Energy for What's Ahead

Everything Electric Vehicle

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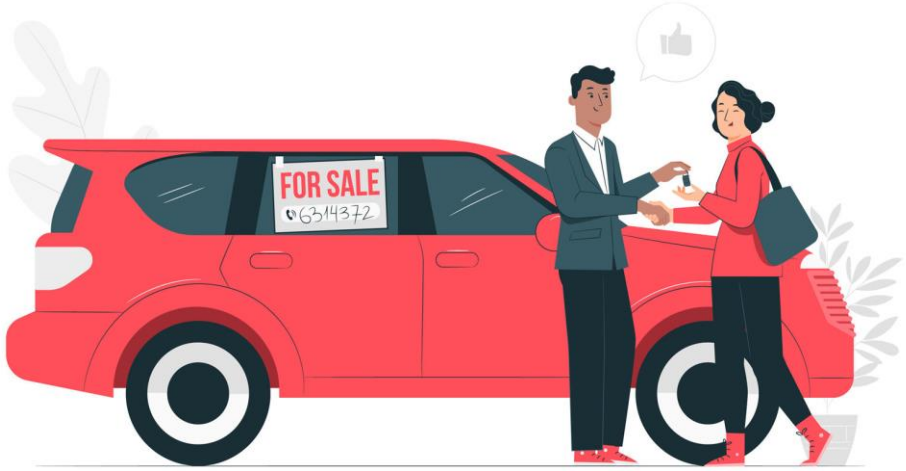
Used car trade-ins: Exposure risk for data security

The used car market is hot right now and maybe you're ready to trade-in and get that EV; do it safely and securely



Modern cars store a lot of personal data, including Bluetooth-pairing information, GPS coordinates for frequented locations, garage door codes, WiFi passwords, contact information, etc.

If you're trading in or selling your car, make sure you secure your personal information before completing the transaction.

Best practices for keeping your data safe prior to handing it over to a new owner

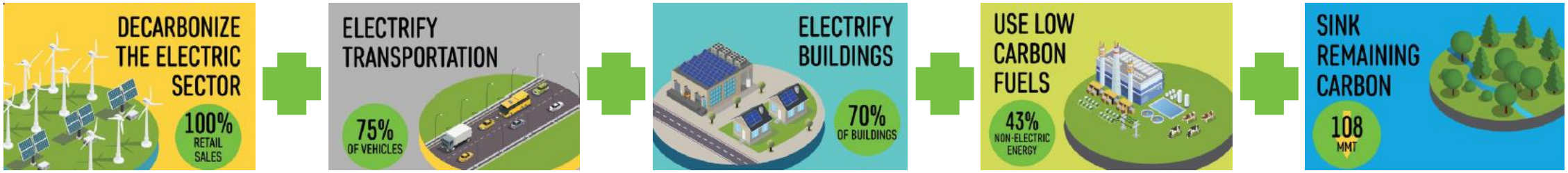
1. Perform a factory reset – good start but may not clear everything
2. Remove any saved routes or locations from your navigation system
3. Forget any paired Bluetooth devices
4. Delete any synced or saved contacts
5. Unprogram built-in garage door openers
6. If you have apps, log out of them
7. Remove all physical items from the car (and be sure to check the weird places like the spare tire compartment)

EVerything Electric Vehicle

Carbon neutrality in 2045 is achieved through electrification

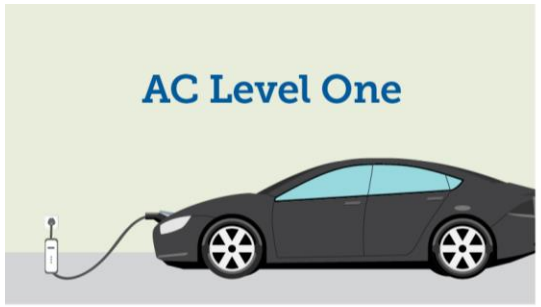
Deep decarbonization of electricity, and the use of low-carbon fuels for hard-to-electrify sectors

- Utilities will provide **100% carbon-free electricity retail sales** per SB 100
- Electrify **75% of passenger vehicles transportation – 26 Million Cars**
  - For **medium-duty vehicles two-thirds**, or **900,000** need to be electric and for **heavy-duty** the number of vehicles needed is **one-third** or **170,000**.
- **Building electrification** will include 70% of space and water heating, enabled through retrofits and new building codes and standards
- **Natural gas use may fall by half**, with roughly 40% of remaining gas sourced with biomethane (RNG) or hydrogen. **Low-carbon fuels target hard-to-electrify applications**
- Carbon emissions can fall nearly 75% to 108 MMT, and **reach neutrality through offsets or sequestration by 2045**



EV Charging Basics

There are three basic "levels" of charging and some recent pushes towards standardizing payment and dispensing methods for public charging



