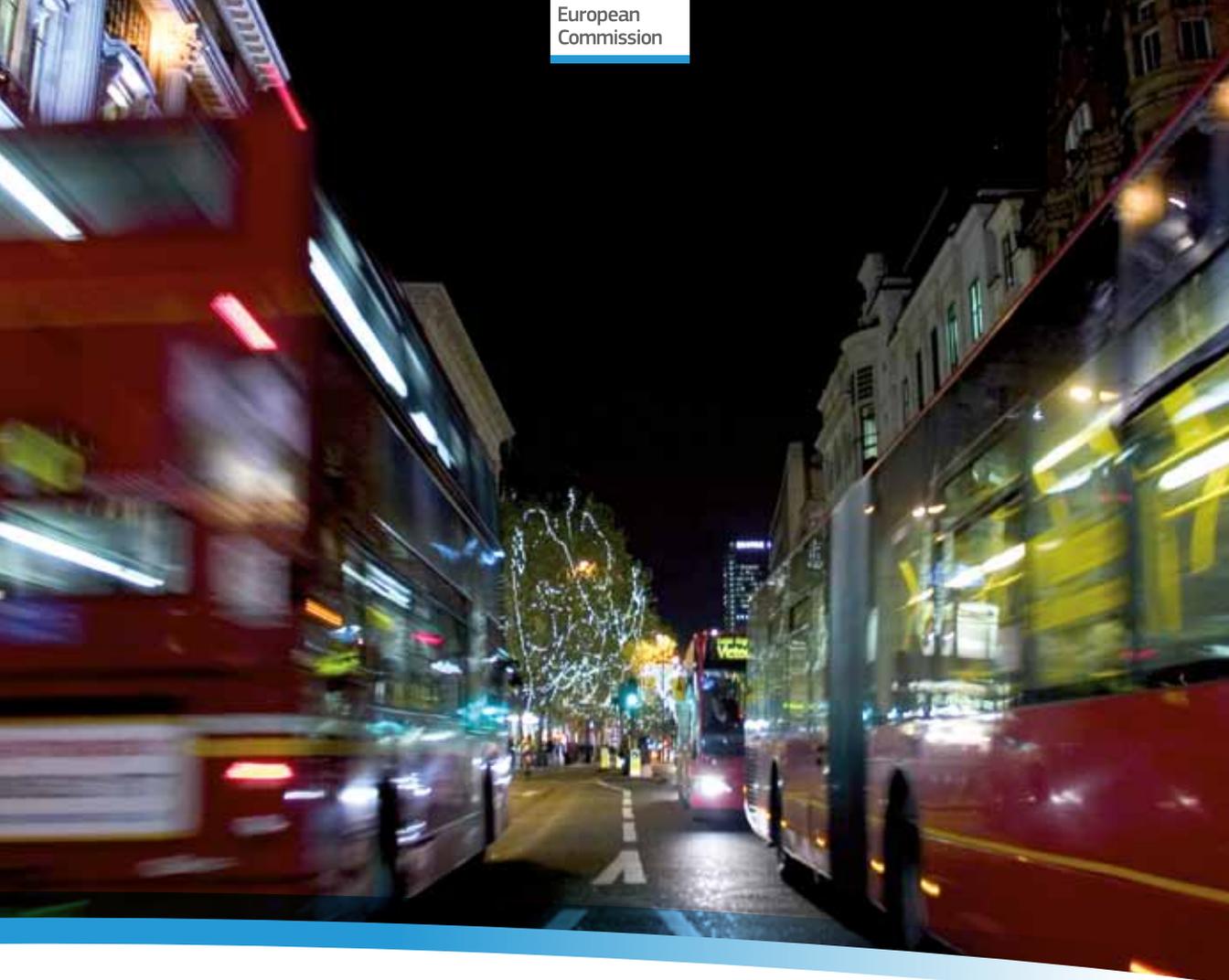




European
Commission



Innovating for a competitive and resource-efficient transport system

COMMUNICATING TRANSPORT RESEARCH AND INNOVATION

www.transport-research.info

Transport



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Foreword



Siim Kallas

Transport plays a vital role in the European economy. It is the heart of the supply chain, enabling trade flows via the movement of goods and people; it is an effective engine of job creation and economic growth. By linking people together, transport is important both for society and our quality of life.

There are some major challenges ahead which will alter the business landscape for decades to come, such as climate change, rising congestion and Europe's overdependence on oil. So we need to act now, to prepare a sustainable and efficient European transport network for the future. And for that, innovation is essential.

Innovation offers enormous potential for 'greening' our transport system, to make it more sustainable, efficient and safer. That is why we are investing heavily in research and development to ensure Europe remains at the cutting edge of technological advances in transport and at the competitive forefront in the global marketplace, particularly in transport manufacturing.

It is also why 'smart, green and integrated transport' is identified as a major challenge for project funding within the European Commission's proposed 2014-2020 research programme, "Horizon 2020".

This will be about resource-efficient transport that respects the environment across all the different modes of travel and will help the European Union achieve its ambitious overall targets for cutting greenhouse gas emissions.

I also believe that it is important to exchange information and communicate about our research and innovation activities. I therefore welcome and fully support the launch of the EU Transport Research and Innovation Portal as a comprehensive source of information about what the EU is doing in this area, as we prepare our transport systems for a cleaner and more sustainable future.

A handwritten signature in black ink, appearing to read 'Skallas', with a long, sweeping underline that extends to the right.

Siim Kallas

*Vice-President of the European Commission,
Commissioner for Transport*

1 INTRODUCTION

Challenges for EU transport policy

Efficient, reliable and safe transport of people and freight within and between the Member States is essential to the continued economic development and social integration of the European Union. Transport is also a major economic sector in Europe, generating 7% of the Gross Domestic Product (GDP) and employing 12 million people including vehicle and equipment manufacture.

In the last few decades, the EU has seen considerable increase in passenger and freight transport. With innovative technologies and more efficient organisation, transport has become more resource-efficient, faster, safer and more convenient. Maintaining and raising performance will not be easily achieved as transport demand continues to increase in the coming decades.

Transport challenges

In meeting the rapidly growing demand for transport in the coming decades, the transport system faces major challenges. A key challenge is to reduce the sector's dependence on fossil fuels and the related environmental impacts. To this end, an ambitious target has been set for 60% reduction in greenhouse gas emissions by 2050 with respect to 1990 level. To achieve this, manifold measures have been identified to promote development of more energy-efficient technologies and to stimulate the use of more sustainable transport solutions.

Demand for passenger and freight transport continues to rise with infrastructure reaching its performance limits. The challenge is to make more efficient use of existing transport infrastructure, while meeting higher requirements for safety, security, and reliability as well as user convenience.

