

An Overview of the Progress Towards Sustainable Transport Development by Using TERM Indicators

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Abstract A sustainable transport system is one of the greatest challenges in the pursuit of sustainable development. A wide range of environmental problems has to be solved in ways that are compatible with social and economic goals. The transport sector has already taken a lot of measures to reduce the burden on the environment. In order to achieve an environmentally and socially sustainable transport system, more action is needed. The integration of environmental concerns into policies and decision-making has to be extended and deepened. There is no doubt that if something can be measured, it can be managed, so the success of current and future integrated policies can only be judged by identifying key indicators that can be tracked and compared with concrete policy objectives (benchmarking). A TERM is a proposed reporting tool on transport and environment, which has been developed by the European Commission and European Environmental Agency. Under the TERM, annual indicator-based reports are produced as a tool to assist policy makers with the assessment of the effectiveness of strategies. The proposed indicators can help in the assessment of policy-level strategies and the level of goal achievements. The aim of this article is to review the effect of sustainable policy implementation based on the TERM indicators in the latest report and draw some conclusions and recommendations how to go ahead to reach the goals assumed in the long-term perspective by 2050.

Keywords Sustainable transport · Policy integration · TERM · Transport policy

Introduction

The relationship between transport and environmental issues is one of the most crucial elements in progress towards sustainable development. It has been recognised for many years that transport contributes significantly to several environ-

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mental problems, in particular to climate change, air pollution, acidification, acoustic climate, land take and fragmentation and disruption of nature habitats. These problems could be mitigated by better integration of environmental concerns into transport policies and decision-making. According to the International Energy Agency (IEA), as appears from their recent analysis, transport is the greatest consumer of energy in the developed world, consuming more than industry. The structure of the OECD total final consumption (TFC) shows that transport was the largest energy consuming sector in 2013 with the growth rate of 2% compared to 2012, accounting for a third (33%) of the final energy consumption, followed by industry with 31% and residential use with 20%. These shares have reversed since 1971, when industry accounted for 41% of total final consumption and transport for 24% [1]. In the OECD European countries, industry is still the biggest consumer, but transport is closing the gap.¹ Oil still makes up around 95% of all transport fuels in the EU, while industry has a roughly equal mix of coal, oil, gas, electricity and other sources, which include biofuels and waste [2].

Taking all these facts mentioned above into consideration, it is very important to combine the environmental elements into sector or branch development. The integration of environmental aspects into the sector policy as a concept in the environmental policy has been known at least since the first UN conference on the environment in Stockholm in 1972. However, the importance of the principle of integration really first seemed to receive attention in transport sector more than a decade later. The EC Expert Group on Transport and Environment described the concept of integration in relation to transport as [3]:

... environmental issues are taken into account on an equal basis to other concerns such as economic and social aspects. All stakeholders would include the relevant environmental aspects in the framework of their responsibilities and these would be reflected in their actions

[integration] must lead to concrete actions by the authorities responsible for transport, and ultimately, by all actors having an influence on the design and the use of the transport system.

Strategies for the integration of environmental and sectoral policies were strongly outlined in the EU's 5th Environmental Action Programme (SEAP) [4]. Better integration of environmental concerns into other policy areas, such as regional policy, agriculture, fisheries, energy and transport, ensures better decision-making and coherent policy approaches that deliver multiple benefits. The

¹There are big variations across the regions. The share of transport in 2013 was the largest in very large countries, such as the USA, Mexico and Australia, all with values around 40%, as well as in Luxembourg (57%), in this case due to price-driven fuel tourism. It was much lower in smaller countries with a strong industrial sector (e.g., Korea, Iceland, Finland, Belgium and the Netherlands). The effect is that in the European OECD countries, transport is still behind the industry sector.

7th Environment Action Programme (7EAP) continues this approach. It guides the European environment policy up to 2020. It also expands this long-term direction by setting out a vision beyond that of where the Union should be by 2050. Three key objectives are identified [5]:

- to protect, conserve and enhance the Union’s natural capital;
- to turn the Union into a resource-efficient, green and competitive low-carbon economy; and
- to safeguard the Union’s citizens from environment-related pressures and risks to health and well-being.

Three so-called action areas will help Europe to deliver these goals:

- better implementation of legislation;
- better information by improving the knowledge base more and wiser investment for environment and climate policy; and
- full integration of environmental requirements and considerations into other policies.

Integration has been given a higher political priority following the Treaty of Amsterdam, which underlines its importance and defines it as a way to achieve sustainable development. The following elements of environmental integration in the transport sector should be distinguished [6]:

- **Institutional Integration:** this means greater coordination between land-use and transport planning and economic policy; greater coordination and synergies between transport planning and other human activities; and increased responsibility for the promotion of sustainable development at the sectoral level;
- **Market Integration:** this means greater cost responsibility for all modes (environmentally related charges, etc.) and differential taxation of vehicles and fuels to encourage the use of environmentally friendly alternatives;
- **Management Integration—relating to the environmental consequences of transport:** this means greater use of environmental and sustainability objectives and targets; increased application of environmental impact assessment procedures at the strategic and project levels; support for research, development and modelling; and creation of the conditions for greater coordination and interoperability between modes of transport; and
- **Monitoring/Reporting Integration:** this means increased monitoring of the environmental implications of decisions and use objectives, targets and indicators to report on progress and effective integration.

