

# 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
- **[Daniel.Richmond@greenmountain.com](mailto:Daniel.Richmond@greenmountain.com)**

# 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  $\text{\$/gal}$ <sup>1</sup>
    - Actually 8.5, but 10 is easier and still gets super-compelling numbers
    - 12.5  $\text{¢/kWh}$  is  $\text{\$1.25/gallon}$
    - $\text{\$1.25/gallon}$  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)
- $\text{\$20/mo}$  to drive my 2012 Leaf
  - When was the last time  $\text{\$20}$  in gas got you a month of driving?

<sup>1</sup> Source: [EPA eGallon Methodology](#)

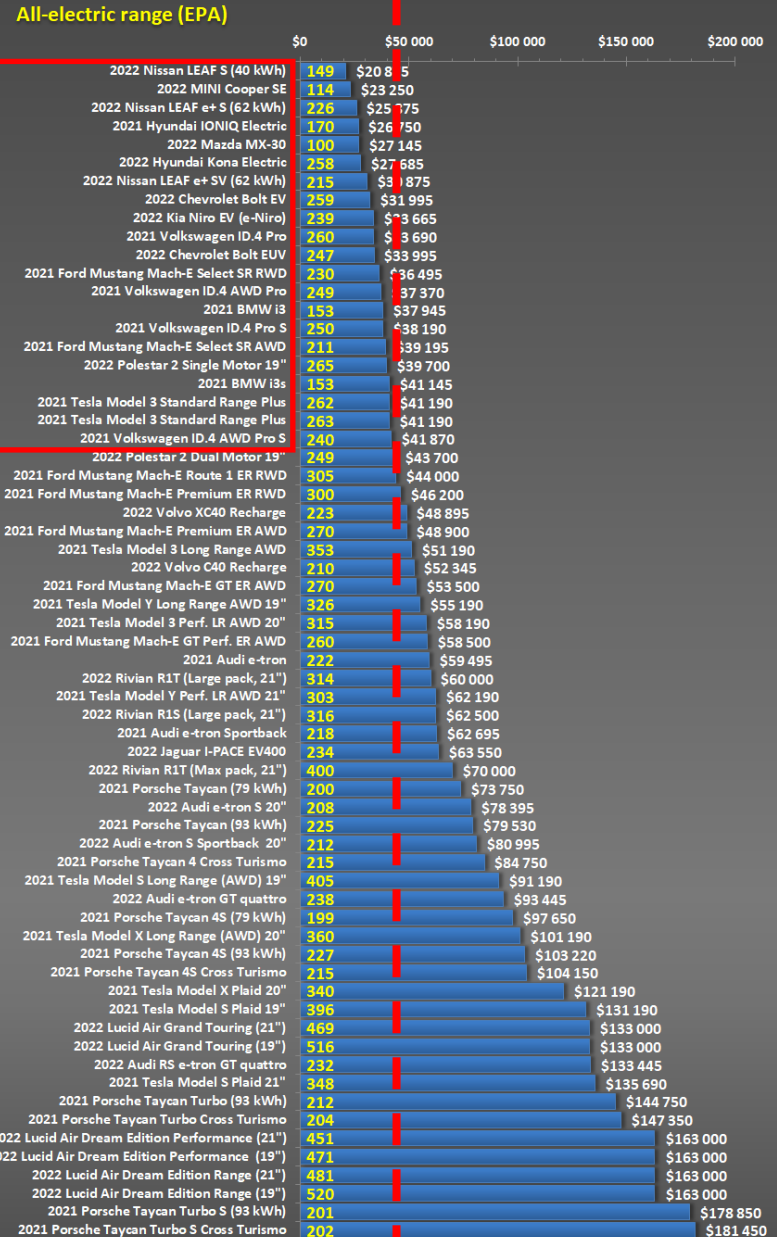
# Cheaper

- Sticker Price
  - Average new car price is ~\$45,000!
- Total Cost of Ownership
  - Fuel (solar!)
  - Maintenance
  - PHEVs vs. BEVs

All-Electric Vehicle Comparison - U.S.



