EV Myths, Misconceptions, Surprises, and Perspectives
A Research- and Personal Experience-Based View

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Agenda

- **30-35 minutes of talking**
  - Lots of different ways to look at EV-related problems
  - I’ll move quickly
  - Cover more topics (in less depth) and dive into detail in Q&A

- **25-30 minutes of questions**
  - Take note of things you want to hear more about!
  - Happy to go into more depth either during the questions or after the webinar

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Why This Topic?

• Contrast with typical mass media article about EVs
  • Deeper dive – more detail
  • Different way of looking at the EV experience

• Summary of 10 years of conversations
  • What made people go “huh!” and think
    • i.e. “EV” vs. “electric car”
  • Not just a carbon copy of talking points
Contents

• Typical article about EVs
  • Range anxiety
  • Charging time / hassle
  • Vehicle cost
  • Charging cost
  • Environmental benefit

• My high-level summary of EVs
  • Cheaper
  • Cleaner
  • More convenient
  • More fun
  • Gotta get used to it

• Useful Technical Factoids
Cheaper

• \( \$ / \text{kWh} \rightarrow \$ / \text{gal} \)
  • Multiply \( \$ / \text{kWh} \) by 10 to get equivalent \( \$ / \text{gal} \)\(^1\)
    • Actually 8.5, but 10 is easier and still gets super-compelling numbers
    • 12.5 \( \$ / \text{kWh} \) is \$1.25/gallon
    • \$1.25/gallon makes the news whenever some gas station accidentally mis-prices their gas

• Hedge / lock in rates
  • No gas station lets you buy in advance
  • Up to 5 years with a REP
  • 30+ years with solar panels
    • ~6 \( \$ / \text{kWh} \) energy charge
    • 30 year contract
    • True net metering still available (if you buy panels through GME)
    • Free L2 chargers available (size for future EV)

• \$20/mo to drive my 2012 Leaf
  • When was the last time \$20 in gas got you a month of driving?

\(^1\) Source: EPA eGallon Methodology
Cheaper

- **Sticker Price**
  - Average new car price is ~$45,000!

- **Total Cost of Ownership**
  - Fuel (solar!)
  - Maintenance
  - PHEVs vs. BEVs
Cheaper

- Model Availability
  - Trucks and SUVs

1 Source: NADA
Cleaner

• Usually the lead point - not always the selling point!
  • Tesla proved people want to buy “fun / high-performance”

• Gotta figure out what resonates with people
  • Can’t ask Americans to change their lifestyle
  • EVs win on ALL fronts

• Usual focus is CO₂
  • Very divisive

• Need to focus on local air quality, too
  • SOx, NOx, VOC, PM, CO
  • Nobody likes smog
  • Much less divisive
Cleaner

• “Charging from a coal power plant is dirtier than gasoline!”
  • Time/place of emissions  Power plant full of V8s?  Running at most efficient output
• Grid power: 65-70% reduction in pollution (CO₂ and local)
• Renewable power from GME: 100% reduction in pollution (CO₂ and local)
• Diesels – not subject to emissions testing in TX!

Sources: UCS, EIA, EPA National Emissions Inventory
Cleaner

- What's the biggest source of CO\textsubscript{2} emissions? House or gas car?

- **Gas car: 800 lbs/mo**
  - 12,000 mi/yr / 25 mpg / 19.8 lbs CO\textsubscript{2} per gallon

- **House: 2,000 lbs/mo**
  - 2,000 kWh/mo / 0.991 lbs CO\textsubscript{2} per kWh ("grid intensity")

- Important to address biggest sources of emissions first!
  - House is much easier to make renewable, too!

- **EVs unsuitable for (1) aviation, and (1.5) long-haul trucking**
  - Super-curious to see how Tesla Semi (and competitors) do
  - Carbon offsets can handle CO\textsubscript{2} emissions of aviation and trucking
  - Similar offsets for other pollutants? Do SOx offsets make any sense?
More Convenient

- Range Anxiety
  - “I’m going to get stranded – either on the road or at home”
  - It exists with gas cars, too!

- Multi-car families
  - At least one EV/PHEV per family

- Typical treatment: “Recharge time from empty”
- More important metric: “Time spent recharging”
  - Usually lower for EVs!
  - Can charge at home, no special trips to fuel up or maintain it, car charges while you do other things
  - Average car utilization: <5%
    - 12,000 miles per year / 30 mph average speed = 400 hrs per year / 8,760 hours in year = 4.5%

- 3-6 months to get into the habit of driving an EV
  - Love to run a study where people get an EV for 3-6 mo. See how many return it early
  - Give them a taste and get them hooked
More Conveniet

• Charging
  • Harder to set up than for a gas car (especially for apartments)
  • But easier to use once it’s set up

• GME offers a free L2 charger if you buy solar panels from us and size your system to power a future EV (i.e. ~120% offset.)
  • True net metering available, too.

