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IECC 2024 EV Charging Infrastructure Requirements

Michael Tillou, PE

May 8th, 2024

U.S. DEPARTMENT OF ENERGY BATTELLE

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DOE Building Energy Code Program (BECP)

Development

- ASHRAE Standard 90.1
- International Energy Conservation Code (IECC)
- DOE Determinations **on code energy savings**

Model Energy Codes

Implementation

- State technical assistance
- State-specific energy, cost and benefit analyses
- Compliance software tools & resources
- User Support
- Trainings
- Field study guideline and methodology

COMcheck REScheck

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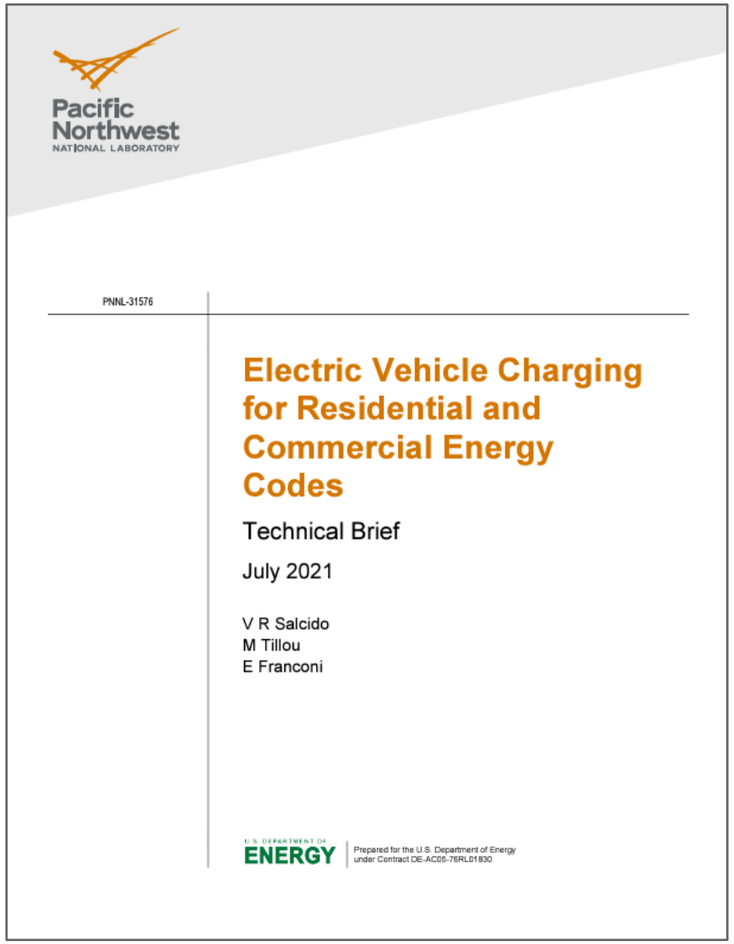
DOE BECP Advancing Energy Codes
With Code Change Proposals and Informative Technical Briefs

Topic	Description
EV Charging	Code language for requirements for electric vehicle installed, ready, and/or capable infrastructure
Load Management	Informative analysis to encourage states to incentivize or establish code requirements for load management measures
Energy Credits	Code language for additional energy efficiency and grid-interactivity measures that go beyond the prescriptive code
Demand Response	Code language for thermostats and water heaters requirements to include demand response capability
PV Required	Code language for on-site solar photovoltaic requirements
Electric Readiness	Code language for requirements electric outlets installed near fossil fuel water heaters, dryers, and cooking equipment
Zero Emissions	Optional residential and commercial code language for a performance-based path to achieve zero emissions

Electric Vehicle Charging for Residential and Commercial Energy Codes

EV Charging Requirements Tech Brief

- Written as an overlay to the IECC 2021
- Developed in collaboration with ICC
- Addresses requirements for both Commercial and Residential new construction
- Formed basis for IECC 2024 proposal for EV charging infrastructure



Source: energycodes.gov

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IECC 2024 EV Charging Working Group Goals

- **Definitions** – Incorporate, match, and/or be consistent with definitions in other codes (NFPA 70 / NEC, ICC Building Code, Zoning Code)
- **Requirements Table** – Provide proper requirements for different residential and commercial building types with different EV charging profiles and usages.
- **Mandatory language** – Provide technically correct minimum requirements for EV charging infrastructure installation and for energy management (smart / managed charging).

Closely aligned requirements across both the IECC Residential and Commercial provisions

EV Charging Definitions

Key definitions for EV Charging adopted into IECC.