Base price (MSRP + DST and after Tax Credit)



# Cheaper

- Model Availability
  - Trucks and SUVs

**New Light-Duty Vehicle Sales, by Year**

Year	New cars	Light-duty trucks	Total light-duty vehicles	Light-duty trucks as % of total
2009	5,456,300	4,945,400	10,401,700	47.5%
2010	5,635,400	5,919,100	11,554,500	51.2%
2011	6,089,300	6,644,900	12,734,200	52.2%
2012	7,242,800	7,199,000	14,441,800	49.8%
2013	7,582,500	7,942,300	15,524,800	51.2%
2014	7,688,900	8,748,100	16,437,000	53.2%
2015	7,525,023	9,861,024	17,386,047	56.7%
2016	6,873,158	10,591,862	17,465,020	60.6%
2017	6,079,584	11,055,149	17,134,733	64.5%
2018	5,304,347	11,910,816	17,215,163	69.2%
2019	4,790,846	12,317,310	17,108,156	72.0%
2020	3,408,778	11,055,157	14,463,935	76.4%

Source: [WardsAuto](#), [Automotive News Data Center](#)

<sup>1</sup> Source: [NADA](#)

# Cleaner

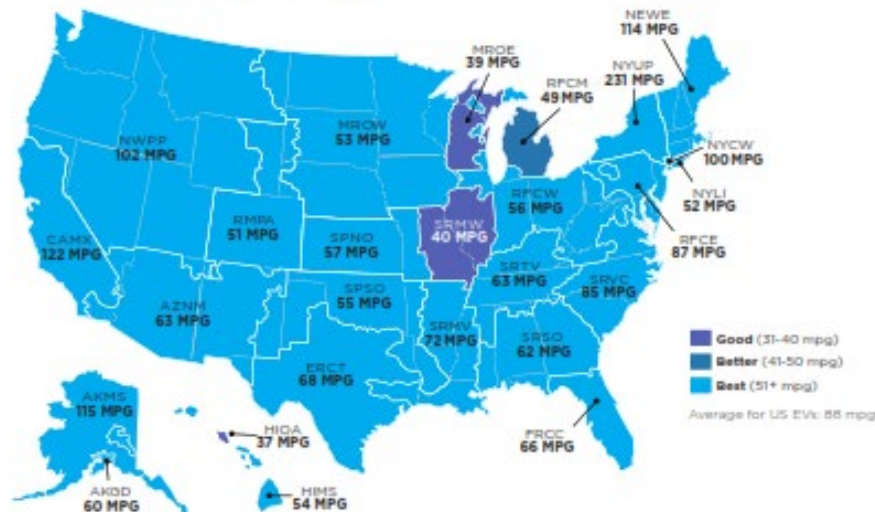
- Usually the lead point - not always the selling point!
  - Tesla proved people want to buy “fun / high-performance”
- Gotta figure out what resonates with people
  - Can’t ask Americans to change their lifestyle
  - EVs win on ALL fronts
- Usual focus is CO<sub>2</sub>
  - Very divisive
- Need to focus on local air quality, too
  - SO<sub>x</sub>, NO<sub>x</sub>, 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 (CO<sub>2</sub> and local)
- Renewable power from GME: 100% reduction in pollution (CO<sub>2</sub> and local)
- Diesels – not subject to emissions testing in TX!

FIGURE 1. EV Emissions Vary by Regional Electricity Supply



# Cleaner

- What's the biggest source of CO<sub>2</sub> emissions? House or gas car?
- Gas car: 800 lbs/mo
  - 12,000 mi/yr / 25 mpg / 19.8 lbs CO<sub>2</sub> per gallon
- House: 2,000 lbs/mo
  - 2,000 kWh/mo / 0.991 lbs CO<sub>2</sub> 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<sub>2</sub> emissions of aviation and trucking
  - Similar offsets for other pollutants? Do SO<sub>x</sub> 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 Convenient

- 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!**

# 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

Available miles per day BEFORE falling below 100% SOC (L1)

		Vehicle mpge (mi/kWh)				
		2.5	3	3.5	4	4.5
Hours of charging (per day)	8	30	36	42	48	54
	10	38	45	53	60	68
	12	45	54	63	72	81
	14	53	63	74	84	95
	16	60	72	84	96	108
		(Model X)		(Model Y)		
		(Model S)		(Model 3)		

Available miles per day BEFORE falling below 100% SOC (L2)

		Vehicle mpge (mi/kWh)				
		2.5	3	3.5	4	4.5
Hours of charging (per day)	8	132	158	185	211	238
	10	165	198	231	264	297
	12	198	238	277	317	356
	14	231	277	323	370	416
	16	264	317	370	422	475
		(Model X)		(Model Y)		
		(Model S)		(Model 3)		

# Technical Factoids / Talking Points

- EV Subsidies
  - EVs: <\$2 billion (2020)<sup>1</sup>
  - Oil/gas: \$10 billion (average 2002-2008)<sup>2</sup>
    - Tax breaks and direct spending
  - Oil/gas: \$0.25-\$0.75/gal<sup>3</sup>
    - Military subsidy to defend free flow of oil
- “Level the playing field?” I’d be happy to.

# 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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