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The need for public charging and current progress

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THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

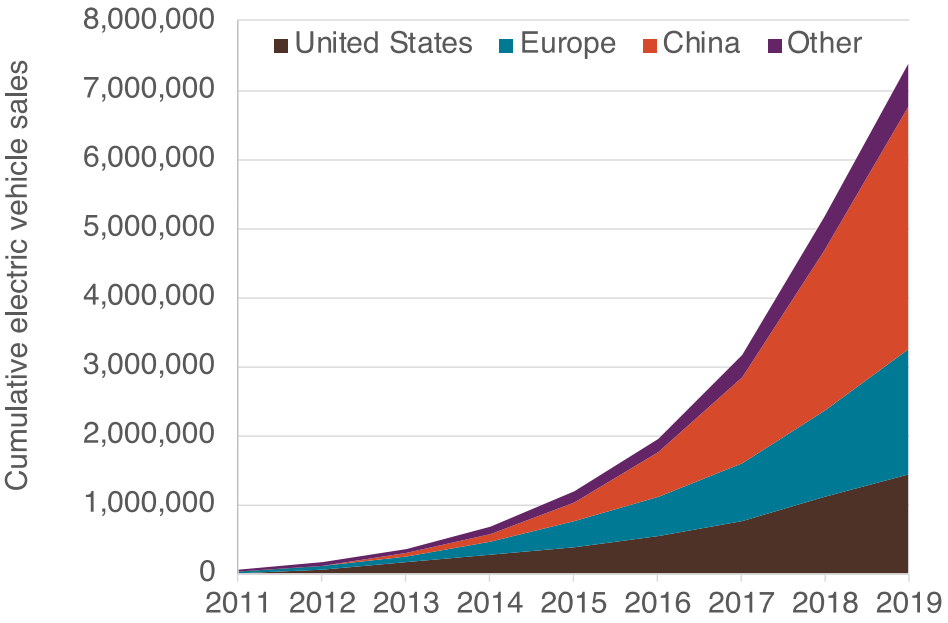
Outline

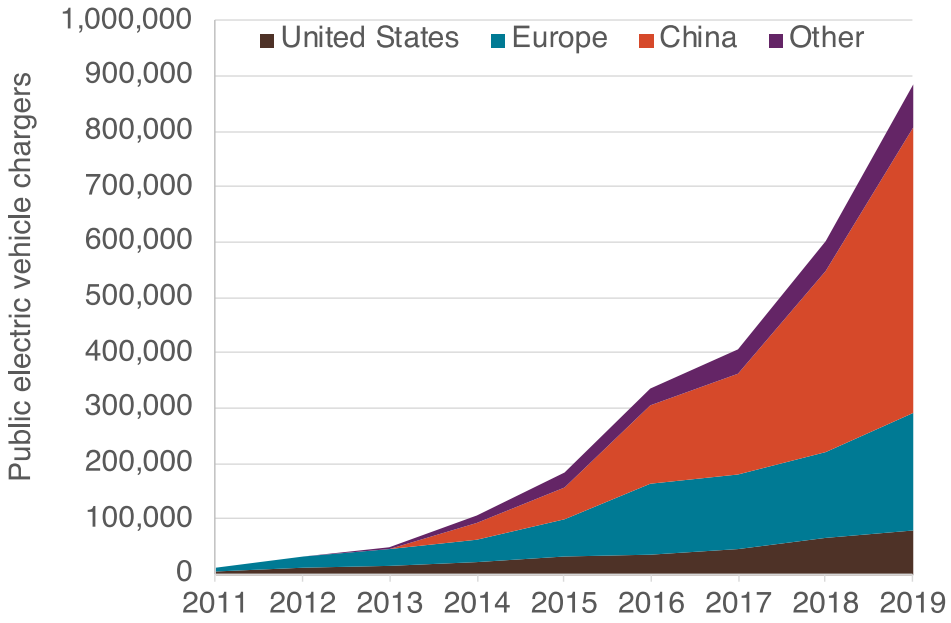
- Overview
  - Vehicles and chargers
  - Charger ratios
  - Access to home charging
  - The use of public charging
  - The charging gap

- Business cases
  - Reasons to install charging
  - Electricity markup
  - Solutions