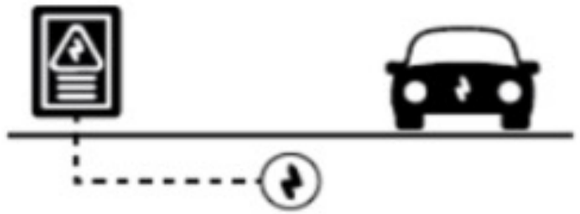
- *AUTOMOBILE PARKING SPACE.*
- *ELECTRIC VEHICLE (EV).*
- *ELECTRIC VEHICLE CAPABLE SPACE (EV CAPABLE SPACE).*
- *ELECTRIC VEHICLE READY SPACE (EV READY SPACE).*
- *ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE).*
- *ELECTRIC VEHICLE SUPPLY EQUIPMENT INSTALLED SPACE (EVSE SPACE).*

The same set of definitions was adopted into both the Commercial and Residential provisions and developed to be consistent with definitions in the NFPA 70 / NEC, and the ICC Building Code.

EV Charging Requirements

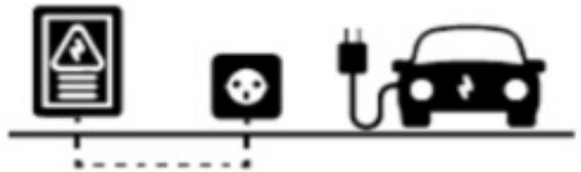
EV Capable Spaces.

Install panel capacity and conduit (raceway) to accommodate the future build-out of EV charging



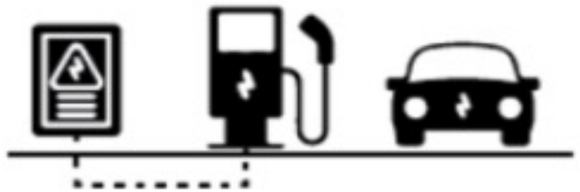
EV Ready Spaces.

Install a full circuit installations including panel capacity, raceway, wiring, receptable, and overprotection devices.



EVSE Spaces.

Install EVSE charging stations during new construction



EV Charging Requirements - Residential

New one- and two-family dwellings and townhouses with a designated attached or detached garage or other on-site private parking provided adjacent to the dwelling unit:

- Provide one EV capable, EV ready or EVSE space per dwelling unit .

New R-2 occupancies or allocated parking for R-2 occupancies in mixed-use buildings:

- Provide EV capable space, EV ready space or EVSE space for 40 percent of the dwelling units or automobile parking spaces, whichever is less.

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EV Charging Requirements - Commercial

REQUIRED EV POWER TRANSFER INFRASTRUCTURE

OCCUPANCY	EVSE SPACES	EV READY SPACES	EV CAPABLE SPACES
Group A	10%	0%	10%
Group B	15%	0%	30%
Group E	15%	0%	30%
Group F	2%	0%	5%
Group H	1%	0%	0%
Group I	15%	0%	30%
Group M	15%	0%	30%
Group R-1	20%	5%	75%
Group R-2	20%	5%	75%
Groups R-3 and R-4	2%	0%	5%
Group S exclusive of parking garages	1%	0%	0%
Group S-2 parking garages	15%	0%	30%

EV Charging Capacity Requirements

System capacity. The electrical distribution equipment supplying the branch circuit(s) serving each *EV capable space*, *EV ready space* and *EVSE space* shall:

- Have a calculated load of 7.2 kVA for each space, or
- When controlled by an **energy management system**, have a calculated load not less than 3.3 kVA per space.

Circuit capacity. The branch circuit serving each *EV capable space*, *EV ready space* and *EVSE space* shall:

- Have a rated capacity not less than 50 amperes
- When controlled by an **energy management system**:
  - Have a minimum capacity of 25 amperes per space, or.
  - Have a minimum capacity of 20 amperes per space for R-2 occupancies where all *automobile parking spaces* are *EV ready spaces* or *EVSE spaces*.

