providers, hub operators, terminal operators and hub users.

Other challenges are:

- Improving rail transport in the new EU-member states;
- Allowing for more efficient trains (longer, heavier, wider, higher) to decrease cost;
- Better interoperability and capacity by implementation of European Rail Traffic Management System;
- ERTMS level 3 and River Information Systems RIS;
- Intelligent planning, dispatching and information systems;
- Cost efficient track building and maintenance with low life-cycle emissions;
- Building of dedicated high speed railway lines to free capacity for freight on conventional network;
- Image problems of and skill shortages in waterborne transport.

A key concern raised by the stakeholders at the Gdansk forum was that initiatives at EU and national levels need to be coordinated in order to reach the goal, since there is a limit to what the EU can solve without involvement of operators and national/local authorities. For instance, regarding taxation the EU has limited jurisdiction at present. It was mentioned that some national governments (although supporting the objective of shifting to more climate and environmentally friendly modes) do not accept the goal and question the relevance of setting a fix percentage. An important issue raised was that member states face different challenges in terms of development of infrastructure, e.g. motorways are particularly strongly emphasized in many Eastern European countries. The target until 2030 was considered rather optimistic as building infrastructure takes a decade or more. The stakeholders found the goals relevant but not very clear. Some of the stakeholders suggested that the EU goals should be used more as a strategy for the separate countries to implement on a national and city level. They thought that the goals should be reached before 2030/50.

3.2 Policies and funding mechanisms

A key policy (also identified at the Gdansk forum by the stakeholders) is the revised Eurovignette (Directive 2011/76/EU). On one hand, it makes it easier to charge external costs of truck transport (emissions, noise, wear etc.). On the other hand, it contains some earmarking of revenues to improve the road network. It would be a useful mechanism for achieving the goal if it would be compulsory for all and charges could be invested in alternative modes, instead of road infrastructure. The 4th Railway Package and the railway corridors will help foster competition. Some stakeholders emphasized the need for initiatives increasing competition in order to achieve the goal. Others disagreed, arguing that liberalization of the freight market already exists and that the EU legislator should focus on essential technological issues (i.e. transhipment technologies for intermodal hubs). However, there was consensus about the benefits of a strong and independent regulator that ensures fair competition. Important initiatives for maritime transport are Navigation and Inland Waterway Action and Development in Europe (NAIADES) and the legislative file of Non-Road Mobile Machinery (NRMM), although the latter could contribute to make waterborne transport more expensive. Switzerland was highlighted as a visionary country to learn from. In contrast to other countries and the EU, which repeatedly mention the same goals without really implementing the policies, Switzerland has set up specific targets, dedicated financing instruments (distance related heavy vehicle fees, increased oil tax and value-added taxes) and a long-term plan for implementation. Finally, it may be noted that the stakeholders had different opinions on whether decided and expected policies would be sufficient to reach the goal. Table 5 gives an overview of policies and funding mechanisms identified for thematic group 2. The particular policies were analysed in terms of relevant measures and expected impacts and are organized according to the time scope and withal according to significance towards White Paper goal. Figure 45 shows the timeline when the different policies were introduced. Following policy documents were identified and selected on the base of internet literature study and in cooperation with the thematic group expert leader who verified the relevance and completeness of these existing policies for chosen White Paper goal.

Table 5: Policies and funding mechanisms identified for thematic group 2

Policy actions, initiatives and programs	**Scope**	**Expected impact and intervention capacity (*multilevel perspective*)**	**Expected coordination with other policy initiatives**
1) A sustainable future for transport: Towards integrated technology – led and user friendly system	Infrastructure: Maintenance development and integration of modal networks To accelerate the transition to a low-carbon society and lead global innovation Promoting market opening and fostering competition Keeping EU at forefront of transport services and technologies Protecting and developing the human capacity	Economic aspects (market opening) Social aspects (safety, security) Environmental aspects Integrated networks	Policy instrument : standard setting
2) EU Freight transport agenda: Boosting the efficiency, integration and sustainability of freight transport	Freight-oriented rail network more competitive Carriage of goods Sustainable mobility Freight rate Transport infrastructure Administration Progress in ICT Synergies : - Focus on corridors - Promotion of innovation technologies in infrastructure - Simplification of freight transport chains - Reinforcement of quality	Strengthen cohesion by enabling business across EU Energy-efficient operations Lower transit times Increasing of reliability Freight becomes Integrated and concentrated global market Enhancing trade relations Reduction of emissions Reduction of	Forecasted 50% growth of freight transport 2000-2020 -increasing fuel consumption -congestion -pollutant emission, noise -dependent on fossil fuels -safety and security need to be enhanced Necessary to adopt appropriate legislative measures, mandating technical standardization, providing political and financial support and encouraging the promotion of best practices

		Fossil fuel Reduction of congestion Reduction of accidents	
3) Marine and Maritime Research Strategy	Capacity building(monitoring and data collection facilities, ocean observatories, sub-sea technologies and specialized research vessels); Development of integration between knowledge and observation data; Promotion of synergies through a combination of different forms of funding; Climate change and oceans Impact of human activities Ecosystem approach Marine biodiversity and biotechnology Continental margins and deep sea Operational oceanography + marine technology Exploitation of marine resources Distinction between Marine and Maritime research : Marine – addresses a branch of earth science that studies the oceans and seas incl. their flora, fauna, their interaction with coastal territories and with the atmosphere (marine organisms, ecosystems dynamics, ocean currents, plate tectonics, geology). Maritime aims at technologies and innovative solutions for a better exploitation of sea and ocean resources such as the design, building and operation of vessels, harbours, oil platforms, tourism.	Development of excellence and efficiency in marine and maritime research to improve the preservation of m. environment and biodiversity Maritime clusters Related issues are conflicting: -maritime transport -shipbuilding -energy -fisheries + aquaculture -tourism + coastal zones -new resources + blue biotechnology	Strategy for maritime research approved by European Council and Parliament. Aim: to create better integration between marine and maritime research. Support to Lisbon Agenda Goteborg strategy Waterborne Technology platform Five principles of Ljubljana Process
4) European Road Safety Action Program	Enlargement of previous measures RSAP Following topics considered: -enforcement -awareness campaigns	Effectiveness Efficiency Consistency Sustainability Negative effects from non-implementation	-

	-training and driving licence -impaired driving -passive and active vehicle safety -infrastructure -professional drivers -post crash medical care -statistics and monitoring -building stakeholders commitment Three main dimensions: -state of implementation -timing of effects - type of impact		
5) European agenda for Freight Logistics **(Freight Transport Logistics Action Plan)**	Sustainable mobility (estimated 50% increase in freight by 2020) Advanced ICT e-Freight Sustainable quality and efficiency Simplification of transport chains Vehicle dimensions and loading standards Green transport corridors for freight Urban freight transport logistics Supporting infrastructure	Environmental sustainability Promotion of energy efficiency Co-modality concept – effective use of different transport modes	Four themes: - Innovation - Quality - Simplification - Green transport TEN-T guidelines
6) EU Maritime Transport Strategy	- to provide cost-effective maritime transport services adapted to needs of sustainable economic growth of EU - long term competitiveness of EU shipping sector, enhancing its capacity to generate value and employment in EU through cluster of maritime industries	Shipping trends Business conditions Human resources Quality shipping International scene Short-sea shipping Research + innovation	
7) ERRAC-Rail Route 2050: sustainable backbone of the single European	Competitive, resource efficient and intelligent rail transport system	By 2050 European rail network fully interoperable	-

Transport Area	(Rail share (freight + passenger markets) will double by 2050) Rail-Route 2050 targets – improved info system, safe + secure environment, punctuality, interoperability with reliable, available, fast and safe trains, the most secure public transport mode, improved competitiveness with new rolling stock, operational systems and infrastructure, modernization and take-up of new technology of rail equipment	Costs and time for -production of rolling stock and equipment significantly reduced thanks new manufacturing processes Maintenance cost of infrastructure reduced by 50% Improvement of station design Accessibility public transport Infrastructure conditions improved	
8) Waterborne Declaration	-More extensive, integrated, efficient and sustainable waterborne transport systems and infrastructure -increase support for emerging offshore food, energy and minerals sectors -reduce impact on environment -more competitive and sustainable low carbon economy -to prioritize safety and security within Waterborne community	Sustainable waterborne transport -assuring security of supply -increasing the energy efficiency of ships -minimizing environmental impact -building safer ships -increasing competitiveness -recruiting skilled workforce -developing advanced infrastructure	Three pillars : -Safe, sustainable, efficient waterborne transport -competitive waterborne industry - managing the growth in transport
9) Long distance Truck Roadmap	By 2030 Road transport is 50% more efficient than today: -energy efficiency (urban passenger) 80% -energy efficiency (long distance freight) 40%	Green corridors and hubs City logistics Intelligent	-

	-share of renewables -reliability of transport times -urban accessibility - safety	logistics solutions	
10) Logistics + Co-modality Roadmap	Green Hubs and Green Corridors City Logistics Intelligent Logistics Systems, optimizing e-freight	More efficient freight Improved load factors Reduced CO_2 emissions Removed congestion	DG TREN – European Energy and Transport Trends to 2030 Transport Flows General Expectation: Seamless Reliable Available Accessible Secure Sustainable Accountable Affordable Transparent
11) NAIDES/PLATINA – Strategic Research Agenda for Inland Waterway Transport	Inland (rivers, canals) mode for all kind of goods Shifting transport to less energy intensive, cleaner and safer transport modes (close cooperation with national and regional authorities, river Commissions) To comprise legal measures	Favourable framework conditions Intermodal freight solutions Sustainable Competitive Environmental friendly	-
12) UNECE Inventory of Main Standards and Parameters of the E Waterway Network, so called Blue Book	BB (2012) presents regularly updated standards and parameters of e-waterways and ports, identifies bottlenecks and missing links, shows infrastructure parameters	AGN agreement: Homogeneous (vessels, barges) Suitable for efficient international transport Integrated	AGN-European Agreement on Main Inland Waterways of International Importance Pan-European E waterway network administered by UNECE

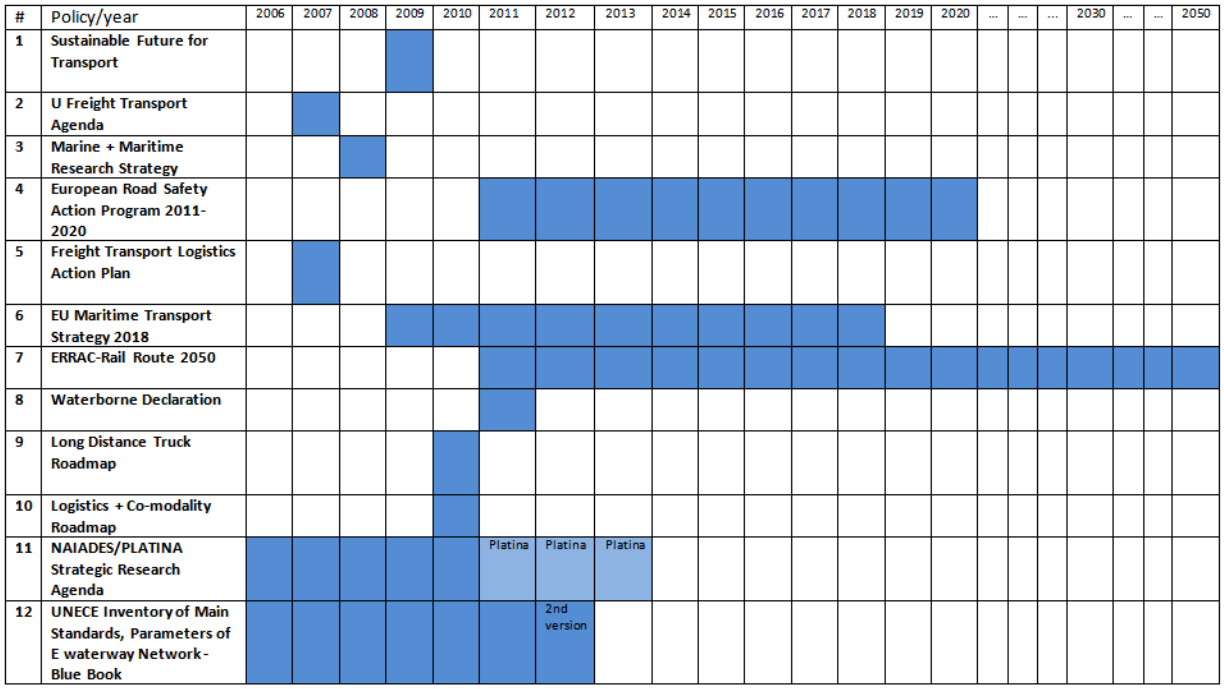


Figure 45: Timeline of policies for thematic group 2

Resource citation links:

1) http://ec.europa.eu/transport/media/publications/doc/2009_future_of_transport_en.pdf
2) http://ec.europa.eu/transport/logistics/freight_logistics_action_plan/doc/action_plan/2007_com_freight_agenda_en.pdf
3) http://ec.europa.eu/research/mmrs/documents/pdf/a_european_strategy_for_marine_and_maritime%20_research_en.pdf
4) http://ec.europa.eu/transport/road_safety/pdf/2dec/working_doc.pdf
5) http://ec.europa.eu/transport/logistics/freight_logistics_action_plan/doc/action_plan/logistics_action_plan_ia_en.pdf
6) http://ec.europa.eu/transport/themes/strategies/2018_maritime_transport_strategy_en.htm
7) http://www.kowi.de/Portaldata/2/Resources/fp/railroute-2050.pdf
8) http://www.waterborne-tp.org/index.php/documents
9) http://www.green-cars-initiative.eu/public/documents/EGCI%20Truck%20roadmap.pdf/view
10) http://www.green-cars-initiative.eu/public/documents/EGCI%20Logistics%20roadmap.pdf/view
11) http://www.naiades.info/
12) http://www.unece.org/fileadmin/DAM/trans/doc/2012/sc3wp3/ECE-TRANS-SC3-2012-inf07e.pdf

3.3 Trends

Total freight volume development

Total European freight transport volume (including intra-EU sea transport) increased from 3060 to 3831 billion tkm between 1995 and 2010. This is a 1.5 % increase annually despite the substantial downturn in 2008-2009, as can be seen in Figure 46 (EC, 2012a). Until now freight volumes (measured as tkm) have followed GDP developments. Between 2000 and 2008 the ratio between freight transport and GDP increased by 3 % while between 2000 and 2011 it decreased by 3.5 % (Eurostat, 2011). There are, however, signs of future trend breaks that may be discerned. With a stagnating population in Europe the demand for new residential areas may be weak, which in turn decreases transport needs. There are also weak signs of a re-regionalization (The Economist, 2011). This means that some American and European companies have brought production back home from "low-wage countries".

