IEA Roadmap targets

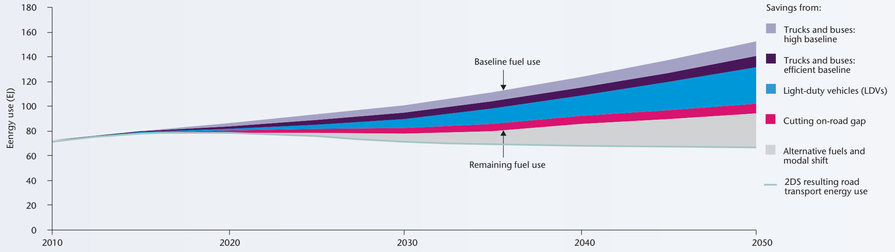
2012 2015 2020 2025 2030 2035 2040 2045 2050

International Energy Agency

Key findings

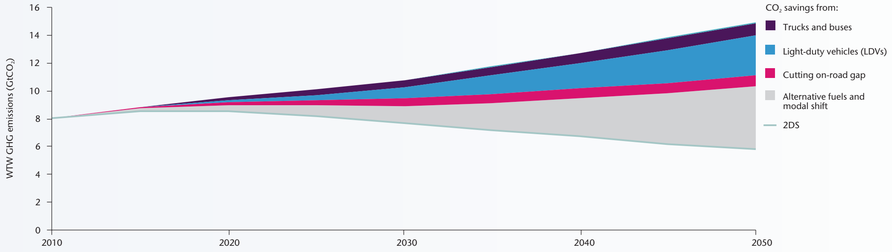
- **Most key technologies for improving the fuel economy of two-wheelers, light-duty vehicles (LDV) and heavy-duty vehicles (HDV) are already commercially available and cost-effective**. Compared with 2005 levels, the potential for improving the fuel economy of all vehicle types within the 2030 time frame ranges from 30% to 50%. This represents a very important opportunity for saving oil and cutting carbon dioxide (CO_2) over the coming two decades and beyond. Fuel efficiency accounts for 4.5 $GtCO_2$ reduction in the 2DS compared to 6DS in 2050, representing 50% of total emissions reductions in the transport sector.
- **Although many fuel-saving technologies are already commercially available and cost-effective, particularly when considered over the lifetime of vehicles, their market penetration is often low because of a range of barriers explained in this roadmap**. Strong policies are needed to ensure that the full potential of these technologies is achieved over the next ten to 20 years.
- **Some technologies need additional research to become commercially viable**, including waste heat recovery devices, electro-mechanical valve actuation, low-friction lubricants and some lightweight materials. New propulsion systems requiring new fuels, such as plug-in electric vehicle systems and fuel cell systems, are beyond the scope of this roadmap and are treated in separate roadmaps.
- **There is often a gap between the fuel economy measured in vehicle tests and in-use vehicle performance**. This gap can be up to 20% and must be reduced to minimise actual fuel use. Strategies to close this gap include better design of fuel economy test cycles, improved traffic flow and better road surface conditions. "Eco-driving", which includes a suite of technologies and actions to improve driving styles and vehicle operating characteristics, also has significant potential to improve fuel economy.
- **Policies that promote fuel economy technologies and improve tested and in-use fuel economy, including fuel economy standards, fiscal measures and information/education programmes, will play a critical role in maximising fuel economy improvements in all countries over the coming decades**. These are introduced in this roadmap and investigated in greater depth in the companion IEA document *Policy Pathway to Improve the Fuel Economy of Road Vehicles* (Box 1).
- **Fuel economy standards are in place in most OECD member countries and China, and are helping to make important progress** in these countries. These can be used as guides for other countries seeking to improve fuel economy. Most major economies should aim to implement fuel economy standards, as part of a comprehensive fuel economy policy package, by 2015, with strong fuel economy improvement targets for 2020 and even out to 2030. Important complementary policies include fuel economy labelling, fuel economy or CO_2-adjusted vehicle tax systems (such as "feebates"), and fuel taxes.
- **In countries that already have strong policies, these policies and their targets should be tightened to maintain progress, and by 2015, extended to 2030** and expanded to cover all road vehicle types, particularly heavy duty vehicles.

Energy reduction potential from fuel economy improvement



"Note: the rest of energy use and GHG emissions reductions to reach 2DS are coming from fuel switching, modal shifting and demand management".