A further challenge is to safeguard and expand the competitive edge of the European transport

industry in the face of competition from emerging markets. European companies are global leaders in transport infrastructure, management, operation, and vehicle and equipment manufacture. The challenge is to strengthen the innovative capacity of these industries through further investment in research and development (R&D).

Far-sighted policies

Changes cannot be made overnight. Far-reaching policies and large investments are required to upgrade and build new infrastructure, to develop resource-efficient technologies and to introduce new generation vehicles. EU policies stimulate smart, integrated and efficient use of transport systems and resources to achieve improvements in the short term. To meet long-term demand, the European Commission promotes R&D and the application of innovative technologies for a sustainable transport system. EU-funded research is dedicated to developing practical solutions to present and future issues. This includes participation of industry in public private partnerships such as the Green Cars Initiative on electric vehicles for urban transport and the Single European Sky Initiative.

This brochure sets out initiatives in EU transport policy and the contribution of innovation, research and development to a transport system to meet future demands. These demands are for efficient and reliable transport that is safe, convenient, and environmentally sustainable.

2 POLICY CONTEXT

Policy and Research for a better transport system

The European transport system is one of the world's most efficient, safest, and technologically advanced. Nevertheless, major challenges have to be addressed in the coming decades to ensure that transport is environmentally sustainable, provides better mobility and contributes to strengthening EU's competitiveness in the global market.

Transport is a key factor in EU economic and social integration which in turn contributes to steady increase in transport demand. Preparing the ground for the European transport system to meet future requirements and challenges is thus a focal point of European policy. High priority is placed on creating a prosperous environment for research and innovation to develop smart and sustainable solutions to meet current and future challenges.

Mobility challenge

Growing transport demand leads to increasing congestion. At the same time, there are higher requirements on transport safety, security and

reliability. As transport demand is predicted to rise further, the future development of the European transport system will have to follow a new path. Meeting mobility targets will require substantial changes based on the development and deployment of smart and innovative solutions. These challenges present major economic and technological opportunities.

Environmental challenge

Transport depends heavily on fossil fuels (96% of all transport uses fossil fuels) and is thus a major source of greenhouse gas emissions in the EU. Even though new, efficient technologies make more efficient use of



resources and reduce greenhouse gas emissions, total emissions from transport are continuing to increase. This results from a combination of factors including rising vehicle numbers, higher transport volumes, longer transport distances and improved safety, speed and comfort. In the light of these challenges, an ambitious target has been set to reduce greenhouse gas emissions from transport by 2050 by 60% on 1990 levels.

Competitiveness challenge

Many European companies are world leaders in transport infrastructure, management, operation, and vehicle and equipment manufacture. This leadership position has to be maintained and strengthened to ensure the transport system continues to underpin the European economy and overall European competitiveness. A major opportunity to strengthen the transport system will be presented in the coming period of technological shift to more efficient, environmentally sound, and more intelligent transport to meet the mobility and the environmental challenges.

EU transport policy

The long-term objectives for EU transport policy are set out in the White Papers prepared by the Directorate General for Mobility and Transport (DG MOVE) every ten years. The title of the current White Paper is *Roadmap to a single European transport area - Towards a competitive and resource-efficient transport system* (EC, 2011a). This White Paper is based on a vision for a competitive and sustainable transport system and sets out the EU transport strategy for the coming decade.

This strategy comprises coordinated activities grouped under three focal points. The first, *A Single European*

“ *The paramount goal of European transport policy is to help establish a system that underpins European economic progress, enhances competitiveness and offers high-quality mobility services while using resources more efficiently* ”

White Paper on Transport, 2011



Transport Area, aims at completing the internal market through effective interoperability and competition within the EU transport system. The second, *Innovating for the future*, presents a strategy for transport research, innovation, and deployment, and for innovative mobility patterns. The third, *Modern infrastructure, smart pricing and funding*, is targeted at creating a European mobility network to meet transport demand in an efficient and environmentally-friendly way and sets incentives for sustainable usage.

Meeting these challenges and achieving the objectives in the current White Paper require investment in research, development and innovation. The need for R&D investment is expressed in each of the three focal points of the EU transport strategy and explicitly in *Innovating for the future*. In addition, the European growth strategy, Europe 2020, provides an even broader umbrella for research, development and innovation.

European research and innovation strategy

EU policies for specific economic sectors are embedded in the European growth strategy Europe 2020, which defines seven flagship initiatives to guide and support these policies (EC, 2010). One of these initiatives is the *Innovation Union* to create an environment to target R&D most efficiently. An approach to innovation is

TARGETS IN CORE AREAS OF TRANSPORT RESEARCH AND INNOVATION FOR 2020

Resource-efficient and environmentally sustainable mobility

- Improved vehicle efficiency
- New generations of low or zero emission vehicles
- Development of alternative fuels
- Employment of intelligent transport systems
- Optimised demand management

Better mobility

- Less congestion
- Improved accessibility
- Integrated door-to-door transport and logistics
- Enhanced intermodality and transport planning
- Fewer traffic accidents
- Improved security for passengers and throughout supply chains

Competitiveness of the European transport system

- Next generation of vehicles and transport concepts
- Smarter control systems
- More efficient production processes
- Shorter development times

Supporting policy-making

- Better understanding of socio-economic trends and prospects
- Provision of evidence-based data and analyses

EC, 2011c

advocated in which research focuses more on practical issues and on bringing innovations to market entry.

This is in line with the European transport policy, as the White Paper recognises that innovation is essential to its strategy, and that EU research needs to address the full cycle of research, innovation and deployment in an integrated way. As the 'R&I pillar' underpinning the White Paper implementation, the *Strategic Transport Technology Plan* (STTP) is the long term transport innovation policy that will identify, in collaboration with all Research and Innovation actors, the most promising technologies that can contribute to the White Paper's objectives.

These objectives have been incorporated in *Horizon 2020*, the new Framework Programme for Research and Innovation. Replacing the Seventh Framework Programme, *Horizon 2020* will combine all EU research and innovation funding in one programme. Funding will be linked more closely to specific policy objectives, which is in line with the Innovation Union, the White Paper on Transport and the Strategic Transport Technology Plan.

Transport research focus

A key priority set in *Horizon 2020* is to support research on practical issues identified in the Europe 2020 strategy. For this purpose, six societal challenges

have been specified, one of which is 'smart, green and integrated transport'. The challenge is to create a resource-efficient and environmentally sustainable transport system that provides safe and seamless transport and benefits citizens, the economy and society. Four core areas for EU-funded research have been defined, each with specific research targets (see box) in line with the policy objectives of the White Paper on Transport.