The electric vehicle market and infrastructure grow together

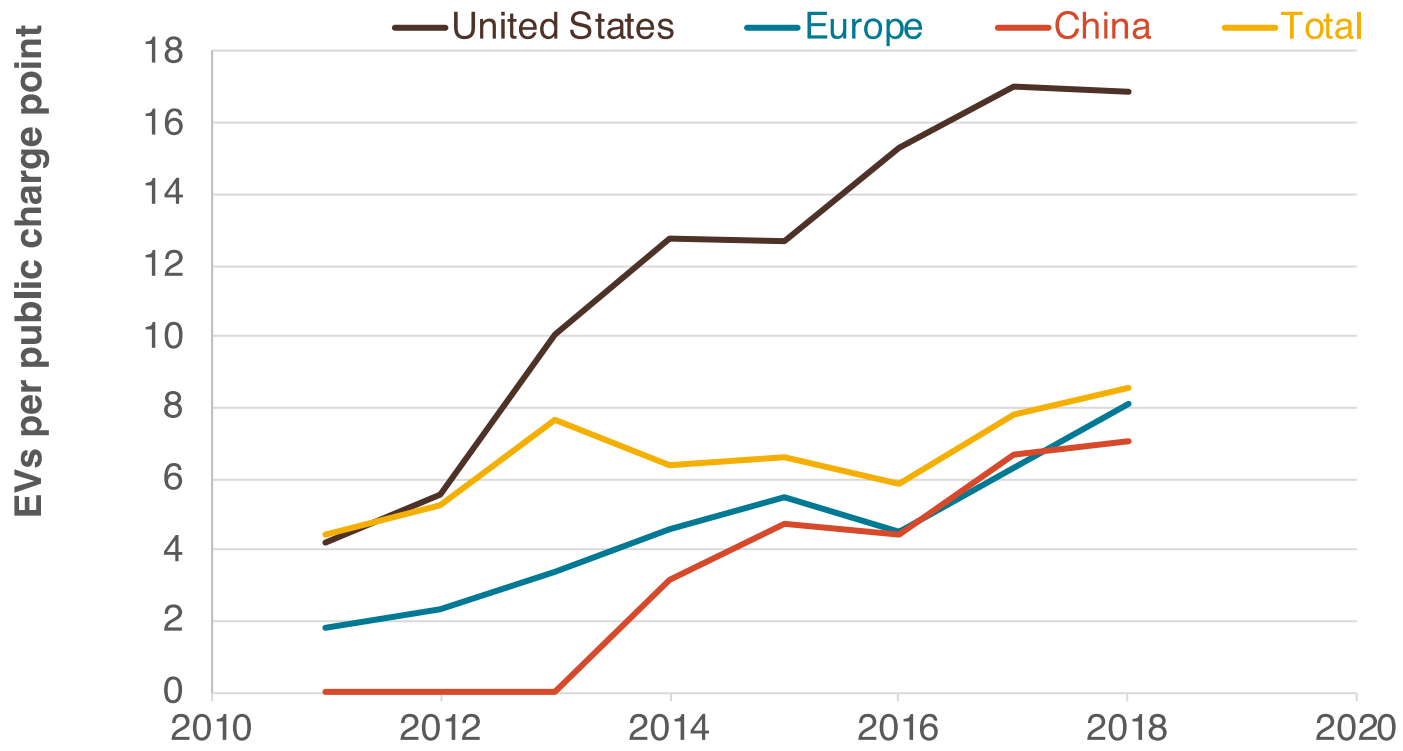
- At end of 2019: About 7 million electric cars and 900,000 public charge points