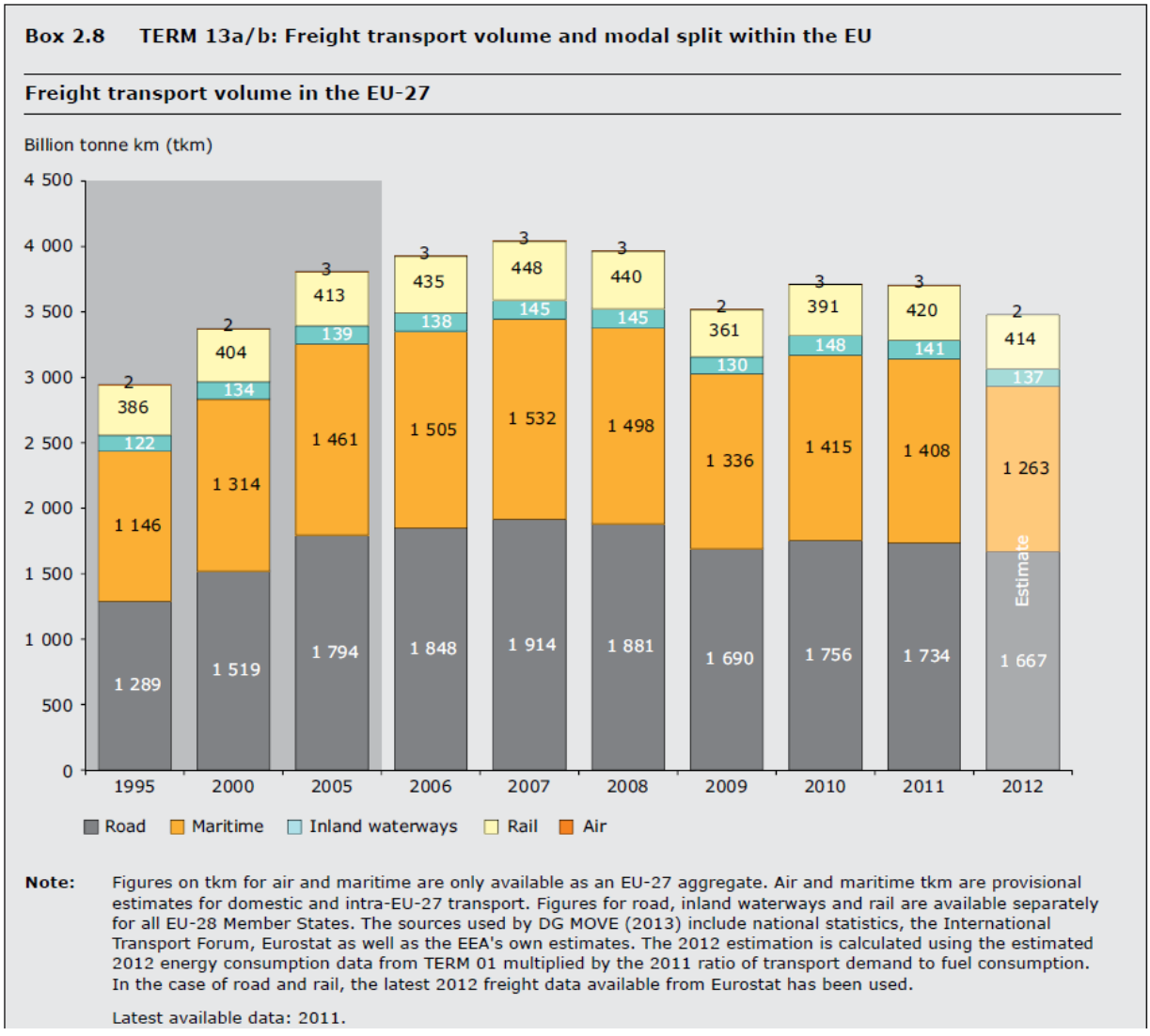


Figure 46: Development of intra-EU freight transport volumes per mode, between 1995 and 2010 (DG Move, 2013)

Modal shares

Road transport is increasing its share while sea transport has a stable share and rail is in decline, in the EU-27. However, the situation differs across the European Union. In the EU-15 rail freight is slightly increasing while the share in EU-12 is decreasing (EC, 2012a). Rail-road combined transport has increased by 29 % between 2005 and 2011 which is much faster than the total European freight market.

Infrastructure investments

In Figure 47 the development regarding infrastructure investments over the last decades is shown. The share for rail investments (of road and rail together) has been around 30 % throughout the whole period in the EU-15. However, for CEEC countries the share for rail investments has been halved between 1999 and 2009 (CER, 2013).

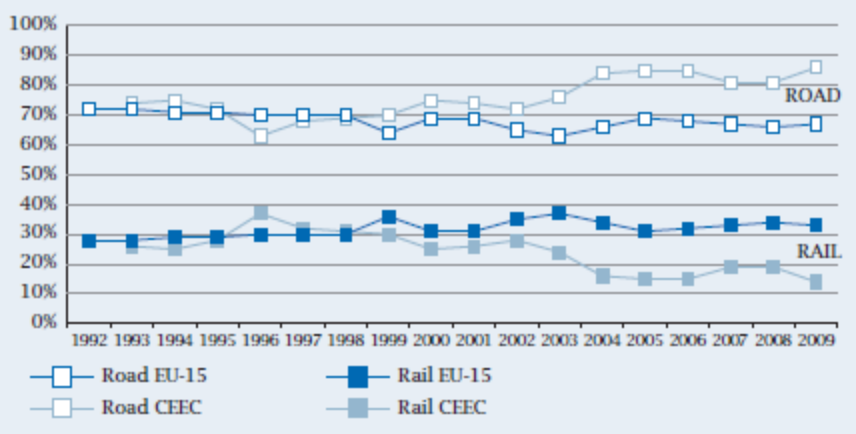


Figure 47: Rail and road market share of infrastructure investment in EU-15 and CEEC, 1992-2009 (CER, 2013)

Fuel availability

In recent years the oil price has hovered around a high of 100$ per barrel with subsequent increases in fuel price over the last decade. This especially affects sea and air transport which are exempt from fuel taxes. The price of bunker oil increased by a factor of about four between 2002 and 2010. Most projections point out increasing oil prices, although short term fluctuations in both directions will probably be common, as they have been historically. They availability and cost of unconventional oil will be a critical factor, as will of course be the political situation in e.g. the Middle East. A factor is also to what extent "dirty" unconventional oil will be demanded by key consumers. For instance, the proposed EU-legislation that takes into account indirect (upstream) emissions will make it difficult for many of such fuels to make it into the European market.

Much interest has lately been put into renewable fuels. In 2009 the European Parliament approved Directive 2009/28/EC, also referred to as the Renewable Energy Directive, RED (European Parliament and the Council, 2009), which states that all member states should reach a share for biofuels in transport (excluding aviation and sea transport) of at least 10 % by 2020. In October 2012, the European Commission

launched a proposal for an amendment of the Renewable Energy Directive (EC, 2012b). With reference to the risk for negative Indirect Land-Use Change (ILUC) effects, the Council and Parliament have agreed on a cap for food-based biofuels at 6 % of total fuels (energy content), thus steering towards the development of second and third generation biofuels, i.e. those based on non-food feedstock's.

These policy initiatives are obviously important for the supply of fuels to the freight transport market. It should however be noted that many sectors, not only within transport, are keen on reducing their emissions by using biofuels. Therefore bioenergy will most likely be a scarce resource within the foreseeable future, resulting in increasing prices. If realized such a development would increase the competitiveness of rail versus road and waterborne transport, at least as long as road freight is not electrified (see next section).

New technologies

Trucks declared fuel consumption per km has been reduced by about 1 % per year, but real in-traffic consumption has shown a much slower reduction. Hybridization is a key trend among truck manufacturers. Although it seems like a perfect technology for distribution in cities, it is claimed to be as economic for long distance truck transport. The fuel saving is much smaller per kilometre for long distance transport, but this is counteracted by the much higher yearly mileage for long distance vehicles.

Electric road transport is also a solution which is much discussed at the moment, both for passenger cars and trucks. For freight the concept would entail a combination of electrification of main roads and hybrid diesel-electric trucks. The advantage with this concept is claimed to be lower infrastructure costs compared to rail and better environmental characteristics than conventional diesel trucks. If realized at a larger scale, investments in this technology will compete for funding with rail.

Several innovative transhipment technologies (CargoBeamer, Modalohr, Innovatrain, CCT, etc.) have been introduced recently but none seems to have become a clear winner. Meanwhile containerization continues. Container ships are increasing in size while interestingly enough their speed is reduced.

Liberalisation of freight markets

Deregulation and liberalization of freight markets is an important trend. The four "Railway packages" constitute key elements for this policy development. The first was passed in 2001 and recently the fourth Railway package was proposed (EC, 2013e). As a consequence markets for rail freight became open for competition in 2007 (Guihéry L., 2013). Although the pace of implementation has differed considerably between member states, on the EU scale effects are evident. The EU-27 market share of new entrants in the freight market was 14 % in 2006, 19 % in 2008 and 25 % in 2010 (CER, 2013).

The reforms in this area are intended to increase economic efficiency generally and to increase the share of rail freight in particular. Thus they will, at least in the longer term, lead to cheaper transport which will increase transport volumes. Deregulation of rail transport may in the end increase competitiveness, but may meanwhile make international transport more difficult if former co-operators turn into competitors. There are also some risks related to liberalization. Intermodal networks are characterized by significant economies of scale, both relating to rail or sea transport and to the transhipment hubs. If several actors attempt to build up parallel networks with little coordination costs increase and the competitiveness of

intermodal alternatives diminishes. Wilmsmeier et al. (2011) points out that in Swedish municipalities uncoordinated decisions to build terminals have created an overcapacity. Such developments could for instance have the effect that a couple of short trains go to different terminals in the same area instead of one long train going to a bigger terminal. Since rail infrastructure stands for a large part of rail freight costs and each train occupies (almost) as large a slot on the tracks regardless of length, this may lead to sub-optimal solutions. For road transport the situation is different since there is little benefit (if any) associated with concentrating road freight along certain corridors.

E-commerce

E-commerce is increasing rapidly. For the coming years e-commerce in the US and Europe is expected to increase by around 10 % annually (Forrester, 2011; eMarketer, 2013). An effect is that consignment sizes are getting smaller and that total transport volumes increases due to increasing distances (Gdansk WS, 2013). The load factor of vehicles may be affected negatively.

Lowered wages in road freight

In the road freight sector new member states are rapidly increasing their market shares. For instance, between 2004 and 2012 trucks registered in Poland increased their transport volume from 102 to 222 billion tkm. In comparison German trucks increased their haulage only slightly from 303 to 307 billion tkm during the same period, and in France the transport volume decreased from 203 to 172 billion tkm (Eurostat, 2013b). An implication of this shift is that average wages tend to decrease in the EU-27 road freight sector. Average annual personnel cost per employee in the road freight sector is 26,000 Euro in Germany, 34,000 Euro in France but only 6,000 Euro in Poland (Eurostat, 2013c). Since wages account for a large part of total costs in road freight transport, this development will significantly increase the competitiveness of the sector in relation to rail and waterborne transport.

Charging/Taxation

A general trend albeit a rather weak one is the internalization of external effects, e.g. by economical instruments. Kilometre based fees for trucks have been introduced in many European countries over the last decades, e.g. in Switzerland, Germany and the Czech Republic. Although countries like Sweden have opposed such instruments, there seems to be a trend in this development. In 2011 the European Parliament and the Council (2011) adopted the Directive 2011/76/EU which enhances the possibilities to levy charges on trucks. It has also been proposed that road tolls will be used more extensively, not primarily for environmental concerns, but as a means to increase public revenues (Gdansk WS, 2013).

New environmental regulations for maritime transport, like the 0.1 % limit for sulphur in maritime fuels from 2015 (The European Parliament and the Council, 2012), may have significant impacts on freight markets. It increases fuel costs and may shift some cargo from waterborne to rail or road. Sea transport is currently the only mode of transport not paying anything for emissions of greenhouse gases, although it is worth noting that also aviation still pays very little compared to road transport. There have been discussions on this issue within IMO and within the UN Climate negotiations but it will probably take a long time until it pays off in terms of concrete policy measures for sea transport.

All freight modes will experience increased costs if externalities are to be fully paid for. For instance, waterborne transport will have to pay for sulphur and greenhouse gas emissions, road freight transport will have to pay more for emissions and infrastructure wear, while rail transport may have to pay for measures reducing noise. The resulting effect on competitiveness among the three modes is not fully clear, although it is likely that at least rail would get an advantage.

Recycling of materials/products

There is a clear trend towards recycling of materials/products under the paradigm "Extended producer Responsibility" (LogMan, 2008). The share of municipal waste going to landfills in the EU-27 decreased from 68 % of the total in 1995 to 38 % in 2009 (Eurostat, 2011). The impact on transport depends on, e.g. collection system and localization of recycling facilities in relation to where extraction of virgin materials occurs.

Other trends

Rising sea level due to global warming may cause a need for re-building some ports. Global warming may also open up the North-West passage (north of Siberia) for maritime transport, thus shortening the transport distance between East-Asia and Europe.

