ESPON

GREECO
Territorial Potentials for a Greener Economy

Applied Research 2013/1/20

Sectoral Report

Transport Sector

Draft for Draft Final Report

EUROPEAN UNION
Part-financed by the European Regional Development Fund
INVESTING IN YOUR FUTURE

This report presents the draft final results of an Applied Research Project conducted within the framework of the ESPON 2013 Programme, partly financed by the European Regional Development Fund.

The partnership behind the ESPON Programme consists of the EU Commission and the Member States of the EU27, plus Iceland, Liechtenstein, Norway and Switzerland. Each partner is represented in the ESPON Monitoring Committee.

This report does not necessarily reflect the opinion of the members of the Monitoring Committee.

Information on the ESPON Programme and projects can be found on www.espon.eu

The web site provides the possibility to download and examine the most recent documents produced by finalised and ongoing ESPON projects.

This basic report exists only in an electronic version.

List of authors

Spiekermann & Wegener
Urban and Regional Research (S&W)

Klaus Spiekermann

Table of contents

Figures

Tables

0 Introduction

There is a strong need, but also a large potential to reduce energy use and greenhouse gas emission from the transport sector. The greening of the transport sector is one of the keys of the development towards a green economy. The transport sector is a strong economic sector which has a tremendous importance in some European regions. The transformation of the output generated by this sector towards environmental friendly cars and lorries and more public transport vehicles and other freight transport vehicles than lorries is a huge challenge. In addition, the development of public transport systems and alternatives to road freight transport to shift transport demand is another challenge.

In general, transport has an inherent territorial dimension as it is derived from the wish or need to move persons and goods from one place to another. The spatial separation of all human activities including the functional specialisation of locations for different economic activities are fundamental causes for the ever rising transport demand. In addition, the environmental impacts of the transport system have a clear spatial dimension. Issues such as landscape fragmentation or population exposure to noise and pollutants differ across different types of territories.

1 Conceptual elements of green transport

There is a strong need, but also a large potential to reduce energy use and greenhouse gas emission stemming from the transport sector. The greening of the transport sector is one of the keys of the development towards a green economy. The transport sector is a strong economic sector which has a tremendous importance in some European regions and for Europe as a whole. The transformation of the output generated by this sector towards environmental friendly cars and lorries and more public transport vehicles and other freight transport vehicles than lorries is a huge challenge. In addition, the development of public transport systems and alternatives to road freight transport to shift transport demand is another challenge.

1.1 The transport sector

In order to enable an integrated view on transport and green economy, the understanding of the transport sector in GREECO is rather broad. This understanding is more comprehensive than a restricted analysis of the economic sector as defined in NACE sector H Transportation and storage. To structure the analysis, the transport sector is decomposed in four elements within GREECO: vehicle production, transport infrastructure provision, transport operation and passenger travel and freight transport.

- ***Vehicle production.*** This element of the transport sector includes the production of different types of vehicles for different transport modes which is part of the manufacturing sector (NACE codes C29 - Manufacture of motor vehicles, trailers and semi-trailers and C30 - Manufacture of other transport equipment). To give some figures on the economic importance of vehicle production: There are about 250 automobile production sites in ESPON space offering almost 2.7 million jobs for people directly making the vehicles. In Europe, more than 18 million passenger cars are produced annually of which almost 90 percent are produced in ESPON space.
- ***Transport infrastructure provision*.** The planning, construction and maintenance of transport infrastructure for all modes of transport is an inherent element of the transport sector. It belongs partly to the construction sector (NACE code F42.1 - Construction of roads and railways) and partly to public and private services. The paved road network in EU27 has a length of about 5 million km, the rail network is more than 200,000 km, the inland waterway network about 40,000 km.
- ***Transport operation.*** This element of the transport sector includes all activities that are offering different kind of transport related services. It includes first the provision of transport services, e.g. by public transport operators, taxis, air carriers, shipping companies and other freight and postal carriers, and other transport related services such as maintenance and repair of vehicles, petrol stations etc. This element of the transport sector is widely represented in the NACE sector H Transporting and storage. In EU27, there are about 9 million jobs available in this kind of transport operations producing an turnover of about 1200 billion Euro in 2008 (European Commission, 2011d).
- ***Passenger travel and freight transport.*** This element represents the demand side of the transport sector. It includes the use of the transport system for personal travel and freight transport. In Europe, transport demand increased continuously and was closely linked to overall economic growth (Figure 1) and is in total more than 6,000 billion passenger km. Household consumption for all kind of transport purposes was about 890 billion Euro in 2009 (European Commission, 2011d).

Territorial dimension of the transport sector

In general, transport has an inherent territorial dimension as it is derived from the wish or need to move persons and goods from one place to another. The spatial separation of all human activities

including the functional specialisation of locations for different economic activities are fundamental causes for the ever rising transport demand.

More specifically, all elements of the transport sector have a strong territorial dimension. The production of transport vehicles is organised in spatial clusters with strong intraregional linkages and also interregional logistic chains, but also with many regions not involved in this economic sector at all. The provision of transport infrastructure is to link different regions and to enable mobility and freight transport. Transport infrastructure is also to some extent responsible for the economic success of regions and subsequently for the development of territorial cohesion in Europe. The way and magnitude, transport operators are developing their services is clearly based on the territorial situation. Also with respect to transport demand, different types of territories offer different potentials to move towards more green ways of mobility.

In addition, the environmental impacts of the transport system have a clear spatial dimension. Issues such as landscape fragmentation or population exposure to noise and pollutants differ across different types of territories.

Linkages with other sectors

The transport sector is interlinked with all other sectors to be analysed in GREECO as all sectors have transport demand. For the bioeconomic sector and manufacturing, it is mainly the demand for freight transport to carry input and intermediate materials and products. For the energy sector, waste and water management and the building and construction sector, transport of raw materials and waste is crucial. For the experience economy the question is more how to get people from their place of residence to the places of interest.

Somehow different is the link to green research and eco-innovation. Here, the transport sector will benefit from research into new vehicle materials and technologies, into new more sustainable forms of transport operation and into transport logistics and new forms of transport demand management.

1.2 A green transport sector

The United Nations Environmental Programme in its basic publication on the green economy defines green transport "as one that supports environmental sustainability through e.g. the protection of the global climate, ecosystems, public health and natural resources. It also supports the other pillars of sustainable development, namely economic (affordable, fair and efficient transport that supports a sustainable competitive economy as well as balanced regional development and the creation of decent jobs) and social (e.g. allowing the basic access and development needs of individuals, companies and society to be met safely and in a manner consistent with human and ecosystem health, and promoting poverty reduction and equity within and between successive generations)" (UNEP, 2011, 382).

Without political interventions, the transport sector would grow in an unsustainable way, i.e. emissions of pollutants, greenhouse gas emissions would rise if not controlled by regulations and/or increased mobility costs. UNEP (2011) sees without political interventions the main risk in a world-wide massive increase in the number of private cars.

However, the main problem is an internal goal conflict within the transport sector. Any policy packages that would reduce the overall growth of mobility and the external effects of transport would potentially have an impact on the economic performance of the sector. It has to be sorted out within the sector analysis on transport within GREECO whether a greening of the transport

sector would also have economic benefits or whether this would lead to economic problems of the vehicle industry and the transport operation sector as claimed by transport lobby organisations.

A green growth strategy for the transport sector was proposed by UNEP (2011). For the greening of the transport sector, a fundamental shift in investment strategies is required. It should be based on three elementary principles:

1) Promotion of access instead of mobility. This means to avoid or reduce trips through the integration of land use and transport planning to promote more compact or mass transit corridor cities and regions and by enabling more localised production and consumption patterns.

2) Shift to less harmful modes of transport. This includes in particular public and non-motorised transport for passenger travel and rail and water transport for freight. This should be enabled by shifts of financing priorities and coupled with strong economic incentives such as taxes, charges and subsidy reforms.

3) Improvement of vehicles towards lower carbon intensity and pollution. The development and widely application of green transport technology fostered by appropriate regulations for fuel and vehicles is seen as a priority to reduce air pollution and greenhouse gas emissions.

UNEPT expects that investment in public transportation, infrastructure for walking and cycling, and vehicle efficiency improvements will improve well-being and generates considerable value to regional and national economies by exceptional economic returns

2 Current state and performance of the transport sector

2.1 Economic importance

Vehicle production.

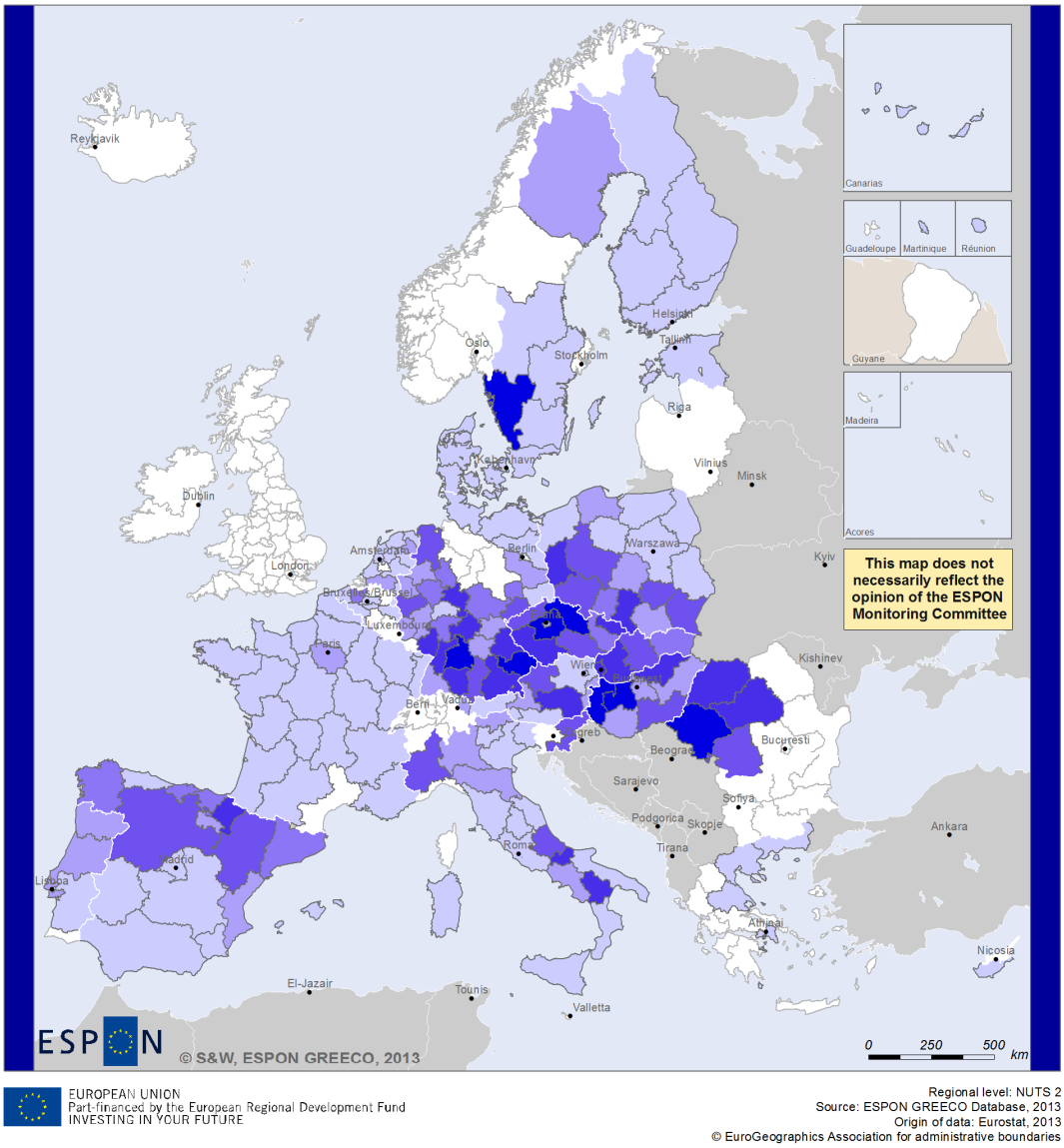


Figure 1. GVA shares in manufacturing of motor vehicles, trailers and semi-trailers

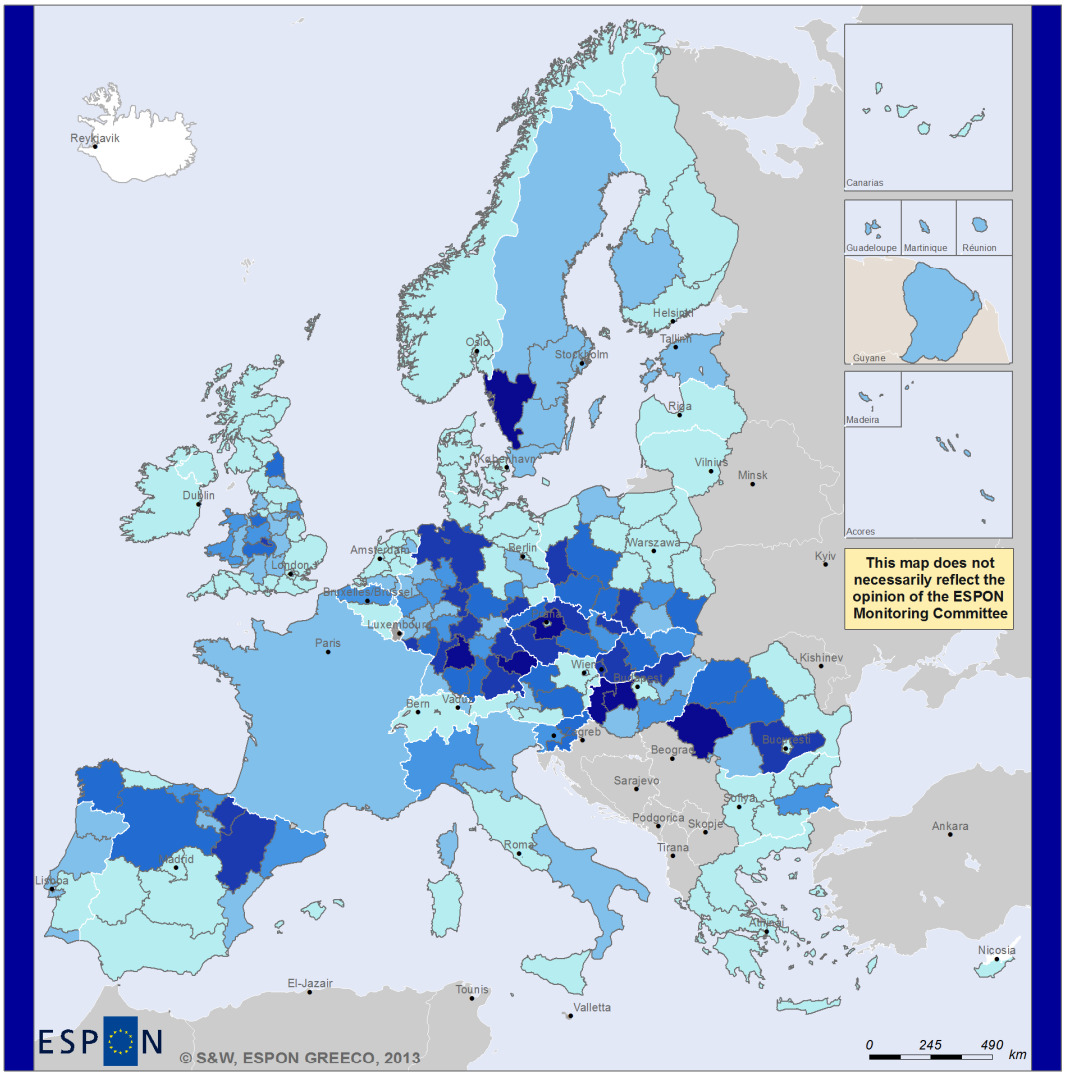


Figure 2. Employment shares in manufacturing of motor vehicles, trailers and semi-trailers