AC Level One

VOLTAGE
120v 1-Phase AC

AMPS
12–16 Amps

CHARGING LOADS
1.4 to 1.9 KW

CHARGE TIME FOR VEHICLE
3–5 Miles of Range Per Hour

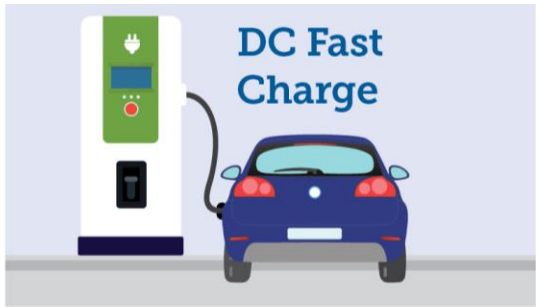
AC Level Two

VOLTAGE
208V or 240V 1-Phase AC

AMPS
12–80 Amps (Typ. 32 Amps)

CHARGING LOADS
2.5 to 19.2 kW (Typ. 7 kW)

CHARGE TIME FOR VEHICLE
10–20 Miles of Range Per Hour



DC Fast Charge

VOLTAGE
208V or 480V 3-Phase AC

AMPS
<125 Amps (Typ. 60 Amps)

CHARGING LOADS
<90 kW (Typ. 50 kW)

CHARGE TIME FOR VEHICLE
80% Charge in 20–30 Minutes

At-Home Charging

Public Charging

Some now charge at 150-350kW if the vehicle allows it

Standards for Public Charging

- Until recently, public chargers were not required to have credit card payment options (App only) but recent CA law requires this for new installations
- A similar law also requires stations to charge on a per-kWh basis (some have and still do charge by the minute)

EV Charging: Case Study

Let's compare two EVs: A Tesla Model 3 and a Ford F-150 Lighting Extended Range charging from 0-80%

Vehicle	Range	Battery Size	Level 1: 2kw $0.21/kWh	Level 2: 7.5kW $0.21/kWh	Level 3: 150kW $0.43/kWh
Tesla Model 3 Performance	315 miles	82 kWh	~33 hours $13.78	~9 hours $13.78	~26 mins $28.21
Ford F-150 Lightning Extended Range	330 miles	130kWh	~52 hours $21.84	~14 hours $21.84	~41 mins $44.72

How does the math work?

- Batteries are sized in kWh, a unit of energy
- Chargers are sized in kW, a unit a power
- Energy = Power x Time
- Time = Energy *divided by* power
  - 100 kWh Battery / 10 kW Charger = **10 hrs**

Of note: just because a charger is rated for 150kW (or 350kW) doesn't mean your car will allow it to charge that fast

This can be limited by both the battery size AND the battery voltage

150kW = 400V x 375A OR 150kW = 800V x 188A (Rough Math!)

Case Study
Panel Upgrade and EVSE Installation

Installing a Residential L2 EV Charger: Service Upgrade

Many older homes may still have only 100A of electrical service; installing a 7.5kW+ charger often exceeds allowable panel loading and requires an upgrade

Ref	Process Step	Time to Completion
1	Customer contacts SCE to request panel upgrade (e.g. 100 to 200 AMP)	20 minutes
2	SCE sends a rep to inspect the current meter install location and, if still ok, leaves an "inspected" sticker on the panel	2-3 days
3	Customer hires a contractor	2 - 3 weeks
4	Contractor pulls permit from local planning office	3 days
5	Customer contacts SCE to remove the lock ring on the meter	15 minutes
6	SCE sends someone to remove the lock ring on the meter to enable contractor work to commence	2 hours (SAME DAY)
7	Contractor Prep work around panel	1-day
8	Contractor removes and replaces panel, including the new meter	1-day (6-hours)
9	Local planning offices (AHJ) does an initial electrical inspection	1 - 2 weeks
10	Local Planning Approval Notifies SCE to come complete the Service Upgrade	1 day
11	SCE contractors upgrades service from pole to meter	4 hours
12	Contractor repairs anything else around the panel area that was damaged during prep and install	3 days after first inspection
13	Local planning office (AHJ) must come and inspect the installation and provide sign-off of completion	Occurred withing 48 hours of completion of the stucco

The cost and complexity of this step will vary greatly home-to-home any should not be underestimated

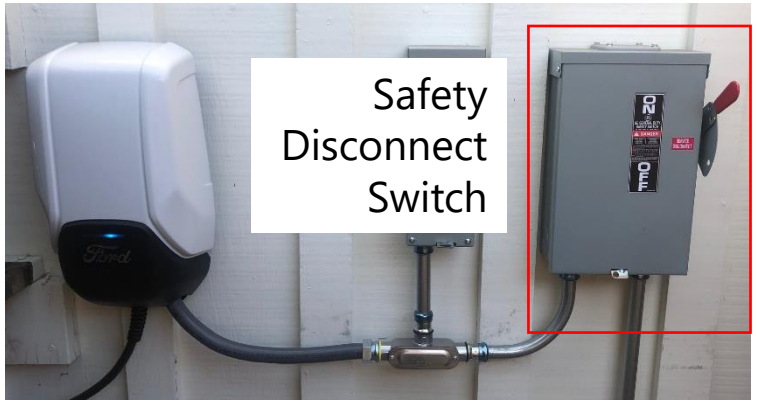
Installing a Residential L2 EV Charger: Charger Selection and Installation

For Level 1 Charging, a hardwired charger isn't necessary, but for Level 2 there are options and things that need to be consider

Portable 240V Charger

- Typically lower power (7.5kw)
- May require fewer circuit items
- May be shareable with existing dryer plugs
- **Safety Concerns**: 240V NEMA plugs are not made for hundreds of "plug-in" cycles and can degrade

Hardwired 240V Charger



- Can be up to 19kW (mine is 11.5)
- Likely to require additional circuit protections
- Higher power = bigger wires and higher installation costs
- May offer web / networking options that portable chargers do not

Things to consider in all case?