Policy Framework for Sustainable Development in the EU Transport Sector

Nowadays, the EU transport system cannot be classified as sustainable, and in many respects, it is moving away from sustainability rather than towards it. The European Environment Agency (EEA) highlights in particular the sector's growing CO₂ emissions. With growing freight and passenger transport, the risk of pollution and congestion is increasing. The European Commission (EC) is working towards a form of mobility that is sustainable, energy-efficient and respectful of the environment. The Europe's general policy framework for reducing the environmental impacts of transport has evolved substantially since the early 1990s. These trends have strongly reinforced the need for fully developing and consistently implementing a policy response, which has had sustainability at its core, as set out in the Green Paper on Transport and the Environment (1992) [7], and taken up by the White Paper on the future development of the common transport policy (1992) [8]. The last one was dedicated to market opening, in line with the priorities at the time.

In July 1995, the EC issued a communication on the transport policy action plan 1995–2000 [9], setting out in more details the timetable for implementing the actions announced in the White Paper (1992). Among the announced measures, the forthcoming Green Papers on the internalisation of external costs (1995) [10] and the Citizens Network (1995) [11], the environmental assessment work on the Trans-European Networks (1995–1996), the environmental framework on road freight transport (1996) and action on air transport and airports (1997 and beyond) were of particular importance for the integration of transport and environment policies.

In 2001 [12], the EC presented the White Paper proposing 60 measures to overhaul the EU's transport policy in order to make it more sustainable and avoid enormous economic losses due to congestion, pollution and accidents. One of the main messages of the White Paper (2001) was that in addition to facilitating the growing demand for transport, a modern transport system must be sustainable from the economic, social and environmental viewpoints. Although it stressed the need to control the growth of air transport and promote the use of non-road transport modes, no specific overall environmental targets were included at the time. Only the need for these to be developed and quantified in the future was highlighted.

The 2006 midterm review updated attempts to rebalance the policy towards economic objectives. The review of the White Paper (2001) stated that the objectives are still relevant, but the context defining European transport policy has changed over the last five years due to the enlargement and globalisation [13].

The integration of the environmental considerations within the transport sector was significantly extended with the publication of the new transport policy in 2011. Now, the 2011 White Paper *a Roadmap to a Single European Transport Area—Towards a competitive and resource efficient transport system* takes a global look at developments in the transport sector, at its future challenges and at the policy

initiatives that need to be considered [14]. It takes on the challenge of seeking a deep transformation of the transport system, promoting independence from oil, creation of modern infrastructure and multimodal mobility assisted by smart management and information systems. The aim of the established seven initiatives is to ensure the more competitive and integrated transport system providing increased mobility and lowering emissions by 2050. The initiatives cover 40 different areas necessary for the transformation of the European transport system and address challenges, such as reducing dependence on oil, tackling congestion and improving infrastructure and cut carbon emissions in transport by 60% by 2050. For the next 40 years, the EC has set forward a range of impressive policy goals in the White Paper (2011) that will require a true transition in the mobility system.

Transport is a complex system that depends on multiple factors [15], including the pattern of human settlements and consumption, organisation of production and availability of infrastructure. Adding to this complexity, any intervention in the transport sector must be based on the long-term vision for the sustainable mobility of people and goods and must be planned well in advance. Figure 1 presents the factors influencing decarbonisation of the transport sector.

As statistics and analysis suggest, road transport plays a vital role in the European society, not only as the main mode for people and goods to move from one place to another, but also as an important economic sector. At the same time, it is responsible for about a quarter of the EU’s energy consumption and about a