4 Complete and maintain the European high-speed rail network

4.1 Introduction

Goal 4 of European Transport White Paper: "By 2050, complete a European high-speed rail network. Triple the length of the existing high-speed rail network by 2030 and maintain a dense railway network in all Member States. By 2050 the majority of medium- distance passenger transport should go by rail."

The development of a European High Speed Rail (HSR) network is one of the components of a more sustainable European transport system. It is initially an answer to the economic issues of passenger mobility. Economic growth is accompanied by a request for speed, related to the increasing scarcity of time. As time budgets for transport are not extensible, higher speed is therefore a condition of enrichment and diversification of our ways of life. HSR answers this request for speed by taking into account the environmental constraints. The train, unlike the plane, can use renewable energies and non-fossil fuels. The development of a European HSR network is thus a powerful lever to reduce not only greenhouse gas emissions caused by transport (which have increased from 19.6 % in 1990 to 24 % in 2008 of total European emissions) but also the dependency of our mobility on non-renewable energies. HSR is also a way of taking into account social and political dimensions of sustainability. More precisely, as with the links between London, Paris and Brussels, HSR establishes easier connections between the various countries of Europe. It thus contributes to reducing the geographical barriers to increased European integration, especially where the network is extended to member states not yet served by HSR. HSR is especially dedicated to corridors which connect areas of a high density of population.

Developing a European HSR network raises a lot of financial questions; on the one hand because this kind of mode of transport requires public subsidies, but also because private finance is often involved in its development. As a start, it is necessary to define the relevant services of transport which can provide high speed rail and the role that the railway companies, competition and/ or the co-operation between them must exhibit. Several European countries have already developed a HSR network, among them – in the order of the length of their HSR network – Spain, France (having been the first in Europe starting already in 1981), Germany, Italy and Belgium, and to a lesser extent also the Netherlands, the UK and Switzerland. The analysis of the practices of these various countries shows that there is not one universal model of HSR. We can, for instance, distinguish between very high speed (> 300 km/h) and high speed (200 or 250 km/h) variants. These various speeds correspond to different services, in turn adapted to different geographies. It is thus necessary to define in detail the appropriateness of HSR. To connect cities which are 500 to 800 km apart does not require the same commercial services as the linkage between cities which are closer to each other (100 to 200 km). These considerations have to be taken into account when planning an extension of the HSR network in Europe - not only in those countries which plan to extend their national networks but also for those countries (e.g. Poland, Portugal and Sweden) which already have concrete plans to construct HSR connections within their countries within the next 10-15 years.

The various "European railway packages" sought to open competition within the rail sector, a sector characterised by decades of monopolistic behaviour. For the time being, competition is carried out for freight and in certain countries for regional train services. But where HSR exists, there is minimal competition and it has to be examined whether this can and should be changed, both on-track (competition between operators on the same network) and off-track (e.g. tendering operation of a route for a certain period of time). The question of competition and/or cooperation is also evident for the relationship between railroad companies and airline companies, especially regarding medium-distance travel. In certain countries, air companies are already cooperating with railway carriers and have set up railway connections to feed their hub airport. But it is undoubtedly necessary to go further. Airline companies may even operate HSR themselves, explicitly substituting air traffic. This brings us back to the question of the service types related to HSR. For instance, travel by train on long distances like Paris-Madrid or Paris-Milan, makes it necessary to consider night trains which would be a new form of HSR service.

Increasing the number of long distance connections, a prerequisite to achieving an integrated European HSR network, depends on a close partnership between the Member States of the EU (e.g. regarding the standardisation and interoperability of HSR stock and infrastructure). Although initially built on the basis of national interests, it would be necessary to look at the HSR network from a European viewpoint. Some research support the idea of an integration of national High Speed Rail Network in a common European High Speed Rail Network Agency (Guihery, 2014). While the European Union contributes to such a perspective already through its financial support mechanisms, other actors need to be mobilised to also take on a European perspective.

Construction costs for one new kilometre of HSR typically range from ca. 10-40 million Euros, depending on topography, planned speed and whether the tracks will also be used by other than HSR trains, e.g. freight trains and/ or local trains. Thus, the further development of the HSR network demands European and national resources. An alternative is to develop PPP (public-private partnerships) (Crozet, 2014). Good practices must be diffused and experience sharing must be encouraged, including significant negative experiences.

The financial question is ultimately linked to the question of how the completion of a European high-speed rail network by 2050 will affect the financial means to maintain a dense conventional railway network for local passenger trains and freight trains. For example, it must be ensured that the relatively high construction and operation costs of new HSR connections do not result in a cutback of local train services. Available financial means must be shared in a fair way between HSR and maintaining a dense local railway network which is needed to fully exploit the potential of HSR to reach the goal that by 2050 the majority of medium-distance passenger transport will go by rail instead of using personal vehicles or aircraft.

By the stakeholders at the Gdansk forum it was observed that tripling the length of the HSR network cannot be the main goal as infrastructure and service has to be aligned with demand (Crozet, 2013). A precondition for such a network to be viable is at least the tripling of demand. Therefore the potential traffic has to be taken into account. Different geographical features in different member states are major factors and will have to lead to nationally differentiated goals. Different national urban structures lead to different

national "models" of HSR which have to be taken into account. An example is the comparison between Spain, France, Italy (long distance between big cities) with Germany (which is a federal state with medium distances between medium size cities). From a European viewpoint, cross-border traffic has a high potential between London, Brussels, Paris, Amsterdam and Cologne (optimal time-distances between big urban regions) but for very long distances between European capitals (greater or much greater than 1,000 km), HSR cannot compete with air. Public policies must not think only in terms of infrastructures but also in terms of services, frequency and quality of connections. Time gains and speed are not the only variables to attract rail passengers. Travel time and time savings are very important; they contribute to justify many of HSR projects. Time savings are important to recruit business travellers as well as tourists. Demand studies show that travel time budget is a very relevant issue but the quality of travel time must not be overlooked. If the main strength of HSR is for trips between 1.5 and 3 hours then economy matters too. The more one develops HSR beyond the 3 hours threshold, the more public subsidies are required, especially between medium size cities. HSR clearly has an important role in meeting future mobility needs. It can carry significant travel volumes between major European cities, provide times gains, ensure quality of travel time, reduce pollution etc. But the development of HSR depends on many factors such as geography and economy which impose some constraints and HSR project are facing some opposition and struggle with countertrends.

4.2 Policies and funding mechanisms

At the Gdansk workshop it was argued that the involvement of railway representative institutions (for sharing knowledge, promoting standards and cooperation) must sometimes be rethought and reinforced, as interoperability and intermodality are two major conditions for the integration of HSR in Europe. A common standard among all Member States would contribute to achieve the goal. It is, until now, the role of the European Railway Agency (ERA), to establish such norms and make them respected. Due to the need for large infrastructure investments, financial issues are obviously also crucial, especially in light of the current economic crisis. Although there is a diversity of possible financing models, there is always a need to define the degree of European subsidies needed for the construction and operation of cross-borders HSR and to reduce congestion in some bottlenecks. This could lead both to a better HSR service and helps developing and maintaining a satisfactory level of conventional rail service.

Table 6 gives an overview of policies and funding mechanisms identified for thematic group 3. The particular policies were analysed in terms of relevant measures and expected impacts and are organized according to the time scope and withal according to significance towards White Paper goal. Figure 48 shows the timeline when the different policies have been introduced. Following policy documents summary was identified and selected on the base of internet literature study and in cooperation with the thematic group expert leader who verified the relevance and completeness of these existing policies for chosen White Paper goal.

Table 6: Policies and funding mechanisms identified for thematic group 3

Policy actions, initiatives and programs	Scope	Expected impact and intervention capacity (*multilevel perspective*)	Expected coordination with other policy initiatives
1) Strategy of Trans-European Transport Network policy	Development of European networks (constantly) Advantages for passengers Link Trans-European transport network policy and cities Growing demand Competitiveness with other modes of transport	To modernize the core transport networks To achieve an integrated market for next transport systems and services To create a market framework capable of attracting investment in all t. modes and management systems To contribute to a more sustainable modal split Transport development with respect of environment Better coherence between planning objectives and implementation capacities Support logistics + co-modal services for passenger and freight Mobility needs while containing CO_2 emissions More national infrastructure networks Europe connection and the world	Transport networks: Road network Rail with HSR network Inland waterway Seaport network Motorways of the sea Airport network Combined t. network Management + info network Air traffic management network Positioning and navigation n. New political circumstances: Climate change objective Enlarged Union Union´s global role Key element In Lisbon strategy Central role in attainment of objectives of Europe 2020 Strategy
2) TEN-T Projects	TEN-T: set of road, rail, water transport networks. 30 Priority Projects : Their completion - planned for 2020 - will improve the economic efficiency of the European transport system	Implementation of high-speed railway links Reduction of regional disparities by connecting countries	Technically and financially managed by Trans-European Transport Network Executive Agency (TEN-T EA)

	and provide direct benefits for European citizens. (18 are railway projects, 3 are mixed rail-road projects, 2 are inland waterway transport projects and one refers to Motorways of the Sea. This choice reflects a high priority to more environmentally friendly transport modes, contributing to the fight against climate change). The completion of these projects provides a concrete illustration of the potential benefits of the TEN-T.	Interoperability Continuity Technological/institutional innovation Strengthen E. dimension in TEN-T planning	TEN-T planning is on two levels: -comprehensive network (plans for rail, road, inland waterway, combined transport etc. -priority projects with cohesion and sustainable development objectives
3) European co-funding policy of new high speed lines	High ambitious standards for all infrastructure Common deadlines to complete networks (2030/2050) Corridors and coordinators for implementation Regulation vs. decision Rail infrastructure provisions (lines equipped with ERMS)	Compliance with technical specifications for interoperability Priority: -ERTMS deployment -noise impact mitigation -higher standards than the minimum set	Financing framework 2014-2020 Connecting E. facility -transport guidelines -energy guidelines -telecom guidelines
4) European rail traffic management system (ERTMS) **(ETCS – European Train Control System +** **GSM-R Global System for Mobile Communication for Railway)**	Measures in the field of : - Communication - Security - Operation management - Operation regulations - Safety control Pilot projects results in Switzerland, Austria, Slovakia, Bulgaria, France, Germany, UK, Italy, Netherland, Spain	Interoperability Integration of systems Competitive advantage of E. rail sector Decrease of technical barriers Maintenance costs savings Safety Reliability Punctuality	ETCS – 3 application levels ERTMS aims at replacing the different national train control and command systems in Europe. More than 20 train control systems in EU

		Traffic Capacity Environmental gains	
5) Council Directive 96/48/EC of 23 July 1996 on the interoperability of the trans-European high-speed rail system and amending acts	Directive on the interoperability of the trans-European HSR system. Measures for interoperability ensuring, in particular in the field of technical standardization Required excellent compatibility in characteristics of infrastructure, equipment and rolling stock (safety, performance levels, quality of service, cost depend)	Area without internal frontiers, advisable, improving of interlinking, interoperability of national HSR networks Etc.	Member states responsible for ensuring compliance with safety, health and consumer protection rules applying to railway networks Etc.

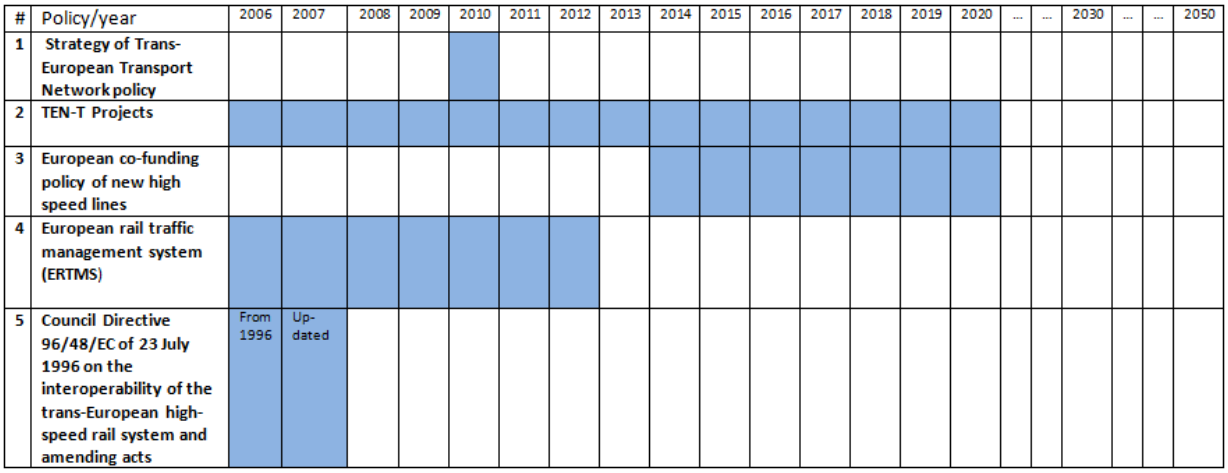


Figure 48: Timeline of policies for thematic group 3

Resource citation links:

1) http://ec.europa.eu/transport/themes/infrastructure/consultations/doc/2010_09_15_consultation_document.pdf
2) http://tentea.ec.europa.eu/en/ten-t_projects/
3) http://en.wikipedia.org/wiki/High-speed_rail_in_Europe, http://ec.europa.eu/transport/themes/infrastructure/studies/doc/2010_high_speed_rail_en.pdf
4) http://ec.europa.eu/transport/modes/rail/interoperability/ertms/
5) http://europa.eu/legislation_summaries/internal_market/single_market_for_goods/technical_harmonisation/l24095_en.htm

4.3 Trends

This section is investigating relevant trends for 2030 – 2050 for the implementation of the White Paper goals concerning High Speed Rail. As expressed in the introduction, "relevancy in this context means that these trends either directly work for or against achieving these goals or that they must be considered as they make up the framework in which policies are implemented".