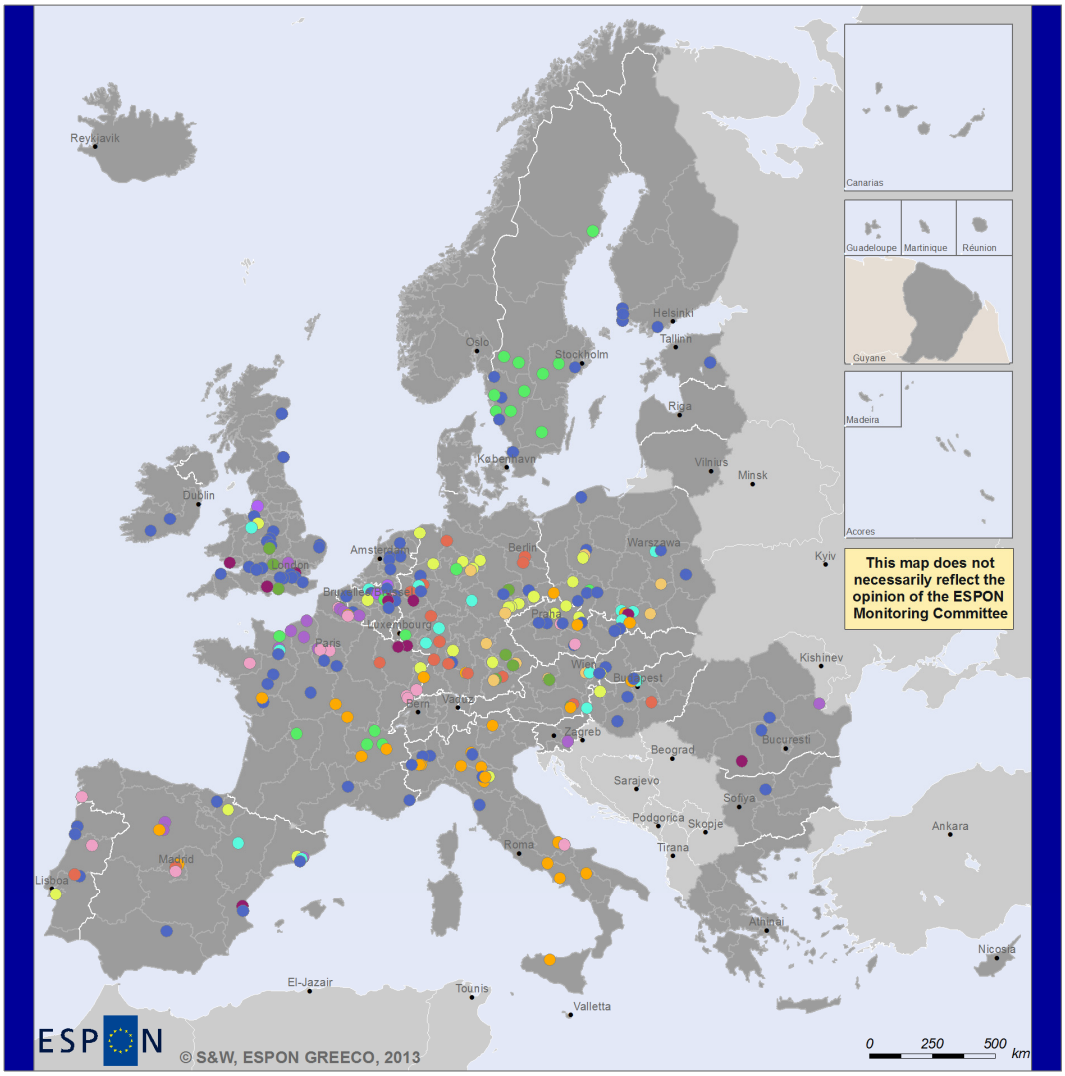


Figure 3. Production sites of automotive industry

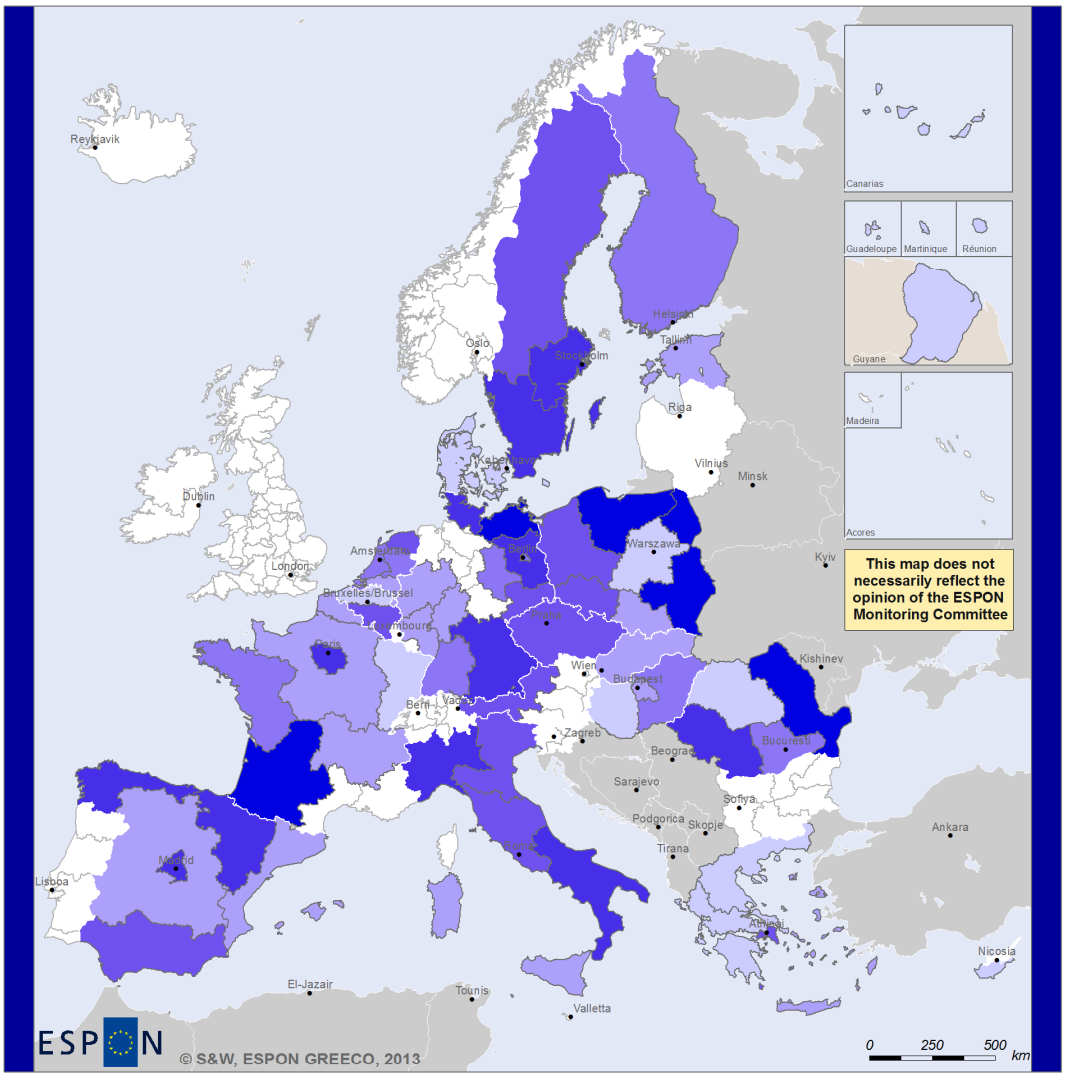


Figure 4. GVA shares of manufacturing of other transport equipment

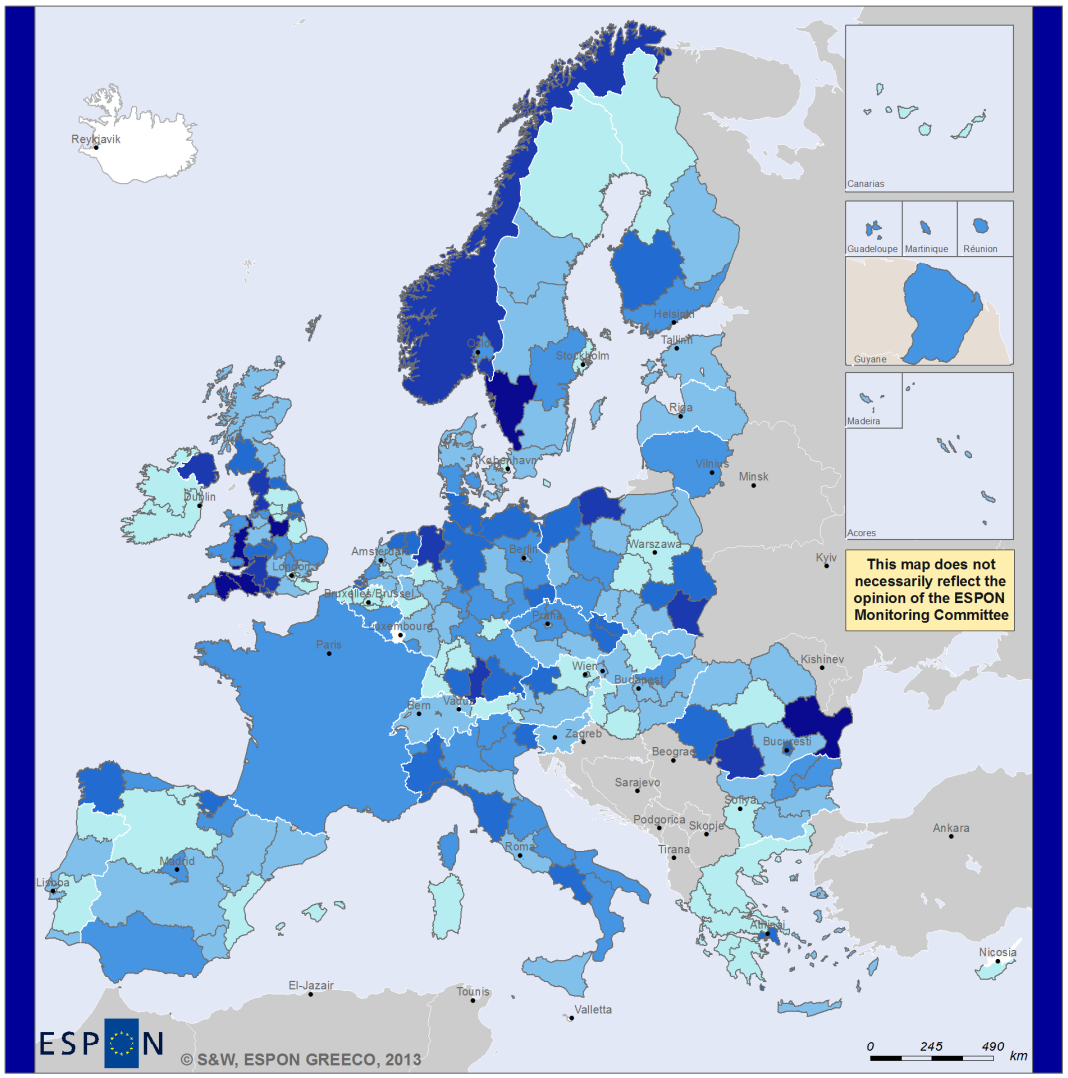


Figure 5. Employment shares of manufacturing of other transport equipment

Transport infrastructure provision.

Transport operation.

