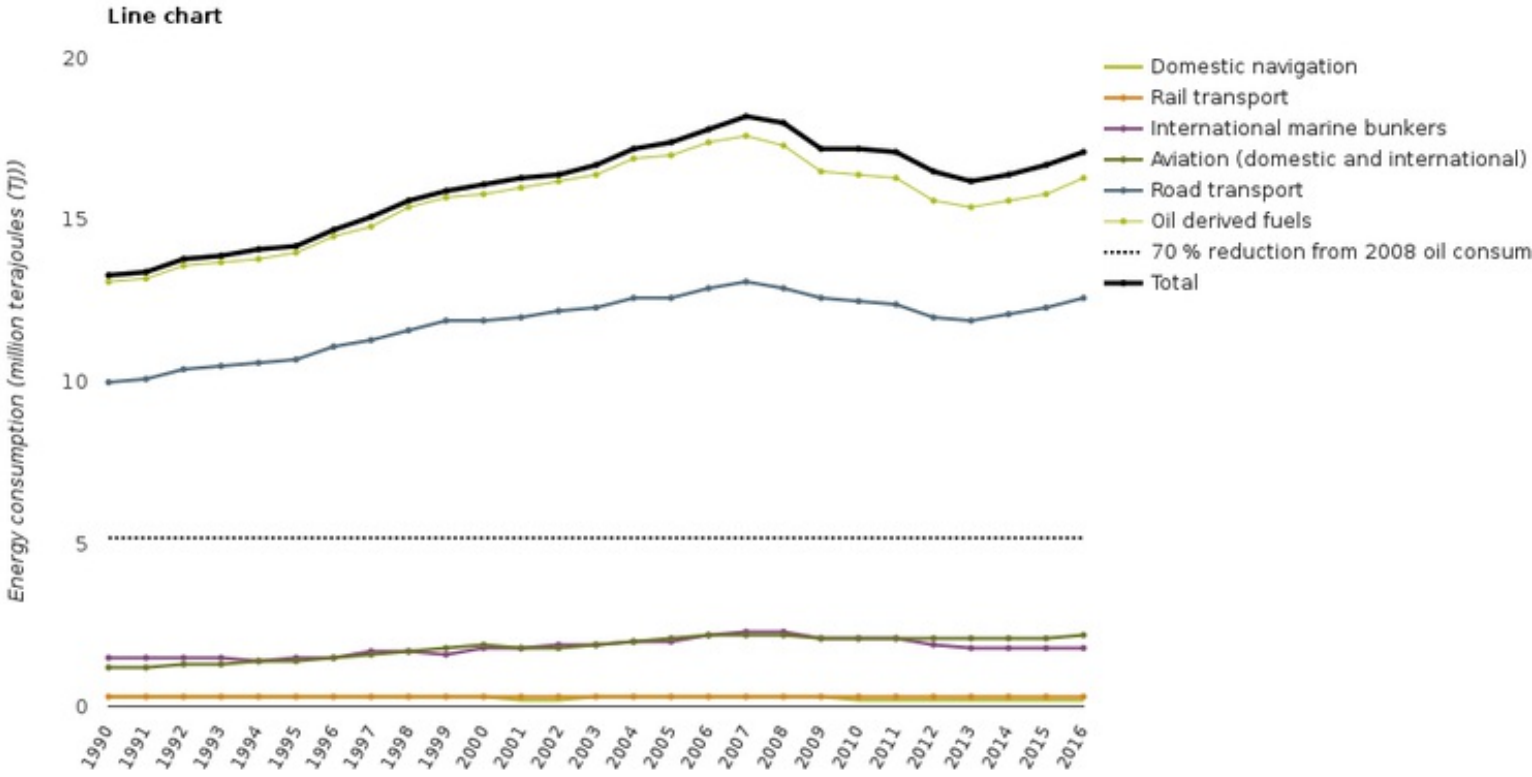
Final energy consumption by mode of transport



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European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark
Tel.: + 45 33 36 71 00
Fax: + 45 33 36 71 99
Web: eea.europa.eu
Enquiries: eea.europa.eu/enquiries