- Location: Indoors or Outdoors?
- Proximity to Electric Panel?
- Existing Circuit with adequate capacity (240V / 30A+)
- Circuit size and safety requirements?

That's great and all, but how do I charge if I am a renter?

Not being able to install new equipment can make things more challenging, but it doesn't mean you can't charge at home!

What you can do depends on what type of property you rent

Single-family home (or space with a garage)

- Don't forget you may be able to use an existing, standard 120V Outlet
- Ask your landlord – they may see the benefit if running a new circuit
  - Renters are eligible for SCE's Charge Ready Home!
- Have an existing 240V plug in your garage but it's occupied by an appliance? Consider a smart splitter, such as the $499 NeoCharge

Multi-family Dwelling

- There may still be 120V plug options…but be careful about who is getting the bill!
- **SCE's Charge Ready Light-Duty Program**
  - Targeting to install over 30,000 Level 2 charging port at multifamily dwellings over the next four years
  - Includes coverage for the make-ready infrastructure and rebates for the charging stations

EV Costs

Cost of Ownership: It's not just the sticker price

EVs are currently more expensive, but the fuel and maintenance savings add up fast

Take a typical Californian
- Drives 15k miles each year
- If an EV owner, then::
  - Charges 85% of the time at home
  - Is on an EV TOU Rate
  - Installed a Home Charger

	F-150 Lighting XLT Standard Range	F-150 XLT	Chevy Bolt	Nissan Altima
Price	$52,974	$44,115	$31,500	$24,900
Economy, Miles/kWh	2.1	-	3.8	-
Economy, Miles/gallon	-	20	-	34
kWh/Year	7143	-	3947	-
Gallons/Year	-	750	-	441
Annual Fuel Cost	$1,736	$4,875	$959	$2,868
Annual Maintenance Costs	$348	$697	$348	$697
Home Charging Station	$3,000	$0	$3,000	$0
5-year Ownership Costs	**$66,390.16**	**$71,977.45**	**$41,033.64**	**$42,725.69**

Even without any incentives, the electric truck is about $1000/year cheaper to own, and the Bolt is about $300/year less expensive

Current EV Federal and State Incentives

Many rebates and tax incentives are available and will stack with SCE's programs – educating the customer and contractor base will be critical to deployment

Item	Max Tax Credit	Max Rebate
Battery Storage Installation	30%	-
Electric Panel	$600	$4,000
Electric Wiring	-	$2,500
EV Charger	$1000	-
EV, New	$7,500	-
EV, Used	$4,000	
Heat Pump AC/Heater	$2,000	$8,000
Heat Pump Water Heater	$2,000	$1,750
Efficiency Rebates	-	$8,000

- There is intentionality around transferability of tax credits to auto dealers (or, arguably installers) but the rules are not yet clear, and perhaps there is a role for SCE or its program implementers / contractors to facilitate these
- Not everyone qualifies for the IRA Tax Credits or Rebates, and vice versa.
- There will need to be some form of income verification for customers to participate in rebates; Federal program rules are not yet defined and there is a possibility for SCE and utility programs to provide some of the upfront qualifications
- Additionally, Renters do not qualify for the infrastructure upgrade rebates or tax incentives, but do for SCE's programs
- **Net**: SCE is looking to enable customer access to the IRA funding so that its approved programs can benefit more customers

Federal Infrastructure Programs Incentives

- NEVI Formula for State DOTs
  - Part of the Bi-partisan infrastructure bill
  - Money deployed to states to get minimum 4-port charging stations every 50 miles on major corridors