EV Charging Cost Effectiveness

Cost effectiveness was also evaluated using data from a more comprehensive October 2021 EV Charging cost study for the Provence of Ontario, Canada

	New Cost (2021 US$)	Future Retrofit Cost (2021 US$)	Real Discount Rate	NPV of the Future Retrofit Cost in Year x								
				2023	2030	2038	2039	2040	2045	2046	2047	2052
Dedicated 40A Circuit (20% EV Ready)	$ 4,875	$ 16,171	7%	$15,113	$9,412	$5,478	$5,119	$4,784	$3,411	$3,188	$2,979	$2,124
			5%	$15,401	$10,945	$7,408	$7,055	$6,719	$5,265	$5,014	$4,775	$3,742
			3%	$15,700	$12,766	$10,077	$9,784	$9,499	$8,194	$7,955	$7,723	$6,662
4-share on 40A circuit (20% EV Ready	$ 2,863	$ 8,926	7%	$8,342	$5,195	$3,023	$2,826	$2,641	$1,883	$1,760	$1,645	$1,173
			5%	$8,501	$6,041	$4,089	$3,894	$3,709	$2,906	$2,768	$2,636	$2,065
			3%	$8,666	$7,046	$5,562	$5,400	$5,243	$4,522	$4,391	$4,263	$3,677
Dedicated Circuits on 4A (100% EV Ready)	$ 3,833	$ 12,772	7%	$11,936	$7,433	$4,326	$4,043	$3,779	$2,694	$2,518	$2,353	$1,678
			5%	$12,164	$8,644	$5,851	$5,572	$5,307	$4,158	$3,960	$3,772	$2,955
			3%	$12,400	$10,082	$7,959	$7,727	$7,502	$6,471	$6,283	$6,100	$5,262
3-share on 40A (100% EV Ready)	$ 2,363	$ 7,759	7%	$7,252	$4,516	$2,628	$2,456	$2,296	$1,637	$1,530	$1,430	$1,019
			5%	$7,390	$5,252	$3,555	$3,385	$3,224	$2,526	$2,406	$2,291	$1,795
			3%	$7,533	$6,125	$4,835	$4,695	$4,558	$3,932	$3,817	$3,706	$3,197
4-share on 40A (100% EV Ready)	$ 1,680	$ 5,483	7%	$5,124	$3,191	$1,857	$1,736	$1,622	$1,157	$1,081	$1,010	$720
			5%	$5,222	$3,711	$2,512	$2,392	$2,278	$1,785	$1,700	$1,619	$1,269
			3%	$5,323	$4,328	$3,417	$3,317	$3,220	$2,778	$2,697	$2,619	$2,259

Study cost data was converted to US$ using Feb 2022 US/CAN international currency exchange rate.

Source: Electric Vehicle Charging Infrastructure Costing Study October 2021
https://cleanairpartnership.org/cac/wp-content/uploads/2021/10/2-21-050-GTHA-EV-Ready-Costing-Study-2021.10.14.pdf

Installing EV Charging infrastructure at time of construction remains cost effective:

- For 18 years at a 7% real discount rate
- For 24 years at a 5% real discount rate
- At 30 years with a 3% real discount rate

EV Charging Strategies in Energy Codes

Next Steps:

- Expand load sharing allowances based on larger branch circuit capacities. Important for occupancies with 100% EV space requirements to manage infrastructure costs and grid impacts.

- Develop requirements that allow greater flexibility for the installation of different types of chargers (ie: DC Fast charging).

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Thank you

Expanding Access to Affordable At-Home EV Charging

How EV-Ready Codes Can Accelerate an Equitable Transition to EVs

Vanessa Warheit, National Lead
EV Charging for All Coalition
EV Codes Conference, May 2024

EVCAC's Mission

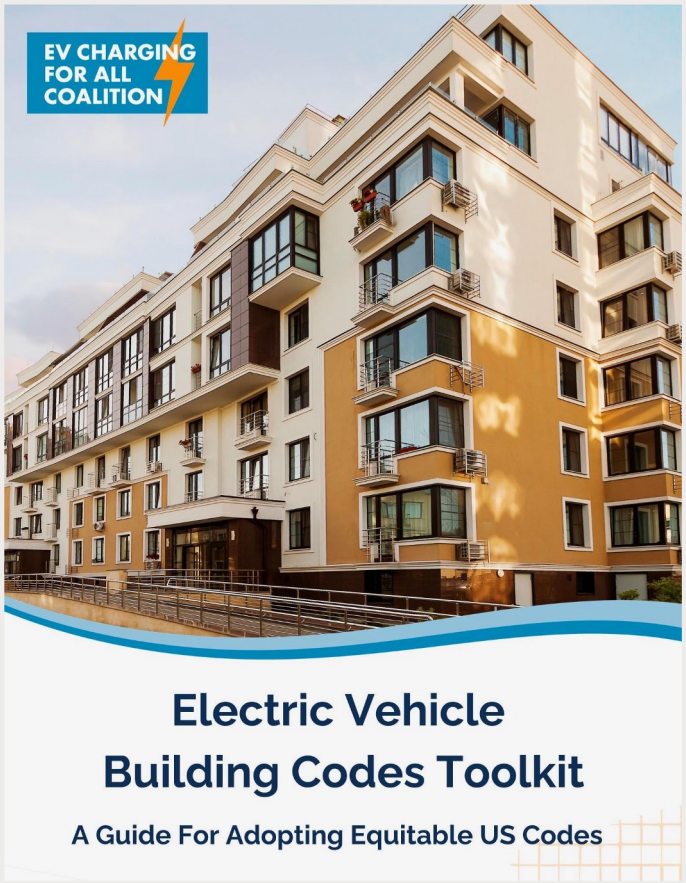
To ensure equitable, safe, and convenient access to affordable EV charging at home and/or at work, for all residents.