• Difficult for public to keep up with rapid advances in EV capabilities
  • EVs in infancy
  • Costs continue to fall, range/capabilities continue to increase rapidly

• Takeaway:
  • Electrify what’s easy to electrify
  • Plenty of opportunity with multi-car-garage single-family homes
  • Worry about edge cases once low-hanging fruit is complete
  • Give people what they want / what they think they need.
More Fun

• EVs vs. Hybrids
  • Hybrids trade off fun driving experience for better mileage. EVs give best of both worlds

• Quieter
  • Live next to a freeway?
  • Listen next time one drives down a street.
  • Conversation between front and back seat

• Zippier
  • All torque available all the time
  • Zip out in front at a stoplight to change lanes
Combining the Above

- Why do I want an EV?
  - Hybrids trade off fun driving experience for better mileage. EVs give best of both worlds

- I want an EV so I can feel less guilty about my lifestyle.
- With an EV, I don’t have to feel bad driving to the grocery store anymore to pick up a gallon of milk.
- I don’t have to feel bad taking a trip because I know it’s zero-emission, I’m not harming the environment, it’s as efficient as I can make it, and I’ve minimized the burden I’m putting on other people (noise and pollution.)
Technical Factoids / Talking Points
To start

• **What is a kWh?**
  • Ineffective definition:
    • “the energy needed to run ten [now nearly-outlawed] 100W light bulbs for an hour”
  
  • Effective / Impactful definition:
    • “8 hours of manual labor (shoveling dirt, etc.) expends 0.5 kWh”
    • “1 full day of manual labor could be replaced by $0.05 worth of electricity”

• **Electricity is powerful**
  • To power an air conditioner, you’d need 40 people pedaling bikes (for 12 hrs/day!)
Technical Factoids / Talking Points

• Comparing gasoline to batteries
  • Gasoline: 6 lbs per gallon
  • Battery: 150 lbs per gallon equivalent (33.7 kWh)
    • Technically 450 lbs, but battery can be used 3x as efficiently as gasoline
  • Will we need more electricity to power these EVs?
  • How much electricity does it take to MAKE gasoline?
    • Explore, drill, transport, refine, transport, pump into tank?
    • 6 kWh. To get you ~25 miles
    • Use the 6 kWh to drive an EV directly? ~25 miles
    • We don’t need more electricity to power EVs. We just need to redirect it away from producing gasoline!

Sources: 1 NBER 2 ELI 3 RAND
Technical Factoids / Talking Points

- Everything about an EV is backwards compared to gas car experience
  - You need charging where you PARK most often, not where you DRIVE most often
    - 225-mile Leaf / 0 fast charges in 6 months
  - City efficiency is better than highway efficiency

- Larger batteries can get by with slower chargers
  - Don’t let L2 charging (or its install cost) be a hurdle
  - Larger batteries let “low mileage” days offset “high mileage” days
  - Not possible with small (~75 mile range) batteries

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<th>Available miles per day BEFORE falling below 100% SOC (L1)</th>
<th>Hours of charging (per day)</th>
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Technical Factoids / Talking Points

• EV Subsidies
  • EVs: <$2 billion (2020)\(^1\)
  • Oil/gas: $10 billion (average 2002-2008)\(^2\)
     • Tax breaks and direct spending
  • Oil/gas: $0.25-$0.75/gal\(^3\)
     • Military subsidy to defend free flow of oil

• “Level the playing field?” I’d be happy to.

Sources: \(^1\)NBER, \(^2\)ELI, \(^3\)RAND
The Future Is Here Today

• New/expanded technologies
  • GME EV app (integrating EV charging with REP)
    • TOU (cost / emissions)
  • Demand Response
  • V2G
    • F-150 Lightning 10 kW out

• Typical day at work for me:
  • Daniel: “The answer is EVs. The answer is always EVs. Sometimes also solar.”
  • Coworker: “…what was the question?”
  • Daniel: “Doesn’t matter.”

• Plug for GME
  • Glad to work there
  • I get to influence electricity product development taking these insights into account
  • Keep an eye out for things we’ll be releasing over the next few years
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