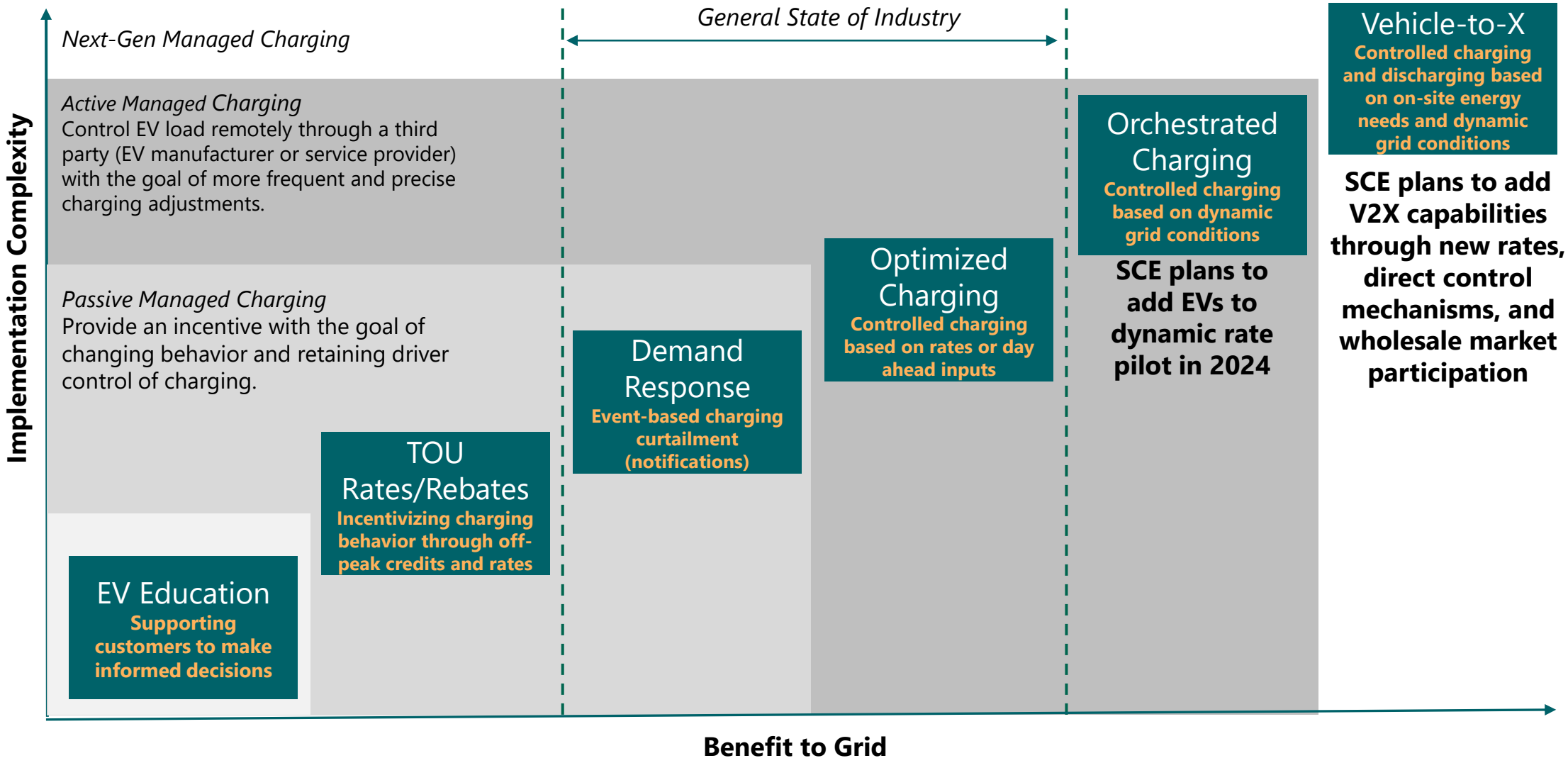
State Incentives

- Post-sale Income Qualifying EV incentives
  - Clean Cars 4 All: Up to $9,500 based on income level

Vehicle-Grid Integration
Using EVs as grid resources

Vehicle Grid Integration (VGI)

VGI covers several types of activities each with their own degrees of complexity, addressable market and implementation timeline



Source: Darcy Partners Managed Charging Benchmark

Vehicle to Building / Home: Ubiquitous back-up or niche application?

V2B has the potential to provide significant resiliency benefits to EV drivers (one Model 3 = 6 Tesla Powerwalls), but it's not as simple as it sounds

Example: Ford's Intelligent Backup Power

- The F-150 Lightning already has an onboard 9.6kW AC inverter, but it doesn't use this because of grid-interconnectivity standards
- The truck requires a higher-than-average cost charging station ($1350) and then another $3000-4000 in inverter/transfer switch equipment
- All in, this solution might be an **extra $8-18K** after the purchase of the truck…certainly not for everyone!
- However, a comparable natural gas automatic backup generator installation might cost $5-8k and can't be "refilled" by rooftop solar if the gas stops flowing.

Also…only 3 manufacturers allow this right now (Ford, Nissan, and Mitsubishi)

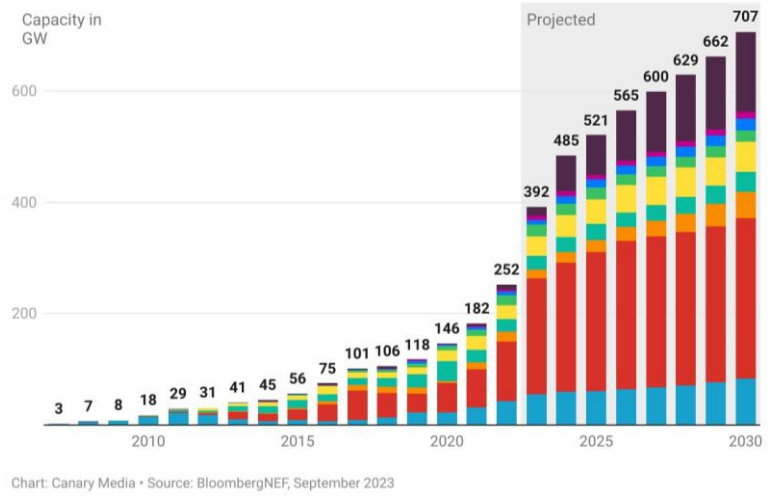
Is this a good deal or not? Depends on how valuable back-up power is to your home.