3 POLICY PRIORITY

Towards smarter mobility

Smart and efficient transport solutions are needed as transport demand rises further and requirements on the transport system will become more complex. The EU pursues policy and research initiatives directed to transport services to meet user needs, to improve the EU transport network, and to make all transport modes safer.

Demand for passenger road transport is expected to double in the next 40 years and for passenger air transport to increase twice as fast. Similar developments are expected in freight transport. Passenger and freight transport demand projections are displayed in Figure 1. The transport system in its current forms will reach the limits of its capacity with congestion forecast to increase by 50% by 2050. Furthermore, the social costs of traffic accidents, noise and air pollution will continue to increase.

Demand is also increasing for more infrastructure and services and for better accessibility, reliability, and safety in all transport modes. In addition, environmental incidents and the threat of terrorist attack call for sophisticated solutions that maximise reliability and security without sacrificing flexibility and without disrupting traffic flows.

Transport infrastructure, equipment, and traffic patterns cannot be changed overnight, and thus decisions made today will determine the EU transport system in 2050. Short-term improvements call for smart, innovative solutions that optimise the existing infrastructure and equipment, for instance, by using advanced technologies such as Intelligent Transport Systems. EU transport policy sets out a number of initiatives to tackle these issues.

Dedicated research activities are the basis for developing and promoting innovative solutions to improve the quality and performance of the transport system.

Integrating European transport networks

Provision of transport services to meet user demand and to respect the environment, places considerable

Figure 1. Passenger and freight demand projections (EU27)



EC, 2008



EU TARGETS FOR THE TRANSPORT SYSTEM

- Zero fatalities in road transport by 2050
- Europe the safest world region for aviation
- Framework for a Europe-wide, multimodal transport information, management and payment system by 2020
- Completion of the European high-speed rail network by 2050
- EU-wide multimodal "core network" by 2030
- Core network airports connected to the rail network by 2050

EC, 2011a

pressure on existing infrastructure. Increasing cross-border traffic between Member States and beyond the EU reinforces the need to integrate national transport networks. The EU has a major role in stimulating the availability and connectivity of trans-European transport infrastructure. In addition to supporting infrastructure investments, the European Commission sets standards for interoperability of modal networks such as a standard railway signalling systems, air traffic control, and road charging systems.

Furthermore, ensuring the transport system meets the combination of economic, social, and environmental

requirements calls for a coordinated approach to infrastructure planning, design and financing. Against this background, EU policy facilitated coordinated initiatives, such as the creation of the **Trans-European Transport Network (TEN-T)**.

In the last decade, 30 priority infrastructure projects in all transport modes have been initiated collectively by Member States. Together with existing national transport networks, these projects are key elements in the TEN-T networks. To improve overall performance, the European network consists of a **core network** of transport modes connecting major urban areas in Europe on top of a comprehensive network. The core network requires sound planning based on future transport demand and new technology. EU-funded research has developed methodologies to predict transport demand, to develop long-term integrated scenarios and to evaluate the manifold impacts of different infrastructure concepts.

User convenience

Demographic changes, more diversified economic activity, changing commuter patterns, and pressure for more efficient use of resources call for transport services that are sustainable and convenient for users. This is the case with public transport and multimodal transport, which are often associated with inconvenience and high user costs.

MULTI-MODAL CORE NETWORK FOR EUROPEAN TRANSPORT SYSTEM

- Missing links (cross-border and other key bottlenecks) to complete and to connect transport networks
- Multimodal stations to improve physical integration of transport modes at strategic points in the network
- Intelligent Transport Systems (ITS) to facilitate integration of modal transport management systems for efficient use of the network
- Multimodal freight corridors to improve freight flows over medium and long distances

EC, 2011b



Source: EC, DG MOVE 2012



The European Commission aims to make **user rights** more transparent by promoting a legal framework for enforcement of their rights on multimodal journeys in all Member States, and a charter of basic rights applicable to all modes. Measures are being introduced to further protect the rights of elderly and disabled passengers, for instance by making infrastructure and vehicles more easily accessible.

Making **multimodal transport** seamless and more reliable for passengers and freight requires physical proximity to transport modes as well as integrated schedules, information on traffic condition, and ticketing. To this end, research on advanced technologies has led to initiatives for an EU-wide information system giving operators and users easy access to real-time information on schedules, routings, and delays. Online reservation and ticketing will facilitate single multimodal ticketing for cross-border journeys, while electronic ticketing via mobile devices and smart cards will replace paper tickets.

For multimodal freight transport, the EU promotes the **e-freight** framework directed to reducing cumbersome transfer transactions and associated high costs. Based on transport research and advanced information technology, these systems provide a single window on the freight chain and a one-stop shop for controls at multimodal transfers using a single electronic waybill. Systems include track and trace of goods throughout the transport chain using technologies such as Radio Frequency Identification (RFID).

Reliability is a major factor influencing choice of transport mode. The European Commission is developing Mobility Continuity Plans to ensure continuity of transport services even in the aftermath of major disruptions such as the volcanic ash cloud in April 2010. High priority is being given to developing common platforms for fast, efficient information exchange and operator coordination between Member States. In addition, flexibility in regulations would allow, for example, temporary relaxation of night and weekend restrictions on freight transport.

Better urban mobility

Ever increasing urban transport for private cars has adverse impacts on the quality of life with increasing noise hindrance, air pollution, and congestion. To reduce these impacts, EU policy stimulates innovative and environmentally friendly transport solutions. This embraces promoting new mobility concepts for passenger and freight transport that integrate different modes in urban transport for more efficient use of existing infrastructure.

Passengers

While there is often a choice of **public transport** services in urban areas, the car is still predominant. A key policy objective is to make public urban transport more attractive by increasing services frequencies and regional coverage. Considerable research has been done on developing urban mobility concepts that focus more on individual user needs. The options

include customised information on schedules, inter-modal journeys, and alternatives such as walking and cycling, as well as innovative vehicle technologies.