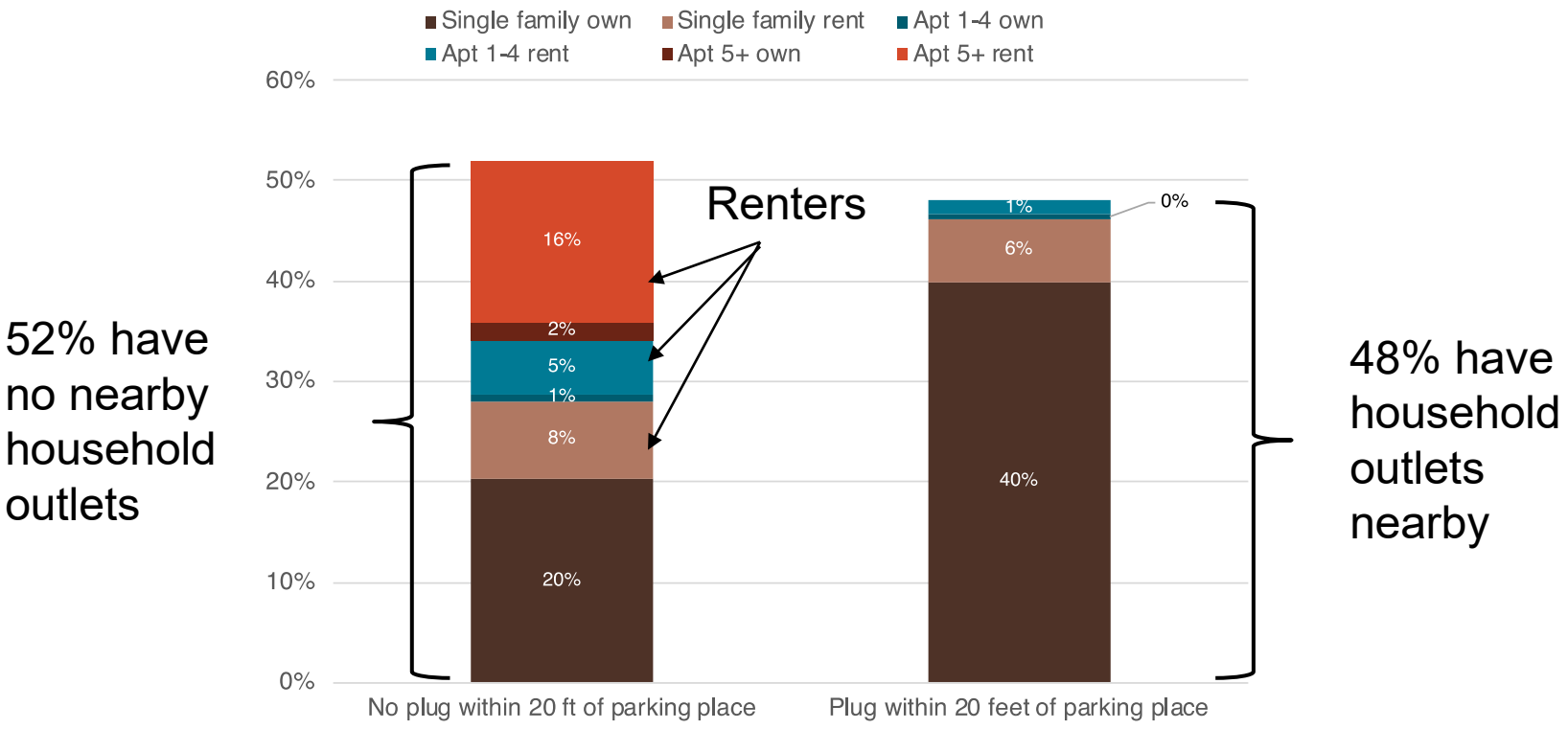
EV to charger ratio differ from region to region

- The United States is at 16 EVs per charger
- Others are at 7-8 EVs per charger



Home charging access in the U.S. Is the glass half full or half empty?