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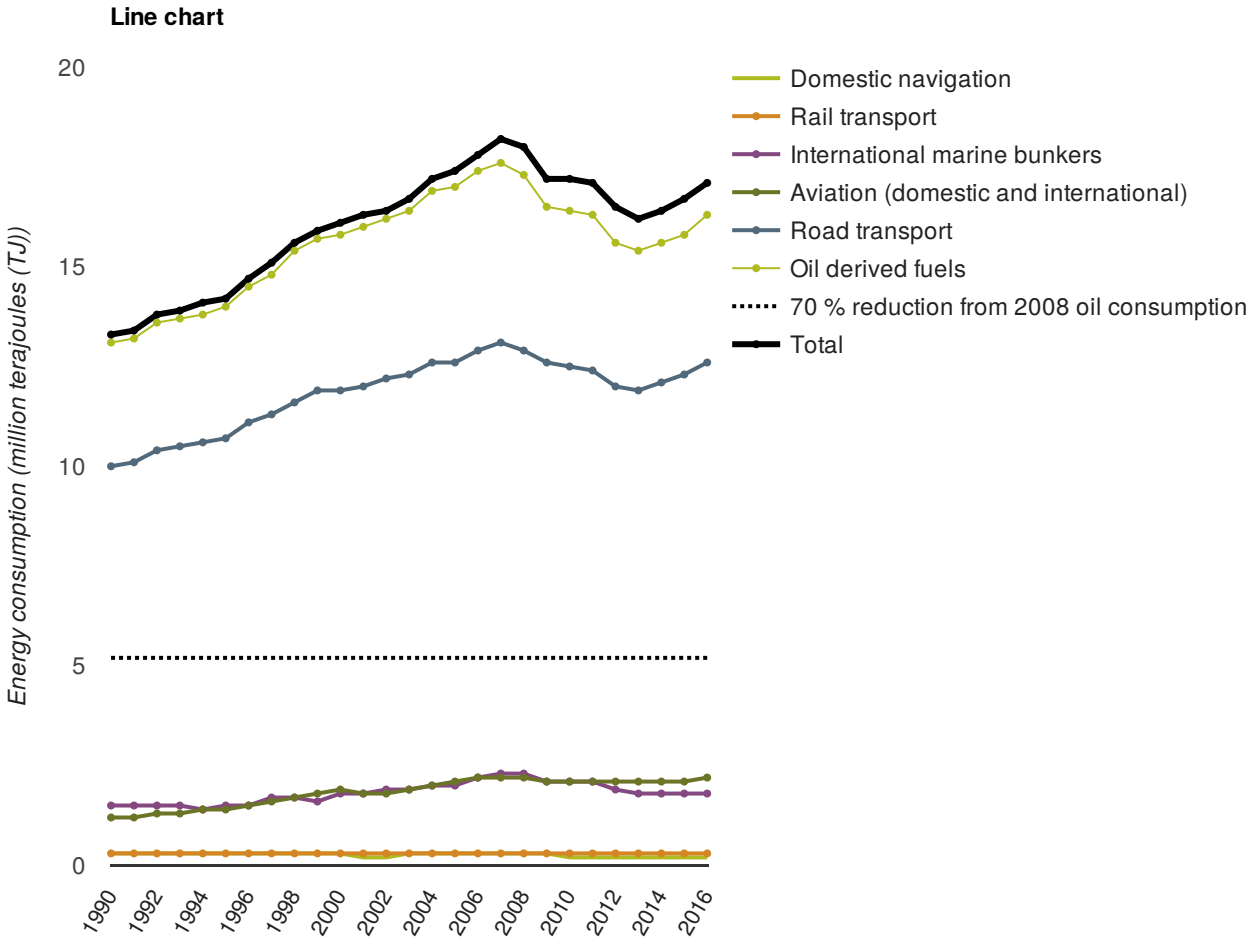
Final energy consumption by mode of transport

Key messages

- The annual energy consumption of transport in the EEA-33 grew by 38 % between 1990 and 2007. However, the economic recession caused a subsequent decline in transport demand leading to a 3 % decrease in the related energy demand between 2007 and 2016. Nevertheless, between 1990 and 2016, there was a 34 % net growth in the energy consumption of transport in the EEA-33.
- The shipping sector saw the greatest decline in energy consumption during the economic recession; it dropped by 11 % between 2008 and 2009 alone, with a total decrease of 19 % between 2007 and 2016. Total energy use in road and rail transport fell by 1 % and 13 % respectively, while air transport increased by 5 % between 2007 and 2016.
- Road transport accounts for the largest share of energy consumption, with 74 % of the total EEA-33 demand in 2016. Despite a decrease in energy consumption since the recession, road transport energy consumption in 2016 was still 32 % higher than in 1990. The fraction of diesel used in road transport has continued to increase, amounting to 74 % of total fuel sales in 2016.