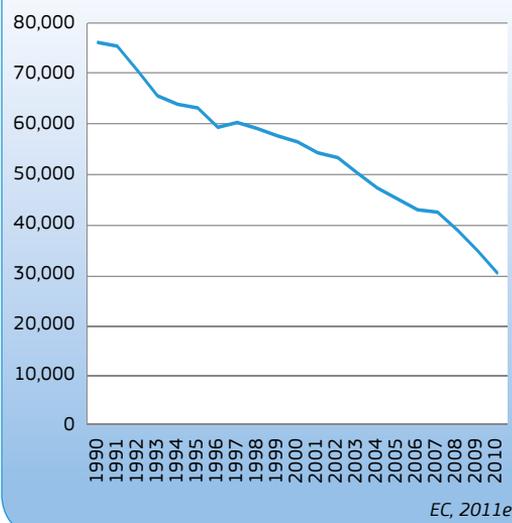
Freight

Attention is given to improving **urban logistics** to reduce inefficiencies and emissions from freight transport and heavy goods vehicles. As a result of extensive research on urban logistics, various measures have been adopted. These measures include stimulating the establishment of multimodal logistic centres on city outskirts and deployment of local trains, river transport and subway network for freight movement at night. Technological advances have opened the way to new developments such as silent, light goods vehicles for night deliveries. Moreover, Intelligent Transport Systems contribute to more efficient city logistics, for example, through online management of slots for cargo unloading.

Advanced pricing measures can contribute to more efficient use of road capacities and thus to reducing congestion and environmental impacts. Based on extensive research in major cities, measures are being promoted to develop an operational and technical framework as well as interoperability standards for tolling equipment to enhance user acceptance and reduce equipment costs.



Figure 2. Road fatalities in EU27 countries



Transport safety

Road safety

Although road safety has improved considerably in the last decade, it is a major concern in all EU Member States. Between 2001 and 2010, road fatalities declined by 40%, but still 30,700 people died in road accidents in the EU in 2010 (see Figure 2).

An ambitious target has been set of zero road fatalities by 2050 and a substantial reduction in road injuries. This calls for improved infrastructure and vehicles and for better protection of pedestrians and cyclists. In addition, a comprehensive set of measures is being developed based largely on technological innovations such as Intelligent Transport Systems. These systems include user information on road conditions, vehicle-to-vehicle communication, and emergency call systems (eCall). Other systems include advanced driver assistance such as lane departure warning, anti-collision warning, and pedestrian recognition.

Road accidents can be reduced by stricter enforcement of safety regulations throughout the EU, by improving testing of vehicle roadworthiness, and by raising standards for driver training and education. Policy initiatives such as the Urban Mobility Action Plan support the deployment of safer infrastructure and provision of safety information in cities.

“New transport patterns must emerge, according to which larger volumes of freight and greater numbers of travellers are carried [...] by the most efficient (combination of) modes.”

White Paper on Transport, 2011

Air safety

The strategy for civil aviation is to make Europe the safest world region and incorporates various measures such as data exchange on potential hazards to aviation in the European domain. This strategy is backed by the European Aviation Safety Agency (EASA), which is the centrepiece of the EU's strategy for aviation safety. EU has legislation to support the Single European Sky initiative to coordinate traffic in EU air space. There are also initiatives to cooperate with the United States and other countries to harmonise air traffic regulation and safety.

Rail safety

While rail transport is one of the safest modes, safety can be further enhanced with greater harmonisation throughout the EU. Advances in technology have opened the way for a European Rail Traffic Management System (ERTMS). This system standardises safety certification of all entities including railway companies and manufacturer of safety critical components. The role of the European Railway Agency (ERA) is being strengthened in harmonising national safety measures.

Maritime safety

Fortunately, major accidents with passenger vessels are rare, but do happen as in the case of *Costa Concordia* in January 2012. Increasing shipping operations also increase the risk of maritime accidents in European waters. Legislation is in place for strict safety requirements. The European Maritime Safety Agency (EMSA) supports the European Commission and the Member States to increase the safety of maritime transport. In addition, the integrated European maritime information system, SafeSeaNet, is being developed and made compatible with River Information Services and the e-Maritime initiative. The ambition is to create an integrated information and surveillance system to support maritime safety, security, and environmental protection.

Transport security

Since 11 September 2001, terrorist attack has become a serious threat to the security of transport systems and users. In adopting EU measures to mitigate such threats, the challenge is to raise security and to minimise disruption to traffic flows and inconvenience to users.

One initiative is the **EU action plan on air cargo** security to harmonise cargo security controls across the Member States, to monitor air cargo and to improve information exchange. Similar cooperation by the Member States is proposed for maritime cargo shipment. These initiatives will require ongoing research to improve screening methods and technologies.

EU legislation requires Member States to improve security control methods, equipment and standards, and stimulates regular testing and introduction of new equipment. To develop further the concept of one stop security, security controls of passengers and baggage at European airports need to be further improved and coordinated. Research, for instance on the **Checkpoint of the Future**, is developing more effective and efficient scanning technologies for passengers and baggage.

Security solutions for urban transport, rail transport and particularly for stations and **passenger terminals** are to be developed in close cooperation with stakeholders in all Member States. This will follow the integrated approach of the Internal Security Strategy of the EU.



CIVITAS

Cleaner and Better Transport in Cities



Status: In progress
Total cost: EUR 370 000 000
EU contribution: EUR 180 000 000
Website: www.civitas-initiative.org

The CIVITAS initiative supports 59 cities in Europe to implement and test packages of technology and policy measures to improve transport sustainability. A critical mass of integrated sustainability measures has been shown to change transport user attitudes and behaviour. For instance, two thirds of the population in Burgos (Spain) were supportive of the transport sustainability actions despite substantial new access control and enforcement policies. Evaluation results and lessons learned are promoted through the CIVITAS Forum to over 160 cities in the EU Member States.

BACKGROUND

Concerted actions on sustainability issues in urban transport can only be addressed by City Authorities because they own and control much of the transport infrastructure and services. These authorities are uniquely placed to deliver measures and to provide political and organisational leadership to industry, commerce, research and other stakeholder groups in a CIVITAS public private partnership.



AMBITIOUS STRATEGIES FOR CLEAN URBAN TRANSPORT IN EUROPE

RESULTS

Since 2002 when the CIVITAS Programme began, 36 cities have participated and some 400

sustainability measures have been implemented. Currently, a further 25 cities are working together in five collaborative projects involving a further 300 measures.

CIVITAS has developed a body of evidence on the impacts of single and integrated measures and on processes to implement these measures. Key findings have been considered in eight policy areas and promoted through 13 Policy Advice Notes in 2009.

Clean fuels and vehicles

Measures on clean fuels and vehicles have focused on the introduction of biofuels. In Toulouse (France), for example, the public transport authority replaced its diesel buses with a fleet of the newest-generation compressed natural gas (CNG) buses. This has led to a substantial reduction in emissions (carbon monoxide by 75%, hydrocarbon by 61%, and particulates by 91%). Other cities are focusing on implementing electric and hybrid vehicles.

Public transport

Measures on collective passenger transport have resulted in more reliable and cost-effective bus and tram services. Together with mobility management and transport telematics to inform travellers, these measures have led to significant changes in attitude and to increased use of public transport. Bus patronage increased by 3.5% in Genoa (Italy) as a result of the mobility corridor for bus priority, online information systems, and new vehicles.

