European Commission

Low-emission Alternative Energy for Transport

Roadmaps

In Brief

Electric battery and hydrogen fuel cell powertrains are now seen as a viable option for many road vehicles. However, aviation, waterborne transport and certain heavy-duty road vehicles are likely to rely on combustion engines and liquid fuels for the foreseeable future.

In order to decarbonise the transport sector it is therefore essential in the short- and medium-term to increase the use of renewable energy sources and improve the overall energy efficiency of the transport system. This will have the benefit of not only reducing greenhouse gases but also pollutants that are responsible for poor urban air quality.

Nevertheless, increasing the share of alternative low-emission energy in the transport sector poses a number of technical and environmental challenges.

The development of a new generation of powertrains will require research and innovation efforts to be focused on a step change in technology. One that allows greater and more efficient use of alternative energies to reduce greenhouse gases. For energy production, research and innovation efforts will need to focus on novel low-emission alternative energies based on renewable and sustainable sources.

The Strategic Transport Research and Innovation Agenda (STRIA) *Roadmap for Low-emission Alternative Energy for Transport* focuses on renewable fuels production, alternative fuel infrastructures as well as the impact on transport systems and services of these technologies for road, rail, waterborne transport and aviation.

Current Developments

Light-Duty Vehicles: Developments in light-duty vehicle technology and fuels have been driven by tailpipe pollutant emission limits as well as average fleet carbon dioxide (CO_2) targets. So far, CO_2 targets and fuel taxation favouring diesel have led to the widespread uptake of diesel, especially for larger and heavier vehicles. In the medium-term, it is expected that stricter CO_2 targets and the implementation of a revised vehicle test procedure will also lead to the uptake of new engine and vehicle technology in the light duty vehicle sector increasing levels of electrification and hydrogen.

Heavy-Duty Vehicles: Heavy-duty vehicles such as trucks and buses are predominantly powered by diesel engines which have higher nitrogen oxide and fine particulate emissions. After-treatment systems have been to used to reduce diesel engine pollution but these have been bulky and expensive. Cost-effective alternative fuels and technology that have lower after-treatment requirements could therefore play a significant role in powering future heady-duty vehicles.

Rail: Rail strategies favour further electrification, but there are routes where electrification is not economically viable. On such routes, locomotives could be fuelled with alternative energies such as hydrogen in combination with some form of electrification.

Waterborne transport: Heavy fuel oil (HFO) accounts for about 77 per cent of waterborne fuel consumption. However, it is a poor quality, low-price, high-sulphur residual fuel. The main alternative to HFO is liquid nitrogen gas (LNG) as it is considered a proven and available solution, with gas engines covering a broad range of power outputs. Current research activities in waterborne propulsion focus on combustion systems to reduce emissions and fuel consumption. In the future, LNG and ultimately hydrogen may be used in high temperature fuel cells to achieve greater engine efficiencies.

Aviation: The aviation sector has seen significant energy efficiency gains. However, these gains will not offset the expected growth in aviation or allow emission reduction targets to be met. Due to the high cost of aircraft and the long fleet replacement time, and limited infrastructure changes, the aviation sector is likely to rely on liquid fuels similar to kerosene to 2050, and is examining alternative blend fuels allowing current jet fuel specifications to be met.

Key Research Innovation Pathways

Decarbonisation of the transport sector depends on the well-to-wheel impacts of alternative energy production, which requires the use of low carbon and renewable fuels.

Research and innovation will need to focus on the efficient use of advanced biofuels, fossil fuels blended with renewable fuels as well as pure renewable fuels. It will also be necessary to match fuel and engine characteristics for specific transport modes such as heavy-duty vehicles, aviation and shipping.

Furthermore, research and innovation would need to examine applications combining electric, fuel cell and renewable fuels, for example, vehicle fuel cell concepts for the on-board generation of power from renewables.

A number of alternative fuel options could be used by each transport mode and increase energy diversification. Some transport modes such as light- and heavy-duty vehicles have the option of substantial electrification or the use of fuel cells. Therefore, the development of light-duty vehicle technology has a lower priority than those transport modes where there is no alternative.

Due to the link between the production and the use of alternative fuels, transport and energy research and innovation have to be analysed and developed together to identify viable options.

Transport Research and Innovation Agenda

The Strategic Transport Research and Innovation Agenda (STRIA) outlines future transport research and innovation priorities to decarbonise the European transport sector.

STRIA is one of five interlocking dimensions set out in the energy union strategy that provides a framework to achieve European Union (EU) energy and climate goals. It supports the vision of a clean, connected and competitive European transport system.

In coordination with Member States and transport stakeholders, STRIA aims to set out common priorities to support and speed-up the research, innovation and deployment process leading to radical technology changes in transport.

STRIA builds on and integrates seven thematic transport research areas:

- Cooperative, connected and automated transport;
- Transport electrification;
- Vehicle design and manufacturing;
- Low-emission alternative energy for transport;
- Network and traffic management systems;
- Smart mobility and services; and
- Infrastructure.

STRIA is also the interface between other relevant sectors such as energy and information and communication technology.

About TRIMIS

The Transport Research and Innovation Monitoring and Information System (TRIMIS) supports the implementation and monitoring of STRIA and its seven roadmaps.

TRIMIS is an open-access information system to map and analyse technology trends, research and innovation capacities, as well as monitor progress in the transport sector.

Contact:
European Commission • Joint Research Centre, Ispra, Italy
Email: EU-TRIMIS@ec.europa.eu

https://trimis.ec.europa.eu/