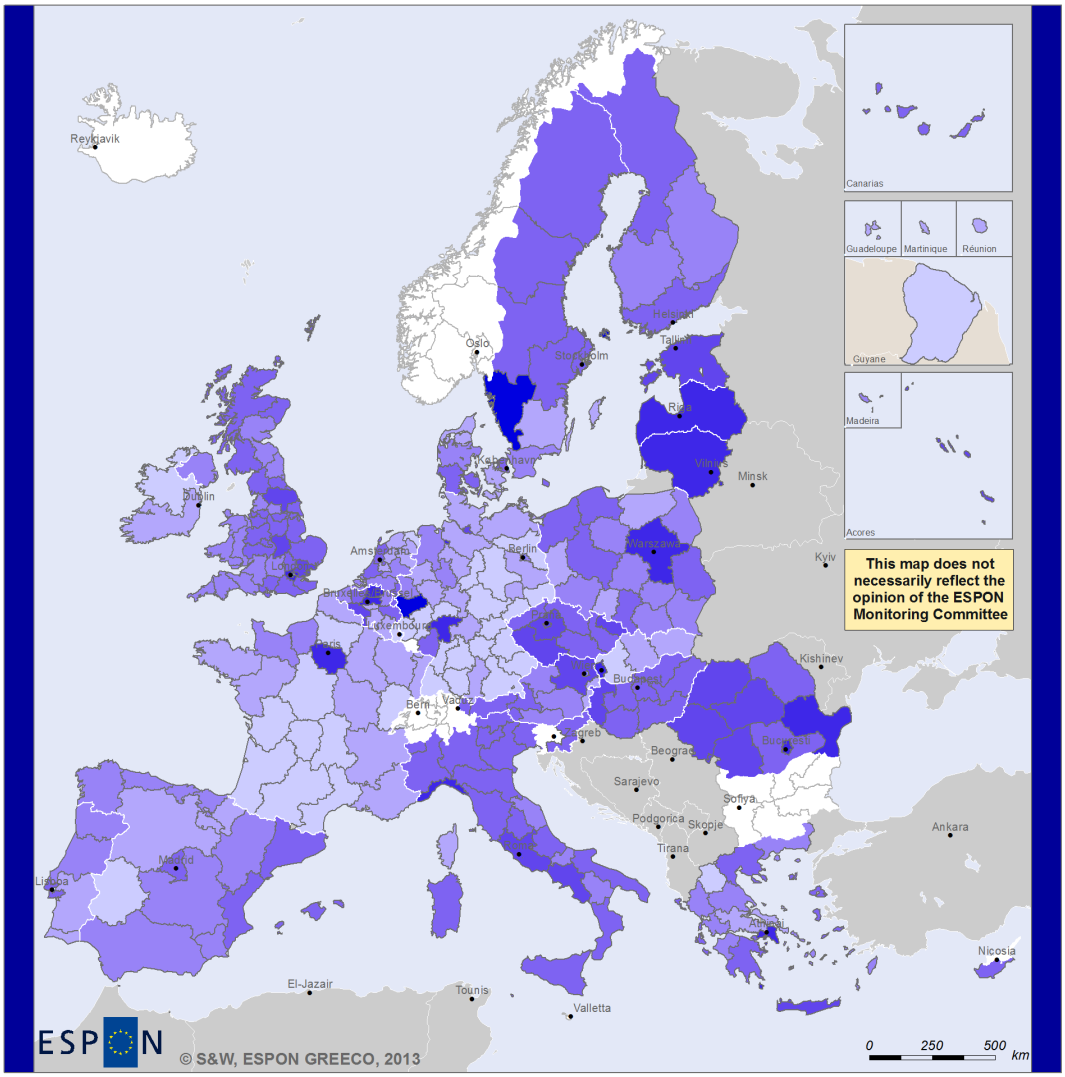


Figure 6. GVA shares of transport operation and storage

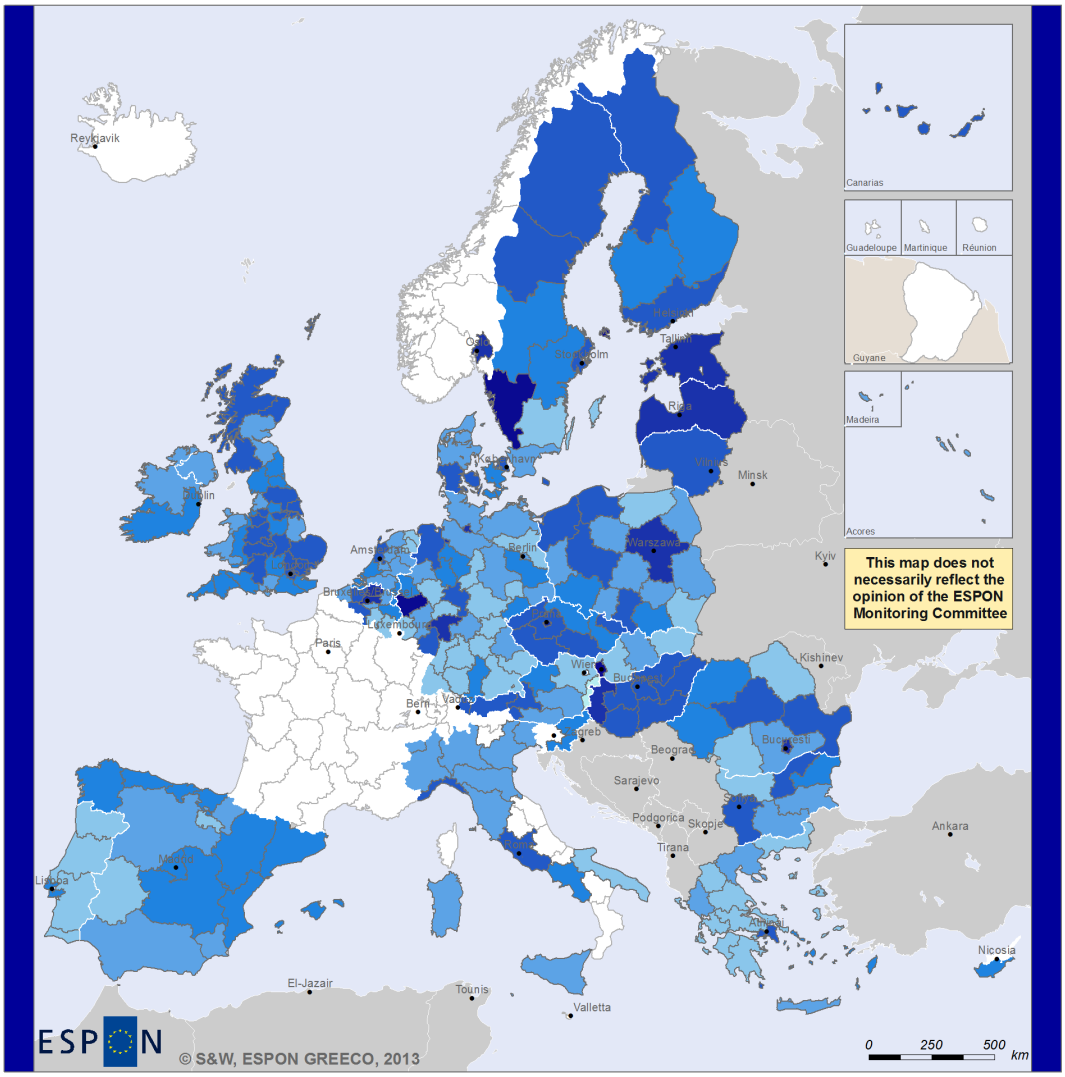
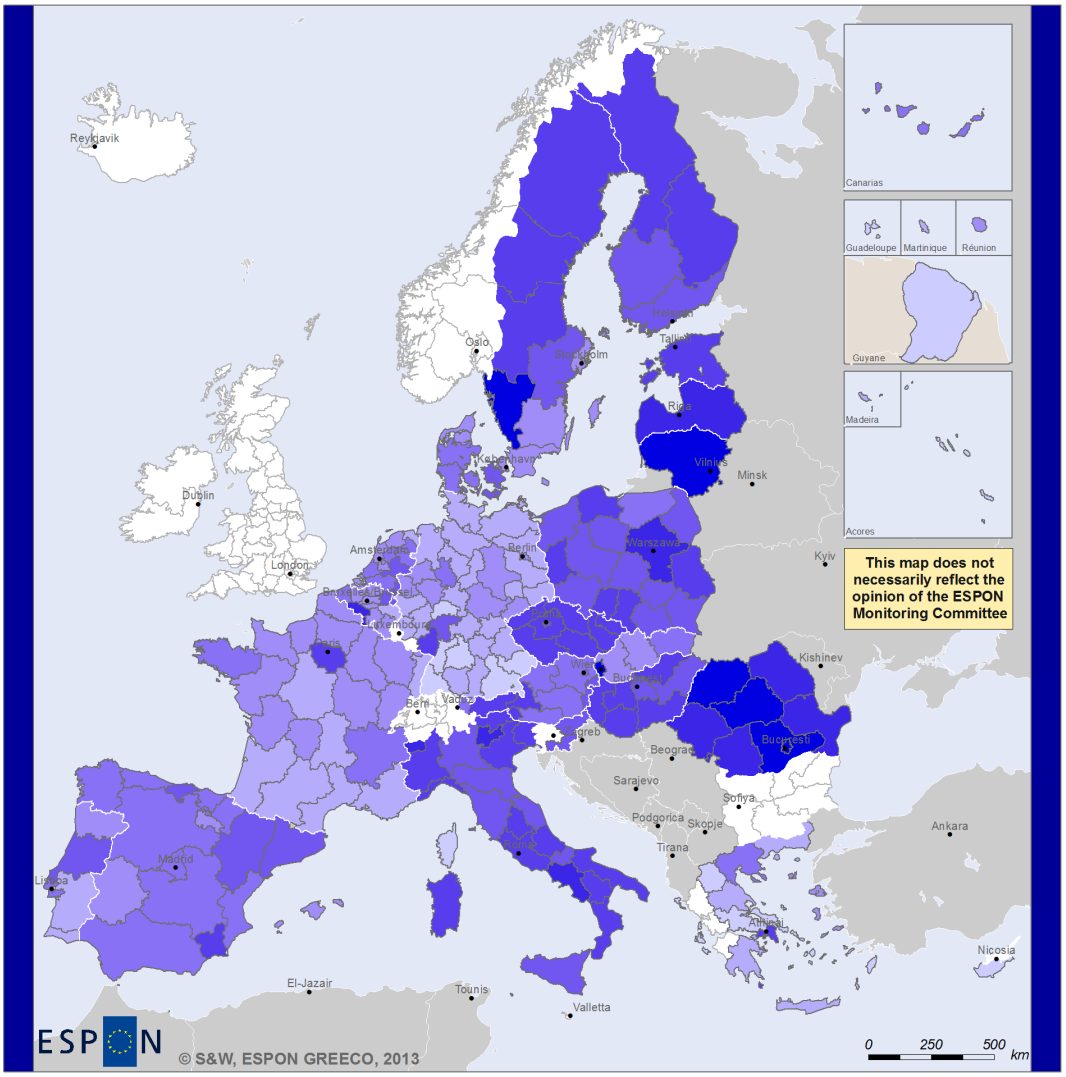


Figure 7. Employment shares of transport operation and storage



EUROPEAN UNION
Part-financed by the European Regional Development Fund
INVESTING IN YOUR FUTURE

Regional level: NUTS 2
Source: ESPON GREECO Database, 2013
Origin of data: Eurostat, 2013
© EuroGeographics Association for administrative boundaries

GVA of transport sector H49 (2009)
Land transport and transport via pipelines

Share of total GVA (in percent)

- < 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 4.5
- 4.5 - 6.0
- > 6.0
- no data

Figure 8. GVA shares of land transport

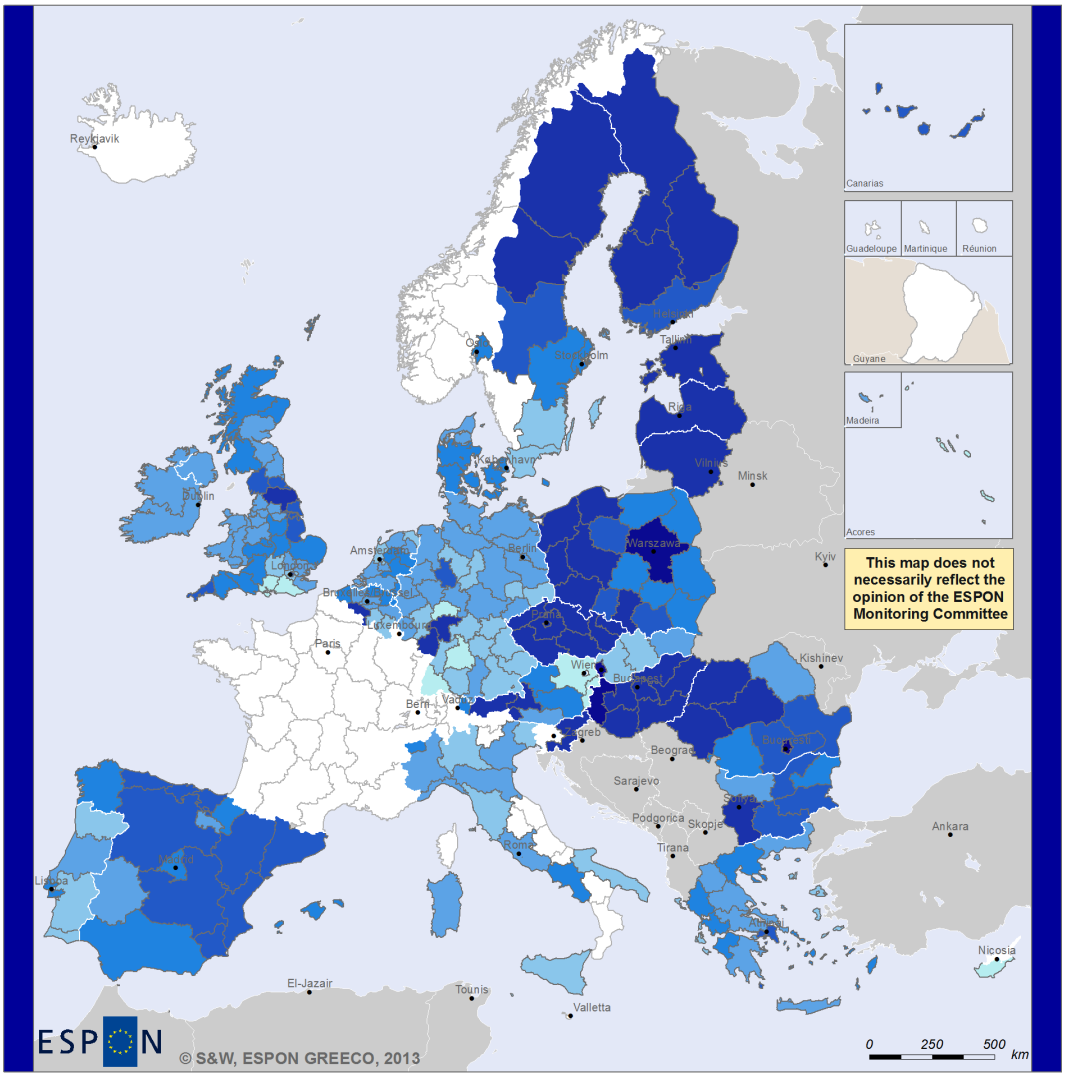
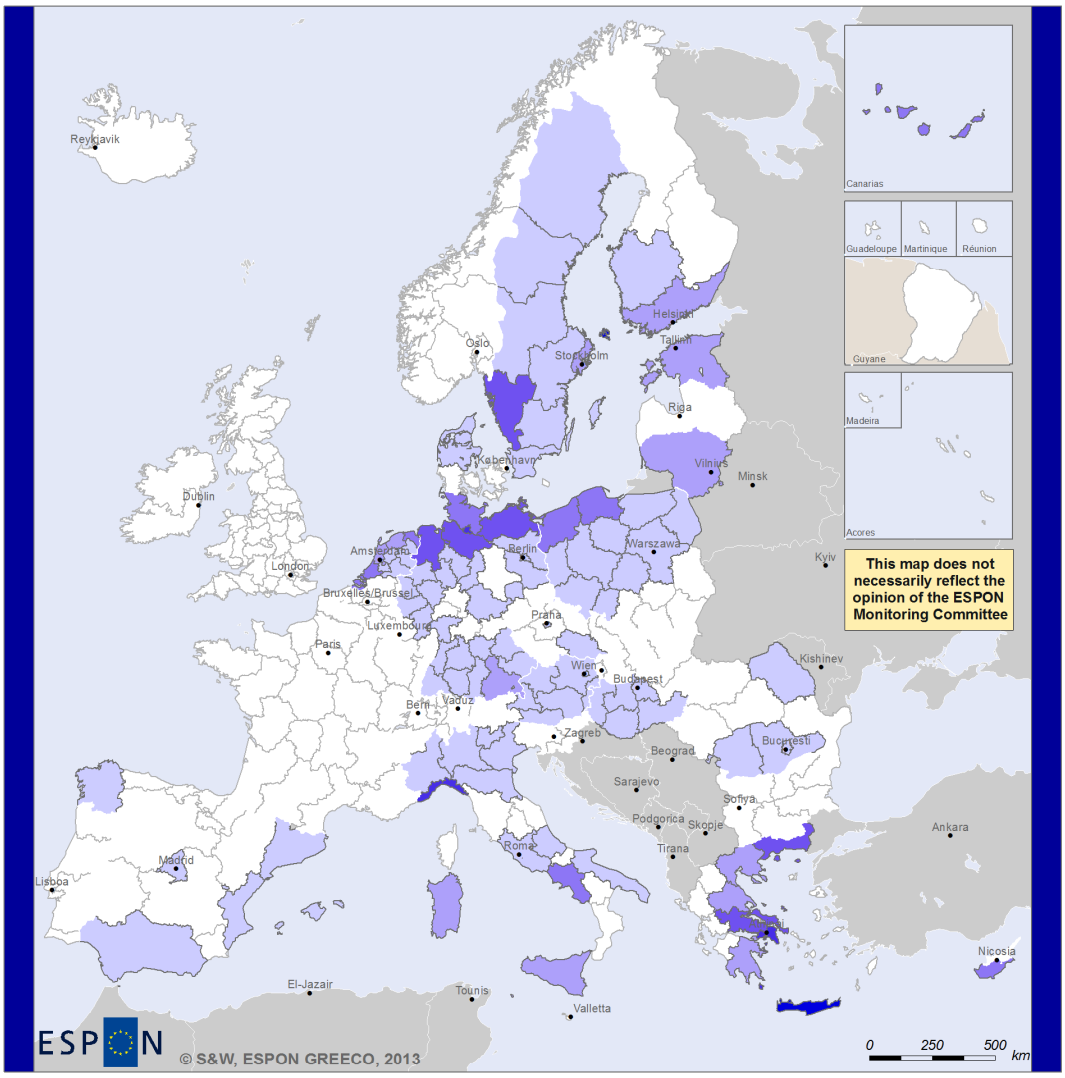