Passenger volume

Recent surveys and research suggest (see Table 7) a rapid development of HSR in the European Union over the last decades (Banister and Givoni, 2011a). From 15.9 % of rail passenger-km in 2005, HSR now represents 26.3 % in 2010. For France this means an increase of 62 % of all travel (in passenger-km) and for Spain 52 %. In Sweden, Germany and Italy, HSR recorded and increase of around 25 % of rail travels. There is a different approach to HSR in the EU. For example in Germany population distribution is taken into account in a different way than in France, by using intermediary stops for integrating middle size cities in the national railway network. HSR is part of a link between middle sized cities in Germany. It is a way to achieve a balanced spread of economic growth within the country through a general accessibility of HSR. This means there is a high level of heterogeneity of understanding – and then implementing HSR – in the European Union.

HSR has to be understood as a part from a door-to-door journey and must be studied from the inter-modality point of view as part of a full transport system with interconnections. The demand for HSR is linked with interconnections between HSR and urban or suburban transport systems as well as airports as we will show later in this contribution. These studies also show that, despite this "rail renaissance" (Banister and Givoni, 2011b, p. 2), air and car transport have experienced the strongest increases in demand among all modes of transport. In the whole EU passenger rail accounts for around 6.3 % of all passenger-km (down from 6.6 % in 1995) while in France it accounts for around 9.2 % of all passenger-km in 2011. The North of Europe has a higher share of rail transport than the South: 10 % in the Netherlands and Denmark, 9 % in Sweden with a maximum with 11 % in Austria (but 17.5 % in Switzerland) and around 6 % in Italy and Spain. As stated in this contribution, a new age of thinking railway, especially HSR, is widely emerging in Europe today.

Table 7: State of the art of HSR in Europe 27 (Banister and Givoni, 2011, p.3)

Thousand M pkm	1995	2000	2005	2010
France	21.43	34.75	43.13	51.89
Germany	8.70	13.93	20.85	23.90
Spain	1.29	1.94	2.32	11.72
Italy	1.10	5.09	8.55	11.61
Sweden	0.42	2.05	2.33	3.10
Belgium	-	0.87	0.98	1.06
UK	-	-	0.45	1.01
Others	-	0.17	1.50	1.75
Total	32.94	58.80	80.11	106.04
% of all rail	9.4	15.9	21.2	26.3

Range of services/Quality of services

Travel time needs to be minimized and speed must increase, "Faster is better". In practice, 350 km/h is considered as the standard maximum commercial speed for HSR. But in fact, most of HSR services operate at much lower average speeds. According to the new HSR paradigm, promoted by Banister and Givoni (2011a, 2011b), from the passengers experience – and not from the engineers experience – the most important criteria of performance is the door-to-door travel time and the quality of services. First of all, the door-to-door travel time means that focus should be put on the time of access to/from the railway station, on the number of stations and on their location (rather in the city centre than outside) and on the accessibility through the rest of the public transport network (urban network, conventional rail network and the main airports).

Furthermore, the quality of services is essential for the new HSR paradigm. More important than average speed is the journey reliability, comfort, security, safety, service frequency, integration with the rest of the transport network and all elements which make up the journey experience. There should be a much greater flexibility in the types of services being offered on HSR as the market is not homogeneous, but heterogeneous as expressed before, and quality of service is central to long term viability. This includes the possibility of different types of service for different users, but in all cases the HSR part of a journey should be seen as part of the total door to door experience of travel. The provision of a wide range of services and facilities (e.g. internet access, catering and restaurant, mobile coffee desk, newspaper (to download on tablets for instance), DVD players and movies rental) for use 'en route' is part of the modern view of travelling where quality time can be spent in travel.

Integration of airports

One of the main factors of the competitiveness of the European Union for the next decades is the ability to offer an efficient transport networks, both at local (urban public transport), regional (regional railway transport), national but also at European and International level. This pyramidal perspective implies hierarchical structure of networks (Guihery, 2004) and efficient interconnections of all networks based on the concept of seamless transport (Perkins, 2012b). The connection of airports with local, regional and HSR networks is a crucial point for the implementation of a climate-friendly urban and regional system. This can be achieved through an efficient and open rail system, with on track competition but also competition for the market (tendering in regional market).

In this framework, airports play a crucial role at the top of the pyramid to connect Europe with the rest of the world. Accessibility of Europe is then based on efficient interconnections between airports and the national and European transport networks, high speed networks in our perspective and, for example, the Trans-European-Network (Guihery, 2013). Once again, interconnections between airports and the railway network must be optimal and understood within the idea of seamless transport (Preston, 2012).

The following graph suggests a layer cake model of an integrated transport network in an efficient way. Keywords are hierarchical structure, seamless interconnection of airports with TEN, and national but also regional transport networks. Figure 50 shows accessibility of main European airports and their current and planned connections with other modes of transports. Figure 49 is showing the seamless interconnection

between the different levels of rail networks: HSR, regional and local. Airport Hubs are connected among themselves in a European wide network of metropolitan areas.

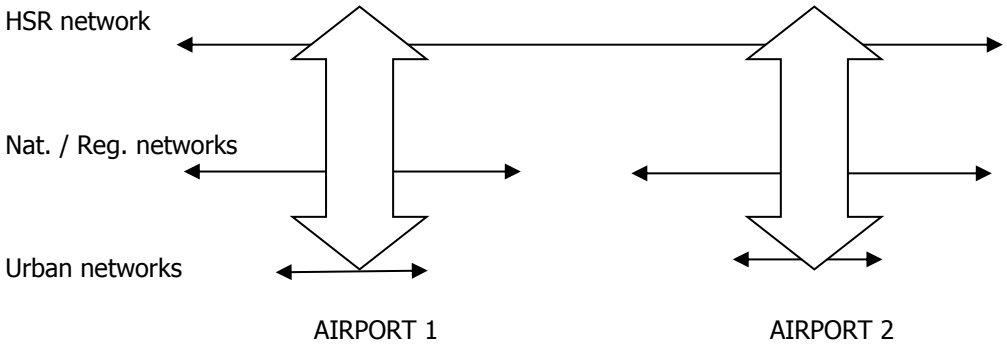


Figure 49: Hierarchical structure and seamless transport in airport networks integration for 2020 - 2050 (Guihéry, 2004)

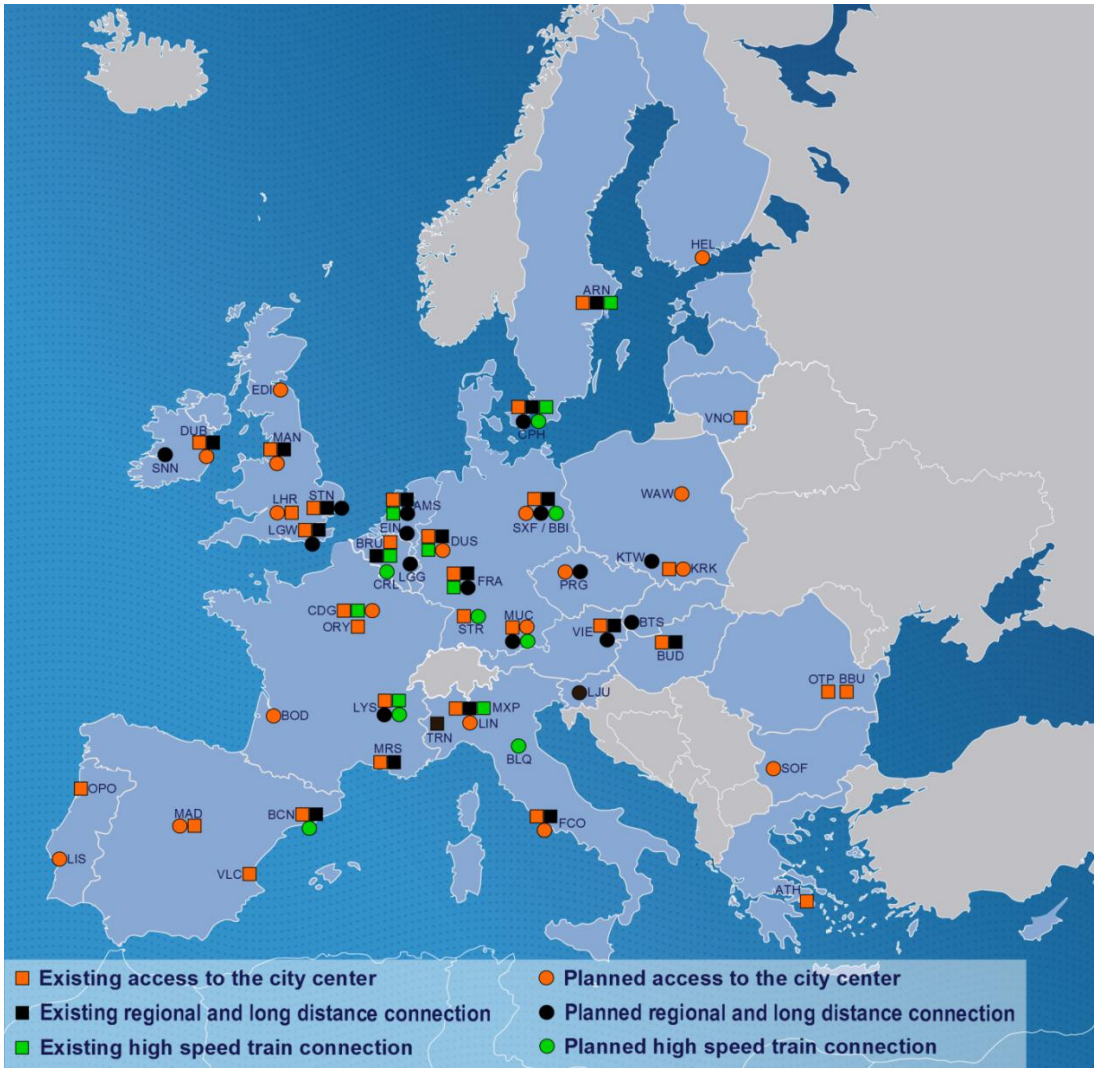


Figure 50: Accessibility of main European Airports (ACI Europe, https://www.aci-europe.org/policy/position-papers.html?view=group&group=1&id=20)

High speed freight

The existing High Speed Train infrastructure is costly and often unused during nights except for maintenance. At peak periods there are few opportunities to integrate high speed freight on the congested tracks. As shown in many researches and contributions (Laroche, 2013a), one of the key issues of the development of High speed freight is then the optimal allocation of tracks, in order to open new slots for new HSR freight trains. The new ERTMS standard, under the supervision of the European Rail Agency (ERA), aims at improving the allocation of tracks on the network in a European perspective of interoperability.

Some projects in the Member States of the European Union focused on implementing the transport of parcels and air freight on the existing high speed rail network in Europe. In France, the Euro Carex project is heavily discussed in this perspective (http://www.eurocarex.com/). The strong growth of express freight, parcels and cargo activities, linked with the development on e-business, gives incentives to think about this possibility for the 2020-2050 perspective.

Some airports, like Frankfurt in Germany, have experienced banning of night take off, with flights allowed to start again only at 5 am in the morning. Here a modal shift from air transport, but also from trucking, towards night high speed train services can be a solution.

In an environmental perspective, modal shift from night air freight transport or from trucks towards rail transport limits negative externalities of road and air freight transport. Some evaluations assessed that Euro Carex Trains emit 35 times less CO_2than trucks and aircrafts (Euro Carex Group, 2010).

In 2009, the creation of the Euro Carex Agency was a next step for starting a process of discussion with rail companies, developing some additional studies and lobbying activities. Paris Charles de Gaulle Airport, Amsterdam Schiphol Airport, Frankfurt Airport, London, Liege and Lyon airports are also involved in this project

One of the propositions of the Euro Carex Agency is to set up 'Railports', rail terminals designed to handle airfreight containers. Studies and discussions are launched on train paths with infrastructure managers and on rolling stock with material industrialists. The debate on building a tunnel through the Alps between Lyon and Torino is a next step in this perspective as this TEN-T Tunnel project will provide tracks for high speed freight trains, if build.

European Network Development

Successful transport, both for passengers and freight transport, is based on the efficient provision, use and management (maintenance, renovation) of transport networks. Optimal allocation of resources – financial framework but also human resources and competencies - for the building, the management and the renovation/maintenance of infrastructure is one of the key elements of successful transport planning. From this perspective, the European Union has implemented a large program to build a Trans-European Network for Transport (TEN-T), mainly addressing rail transport.

In the perspective 2020-2030, the building of a network is not enough. As Curien (2000) noticed, networks are based on three layers: infrastructure, infostructure (i.e. the signalling system and the management of track allocations and slots), and services on the dedicated network. As financial resources

are now scarce on the side of the infrastructure, we consider that improvements of the infostructure of the networks but also – and mainly – on the service side of the network will allow the European Union to take up the challenge of the mobility for 2020 – 2050.

European network development in the future should thus invest in the infostructure: the development of a common signalling and information system within all high speed networks in the European Union – the ERTMS (European Rail Traffic Management System) standard is now implemented by the European Commission on the European Railway tracks (Laroche and Guihery, 2013). It will make track allocation more efficient and allow better competition among operators on the network. Because of its technical specificity, it is outside of the debate and focus of the public opinion, it can then be considered as a 'nudge' measure – few costs, high relevancy and potential for implementing the White Paper goals - to increase market share of rail transport, both for passenger and freight transport (Thaler, Richard., and Sunstein, 2008). On the side of services, clear and efficient regulation, open access to new entrants, control of collusion and monopolies and incentives for more competition on the network will provide better services, lower prices and innovation: modal split of railway transport should increase and less environmental damages – negative externalities – should occur following the European Union transport policy objectives.

Public acceptance

Opponents to high-speed rail are counted traditionally among the people living close to the track but also, for different reasons, among environmentalists, geographers and economists. The opposition side in the development of high speed rail has recently expanded (FNAUT, 2011a). The debate is now looking to strengthen the finer definition of the links suitable for the HSR and also aims to clarify the criteria for acceptability of a new HSR line. The arguments of the traditional opponents are well-known. Beyond arguments expected of residents ("not in my back yard"), environmentalists point out the negative effects of noise and damage on the environment. For geographers, the effects of HSR on the land are usually strengthening metropolization which implies a drying out of intermediate territory between cities. For economists, the protest is traditionally expressed in terms of economic or social considerations like profitability and financing (Bonnafous and Crozet, 1997; Vickerman, 1991).

