Scaling behavior for electric vehicle chargers and road map to addressing the infrastructure gap

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Charging infrastructure needs in the long run

Question: what is the number of charging stations needed in the long run in each location (e.g., county, MSA)?

Method: the number of EVSE stations needed to match the power delivery of YGS gasoline stations (or power parity):

$$\hat{Y}_{EVSE} = \frac{1}{3}\frac{P_{GS}}{P_{EV}} \underbrace{Y_{0,GS} N^{\beta_{GS}}}_{Y_{GS}} \approx 17 Y_{GS}$$

- 1.8 million charging stations needed, compared to 62k now (47k in 2020)
- The median county needs a 500-fold expansion

Comment 1: Key Assumptions

- No home charging
  - Most charging are done at home (80%?). Vary depending on whether live in single-family home or not
  - Sensitivity analysis based on % people with access to private charging
- Scaling parameter, $\beta_{GS}=\beta_{EV}$ in the power function $Y = Y_0 N^{\beta}$
  - May scale differently: charging stations often build in grocery stores, hotels, restaurants..
  - What is the scaling exponent for them?

Comments 2: Dynamics

- Time path of network expansion: $\hat{Y}_{t,EVSE}$. How many to build each year? Where to build first?

Figure: Indirect network effect and critical mass