EV CHARGING FOR ALL COALITION

Outline

- Introduction
- Equitable, affordable solutions: 4 MFH principles
- Best Practices for Multi-Family charging
- Case studies
- Q&A and Discussion

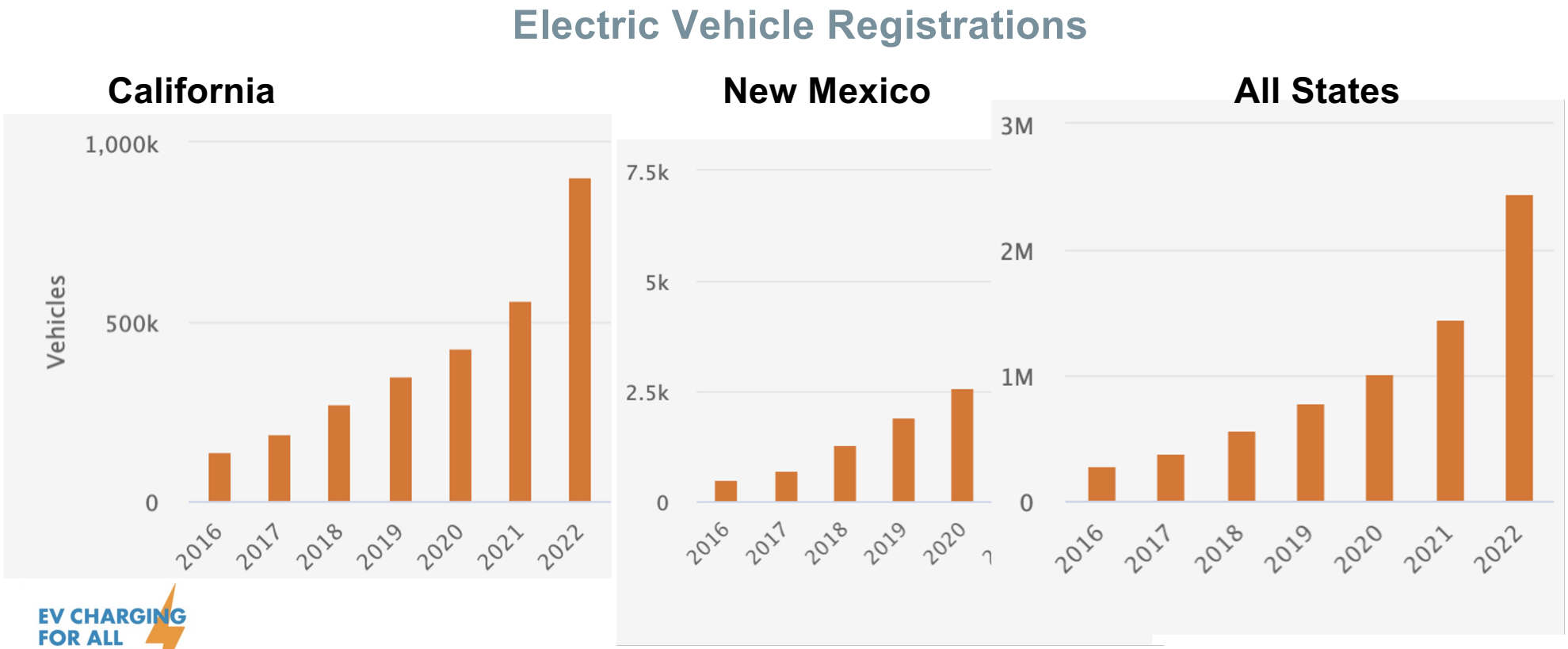
EV CHARGING FOR ALL COALITION



EV CHARGING FOR ALL COALITION

bit.ly/EVcodestoolkit

EVs are on an exponential growth curve, everywhere



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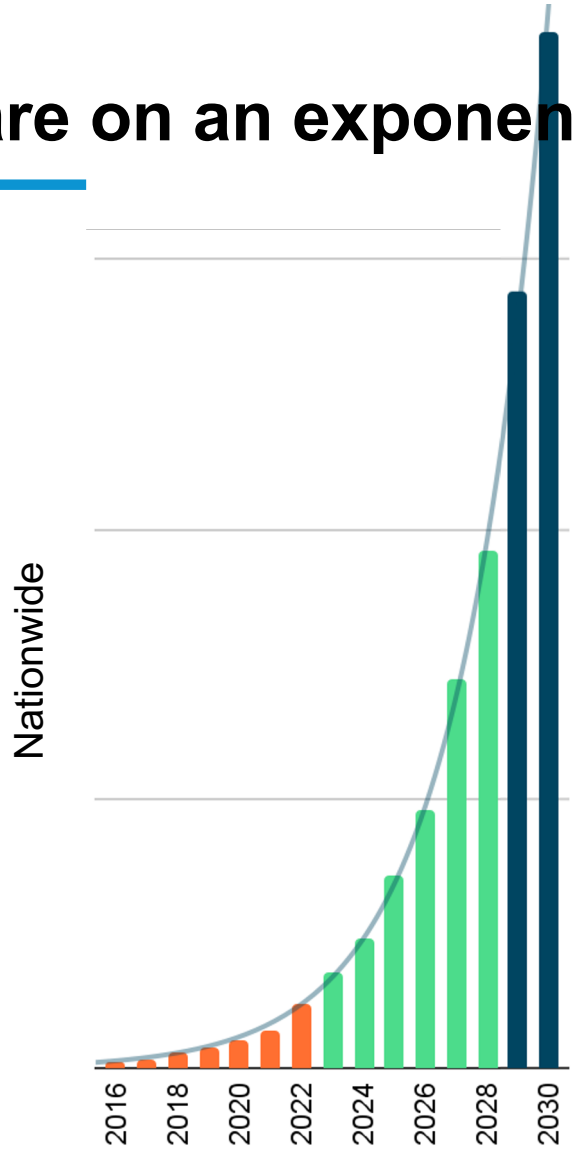

