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US–Mexico Second-hand Vehicle Trade: Implications for responsible EV end of life management and material circularity in North America

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Issue

Second-hand (SH) vehicle imports from the US comprise nearly 20 percent of the 30 million light-duty vehicles (LDV) currently registered in Mexico. As demand for electric vehicles (EVs) in Mexico grows and the share of EVs in the US fleet continues to increase, the SH EV market in Mexico is likely to start developing, introducing new challenges for vehicle lifetime and end-of-life (EoL) management needs. Using system dynamics modeling, researchers at the University of California, Davis, developed scenarios to project future trends in EV adoption and SH vehicle trade flows in Mexico. Results indicate potential synergies with respect to market timing, but also a risk of disproportionate burdens from spent batteries in Mexico, since used EVs have less remaining battery life and thus generate spent batteries more quickly than a new EV. This trade of SH EVs between Mexico and the US should be managed bilaterally, ensuring that imports to the country deliver sufficiently long operational lives, and exploring opportunities to set up regional battery recycling systems to recover critical minerals, so that the burden of EoL managements do not outweigh the benefits of affordable EVs.

Key Research Findings

1. Steady Shift to EVs: By 2030, new and SH EVs will account for 5% of Mexico's total in-use vehicle stock, a significant increase from the mere 0.02% in 2022. By 2050, the EV share of the total in-use vehicle stock will have risen to 54%.

2. Second-Hand Vehicle Import Scenarios: Results indicate that by 2050 84% to 99% of SH vehicle imports from the US will be EVs. Furthermore, Mexico is expected to see a cumulative 30.4 million EV registrations, 3.8 million of which will be SH EVs imported from the US. Figure 1 illustrates the breakdown of the composition of the Mexican in-use vehicle stock over the study period.

3. Battery Recycling Potential: As EV adoption grows, the total mass of batteries from deregistered EVs in Mexico is projected to dramatically rise from 1,942 tons in 2035 to 1,208,452 tons in 2050. This underscores the need for effective recycling systems to recover valuable battery materials such as lithium, cobalt, and manganese, essential for battery production and sustainable energy transitions.

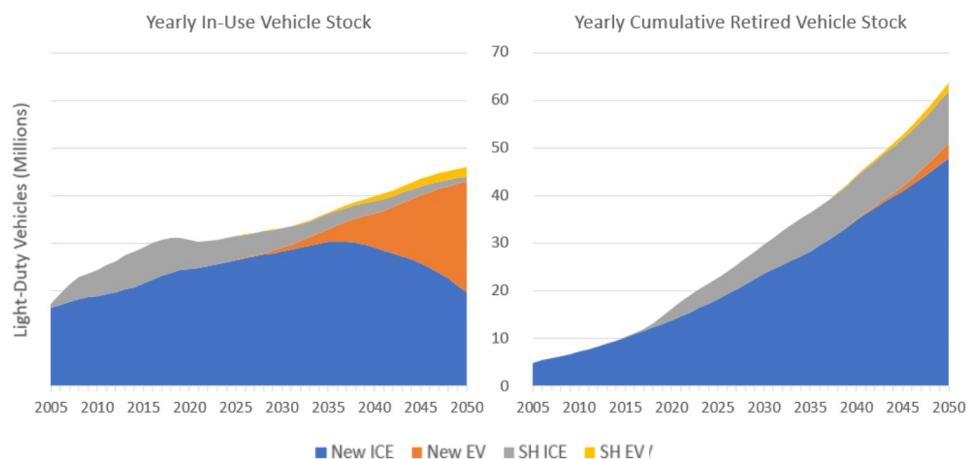


Figure 1. Evolution of the composition of the Mexican In-Use and Retired Vehicle Stocks.

Policy Considerations

The policy recommendations outlined below are motivated by the need to address various concerns related to EV adoption, end-of-life management, and cross-border collaboration between Mexico and the United States.

Mexico:

1. Establish mechanisms for managing EV imports:

Mexico should consider implementing mandatory state of health (SOH) checks on used batteries to prevent the import of vehicles with compromised batteries. Pre-export verification can also be employed to verify compliance with these regulations and ensure the environmental sustainability of the imported EVs.

2. Measures to grow domestic recycling capacity:

Mexico could explore incentives to attract recycling companies to establish local operations, thereby creating a robust EV recycling infrastructure. This could help manage the disposal of EoL EVs and their batteries, create job opportunities, and contribute to the local economy.

3. Developing a circular battery economy:

Mexico can learn from the European Union's (EU) circular battery economy approach, which includes battery manufacturing using primary or secondary (recycled) domestic material sources and second-life applications for used batteries in stationary energy storage or backup power systems.

United States:

1. Binational battery recycling programs: The US should work closely with Mexico to develop joint programs to enhance the North American battery recycling supply chain. This collaboration could facilitate the return of critical minerals to the US and help secure the supply chain for EV battery manufacturing.

2. Streamline trade registrations: Collaborating with Mexican customs to unify and streamline trade registrations could simplify the export

process, ensure compliance with regulations, and facilitate tracking SH EVs crossing the border.

Joint Actions:

1. Coordinated regional end-of-life responsibility determinations:

The United States-Mexico-Canada Agreement (USMCA) countries could establish a coordinated program to determine responsibilities and responsible parties in battery EoL management. This system would incentivize parties to design systems through a lens of sustainability and material recovery and recycling.

2. Shared database platform: Establishing a shared database platform for the USMCA region, akin to the EUs Digital Battery Passport, can enable efficient tracking of EVs and their battery life cycle, fostering greater transparency and accountability in the management of EoL for EVs and their batteries.

3. Right to repair legislation: Advocating for legislation supporting the right to repair electric motor vehicles can empower consumers and independent repair shops to maintain and prolong the lifespan of SH EVs, reducing the burden on recycling infrastructure and conserving resources.

More Information

This policy brief is drawn from "US-Mexico Second-Hand Electric Vehicle Trade: Battery Circularity and End-of-Life Policy Implications," a report from the National Center for Sustainable Transportation, authored by Francisco Pares Olguin and Alissa Kendall of the University of California, Davis. The full report can be found on the NCST website at <https://ncst.ucdavis.edu/research-product/us-mexico-second-hand-electric-vehicle-trade-battery-circularity-and-end-life-0>.

For more information about the findings presented in this brief, contact Francisco Olguin at fapares@ucdavis.edu.

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