CO_2 mitigation potential from fuel economy improvement

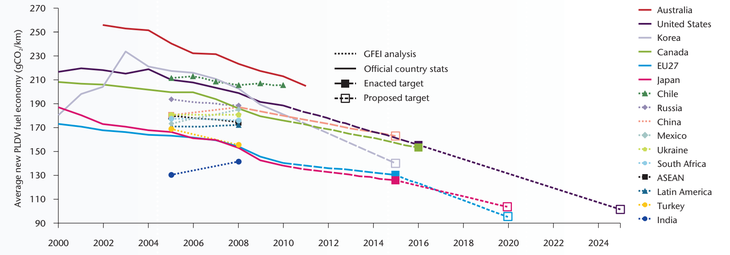


Policy actions and milestones

Key actions over the next ten years

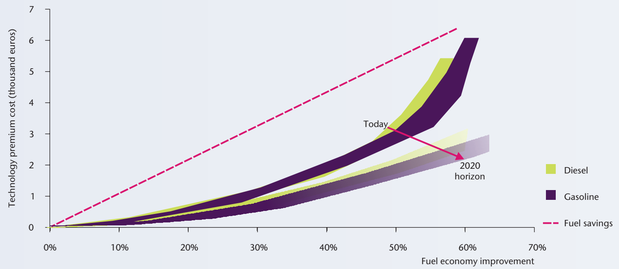
- All markets should provide consumer information on the vehicle fuel economy, *e.g.* through a fuel economy label; new and second-hand vehicles should be considered, depending on the registration profile of a given country.
- Comprehensive fiscal policy packages should be put in place to cover vehicles purchase price linked with fuel economy and fuel tax based on carbon content.
- Decrease and remove fuel subsidies to avoid public funding of carbon intensive energy sources.
- Implement fuel economy standards for cars and trucks in all major markets, with tightening targets over time; 80% of new vehicles should be covered in order to engage global industry players.
- The world harmonised test cycle should be adopted by most countries in accordance with local specificities; the test cycle has to be as representative as possible of real driving conditions in order to reduce the gap between measured and real fuel economy.
- Include upstream emissions when developing new certification procedures and information strategies.
- Governments should support advanced technologies for powertrain and vehicle structure that can substantially improve fuel economy through RD&D programmes, which should remain technology neutral.

Evolution of fuel economy, and regulation targets enacted and proposed, 2000 to 2025



Note: The enacted targets represent the maximum fuel economy allowed for a specific year; *e.g.* Japan has already reached its 2015 target in 2010, not meaning they will stop improving between 2010 and 2015.

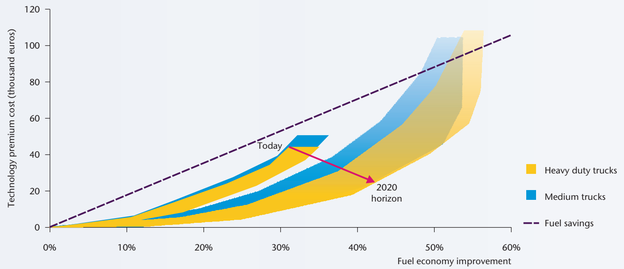
Passenger cars cost curves



Source: IEA analysis based on TNO, 2009 and ICCT, 2012.

Note: Fuel savings over the lifetime of the vehicle are calculated based on 150 000 km, for a base fuel economy of 8L/100 km, with a fuel price of EUR 1 per litre (USD 4.7 per gallon), with no rebound effect as fuel economy improves.

Heavy duty trucks cost curves



Source: IEA analysis based on AEAT, 2011.

Note: Fuel savings over the lifetime of the vehicle are calculated based on 600 000 km, for a base fuel economy of 30L/100 km, with a fuel price of EUR 1 per litre (USD 4.7 per gallon), with no rebound effect as fuel economy improves.

The cost curve figures for cars and trucks show the increasing cost and fuel savings (over vehicle life) associated with different degrees of fuel economy improvement, and indicate that fuel savings is greater than cost except for very high percentage changes in fuel economy (since the dotted lines showing fuel savings are above the areas indicating costs). The figures also show the expected reduction in technology costs between today and 2020, reflecting innovations, scale economies and optimizations in the production of new technologies. For example, for gasoline cars, cutting fuel economy by 50% costs around EUR 3 000 today, but this drops to under EUR 2 000 by 2020.