EV Programs: What's SCE Doing

Never underestimate what can be accomplished in a decade

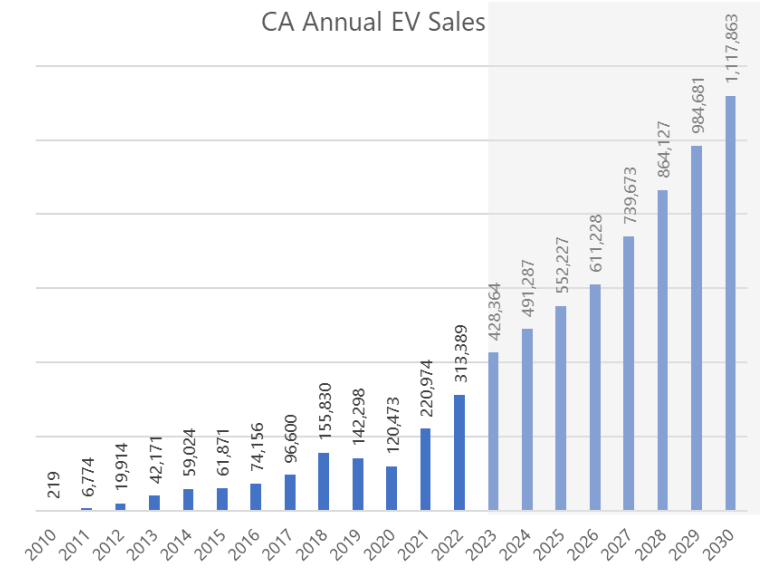
Incremental change is hard to observe, and it wasn't until the last few years that we entered the energy transition. But policies now are likely backstops to the inevitable

What this chart forecasts is that in 2023-2025 the world will install **more PV solar than has been installed in all years through 2022** (and then will at the same amount again in 2026-2027)

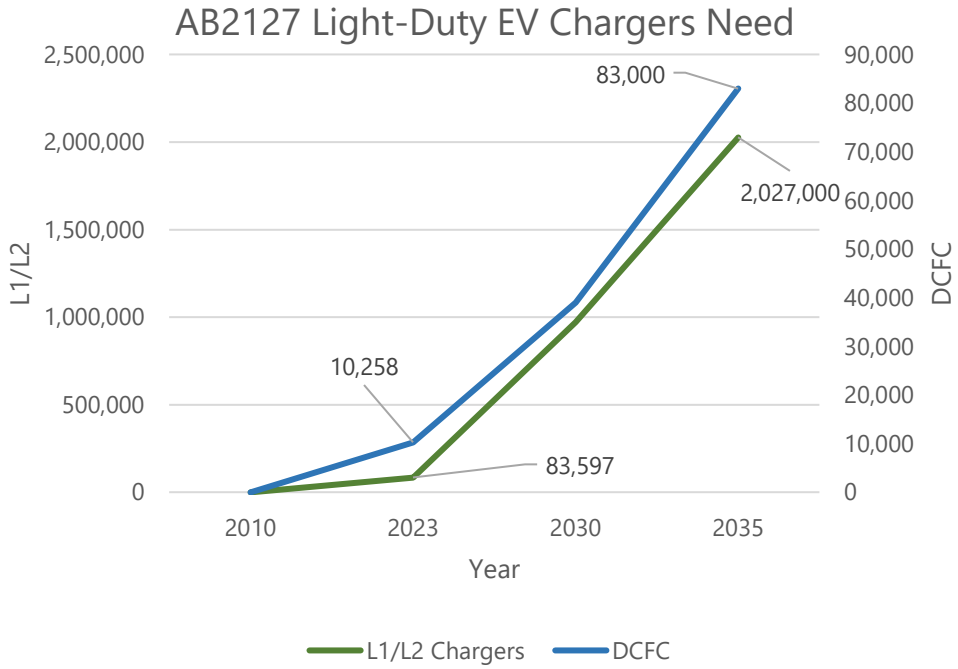


What this chart forecasts is that in 2023-2025 more EVs will be sold in CA than have **been sold in all years through 2022** (and then will at the same amount again in 2026-2027)

Growth in light-duty EV sales are on track but significant growth still needed to meet state targets



AB 2127 (2018) requires the California Energy Commission to biennially assess the electric vehicle charging infrastructure needed to meet the state's goals.



These curves are similar in shape, which means it can be done!
That said, deploying infrastructure requires more coordination between local planning, utilities, and customers than buying vehicles

SCE's Transportation Electrification Programs: Leading the Charge!

SCE has programs in-market that will provide $1-1.5B of support in incentives and infrastructure over the next 4 years to support California's growing EV population

Light-Duty Vehicle Infrastructure

- **Charge Ready Light Duty:** $432M program to support the installation approximately **30,000 ports ,** including **c**harging station rebates for qualified applicants. **ACTIVE**
- **SCE Own & Operate**: Programs where SCE owns, maintains, and operates L2 charging stations at multifamily, schools, and CA State parks and beaches. **ACTIVE**