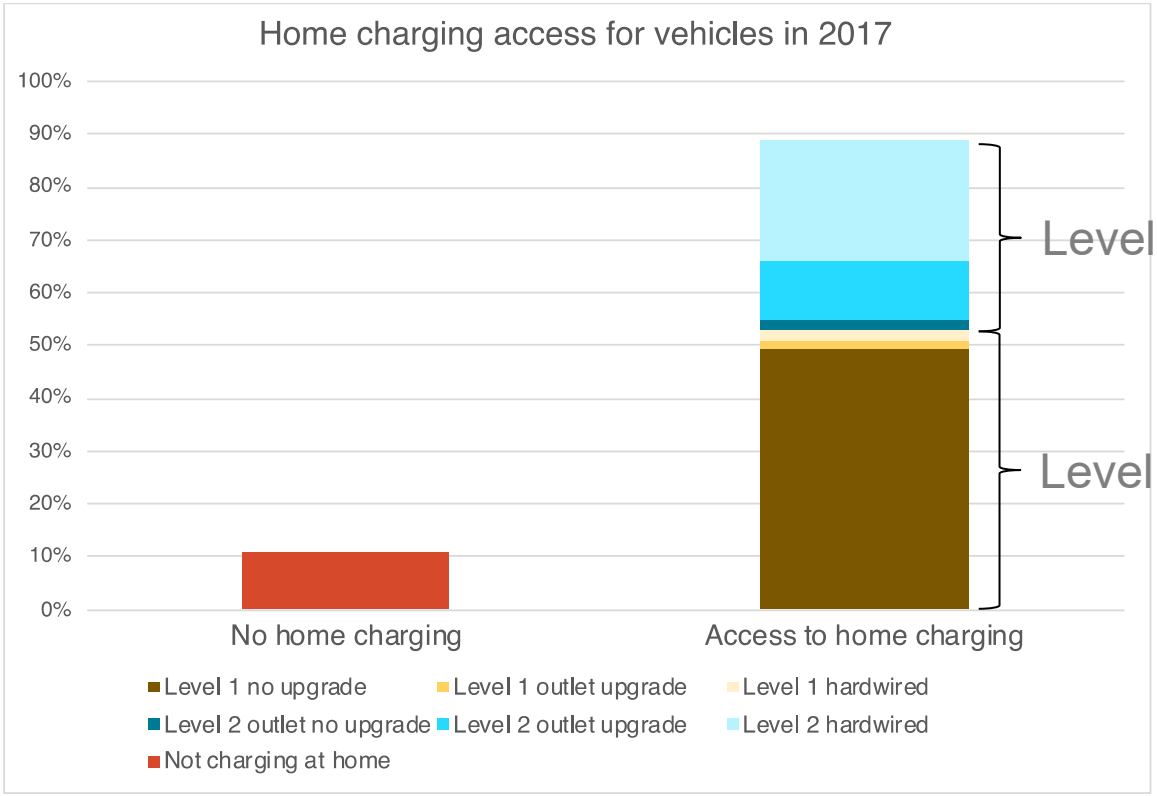
- The U.S. EIA survey says that 48% of the population parks within 20 feet of a plug
- Renters are less likely to have charging access



U.S. Energy Information Administration (EIA) (2015). 2015 Residential Energy Consumption Survey (RECS) Data; https://www.eia.gov/consumption/residential/data/2015/#structural

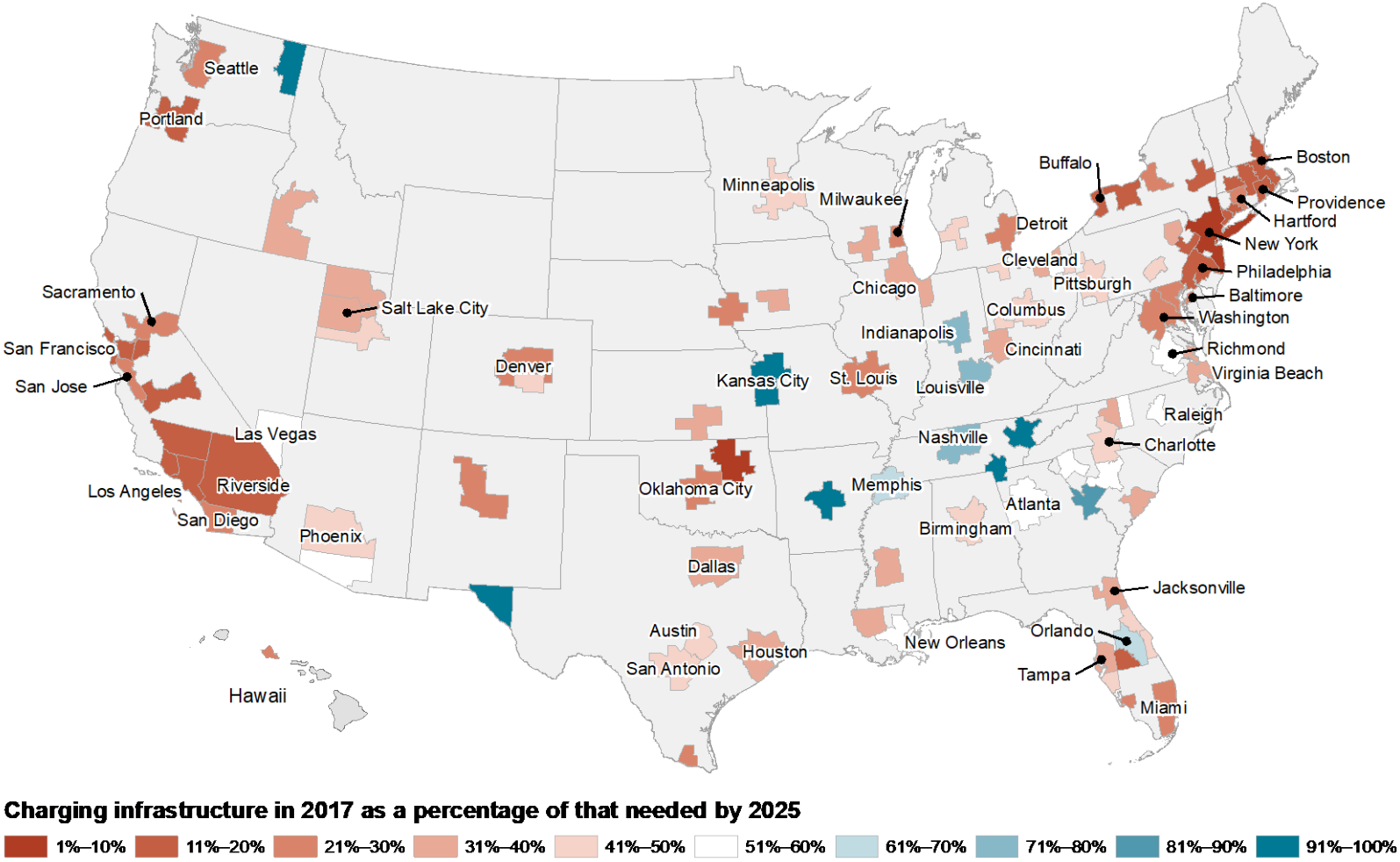
However, home charging access is available for about 90% of current EV owners