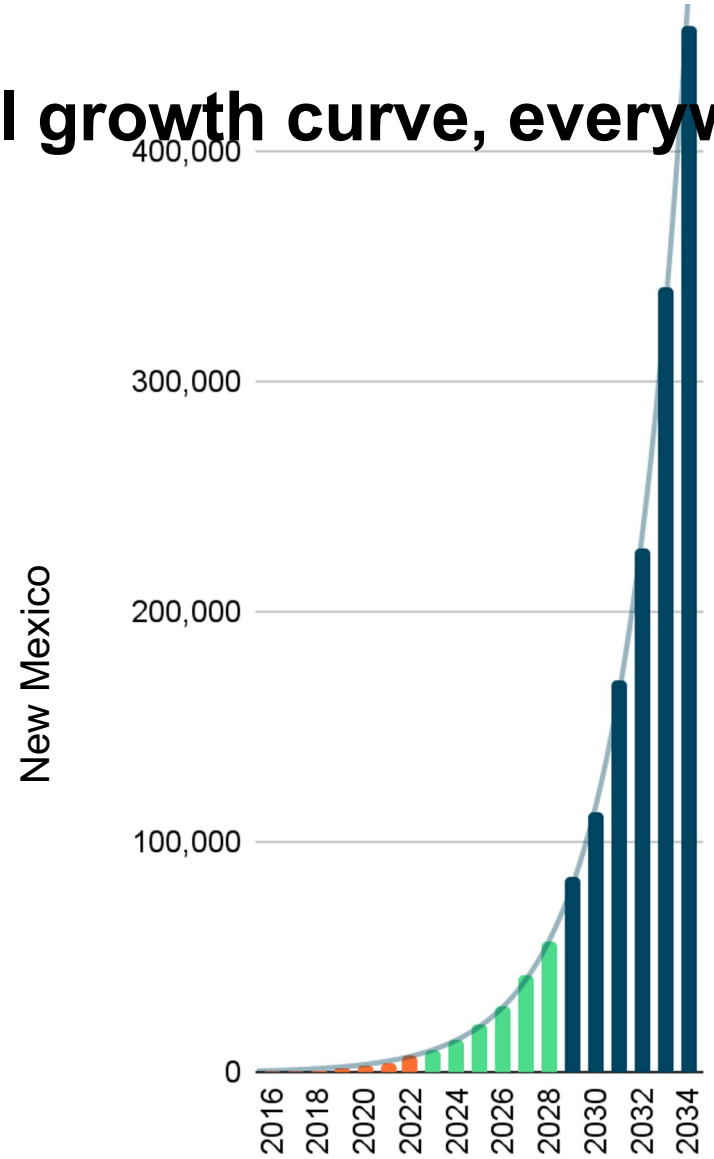

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