Recently, and especially in France following the "Grenelle de l'environnement" (environmental law), the debate over whether to extend the HSR network was intensified by the emergence of new opponents and new arguments. Critics of the existing developments emerge from groups previously in favour of the development of the high speed rail network.

Economists are now seeking, in the 2030 perspective, to strengthen the finer definition of the relevant links for HSR (Crozet, 2012, Nash, 2009; Rus and Nombela, 2007). Very generally, the estimates show a lower than expected economic and socio-economic profitability (Crozet, 2012). Economists also aim to better understand who are the winners and losers of the speed increase in terms of social categories of territories (Martínez Sánchez, Givoni, 2009). Planners and geographers focus on the reasons leading to different 'effects' of HSR in the territories (Deleplace, 2011; FNAUT, 2011b). For some geographers, the priority that is given to the development of high speed networks has an opposite impact on the classic railway network (Auphan, 2012).

Technological trends/Disruptive technologies

Since its start in France in 1981, HSR has gradually spread throughout Europe. This development was first done through 2,500 km of new lines build in less than 20 years. But high-speed trains were also implemented on more than 14,000 km of classical lines where 'tilting' technology offers interesting perspectives. Significantly increasing commercial speeds while demanding little investment in new infrastructure, this new technology is a core element of the new reality of high-speed rail (Walrave, 1997).

For various reasons (see above), the construction of new high-speed lines is currently challenged everywhere in Europe. The development of high-speed rail should then consider other strategies. One such strategy exists thanks to the renewal of rolling stock in the form of tilting HST. Associated with new methods of signalling and control systems (European Train Control System and the European Rail Traffic Management System: ERTMS being implementing or ERTMS 3 post 2030-2050) and new rolling stock material (AGV technology to combine an articulated architecture with distributed power), the tilting technology optimizes the entire conventional network and high-speed network. In limiting new investments in infrastructure, which are costly in this time period of scarce public money, new opportunities are likely to occur for a simultaneous development of several projects in a large planning perspective (Essig, 1997). Studies are being launched to identify bottlenecks on the infrastructures and deal with the effect of saturation of the infrastructure as well as dealing with the prediction of traffic increases (Laroche, 2013b).

Financing

The cost of a new railway line, and especially a new high speed line, is very high, at least 10-40 million Euros per km and sometimes 5 or 10 times more (urban, suburban, tunnels, bridges…). Therefore, also in a long terms perspective (2030-2050), public funds are often required. But due to the scarcity of public money, more and more decision makers are trying to set up Public Private Partnerships (PPP) in order to attract private money. But it is not so easy because even when the line is open, traffic may not be as expected and rail access charges remain at a high level. Therefore HSR is relevant only for relations with high potential traffic. In a recent working paper, Dehornoy (2012) made a detailed survey of Rail PPPs at a global level (see Figure 51). He observed that in a lot of countries, PPPs have been facing huge difficulties. The promised benefits of private involvement in the process are not obvious. Very often public authorities have been obliged to rescue the project at a high cost for public finances.

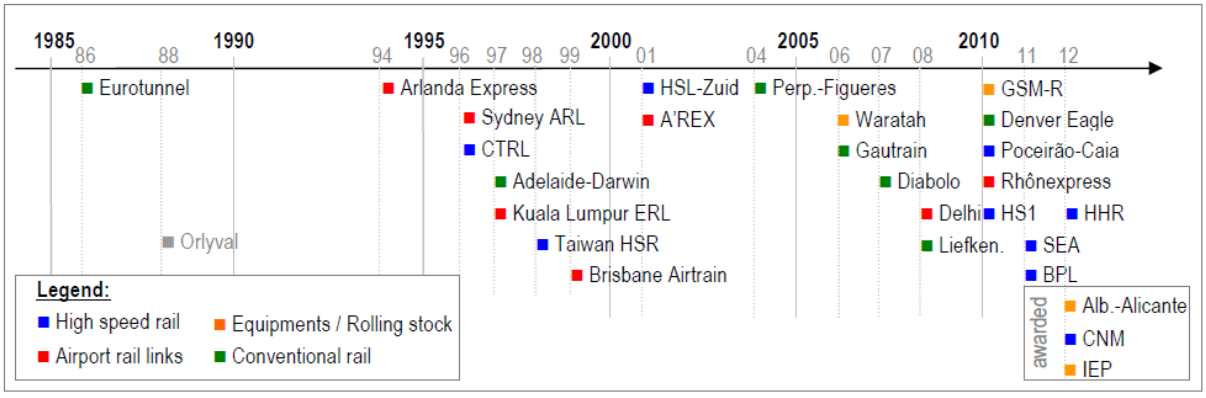


Figure 51: Rail PPPs by signing year and types (Dehornoy, 2012)

The main reason of PPPs failures (total or partial) is related to the overestimation of traffic and demand (Flyvbjerg et al., 2006). The result for PPPs is not the end of this practice but something like a learning process leading public authorities to substitute "traffic based concessions" by "availability based concessions".

- Within a traffic-based concession, the concessionaire receives commercial revenue (rail access charges or fares revenue) and does not receive any payments from the public authority during operating years.

- Within an availability-based concession, the public authority retains the commercial risk: it receives commercial revenue (rail access charges or lease fees for asset-only PPPs, or fares revenue for integrated PPPs) but makes payments to the concessionaire based on performance indicators.

The attractiveness of traffic-based concessions is related to the transfer of all commercial risk to the private operator (i.e. *Eurotunnel*, *Sydney ARL*, *Brisbane ARL*, *Seoul ARL*). But experience suggests that transferring the commercial risk to the private stakeholder increases the likelihood for a PPP to fail (see below). Most traffic-based rail concessions have been financial failures.

Dehornoy (2012) counted 14 traffic-based concessions where contracts were awarded and signed. He distinguished three categories:

- Those in which public authorities had to intervene, in order to rescue the project,

- Those where financiers faced important losses but public authorities did not intervene,

- Those which haven't failed.

He also distinguished the "mature concessions" (with more than 2 years of operation) from the projects still under construction or those recently opened.

Among the mature concessions, five PPPs had to have public authorities step in and effectively transform the PPPs into public projects or companies:

- *Sydney ARL*: on the first year of operation (2000), the concessionaire defaulted on its loans and the New South Wales Government had to bail out the project;

- *CTRL*: two years after construction started (1998), banks refused to lend more money to the concessionaire and the Government had to rescue the project by virtually nationalizing the PPP and transforming it into design-build contract;

- *Seoul ARL*: after two years of operation (2009), as actual ridership was only 8% of forecast, the Government asked Korail, the national rail operator, to buy 88.8% of the project shares without any further change in the concession contract, thus nationalizing the PPP;

- *Taiwan HSR*: after two years of operation (2009), the Government took over the management of the concessionaire. This was the final step of the share increase of direct and indirect public financing of the project (0% in 1998, 37% in 2005, 84% in 2009) in order to offset the very high interest loans on private debt.

In three other mature PPPs, investors and lenders faced big financial losses but the contract hold and the PPP did not have to be rescued by public authorities:

As an example, *Eurotunnel*: due primarily to traffic overestimates and construction cost increases, liabilities had to be restructured in 1997 and 2007, with investors and lenders losing more than two thirds of their investment. The concession benefited from public support via the extension of the concession duration from 55 to 99 years and through the "minimum usage charge", a minimal revenue guarantee whose cost was ultimately covered by the French national railways (SNCF) and the British Government.

The list of failures is impressive and can be explained by recalling the 4 main advantages of PPPs in a long term perspective: reducing construction costs, reducing project lead time, increasing the first year rate of return and improving the gradient of the annual benefit over time. We can observe that the advantages correspond largely to a reduction in building and operating cost. It is therefore not a surprise if the recent PPPs are more 'availability based' than 'traffic based'. But transferring the commercial risk to the public entity is not enough to ensure the success of PPPs. Some other barriers remain.

Other issues

Today, it is an accepted fact that there is a limited area of relevancy of HSR. As a consequence HSR is not relevant everywhere. In other words, geography matters! The HSR relevancy zone covers journey with travel times from 1h30 to 3h. Between those two terms and in a long term strategy 2030 - 2050, HSR can be the dominant mode of transport as it is already the case between Paris and Brussels, Paris and London, Paris and Lyon, but also between Paris and Nantes, Rennes, Strasburg, Marseilles. The success story of the French model of HSR is mainly due to geography but also to history, as cities were established with distance to the capital that allow a HST round trip in one day. But it's important not to forget that, with a different geography and history pattern, Germany has developed another HST model. Cities being smaller and closer to each other, stops are more frequent and average speed much slower (180 to 200 km/h instead of 300-320), thus, traffic mainly concerns daily home-work trips.

The issue of the relevancy of HSR is based on this question of type of traveling. Lots of postponed or abandoned projects planned to implement high speed in highly urbanized areas, e.g. lines in PACA (between Marseilles and Nice), Paris-Normandy, Paris-Orleans etc. For this kind of trips, users' willingness to pay was reduced while building costs were enormous. The financial barriers become more and more important.

Based on the LOTI rule (a precious French nugget of public power economic culture) a recent study assesses the French HSL program. Its main teaching is that public interest, despite public subsidies or rather thanks to it, is a clear benefit of the program. It is mainly explained by the users' gain in time. In simple words, this means, for example, that public subsidies are totally justified by the Alsatians' and Lorrains' time savings when travelling to Paris. Beyond what users paid to have high speed, there's a gain, both individual and collective, that justifies past investments. But the same scheme doesn't apply for future investments.

The future French HSR projects (Marseilles-Nice, Paris-Normandy, Lyons-Turin, Bordeaux-Hendaye, Paris-Orleans-Clermont-Ferrand) require a gigantic financial charge for public budgets, even in absence of

the public financial crisis. The difficulty is due to the scissor effect, as on one side the high cost of those new projects and on the other side its frequency issue. Here are two examples.

The construction cost of the SEA line (Tours-Bordeaux) will be of 7 billion Euros. But its expected traffic is high and users have a significant will to pay, according to the effective distance (>500km). Nearly 60 % of the infrastructure cost, namely 4 billion Euros, will be covered by users' ticket prices. This line then required 'only' 3 billion Euros of public subsidies, brought equally from both the State and territorial communities. If this amount is related to traffic, this means that subsidies are of 4 to 5 Euros per traveller during 50 years, which could be significant, but which is still less than 10 % of the average price of a ticket.

Supposing now that a 16.5 billion Euro project who's financing by users can't exceed 10 % as demand and will to pay are too low, due to the shortness of travels or daily mobility. It left 90 % of the costs, 15 billion Euros, to be financed on pubic credits, through loans. It means, with a 5 % interest rate during 50 years, a 690 million Euros annuity for society (State, territorial communities…). If the traffic is, as predicted, of 20 million passengers per year, it stands for a subsidy of 34.5 Euros per passenger per day, for 50 years! This amount could exceed the price of a ticket, paid by the users if they travel only short or medium distance (100 to 250 km).

The British project High Speed 2 is facing the same financial barrier. How to justify a cost of 60 billion Euros, even for 80 million of passengers per year?

Intercultural Differences

At a first glance, speed is the main characteristic of HSR, common to all HSR projects. But it is not so obvious. We have already indicated that, according to geography, history and economy there are different HSR models. The German model is not the same than the French model. The Spanish model is also a special one. So, national and cultural differences play an important role; especially if we consider environmental issues (see the big debate in Sweden about the HSR project Stockholm- Gothenburg). When environmental issues are considered, one must not forget nuisances that a HSR building implies. A recent Carbon-balance lead by RFF (infrastructure manager) on the Eastern section of the Rhine-Rhone HSR, showed that 12 years traffic – then decrease of CO_2 emissions enabled by the HSR - are necessary to compensate emissions due to the construction. Simply for information, 100 m^3 must be moved to build one meter of a line! To all this, it is also necessary to add emissions due to production and transportation of concrete, steel etc. Eventually, unitary emissions of HSR have been revised upwards, partly to take into account the energy-mix that provides electricity to trains.

There is a threshold, from which financial and environmental costs of a HSR are hardly compensated by time savings of a limited number of users. Along with the infrastructure cost issue, questions can be raised in a 2030 to 2050 perspective about optimum services and the demand they generate. For the traffic to be reached, should not only the infrastructure but also the exploitation, be subsidized. Moreover, predicted train stations, when implemented in suburban areas, raise the issue of accessibility. If they happen to be located far from housing and employment areas, such stations could actually be a car use stimulator! That way, through the perspective of regional HSR increasing public subsidies could have adverse effects on

land use and urban sprawl. Also significant: on dense traffic spots, some conflicts for rail tracks use can arise between regional and other traffics.

Thus, relevancy of HSR is reduced for daily mobility on short and medium distances. But if this HSR relevancy is obvious on long distance travels, on the French scale, it's not that easy from the European point of view, as HSR can't always replace air traffic on intra-European trips. As a first analysis, according to some lines already planned, it could be possible to travel from London to Madrid, Brussels to Barcelona, even from Rome to Paris or Amsterdam to Geneva, in a few years' time. But currently, such travels happen to be out of the relevancy zone for HST as travel time, even supported by high-speed, will reach 5 or 6 hours, or even more. In that case, air transport remains relevant, especially because of low-cost airlines which propose more and more affordable prices on the same routes, low enough that the train cannot even compete with them. HSR is less and less a substitute for air and more and more complementary to air travel. More precisely, origin-destination pairs between which HSR could substitute air travel have been already covered in France, if we consider HSL existing or under construction. The increase of constraints that burden airways in the future will possibly lead to shifts of passengers between the two modes of transport, but only to a reduced extent.

The experience of France in High Speed Rail is interesting at the European level because high speed rail has been a priority at national level for the last 30 years. However this trend is now challenged as profitability of HSR in France is declining. The main lines are built and in operation and new links are questionable both in financial terms and regarding transport efficiency. It is important to notice that at European level there are other models of HSR which differ from the one developed by France and these models have to be investigated, for example on existing lines. High speed rail is not just a matter of technology; it also depends on the geography of the country, on the country's institutions and on its ability to master the art of project assessments. Connection to airports and intermodal hubs as well as interconnections with local and regional railway networks are then crucial.