- Only 11% of EV owners have no home charging. Public charging is not yet sufficient.
- Level 1 is used by 53% of owners. Level 2 is becoming more important for larger battery vehicles



California Air Resources Board, "California's advanced clean cars midterm review: Summary report for the technical analysis of the light duty vehicles standards Appendix B" (2017), https://www.arb.ca.gov/msprog/acc/acc-mtr.htm

How much charging will be needed in 2025 versus 2017?



Michael Nicholas, Dale Hall, and Nic Lutsey, Quantifying the electric vehicle charging infrastructure gap across U.S. markets, (ICCT: Washington DC, 2019), https://www.theicct.org/publications/charging-gap-US

Improving the business case

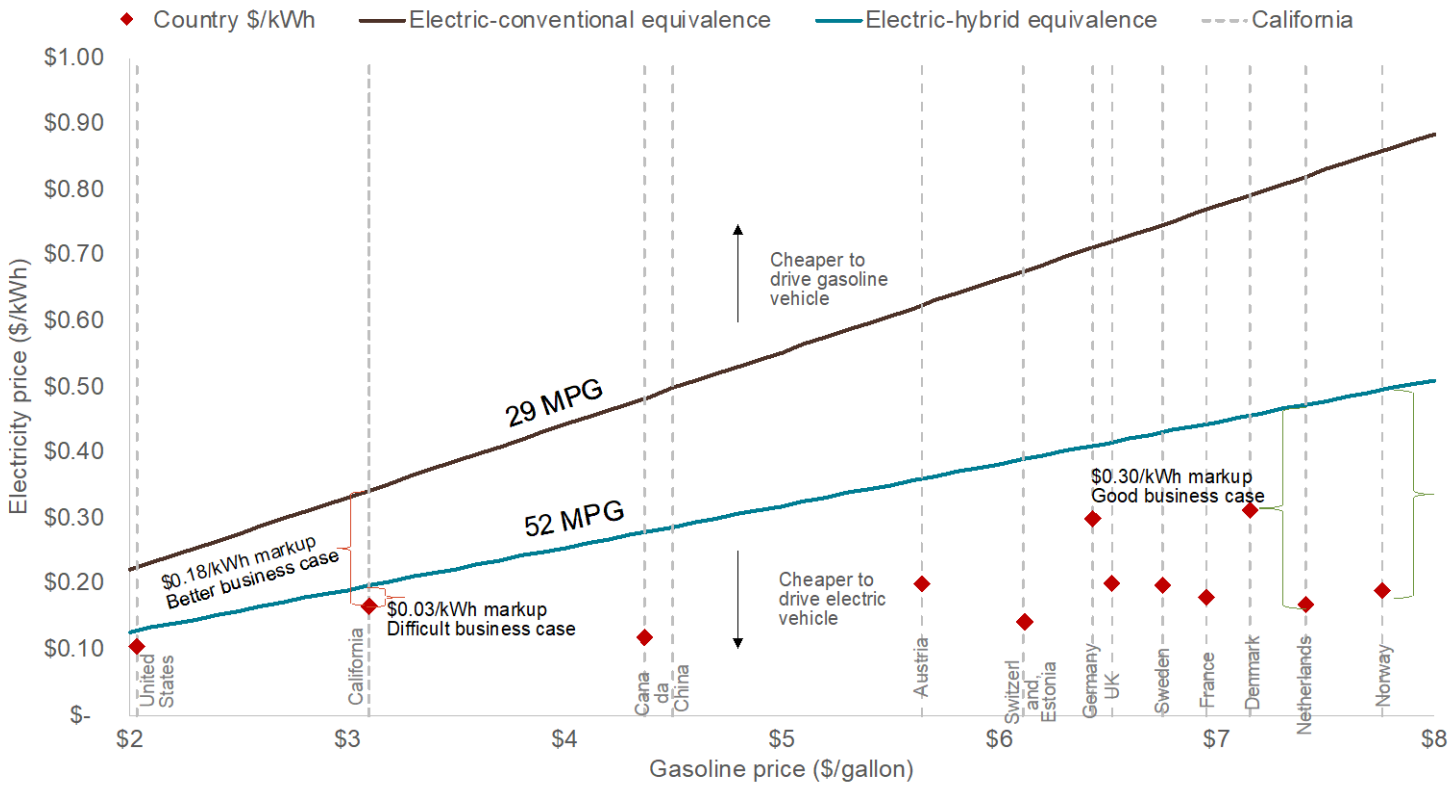
What is the business case for entities, other than government, to install nonhome charging?