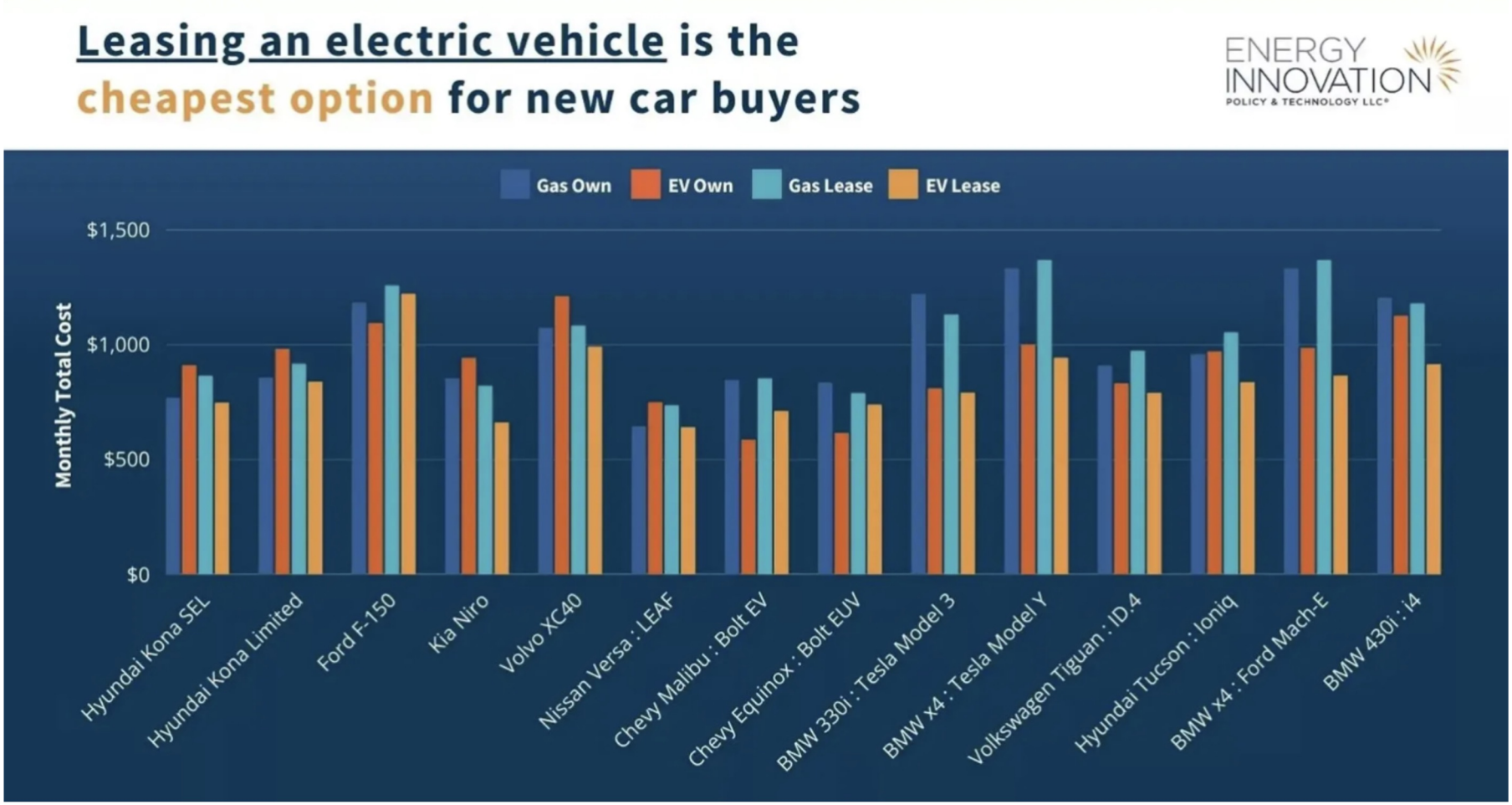
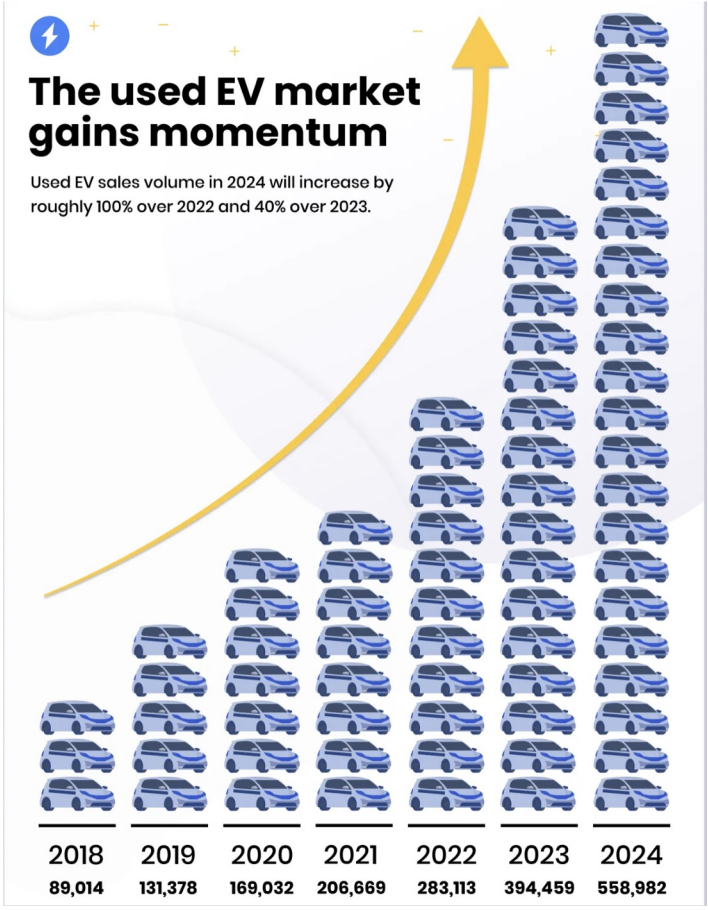