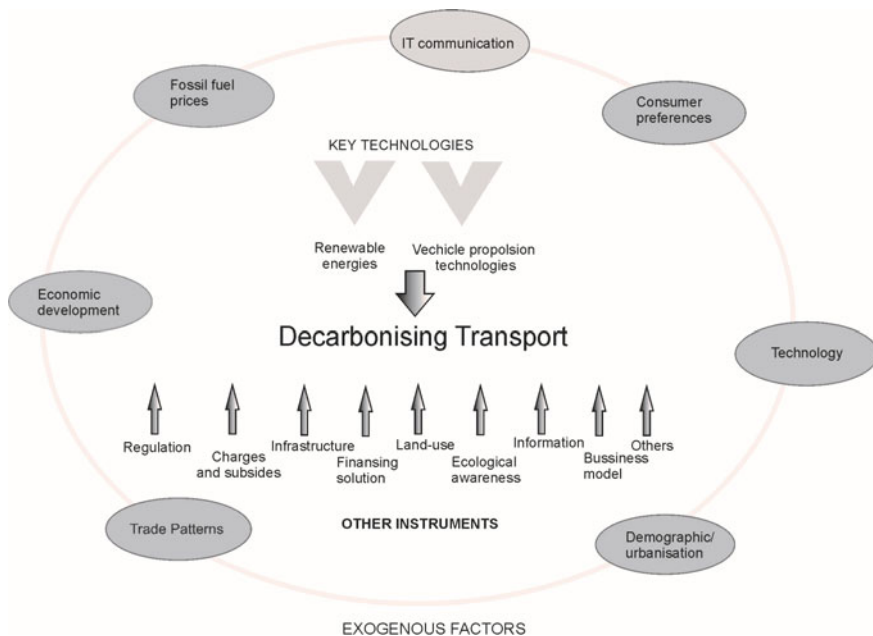


Fig. 1 The factors influencing decarbonisation of transport sector. *Source* Own elaboration

one-fifth of its CO₂ emissions. It is important that while these emissions fell by 3.3% in 2012, they are still 20.5% higher than in 1990. Transport is the only major sector in the EU where greenhouse gas emissions are still rising [16].

Review of the TERM Indicators Towards Achieving Transport Policy Targets

Sustainable transport is a key challenge of the EU Sustainable Development Strategy (EU SDS) [17]. The objective of this strategy is to ensure that the member states' transport systems meet the public's economic, social and environmental needs, without causing any negative effects that may affect meeting these needs. The environmental pressures from the transport sector depend on the following factors: the number and length of trips, the modes of transport used, where some are more environmentally friendly than others, and the technology that each mode uses.

There is no doubt that if something can be measured, it can be easily managed, so the success of current and future integrated policies can only be judged by identifying key indicators that can be tracked and compared with concrete policy objectives (benchmarking). A Transport and Environment Reporting Mechanism (TERM) has been set up specifically for this purpose. As part of this process, the concept of an indicator-based system for the EU was initiated in early 1998. It has been designed to help the EU and member states to monitor the progress of their transport integration strategies, and to identify changes in the key leverage points for the policy intervention (such as investments, economic instruments, spatial planning and infrastructure supply). Seven questions are addressed, which policy makers in the EU regard as key to understand whether the current policy measures and instruments are pushing the transport/environment interactions towards the sustainable direction [18]:

1. Is the environmental performance of the transport sector improving?
2. Are we getting better at managing transport demand and at improving the modal split?
3. Are spatial and transport planning becoming better coordinated so as to match transport demand to the needs of access?
4. Are we optimising the use of existing transport infrastructure capacity and moving towards a better-balanced intermodal transport system?
5. Are we moving towards a fairer and more efficient pricing system, which ensures that external costs are recovered?
6. How rapidly are improved technologies being implemented and how efficiently are vehicles being used?
7. How effectively are environmental management and monitoring tools being used to support policy and decision-making?

Initially, in order to answer these questions, a selection of 31 indicators was made to deal with the various aspects of the transport and environment system. Today, after 15 years, the set of indicators is wider but is still developing. It consists of 40 indicators used for tracking the environmental performance of the transport sector and measuring the progress in meeting the key transport-related policy targets. The European Environment Agency (EEA) uses the DPSIR approach (Driving forces, Pressures, State, Impact and Responses) as a generic tool to support the understanding of these complex relationships and reporting them across the whole range of environmental issues [19]. The DPSIR model shows the connections between the causes of environmental problems, their impacts and the society's responses to them in an integrated way [20].

The TERM indicators cover the most important aspects of the transport and environment system. They represent a long-term vision of the indicators that are ideally needed to answer the above-mentioned aspects. The TERM addresses seven issues [21]: (1) freight transport and the modal split; (2) passenger transport and the modal split; (3) need for demand management; (4) greenhouse gas emissions from the transport sector; (5) transport fuel developments; (6) transport noise; and (7) local emissions and air quality. Table 1 presents qualitative evaluation of key indicator trends.

As the article length constraints do not allow for an in-depth analysis of observed trends and description of indicators, only brief comments will be provided to selected indicators for the above 7 groups.

The Freight and Passenger Transport Demand, Modal Split and Need for Demand Management

Minimising the negative social and economic impacts of the transport sector is a central theme in the EU transport policy. The objective of decoupling the freight transport demand from GDP was first mentioned in the transport and environment integration strategy, which was adopted by the Council of Ministers in Helsinki [22]. The expected growth in the transport demand was named as the area where urgent action was needed. In the sustainable development strategy adopted in Gothenburg, the objective of decoupling is set in order to reduce congestion and other negative side effects of transport [23].