- Non-traditional business models
  - Customer/employee demand
  - Employee retention/recruitment
  - Pre-tax employee benefit
  - Corporate environmental responsibility
  - Automaker vehicle promotion
- Customers shop longer
- Utility grid benefits

- Profit? Depends on gas and electricity price. Difficult in the U.S. Better in Europe.

A significant business opportunity for public charging exists when gasoline is expensive and electricity is cheap

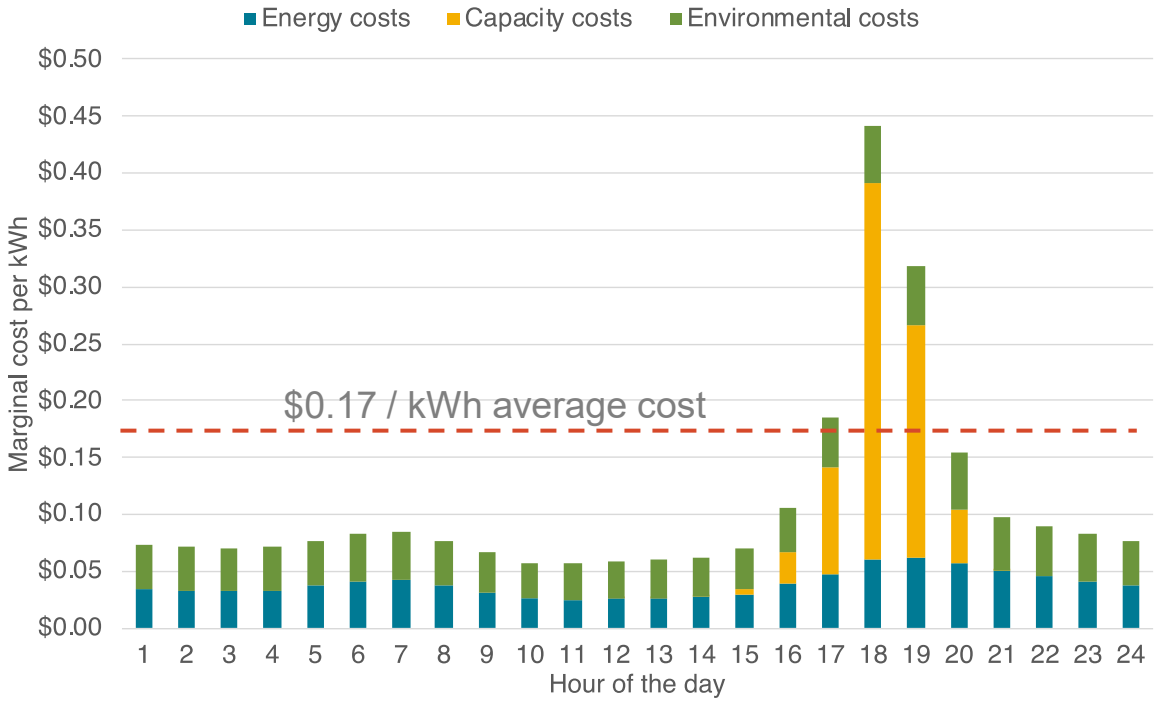
- Low gasoline prices (CA = $3.10) and high electricity prices ($0.17/kWh) mean that the prices operators can charge is only 3 - 18 cents/kWh over cost. Norwegians can markup 30 – 60 cents/kWh



