AT A GLANCE

Requested by the TRAN Committee

Study in Focus

European Parliament

Environmental challenges through the life cycle of battery electric vehicles

See the full study

The take-up of battery electric vehicles (BEVs) is expected to be **the main mechanism for achieving the CO2 regulation for passenger cars**, but BEVs are only zero emission at their point of use, and a range of policies need to work synergistically to ensure overall reductions in environmental impacts across the vehicle life cycle.

The **European Green Deal** and **Fit for 55** initiatives have resulted in a substantial revision of the regulatory and policy landscape at EU level on the environmental performance of road vehicles, considering all vehicle life cycle stages.

The study

provides an up-to-date expert assessment and comparison between the life cycle's carbon footprint of battery electric and internal combustion engine passenger cars.

This study:

- presents an **overview of the technology and policy developments** related to passenger vehicles and provides a comparison of BEV vs Internal Combustion Engine Vehicle (ICEV) Life Cycle Assessment (LCA) by life cycle stage, based on extensive literature review and an LCA modelling exercise;
- provides an **understanding of the current and future outlook** based on Fit For 55 and technological development;
- provides **policy recommendations** based on the findings from the LCA comparison.

Key findings

- Battery electric vehicles tend to exhibit **significantly lower life cycle greenhouse gas** (GHG) impacts than internal combustion engine vehicles (ICEVs), despite their initially higher emissions during manufacturing.
- A typical battery electric car in the current situation **already saves over ~60% kgCO2eq** compared to an equivalent conventional gasoline car in average EU conditions. Significant life cycle GHG emissions reductions were also found across different situations and countries.
- Large scale deployment of e-fuels or biofuels in road transport will still have higher emissions than a move to BEVs.

- The GHG benefits of BEVs are **expected to further increase**. By 2030, average BEV GHG impacts in the EU27 could be 78% lower than those of an equivalent conventional gasoline car. By 2050, these savings could increase to 86%.

Policy recommendations

- It is essential to **develop an ambitious policy agenda around battery recycling and circular economy concepts for critical raw materials at EU level**. The combined effectiveness of the Battery Regulation and revised ELV Directive needs to be closely monitored to ensure these instruments deliver on policy goals. Particular attention should be given to enforcement, monitoring methods and targets in view of potential market and technological innovations in the next years.
- **Decisive policy action** on some specific issues will be needed **to maximise the benefits** of BEVs and **mitigate existing risks**, including an ambitious policy agenda around circular economy approaches for vehicle components at EU level, particularly for EV batteries.
- Tailpipe CO2 emissions regulations provide a **suitable regulatory framework**, considering current technical limitations for a regulation on a life

Policy Department for Structural and Cohesion Policies
Directorate-General for Internal Policies of the Union
Authors: Nikolas HILL, Marco RAUGEI, Aleix PONS, Nikos VASILEIADIS, Hugo ONG, Lorenzo CASULLO
PE 733.113 - March 2023

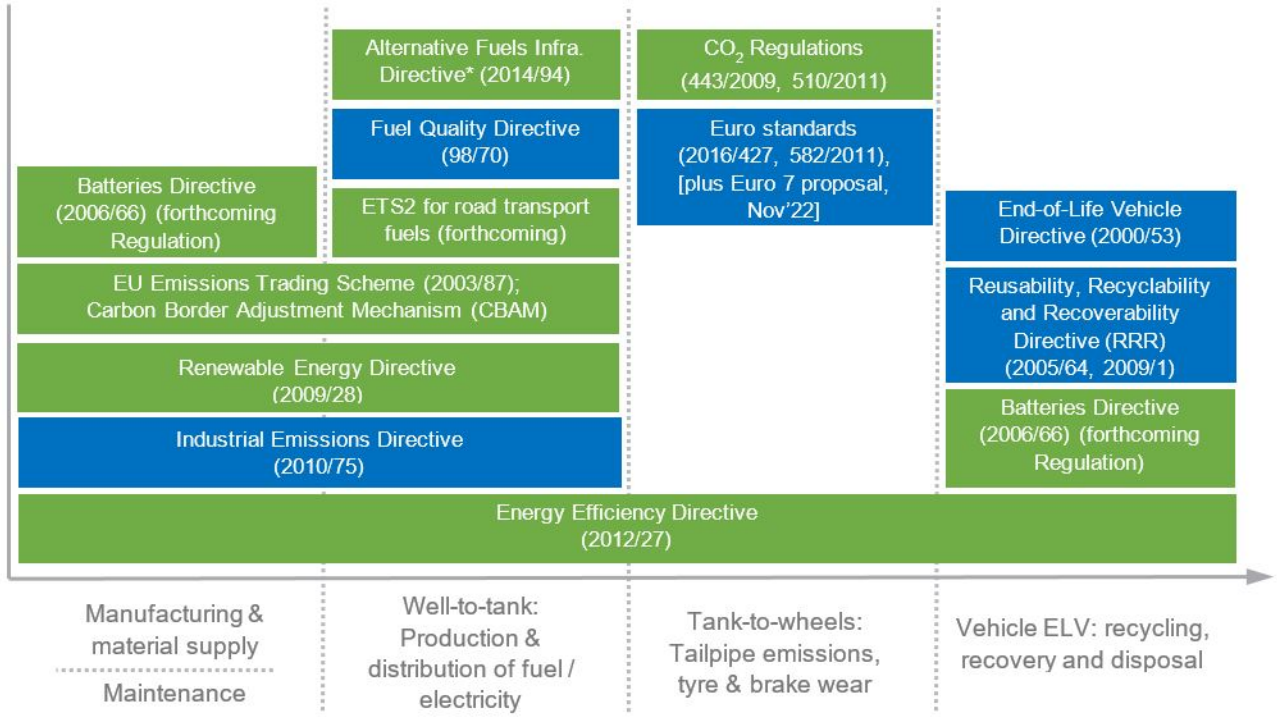
EN

Access this note

cycle basis and the presence of complementary legislation to regulate upstream and end-of-life emissions. However, **LCA reporting should be encouraged**.

- **Incentives to promote** right-sized BEVs/batteries may be needed as BEVs consolidate their market position. These could be introduced in terms of energy efficiency targets for BEVs or zero-emission vehicles more widely.
- **Further EU-wide research is required to foster innovation** in the field of battery technology and particularly on more materially-efficient battery variants that utilise smaller amounts of critical elements per unit of storage provided.
- **A wider set of policies**, including policies to promote a modal shift towards sustainable travel modes and the adoption of mobility-as-a-service, is needed to further reduce emissions on a passenger-km basis.

Simplified mapping of key European legislation to vehicle life phase



Source: Ricardo (own elaboration.)
Notes: Additions/updated proposals in 2021 / Fit For 55 legislative package highlighted in green

The present note is based on the study *Environmental challenges through the life cycle of battery electric vehicles*, authored by: Nikolas HILL, Marco RAUGEI, Aleix PONS, Nikos VASILEIADIS, Hugo ONG, Lorenzo CASULLO
Publication: March 2023. © Image on page 1 used under the licence from Adobe Stock
Responsible for this At a Glance Note: Kinga OSTAŃSKA and Davide PERNICE
Contact: Poldep-cohesion@ep.europa.eu; Further information: www.research4committees.blog/tran. Follow us: @PolicyTRAN
This document is available at: www.europarl.europa.eu/supporting-analyses