Medium/Heavy Duty Charging & Electrification

- **Charge Ready Transport:** $356M program installing charging equipment to support the deployment of **8,490 electric vehicles**. Charging station rebates available for transit/school buses and sites in disadvantaged communities. **ACTIVE**
- **TE Advisory Services:** $4.8M program provides educational services to fleets and property owners early in the electrification planning phase: **ACTIVE**
- **Drayage Truck Rebate:** $88M in funding to support electrification of drayage trucks in SCE's territory. **LAUNCHING Q2 2024**
- **MDHD Loan Loss Reserve:** $20M to establish a financing assistance program in partnership with the State **LAUNCHING Q2 2024**

Residential Electrification Incentives

- **CA Clean Fuel Reward**: SCE administers California's on the hood rebate on behalf of all state utilities. Disbursed ~$470M in rebates in 2021-2022. **PAUSED**
- **Pre-Owned EV Rebate:** $53M in funding to support used EV sales, with higher rebates for low-income applicants. **ACTIVE**
- **Charge Ready Home:** $61M in funding to support residential panel upgrades for home charging, with higher rebates for low-income applicants **ACTIVE**
- **Affordable Public Charging:** $20M in funding to subsidize public charging for lower-income EV drivers that works on all charging networks **PROPOSED**

Transitioning from programs to normal-course-of business

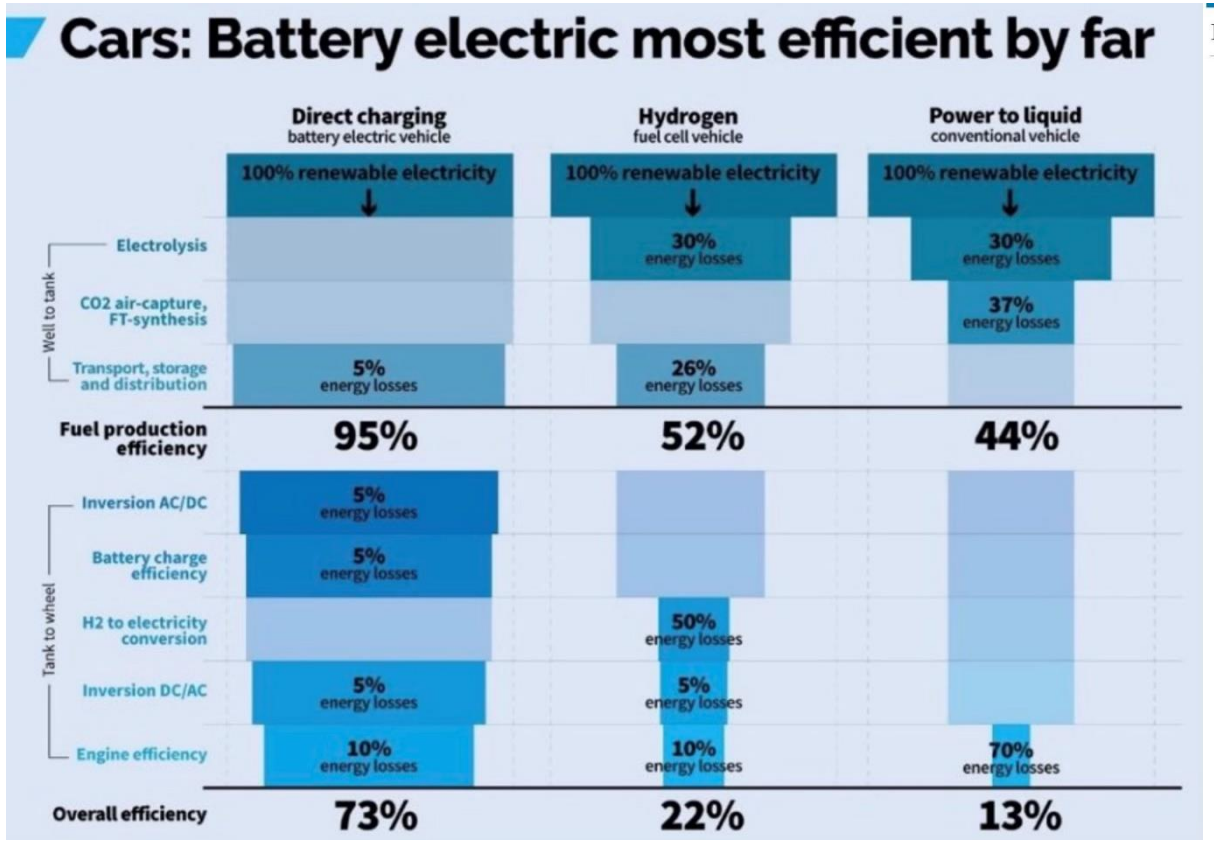
- A new offering, **Rule 29**, allows SCE to process customer requests for new electrical service for EV charging as part of normal operations → just like requesting service for other new, commercial loads, SCE will simply process the utility-side upgrades