Nicholas, M. and D. Hall *Lessons learned on early electric vehicle fast-charging deployments*. The International Council on Clean Transportation. 2018.https://www.theicct.org/publications/fast-charging-lessons-learned

Electricity cost for a utility varies by time of day, but costs are passed on to the customer in various ways

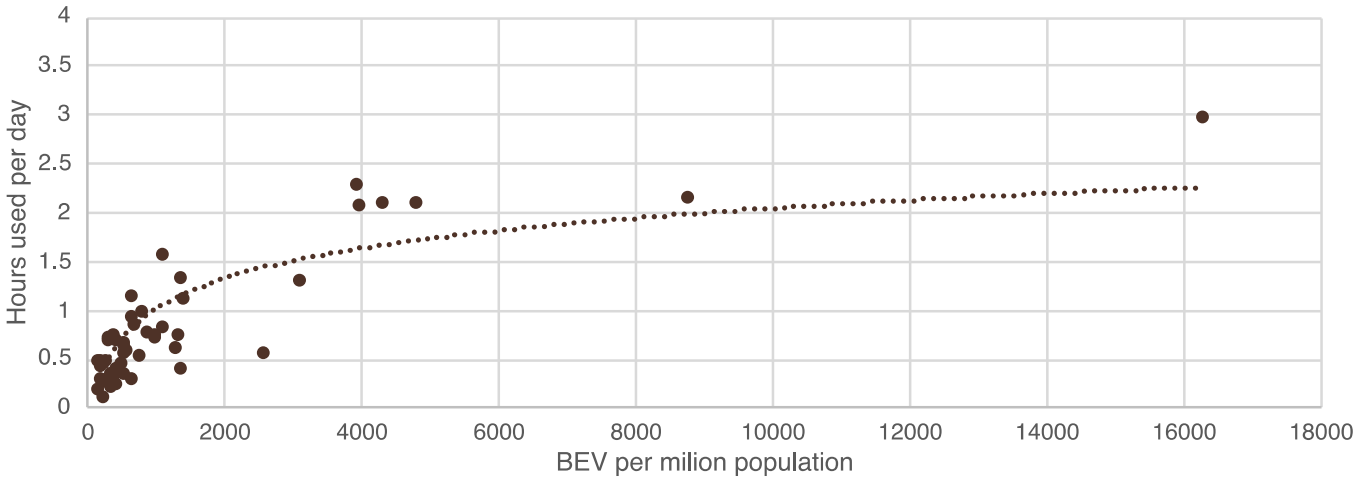
- Average costs per kWh are driven by high costs midday
- EVs have the potential to avoid these expensive times
  - Time of use pricing
  - Smart charging with real time pricing signals
  - V2G



"Avoided Cost Calculator," Energy and Environmental Economics and California Energy Commission, http://www.cpuc.ca.gov/General.aspx?id=5267