Demand management strategies

Physical and financial access control measures have led to a reduction in car usage. For instance, in Rome (Italy) access control led to 12% reduction in car usage. Measures to support a car-independent lifestyle with increased walking and cycling have also been successful even in adverse geographic and environmental conditions. In addition, safety and security measures have been implemented to address traveller concerns and a variety of speed control systems introduced to reduce road traffic accidents.



4 POLICY PRIORITY

Towards a more environmentally friendly transport system

A key target in EU transport policy is a transport system that is environmentally sustainable. EU is committed to a 60% reduction in greenhouse gas emissions from transport by 2050 with respect to the 1990 level. Achieving this ambitious target requires close interaction between transport policy and EU-funded research. Research on more sustainable transport needs to address reducing dependency on fossil fuels, stimulating more resource-efficient modes, and promoting energy-efficient transport management and user behaviour.

Considerable progress has been made in the last decade in adopting green technologies and in fostering more efficient transport management. Nevertheless, the transport sector depends heavily on fossil fuels (96% of fuel consumption) and contributes up to 25% of all greenhouse gas emissions in Europe. If no action is taken, by 2050, CO₂ emissions from transport are expected to increase by 35% because of rising transport demand. Transport is also a major source of emissions such as fine particulates (PM10) as well as noise and vibration hindrance in cities and environmentally sensitive areas.

Policy to mitigate the environmental impacts of transport focused initially on road vehicles. Voluntary agreements have been made with manufacturers to reduce CO₂ emission levels from passenger cars. Community's strategy to reduce CO₂ emissions from road vehicles includes emissions standards (EURO categories for cars), fuel economy labelling, and fiscal measures. Since 2000, EU policy on transport emissions has been extended progressively to incorporate more efficient vehicle technology, and to eco-driving, information campaigns and regulatory measures for vehicle end-of-life.

Policy now includes measures to reduce the impact of air transport on climate change. These measures range from stimulating research on new technologies,

reducing fuel consumption, improving energy efficient vehicles through appropriate design for rationalising air traffic movements, to imposing fuel taxes.

The White Paper on transport presents a roadmap with initiatives to improve the long-term environmental sustainability of the sector. These initiatives incorporate factors that drive energy demand and include vehicle efficiency, fuels and propulsion systems, modal choice for passenger and freight transport, energy-efficient user behaviour and fleet management.

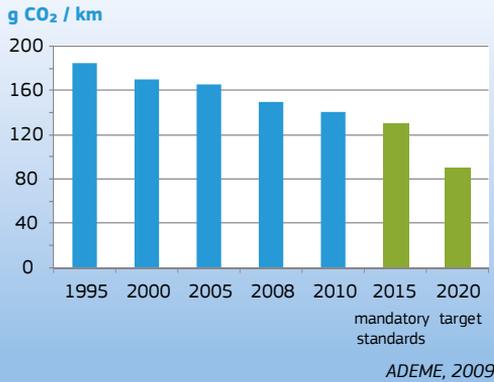
CLIMATE CHANGE TARGETS FOR TRANSPORT IN 2050

The EU climate change target for transport is 60% reduction in greenhouse gas emissions by 2050. This is to be achieved by:

- No conventional fuelled cars in urban areas
- CO₂-free logistics in large centres
- 40% of aviation fuel is low carbon
- 40% reduction in CO₂ emissions from maritime bunker fuels
- 50% shift of long distance freight (more than 300 km) from road to rail or water transport

EC, 2011a

Figure 3. CO₂ emissions of new cars:
Observed values vs. target (EU)



Energy-efficient vehicles, sustainable fuels, and propulsion systems

EU policy on reducing transport emissions together with extensive R&D investment have resulted in substantial improvement in car energy efficiency. In the last decade, CO₂ emissions have decreased by 15 to 20% (from 155 g to 140-130 g CO₂ per km, see Figure 3). Further reductions can be achieved with additional research on vehicle efficiency measures such as tyres with low rolling resistance, dashboard displays on tyre pressure and gear change, and a gradual transition to **lower carbon fuels**.

CO₂ mitigation measures have also been extended to commercial road vehicles, diesel locomotives and marine engines. For instance, research has resulted in **innovative power trains** for on-board power supply and energy transfer from roadside charging stations to vehicles. Research contributes to the development of cleaner, more efficient technology in aviation. The European Commission and the aviation industry are collaborating in the Clean Sky Joint Technology Initiative directed to **greener air transport** by optimising aircraft technology with, for instance, smart wings, more energy-efficient engines and aircraft design (eco-design).

The European Commission has developed a technology roadmap to integrate joint research efforts supporting clean, safe and efficient vehicles in all transport modes. One strategic line of action is to identify appropriate governance mechanisms and financing instruments for the rapid deployment of cleaner, more efficient technologies resulting from research programmes. The Fuel Cells and Hydrogen Joint Undertaking (FCH JU), a unique public private partnership, supports research, technological development and demonstration (RTD) activities in **fuel cell and hydrogen energy technologies** in Europe. Examples with respect to **electro mobility** include large-scale demonstration projects in vehicle fleets such as urban buses, rental cars, vans, whilst longer term solutions will be sought for heavy goods vehicles.



Resource-efficient transport modes

To meet the ambitious targets for transport, technological solutions for improving **vehicle energy efficiency** need to be supplemented with other measures. Additional gains can be made with a substantial shift from road to more resource-efficient modes. For instance, conditions for pedestrians and cyclists need to be improved in urban areas. For long distance journeys, rail or maritime transport can be efficient alternatives to road for both passengers and freight. A key factor in achieving **modal shift** is user awareness of the ease and convenience of the alternative modes offered.

The European Commission pursues several initiatives to increase the volume of freight carried by rail and water. One such initiative is the creation of **green corridors** for long-distance freight transport using advanced technology and co-modality to make optimum and sustainable use of resources. Another initiative is **e-freight**, electronic data exchange linked to real-time freight flows. E-freight uses advanced technology to stimulate competitive co-modality in freight transport and thus contributes to more environmentally sustainable transport.

User behaviour and transport management

User behaviour has substantial impact on vehicle energy efficiency and environmental emissions. For instance, vehicle choice, maintenance, and occupancy, as well as how a vehicle is driven have impacts on fuel consumption and thus on CO₂ emissions. For medium to long distances, a choice for rail travel instead of the private car can have considerable impact on emissions. Other alternatives to private car usage are commuter car sharing, and non-motorised transport for short journeys.

