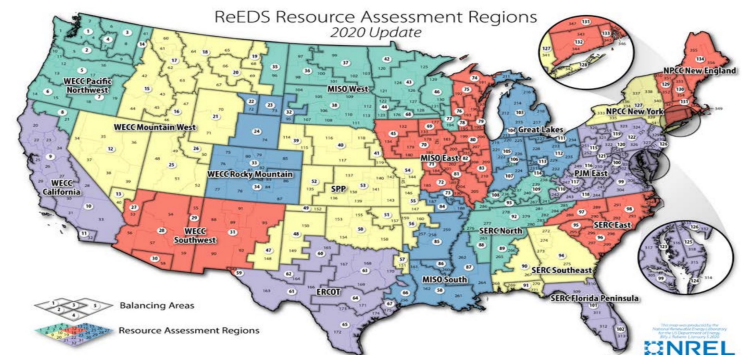


EV SMART-CHARGING IMPACTS ON US POWER GRIDS

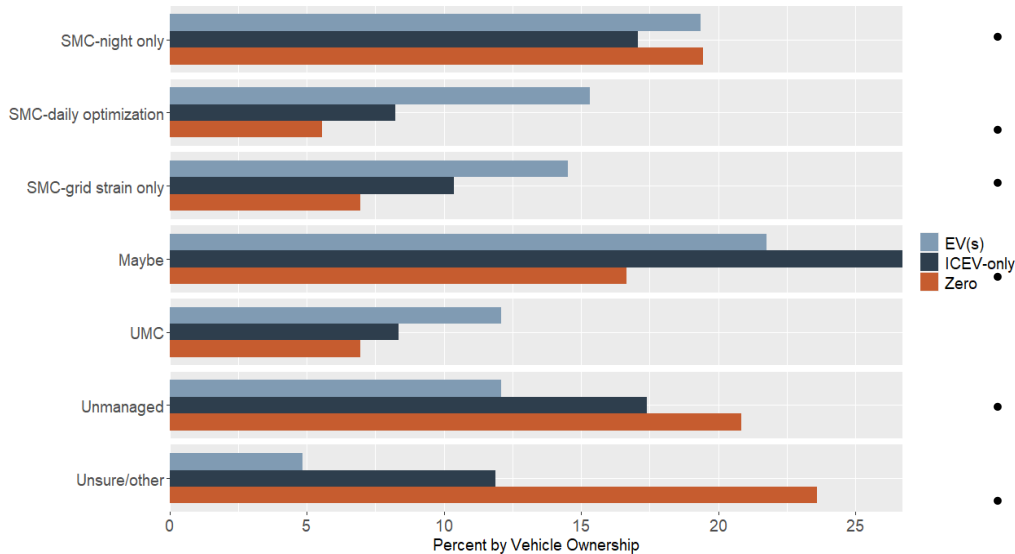
Bala Sambasivam, Matt Dean, Kara Kockelman, Benjamin Leibowicz

- **Background:** World EV ownership has risen from **near-zero** in 2010 to over **10 million** in 2020 & projected to reach **145 million** by 2030 (**7%** of world fleet).
- When drivers' charging strategy **aligns with power network needs**, EVs can become a potential asset for the grid with more renewable energy intake and reducing stress.
- **Goal:** This study explores **impacts** of various **EV charging strategies** on US power sector's **economic & environmental** outcomes. Strategies & participation rates will **align** with smart-charging-**preferences survey** (n=1050 American adults) by Dean et al. (2023).
- **Methodology:** NREL's **Regional Energy Deployment System** model (**ReEDS**) predicts & prescribes **evolution & operation** of US power **grid's** generation, transmission & end-use (demand) technologies.