5 Framework for a European multimodal information, management and payment system

5.1 Introduction

Goal 8 of TRANSPORT White Paper: "By 2020, establish the framework for a European multimodal transport information, management and payment system."

Information and data are the backbone to any modern transport system and essential preconditions for enhanced efficiency and improved use of available resources. Based on this understanding, the exchange of information between transport providers, technical systems, transport modes, etc. are a key element for achieving integrated, competitive and sustainable transport systems (European Transport White Paper 2011, p. 5f.).

Establishing a common European multimodal transport information, management and payment system has the potential to ensure that any kind of transport is carried out in the most efficient manner, while taking into account various mode-specific requirements. Such systems should allow users to optimise their choice of transport mode(s) depending on their different selection criteria (e.g. cost minimization, speed of delivery, emissions, time schedule, and ease of use). This way it is possible to make efficient use of existing infrastructure resources and at the same time to ensure cost efficiency and minimal environmental impact while meeting user needs.

Already, the 2006 mid-term review of the 2001 Transport White Paper acknowledged the important role of ITS in making transport more efficient, safer and greener since action at the EU-level in this field is key to ensuring ITS interoperability across borders and alternative systems. This is also confirmed by the Impact Assessment of the White Paper, where ITS solutions are considered to be beneficial in all modes of transport. However, in order to achieve such integrated systems, it is necessary to bring together different activities which are currently still carried out at different levels (e.g. European and national scales). Most importantly, interfaces must be established which allow information exchange between different transport providers as well as between them and their customers. Only once this has been achieved, online information and electronic booking and payment systems can respond to all means of transport and eventually facilitate multimodal transport. Consequently the framework for a European multimodal transport information, management and payment system - aspired in the current White Paper to be established by 2020 - should define how information exchange happens between transport providers, and how this information can be used to manage and optimise multimodal transport.

Although not expressly stated in the White Paper, the main focus is on passenger transport. Freight transport plays a role as well, as it normally uses the same infrastructure. A framework should provide the basis within which developments can take place to ultimately achieve the overall goal. This framework has many different facets which must be considered. This starts with normative issues, technical developments

and standards, security for long term investments, data security issues, ownership rights, and so forth. In this context it was envisioned that in the long run, a European-wide system could be establish for this purpose. Since the development of the White Paper a number of changes have taken place making it necessary to further define this goal in the current context. One of these developments is the rapid implementation of local and regional solutions which work well in their environment but usually are not compatible to each other. This has been further supported by the rapid spread of smartphones and the relative ease of creating applications for them. Open data initiatives have gained more momentum then could be envisaged in the past. At the same time, data privacy concerns have come much more into focus in the recent past. On the other hand, more economic constraints exist.

Multimodal information, management and payment systems represent an important step towards a highly accessible mobility system which allows each participant to make an informed choice of the most suitable transport options depending on the relevant demands. At the same time it helps to make optimal use of the available transport capacity and should allow an optimized management based on different criteria (e.g. time, emissions, speed, and so forth). When examining goal 8 (i.e. establish a framework for a European multimodal information, management and payment system) it is clear that we actually have to look at three separate systems: one for information, one for management and one for payment/ticketing. What these systems have in common is that they often use the same kind of data and are sometimes dependent on one another, but it does not necessarily have to be one single system but can also be a range of different systems between which data and information can be exchanged.

The key challenges towards achieving an integrated European system are not primarily of technical nature but rather relate to "soft" areas like standardization, funding, legislation and competition. This is confirmed by the many projects which have been carried out in the past at the European and national level which provide technical solutions to many questions, yet have so far not been implemented on a larger scale. Before any changes or new systems can be introduced it is necessary to establish a common basis as to how these systems should function, what their specifications should be and how they are to be developed in the future. This is necessary in order to give infrastructure providers guarantees for their investments and ensure interoperability.

As a basis for the introduction of a European-wide system various standardization and interoperability requirements have to be identified and related barriers have to be eliminated. Establishing a new information exchanging scheme will lead to (new) data security, data privacy and liability issues. In terms of payment, common EU ticketing standards are needed which consider EU competition rules. Therefore, knowledge on new standards which address these issues will have to be developed and transferred into practical guidelines.

An important prerequisite to achieve an integrated, competitive and sustainable transport system is the commitment of all relevant actors and stakeholders involved. All parties have to be willing to adapt or upgrade their existing systems and services. Since these changes are usually associated with costs, funding must be available to support this process.

A legislative framework for passenger transport has to be established to cover multimodal journeys within a single billing system and to achieve a seamless door-to-door mobility. New technologies (smart

cards, smart phones, etc.) provide the opportunity for new kinds of electronic ticketing, therefore interoperable systems are necessary to harness their full potential. In the case of freight transport, it is necessary to adapt the legal environment regarding inter-modal freight documentation, insurance and liability. Legislative measures might further be needed to guarantee access of transport providers to real time traffic information.

Funding must be available to support necessary changes and investments in new services (e.g. traffic monitoring, communication services, payment system, etc.). Funding of research on a national and European level will continue to be a cornerstone for future developments. In addition, the European Commission encourages special Public Private Partnerships - since the current global economic crisis - which are financed with funds provided by the EC, the Member States and the European Investment Bank. It is important that the EU funding supports projects which could help to minimise environmental impacts, enhance user safety and security and therefore could lead to a higher level of European added-value.

The stakeholders at the Gdansk forum agreed that the White Paper goal centres on a European-wide integration of multimodal traveller information systems (TIS). They noticed that the problem of data access for these systems is not highlighted enough in the debate about a European Framework. There is a significant demand for an open data access strategy. Today even within single member states most metropolitan regions have proprietary systems. Harmonization and cross-regional coordination among these systems is crucial.

Public transport operators often resist a harmonized approach for reasons of data ownership. In countries where systems and services are introduced at national level, cooperation with the regional and "Länder level" is crucial. Additional emphasis is put on data and cyber security at national levels. Stakeholders signalled significant demand for a European "code of conduct" regarding the organization of open data access. At the European policy level it is not intended to achieve a Single European multimodal information system, but to remove obstacles to coordinate / connect existing regional and local systems and platforms. Access to data has to be open and provided across all modes allowing the market to take up initiatives, e.g. with existing mobile apps. European level problem solving regarding current licensing regimes is seen as important. A problem is still to find common understanding regarding data access strategies at different policy levels.

5.2 Policies and funding mechanisms

At Gdansk past, recent and future policy actions up to 2020 (= timeframe for achieving the goal) were discussed. A most recent European directive foresees harmonized roaming rules for mobile network operators in the EU decreasing charges for roaming not only for voice but for data transfer. This policy initiative may imply that costs for data transfer will increase in coming years. Other data transfer technologies (Wi-Fi, NFC, etc.) along main infrastructures will advance and alternative services may take-up market shares to provide customers. The EC is by now not planning to launch a Single European Multimodal Traveller Information, Management and Ticketing System. Open data access strategies are supposed to activate markets to provide such services. European policy is the main driver for a platform for travel

planning and integrated ticketing for long distance travelling. Main actors are aeronautics and rail industries. This system is seen as significant to increase the convenience of cross-border long distance journeys from door to door and to facilitate flexible and effective action in cases of disruption. It was understood that European policy recognizes that the proliferation of multimodal traveller information and traffic management systems is driven by regional/local policy levels and - in some smaller European countries - nationally. Traffic information (car) and traveller information (PP) systems are converging in urban/metropolitan regions with all sorts of personal mobile devices as user interface. European policy level authority can direct member states' policies, but only indirectly influence regional level and metropolitan area policies. A range of amendments to the European ITS Directive are under negotiation. The amendments, e.g. for real time data exchange and multimodal traveller information systems, are expected to be more comprehensively phrased, addressing harmonization at a general level leaving technical specification to standard deliberation (CEN/CENELEC). More distinct specifications and best practices are explored in several cross-regional projects. Most of them run until 2016 and will provide best practices and technical specification proposals. Best practice may include examples for simplifying regional tariff structures, although this is not alone a policy issue, but due to political negotiations. Table 8 gives an overview of policies and funding mechanisms identified for thematic group 4. The particular policies were analysed in term of relevant measures and expected impacts and are organized according to the time scope and withal according to significance towards White Paper goal. Figure 52 shows the timeline when the different policies were introduced. Following policy documents summary was identified and selected on the base of internet literature study and in cooperation with the thematic group expert leader who verified the relevance and completeness of these existing policies for chosen White Paper goal.

Table 8: Policies and funding mechanisms identified for thematic group 4

Policy actions, initiatives and programs	**Scope**	**Expected impact and intervention capacity (*multilevel perspective*)**	**Expected coordination with other policy initiatives**
1) Strategic Transport Technology Plan	To meet Union´s target regarding the reduction of energy consumption, traffic noise, air pollutants and GHC emissions Seamless door-to-door mobility chains Increasing of support for SMEs through facilitating their access to EU funds Protection of vulnerable road users and access-ability for all Development of innovative infrastructures Promoting independence from oil	Sustainable mobility Smart management and information system Improving intermodal transport systems To modernize the transport sector - to contribute to increasing competitiveness and lowering emissions Health and quality of life	EC will conduct projects under Horizon 2020 STTP presents technology areas – comprehensive set of technologies, methods and practices with a shared focus on application (research, demonstration to market take-up, standardization) White Paper´s vision for integrated, efficient, safe, secure and environmentally friendly European transport system by 2050 Commission aspires to

	Promoting of multimodal mobility Reducing of administrative barriers To form the basis for preparation of roadmaps for identified technologies		facilitate coordination of public and private research and innovation efforts across E.
2) ITS Directive and its Action Plan	Directive 2010/40/EU – instrument for coordinated implementation of ITS in E. Under this Directive the EU has to adopt functional, technical, organizational and services provisions to address the compatibility, interoperability and continuity of ITS solutions across the EU. Priorities: Traffic and travel information e-Call emergency system Intelligent truck parking Road Safety Congestion reduction Development of specifications and standards Action plan suggested a number of targeted measures and included the proposal for this Directive. The goal is to speed up market penetration of rather mature ITS applications and services in E.	Cleaner, safer and more efficient transport system Use of info and communication technologies in transport -dynamic traffic management -real-time traffic information -satellite navigation, tracking, tracing -multimodal journey planners -electronic toll collection -in-vehicle safety systems ITS Directive: -coordinates ITS deployment in road transport -supports road safety, congestion and climate change objectives	-
3) Single European Sky ATM Research Program (SESAR)	Collaborative project solves European airspace and Air Traffic Management (ATM) in three phases: - to deliver ATM master plan defining content, development and deployment plans of next generation of ATM systems - Development phase (2008-2013) -Deployment phase (2014-2020)	Technological Dimension Developed and modernized air traffic management system for Europe Safety and fluidity of air transport	-

	Targets: Network operation plan Full integration of airport operations Trajectory management New aircraft separation modes System-wide information management Humans as central decision-makers		
4)European Rail Traffic Management Systems (ERTMS)	To enhance cross-border interoperability and procurement of signalling equipment by creating a single Europe-wide standard for train control and command systems Two main components: European Train Control System (ETCS) GSM-R mobile communications standards for railway operations	ERTM will replace traditional railway signals with a computer display inside every train cab, reducing the costs of maintaining the railway, improving performance and enhancing safety Interoperability Clean ERTMS operation Mixed operation	-
5) Maritime Surveillance systems (SafeSeaNet)	European platform for maritime data collection, dissemination and exchange Port state control Requirements for seafarers Communication between - authorities at local/regional level and central authorities	Prevention of accidents at sea and marine pollution Passenger vessels more safety To produce statistics for EMSA Increase overall competitiveness of e-ports	Directive 2002/59/EC
6) River Information Services (RIS)	To support traffic and transport management in inland navigation – is seen as reliable, economical, environmentally-friendly mode Information system for inland shipping Excellent environmental performance	Increased competitiveness Optimized use of infrastructure Improved safety Reduced carbon	Regulated under Directive 2005/44/EC

	Integrated, innovative, flexible, efficient measures To adapt to new market needs and to intermodal integration	emissions Increased energy efficiency Sustainable mobility Integrated intermodal logistics chains	
7) Marco Polo Program	Promotive program Financial tool for: Congestion decreasing Inter-modality increasing Supports: -combined transport -modal shift action -common learning action	Fewer trucks Less congestion Less pollution More reliable and efficient transport of goods	-
8) European Electronic Toll Service (EETS)	EETS domain statement: To provide sufficient details for EETS provider To provide sufficient explanation to satisfy the relevant national conciliation body that the contractual conditions and commercial arrangements being offered to EETS providers are fair and reasonable	Interoperability of electronic road toll systems	Directive 2004/52/EC
9) Freight Transport Logistics Action Plan	To ensure sustainable and competitive mobility in Europe and contributing to cleaner environment, security of energy supply, transport safety and security Focused on planning, organization, management, control and execution of freight transport operations in the supply chain	Improved efficiency and sustainability of freight transport in Europe e-Freight and Intelligent Transport Systems	Necessary to adopt appropriate legislative measures, mandating technical standardization, providing political and financial support and encouraging the promotion of best practices
10) UNIDO United Nations Industrial Development Organization	Agency of UN – to promote and accelerate sustainable industrial development in developing countries and economies in transition and work towards improving living conditions in poorest countries Priorities:	Main objective: to continue to further develop the partnership between EU and UNIDO Facilitate the strategic position of UNIDO Identify emerging	-