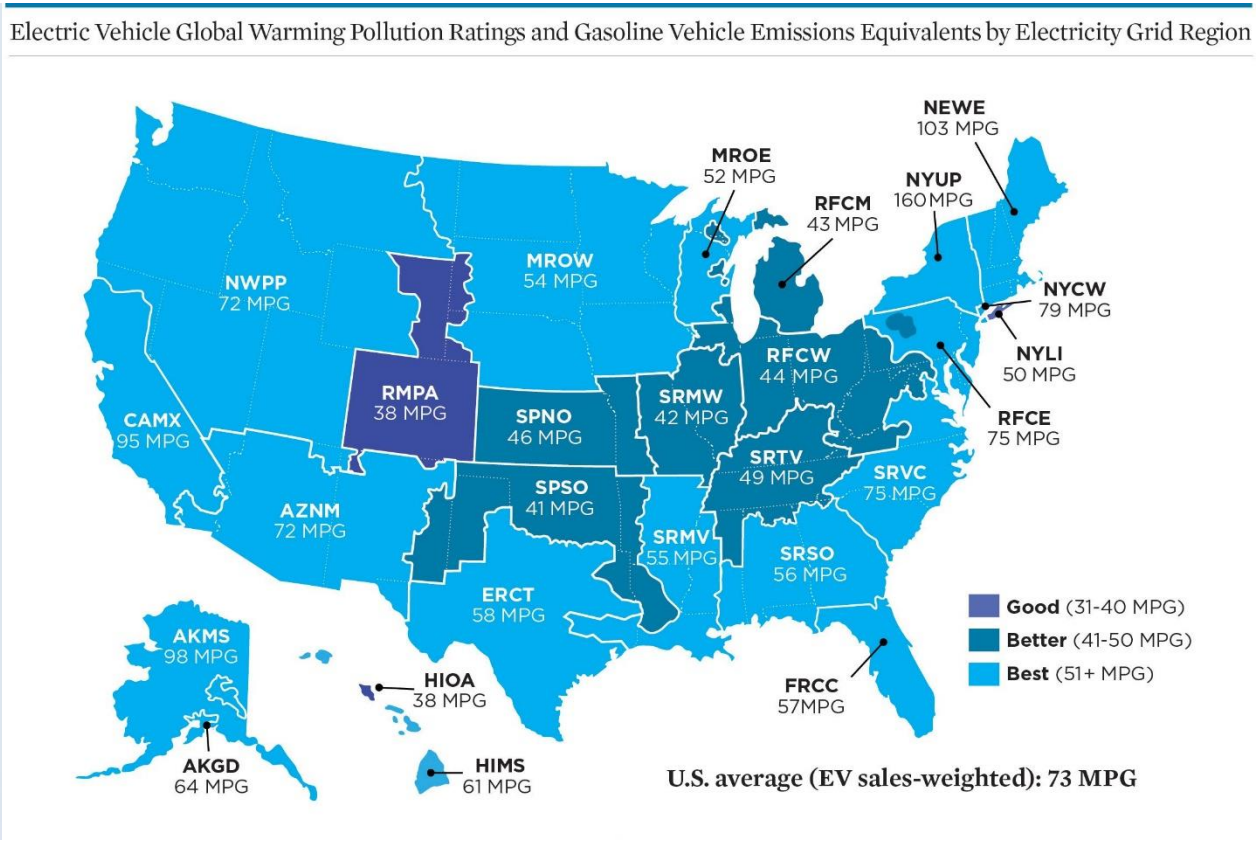
EV Myths: Fact or Fiction?

Myth #1: EVs pollute more than gas cars

Categorically false! On grids powered mostly by fossil fuels, EVs still emit fewer lifecycle emissions than gas cars if driven more than 50,000 miles

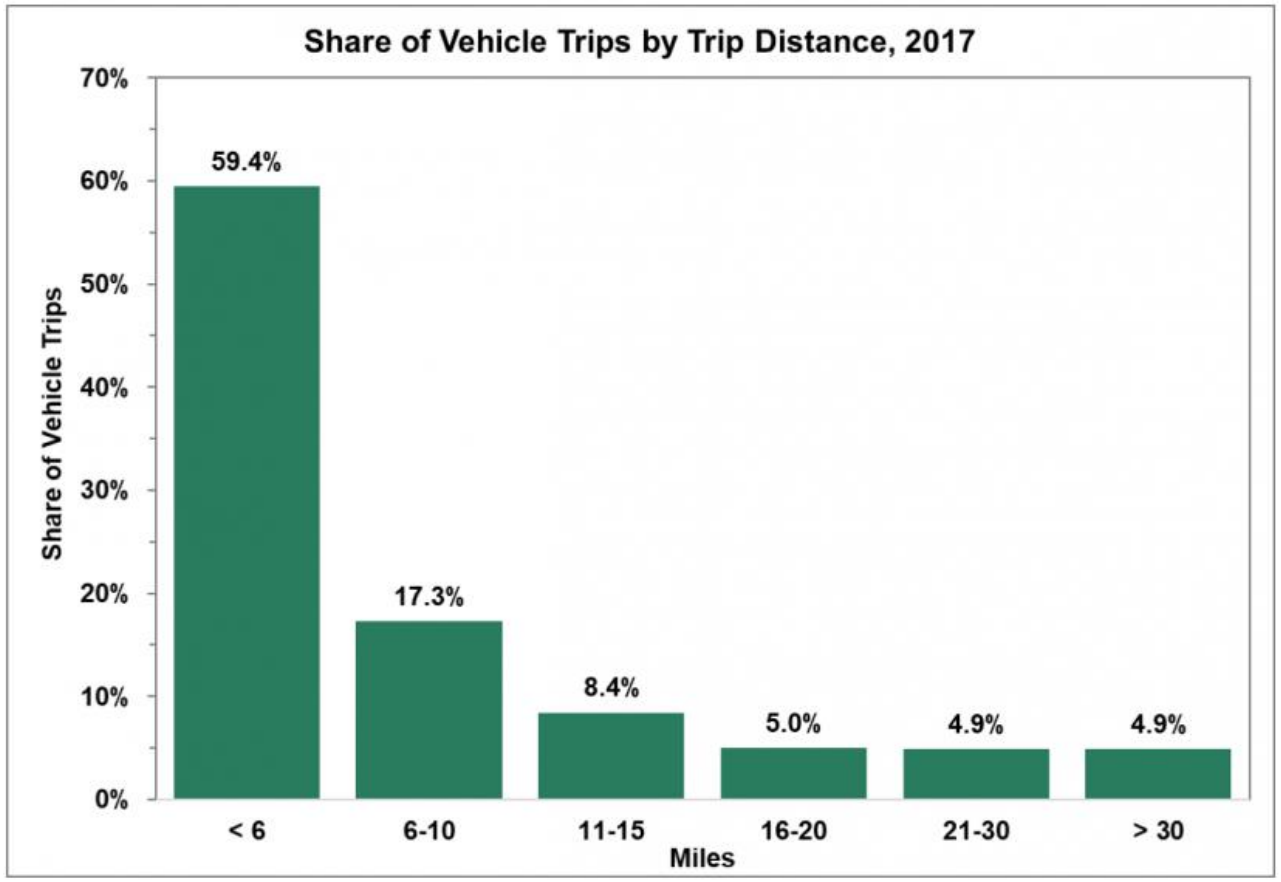
Even with higher manufacturing emissions, EV's are so efficient that it's not even close