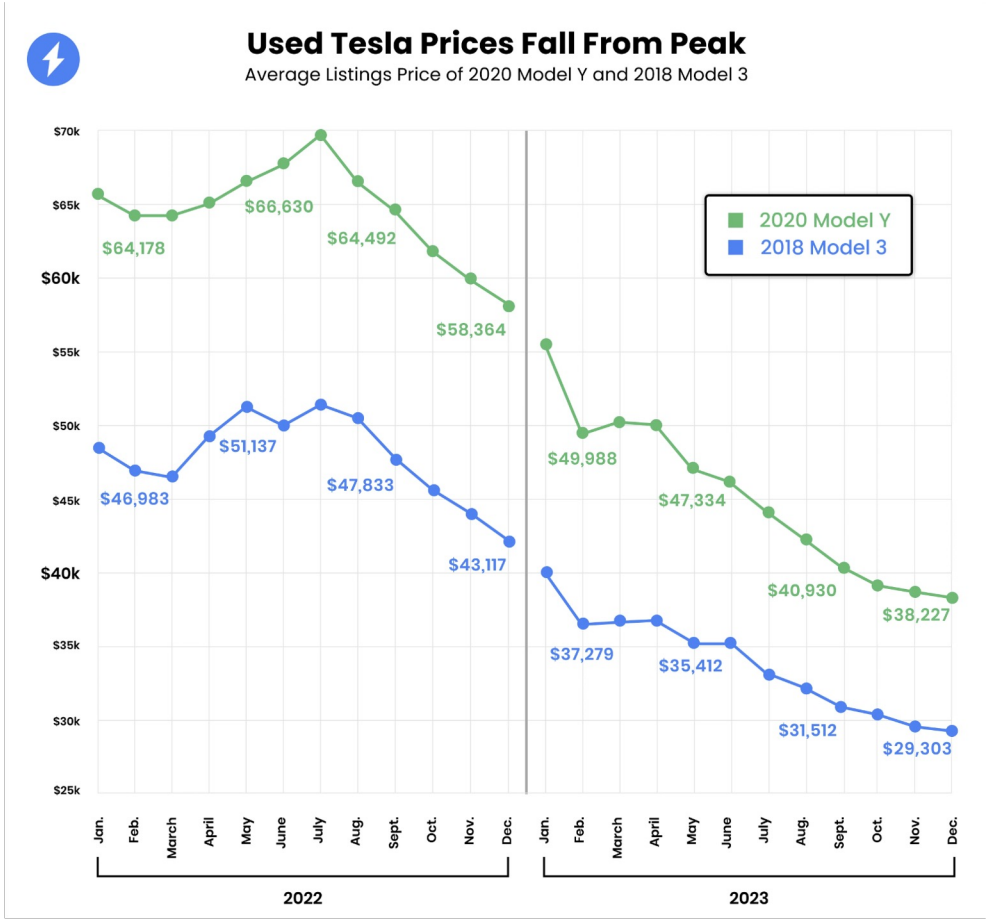
EVs Are Affordable