	-Poverty reduction through productive activities -Trade capacity-building -Environment and Energy	opportunities Advocate for UNIDO policies and expertise Coordinate UNIDO activities Represent at political meetings Deliver statements Provide advice to UNIDO headquarters	
11) OECD: Green growth and eco-innovation	To promote economic growth while reducing pollution and greenhouse gas emissions, minimizing waste and inefficient use of natural resources, maintaining biodiversity Sustainable manufacturing	Improving health prospects for populations and strengthening energy security, less dependence on imported fossil fuels Making investment in environment a driver for economic growth Environmental improvement	-
12)Small Business Act for Europe	To improve overall approach to entrepreneurship To promote SME´s growth To ensure competitive and dynamic economy Acceleration of technological changes To release full potential of SMEs To strengthen SMEs sustainable growth and competitiveness Aim: to improve the overall policy approach to entrepreneurship Set of new policy measures which implement ten principles according to the needs of SMEs both at Community and Member State level	EU´s strategy for better regulation Modernization and simplification of existing EU legislation To reduce administrative burdens	-
13 Sustainable Consumption and Production and	Action plan includes: EU Eco-Design Directive for	Developed comprehensive national programs on sustainable	OECD – measures for sustainable manufacturing

Sustainable Industrial Policy	Energy-Using Products Energy Labelling Directive EU Eco-label Communication on Green Public Procurement EU Eco-Management and Audit Scheme Action plan addresses EU goals for environmental sustainability, economic growth, public welfare. -improving environmental performance of products, more sustainable products and production technologies -definition for sustainable consumption - use of "eco-friendly" products -strategy on use of natural resources -strategy on waste prevention and recycling	consumption and production, social and economic development	production
14) ETAP Forum: Overcoming barriers to SMEs in eco-innovation	Declaration formulates recommendations addressed to Commission and Member States how to make eco-innovation and true driver for growth for European SMEs. SMEs play crucial role as eco-innovators and recipients of green technologies. Econ-innovation is key to support society over next 50 years.	Policies to accelerate demand Getting eco-innovation to market Greater green investment Green skills Green partnership International trade co-operation Political support	Bilbao Declaration on eco-innovation in SMEs

#	Policy/year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	...	...	2030	...	...	2050
1	Strategic Transport Technology Plan																					
2	ITS Directive and its Action Plan																					
3	Single European Sky ATM Research Program (SESAR)																					
4	European Rail Traffic Management Systems (ERTMS)																					
5	Maritime Surveillance systems (SafeSeaNet)																					
6	River Information Services (RIS)																					
7	Marco Polo Program																					
8	uropean Electronic Toll Service (EETS)																					
9	Freight Transport Logistics Action Plan																					
10	UNIDO United Nations Industrial Development Organization																					
11	OECD: Green growth and eco-innovation																					
12	Small Business Act for Europe																					
13	Sustainable Consumption and Production and Sustainable Industrial Policy																					
14	ETAP Forum: Overcoming barriers to SMEs in eco-innovation																					

Figure 52: Timeline of policies for thematic group 4

Resource citation links:

1) http://ec.europa.eu/transport/themes/research/sttp/
2) http://ec.europa.eu/transport/themes/its/road/action_plan/
3) http://www.sesarju.eu/about
4) http://ec.europa.eu/transport/modes/rail/interoperability/ertms/index_en.htm
5) http://ec.europa.eu/maritimeaffairs/policy/integrated_maritime_surveillance/documents/maritime-surveillance_en.pdf
6) http://www.transport-research.info/Upload/Documents/201104/20110405_145853_15995_Brochure_RIS_web.pdf
7) http://ec.europa.eu/transport/marcopolo/index_en.htm
8) http://ec.europa.eu/transport/media/publications/doc/2011-eets-european-electronic-toll-service_en.pdf
9) http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0607:FIN:EN:PDF
10) http://www.unido.org/who-we-are/unido-in-brief.html
11) http://www.oecd.org/greengrowth/oecdworkongreengrowth.htm
12) http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0394:FIN:EN:PDF
13) http://ec.europa.eu/environment/eussd/escp_en.htm
14) http://ec.europa.eu/environment/archives/ecoinnovation2010/1st_forum/

5.3 Trends

Multimodal information, management and payment systems represent an important step towards a highly accessible mobility system which allows travellers to make an informed choice of the most suitable transport options depending on their individual preference and requirements. At the same time it helps to make optimal use of the available transport capacity and can support network management based on different criteria (e.g. time, emissions, speed, and so forth). In the following sections, different trends which may have an impact on future developments in this area are discussed. The questions whether their impacts are always considered to be beneficial cannot be clearly made in all cases, as this sometimes depends on the point of view one takes and the interest one represent. It is also important to bear in mind that some developments may be highly relevant in the future although their possible impacts cannot yet be fully grasped (e.g. social media). Nevertheless they must be considered and observed carefully in the time to come.

Standardisation

As multimodal transport involves at least two different types of transport modes this very often also means the involvement of more than one transport operator with their own information, management and payment system. Transport service and infrastructure operation can also be separated, increasing the number of players even further. Service providers can also be involved, thus stressing the need for harmonized data exchange. Some of these companies may be private and some of them publicly owned. In order to support data exchange, a number of standards exist at the moment within CEN, ETSI and ISO (e.g. DATEX, TRANSMODEL, SIRI, NETEX etc.) and are being further developed in the future.

For a successful deployment of Multimodal Information Services, the (Urban ITS Expert Group, 2012) recommends that the use of existing standards for new Multimodal Information Services should be made mandatory. Further, information about new services like car-sharing/pooling, free bike services needs to be included into multimodal information services to provide a complete solution. To ease the exchange of information and decrease the software costs, the structure and architecture for the multimodal urban data set should be standardized to facilitate interoperability between cities, working towards a real multimodal approach.

DATEX II is a standard for interfaces in the area of traffic related data. It was developed as the successor of DATEX and ALERT-C within the EasyWay project from 2005 and takes a leading role in European ITS implementation. In the road transport sector, the DATEX standard has been developed for the exchange of information between traffic management centres, traffic information centres and service providers. Based on this, DATEX II also offers applications for the traffic and travel information sector. The DATEX II specification is intended to operate and represent the interface between information technology and dynamic traffic. The legal foundation was finally established by the ITS Directive 2010/40/EU. As clearly defined in the ITS Action Plan, the DATEX II standard should be used to feed information to Service Providers. A first (pre-) release of DATEX II was published in end of 2006. In June 2011 the version DATEX II 2.0 has been released, in June 2012 version 2.1.The standardization is carried out in stages and should be

completed by 2015. The first three parts have already been realized in the context of CEN 16157 as technical specifications, part 4 and 5 should still follow, 2013, Part 6 and 7 then until the end of 2015. The DATEX II usage in Europe (as of Sept. 2011) can be seen in Figure 53.

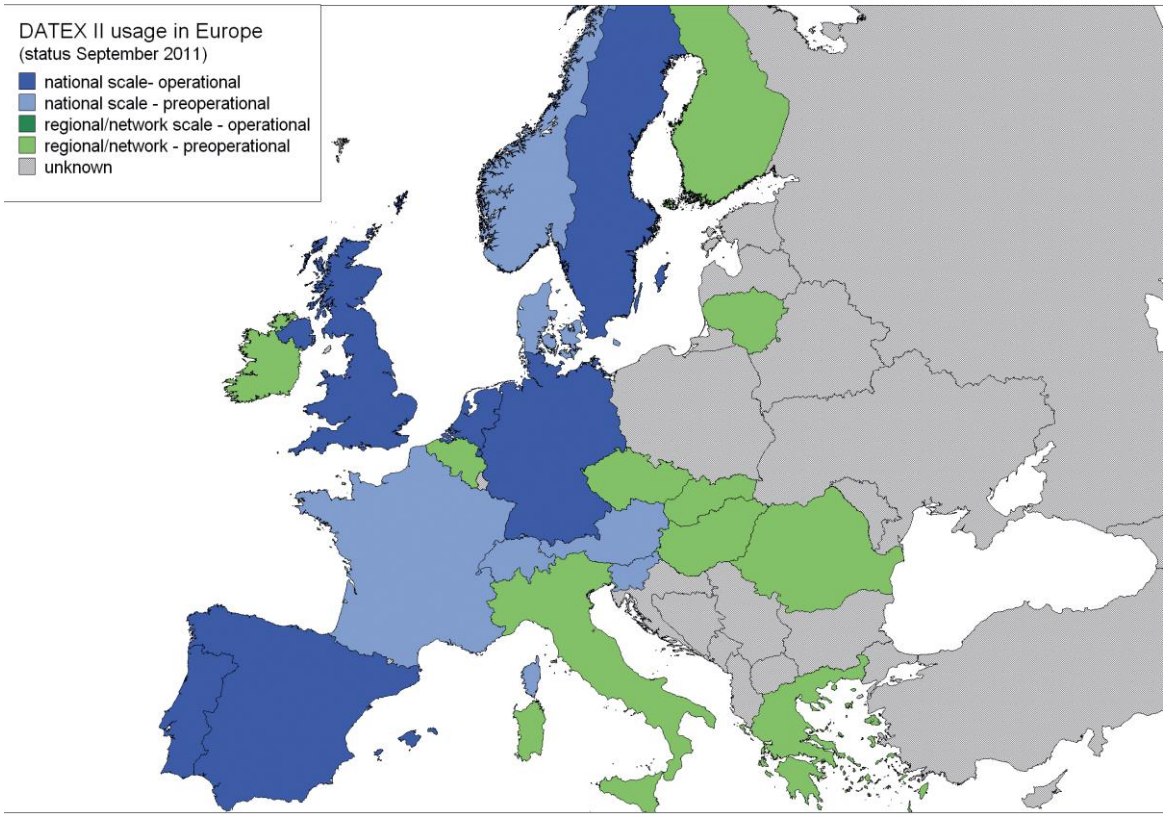


Figure 53: DATEX II usage in Europe (EasyWay, 2011, p.6)

TransModel was created as an equivalent standard reference data model for public transport. Based on TransModel national data models across Europe have been derived (e.g. TransXChange in the UK or SIRI in Germany/Austria) (DFT, 2013). There is also already a TransModel based on the XML-scheme for Google Transit (Transport direct, 2008).

SIRI (Standard Interface for Real-Time Information) is standardized XML-protocol for exchanging XML (real-time) data in public transport between control centres and information systems, used e.g. in Austria and Germany. It enables the exchange of (real-time) data on schedules, vehicles, and the terminals of a transport operator. SIRI is usually used to exchange information between operational control systems. SIRI is certified as a European standard (CEN TS 15531), references are available in several major European countries such as Germany (with the VDV Realtime Interface 453 454 as a subset), UK, France and Sweden, but also in the USA and Canada. Since April 2013 there is a draft version 2.0 available (parts 1 to 3) (VDV, 2013).

NeTex (Network and Timetable Exchange) is a service based on TransModel, IFOPT and SIRI to support information exchange of relevance to public transport services. It defines the data exchange format for public transport network topology, scheduled timetables, and fare information. This information is of

importance for multimodal information systems to provide planned passenger information as well as real-time services (as described in the SIRI specifications) (NeTEx, 2009).

Mobile platforms – ICT solutions

Mobile computing in the form of smartphones and tablets will continue to have a large impact on the ability and willingness of users to use platforms for information, management and payment systems. Already in five major European countries (Spain, Germany, Italy, France and the UK), market penetration of smartphones is over 50 %, with the highest in Spain at 66 % in the second quarter of 2013 (MobileNewsBlog, 2013) and the lowest in Germany with 51 %. While the market is already showing some signs of saturation, it can, nevertheless, still be expected that the market share of such devices will continue to experience further growth. Besides smartphones, tablets are also becoming more widely available. Here it is interesting to note that tablets with their intuitive interfaces and their larger size, compared to smartphones, are opening up a new user group among the 55+ (TUAW, 2012). However, it was observed at the meeting in Gdansk that the uptake of mobile Apps might be slowed down as more elderly people are integrated in the transport system of tomorrow.

In this area, new inventions like Google Glass could have a significant impact, which is a wearable computer with an optical head-mounted display. It communicates via voice commands (or input via a touchpad or app) with the internet and displays information in the visual field. This information can be combined with the (live) data from the integrated digital camera (augmented reality). On the one hand, it is a milestone for many IT experts. But on the other hand, of course, this brings up discussions about data protection and privacy issues for the user and the people around. There are many concerns because it is able to discreetly spy on the environment of the wearer and all records of all users are transmit on Google's own servers. The release for consumers is expected in 2014 (Google, 2013).

The convergence of different mobile ICT solutions (mobile phones, tablets, etc.) should lead to systems which are convenient and simple to use. Improved usability will continue as a trend and will play a more important role in the future. As more and more systems become available, users will be able the chose the system that best meets their needs.

Economic development

Economically Europe is developing at very different speeds. This is not only true for different countries but also regions within countries. Statistics by Eurostat based on the Gross Domestic Product (GDP) confirm this development (Eurostat, 2013d). Within regions, large urban areas will continue to attract people from rural areas, making it more and more difficult to keep public transport services at a feasible service level. Here creative solutions are necessary in order ensure a minimum service level while at the same time keeping the costs low. This also highlights the need of different transport operators to work together and make their services as accessible as possible and make use of different modes of transport. The former trend of removing unprofitable branch lines leads to short term costs cuts but the long run can jeopardize the aim of encouraging the use of public transport. Many transport operators now run as private companies and cannot afford to run at a loss as was possible in former times when publicly owned transport operators were

heavily subsidized. However, private transport operators try to gain a competitive advantage by improving the service quality.

The consequence of such a development is that less money is available for infrastructure and other investment, with some regions and cities facing more pressures than others. On the one hand this could jeopardize in the long run the introduction of a European-wide information, management and booking system, on the other hand it clearly shows that a focus must be on an affordable system. It also shows the need for a synchronized approach between transport operators as the investment must be secure for a long time.