Myth #2: We need 500+ mile ranges to make EV work

False for most cases! People make purchase decisions based on behavior at the extremes. Low-range BEVs have been adequate for most trips for many years



95% of trips were less than 30 miles

In 2021 the average Californian drove 12,524 miles

- If this was only workdays, that's only 50 miles/day
- From discussion on charging speeds, this is only 2-3 hours on L2 of 6-12 hours on L1 depending on your vehicle efficiency (easily done overnight!)

<u>Anecdote: Recent Road Trip</u>

Last year I drove my 230 mile range BEV on a 294 mile one-way trip into the Sierra mountains. Because of charging station locations, this required 3 stops on the way up, and 2 stops on the way back, as opposed to ~3 total gas stops.

- If a gas stop is ~5 minutes and a charging stop was ~30 minutes, this added 2.25hrs to my trip. However, one charging stop was short (10 minutes) and another coincided with a grocery errand in Bishop so this only added about 1.5 hours to 9 hours of driving(17%)
- I used 179kWh of public charging at $0.43/kWh for a total cost $76.97. In my 28mpg ICE alternate, this same trip would have cost $118 at $5.60/gallon

Myth #3: The batteries degrade and don't last long enough

False! While first generation EVs had battery design issues, a modern EV drive train will last longer than most other parts of the car

Even a few years ago, lithium ion batteries were typically designed to be useable for 2,000 "cycles"

Cycle = full charge and discharge….in vehicle speak that could mean number of "fill ups"




Model	Gen 1 Nissan Leaf	Tesla Model 3 Extended Range	Kia EV 6	F-150 Lightning Standard Range
Range per "Cycle"	90 miles	358 miles	310 miles	230 miles
Designed Cycles	2,000	2,000	2,000	2,000
Est. Battery Life	180,000 miles	**716,000 miles**	620,000 miles	460,000 miles

Real World Example
2016 Tesla Model X 90D drove 317,000 miles before needing a battery replacement

And if that doesn't convince you, Federal law requires automakers to ensure EV and hybrid batteries for at least eight years or 100,000 miles. California goes even further, requiring a **10-year, 150,000-mile** warranty on EV and hybrid batteries

Myth #4: Batteries are dangerous and explode

Partially true. All stored energy is dangerous! Batteries can catch on fire, but so do gasoline cars, and at a much higher rate!

Number Recalled (2020)	Fuel Type	Number of Models Affected	Make/Model(s)	Cause of Fire
430,000	Gas	1	Hyundai Elantra	Electrical Short
308,000	Gas	2	Kia Cadenza & Sportage	Electrical Short
250,000	Gas	1	Honda Odyssey	Electrical Short
95,000	Gas	2	Hyundai Genesis & Genesis G80	Anti-Lock Braking System
82,000	EV	1	Hyundai Kona	Battery
70,000	EV	1	Chevrolet Bolt EV	Battery
27,600	Hybrid	1	Chrysler Pacifica	Battery
4,500	Hybrid	7	BMW 530e, xDrive30e, Mini Cooper Countryman All4 SE, i8, 330e, 745Le xDrive, & X5 xDrive45e	Battery
2,800	Gas	2	McLaren Senna & 720S	Fuel Leak

Table: AutoInsuranceEZ.com
Source: Recalls.gov

It's true that EV battery fires can be quite catastrophic. While they are more rare than ICE fires, most spontaneous EV fires are related to the **thermal management** of the battery. This is often the principle point of R&D for battery and vehicle manufacturers and as more EVs are made more and more knowledge and best practices are being accumulated.

Q&A