

Deep Decarbonization of the Transport Sector: Banning the Sale of Diesel and Petrol Vehicles

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Short abstract

Banning sales of new conventional cars aims to stimulate investments in low emission technologies. This paper carried out a comprehensive and model-based analysis of such a car ban. Energy and emission scenarios and policy implications are provided.

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Abstract

For the goal of Paris Agreement of maintaining the average global temperature increase to well-below 2 degrees Celsius above the pre-industrial era, the International Energy Agency (IEA) estimated that global internal combustion engine (ICE) car sales must fall to close to zero by 2050 (IEA, 2017a; ITF, 2019). Currently, ICE cars still dominate car markets globally, while electric cars only accounted for 2.6% of car sales and about 1% of car stock in 2019 (IEA, 2020b). The slow historical tendency of electrifying the transport sector highlights the necessity to explore more options in the whole policy package to contribute meaningfully to deep decarbonisation.

Technology phase-out mandates can, in part, be a potential complement to current market based tools (e.g., carbon taxes) to stimulate new investments in low emission technologies and accelerate deep decarbonization. A few countries and regions (e.g., Ireland, China, Denmark, California, and British Columbia) announced their ambitious plans of banning new conventional cars sales. The environmental concerns, industrial upgrading and renewal for new vehicle technologies, and political signaling to promote technology transition have been the main reasons for car bans (Meckling and Nahm, 2019).

In practice, the design and implementation of the announced car bans remain vague. To contribute to a comprehensive analysis of such a car ban, this paper aims to make comparisons between introducing a ban on car and other transport-related policies, and between different designs of car bans through a modelling approach. The objective of the paper is also to examine impacts of possible behavioral changes induced by car bans. For these purposes, a national passenger transport model with detailed vehicle profiles is established to project transport demand, energy consumption and emissions from 2015 to 2050.

The results show that, with the continuously increasing passenger transport demand, energy consumption is significantly reduced through improving energy efficiency (by 38% by 2050 relative to 2015), supporting EVs (by 43%) and implementing car bans (by 46%). The latter two measures are more likely to reach carbon neutrality in 2050, but adding a car ban achieves less cumulative emissions. A car ban also reduces uncertainties in the car market and emission reductions that rely on behavioural changes, such as company R&D investments in reducing battery production cost and consumer preference to new technologies. Furthermore, given emission reduction paths to reach ambitious climate targets, policy implications on car ban implementation time (no later than 2030) and coverage of vehicle types (exempting BEVs and/or PHEVs) are provided. Additionally, different behavioral assumptions (variations in electric motor usage with PHEV, investments in battery cost reduction, and car scrappage) show variations in tailpipe emissions reductions by 77% - 100% , which implies potential benefits of relevant ancillary policies.

In all, a car ban is not a silver bullet in achieving long term climate neutrality, but should be taken as one important part of a comprehensive policy package for deep decarbonisation. With a whole package of market-based policy instruments (e.g., CO₂ based vehicle taxes, carbon taxes, and fuel taxes), carbon emissions are highly priced, but progress in emission reduction from transport and transition to low/zero emissions vehicle technologies have been relatively slow. As one of the implemented or proposed regulatory instruments ("command and-control"), a car ban can play an

important role in accelerating decarbonization, especially in the light of the urgency for early and substantial emissions reduction proposed in the Paris Agreement. It can also reduce uncertainties with respect to achieving climate objectives where there is a lack of specific and actionable transport-related mitigation measures evident in the Nationally Determined Contributions (NDCs).

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Topic

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