The utilization of nonhome charging improves over time

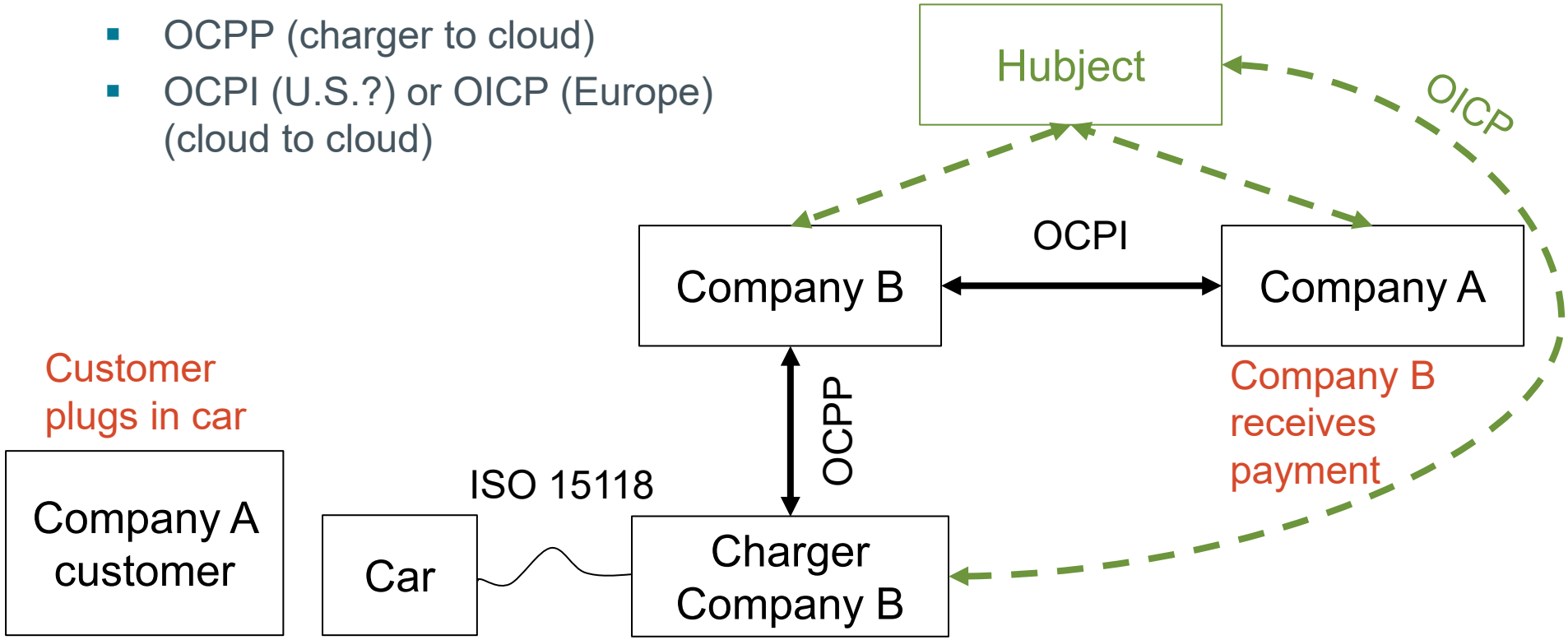
- Early markets (in terms of EV per million population) must have geographic coverage in advance of heavy usage
- Chargers in early markets will have low usage in hours per day
- Early market chargers must receive financial support to compensate for low usage



Nicholas, M. and D. Hall *Lessons learned on early electric vehicle fast-charging deployments*. The International Council on Clean Transportation. 2018.https://www.theicct.org/publications/fast-charging-lessons-learned

Create the conditions for competition and vehicle to grid benefits by encouraging open standards and interoperability

- 4 relevant standards
  - ISO 15118 (car/customer to charger)
  - OCPP (charger to cloud)
  - OCPI (U.S.?) or OICP (Europe) (cloud to cloud)



Incentivize charging - especially in the early years

- Tie money with the guarantee of open charging access, data collection and sharing, and smart charging requirements
- Grants – give money towards the purchase and installation of chargers at home, work, public, and DC fast
  - Utility
  - State
  - Federal
  - City
- Tax credits – reduction in tax liability
- Cap and trade money dedicated to charging
- LCFS capacity and operation credits
- Utility funded nonhome infrastructure or capacity upgrades
- Utility rates
  - Specialized EV rates at home
  - Low introductory rates for fast charging
  - Electricity rates for medium and heavy duty

More info

ICCT electric vehicle page:

http://theicct.org/electric-vehicles

Acknowledgements

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Create coordinated city charging tenders

- City creates a bidding process where vendors compete for the right to install and operate a set number of charging stations on publicly controlled land such as on curbsides and public parking lots
- Tenders allow for
  - Guaranteed number of chargers
  - Guaranteed maintenance
  - Adherence to interoperability or smart charging standards
- Examples
  - London https://www.electrive.com/2019/03/02/richmond-ubitricity-to-install-200-lamp-post-ev-chargers/
  - Berlin https://www.ubitricity.com/unternehmen/newsroom/berlin-bis-zu-1-600-ladepunkte-mit-sofortprogramm-saubere-luft/
  - Amsterdam https://www.nuon.nl/producten/elektrisch-rijden/openbare-laadpaal/laadpaal-amsterdam/