Research has also shown that better driving techniques can reduce fuel consumption and CO₂ emissions by as much as 25%. Efficiency measures adopted by drivers are referred to as eco-driving in the Transport White Paper and are proposed for inclusion in future revisions of the driving licence directive. The White Paper also proposes accelerating the application of Intelligent Transport

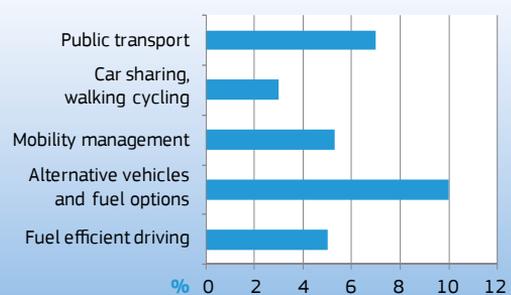


Systems (ITS) to support driving efficiency with dashboard information on tyre pressure, traffic congestion, and route optimisation.

Figure 4 highlights the relative contribution of behavioural changes to reach the CO₂ emission targets.

Research in freight transport, sophisticated transport management and intelligent logistic structures can limit vehicle mileage and thus contribute to emission reduction. Furthermore, intelligent transport management systems could facilitate wider use of intermodal transport services by enabling the comparative advantages of each mode to be exploited. New types of “roadtrains” using non-conventional fuels will be tested.

Figure 4. Relative contribution of behavioural measures to reach the CO₂ emission targets (EU)



EC, Joint Research Centre IES, 2008

CITYMOBIL

Towards advanced road transport for the urban environment

Project reference: TIPS-CT-2006-031315

Status: Completed

Total cost: EUR 41 774 538

EU contribution: EUR 11 000 000

Coordinator: TNO - Netherlands Organisation for Applied Scientific Research

Website: www.citymobil-project.eu



CityMobil project has demonstrated the transport systems in high-speed mass transport and individualised on-demand transport. The project has shown that advance systems such as Personal Rapid Transit (PRT) and high tech buses increase accessibility, improve transport reliability and safety, and reduce environmental emissions from urban transport.

BACKGROUND

Solutions for improving mobility and reducing congestion in urban areas involve a shift from the private car to efficient, safe and convenient public transport that provides high-speed scheduled mass transport as well as individualised on-demand, short-distance transport. The CityMobil project tested and evaluated solutions leading to a more effective organisation of urban transport. The project addressed specific priorities in urban transport of improving safety and security, increasing accessibility, and reliability together with reducing urban congestion and environmental impacts.

CityMobil assessed the impact of advanced city vehicles in demonstration projects in selected cities including London-Heathrow (UK), Rome (Italy), and Castellón (Spain).

RESULTS

The project results indicate that technology is sufficiently developed for implementation of advanced urban transport concepts. The suitability analysis indicated that PRT is the best option for short journeys in low to medium density areas, while high tech buses are suitable for longer journeys. Small automated vehicles, such as the cyber car, and dual mode vehicles can function as feeders to public transport systems in low-density areas.



Personal Rapid Transit

PRT has been designed for passenger movement in small and medium size cities, and for services between city centres, between inner suburbs and city centre, and between inner suburbs. These automated systems operate on a specially built network and carry four to six persons in private cabins between designated stations. The system demonstrated at Heathrow Airport (London) was rated highly by users who identified ease of use as the best feature. Operating statistics indicated high service reliability (about 99%) and drastic reduction of almost half in CO₂ emissions per passenger-km. CityMobil has shown that PRT systems

connecting inner suburbs have high potential to increase the accessibility of low-income areas.

High tech buses

High tech buses, which operate manually in mixed traffic and automatically in dedicated lanes, were found to be most suitable for services between suburbs and city centres and in between suburbs in large cities. The user acceptance survey in Castellón (Spain) indicated that high tech bus services were reliable, well integrated, user-friendly, comfortable, safe and secure. Furthermore, high tech buses contributed to reducing emissions and accidents, and to improving accessibility.



5 POLICY PRIORITY

Towards a more competitive Europe

In ensuring transport continues to contribute to the economic development of the EU and supports its competitiveness in global markets, strategic transport hubs and their hinterland connections are key factors in EU transport policy. The European transport industry itself is a major sector in the EU economy. In order to serve future demand and to maintain the highly competitive position of EU transport in global markets, smart innovative solutions need to be developed.

R&D has a substantial function in providing solutions to the challenges of the European transport system, and it contributes to improving the global competitiveness of the EU. Measures to obtain a highly competitive transport sector will also strengthen the European economy, such as ensuring market opening and integration, and establishing standards for safety, security and passenger rights.

The Transport White Paper emphasises that European competitiveness is underpinned by a competitive transport system that ensures high mobility, uses modern infrastructure and services, and reduces environmental impacts. Transport research is contributing to the development of highly efficient mobility systems in Europe and to fostering technological developments in the European transport industry.





Strategic hubs

Europe's air and sea ports are essential to the Union's global competitiveness because these strategic transport nodes connect Europe with world markets, and are vital to transport operations throughout Europe. Thus, continued improvement in their capacity and performance are key factors in EU transport policy to facilitate the movement passengers and freight. These policies are essential to maintaining and strengthening the long-term competitiveness of the EU in world markets, European transport

operators in global competition, and the transport sector within Europe.

Airports

Constantly growing air traffic volumes place high demand on air traffic management in the air and on the ground because many European airports are operating at their performance limits (see Figure 5). EU policy aims to establish a legislative framework, which will promote efficient use and extension of existing airport

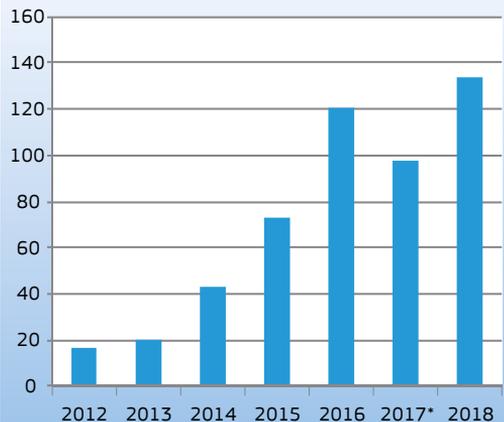
MARKET ASPECTS OF THE EU TRANSPORT SECTOR

- The transport sector contributes 7% of GDP in the EU
- The transport sector provides 5% of total employment in the EU
- Nine million people are employed in transport services and some three million in the vehicle and equipment manufacture
- Almost 90% of the EU external trade is sea-borne
- EU's trade balance surplus for road vehicles and other transport equipment amounted to € 88.5 billion in the year 2010
- In 2008, the corporate research and innovation budget in the EU was € 3 billion
- Between 1992 and 2008, the number of flights within the EU increased by 120%, and on routes with competing airlines, flight numbers increased by 320%

EC, 2011f; EC, 2009a

Figure 5. Unaccommodated demand for flight movements due to constraints at European airports

flights (in thousands)



*In 2017 a relaxation of capacity constraints is expected due to the completion of additional airport facilities.