Figure 9. Employment shares of land transport



EUROPEAN UNION
Part-financed by the European Regional Development Fund
INVESTING IN YOUR FUTURE

Regional level: NUTS 2
Source: ESPON GREECO Database, 2013
Origin of data: Eurostat, 2013
© EuroGeographics Association for administrative boundaries

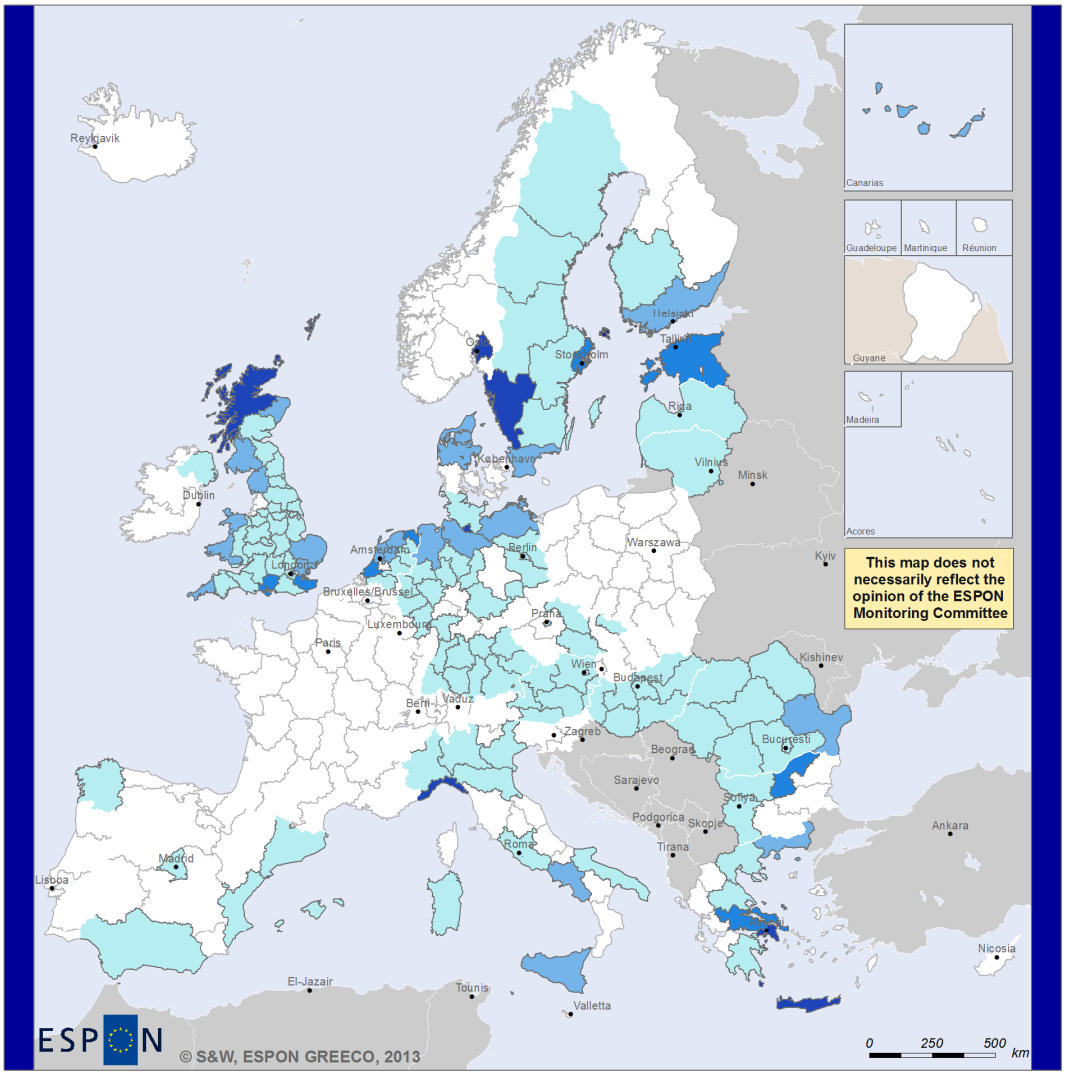
GVA of transport sector H50 (2009)
Water transport

Share of total GVA (in percent)

- < 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.5
- 2.0 - 5.0
- > 5.0
- no data

F

igure 10. GVA shares of water transport



EUROPEAN UNION
Part-financed by the European Regional Development Fund
INVESTING IN YOUR FUTURE

Regional level: NUTS 2
Source: ESPON GREECO Database, 2013
Origin of data: Eurostat, 2013
© EuroGeographics Association for administrative boundaries

Employment in transport sector H50 (2009)
Water transport

Share of total employment

- < 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 3.0
- > 3.0
- no data

Figure 11. Employment shares of water transport

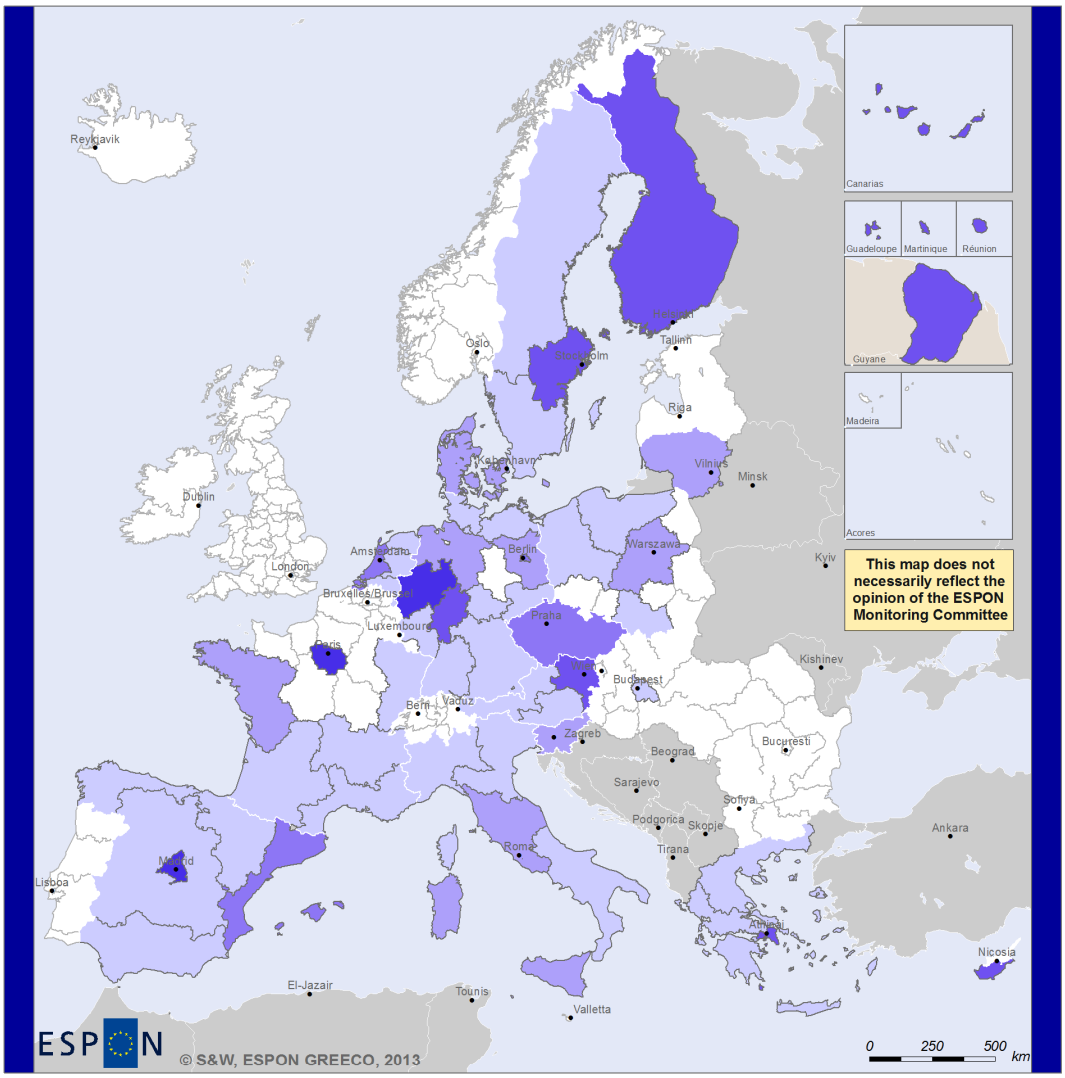


Figure 12. GVA shares of air transport

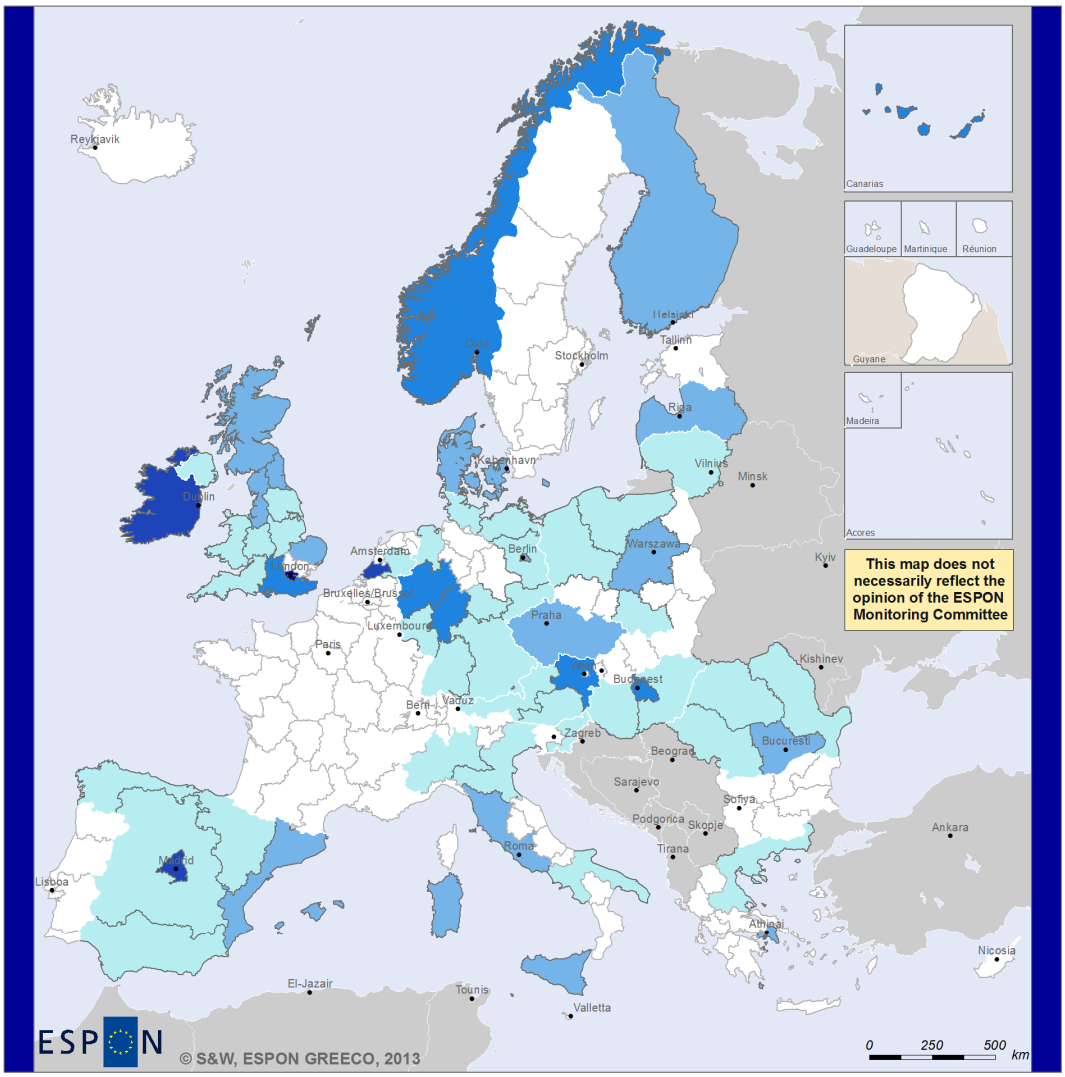
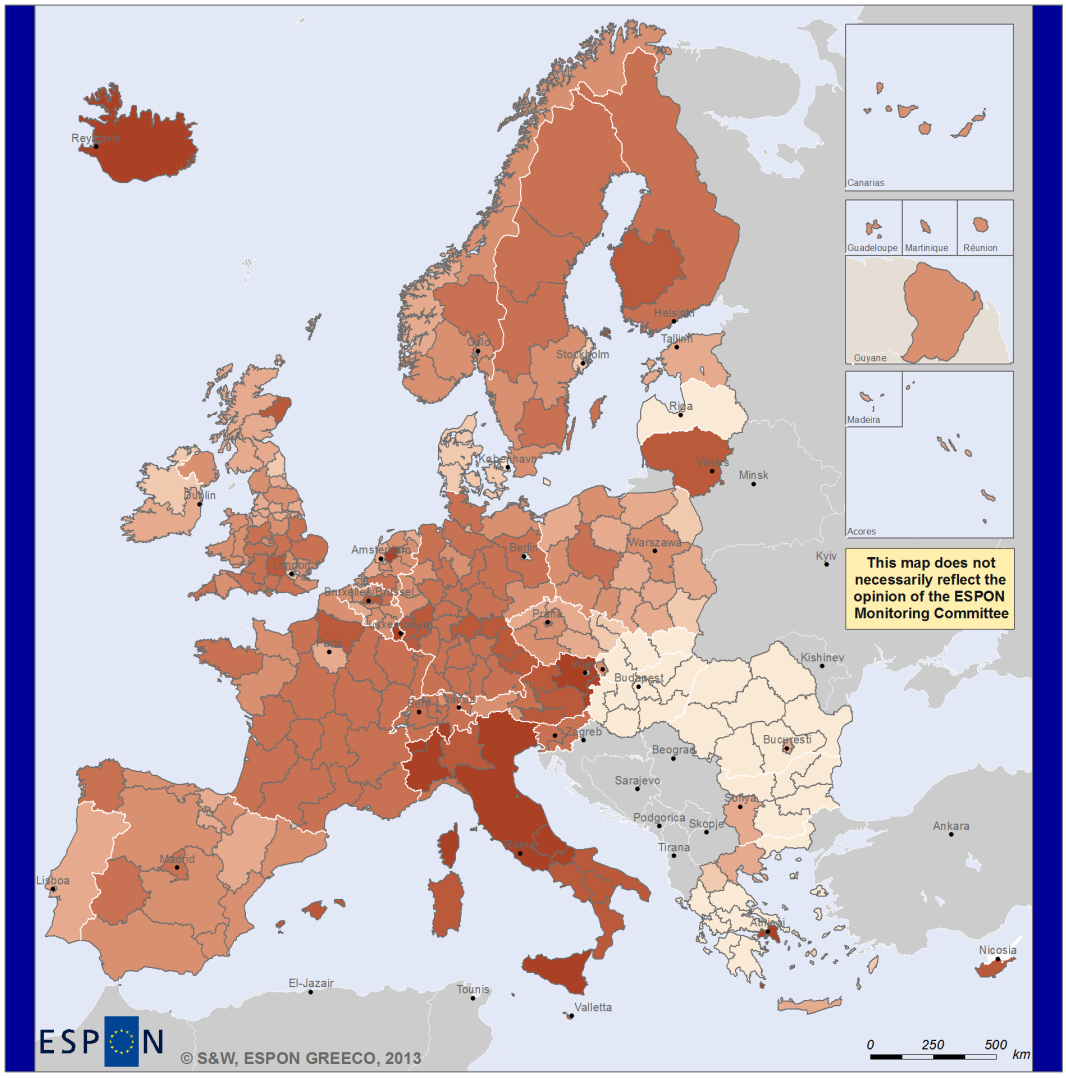


Figure 13. Employment shares of air transport

Passenger travel and freight transport.