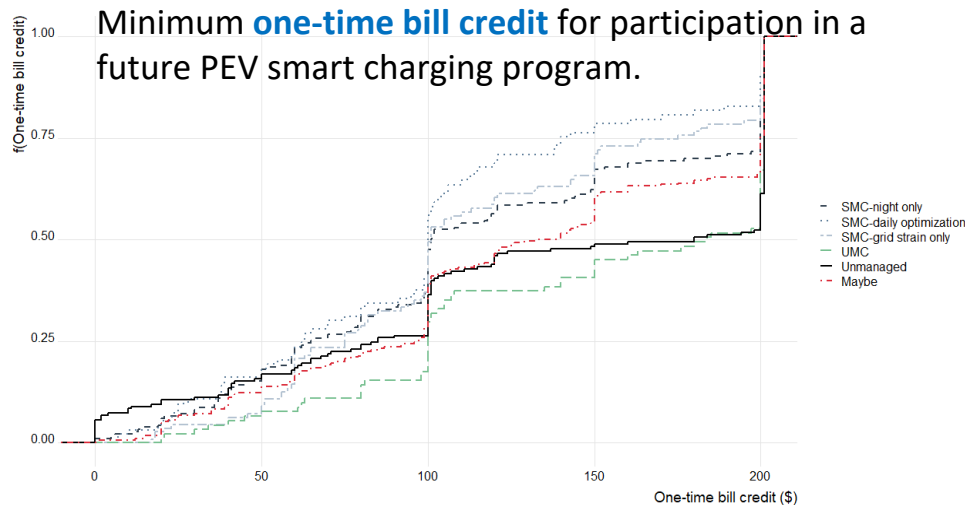
EV Smart-Charging Survey Results

Preferred **PEV smart charging option** by household vehicle status.

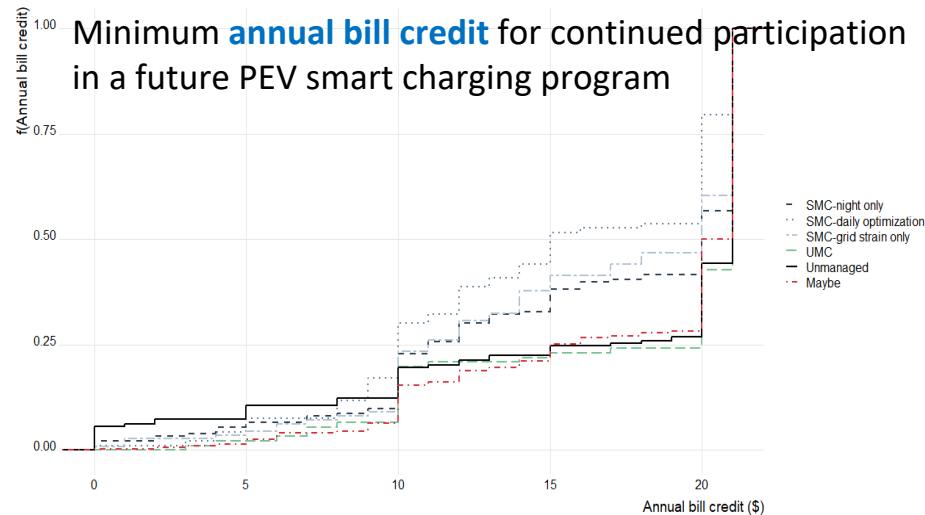


- **25%** of respondents **not** inclined towards Supplier managed charging (**SMC**) program.
 - **25%** may **cede control** but need **more information** for participation.
 - **37%** **accept SMC** under different conditions.
 - **Current** EV owners (n=124) likely to **accept** supplier/user managed charging program.
- People **without** educational degrees (**30.8%**) prefer unmanaged charging **than** educated people (**8.8%** with Ph.D. & **14.8%** with Masters).
- Most **prohibit** SMC during **daytime** but give up **control at night** with assurance of full charge by morning (17.5%).
 - **10.6%** willing to **allow** SMC during high **grid-strained** days.

Minimum **one-time bill credit** for participation in a future PEV smart charging program.



Minimum **annual bill credit** for continued participation in a future PEV smart charging program



Coming Research

- Run ReEDS with **different smart-charging strategies** to identify how much EVs hurt vs help the grid, and impacts transportation emissions.
- **Design incentives** to cede EV charging control to utilities at night with assurance of full charge by morning.
- Design incentives to **shift EV charging** to different **times of day**.
- Simulate incentives to shift EV demand during **grid strain days**.
- Shift demand to **high wind + solar** generation periods.

Smart Charging Survey -“Americans’ opinions and interests in plug-in electric vehicle smart charging programs”

Paper available upon request (mattdean@utexas.edu)