EUROCONTROL, 2012

capacities, improve ground-handling services, increase airport security and stimulate efficient links between airports and rail networks. This policy is supported by the public private research cooperation. Single European Sky Air Traffic Management Research (SESAR). The research includes smart and innovative airport design, airport infrastructure and airport operations.

Sea ports

Sea ports have long been logistic hubs for the movement of goods and passengers and their efficient operation requires reliable access to their hinterlands. Policy is directed to facilitating rational and efficient development of EU sea ports to handle increasing volumes of freight and passengers within the EU and with the rest of the world. To this end, research has contributed to policy on, for example, the Single Window concept to enable transport operators to lodge a single document electronically for customs clearance and other procedures for cross-border freight movement.

Efficient hinterland connections

With maritime transport in the EU-27 predicted to grow from 3.8 billion in 2006 to 5.3 billion tonnes in 2018, fast, efficient hinterland connections are essential, connecting maritime transport with inland waterways and land-bound modes. Research inputs have contributed to intelligent intermodal transport solutions, which are a basis for **efficient freight transport** between maritime ports and final destination. Moreover, demand analyses and forecasts have facilitated identification of bottlenecks in port capacity and in transport corridors feeding these ports.



AIRBUS: Combining Competitive Strengths

The aircraft manufacturer, Airbus, is a leading example of industry cooperation in Europe. Airbus designs and develops innovative technology to improve the economic efficiency and environmental performance of commercial aviation, with significant spin-offs for the competitive position of European aircraft industry. Launched in May 1969 as a French-German consortium, Airbus is today a world leader in commercial jetliners and military airlifters. The company has a workforce of 119,000 employees, and fully owned subsidiaries in many countries, including the United States, China and Japan.

Global leader in transport industry

European companies are global leaders in transport infrastructure, management, operation, and vehicle and equipment manufacture. The transport sector in its own right is a major contributor to the EU competitive position in world markets. The sector is a **major employer** providing some nine million people in transport services and three million in vehicle and equipment manufacture. Against a background of **increasing global competition** and rising demand side requirements, R&D will continue to play a key role. As well as contributing to the competitive position of the transport industry, R&D is essential in creating innovative solutions to benefit all users.

Targeted interventions include the development of innovative vehicle technologies, smart control systems, advanced production processes, shorter development times, and interfaces between vehicles and transport infrastructure with a view to defining common operational standards.

European Green Cars Initiative



Status: In progress
EU contribution: EUR 1 000 000 000
Website: www.green-cars-initiative.eu

The Green Cars Initiative supports development of technologies, systems and services to reduce environmental pollution and the use of fossil fuels in road transport. This public private partnership with public financial support for R&D is developing leading edge technologies mainly in electrification of road transport. The research also covers alternative fuels, internal combustion engines, co-modality logistics and long distance freight.

BACKGROUND

The Green Cars Initiative is one of three public private partnerships launched in November 2008 under the European Recovery Plan to alleviate the consequences of the economic crises. Under the leadership of industry, representatives of the European Commission and researchers

determine research priorities in three focal areas: electrification of road transport; long-distance truck transport; and logistics and co-modality.

Furthermore, R&D on the next generation of vehicles, systems and services will underpin Europe's future competitiveness. Solutions in these areas are vital for transport in urban



areas faced with pressing issues of congestion and air pollution. Electrification of urban vehicles combined with new systems and services will contribute substantially to reducing emissions in conurbations.

RESULTS

Electrification of road transport

All vehicle manufacturers are currently offering or will shortly offer electric or electric hybrid vehicles. These first generation electric vehicles have evolved from fossil-fuelled designs and have limited range and performance. Research on electrification of road transport relates to electric vehicle components, integrated management of vehicle/battery control systems, external supply of electricity, and management of supply through, for example, a smart grid interface. Work is also being undertaken on vehicle safety, durability and reliability. In addition, technological improvements

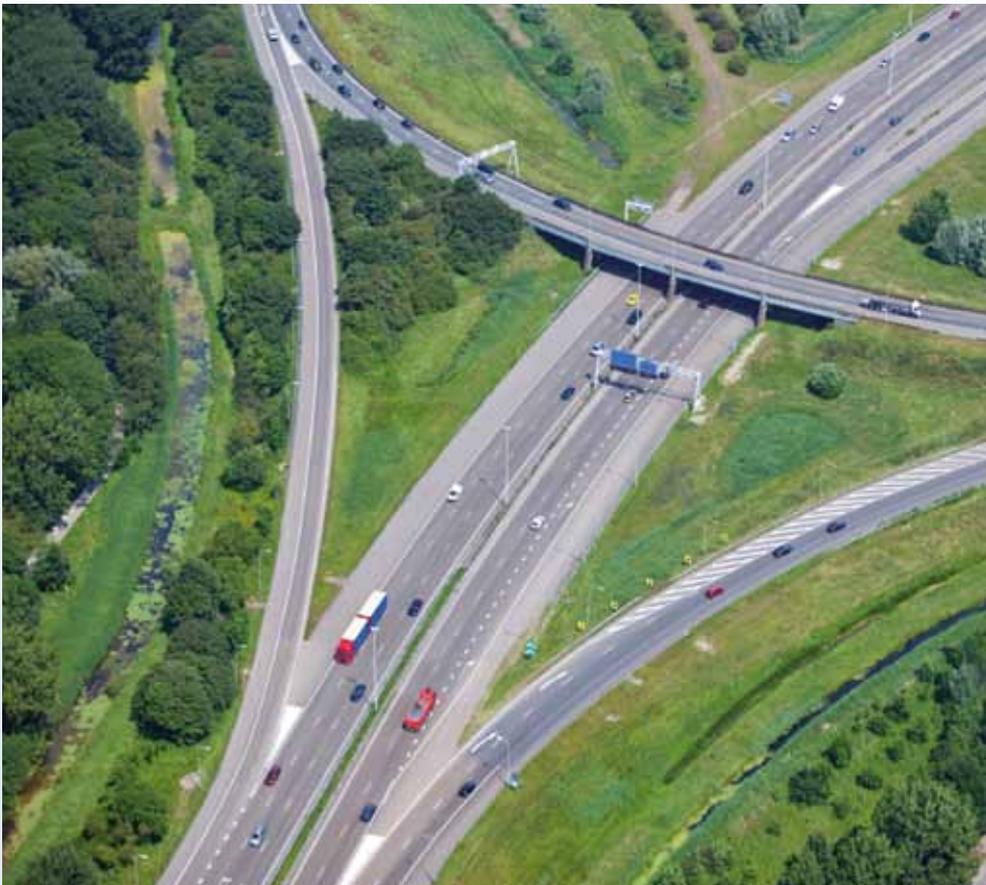
will need to be accompanied by political initiatives to implement EU-wide standards.