EUROPEAN UNION
Part-financed by the European Regional Development Fund
INVESTING IN YOUR FUTURE

Regional level: NUTS 2
DK, FI (partly), IS, IT (partly), PT: NUTS 0
FR data for 2009
Source: ESPON GREECO Database, 2013
Origin of data: Eurostat, 2013
© EuroGeographics Association for administrative boundaries

Passenger cars per 1000 inhabitants 2010

< 350	500 - 550
350 - 400	550 - 600
400 - 450	> 600
450 - 500	no data

Figure 14. Motorisation rate

2.2 Environmental performance

Passenger travel and freight transport accounts for one third of European energy consumption. Of this, road transport is responsible for more than 80 percent of the energy consumption. Biofuels are currently only about 6 percent of all energy.

Whereas total greenhouse gas emissions in EU27 was reduced by about 10 percent from 1990 to today, transport's greenhouse gas emission has increased by one third. Today's share of total EU27 greenhouse gas emission is about 26 percent, but was only about 17 percent in 1990. The increase is mainly due to strong increases in road transport and also in civil aviation.

The transport sector generates emissions of different pollutants and noise. Whereas emissions are being clearly reduced through EU regulations, traffic noise continues to be a problem. Exposure to population, in particular in urban areas, and related health effects are the outcome.

Increasing landscape fragmentation created by new transport infrastructure is a side-effect of linking peripheral regions and of densification of transport links in other regions.

There are enormous environmental risks induced through the transportation of hazardous goods. Accidents of oil tankers or other ships, lorries or freight trains might cause huge damage to the environment.

Vehicle production.

Transport infrastructure provision.

The transport sector is an important consumer of land resources. The LUCAS (Land cover and land use, landscape) survey based assessment of land use in Europe by Eurostat (2012) states for the 23 EU countries involved that 91,790 square kilometre are covered by transport infrastructure. This is 2.3 percent of the territory. However, the range between countries is widespread. The share of land covered by transport infrastructure is only about 1.0 to 1.5 percent in the Nordic countries and the Baltic States and Slovakia, but rises to about four percent in Germany, five percent in Belgien, six percent in Luxembourg and even 11 percent in the Netherlands (see Figure xxx).

Figure xxx: Share of total territory covered by transport infrastructure (Source: Eurostat, 2012)

In Germany, transport infrastructure covers about five percent of the European territory; 90 percent of the area devoted to transport is used by streets. This is in line with assessments for other European countries in which streets cover more than 90 percent of the land use category transport. The remaining parts are half covered by rail infrastructure, the other half by air and water transport.

Transport operation / Passenger travel and freight transport.

2.3 Decoupling transport and economic growth

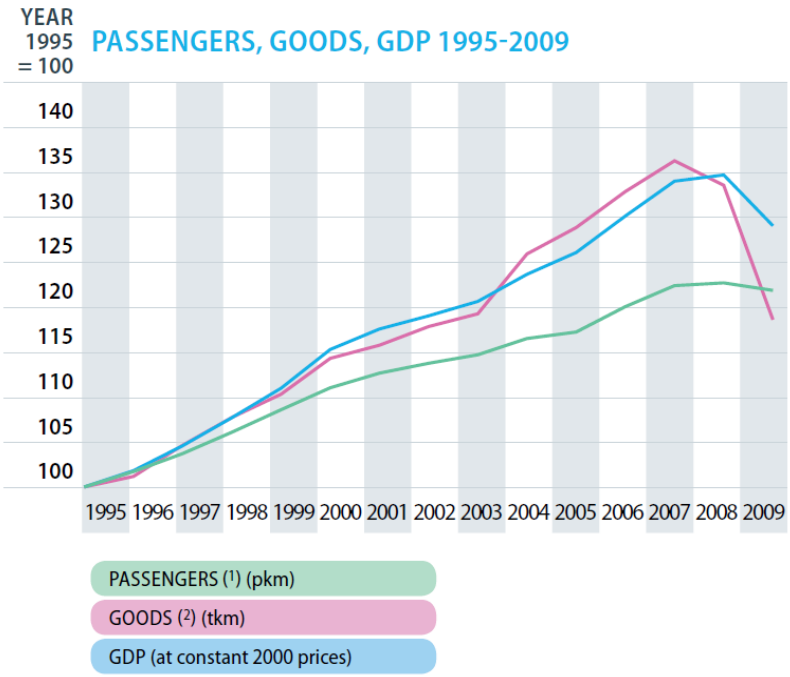


Figure 15. Transport development, EU27 1995-2009 (European Commission, 2011d)

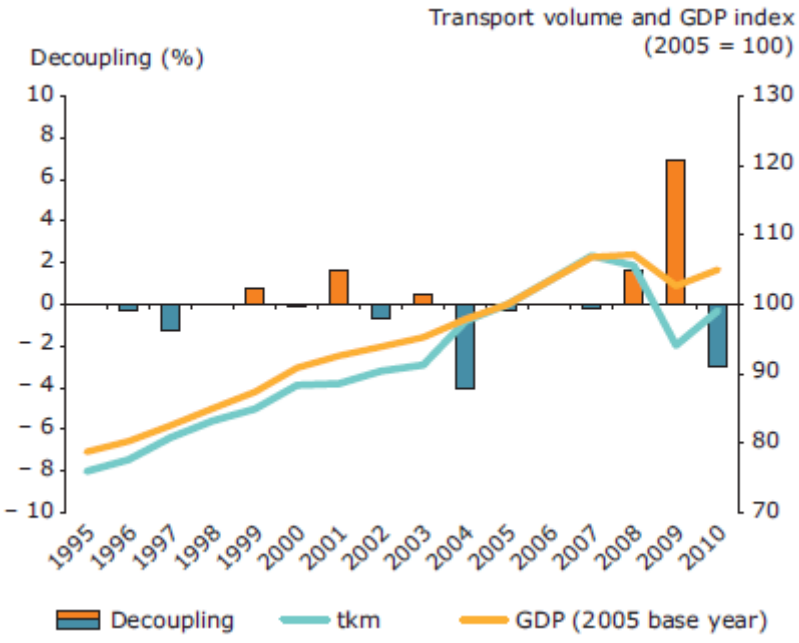


Figure 16. Decoupling of freight transport and GDP (EEA TERM 2012, p. 29)

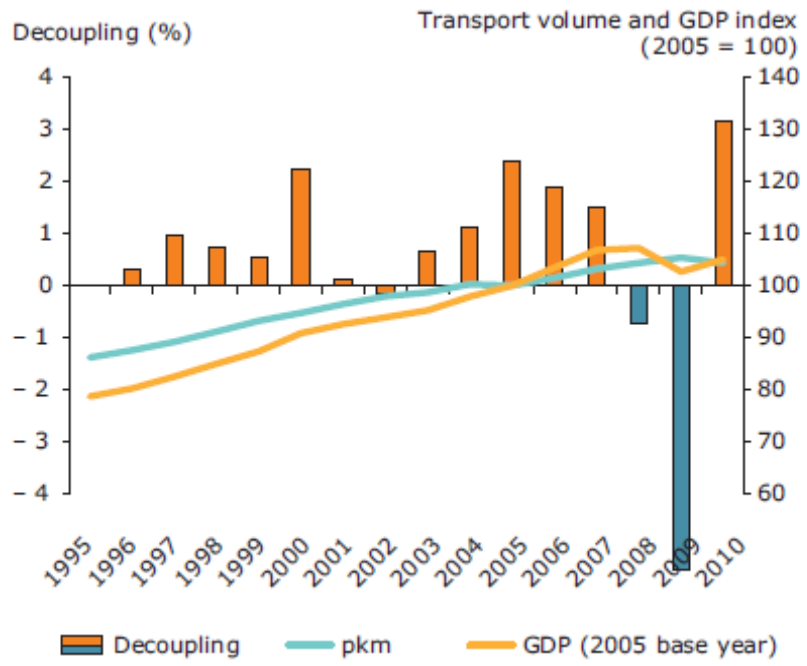


Figure 17. Decoupling of passenger transport and GDP (EEA TERM 2012, p. 31)

Vehicle production.

Transport infrastructure provision.

Transport operation / Passenger travel and freight transport.

3 Drivers and Enablers

3.1 Policies at EU level

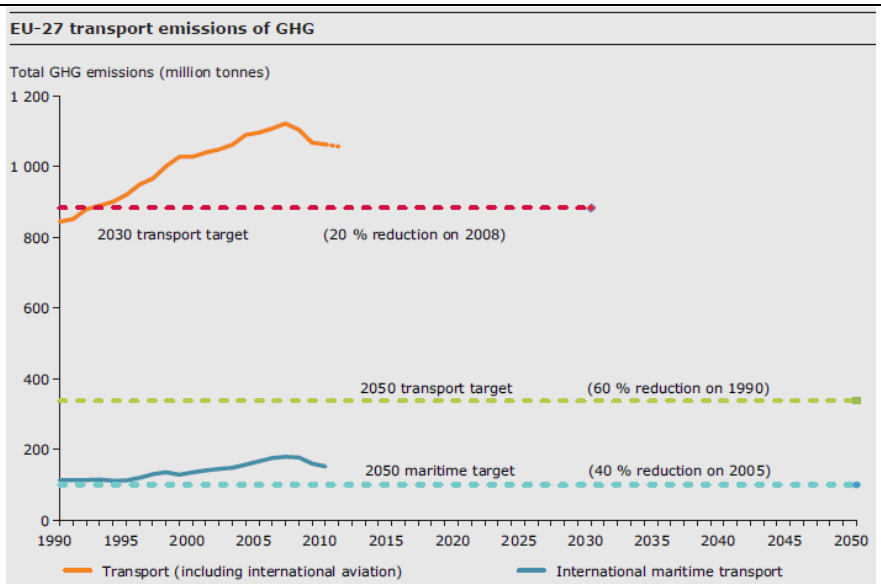
There are several EU policies at work for the transport sector. The most important current document is the White Paper Roadmap to a Single European Transport Area (European Commission, 2011a) as it sets the environmental targets to be reached. In addition, there are several EU directives, regulations and initiatives for greening the transport sector (to be discussed here).

Table P1. Transport White Paper

Type of policy and hierarchy	White Paper
Name	White Paper 'Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport *Related sources:* EC - European Commission (2011a): White Paper 'Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system. COM(2011) 144 final. EC - European Commission (2011b): Impact Assessment. Accompanying document to the White Paper 'Roadmap to a Single European Transport Area – towards a competitive and resource-efficient transport system. SEC(2011) 358 final. EC - European Commission (2011c): 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.
Description	The White Paper on transport is a roadmap for the transport system in Europe. It contains the vision of the European Commission for a competitive and sustainable transport system, includes ambitious targets to be achieved and defines the policy agenda for the next years. The White Paper emphasis the important role transport has for the European economy and citizens, thus accepting growing transport volumes and mobility as "curbing mobility is not an option" (EC, 2011a, 5). At the same time, the White Paper tries to handle this with objectives and measures for strictly greening the performance of the transport system. "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. In practice, transport has to use less and cleaner energy, better exploit a modern infrastructure and reduce its negative impact on the environment and key natural assets like water, land and ecosystems" (EC, 2011a, 5). By doing so, the transport system is expected to clearly reduce its oil dependency and to reach a 60% reduction of greenhouse gas emissions by 2050 compared to 1990. Other parts of the vision elaborated in the White Paper on transport include efficient core networks for multimodal intercity travel and transport, considerations for long-distance travel and intercontinental freight by air and mari-

	time, expectations for clean urban transport and commuting and a set of ten goals for the transport system (see below). The implementation strategy outlined in the White Paper is very comprehensive. It is organised in four main pillars, a single European transport area as framework for transport users and operators, innovation in technology and behaviour, modern transport infrastructure including smart pricing and funding, and finally the external dimension of transport. The White Paper includes a list of 40 initiatives foreseen most of them subdivided in several parts. Those initiatives are to be taken into consideration in the ongoing decade to move from the vision to future reality (see also EC, 2011c).
Targets	The key target of the White Paper on transport for the European transport system is to reduce greenhouse gas emissions of at least by 60% in the year 2050 compared to 1990. As intermediate target for 2030, the greenhouse gas emission of transport should be 20% below the 2008 level. Because of the growing emissions throughout the last two decades this target for 2030 would still be 8 % above the level of 1990. The White Paper on transport includes a set of ten objectives organised under three main headings to develop a competitive and resource-efficient transport system and to achieve the greenhouse gas emission targets (EC, 2011a): **Developing and deploying new and sustainable fuels and propulsion systems:** • (1) 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. • (2) Low-carbon sustainable fuels in aviation to reach 40% by 2050; also by 2050 reduce EU CO_2 emissions from maritime bunker fuels by 40% (if feasible 50%). **Optimising the performance of multimodal logistic chains, including by making greater use of more energy-efficient modes:** • (3) 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. • (4) 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. • (5) A fully functional and EU-wide multimodal TEN-T 'core network' by 2030, with a high quality and capacity network by 2050 and a corresponding set of information services. • (6) By 2050, connect all core network airports to the rail network, preferably high-speed; ensure that all core seaports are sufficiently connected to the rail freight and, where possible, inland waterway system. **Increasing the efficiency of transport and of infrastructure use with information systems and market-based incentives** • (7) Deployment of the modernised air traffic management infra-

	structure (SESAR12) in Europe by 2020 and completion of the European Common Aviation Area. Deployment of equivalent land and waterborne transport management systems (ERTMS13, ITS14, SSN and LRIT15, RIS16). Deployment of the European Global Navigation Satellite System (Galileo). • (8) By 2020, establish the framework for a European multimodal transport information, management and payment system. • (9) By 2050, move close to zero fatalities in road transport. In line with this goal, the EU aims at halving road casualties by 2020. Make sure that the EU is a world leader in safety and security of transport in all modes of transport. • (10) Move towards full application of "user pays" and "polluter pays" principles and private sector engagement to eliminate distortions, including harmful subsidies, generate revenues and ensure financing for future transport investments.	
Territorial implication	**Characterisation**	strong
	Description	The implications for territorial development of the White Paper on transport are widespread. If the planned transformation of the transport system will be realised, all territories will be affected by the different actions. There are also several elements of the roadmap for which the implementation is with the national and/or regional level.
Indicators	The impact assessment accompanying the White Paper on transport (EC, 2011b, 88f.) contains a list of core transport indicators that should be used to measure to what extent the measures taken will be in line with the objectives stated. The indicators include: • Share of renewable energy in transport • GHG emissions from transport • Emissions of particulate matter from transport • Fragmentation due to transport infrastructure • Average CO2 emission per km from new passenger cars • R&D intensity in transport • Modal split of passenger transport • Modal split of freight transport • Investment in transport infrastructure to GDP • Road safety	
Distance to target (Graph or map should be provided in support of the distance to target analysis)	***Transport emission of greenhouse gases***	