The White Paper 2011 states that freight shipments over short and medium distances (below some 300 km) will mostly remain on trucks. For longer distances, the options for road decarbonisation are limited and efficient options for freight multimodality are needed. Based on the EUROSTAT data, road freight (over 300 km) represents 11% of tonnes lifted and 56% tkm. The major groups of goods carried in road transport exceeding 300 km are food products (17% tkm), agricultural products (10% tkm), mixed goods (10% tkm), chemical products (9% tkm), metal products (9% tkm) and wood, paper and pulp (8% tkm) [24].

Table 1 Qualitative evaluation of key indicator trends

TERM no.	Key indicators	Integration question	Target	Evaluation of indicator trends
TERM 01	Transport final energy consumption by fuel	5	70% reduction of transport oil consumption from 2008 to 2050	⊕
TERM 02	Transport emissions of greenhouse gases	4	Transport GHGs (including international aviation, excluding international maritime shipping): 20% ↓ (vs. 2008) 2030 60% ↓ (vs. 1990) 2050 EU CO ₂ emissions of maritime bunker fuels 40% ↓ (vs. 2005) 2050	⊕
TERM 03	Transport emissions of air pollutants	7	EU limit values on concentrations of individual pollutants in ambient air	⊕
TERM 04	Exceedances of air quality objectives due to traffic	7	Good quality of air	⊕
TERM 05	Exposure to and annoyance by traffic noise	6	Good quality of acoustic climate	⊕
TERM 12	Passenger transport volume and modal split	1	The majority of medium distance passenger transport should go by rail	⊕
TERM 13	Freight transport volume and modal split	1	Road freight over 300 km shift to rail/waterborne transport: 30% shift 2030 50% shift 2050	⊕
TERM 20	Real change in transport prices by mode	3	Internalisation of external costs	⊕
TERM 21	Fuel tax rates	3	Internalisation of external costs	
TERM 27	Energy efficiency and specific CO ₂ emissions	5	Target average type-approval emissions for new passenger cars: 130 g CO ₂ /km 2012–2015; 95 g CO ₂ /km 2020	⊕

(continued)

Table 1 (continued)

TERM no.	Key indicators	Integration question	Target	Evaluation of indicator trends
TERM 28	Specific air pollutant emissions	7	Target average type-approval emissions for new light vans: 175 g CO ₂ /km 2014–2017 147 g CO ₂ /km 2020	☺
TERM 31	Proportion of renewable energy in the transport sector	5	The reduction of specific emissions from road transport (VOC, CO, NO _x , PM per paskm, tkm) 40% proportion of low carbon sustainable fuels in aviation—2050 10% proportion of renewable energy in the transport sector’s final energy consumption for each member state Fuel suppliers to reduce life cycle GHGs of road transport fuel 6–10% ↓ (vs. 2010 fossil fuels) 2020	☹
TERM 33	Average age of the vehicle fleet	1/2	Improving the environmental performance of the fleet	☺
TERM 34	Proportion of vehicle fleet by alternative fuel type	5	Use of conventionally fuelled cars in urban transport: 50% ↓ 2030; 100% ↓ 2050 Target average type-approval emissions for new light vans: 175 g CO ₂ /km 2014–2017; 147 g CO ₂ /km 2020	☹

- ☺ positive trend (moving towards objective)
- ☹ some positive development (but insufficient to meet objective)
- ☹ unfavourable trend (large distance from objective)

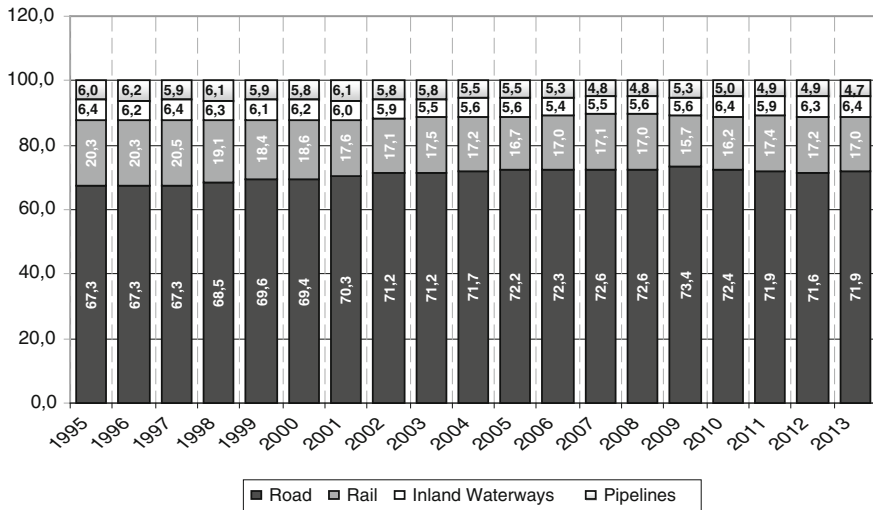


Fig. 2 The modal split of freight transport (1995–2013). *Source* [32]

The trends analysis revealed that the modal split for inland freight transport has not changed substantially since 2000. Freight is generally transported by road, rail, inland waterways and pipelines. In 2013, road transport constituted almost 72% of all tkm performed in the EU-28, followed by rail (17%), inland waterways (6.4%) and pipelines (4.7%). The analysis of trends in road transport distinguished two clear developments. First, the share of road transport increased steadily between 2000 and 2009. Second, road transport lost more than 1.5% in the aftermath of the economic crisis between 2009 and 2013 as other transport modes started gaining ground. In this context, the support to shift freight from road to water and rail is an important strategic element in the EU transport policy. Figure 2 presents the modal split in freight transport.