Long distance truck transport

Research on long distance trucks focuses on improving efficiency of vehicles, drivelines and drivers. The objectives are to achieve better vehicle design, intelligent management of vehicle system, and better match of vehicles to operation. A target for 2025 is a 'sustainable truck' that will be a world leader.

Logistics and co-modality

Research is targeted at developing electric delivery vehicles for use in new operating models for urban freight distribution. The concepts involve green hubs and corridors with technology providing integration for more efficient and effective operation. Eleven projects are currently being funded with trials and demonstrations throughout Europe.





WHAT'S NEXT?

Policy and Research outlook

European transport policy focuses on developing and operating a competitive and resource-efficient transport system.

The key objectives are to strengthen the competitiveness of the transport industry, which is an important part of the European economy, and to support mobility while meeting emission reduction targets for transport Europe-wide. This implies making transport more environmentally sustainable and decoupling transport from dependency on fossil fuels. The EU research and innovation strategy Horizon 2020 is aligned with these EU transport policy objectives and identifies the development and operation of smart, green, and integrated transport as a priority societal challenge.

Previous and ongoing EU-funded research initiatives have already contributed to making transport more sustainable, more efficient, safer and more strongly oriented to the needs of users. Research is essential to the development of innovative technologies to improve vehicle efficiency, to making optimal strategic use of transport network, and to improving security

and safety of transport operations. Furthermore, Improving traffic management and information systems by initiatives such as SESAR, ERTMS, RIS and the ITS Action Plan will be increasingly important in the European transport system.

Transport research and innovation will continue to play a vital role and will be directed by the ambitious targets set by the 2011 White Paper on Transport and the societal challenges identified in the Horizon 2020 Framework Programme. A strong foundation of EU-funded research will be required in identifying adequate policy instruments and developing innovative concepts for smart, green and integrated transport

New transport solutions will foster the competitiveness of the European integrated market and of the European transport industry, increasing growth and export which will benefit European citizens and the environment.



Bibliography

- ADEME (2009): Energy Efficiency Trends and Policies in the EU 27, Results of the ODYSSEE-MURE project, October 2009, Paris.
- Civitas Initiative (2012): Cleaner and Better Transport in Cities, <http://www.civitas-initiative.org>.
- Citymobil Consortium (2011): CityMobil – Advanced Transport for the Urban Environment, Final CityMobil Brochure, November 2011.
- European Commission (2008): European Energy and Transport Trends to 2030, Update 2007, Office for Official Publications of the European Communities, Luxembourg.
- Eurocontrol (2012): EUROCONTROL Medium-Term Forecast, Flight Movements 2012–2018, February 2012, Luxembourg.
- European Commission (2009a): Communication from the Commission, A sustainable future for transport: Towards an integrated, technology-led and user friendly system, COM (2009) 279 final, Brussels.
- European Commission (2009b): Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Strategic goals and recommendations for the EU's maritime transport policy until 2018, COM (2009) 8 final, Brussels.
- European Commission (2010): Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Europe 2020 Flagship Initiative, Innovation Union, SEC (2010) 1161, Brussels.
- European Commission (2011a): White Paper, Roadmap to a Single European Transport Area, Towards a competitive and resource efficient transport system, COM(2011) 144 final, Brussels.
- European Commission (2011b): Commission Staff Working Document accompanying the WHITE PAPER, Roadmap to a Single European Transport Area, Towards a competitive and resource efficient transport system, SEC (2011) 391 final, Brussels.
- European Commission (2011c): Commission Staff Working Paper, Impact Assessment accompanying the Communication from the Commission, Horizon 2020 – The Framework Programme for Research and Innovation, SEC (2011) 1427 final, Brussels.
- European Commission (2011d): Proposal for a Regulation of the European Parliament and of the Council, establishing Horizon 2020 – The Framework Programme for Research and Innovation, COM (2011) 809 final, Brussels.
- European Commission (2011e): Transport in Figures, Statistical Pocketbook 2011, Brussels.
- European Commission (2011f): External and intra-EU trade, A statistical yearbook, Data 1958–2010, 2011 edition, Publications Office of the European Union, Luxembourg.
- European Commission, Joint Research Centre, Institute for Environment and Sustainability (IES) (2008): Backcasting approach for sustainable mobility, edited by Apollonia Miola, JRC45824, Luxembourg.
- European Green Cars Initiative (2012): Public-Private Partnership European Green Cars Initiative, <http://www.green-cars-initiative.eu>.

Glossary

CIVITAS	Clean and Better Transport in Cities
CNG	Compressed Natural Gas
CO ₂	Carbon dioxide
DG MOVE	Directorate General for Mobility and Transport
EASA	European Aviation Safety Agency
EMSA	European Maritime Safety Agency
EC	European Commission
eCALL	Emergency Call – system that provides an automated message to the emergency services following a road crash
ERA	European Railway Agency
ERTMS	European Rail Traffic Management System
EU	European Union
EURO CATEGORIES	Categories of European emission standards
FCH JU	Fuel Cells and Hydrogen Joint Undertaking
GDP	Gross Domestic Product
ITS	Intelligent Transport Systems
PM10	Particulate matter smaller than about ten micrometers
PPP	Public Private Partnership
PRT	Personal Rapid Transit
R&D	Research and Development
R&I	Research and Innovation
RFID	Radio Frequency Identification
RIS	River Information Services
RTD	Research, Technological Development and Demonstration
SESAR	Single European Sky Air Traffic Management Research
STTP	Strategic Transport Technology Plan
TEN-T	Trans-European Transport Network
TRIP	Transport Research and Innovation Portal
TRKC	Transport Research Knowledge Centre

Transport is vital to the economic prosperity and social integration of Europe. EU transport policy is directed to developing a smart, efficient transport system with reduced dependency on fossil fuels and less environmental impacts that will enhance mobility in Europe and will underpin Europe's competitiveness in global markets. This includes the transport sector itself, which is an important part of the EU economy. In contributing to achieving these ambitious goals, extensive investments are made in research and development for sustainable and innovative solutions. This Policy Brochure, which is produced by the Transport Research and Innovation Portal (TRIP), highlights the contribution of research, development, and innovation in securing a competitive and resource-efficient transport system in Europe.

www.transport-research.info

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