Is the total energy consumption of transport growing?

Final energy consumption by transport mode



Note: Oil derived fuels cover all fuels excluding biodiesel, biogas, biogasoline, electrical energy, natural gas and solid biofuels. In 2016, oil derived fuels accounted for 95 % of all fuels consumed. At 3 % of total energy consumption, biodiesel was the largest source of non-oil derived fuels, while rail electricity was second at 1 %. The '70 % reduction from 2008 oil consumption' is an EU-28 goal that relates to an impact assessment that accompanied the European Commission's Transport White Paper (EC, 2011a), which in turn suggested that a 70 % reduction (from 2008 levels) in oil consumption in transport should be achieved by 2050.

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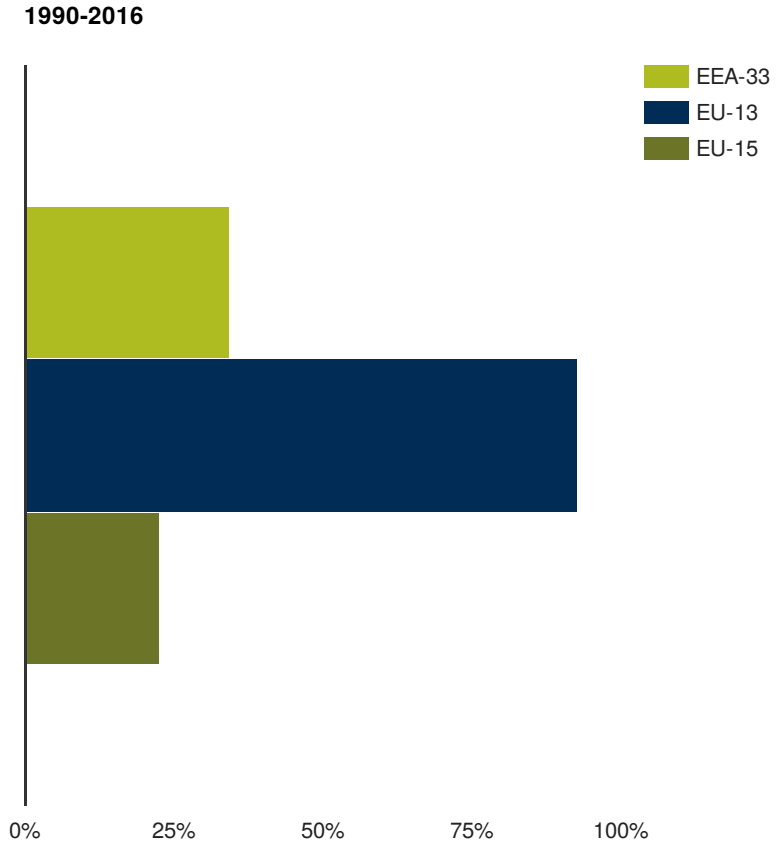
Data sources:

- Energy statistics - supply, transformation, consumption provided by **Statistical Office of the European Union (Eurostat)**

Growth in energy consumption in transport



Note: No data are available for Liechtenstein and Switzerland.

