MIT Mobility Initiative
Electric Vehicle Charging Infrastructure
Research Briefs

David R. Keith
Mitsui Career Development Professor
System Dynamics Group
MIT Sloan School of Management

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Context

- US charging infrastructure market is:
  - Fragmented
  - Mostly uneconomic for investors
  - Mostly unsatisfying for (non-Tesla) EV drivers

- Lots of theories currently, not a lot of evidence, but that isn't stopping policymakers, utilities etc. from moving forward

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Proposal: MMI Research Briefs

Short: ~5 pages in length

Sharp: Addressing questions that are of immediate relevance to the entire charging ecosystem but not competitive in nature

Regular: Published every ~2 months for the next year

Collaborativee: Leverage the expertise, resources and connections of this stakeholder group

Data Driven: Where can we gather and analyze data to reduce uncertainty?

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1. Charging Station Reliability

- According to rough estimates, 20-30% of EV charging stations in the US aren't working at any given time
- Why are so many chargers not working technically?
  - Power? Connectivity? Payments? User Error?
- Why are so many chargers not working organizationally?
  - Ownership? Maintenance? Funding?
- What more should we be doing to ensure very high reliability?

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2. Grid Interconnection Costs

- Soft costs including grid interconnection costs are a major source of upfront costs – approx. 100% of hardware costs
- Grid interconnection costs are largely unknown until an application to the utility is made – capacity maps for EV charging are rare, and the cost charged by utilities given available capacity is opaque
- How do utilities approach interconnection costs? What ranges of interconnection costs are observed? What factors influence these costs?

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3. Availability of Off-Street Charging in US Cities

- Theories about the need for public charging are strongly conditioned by assumptions about the availability of off-street parking and charging in urban areas
- Traut et al. (2013): 56% of US vehicles have a dedicated off-street parking space, and only 47% at an owned residence
- What is being done to improve our understanding of where off-street EV charging at home is a realistic possibility? And what do they find?

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4. Tariff Design for DC Fast Chargers

- Utility tariffs that impose $/kW demand charges are extremely costly for DC fast chargers that receive low utilization
- However, the removal of demand charges (e.g. National Grid and Eversource rate cases currently under consideration) removes the incentive to minimize the grid impacts of high electrical loads
- How does tariff design affect the viability of charging hardware choices (e.g. DCFC power levels, on-site battery storage)?
- How can tariffs be designed to balance the needs of grid operators and infrastructure investors most effectively?

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5. Lessons from International Markets

- The European EV market is many years ahead of the US, with 20%+ EV market share in 2022

- What can we learn about demand for public charging where considerably more EVs exist?
  - EVs per charger
  - L2 vs DCFC
  - Utilization %
  - Cities, highways, multi-unit dwellings, etc.

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