Looking at individual countries in the context of the modal split in the long term, countries that joined the EU in 2004 and 2007 recorded the largest increases in the share of road transport in the total inland transport performance. One reason is that the extension and integration of the common market are heavily interlinked with the transport demand. The resulting additional demand for transport will overflow onto roads, as this form of transport is the easiest to interconnect and cheaper compared to other modes.

Additionally, the projection developed in “EU Energy, Transport and Greenhouse Gas (GHG) Emissions Trends to 2050 Reference Scenario 2013” [25] shows an increase in the total freight transport activity by about 57% (1.1% per year) between 2010 and 2050. Road freight is projected to grow by 55% during the same period, while rail freight is projected to grow by 79% and inland waterway by 41%. This means that road freight is projected to amount 2721 billion tkm by 2050. This projection proves that additional measures will be needed to obtain the objectives defined in White Papers.

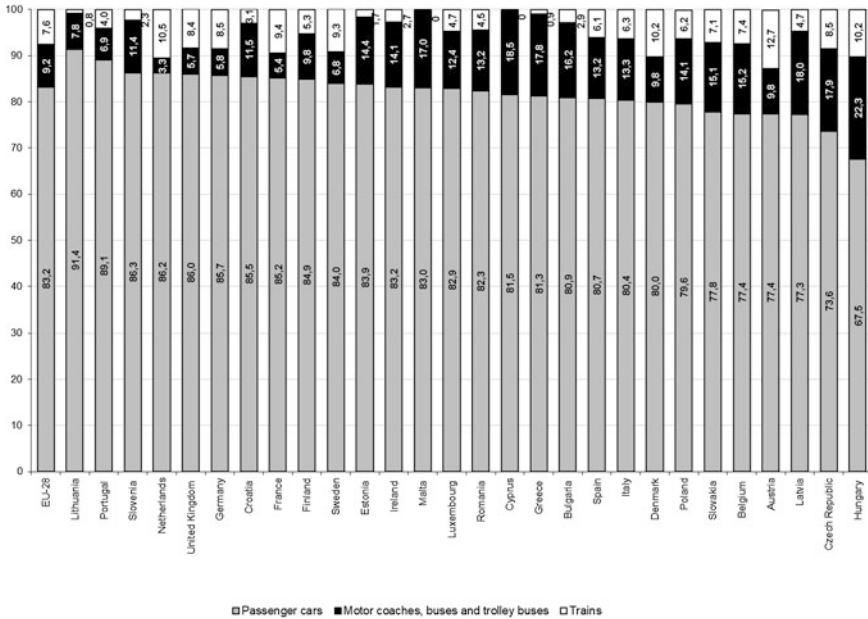


Fig. 3 The modal split of inland passenger transport, 2013. Source [32]

The total demand for passenger transport in 2013 was 8.4% higher than in 2000. Passenger cars accounted for 83.2% of inland passenger transport in the EU-28 in 2013, with coaches, buses and trolley buses (9.2%) and trains (7.6%). Among the EU Member States, the relative importance of passenger cars was the highest in 2013 in Lithuania, where it accounted for 91.4% of passenger transport in 2013. In most countries, the passenger car share was between 80.0% and 90.0%, although there were seven countries where this share was lower, most notably in Hungary (67.5%). In 2013, trains accounted for more than the one-tenth of all inland passenger transport in Austria, the Netherlands, Denmark and Hungary, while their share fell below 2.0% in Estonia, Greece and Lithuania (Fig. 3).

The differences in trends are easily noticed between EU-15 and EU-13. The average pkm in the research period fell slightly in the first group, while grew significantly in the EU-13. There is, however, considerable variation across the individual states. The decreasing average distance travelled by a car was also observed. Looking at air transport is also very important because of the very dynamic rate of growth in this mode reaching 27% since 2000. It grew rapidly between 2000 and 2007, but then the economic crisis caused the sudden decrease by 6.9% in 2009. The crisis hit especially traditional airliners, while low-cost operators have grown steadily since 2008.

