

Science Policy Outreach Task Force at Northwestern University

OVERVIEW OF ELECTRIC VEHICLE STANDARDS AND OUTLOOK



SPOTlight: Electric vehicles (EVs) are becoming increasingly popular. Further development will require improvements to EV charging infrastructure and grid integration.

What are electric vehicles (EVs)?

- Electric vehicles, or EVs, use rechargeable batteries or fuel cells to run. Unlike vehicles that use internal combustion engines (ICEs), EVs have no dependence on fossil fuels and emit no harmful pollutants.¹
- EVs fall into two categories: hybrid EVs (HEVs), which use electric motors along with ICEs, and all-EVs (AEVs), which use only electric motors and no ICEs.¹

What is the current status of EV technology?

- Commercialized EVs are available in 18 different models from 11 manufacturers. Depending on the model, driving distance between charges can range from 25 up to 315 miles, with most EVs clocking in at 60 miles.¹
- EVs require electricity sourced from the grid, which can be obtained at private (i.e. residential) or public charging stations. While most charging stations today have “slow charging” ports that take several hours to fully charge an EV, “DC fast charging” technology exists that can charge an EV in less than an hour.¹
- EVs are not yet “zero-emission,” since in many regions grid electricity is sourced to an energy mix with a larger proportion of fossil fuels (i.e. coal, natural gas) than renewables.²

How many EVs are currently in use and where are they located?

- The global EV stock of nearly 6 million units in 2019 has tripled from what it was before 2016.¹
- In the US annual sales of EVs increased elevenfold from 18 thousand units in 2011 to 190 thousand units in 2017 for a year-to-year growth rate of 49% and a total stock of 750 thousand units.³
- In 2018 seven countries split over 90% of the market share of EV sales, with the US accounting for only 2.10% of the global market.¹
- As of 2020 there are nearly 25 thousand charging stations across the U.S. with ¼ located in California. Illinois is 13th in the nation with 587 charging stations.⁴

What are the benefits of EV incorporation?

- Every electric mile driven can be assumed to offset one gasoline mile. Argonne National Laboratory (ANL) estimates that in 2017, EV usage offset 210 million gallons of gasoline.³
- Cumulatively, ANL estimates that EV usage has prevented 2.6 million metric tons of CO₂ emissions.³
- Smart charging infrastructure could allow EVs to compensate for variable demands on the grid, and even act as a distributed energy storage system to compensate for the intermittency of renewable energy sources.¹

What are the outstanding challenges for EVs?

- An electrified transportation sector poses challenges for the grid such as load demand increases, reduced transformer lifespan, and instability and power loss in the distribution system.¹
- There is a lack of global standardization in charging equipment and charging station layout, which limits penetration of EVs in the market.¹
- Planned EV charging station locations are predominantly in cities, whereas prospective EV owners are also concerned about the accessibility of charging stations along major highways.¹

What is the status of EVs in Illinois?

- As of January 1, 2020, the annual base registration fee for an electric vehicle in Illinois is \$251/year.¹ Prior to this change, the fee was \$17.50/year, renewable every two years.⁶
- A 2017 cost benefit analysis found that “moderate” EV adoption in Illinois could lead to cumulative net benefits in excess of \$12.2 billion statewide by 2050, in the form of reduced electric bills and annual vehicle operating costs. “High” adoption of EV technology could cause these benefits to exceed \$43 billion.⁷

References and additional resources:

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- [7] Lowell, D. J., et al., Plug-in Electric Vehicles Cost-Benefit Analysis: Illinois. *M. J. Bradley & Associates* **2017**.
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