ELECTRIC VEHICLES

Electric vehicle (EV) technology has existed since 1828, but until recently, the availability of cheap and abundant oil created economic barriers to widespread EV deployment. Recent advances in lightweight efficient batteries that can sustain driving for long ranges have propelled EV sales forward. As a result, more affordable options are now becoming widely available and EVs have dramatically gained in popularity.

EVs can be charged at home through slow-charging cords that can be plugged into regular electrical outlets or at a faster speed through 220-volt circuits, or they can be charged at public 220-volt or fast-DC charging stations, often located at workplaces, park-and-rides, and shopping centers. EVs may cost more up-front than other comparable vehicles, but a variety of state and federal tax incentives are in place to bring down these prices, and over their lifetimes, EVs can save drivers money due to savings in fuel expenses and mechanical repairs.

When EVs draw their charge from a fossil-powered grid, they produce 50% fewer GHG emissions compared to typical internal combustion engine (ICE) vehicles because of their efficiency.[1] However, when powered by clean or renewable energy, they have no operational emissions to at all. Although the manufacturing processes associated with EVs and their batteries is more emissions-intensive than for ICE cars, lifetime emissions are still far less. The "break-even" point at which an EV's lifetime emissions fall below the lifetime emissions of an ICE vehicle depends on the prevailing energy generation mix in a given geographical area. For the U.S. energy mix as a whole, a Tesla 3 charged with electricity from the grid has to drive 13,500 miles before its lifetime emissions outperform a Toyota Corolla.[2] As more renewable energy comes online, however, this baseline will shift, making EV lifetime emissions even more competitive compared to ICE vehicles.

Other environmental impacts of EVs relate to the material inputs needed to produce batteries. For example, a typical EV requires six times the mineral inputs of a conventional car,[3] including lithium, cobalt, copper, graphite, and manganese and nickel (see Figure 1). Most of the world's lithium comes from salt flats in the Andes, where mining requires vast amounts of groundwater, sometimes causing groundwater depletion, soil contamination, and other forms of environmental degradation.[4] Almost half of the world's cobalt is derived from artisanal mines in the Congo, where children are sometimes employed in dangerous conditions. Waste from

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[1] Drawdown. "Electric cars." https://drawdown.org/solutions/electric-cars

[2] Lienert, Paul. "Analysis: When do electric vehicles become cleaner than gasoline cars?" https://www.reuters.com/business/autos-transportation/when-do-electric-vehicles-become-cleaner-than-gasoline-cars-2021-06-29/

[3] International Energy Agency (2021). *The role of critical minerals in clean energy transitions.* https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/executive-summary

[4] United Nations Conference on Trade and Development (July 22, 2020). "Developing countries pay environmental cost of electric car batteries." https://unctad.org/news/developing-countries-pay-environmental-cost-electric-car-batteries

cobalt mining can produce sulfuric acid when exposed to air, which can negatively affect rivers, streams, and aquatic life for hundreds of years.[5] Graphite mining is also known to be hazardous and environmentally damaging.[6]

There is now growing interest in mining the deep seabed, especially the Clarion-Clipperton Zone in the Pacific Ocean, for manganese nodules which often contain small amounts of cobalt, nickel, copper, and traces of rare earth elements. The environmental impacts of deep-sea mining are only minimally understood at present, but may be significant.[7] To resolve these problems, it is vital to develop technology and economic incentives to perform mining sustainably, develop less mineral-intensive batteries, and recycle battery materials.

One of the most important actions that states, municipalities, the federal government, utilities, and businesses can take to support the transition to EVs is to install abundant EV charging infrastructure. There are various policies that can help incentive charger installation, including:[8]

- Incentives to utilities to invest in "make-ready" infrastructure (building/upgrading the electrical infrastructure necessary to install chargers).
- Utility-run programs such as time-of-use electricity rates or special rates that reduce the cost of EV charging. Some utilities offer financial incentives for the purchase of EVs or EV charging equipment.
- Formulation of charging infrastructure plans to ensure that chargers are placed in strategic locations so that drivers have access to charging when and where they need it.
- Parking infrastructure requirements, such as requiring parking lots to make a certain percentage of their parking spaces into EV charging spaces.
- Financing and financial incentives to install EV chargers. These may include sales, property, and income tax credits, and low interest loans, grants, and rebates.
- Legislation can be put into place to make it easier for lessees, renters, and members of a homeowners' association to install charging equipment, by requiring landlords to allow tenants to install EV charging stations at their own expense and barring homeowners' associations from restricting their members from installing EV charging stations.
- The U.S. Department of Transportation coordinates an Alternative Fuels Corridor program to make sure that certain travel routes have EV charging stations located at least every 50 miles and no more than 5 miles off the highway. New routes are

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[5] United Nations Conference on Trade and Development (July 22, 2020). "Developing countries pay environmental cost of electric car batteries." https://unctad.org/news/developing-countries-pay-environmental-cost-electric-car-batteries

[6] United Nations Conference on Trade and Development (July 22, 2020). "Developing countries pay environmental cost of electric car batteries." https://unctad.org/news/developing-countries-pay-environmental-cost-electric-car-batteries

[7] Schlossberg, Tatiana (August 4, 2021). "The race for electric vehicle parts leads to risky deep-ocean mining."