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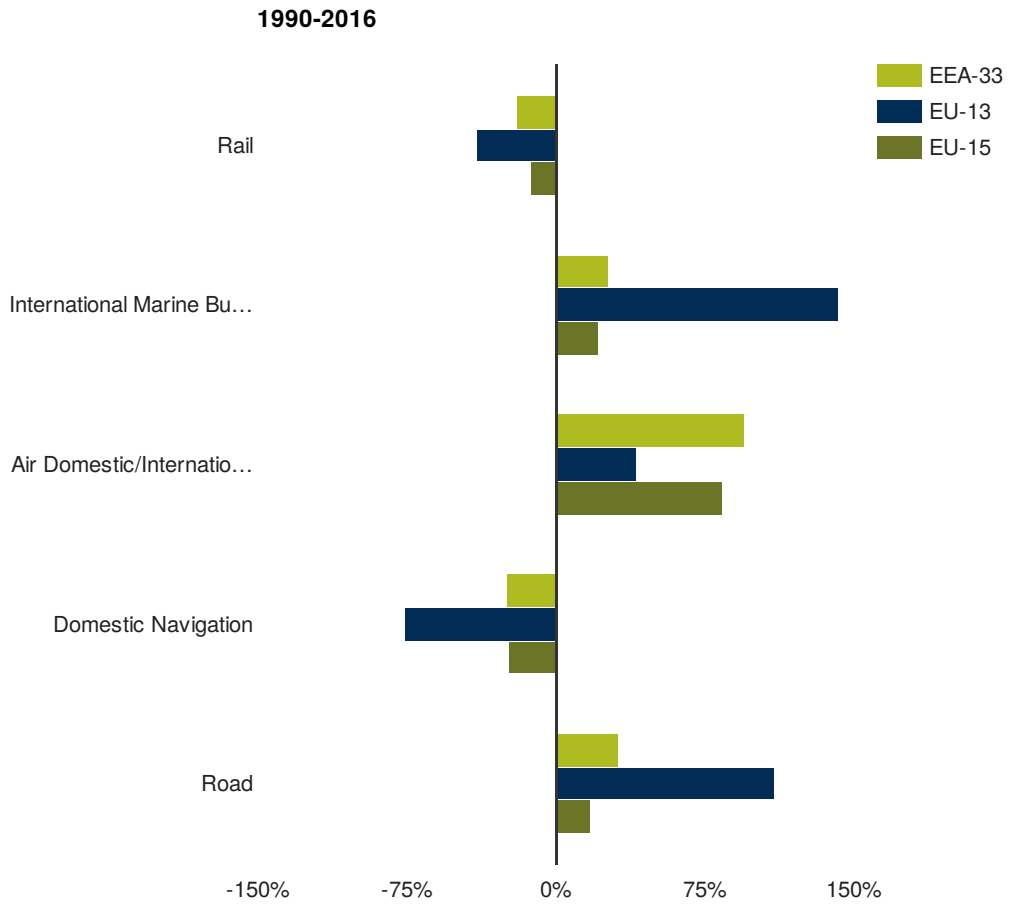
Data sources:

- Energy statistics - Supply, transformation and consumption provided by **Statistical Office of the European Union (Eurostat)**

Change in final energy consumption by transport mode



Note: No data are available for Liechtenstein and Switzerland.