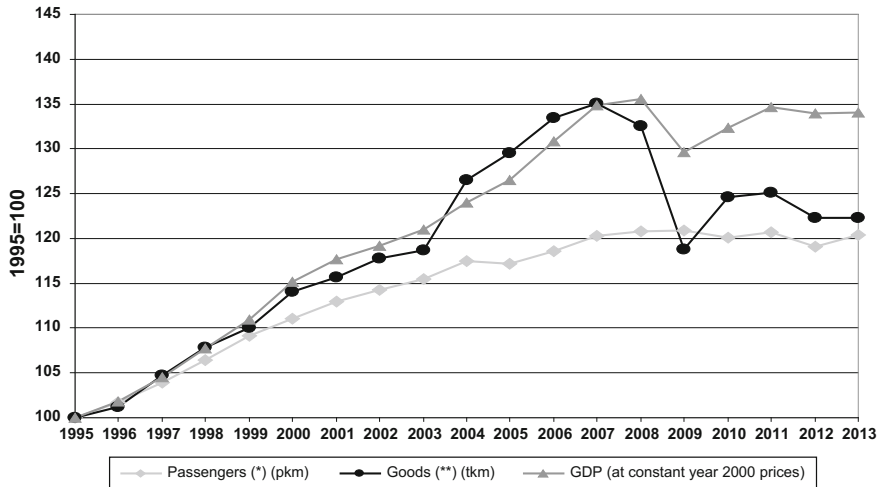


Fig. 4 Transport performance and the relation to GDP (1995–2013). *Source* [32]. (*): passenger cars, powered two wheelers, buses and coaches, tram and metro, railways, intra-EU air, intra-EU sea. (**): road, rail, inland waterways, oil pipelines, intra-EU air, intra-EU sea

The analysis of statistics presented in the TERM revealed that freight transport grew considerably in the EU 28 between 2000 and 2008. Passenger transport increased until 2008, but it then remained broadly stable after being hit by the economic recession. One of the operational objectives of the EU Sustainable Development Strategy has been “decoupling economic growth and the demand for transport”. So far, this has only been observed during the economic crisis. In the period of positive economic growth, before 2007, the freight transport volume increased at much greater pace than GDP. Figure 4 presents the extent to which the freight and passenger transport volume is coupled with a slowdown in economic growth between 2000 and 2013. Thus, the transport demand intensity (the transport volume associated with one Euro of GDP) was lower in 2013 than in 2000. Over the long-term period, between 2000 and 2013, both GDP and transport volumes increased: GDP grew by 16.1% and transport volumes by 11.5%. As a result, relative decoupling between transport volumes, both passenger and freight, and economic growth took place.

Greenhouse Gas (GHG) and Local Emissions from the Transport Sector

The total GHG emissions in the EU-28 have decreased by 1203 million tonnes since 1990 (or 21.2%), reaching their lowest level during this period in 2013. Such a commitment is included in the EEA report concerning GHG emissions

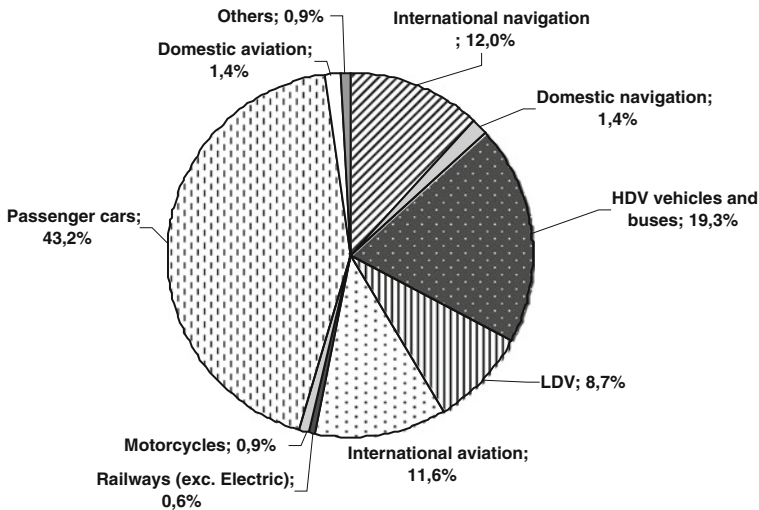


Fig. 5 The contribution of different modes of transport to the EU’s transport GHG emissions in 2013. *Source* [26]

monitoring. It means absolute decoupling of GDP and GHG emission compared to 1990, with an increase in GDP of about 45% alongside a decrease in emissions of over 21% over the 23-year period [26]. GHG emissions decreased in the majority of sectors, with the notable exception of transport, including international transport, and refrigeration and air conditioning.

According to the TERM 2015 report, GHG emissions from transport have increased by 19.4% since 1990. In 2013, transport accounted for almost a one-quarter (24.4%) of the EU’s total GHG emissions (one-fifth excluding international aviation and maritime emissions). Passenger cars contribute almost 45% and heavy-duty vehicles a further 20% of the transport sector’s emissions [21]. Transport urgently needs to find a pathway towards providing carbon neutral mobility. The technological progress is important but not enough to obtain assumed targets. Figure 5 presents the contribution of different modes of transport to the EU’s transport GHG emissions in 2013.