[8] SPOT. "Vehicle charging infrastructure incentives." https://spotforcleanenergy.org/policy/vehicle-charging-infrastructure-incentives/

designated every year. So far, 165,722 miles of the National Highway System are covered by Alternative Fuels Corridor designation.[9]

Although all of these policies can make important contributions to accelerating the adoption of EVs, there are signs that organic consumer demand is now playing an even bigger role than regulations in escalating the EV market. Between Q3 2020 and Q3 2021, global passenger EV sales almost doubled, with most sales taking place in China and Europe where fuel economy regulations are driving expansion of EV manufacturing.[10] Although North America has traditionally lagged behind these other regions in EV market penetration, EV sales accounted for 5% of new car sales in 2021, the highest proportion yet.[11]

- Fishery friendliness: Concerns related to mining and disposal of mineral components of EV batteries should be addressed as part of a fishery friendly approach to climate action. EVs represent the electrification of previously non-electrified transportation, causing their fishery friendliness to depend in part on the friendliness of the electricity sources that power them.
- Co-benefits: Adoption of EVs can reduce noise, improve air quality, and help drivers save money over time.
- Environmental externalities: EV batteries produce some lifecycle GHG emissions and can have environmental impacts associated with mining and manufacturing.
- Policy catalysts: EV adoption can be promoted through tax incentives, rebates, grants, loans, fuel economy or low-carbon fuels standards, and carbon pricing. Installation of EV charging infrastructure by private and public entities can be promoted through incentives to utilities to invest in "make-ready" infrastructure, utility-run programs to provide discounts or special rates on electricity used for EV charging, development of charging infrastructure plans, parking infrastructure requirements, and financial incentives such as tax credits, loans, grants, and rebates.
- More information:
    - Drawdown: Electric cars
    - C2ES: Electric vehicles
    - SPOT: Vehicle charging infrastructure incentives, Advanced vehicle incentives
    - DOE: Alternative Fuels Data Center - Electricity
    - Tabuchi, Hiroko and Plumer, Brad (March 2, 2021; updated November 9, 2021). "How green are electric vehicles?" *New York Times.*

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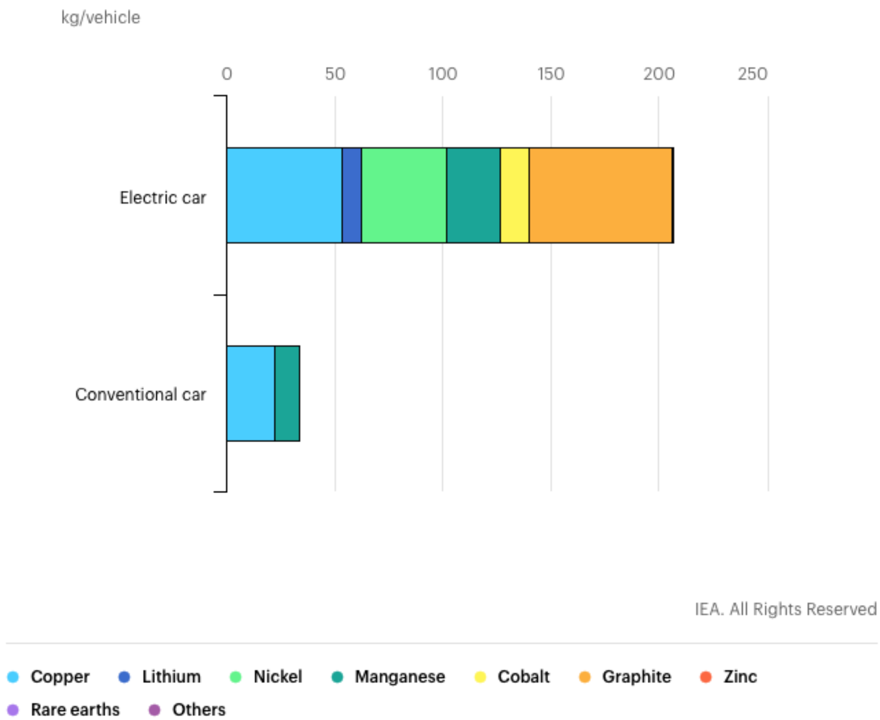
[9] Lamb, Eleanor (April 23, 2021). "Secretary Pete Buttigieg unveils new alternative fuel corridor designations." *Transportation Topics.* https://www.ttnews.com/articles/sec-pete-buttigieg-unveils-new-alternative-fuel-corridor-designations

[10] Rybczynska, Aleksandra (December 15, 2021). "Global EV sales on track to hit record 6.3 million in 2021: BNEF." *Bloomberg.* https://www.bloomberg.com/press-releases/2021-12-15/global-ev-sales-on-track-to-hit-record-6-3-million-in-2021-bnef

[11] Rybczynska, Aleksandra (December 15, 2021). "Global EV sales on track to hit record 6.3 million in 2021: BNEF." *Bloomberg.* https://www.bloomberg.com/press-releases/2021-12-15/global-ev-sales-on-track-to-hit-record-6-3-million-in-2021-bnef

- [Roy Choudhry, Saheli (July 26, 2021). "Are electric cars 'green'? The answer is yes, but it's complicated." *CNBC.*]

Figure 1. Minerals used in electric vehicles (EVs) compared to internal combustion engine (ICE) cars. Source: IEA 2021 [12]



Continue reading at https://fisheryfriendlyclimateaction.org/solutions

[12] IEA. 2021. *The role of critical minerals in clean energy transitions.* https://iea.blob.core.windows.net/assets/24d5dfbb-a77a-4647-abcc-667867207f74/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf