EV Policy

Insights from a Policy Wonk, Regulator, and Academic

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EV Future is Socially Determined (Not Technologically Determined)

- Technological determinism: society's technology determines the development of its social structure and cultural values.
- Social determinism: society is autonomous force shaping technology, cultural values, social structure and/or history.
- **EVs are mostly "socially determined".** Without policy, I believe EVs are not inevitable for at least the next 20-30 years--market forces and consumer preferences will not by themselves motivate the transition to EVs. Society is making choices regarding EVs—through regulations, incentives and investments—**market penetration trajectory depends on policy!**

EVs are Policy Imperative for Climate Mitigation

- EVs are THE most important strategy to decarbonize transportation—by far! (2nd most important overall, after "zero-carbon" electricity)
- Automakers are ready and moving in EU and China, but await policy requirements and market acceptance in US

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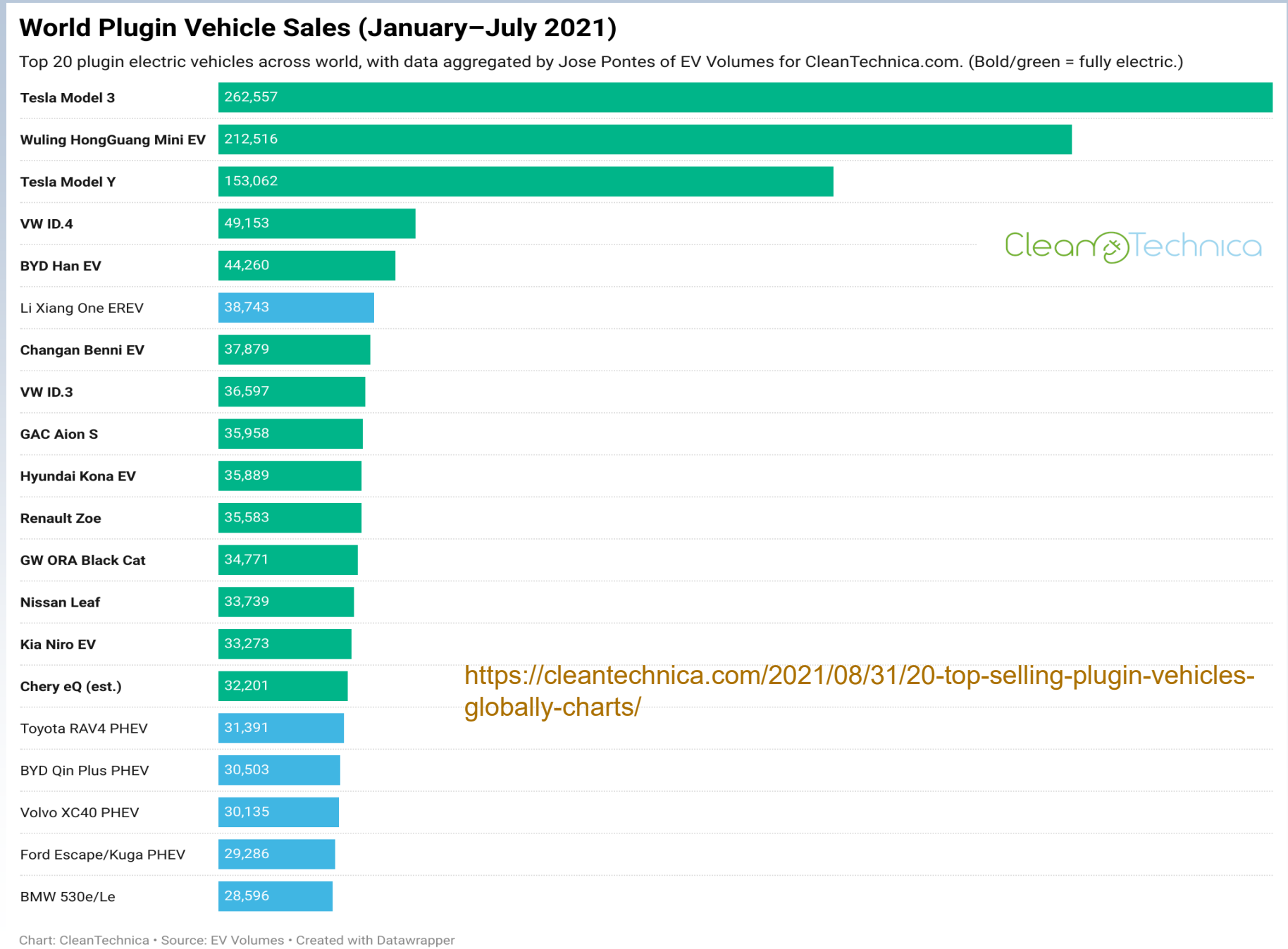
Tesla #1 Producer of EVs in World … and 2/3 of US Market.

All legacy automakers are lagging!

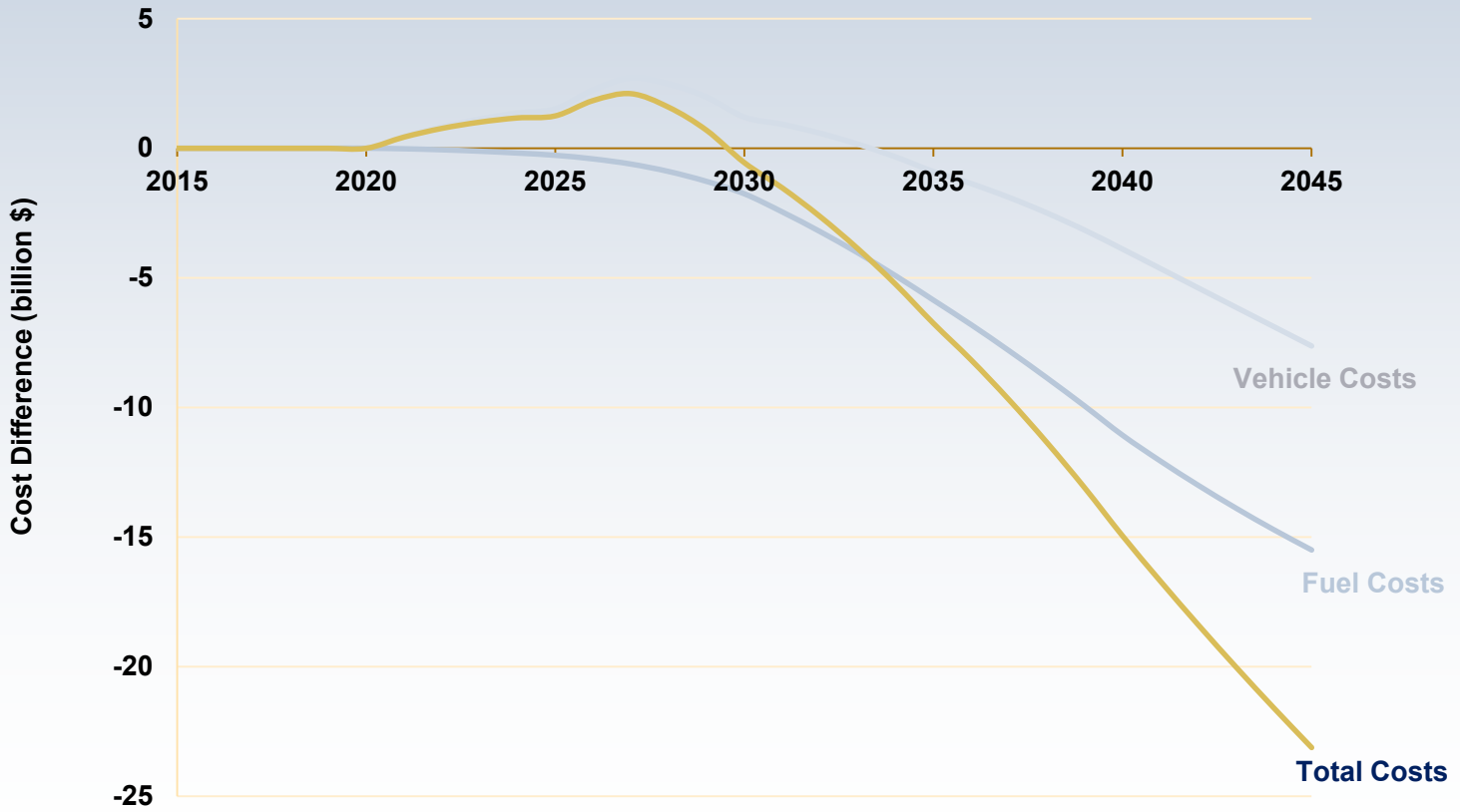


https://cleantechnica.com/2021/08/31/20-top-selling-plugin-vehicles-globally-charts/

My Most Important Message … For Policymakers

Aggressive low-carbon policies result in carbon reductions *and* cost savings *and* reduced health costs

Strong transportation decarbonization policies will result in net cost savings starting in ~10 years



BUT…Consumers Don't Make Decisions Based on Total Cost of Ownership (TCO)

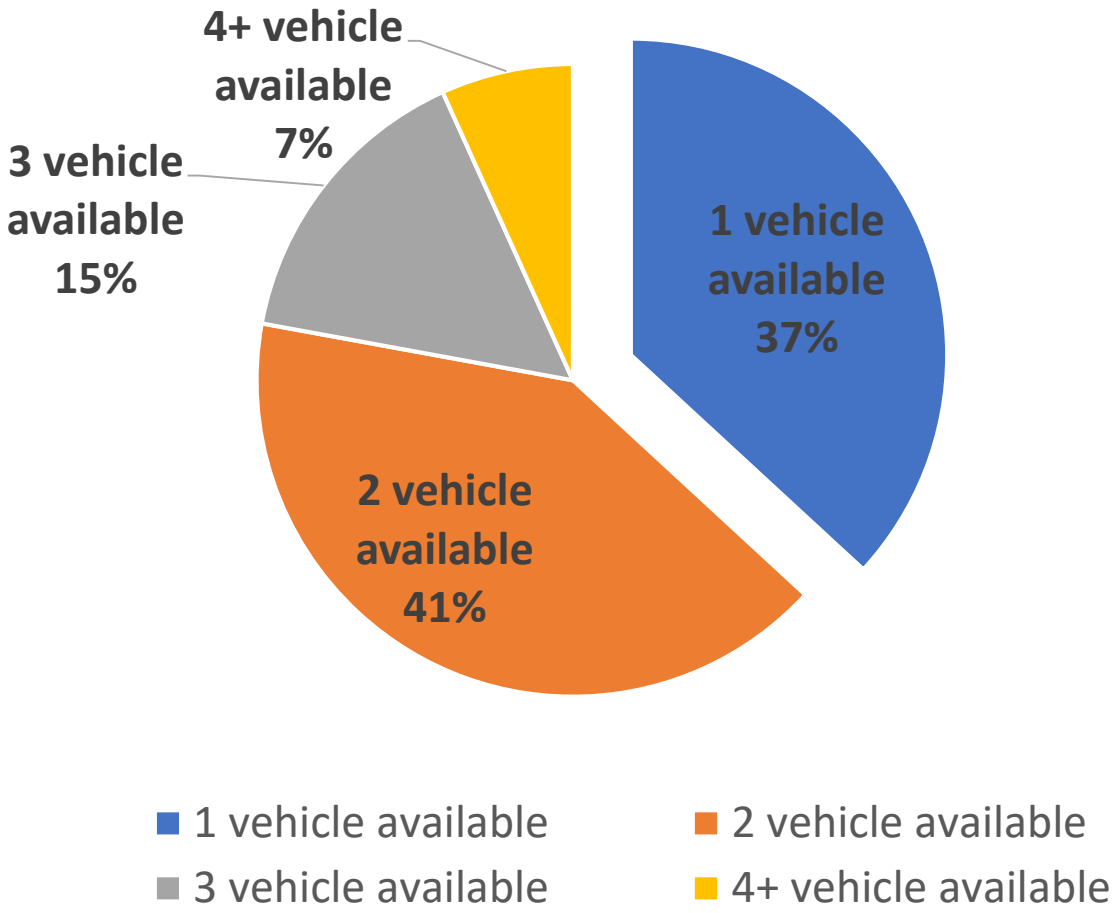
- Individual buyers are "conservative": concern over resale value, future price of energy, loss aversion, range anxiety
- Trucks are different: fleet owners are more likely to use TCO as decision variable

➢ *Incentives will be needed for a long time*

… but incentives don't need to be paid by taxpayers (e.g., feebates)

The First 50% Market Share Will Be Relatively Easy … the Last ~30% Will Likely Be Much Harder

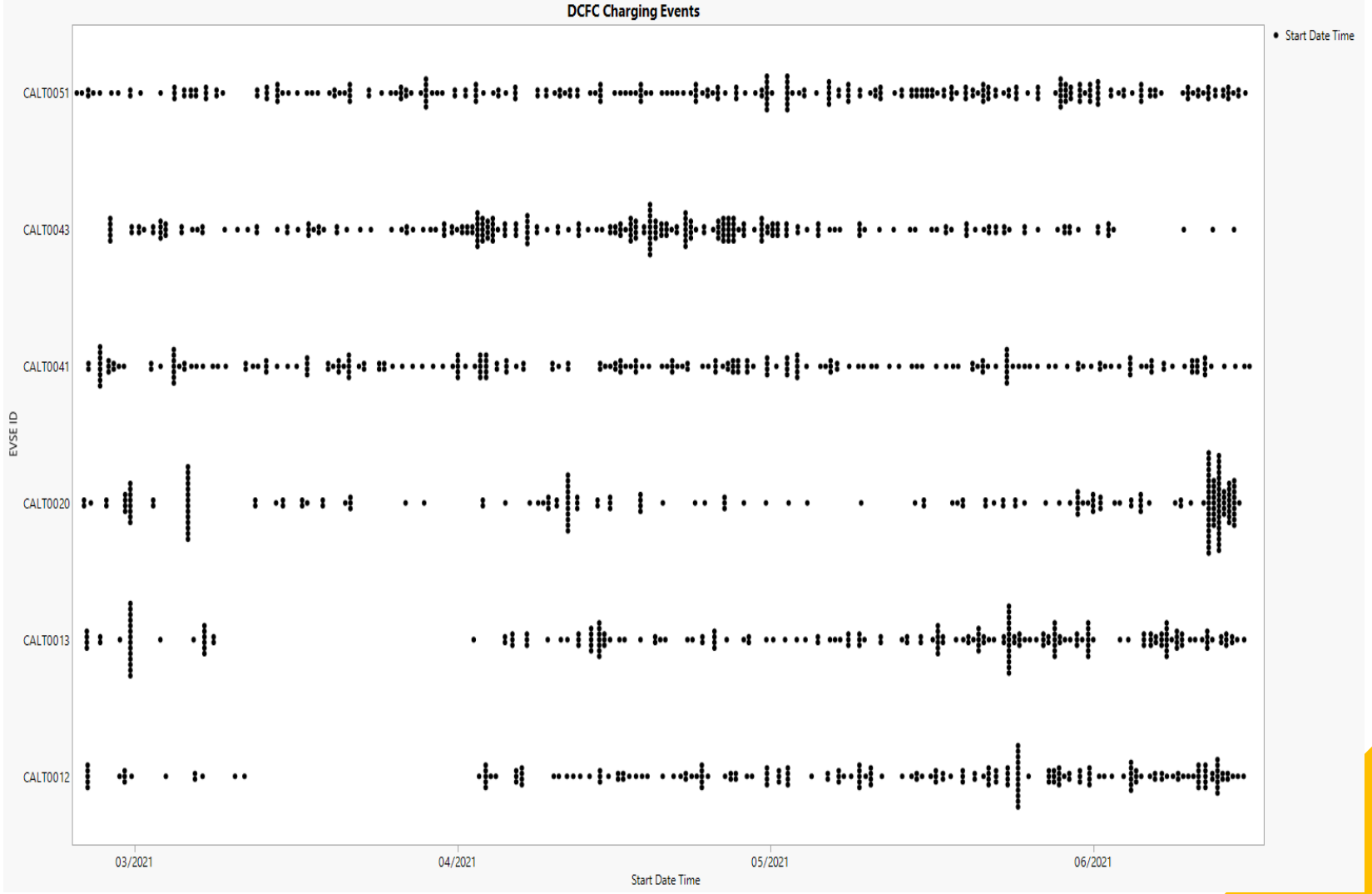
US Vehicles per Household



Charger Reliability is Often Poor

DCFC Charger Data Shows Many Episodes of "Non-Use"

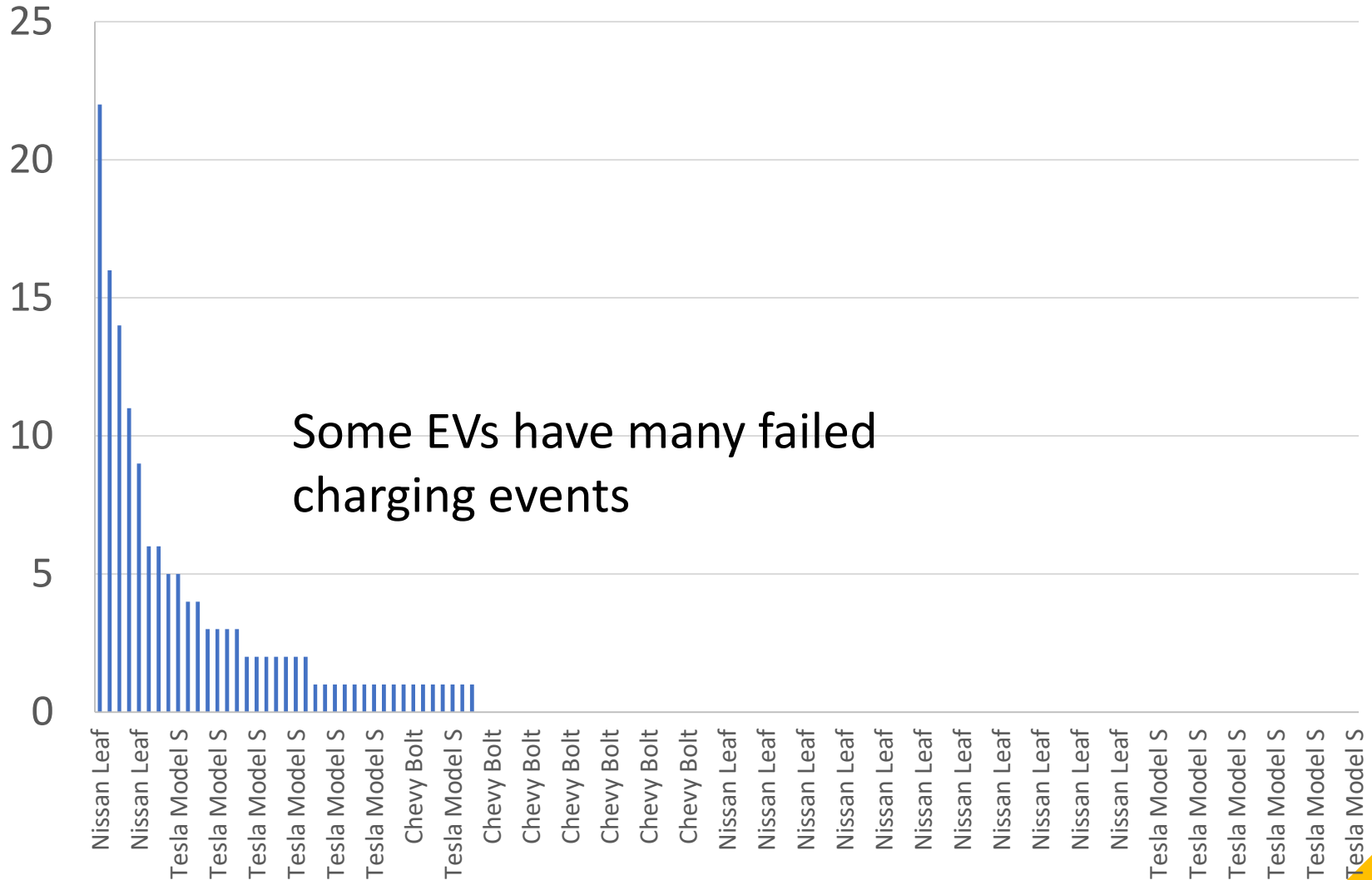
- Power out
- Data connection out
- Payment issue
- charger-vehicle communication issue
- Charger technical problem (Broken)
- Charger blocked (ICED)
- Location blocked



Charger Reliability is Often Poor

Vehicle Data Shows Many Failed Charging Events (DCFCs)

- Power out
- Data connection out
- Payment issue
- charger-vehicle communication issue
- Charger broken
- Charger blocked
- Location blocked



California Requires Most Trucks to be Zero Emissions by 2035 (with new rulemaking underway to further accelerate sales)

- Adopted June 2020, effective 2024
- Applies to large truck manufacturers who sell trucks in California
- Credit trading allowed
- Partial credits allowed for PHEVs (based on all-electric miles): up to 50% of compliance obligation

Model Year (MY)	Class 2b-3	Class 4-8	Class 7-8 Tractors
2024	5%	9%	5%
2025	7%	11%	7%
2026	10%	13%	10%
2027	15%	20%	15%
2028	20%	30%	20%
2029	25%	40%	25%
2030	30%	50%	30%
2031	35%	55%	35%
2032	40%	60%	40%
2033	45%	65%	40%
2034	50%	70%	40%
2035	**55%**	**75%**	**40%**

CARB

My Seven Insights

(based on research, regulatory experience, personal experience)

1. EVs are most important decarbonization strategy for transport—by far
2. Aggressive regulations on automakers are a necessary condition for accelerated transition to EVs
   - Automakers are still holding back in US
   - EU and China leading with aggressive regulations (~20% market share in Q3, vs 3-4% in US)
   - Weak CAFE/GHG stds less important than ZEV requirements
   - LCA important for fuel policy, but not vehicle policy
   - ➢ **California and other states likely to lead the transition in the US**
3. Last 30-50% of market will likely be very different (and harder) than first 50%
   - Greater role for PHEVs and FCVs?
4. Govt funding is necessary but not sufficient condition for charging infrastructure
   - Almost impossible to make money selling electrons to vehicles (no business model)
   - Reliability/accountability, ubiquitous ease of use is essential (Tesla model)
   - New subsidy approaches: pay for kwh or event; move to PPP model?

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Seven Insights (cont'd)

5. Vehicle purchase incentives will be needed through entire transition
   - TCO analyses are misleading—for users of public charging, when off-peak rates not available, less vehicle mileage, demand charges for fleets
   - Buyers use vehicle cost as most important variable in purchase decision

6. Purchase incentives especially important for social and environmental justice
   - Political and social imperative
   - Higher new car incentives plus incentives for used car sales

7. Need better incentives that send clear market signals to consumers (and industry)
   - Today's incentives are financially unsustainable
   - Today's incentives not very effective (not at point of purchase and tax credits only for "rich")
   - Feebates are revenue neutral (could build on gas guzzler tax)