Explore chart interactively

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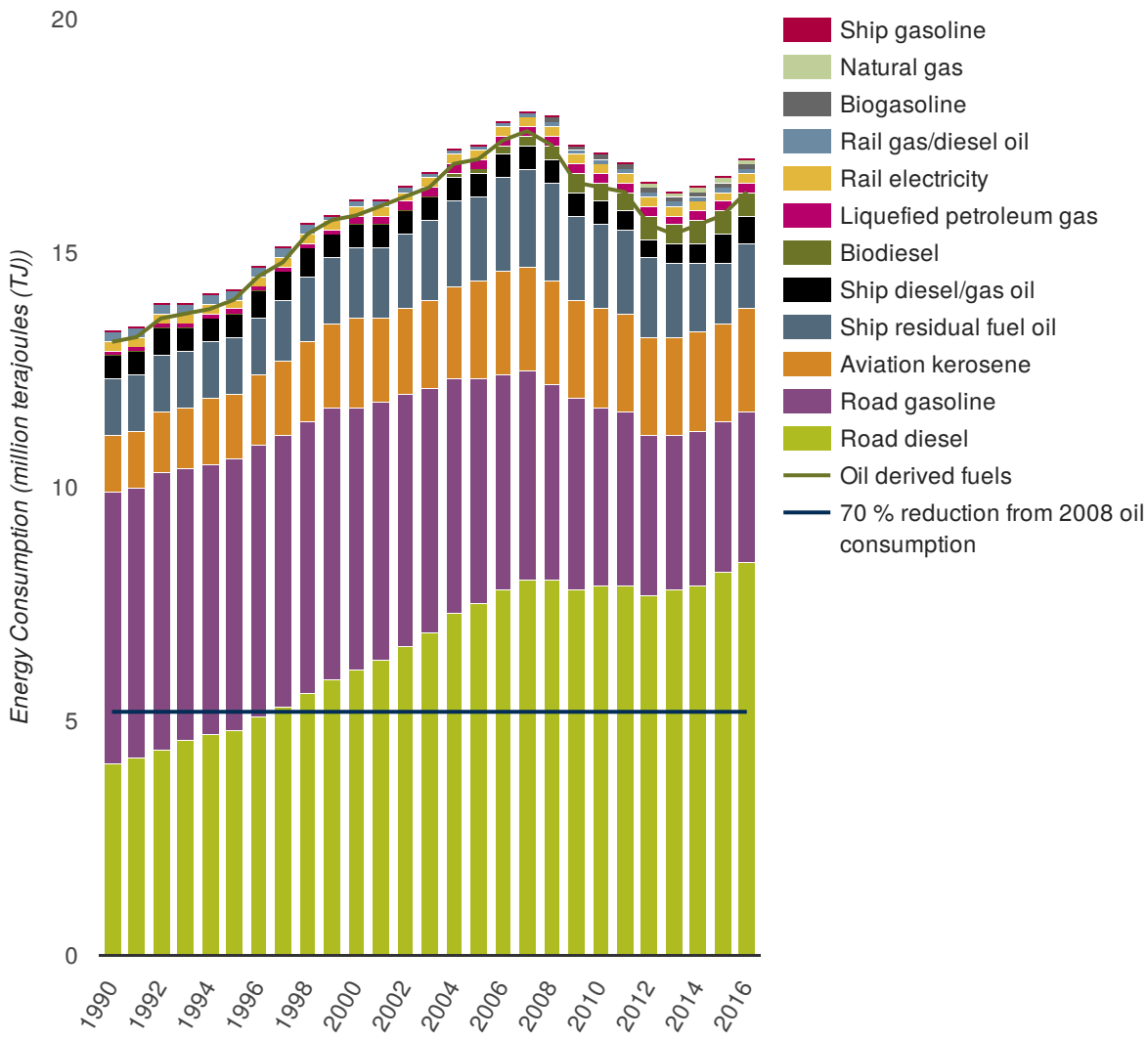
Data sources:

- Energy statistics - Supply, transformation and consumption provided by **Statistical Office of the European Union (Eurostat)**

Energy consumption in transport

Chart



Note: The green line represents total oil derived fuel, while the blue line represents the 70 % reduction from 2008 oil consumption by 2050.
LPG is liquefied petroleum gas.

Explore chart interactively

European Environment Agency

Data sources:

- Supply, transformation and consumption of oil - annual data provided by **Statistical Office of the European Union (Eurostat)**
- Supply, transformation and consumption of gas - annual data provided by **Statistical Office of the European Union (Eurostat)**
- Supply, transformation and consumption of electricity - annual data provided by **Statistical Office of the**

European Union (Eurostat)

- Supply, transformation and consumption of renewable energy - annual data provided by **Statistical Office of the European Union (Eurostat)**
- Energy statistics - supply, transformation and consumption provided by **Statistical Office of the European Union (Eurostat)**

Total growth

In 2016, energy consumption in transport in the EU-28 was 29 % higher than in 1990 (Figure 1). For the EEA-33, the figure was 34 % (Figure 2). In the EU-13, most of this growth occurred in road and maritime transport. In the EU-15, however, the growth occurred mainly in air transport, although the largest absolute increase in energy consumption occurred in road transport.

Split of energy consumption between old and new EU Member States

In 2016, transport in the the EEA-33 countries consumed approximately 18 649 petajoules (PJ, 10^{15} joules) of energy. The original EU-15 Member States consumed the vast majority of the energy (80 %), with just 12 % consumed by the EU-13 Member States. The final 8 % was used in the remaining EEA member countries.

Overall trends in transport energy consumption

Since 1990, energy consumption in transport has increased by 93 % in the EU-13 (see Figure 2). In 2016, just two Member States consumed less energy in the transport sector, compared with 1990: Estonia and Lithuania; Consumption in Latvia remained more or less unchanged. Seven Member States more than doubled their energy consumption over the same period: the Czech Republic, Ireland, Luxembourg, Poland, Romania and Slovenia.

Between 1990 and 2007, the energy consumption of transport in the EU-15 showed steady growth. In 2016, three of the EU-15 Member States saw a reduction in transport energy consumption (Italy, France and the Netherlands). Total energy consumption in the EU-15 was still 22 % higher in 2016 than it was in 1990.