	 Source: EEA (2012, 16) The targets are: - 60 % reduction in 2050 with 1990 as reference - 20 % reduction in 2030 with 2008 as reference	
Policy effectiveness	**Characterisation**	*n/a*
	Description	As the White Paper on transport is only two years in place and the targets are set for the next four decades, it is too early to make an assessment of the effectiveness of the policy.
Transformative character of policy	**Characterisation**	*Incremental - radical*
	Description	Some of the elements of the White Paper on transport are incremental such as many of the technological options and emission regulations foreseen, other are more radical such as the ban of conventionally fuelled cars from cities. However, as the White Paper does not change fundamentally the way transport is driven by demand, it cannot be seen as transformative, i.e. it does not aim at a complete paradigm shift.
Green economy implication	**Characterisation**	*Positive strong (++++)*
	Description	The transformation of the transport system as foreseen in the White Paper on transport has widespread implications for all domains of the green economy as defined in GREECO (EC, 2011b): • In the economic sphere, the "decarbonisation of transport can be expected to have a favourable effect on 'green jobs' in Europe" (EC, 2011b, 70). Accordingly, improvements of the transport system would foster employment in transport services, transport technology improvements would benefit the sector of manufacturing equipment, particularly with demand for highly skilled labour force. • In the environmental sphere, the implementation of the transformation of the transport sys-

		tem would be beneficial in many respects. The White Paper's impact assessment (EC, 2011b) foresees a reduction in CO_2 emissions by the year 2050 clearly below the target for transport of 60 % of the level in the year 1990. Similar impacts can be expected for NOx and PM emissions which would go down to 20 to 30 % of current levels. Final demand of oil by transport would go down from currently 350 Mtoe to about 100 Mtoe. However, the White Paper contains also a strong transport infrastructure component which would lead to increase in land use for transport with consequences of additional pressure on biodiversity and ecosystem services. • In the societal sphere, public health and quality of life would strongly increase due to less air pollution and reduced noise levels. • In the econosphere, energy intensity would be clearly improved. Energy use per passenger-km would go down to about 35-40 % compared to today; energy use per tonne-km would go down to 50% of current levels.

Table P2. Trans-European Transport Network

Type of policy and hierarchy	Guideline
Name	Trans-European Transport Network *Related sources:* European Commission (2011): Proposal for a regulation of the European Parliament and of the Council on Union guidelines for the development of the trans-European transport network. COM(2011) 650 final/2. European Communities (1996): Decision No 1692/96/EC of the European Parliament and of the Council of 23 July 1996 on Community guidelines for the development of the trans-European transport network. Official Journal of the European Communities L 228, 9.9.1996. European Union (2010): Decision No 661/2010/EU of the European Parliament and of the Council of 7 July 2010 on Union guidelines for the development of the trans-European transport network (recast). Official Journal of the European Union L 204, 5.8.2010.
Description	The development of trans-European transport networks has been established as a policy field of the European Union in the Treaty of Maastricht Treaty on the European Union in 1992. Following that first guidelines were decided in 1996 (European Communities, 1996) and subsequently amended (see European Union, 2010). In 2013, the European Union's transport infrastructure policy got a major revision as agreed in a Trialogue of the Commission, the Council and the Parliament based on a Commission proposal (European Commission, 2011).

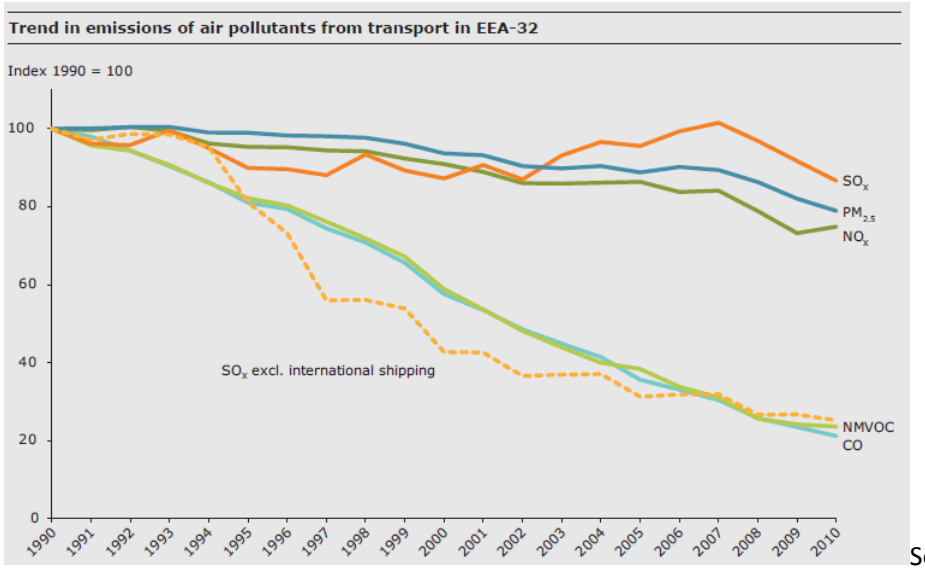
	The new TEN-T network will consist of a core transport network and a comprehensive network. The core transport network is defined by nine major corridors (two north-south, three east-west and four diagonal corridors). It shall be completed by 2030. The core network is to remove missing links and bottlenecks, to upgrade infrastructure, to improve connections between different transport modes and to enhance cross border transport for passenger and freight. The core network is expected to be the backbone of the Single Market and to contribute to the EU's climate change objectives. The comprehensive network shall cover the full territory of the EU and shall link all regions to the core network.	
Targets	Core network by 2030. Comprehensive network by 2050. "The aim is to ensure that progressively, and by 2050, the great majority of Europe's citizens and businesses will be no more than 30 minutes travel time from this comprehensive network" (European Commission, 2013, 1).	
Territorial implication	**Characterisation**	***Strong***
	Description	As all regions of the European Union will be connected to the trans-European transport network, territorial effects are to be expected all over Europe. The general expectation for the effects is that the TEN-T will contribute to competitiveness of regions and to territorial cohesion.
Indicators	Possible indicators include • Investment in TEN-T • Length of newly built TEN-T network by mode	
Distance to target (Graph or map should be provided in support of the distance to target analysis)	n/a	
Policy effectiveness	**Characterisation**	*Average to strong*
	Description	The TEN-T guidelines of the last two decades have been too optimistic with respect to the time needed to build the infrastructure. The result is that a good part of the infrastructure plan was realised, but not everything. Reasons for delayed implementation can be seen in problems of financing and in the fact that final decisions on infrastructures to be built are with the member states which might have other priorities. However, for the next financial period 2014-2020 the EU contribution via the Connecting Europe Facility is with 26 billion Euro three times higher than currently and is about 10 percent of the investment needed in that time period for the core network. About 11 billion Euro of this budget is foreseen for cohesion countries.
Transformative character of policy	**Characterisation**	*Incremental*
	Description	The TEN-T policy is a continuation of infrastructure policy of the past which tries to serve transport demand. However, there seems to be a shift in focus towards more environmental friendly modes of transport.
Green economy	**Characterisation**	*Mixed*

implication	**Description**	The TEN-T is seen "as an essential tool for transport policy to meet the overall target to reduce by 60% emissions from transport by 2050" (European Commission, 2013, 7). The expectation is that the TEN-T network as multimodal network will induce a substantial shift of passengers and freight from road to rail and other transport modes. However, it can also be expected that new transport infrastructure induces new demand. In any case, new transport infrastructure has negative environmental implications in terms of land take and fragmentation. Expectations for impacts on the economy and territorial cohesion are positive. However, it depends on the type of infrastructure whether the economic impact has a "green" component.

Table P3. Transport emissions and energy use

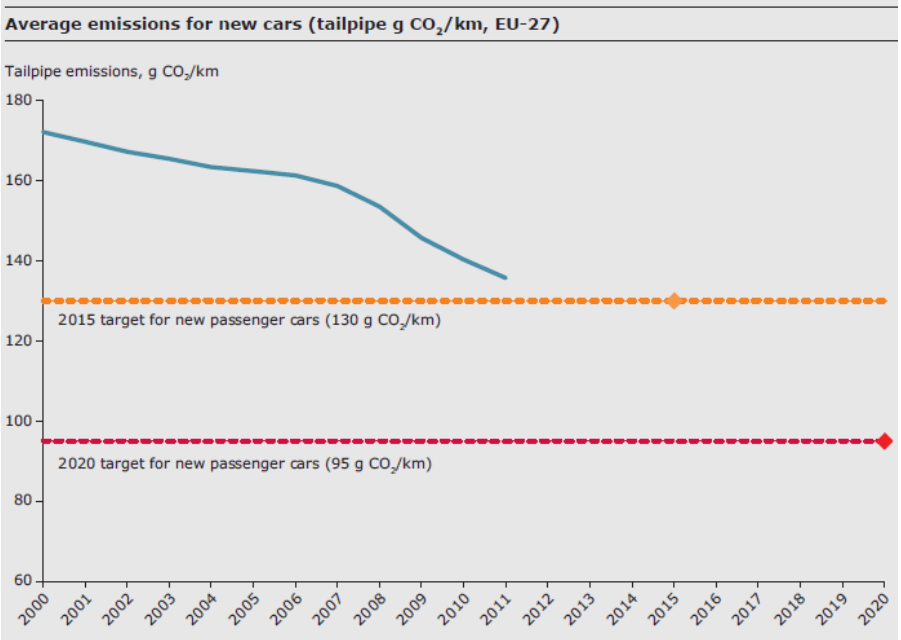
Type of policy and hierarchy	**EU regulations and directives**
Name	Several EU regulations and directives on transport emissions and energy use *Related sources:* European Union (2007): Regulation (EC) No 715/2007 of the European Parliament and of the Council of 20 June 2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information. Official Journal of the European Union L 171, 29.06.2007. European Union (2008): Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe. Official Journal of the European Union L 152, 11.06.2008. European Union (2009a): Regulation (EC) No 443/2009 of the European Parliament and of the Council of 23 April 2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO2 emissions from light-duty vehicles. Official Journal of the European Union L 140, 5.6.2009. European Union (2009b): Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. Official Journal of the European Union L 140, 5.6.2009. European Union (2009c): Regulation (EC) No 595/2009 of the European Parliament and of the Council of 18 June 2009 on type-approval of motor vehicles and engines with respect to emissions from heavy duty vehicles (Euro VI) and on access to vehicle repair and maintenance information and amending Regulation (EC) No 715/2007 and Directive 2007/46/EC and repealing Directives 80/1269/EEC, 2005/55/EC and 2005/78/EC. Official Journal of the European Union L 188, 18.7.2009. European Union (2011): Regulation (EU) No 510/2011 of the European Parliament and of the Council of 11 May 2011 setting emission performance standards for new light commercial vehicles as part of the Union's integrated approach to reduce CO_2 emissions from light-duty vehicles. Official Journal of the European Union L 145, 31.05.2011.
Description	During the last decades, the European Union has developed a set of regulations and directives that directly address the environmental performance of transport, in particu-

	lar of road vehicles. This includes CO_2 emissions of new road vehicles, air pollution from road vehicles, the use of renewable energy in transport and air quality standards. In addition, there are other regulations and directives for the transport sector not further detailed here such as the directive on automotive fuel quality (European Union, 2003)	
Targets	• CO_2 emissions of new cars are regulated. Regulation 443/2009/EC (European Union, 2009a) sets for the new car fleet an average passenger car emissions target of 130 g CO_2/km by 2015 and of 95 g CO_2/km from 2020 onwards. Regulation 510/2011/EC (European Union, 2011) gives for new light commercial vehicles a target for the new fleet of 175 g CO_2/km by 2017 and of 147 g CO_2/km by 2020. • Maximum emissions of air pollutants from cars and heavy vehicles are defined in the Euro standards. Regulation 715/2007/EC (European Union, 2007) defines the Euro 6 standards to be applied for new light vehicles from 2014 onwards and for new types of cars from 2015 onwards. Regulation 595/2009/EC (European Union, 2009c) defines the Euro VI standards for heavy vehicles from 2012 onwards.. • Directive 2008/50/EC (European Union, 2008) on ambient air quality and cleaner air for Europe defines limit values for the atmospheric concentrations of main pollutants, including sulphur dioxide (SO_2), nitrogen dioxide (NO_2), airborne particulate matter (PM) with a diameter of 2.5 micrometers or less (PM2.5) or a diameter of 10 micrometers or less (PM10), lead, carbon monoxide (CO), benzene (C6H6), and ozone (O3) for EU Member States. • Directive 2009/28/EC on renewable energies (European Union, 2009b) requires from all EU Member States to achieve a 10 % share in renewable energy by 2020 for all transport.	
Territorial implication	**Characterisation**	*weak (implementation)* *strong (effects)*
	Description	Regions do not have a role in the implementation of this type of policies as this is directly with the European Union or has to be done by the member states. However, the territorial effects are strong as regions do benefit by improved environmental conditions. This is particular the case for those regions that are nowadays mostly harmed by transport caused air pollution, i.e. agglomerations but also small and medium-sized cities. Also, rural regions will have additional economic opportunities provided through the possible production of biofuels.
Indicators	• CO2 emission of transport • CO2 emission of new vehicle fleet • air pollution from transport for different pollutants • share of renewable energy in transport • air quality	
Distance to target (Graph or map should be provided in support of the distance to target analysis)	***Air pollution from transport***	



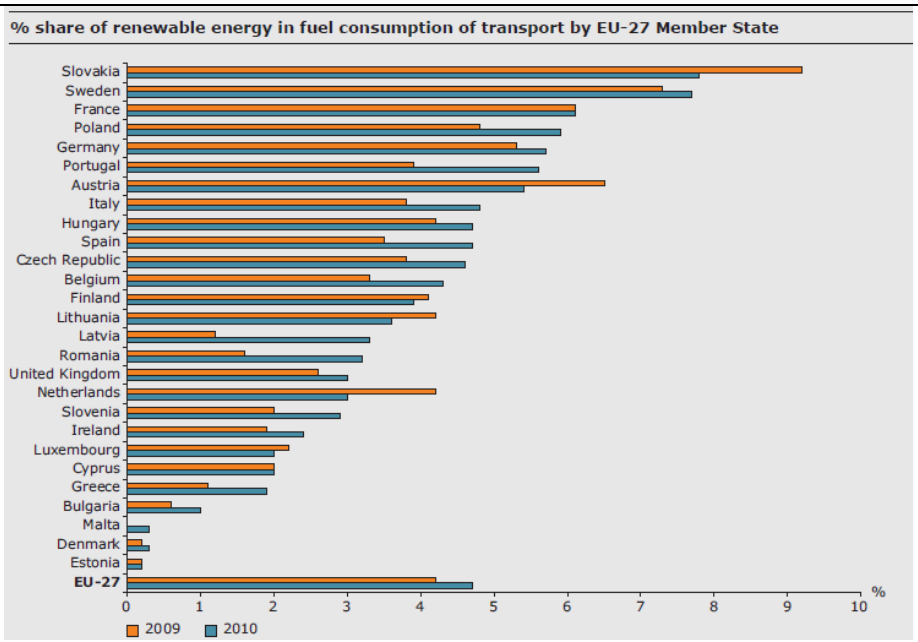
Source: EEA (2012, 17)

Average CO2 emission for new cars



Source: EEA (2012, 24)

Renewable energy in fuel consumption of transport



Source: EEA (2012, 25)

Policy effectiveness	**Characterisation**	*Strong*
	Description	As most of the policies referred to contain binding targets in form of emission standards, the automotive industry has to follow it. For other targets such as the share of renewal energy in transport's energy consumption to be achieved by each member state, all countries are on the right path.
Transformative character of policy	**Characterisation**	*Incremental*
	Description	The policy instruments are mostly a continuation of past legislation with more ambitious targets for the reduction of pollution and CO2 emission and to increase the share of renewable energy in transport.
Green economy implication	**Characterisation**	*positive strong*
	Description	• The EU regulations and directives have a positive impact on the environment as air pollution from transport will be further reduced. • Stricter emission standards contribute to innovation in the automotive industry. GVA and employment effects are difficult to assess. The production of biofuels potentially provides new economic opportunities. • The decrease of air pollution reduces the health risk of the population, in particular in cities.