As it is shown in Fig. 5, road transport is responsible for about 73% of all GHG emissions. The passenger cars’ share is 60% of all road transport emissions, while HDVs’ share is 27%. Emissions from LDV are accounted for 8.7% of the total transport GHGs. Domestic and international aviation is responsible for about 13%, and the same share belongs to international and domestic navigation.

The COP21 Paris Agreement from December 2015 created a political pathway for the global CO₂ mitigation efforts by setting up a five-year review cycle for national decarbonisation commitments, starting in 2020 [27]. The Paris commitments and their milestones are vitally important and represent an exceptional opportunity for the transport sector to develop a road map towards carbon

neutrality. While advances in the renewable power generation and propulsion technology will deliver significant progress, this will not suffice [28]. Changes in behaviour and novel approaches to organise mobility and land use will be necessary. At the same time, the transport demand is rising, and changing demographics, rapid urbanisation, new trade patterns, digital connectivity and future infrastructure need to be considered.

Transport Fuel Development and Improving Energy Efficiency

The annual transport energy consumption grew significantly between 1990 and 2013. However, the impacts of the economic crisis caused a decline in transport demand, and hence, energy consumption also decreased by 10.5% between 2007 and 2013. Overall, between 1990 and 2013, the net growth of the EU-28 transport energy consumption is estimated at 22.3%. Road transport accounted for 8.6% of the transport energy consumption in the EU in 2013, followed by international aviation with 12.7% [16]. The energy consumption growth analysis indicated that factors, such as high oil prices in the past, the economic recession, higher efficiency of vehicles and slower growth in mobility, as well as other specific causes contributing to changes in energy consumption over the past decades, should be taken into consideration.

The target of 60% reduction of CO₂ emissions from transport by 2050 set out in the White Paper (2011) is a very ambitious goal. One way of bringing the transport sector closer towards reaching this goal is alternative fuels. At present, the market development of alternative fuels is still held back by the technological and commercial shortcomings, the lack of consumer acceptance and missing adequate infrastructure. The current high cost of innovative alternative fuel applications is largely a consequence of these shortcomings.

The use of fossil fuels across the EU economy continues to decline, in part, due to increased consumption of renewable energy sources, such as wind, solar and biomass [29]. The transport sector is very important concerning its share in energy consumption. The amount of transport energy used to produce one unit of GDP has declined since 2000. In 2013, about 33 g of oil equivalent for each EUR of GDP was used to satisfy the total transport demand in the EU, compared with some 37 g in 2000 [16]. This ongoing reduction indicates relative decoupling of energy consumption in transport from economic growth over the long term. It means that GDP grew at greater pace than energy consumption from the transport sector. This target was set out in the previous White Paper 2001. It should be also noted that although energy consumption of transport per unit of GDP declined, the long-term trend is unfavourable because energy use was still slightly higher in 2013 than in previous years.

Table 2 Renewable energy final consumption in transport (biofuels) in the EU-28

Technology	Final energy (ktoe)					Growth rate (%)		
	2005	2012	2013	Proxy 2014	NREAP 2020	2005–2013	2012–2013	2013–2020
Biodiesels (all)	2,565	11,492	10,293	11,076	20,920	19	–10	11
Biogasoline (all)	560	2858	2717	2700	7324	22	–5	15
Other biofuels (all)	155	117	126	357	746	–3	7	29
Compliant biofuels	3,240	11,595	11,932	12,841	28,989	18	3	14
Total	3,276	14,467	13,135	14,133	28,989	19	–9	12

Source [29]

According to the TERM, the proportion of renewable energy used by the transport sector is growing, but is still considerably small. The share of renewable fuels in transport in the EU-28 was 5.4% in 2013. Table 2 shows the development of the use of biofuels in this sector up to 2013, approximated estimates for 2014 and their expected development based on the National Renewable Energy Action Plans (NREAPs).

The gross final consumption of compliant biofuels was 11.9 Mtoe in 2013, which corresponds to an increase of about 0.3 Mtoe compared to 2012. It can be noticed that over the period 2005–2013, the annual growth rate was 19% per year. It is worth mentioning that in order to realise the NREAPs target for 2020, the growth rate should be about 14% per year over the remaining period. The trends in biofuels consumption emphasise that since 2005, the gross final consumption of biofuels has increased strongly, but it has slowed down and more or less stalled since 2010. Year 2013 was the first year when the total consumption of biofuels decreased compared with the previous year. Most countries are below the expected realisations in their NREAPs.