In the EU-15, total transport energy consumption slightly increased by 2 % between 2015 and 2016. Maritime, rail and air transport increased the most by 4 % each. In the EU-13, energy consumption increased across all sectors, except rail transport. The growth was largest for maritime transport (15 %), followed by air transport (10 %). Road transport grew by almost 8 %, while inland navigation grew by 2 %. Rail transport decreased by 1 %.

Sectoral trends

In the EEA-33, aviation has shown the largest growth in energy consumption of all modes, increasing by 94 % between 1990 and 2016, as shown in Figure 3. In 2016, it was the mode with the second highest energy consumption after road transport. This growth has mostly come from

the EU-15, where air transport fuel consumption increased by 83 % over the period. The strongest period of growth for aviation in the EEA-33 was between 1990 and 2007, when it grew by 85 %. However, between 2007 and 2015, energy consumption in aviation in the EEA-33 increased by just 5 %. Air transport is predicted to be the mode that grows the most, becoming the second biggest passenger mode after road transport by 2050. This is because of, for example, the increasing number of international trips to emerging economies in Asia. Nonetheless, energy consumption is predicted to grow less than aviation activity as more energy efficient aircraft are introduced and the fleet is renewed. The International Air Transport Association (IATA) has set ambitious targets for reductions in fuel consumption and emissions by improving fuel efficiency by 1.5 % per year until 2020 and capping aviation emissions from 2020 (EC, 2013).

In the EU-13, energy consumption in road transport grew by 110 % between 1990 and 2016. In the EU-15, it grew by 17 % over the same period. Overall, the price of passenger cars has decreased since 1990, encouraging growth in vehicles in the EEA-33 (see TERM 20).

Energy consumption in maritime transport increased by 56 % across the EEA-33 between 1990 and 2007, before decreasing by 19 % between 2007 and 2016. The countries with the highest maritime transport energy use are the Netherlands, Belgium and Spain.

The low share of energy consumption in rail transport is partly because of a relatively small modal share, but also because, in most situations, rail transport is less energy-intensive than other modes. Rail and domestic waterways in the EEA-33 were the only modes that recorded an absolute decrease in energy consumption between 1990 and 2016 .

Energy consumption in domestic waterways in the EEA-33 remained fairly constant throughout the 1990s and early 2000s. The sector experienced an increase in activity between 2002 and 2006, most notably in the EU-15, with energy consumption in 2006 up 18 % on 1990 levels in the EEA-33. It has since declined and in 2016, consumption was 25 % lower than in 1990 both for the EU-15 and for the EEA-33.

Final transport energy consumption for the EEA-33 was 34 % higher in 2016 than in 1990.

Policy

Policies that (1) reduce the demand for transport or encourage a shift towards more environmentally-friendly modes; (2) improve transport management; and (3) enhance vehicle energy efficiency are required to meet greenhouse gas reduction targets set by the Kyoto protocol and the EU 2030 climate and energy package. They are also required to meet the 70 % reduction in oil consumption from 2008 until 2050, which is included in the Transport White Paper. The EU 2030 policy framework for climate and energy, agreed in 2014 (EC, 2014b), includes:

- An EU domestic emission reduction target of 40 % below 1990 levels by 2030;
- An increase in the share of renewable energy to at least 27 % of the EU's energy consumption by 2030;

- A target for increase in energy efficiency of at least 27 % by 2030;
- A reform of the EU Emissions Trading System.

In 2018, a political agreement was reached between the Council and the European Parliament to raise the 2030 ambition on renewable energy to a binding target of at least 32 % and on energy efficiency to a target of at least 32.5%.

Policies that only focus on the incremental efficiency of vehicles will not be sufficient to deliver a long-term, low-carbon transport sector. Further development must also optimise the performance of multi-modal logistics chains, and use transport and infrastructure more efficiently through improved traffic management and information systems, advanced logistics and market measures (such as the completion of an integrated European railway market), and the removal of barriers to short-trip sea shipping, etc. (EC, 2011a).

In May 2014, the EEA member countries adopted the Athens Declaration, which emphasised the role of short-trip sea shipping in an attempt to shift long-distance transport away from roads and address capacity, energy and climate challenges (GR, 2014). This builds on the Transport White Paper (EC, 2011b) goal, which aims to shift 30 % of road freight travelling over 300 km to other modes such as rail or waterborne transport by 2030, and more than 50 % by 2050. This will be done by facilitating efficient and 'green' freight corridors. A review of the implementation of the Transport White Paper was undertaken in 2015 (EC, 2015b). This reiterates support for the targets and the need for a comprehensive strategy to decarbonise transport.