3.2 Policies at national and regional level

industrial policy

infrastructure policy

spatial planning

speed limits

road pricing

environmental zones

financial incentives

3.3 Non-policy drivers

Table D1. Energy price for transport

Factor	***Energy price for transport***
Description	The operating costs of vehicles for individual transport include three main elements: motor vehicle taxes and insurance cost, energy costs (including taxes on energy) and maintenance and repair costs. As oil-based energy is still the main source for cars and trucks, the development of world oil price is an important factor for the price of transport energy. The world oil price is subject to political and strategic decisions of the oil producing countries and enterprises with the consequence of frequent fluctuations of the price. However, the fluctuations of the world oil price are not directly reflected in the fuel price at the pump station; market elements are an important filter to dampen the price fluctuation. In times of oil peak and the raising consciousness that crude oil is a limited resource, it can be expected that the price for it will steadily rise in future. It has to be noted that the energy price for transport is not a clear non-policy green growth factor as energy for transport is subject to financial policies. If one decomposes the energy price, in many countries the tax component including energy and value added tax is as high or even higher than the pure energy cost component.
Specificity for the green economy	The cost of energy for all types of transport was for decades a factor that was almost neglected. The development of less dense settlement types, of urban sprawl, deurbanisation etc. was only possible because transport costs, in particular fuel costs for personal cars, did not play a major role in location decision. In the same line of arguments, the functional separation of the economy, eventually leading to globalisation, was only possible, because transport costs are a very minor part of the costs of a product. Low energy costs are therefore responsible for rising transport volumes. Rising transport energy costs would support all components of the avoid, shift and improve strategy. For personal travel, it would mean to

	reconsider the necessity for long-distance travel, it might shift trips to more sustainable modes of transport, i.e. it would reduce passenger km demand. However, it has been shown that the price elasticity of fuel demand is rather in-elastic if the price increases are rather moderate. It would also increase the demand for more energy-efficient cars. For goods transport, it would mean that transport costs would play a larger role in production costs. The relationship of the locations of production and markets would be reconsidered which might lead to production of goods more closely to markets. On the production side of the transport sector, rising energy prices for transport would accelerate the ongoing progress towards more energy-efficient vehicles. Technical potentials exist in the field of optimising existing and alternative engine systems and in the reduction of vehicle weights and the related downsizing of vehicles. It would also give a boost for innovations in collective travel.
Provable impact on the green economy spheres	**Economic: positive impact (+)** Steadily rising transport energy costs would give an impetus to the automotive industries to invest more in innovation and to develop energy-efficient vehicles and vehicles driven by alternative energy forms. **Environmental: positive impact (+)** Rising transport energy costs would have a positive impact on the environment. Decreasing transport volumes, more energy-efficient and less polluting cars would generate much less external costs of the transport system than today. **Social: neutral to negative impact (o +)** Rising transport energy prices would be at the disadvantage of less affluent population groups. It would put such groups at risk that they cannot fulfil their mobility demands. However, it can be expected that the efficiency gain of transport vehicles and the development of innovative forms of public and semi-public transport would offset such negative impacts. **Territorial: positive impact (+)** Rising transport energy prices would work in favour of more balanced and compact territorial developments. Local qualities and accessibility would matter again much more as factors for location decisions of households and firms. In addition, the external costs generated by the transport sector would be reduced which would also be of benefit for different territories.
Trade-offs: mixed +/- impacts on green economic spheres?	n/a
Externalities: impact on other sectors / case studies	There are strong impacts on other sectors of the economy. As transport is crucial for almost all economic activities, rising transport energy costs would lead to higher production costs of goods. This might have a nega-

	tive impact on those sectors in the beginning, however, in the medium and long term this would lead to a reorientation of the spatial organisation of the economy and would work in favour of endogenous regional economic development.
Interactions with other factors	This factor has an impact on the factor behavioural change (see below)
Causal level of operation (proximate/direct versus underlying/indirect factors)	Energy price is an indirect factor as its effectiveness is vial a longer and long-term impact chain
Spatial level of operation（internal versus external factors)	The spatial level of operation is clearly external as it comes to regions from outside and can hardly be influenced there.
Type of market force involved	Rising transport energy prices is both a demand-side factor and a supply-side factor. At first, it influences transport demand, but in consequence it has a strong impact on the supply-side in the transport system.
Policy recommendations: making the link between policy and non-policy factors	As stated above, rising transport energy costs can be happen because of the world crude oil market and possible scarcity of resources (peak oil), but can also be introduced as a policy. Such a policy could be justified by the negative climate impacts of using fossil fuels. On the other hand, policies fostering R&D in the automotive sector for a more energy-efficient transport system, policies supporting alternative and innovative ways of collective transport would enhance the greening of the transport induced by the factor rising transport energy costs.
Possible indicators	Fuel price

Table D2. Income and wealth growth

Factor	***Income and wealth growth***
Description	At the micro level, the disposable income of households is a decisive for the way the household interacts with the transport system. In general, it can be said that with higher income the household tends to have more cars, to have cars with larger engine sizes and energy use, to travel longer distances and to use more often the airplane. This pattern is repeated at the macro level of society. The higher the GDP per capita in a given country the higher is for instance the motorisation rate in that country and also the freight transport volume.
Specificity for the green economy	One of the challenges for greening the transport sector is to decouple the relationship of wealth and higher transport volumes. If it would be possible to channel the income spending into clean transport, it could be one of the most important factors for the transformation towards the greening of the sector.

Provable impact on the green economy spheres	**Economic: positive impact (+)** Rising income probably leads to higher volumes spent for transport. **Environmental: negative to positive impact (- +)** If it is possible to channel the income spending into clean transport, the environmental impacts would be positive, if not, negative as in the past. **Social: positive impact (+)** Rising income and wealth levels should have a positive impact on all social groups. However, there is always the risk of social exclusion, i.e. groups of the society that take not part in such upswings. **Territorial: negative impact (-)** Rising income and wealth is often associated with sprawl of activities over the territory and increased land consumption.
Trade-offs: mixed +/- impacts on green economic spheres?	Rising income is in principle a boosting factor for the transport sector. However, if rising incomes cannot be guided into greener transport, it has negative side-effects on the environment. Negative territorial impacts in form of undesirable spatial development trends such as sprawl might happen with rising income regardless whether it leads to a greening of the transport sector or not.
Externalities: impact on other sectors / case studies	Rising income and wealth have a positive impact on most economic sectors. However, whether this is in favour of greening those sectors is subject to many other factors, in particular to the question whether behavioural change and a move towards more greener lifestyles might happen.
Interactions with other factors	In order to safeguard the green impact of this factor, it probably has to come along with the factor described next, the behavioural change of population. Otherwise, there is the risk that rising income would lead to a less green transport system, in particular driven by demand for stronger and less energy-efficient engines, long-distance air travel and overall rising transport volumes.
Causal level of operation (proximate/direct versus underlying/indirect factors)	Rising income and wealth works as an indirect factor.
Spatial level of operation（internal versus external factors)	Rising income and wealth is working from both sides, internal and external.
Type of market force involved	Rising income and wealth is a demand side factor as it enables population to increase demand.
Policy recommendations: making the link between	Policies must be in place that guide rising income to invest in greening of the transport sector, i.e. in investing in energy-efficient vehicles, in travelling less and spend the money in the local markets etc.

policy and non-policy factors	
Possible indicators	- Disposable income - GDP per capita (PPS)

Table D3. Behavioural change

Factor	***Behavioural change***
Description	The demand side of the transport sector is driven by the behaviour of the population with respect to the number of trips, the distances travelled, the transport mode used but also with respect to medium and long-term decisions such as the purchase of certain types of cars or other transport vehicles and the choice of places of activities, in particular choice of place of residence and work.
Specificity for the green economy	Behavioural change might come by a growing awareness of the society for the environment and global climate change. Behavioural change might also come from other motivations than environmental protection. There are for instance growing tendencies of urban or metropolitan lifestyles. A substantial number of that group does not care about owning a car, mobility demand is fulfilled by a variety of transport means ranging from walking via cycling to public transport or car sharing and car rent if necessary.
Provable impact on the green economy spheres	**Economic: neutral to positive impact (o +)** To assess the economic impact of behavioural change related to the transport sector is difficult. It can be expected that the effect is not too big or is depending on the magnitude of behavioural change mainly with respect to purchase of new vehicles. If it would lead to a clear shift in demand for clean cars, it might give an additional boost for the greener fraction of the automotive industry. **Environmental: positive impact (+)** The motivation of parts of the population that is changing behaviour is driven by having positive environmental impacts by doing this. **Social: neutral to positive impact (o +)** Social impacts might not exist or might be positive. **Territorial: positive impact (+)** This type of behavioural change will lead to more compact types of urban systems and less sprawl.
Trade-offs: mixed +/- impacts on green economic spheres?	n/a
Externalities: impact on other sectors / case studies	Behavioural change induced by environmental motivation will probably not be solely related to the transport sector, i.e. other sectors will see increasing demand for greener products.

Interactions with other factors	Behavioural change might be accelerated by the factor rising transport energy costs
Causal level of operation (proximate/direct versus underlying/indirect factors)	Behavioural change is working as a direct factor, i.e. demand for greener transport, but other effects will be more indirect through a longer impact chain, for instance via different location behaviour.
Spatial level of operation（internal versus external factors)	The spatial level of operation is internal as behavioural change comes from the residents of the regions.
Type of market force involved	Behavioural change is clearly a demand side factor
Policy recommendations: making the link between policy and non-policy factors	Policy has to provide the framework conditions for greening the transport sector as explained in other parts of the transport sector study so that behavioural change is possible much easier and will not only be done by a few people but will become a mass phenomenon.
Possible indicators	- Passenger km travelled - Modal split - Alternative vehicles

4 Concluding remarks

The transport sector with its main components vehicle production, transport infrastructure provision, transport operation and passenger travel and freight transport is important for the move of Europe and its regions towards a green economy. There is a strong need, but also a large potential to reduce energy use and greenhouse gas emission stemming from the transport sector. The transport sector is a strong economic sector which has a tremendous importance in some European regions and for Europe as a whole. The transformation of the output generated by this sector towards environmental friendly cars and lorries and more public transport vehicles and other freight transport vehicles than lorries is a huge challenge. In addition, the development of public transport systems and alternatives to road freight transport to shift transport demand is another challenge.

However currently, the transport sector development is not fully on a green path. Some environmental improvements have been achieved, but transport volumes have grown, modal shares are dominated by less environmental modes, Transport was the only sector in which CO2 emissions went still up in times in which other economic sectors made already good progress in the reduction of greenhouse gas emissions. However, CO2 emissions are slightly going down now in Europe. Technological improvements for more energy-efficient vehicles were implemented, but in terms of the overall performance of the transport sector such improvements were outweighed by growing transport volumes and the trend to larger engine sizes. Signs of decoupling of the energy use of transport and its CO2 emissions from economic development visible during the last years cannot simply be attributed to success of policies and behavioural changes, but might also be the outcome of the economic crisis.

A framework for developing a green transport sector in Europe should be based on the green growth strategy for the transport sector proposed by UNEP (2011). For the greening of the transport sector, a fundamental shift in investment strategies is required. It should be based on three elementary principles, namely avoid, shift and improve:

1) Promotion of access instead of mobility. This means to avoid or reduce trips through the integration of land use and transport planning to promote more compact or mass transit corridor cities and regions and by enabling more localised production and consumption patterns.

2) Shift to less harmful modes of transport. This includes in particular public and non-motorised transport for passenger travel and rail and water transport for freight. This should be enabled by shifts of financing priorities and coupled with strong economic incentives such as taxes, charges and subsidy reforms.

3) Improvement of vehicles towards lower carbon intensity and pollution. The development and widely application of green transport technology fostered by appropriate regulations for fuel and vehicles is seen as a priority to reduce air pollution and greenhouse gas emissions.

However, greening of transport seems to be in a dilemma between economic and environmental objectives. Any policy packages that would reduce the overall growth of mobility and the external effects of transport would potentially have an impact on the economic performance of the sector. It cannot properly be assessed whether a greening of the transport sector would also have net economic benefits or whether this would lead to economic problems of the vehicle industry and the transport operation sector as claimed by transport lobby organisations.

The discussions on greening the transport sector have reached official European policy. Several initiatives, legislative decisions and the development of a long-term roadmap are outcome of these. However, expectations to the transport sector from other parties are even more demanding.

The main lessons learned from the analysis of the green performance of the transport sector in Europe and its regions and the transport policies in place can be summarised as follows:

Broadly accepted long term vision for green transport necessary. The White Paper on transport contains a roadmap for the development of transport in Europe for the next forty years. It defines a range of objectives and actions to be taken in the next decade that definitely work in the direction of greening the transport sector. C02-free passenger transport and logistics in cities, multimodal transport networks, shift to more energy-efficient modes of transport, greenhouse gas reduction targets for air and shipping and traffic information and management systems will clearly enhance the environmental performance of the transport system. However, such a long term vision at the European level is not sufficient in two respects. First, more aspects of the vision than now have to be translated in concrete policy action. In particular, to achieve the long term targets, concrete policy actions have to be approached now as it is foreseen by the European Commission. Second, such a long term vision has to be shared by the member states. The European Union has only limited implementation power to approach its transport related objectives. Thus, member states and regions are required to share such a vision and to develop and implement policies supporting the way to reach the targets.

Strong environmental legislation at EU level important. The environmental performance of the transport sector is strongly driven by regulations and directives of the European Union. Without that the green performance of the transport sector in Europe would be much worse. The continuous increase of emission standards of new vehicles did not only improve air quality in Europe, but was also a major driver of innovation in the automotive industries. However, automotive industries, their lobbies and the member states having important automotive industries often acted as stakeholders to decelerate progress in environmental standards.