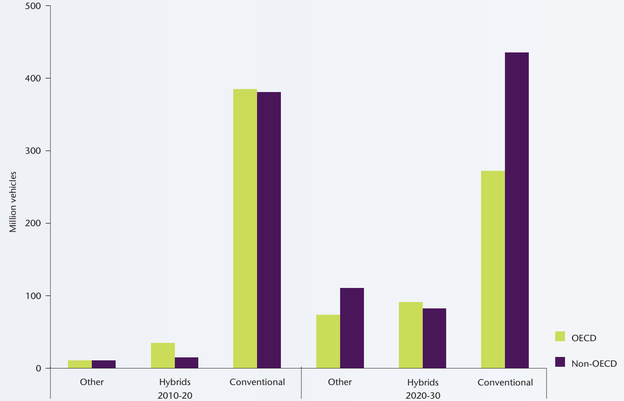
Technologies for fuel economy improvements for trucks are more expensive than for cars; this, however, should not prevent the adoption of these technologies by truck owners for two reasons:

- trucks are often driven much more per year, and over their lifetimes, than cars, so the fuel savings is larger;
- trucks are more expensive to buy and so the premium cost percentage for fuel efficient technologies is similar similar to passenger cars.

These fuel economy improvements are achieved with internal combustion engines; additional improvements from shifting to electric vehicles can also help, but the cost will be higher in the near term.

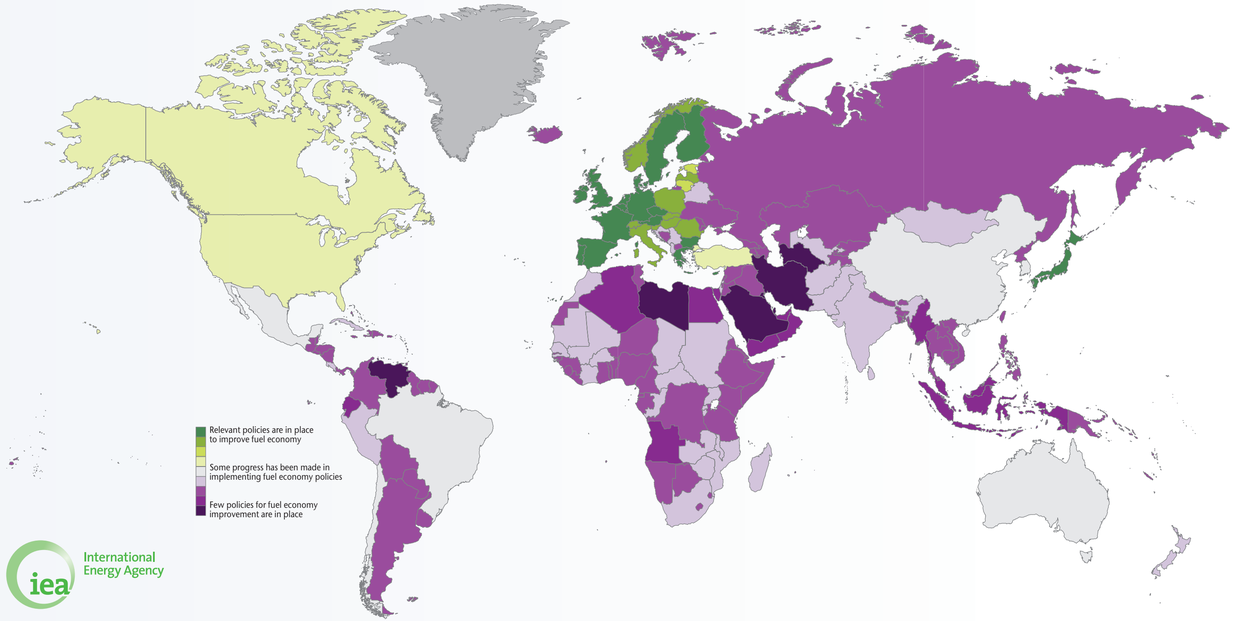
The graph on the right further shows the numbers of vehicle fitted with conventional internal combustion engines in the next two decades. The vehicles fitted with conventional internal combustion engines will represent more than 90% of new sales in the coming decade, and will remain dominant throughout the 2020s.

Importance of ICE engines in future sales



Fuel Economy

Fuel economy readiness index status, 2010



The IEA fuel economy readiness index is a scoring system combining countries' implementation of four key policies to incentivise fuel economy: fuel tax, CO_2-based vehicle purchase taxation, labelling schemes, and fuel economy standards for light duty vehicles (LDVs) and heavy duty vehicles (HDVs). More details on the scoring scale can be found in page 41 of the main report.