The renewable transport sector has a separate RES target for 2020, which is equal to 10% for each member state. Of all EU countries, Sweden consumes the largest amount of renewable energy in transport, with a figure of more than 16% in 2013, and therefore has already reached the Directive's 2020 target. Finland showed a considerable increase in the use of renewable energy sources in transport compared to previous years, with a share reaching almost 10% in 2013. Finland is very close to reach this level. The 7% share is observed in such member states as France and Austria. If an average of 5.4% is assumed, 19 countries are below this average and 5 countries (Bulgaria—5.6%, Denmark—5.7%, Germany—6.3%, Poland—6%, Czech Republic—5.7%) are above 5.4%. The lowest share occurred in Spain (0.4%), Portugal (0.7%), Estonia (0.2%), Cyprus and Greece (1.1%).

In summary, the proportion of renewable energy used by the transport sector is growing but remains small. Several reasons lie behind the slow uptake of renewable

fuels across the EU, including the market uncertainty caused by delays in finalising the legislation limiting the risk of greenhouse gas emissions due to indirect land-use change, relatively high abatement costs related to biofuels and slow progress in the deployment of second generation biofuels.

Alternative fuels are also urgently needed to reduce the overdependence of European transport on oil. Transport in Europe is 94% dependent on oil, 84% of it being imported. As it is stated in the White Paper (2011), the challenge is to break the transport system's dependence on oil without sacrificing its efficiency and compromising mobility. In line with the flagship initiative "Resource efficient Europe" set up in the Europe 2020 Strategy and the new Energy Efficiency Plan 2011, the paramount goal of the European transport policy is to help establish a system that underpins the European economic progress, enhances competitiveness as well as offers high-quality mobility services in line with the efficient use of resources.

The supply of oil, and thus the mobility, depends to a large extent on politically unstable regions, which raises concerns about the security of supply. According to the EC, the EU strategy for the transport sector to gradually replace oil with alternative fuels and build up the necessary infrastructure could bring the annual savings on the oil import bill of 4.2 billion in 2020 [30]. More importantly, this support to the market development of alternative fuels as well as investments in their infrastructure will generate growth and employment in Europe.

In addition to influencing the demand for transport and the energy consumption, improved efficiencies and technological factors have also greatly affected the environmental performance of transport. However, these improvements in energy efficiency alone are often insufficient to reduce the environmental pressures, especially that energy efficiency can make products or services cheaper, which in turn may lead to the increased demand, and this phenomenon is known as a "rebound effect" [21].

The technological development of the "Euro" emission standards plays an important part in reducing emissions of air pollutants from passenger cars, LDVs and HDVs. Over time, the standards have been progressively tightened, therefore necessitating improvements in the exhaust control technologies. Unfortunately, although the vehicle emission standards can be effective in reducing exhaust emissions per vehicle, the real reduction in emissions was not always significant. However, this approach is also important in other transport modes (i.e. maritime and aviation in particular). These modes face the substantial time lags before the introduction of new technologies.

Conclusions

As it was stated in the introduction, the sustainable transport system is one of the greatest challenges in the pursuit of sustainable development. A wide range of environmental problems has to be solved in ways that are compatible with social

and economic goals. The EU itself has set the ambitious targets for the decarbonisation of the transport sector. However, according to the European Commission's own projections, the White Paper's (2011) decarbonisation targets will not be met unless further ambitious measures are taken. It is clearly stated that curbing mobility is not an option. New transport patterns must emerge, according to which a larger volumes of freight and greater numbers of travellers are carried jointly to their destination by the most efficient transport. Individual transport is preferably used for the final miles of the journey and performed with clean vehicles.

'Growing out of oil' will not be possible if relies on a single technological solution. It requires a new concept of mobility, supported by a cluster of new technologies as well as more sustainable behaviour. Such tools as land-use planning, the support of intermodality and integration between modes, pricing of infrastructure or building public acceptance should be included in the active transport policy instruments [31].

Land-use planning is an essential tool to integrate the environmental concerns into the transport policy. By influencing spatial structures and the use of these, land use notably affects the length of trips and the choice of transport modes. Integration within the transport modes supports these actions.

The technology penetration, market creation and technology developments are key measures of the progress towards clean energy deployment. However, it should be pointed out that public acceptance is crucial for every integration approach. Very often, it is a major obstacle for the introduction or wider use of some types of policy instruments. Experience also shows that acceptance tends to increase after implementation. Nonetheless, building acceptance is a long process that must start long before the tool begins operation and continue afterwards. Moreover, acceptance depends heavily on the way in which technical information on impacts is provided to the public.

Another important area is an institutional cooperation between ministries (transport, environment and, where applicable, spatial planning and health). This is essential for the development and implementation of integrated transport and environment strategies. Improving the coordination of transport, environmental and spatial planning policy by means of systematic cooperation between transport and other ministries can meaningfully attribute to the development of broadly supported, transparent transport policy.

There is a need for a long-term strategy on alternative fuels that has to meet the energy needs of all transport modes and be consistent with the EU 2020 strategy, including decarbonisation. The security of energy supply to transport is warranted by the wide diversification of sources for different alternative fuels, in particular through the use of the universal energy carriers of electricity and hydrogen, and the close link to renewable energy sources.

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