Indicator specification and metadata

Indicator definition

This indicator considers the total energy consumption of transport in Petajoules (PJ) from 1990 onwards. Transport modes included are bunkers (sea), air transport (domestic and international), inland navigation, rail and road transport.

Units

In this indicator, the energy consumption of transport is measured in Petajoules (1 PJ = 10^{15} J).

Rationale

Justification for indicator selection

Energy consumption is an important driver of environmental pressures, most notably climate change. The growth of energy consumption in the transport sector is hampering efforts to reduce total greenhouse gas emissions and, to date, measures to reduce energy consumption in transport have not had the desired effect.

Scientific references

- 2030 climate and energy goals for a competitive, secure and low-carbon EU economy IP/14/54 22/01/2014.
- Energy, Transport and GHG Emissions Trends to 2050: Reference Scenario 2013 European Commission. ISBN 978-92-79-33728-4, doi: 10.2833/17897.
- Towards low carbon transport in Europe Transport Research and Innovation Portal, DG MOVE. ISBN: 978-92-79-23255-8, doi:10.2832/7573

Policy context and targets

Context description

Reductions in fuel consumption in the transport sector and/or reductions of its related impacts, may be achieved via three primary means:

- **Avoid**: reduce transport demand by limiting the number of trips and their length;
- **Shift:** shift to more fuel efficient transport modes;
- **Improve:** increase the energy efficiency of vehicles and their energy sources. This includes fuel switching, i.e. changing to renewable or low carbon fuels such as sustainable biofuels or using renewable technologies for electric or fuel cell vehicles.

Although climate policy and the Kyoto protocol are important drivers in reducing fossil fuel consumption (and air quality policy to a lesser extent), this indicator is primarily concerned with energy policy. Other related issues are addressed in TERM002 (Transport Emissions of Greenhouse Gases), TERM003 (Transport Emissions of Air Pollutants) and TERM031 (Uptake of Cleaner and Alternative Fuels).

Targets

The EU has set itself the following targets:

- By 2020 there should be a 30 % reduction in greenhouse gas emissions from 1990 levels, in the context of a global agreement and a 20 % unilateral reduction.
- The EU Roadmap for moving to a low-carbon economy in 2050 calls for an 80 % reduction in greenhouse gas emissions by 2050 as a global action to prevent climate change (Decision No 406/2009/EC).

If the 2030 policy framework, proposed in January 2014, is accepted, these targets will be built upon. Additional targets, which aim to reduce greenhouse gas emissions by 40 % by 2030, and increase the renewable energy share by at least 27 %, also by 2030, will be set. Improvements in energy efficiency are still encouraged (from the '20-20-20' target of increasing energy efficiency by 20 % by 2020), but no new target has been proposed (EC, 2014a).

Two key documents published by the European Commission in 2011 outline possible strategies for the transport sector, which are compatible with the 2050 target. These are the Roadmap for moving to a competitive low carbon economy in 2050 (EC, 2011a) and the third decennial Transport White Paper, Roadmap to a Single European Transport Area — Towards a competitive and resource efficient transport system (EC, 2011b).

The impact assessment that accompanied the 2011 Transport White Paper (EC, 2011a) suggests that a 70 % reduction in oil consumption in transport from 2008 levels should be achieved by 2050.

Related policy documents

- 2009/29/ec

Directive 2009/29/ec of the European parliament and of the Council amending directive 2003/87/ec so as to improve and extend the greenhouse gas emission allowance trading scheme of the community.

- COM (2008) 11

First assessment of national energy efficiency plans as required by Directive 2006/32/EC on energy end-use efficiency and energy services – Moving towards together on energy efficiency

- COM (2011) 112 - A Roadmap for moving to a competitive low carbon economy in 2050

With its "Roadmap for moving to a competitive low-carbon economy in 2050" the European Commission is looking beyond these 2020 objectives and setting out a plan to meet the long-term target of reducing domestic emissions by 80 to 95% by mid-century as agreed by European Heads of State and governments. It shows how the sectors responsible for Europe's emissions - power generation, industry, transport, buildings and construction, as well as agriculture - can make the transition to a low-carbon economy over the coming decades.