Less demand driven but green priority oriented infrastructure policy necessary. For decades, infrastructure policy simply followed demand. When transport volumes increased, the infrastructure based solution was always to built more infrastructure to increase capacities. This resulted primarily in the construction and enhancement of the road network with strongest increases in the less environmental-friendly mode of transport. The White Paper on transport sets right-way infrastructure development targets such as the maintenance of dense rail networks in all member states and the tripling of the high-speed rail network by 2030 and a full high-speed rail network by 2050. It sets also the right-way targets for modal shift such as medium and long distance freight from road to rail and inland waterways with 30 percent by 2030 and 50 percent by 2050 or that 50 percent of medium distance passenger should travel by rail. However, given the capacity and quality problems rail transport today has in many parts of Europe, such targets are realistically not to be reached if there is not a much stronger shift in transport infrastructure policy to increase the performance of the rail system in Europe. A concentration on high-speed rail is by far not enough.

Transport policy together with integrated spatial planning to address also the “avoid” part of a green transport strategy. Transport demand seems still to be a pre-given condition for transport policy that is not to be touched. However, in greening the transport sector, the reduction of transport volumes in terms of trips and distances is an important integrated component for greening the transport sector tackled. Here, transport policy has to be combined with other sector policies. Important tasks in this are with integrated spatial planning at all levels of planning, from the European via the national and regional levels to the very local. Integrated spatial strategies have to aim at spatial structures that reduce the need the travel as such or at least the need to travel longer distances.

http://greenlogisticsgroningen.nl

5 References

European Commission (2011a): *Transport White Paper 2011. Roadmap to a Single European Transport Area - Towards a Competitive and Resource Efficient Transport System*. COM(2011) 144 final. Brussels: European Commission. http://ec.europa.eu/transport/strategies/2011_white_ paper_en.htm

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.. http://ec.europa.eu/transport/strategies/2011_white_ paper_en.htm

European Commission (2011c): 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.

European Commission (2011d): *EU Transport in Figures 2011*. Luxembourg: Publications Office of the European Union. http://ec.europa.eu/transport/publications/statistics/doc/2011/pocketbook 2011.pdf

European Commission (2013): *New EU transport infrastructure policy – background*. Memo/13/897. Brussels: EC.

European Union (2003): Directive 2003/17/EC of the European Parliament and of the Council of 3 March 2003 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels. *Official Journal of the European Union,* L 76, 22.3.2003.

European Union (2007): Regulation (EC) No 715/2007 of the European Parliament and of the Council of 20 June 2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information. *Official Journal of the European Union* L 171, 29.06.2007.

European Union (2008): Directive 2008/50/EC of the European Parliament and of the Council of

21 May 2008 on ambient air quality and cleaner air for Europe. *Official Journal of the European Union* L 152, 11.06.2008.

European Union (2009a): Regulation (EC) No 443/2009 of the European Parliament and of the Council of 23 April 2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO2 emissions from light-duty vehicles. *Official Journal of the European Union* L 140, 5.6.2009.

European Union (2009b): Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. *Official Journal of the European Union* L 140, 5.6.2009.

European Union (2009c): Regulation (EC) No 595/2009 of the European Parlia-ment and of the Council of 18 June 2009 on type-approval of motor vehicles and engines with respect to emissions from heavy duty vehicles (Euro VI) and on access to vehicle repair and maintenance information and amending Regulation (EC) No 715/2007 and Directive 2007/46/EC and repealing Directives 80/1269/EEC, 2005/55/EC and 2005/78/EC. *Official Journal of the European Union* L 188, 18.7.2009.

European Union (2011): Regulation (EU) No 510/2011 of the European Parliament and of the Council of 11 May 2011 setting emission performance standards for new light commercial vehicles as part of the Union's integrated approach to reduce CO_2 emissions from light-duty vehicles. *Official Journal of the European Union* L 145, 31.05.2011.

EEA - European Environment Agency (2011): *Laying the foundations for greener transport. TERM 2011: Transport indicators tracking progress towards environmental targets in Europe.* Copenhagen: EEA. http://www.eea.europa.eu/publications/foundations-for-greener-transport/at_download/file

EEA - European Environment Agency (2012): *The contribution of transport to air quality. TERM 2012: Transport indicators tracking progress towards environmental targets in Europe.* Copenhagen: EEA.

Eurostat (2012): *Land cover and land use, landscape (LUCAS).* file: lan_lu_hea, last updated 06.03.2012. http://epp.eurostat.ec.europa.eu/portal/page/portal/lucas/data/database

UNEP – United Nations Environmental Programme (2011): *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication*. Nairobi: UNEP. www.unep.org/greeneconomy

Annexes

A1 Territorial dimension of the transport sector - a snapshot

Are the following *territorial factors* important in relation to greening of the sector:		
1. ***Settlement types***	***y/n***	***Why? Why Not?***
i. Urban areas	***y***	*With respect to intra-regional relations, urban areas tend to generate less traffic volumes in terms of passenger km than rural areas in which different functions are less close together. In addition, higher densities in urban areas compared to rural areas allow the use of non-polluting transport modes such as walking or cycling or the more efficient operation of public transport which is considered to be greener than individual travel by car or motorbike. Empirical studies have shown that the modal split in urban areas is much more dominated by "green" modes of transport than rural areas. Shorter travel distances in urban areas tend also to be in favour of greener cars such as electric vehicles which, at least nowadays, have a limited cruising range.* *With respect to inter-regional relations, a polycentric urban system allows the operation of efficient and fast rail services usually being considered as being more "green" than individual travel by car. Urban-rural interactions are a specific form of inter-regional relations. For people commuting from rural places of living to urban places of work, the car Is the dominant transport mode. This is because distances are to long for walking or cycling and lower densities do not allow efficient and fast public transport, i.e. public transport is usually not considered to be an alternative.* *In conclusion, the spatial organization of society is a crucial factor for the traffic volume generated and for the way traffic demand can be handled by different types of transport means.* *Headquarters, research centres and production sites of the automotive industry and other vehicle manufacturing industries tend to be located in urban areas. This is favoured by the quality and quantity of the available labour force. However, clusters of automotive supply industries are also to be found in areas in-between urban areas.*
ii.Rural areas	***y***	
iii. Urban-rural interactions	***y***	

2. ***Land and land-based resources***	***y/n***	***Why? Why Not?***
i. Land consumption or dependence	***y***	*The transport sector is an important consumer of land resources. The LUCAS (Land cover and land use, landscape) survey based assessment of land use in Europe by Eurostat (2012) states for the 23 EU countries involved that 91,790 square kilometre are covered by transport infrastructure. This is 2.3 percent of the territory. However, the range between countries is widespread. The share of land covered by transport infrastructure is only about 1.0 to 1.5 percent in the Nordic countries and the Baltic states and Slovakia, but rises to about four percent in Germany, five percent in Belgien, six percent in Luxembourg and even 11 percent in the Netherlands* *A greening of the transport sector along the avoid, shift and improve strategy might lead to less land covered by infrastructure. However, a much stronger focus on rail would also lead to more land consumption for new (high-speed) rail lines or light rail services in urban areas.*
ii. Material Consumption or dependence	***?***	*A greening of the transport sector would see vehicles, in particular cars, that are built from modern materials and which are lighter than today.*
iii. Energy consumption or dependence on specific energy types or systems	***y***	*The transport sector in EU27 consumes about 365 million tons of oil equivalents (in 2010) which is about one third of final energy consumption. Most of the energy used for transport is derived from oil resources. Renewable energy sources account for about five percent. Within the transport sector, road transport is responsible for more than 80 percent of energy consumption, domestic and international aviation for 14 percent and rail transport for two percent only.* *A greening of the transport sector would lead to a clear decrease in overall energy use and in particular to a decrease in oil as basic resource.*
iv. Management of ecosystem services (types of ecosystems/landscapes;	***n***	*There is no direct link of the management of ecosystem services to the greening of the transport sector. However, a larger emphasis on the management of ecosystem services might lead to restrictions of the transport*

spatial characteristics of ecosystems; options for maintaining and developing these services)		*sector either in form of traffic restrictions in certain areas or to non-construction of planned transport infrastructure or even to deconstruction and renaturation of transport infrastructure.*
3. ***Market relations (Production; consumption; export, import) and innovation***	***y/n***	***Why? Why Not?***
i. Local/regional markets	***n***	*The European automotive and other vehicle manufacturing industries are heavily embedded in global markets, i.e. strong competition. On the one hand, Europe is exporting vehicles to other continents, xxx percent of the passenger cars produced in Europe are exported to xxxx. On the other hand, Europe sees the import of xxx cars yearly from non-European production sites.* *However, globalization in the automotive industries is more complex than that seeing joint ventures, the overtake of other companies, the opening of production sites in other parts of the world or the settling down of non-European-based car manufactures in Europe (such as Toyota, Nissan, Hyundai-Kia or Mitsubishi). Economic crises such as the last recession in Europe and the world are always strongly affecting the automotive industries leading to large overcapacities in European production sites.* *A greening of the transport sector is embedded in such global competition and the different strategies of the different firms. Whereas the European automotive industries seems to follow always the standards according to European regulation concerning emissions of pollutants and CO2 only, car manufacturer in other parts of the world seem to be more innovative in the introduction of more advanced vehicles.* *A negative side-effect of greening of the transport sector in Europe might be the non-regulated export of older, more energy consuming and polluting vehicles (that are being replaced by greener cars) to third world countries. If such vehicles almost at the end of their life cycle are not to be recycled in Europe, the greening of the vehicle fleet in Europe would have negative environmental effects in other, less developed parts of the world.*
ii. National markets	***y***	
iii. EU markets	***y***	
iv. Global markets	***y***	

4. ***Inter- and intra-territorial relations***	***y/n***	***Why? Why Not?***
i. Within territories (place based; local cultures; relating to territorial/national policies)	***y***	*Within territories, clusters of automotive industries and automotive suppliers are very relevant. However, in globalized just-in-time production chains this is also relevant between and across territories.*
ii. Between territories (networks; competition)	***y***	
iii. Across territories (cross-border supply and demand)	***y***	
5. ***Place-based factors***	***y/n***	***Why? Why Not?***
i. Competitiveness through strong local economies		
ii. Multi-functionality		
iii. Tacit/experiential knowledge		
iv. Proximity		
6. ***Consumer relations***	***y/n***	***Why? Why Not?***
i. Are development and innovation consumer-demand driven?	***y***	*Development and innovation in the automotive and other vehicle manufacturing industries are partly consumer demand driven and partly producer driven. However, both are enforced by policy regulations concerning emission standards and rising energy prices.*
ii. Are development and innovation producer driven?	***y***	
iii. Are development and innovation based on well-defined territorial conditions or on open access?	***n***	
7. ***Accessibility and mobility***	***y/n***	***Why? Why Not?***
i. Transport connections (transport of materials; transport of labour)	***y***	*The transport sector is directly providing these territorial factors.*
ii. Regional Accessibility	***y***	*A greening of the transport sector following the avoid, shift and improve strategy would mean that the total*

(access to markets; access to supply of materials; access to public services)		*transport volume in terms of passenger, ton-and vehicle km would be clearly reduced and that transport would be organised with less energy-intensive and less polluting means of transport. Ideally, the level of accessibility would be maintained. Bit this does not necessarily mean that the level of physical mobility will be maintained as well. Access to markets, to supply of materials and to public services must not automatically involve personal travel or goods transport. New information and telecommunication technologies can provide a comparable level of access but without physical movements (see below).*
iii. Information connections (use of communication and information services; need of interaction; questions of consumer and producer cultures)	***y***	*The reduction of the need to travel is central part of the avoid, shift and improve strategy for the greening of the transport sector. For the avoidance part of the strategy it is hoped that personal travel can be partly substituted by modern communication technologies. For instance, high-quality video conferences based on broadband infrastructure shall get the same quality as a personal meeting; E-commerce combined with advanced logistic systems shall result in less traffic, etc.*
8. ***Policy and governance by territorial level***	***y/n***	***Why? Why Not?***
i. Scale of sector-based policy support	***y***	*The greening of the transport sector requires policy action and support at all territorial levels. The upper levels are necessary to provide necessary Europe-wide or national regulations, the lower levels are important to provide conditions in which green transport operation can happen.*
• From the EU level	***y***	*The EU-level is the most important level for providing the legislation necessary for the greening of the transport sector. The EU legislation for the reduction of energy use and emissions of all types of vehicles implemented in the past as well as those legal settings to be expected following the White Paper on Transport constitute the main drivers for the third pillar of the avoid, shift and improve strategy for greening the transport sector. Such Europe-wide legislation is forcing the automotive and other vehicle manufacturing industries to invest in vehicle-related green innovation and to supply the market with emission-free vehicles in the long term.* *The EU level is also important for coordinating and co-financing of the transport infrastructure at the European strategic level, i.e. the trans-European transport networks. The shift towards more sustainable modes of transport in the recent update of the TEN-T outline*

		plans, thus following the roadmap of the White Paper on Transport is also a clear shift towards greening the transport sector. However, the European Union has no competence to implement the infrastructure outline plans, this is with the member states. But the European Union can give through TEN-T Budget, Regional Structural Funds etc. important financial incentives to the member states to
• From the national level	***y***	*At the national level, infrastructure policies including the implementation of infrastructure is important. In addition, national levels have a couple of financial instruments at hand such as taxes, road pricing etc.*
• From the regional level	***y***	*The lower levels are responsible for regional/local transport plans and regional/local transport infrastructure and for the coordination of regional/local public transport*
• From the local/municipal level	***y***	
ii. Role of other EU policies with territorial dimension	***y***	*As programmatic agreements, the ESDP, the Territorial Agenda and the Territorial Agenda 2020 are important in putting high emphasis on issues of accessibility. EU regional policy is important in co-financing transport infrastructure.*
iii. Private versus public sector – led development. Are consumer organizations advocating for developing the green economy. At what political scale are they located?	***y***	*For the greening of the transport sector, the basic decisions have to be taken by the public sector. Past development has shown that clear improvements in vehicle technologies concerning emissions and energy use have been implemented only if binding legislation was in place. Also, basic decisions on transport infrastructure and public transport services have to be taken by the public sector. To leave this to the private sector, i.e. leave it to market mechanism, would have serious consequences for non-profitable connections. In consequence, rural, peripheral or economic lagging regions might be underserved with following impacts on livability and economic development, thus impacts on territorial cohesion in Europe and its member states.*

Territorial outcomes of greening the sector:	
Inter- and intra-territorial relations	*Might be reduced as the avoid, shift and improve strategy for greening the transport sector will lead to diminished transport volumes.*
Settlement types	*Might induce tendencies to strengthen urban areas*

Land and land based resources	*Might lead to a net reduction of land consumption for transport infrastructure, however new green transport infrastructure (e.g. for new rail links) will consume land resources*
Market relations (Production; consumption; export, import) and innovation	
Place-based factors	*A greening of the transport sector would put more emphasis on place-based factors*
Accessibility and mobility	*The challenge is to guarantee existing accessibility levels, however, with reduced need to travel*
Policy and governance by territorial level	*Policies and governance at all territorial level will face the challenge to provide living and production conditions that are in line with and would support the avoid, shift and improve strategy for greening the transport sector.*

A2 Transport non-policy factors - a snapshot

A3 Transport sector policy analysis - a snapshot

www.espon.eu

The ESPON 2013 Programme is part-financed by the European Regional Development Fund, the EU Member States and the Partner States Iceland, Liechtenstein, Norway and Switzerland. It shall support policy development in relation to the aim of territorial cohesion and a harmonious development of the European territory.