Car ownership among younger people

In recent years a development could be observed that while younger people still obtain driving licenses, fewer own their own vehicles, especially in urban areas (Economist, 2012) . According to (Hodges, 2013) surveys in several countries (USA, Germany, Japan, France, the UK and Norway) the car ownership among younger people has decreased, primarily the young men's share, in most study countries, whereas the women's share seems to remain stable. A number of reasons can be mentioned for this development. One is the costs associated with car ownership. Many people are either unable or unwilling to buy and maintain a car, made even less attractive by charging zones, parking management, etc. in many cities across Europe. Another is the shift of cars as a status symbol to other objects (smartphones, etc.). In recent years, the average age of buyers of new cars has increased. Environmental awareness is another factor as is the movement towards *using* instead of *owning*. Car-sharing, multimodal transport etc. have gained a much higher acceptance than in the past and are now much more accessible. This development can be further supported by the increasing presence of internet platforms providing information on where and how sharing can take place. It can be expected that in the future this generation will increasingly expect information on multimodal transport as well as on other services (e.g. indoor navigation in stations, environmental impact of transport options …) to be available.

Freight transport

In the past, production was more and more off-shored to other continents, especially to Asia. This was supported by improved logistics, low transport costs and the competitive advantage of low labour costs outside of Europe. This trend is not yet reversed but is certainly experiencing some changes. Some companies (e.g. Zara) opted for reasons of flexibility and speed to produce closer to Europe (e.g. Turkey) and some companies have even stopped or reduced their engagement outside Europe. This coincides with the new slogan of "reindustrialising of Europe" (EC, 2013e). In order to support this emerging trend of re-shoring of production, logistics and freight transport must not only be able to deliver fast and reliable services but also in a way that is environmentally acceptable. This is also addressed in other goals examined in TRANSFORuM and information services will play an important role in the future to support this development. Smart urban logistics will continue to play an important role and if this trend continues, especially in combination with electric vehicles, distribution centres along the edges of cities and collective transport, information is essential for successful operations.

Education and income

Access to ICT infrastructure will strongly depend on income and location. Education will remain to be a key driver in terms of modal choice and for using multi-modal traveller information system. People with a higher education level are more likely to make a more distinguished choice of transport modes and are more likely to use multi-modal traveller information systems. They will probably also drive the demand for such information systems in the future.

Education and income are connected to a certain extent although in Europe we are currently experiencing a situation with high unemployment, especially among young people, that shows higher education is no guarantee for suitable work. They are, however, highly computer literate, more prepared to move to other places and used to voice their interests which is related to the next trend.

New service providers

In the past, services related to information on public transport have been provided by transport operators in a very top-down approach. Social media, computers, smartphones, etc. have increasingly led to bottom up approaches, filling gaps left by the transport operators. For instance, social networks providing information faster and more reliable than operators in case of delay, direct comments on service quality etc. This also puts on an enormous pressure on operators to provide better service quality. Coupled with new regulations concerning the availability of information (see also below) this can lead to fast and efficient services, often provided free of charge. Of course here no service guarantee can be given and these services depend on the availability of publicly accessible data, nevertheless, any other service must be at least as fast and reliable as these services. In this context, open innovation should also be mentioned, as this not only contains the elements of self-organization but also open data and information exchange. Here innovation is supported by the free flow of ideas, one building on the ideas of another and sometimes leading innovation to completely unexpected directions. Especially with the free availability of data and the necessary platform (open source), the entry barrier is very low for anybody to develop new services.

Data security and privacy

A big issue is data security and privacy. It must be ensured that the correct data is available when needed and transferred in a secure way without any dangers of data manipulation. Privacy concerns relate to the question: who has access to personal data concerning all operations related to booking and ticketing. The questions of possible surveillance is one that is being asked more frequently than in the past and any information, management and payment system must stand public scrutiny and ensure that privacy and security issues can be answered satisfactorily. If this is not the case, then this might be an issue where, in the long run, public acceptance could be lower than expected as well as needed in order to have the necessary impact on modal choice. There might be a need for security specifications embedded in national law.

Free versus payable services

Willingness to pay for information only exists if the service provides notable additional value to the users. If this is the case it is possible to build a real user trust relationship. This is, however, increasingly

difficult as users are becoming more and more mobile and thus prepared to change services providers. A real added value can be achieved by the integration of different services and transport operators.

Needs of different generations

Care should be taken to ensure that transport services also cater for the need of people of old age. Very often they are still highly mobile with a relatively high disposable income. On the other hand they grew up at a time when car ownership and use was the norm. Services must ensure that multimodal transport is accessible to them. Uncertainties regarding the economic outlook make it, especially for younger people, more difficult to commit themselves to larger investments and they often prefer the flexibility associated with sharing-schemes.

Booking and payment systems

Currently, booking and payment systems differ from country to country and region to region. At the moment each national and regional transport operator uses its own booking and payment system often making it inconvenient when travellers have to change modes of transport and/or operator. Although many local and regional cooperation's between operators exist and information on schedules is available, booking and payment systems are less integrated. In the future it can be expected that different systems and services will grow together. For the user it must be irrelevant where they book and buy their ticket. With the absence of printed tickets this will be more easily possible and payment will be done by bank or credit card. For the transport operator it is relevant that the ticket price is transferred as quickly and with as little administrative cost as possible. In order for transport operators to participate in such a scheme, calculations must be carried out correctly and there must be known advantages/disadvantages for the different operators on the different booking platforms. At the same time, discounts or other reductions must be made available to the travellers. This calls for a simplification of the fare structure and transparent pricing systems. Local, regional and national operators across different modes must develop a trust relationship. Smart ticketing solutions should help to make the booking and payment process as transparent as possible and ensure that collected fares are correctly distributed between the different operators. The benefits for public transport users will be a system which is better adapted to their needs as well as the travel patterns of each person (CIVITAS, 2010). At the moment this is still hampered by different access systems (open, closed, different cards) used by different operators.

Trusted 3rd Party

Multimodal transport and associated payment and booking systems are also a great challenge for transport providers. On the one hand, confidential information should not be made available to competitors, on the other hand, in a truly integrated system, booking and payment must be possible on one platform for different modes of transport and transport operators. Here the concept of a trusted 3rd party will play an important role, where a third party carries out the transactions between the different operators in a way that is fair and impartial while at the same time ensuring that no sensitive information is exchanged. Such a development could greatly ease the cooperation between different partners in the transport system and could present a level playing field for everyone involved. At the same time this could also lead to entry barriers depending on how open a trusted 3rd party is to new operators and service providers.

Acceptance of IT solutions

Closely connected to security and privacy concerns is the general acceptance of IT solutions. In order to be effective, an information, management and payment system must be used by a large share of travellers. In terms of economies of scale this is advantageous to transport operators and making their investments feasible. Travellers must perceive a benefit from using these systems or otherwise would not only find it inconvenient to use but are also less likely to use multimodal transport. This also means that different target groups which also have different ways of approaching electronic platforms have to be addressed. At the same time it must be assured that those who do not have the chance to access electronic systems, are not prohibited from using public transport (e.g. not only relying on smartphones).

Data exchange

Data exchange is a very crucial topic for a multimodal information, management and payment system. The re-use of public sector information, collection and publication of geographical information on the transport network by public authorities as well as ITS deployment and support of a coordinated ITS implementation can help to support the compatibility, interoperability and continuity of transport across the EU.

The Directive 2003/98/EC (Public Sector Information (PSI) Directive) provides a common legal legislative framework on the re-use of public sector information that encourages EU member states to make as much public sector information available for re-use as possible. Before, this area had to be regulated by each member state itself. The directive deals with the economic aspects of information (member state, national, regional and local level) more than the access of citizens to information and is building on the two key pillars: transparency and fair competition of the internal market. The directive was adopted on the 17th November 2003 and entered into force at the end of December 2003. In May 2008 the directive was fully implemented in all 27 Member States. In December 2011 there was a proposal from the European Commission to revise the directive, since it was found that several barriers still exist like attempts by public sector bodies to maximize cost recovery, as opposed to benefits for the wider economy, the competition between public and private sector, practical problems hindering re-use (e.g. lack of information on available PSI) and the awareness of public sector bodies regarding the economic potential (EC, 2013f). The PSI directive covers written texts, databases, audio files and film fragments. The following issues are covered by the directive (EC, 2013f):

- Procedures: how to deal with requests
- Availability: formats, languages, timeframe, tools
- Charging: based on costs incurred, lower/no costs can be applied, method must be indicated
- Transparency: transparency of charges and conditions, clear information in case of refusal
- Non-discrimination: conditions shall not be discriminatory for comparable categories of re-use.
- Cross-subsidies: cross-subsidies are prohibited.
- No exclusive arrangements: exclusive arrangements are prohibited (in exceptional cases possible)
- Licensing: Availability of standard licenses (digital format), not restrict possibilities for re-use

Overall, the aim of the Directive is to (EC, 2013g):

- Support and ease the creation of community-wide services based on//integrating public sector information
- Facilitate the effective cross-border re-use of information to established improved products and services
- Restrict the distortion of competition on the Community information market

As a result the web portal "ePSIplatform" (http://www.epsiplatform.eu), former called ePSIplus was established.

The ITS Directive (2010/40/EU) was adopted in July 2010 and shall act as framework for the Coordinated and Effective Deployment and Use of Intelligent Transport Systems. The aim is to speed up the ITS deployment and support a coordinated ITS implementation across Europe. The directive addresses compatibility, interoperability and continuity of ITS solutions across the EU. Within seven years specifications regarding functional, technical, organizational or services related provisions shall be adopted with the first priorities on traffic and travel information (eCall and intelligent truck parking). Already in December 2008 an Action Plan was adopted for the deployment and use of ITS in road transport (and interfaces to the other transport modes), which targeted several measures including the proposal for the ITS Directive. DG Mobility and Transport (lead), DG Information Society and Media, DG Research, DG Enterprise and Industry and DG Climate Action support this initiative (EC, 2013g).

The directive states the following priority areas (EC, 2010a):

- Optimal use of road, traffic and travel data,
- Continuity of traffic and freight management ITS services,
- ITS road safety and security applications,
- Linking the vehicle with the transport infrastructure.

Within them, the following priority actions are set (EC, 2010a):

- the provision of EU-wide multimodal travel information services;
- the provision of EU-wide real-time traffic information services;
- data and procedures for the provision, where possible, of road safety related minimum universal traffic information free of charge to users;
- the harmonised provision for an interoperable EU-wide eCall;
- the provision of information services for safe and secure parking places for trucks and commercial vehicles;
- the provision of reservation services for safe and secure parking places for trucks and commercial vehicles.

For these priority areas and actions the necessary standards need to be developed and will be processed by relevant standardization bodies (according to Directive 98/34/EC) to ensure that the standards can be adopted quickly (EC, 2010a). According to the ITS Directive, the EC has established (Decision 2011/C 135/03) in May 2011 an expert group on ITS called European ITS Advisory Group to counsel the EC on business and technical aspects. The 25 members were nominated in January 2012, which consists of persons from different relevant fields (ITS services providers, associations of users, transport and facilities operators, manufacturing industry, social partners, professional associations, local authorities and other relevant fora) (EC, 2011b).

In July 2011 the reporting guidelines for the Member States were adopted, an initial report should show the current state of national activities and projects in the priority areas. Every three years, following the initial report, the progress made since the last report has to be documented in a progress report (EC, 2011c). Within the context of the directive, specifications for the EU-wide multimodal travel information services shall be presented before the end of 2014.

The INSPIRE Directive (2007/2/EC) came into force in May 2007 and deals with collection and publication of geographical information on the transport network by public authorities. It will be implemented in several stages, the full implementation needs be finished by 2019. The goal is to develop a European Union spatial data infrastructure which will help in cross-border policy making and encourage sharing of environmental spatial information between public sector organizations and support public access to spatial information across Europe. The INSPIRE directive covers extensive spatial data and a wide range of technical and present topics, and is based on several common principles like the most effective collecting and maintaining of data; possibility to combine seamless spatial data from different sources across Europe and share it; possibility to share collected information from a certain level to all level; transparency and availability of geographic data necessary for good governance at all levels; easily find what geographical data is available, how it can be utilized to fulfil certain needs and under which requirements acquired and used (EC, 2013h).

6 Summary

This document gives an overview of the current policies, funding mechanisms and trends relevant for each thematic area (urban mobility, freight, high-speed rail and ITS). The goal is to provide an input for the road mapping process and the strategic outlook carried out during the TRANSFORuM project. In addition, the actor landscape was examined but not elaborated in detail for each thematic group as this is still an ongoing process and closely linked to the stakeholder database.

The policy sections show that already a large number of policies and actions have been implemented or are in the process of making. Nevertheless, inputs from stakeholders and discussion show that in each area, additional policies are needed in order to help achieve the white paper goals or at least provide the necessary framework for the next steps. Standardisation and subsidiarity are important issues for all goals. A very important issue, which was also highlighted from stakeholders, is the interpretation of goals in view of current and future technological or social developments. The European intermodal, information, management and ticketing systems may serve as an example. At the time of writing a single integrated European solution may have been in the minds of the authors. Since then, technological development, the widespread use of smartphones, open data initiatives, and so forth have led to a development where already a large number of local regional solutions exist which must now be integrated. Another example is the political acceptability of high-speed rail, both from a financing as well as a societal point of view. In order to be relevant for the future, it is necessary to consider current developments for the road-mapping process which the TRANSFORuM partners will carry out in subsequent work packages of the project. Even if the ultimate goals were not questioned, any roadmap must take account of the current situation and at least provide for possible future changes.

The trend sections for the different thematic groups show the complexity of the environment for each goal, made more difficult by the overall global and European trends in which they are embedded. As we can see from the current discussion on climate change it is very difficult get reliable data let alone agreed forecasting models and ultimately priorities and goals. Demographic changes on a short term basis can be predicted more easily but on a long term basis many factors besides birth and death rate play a more and more important role. Nevertheless, it is necessary to consider the trends as they are known today and from that perspective for each thematic group some priorities might be identified were actions need to be taken in order move forward.

Funding mechanisms, especially on EU level, are well defined and it is clear that model like public-private-partnerships (PPP) are becoming more important. This also reflects that there are limits to what can be financed by public funding alone. Nevertheless, sound investments in infrastructure are important and must ensure cross border interoperability. Learning from best practice examples (examined in work package 5) can help support this.

The current document will serve as an input to the subsequent work packages. At the same time, the stakeholder database will be further updated and relevant actors identified for the final TRANSFORuM outputs.

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