- COM(2005) 265 final. Green paper on energy efficiency or doing more with less. European Commission.

GREEN PAPER on Energy Efficiency or Doing More With Less.

- COM(2006) 545

Action Plan for Energy Efficiency

- COM(2007) 19

Results of the review of the Community Strategy to reduce CO2 emissions from passenger cars and light-commercial vehicles.

- COM(2010) 2020 final, Europe 2020: A strategy for smart, sustainable and inclusive growth

European Commission, 2010. Europe 2020: A strategy for smart, sustainable and inclusive growth. COM(2010) 2020 final.

- COM(2011) 21

A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy

- COM(2011) 144 Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system

PREPARING THE EUROPEAN TRANSPORT AREA FOR THE FUTURE

- COM(2014) 15 final A policy framework for climate and energy in the period from 2020 to 2030

Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions "A policy framework for climate and energy in the period from 2020 to 2030". 22 January 2014, COM(2014) 15 final; {SWD(2014) 15 final}, {SWD(2014) 16 final}. This Communication p resents an integrated policy framework with binding EU-wide targets for greenhouse gas emission reductions and the development of renewable energy sources and with objectives for energy efficiency improvements for the period up to 2030.

- Decision No 406/2009/EC (Effort Sharing Decision)

Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020

- DIRECTIVE 2009/28/EC

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

- DIRECTIVE 2009/30/EC

DIRECTIVE 2009/30/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC

- REGULATION (EC) No 443/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL 443/2009

Regulation (ec) no 443/2009 of the European parliament and of the Council setting emission performance standards for new passenger cars as part of the community's integrated approach to reduce CO2 emissions from light-duty vehicles.

- REGULATION (EC) No 661/2009

REGULATION (EC) No 661/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning type-approval requirements for the general safety of motor vehicles, their trailers and systems, components and separate technical units intended therefor

- REGULATION (EU) No 510/2011

REGULATION (EU) No 510/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL 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

Methodology

Methodology for indicator calculation

Energy statistics for transport are collected from Member States and collated by Eurostat. To assess whether total energy consumption in transport is growing, time series data for energy consumed were obtained from Eurostat. Data for various fuels were downloaded for bunkers (sea), air (domestic and international), inland navigation, road and rail transport. Data for bunkers cover the quantities of fuel delivered to sea-going vessels of all countries. Data for inland and coastal waters are not included in bunkers (sea). Data for air cover quantities of fuel consumed in national and international air traffic. Energy consumed by electric and diesel trains is included within rail data.

Since Eurostat data are being used to process statistics, the Eurostat methodology should be referred to for data collection and specification (see Eurostat, ITF and UNECE, 2009).

Methodology for gap filling

No methodology for gap-filling is applied for this indicator.

Methodology references

- Eurostat, ITF and UNECE, 2009. Illustrated glossary for transport statistics. 4th Edition. The Glossary comprises 735 definitions and represents a point of reference for all those involved in transport statistics.

Uncertainties

Methodology uncertainty

Data trends within individual countries are difficult to ascertain as energy consumption data often show unexpected volatility from year to year. Energy consumption is calculated based on fuel sales and a common questionnaire is used to report it.

Data sets uncertainty

National data vary significantly from country to country and depending on the fuel type and production/consumption sector. The most reliable data come from the EU-15 Member States. However, oil pipeline data are lacking for the majority of countries, making them less reliable. Occasionally, data used in older time series may change due to revisions in the methodology used. Such changes have resulted in small alterations of a few percent.

For the EU-13, data are generally much less reliable. Gaps are frequent, as are conspicuous jumps in consumption (e.g. doubling or more).

Rationale uncertainty

No uncertainty has been specified.

Data sources

- Energy statistics - supply, transformation and consumption

provided by **Statistical Office of the European Union (Eurostat)**

Generic metadata

Topics:

Transport , Energy

DPSIR: Pressure

Typology: Descriptive indicator (Type A - What is happening to the environment and to humans?)

Indicator codes

- TERM 001

1990-2016

Contacts and ownership

EEA Contact Info

Diana Vedlugaite

Ownership

- European Environment Agency (EEA)

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Related content

Related briefings

Progress of EU transport sector towards its environment and climate objectives [https://www.eea.europa.eu/themes/transport/term/term-briefing-2018]

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