UNPLUGGING THE ROSE-COLORED BIDIRECTIONAL CHARGER:
MISSING INPUTS IN V2G ECONOMIC MODELS

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WHAT IS V2G?
VEHICLE TO GRID (V2G)

- Proposed in 1997
- Major funders
  - Multi-million $ programs
- Hugely popular in academic journals ....

~14,000 results Google Scholar
EXISTING ECONOMIC ANALYSES

• Overwhelmingly find V2G economically viable

• Assumptions:
  • Historically high grid service prices
  • Huge maintenance savings
  • Diesel price ($4.20/gal and 8.5% escalation)

• But I’m not here to talk about mis-specified inputs…
OMITTED INPUTS

- Efficiency Loss
- Voided Warranty
- Aggregator Fees
- Temperature Limitations
- Convenience Loss
- Demand Charge
- Risk Premium
- Private-Public Consistency
- Competitive Pressures
- Marginal Emissions
EFFICIENCY

• V2G is ~60% efficient (Apostolaki et al., 2017)
  • Transformer → Breakers → EVSE → PEU → Parasitic → Battery

• Owner is paid for storing the energy, but responsible for any energy losses

• V2G is ‘lossy’. Electricity losses are largest cost of business*

*Shirazi and Sachs (Under Review)
WARRANTY COVERAGE

• No vehicle sold in the US is V2G-enabled off the lot
• V2G immediately and irreversibly voids warranty policies*
  • Prohibit ‘using the vehicle as a power source’
  • Tesla, Nissan, Chevy, others

• Need to assess cost of voided warranty

*Hutton and Hutton (2012)
AGGREGATOR

• ‘Selling tomatoes to Walmart’
• Provide Scale and Sophistication
• Minimum bidding increments of 100 kw -1,000 kw
  • Typical charger is 50 times smaller
• Fees estimated at 10% - 50% of revenues*
• **Aggregators are necessary, costly middlemen in V2G operations**

*Hill et al (2012)
ADVERSE TEMPERATURE

• “By 35°F our vehicles are only able to provide 20% of typical power…” (Personal communication 2015).

• Temperatures constraints limit V2G revenue*. 

*Shirazi et al., 2015
Convenience losses create very large user costs
DEMAND CHARGE (FEE PER KW/MONTH)

- Charging quickly to maximize V2G hours
  - Leads to astronomical demand charges ($10/kW/mo)

- Cost to charge is dominated by demand charge (kW) not energy charge*

*Shirazi et al., (2015)


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V2G APPLICATIONS

Frequency Regulation
(Now/Near Future)

‘Carbitrage’
(Long Term)