Used EVs: Volume Rises, Prices Drop





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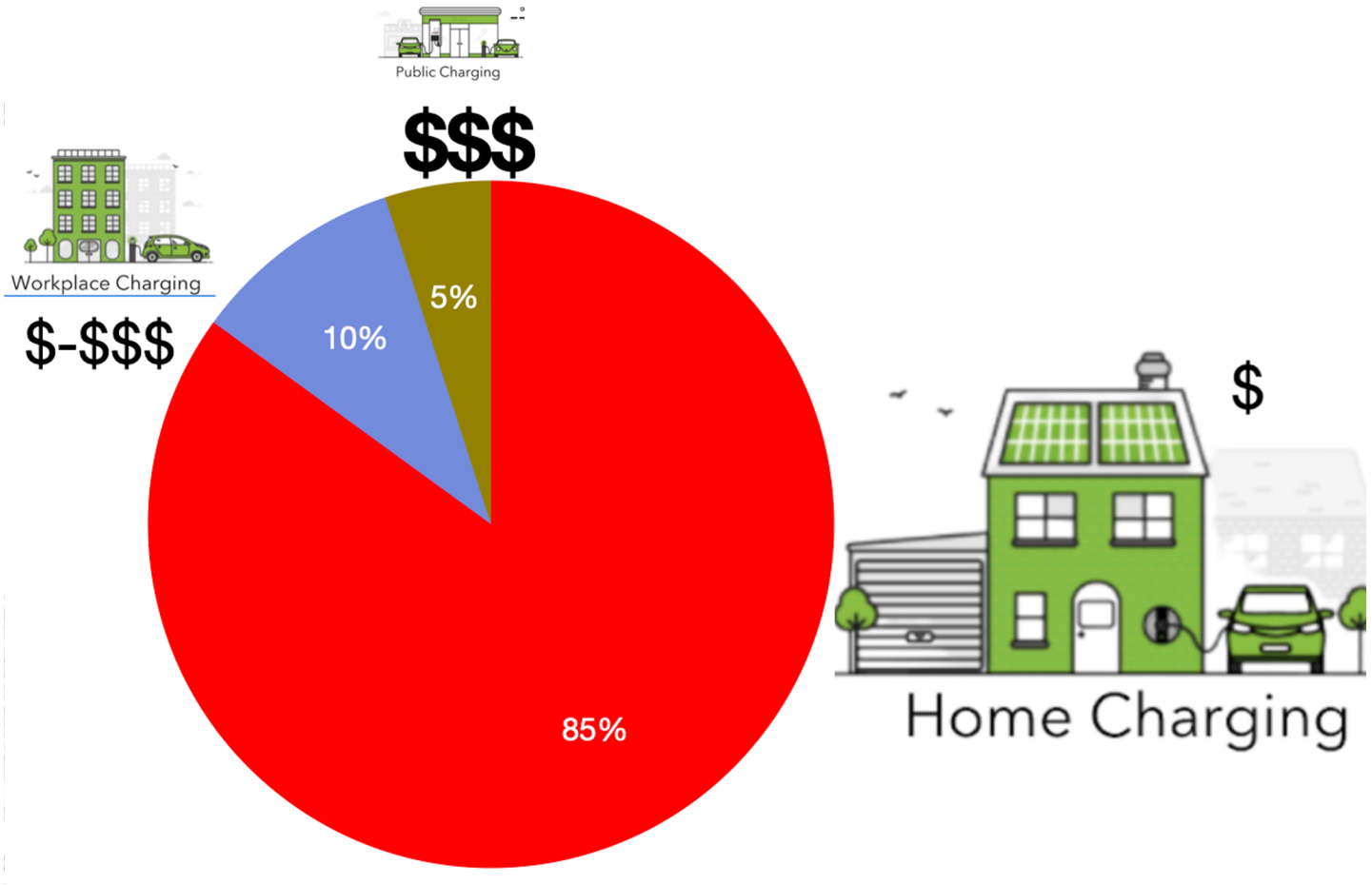
Access: “There’s No Place Like Home”



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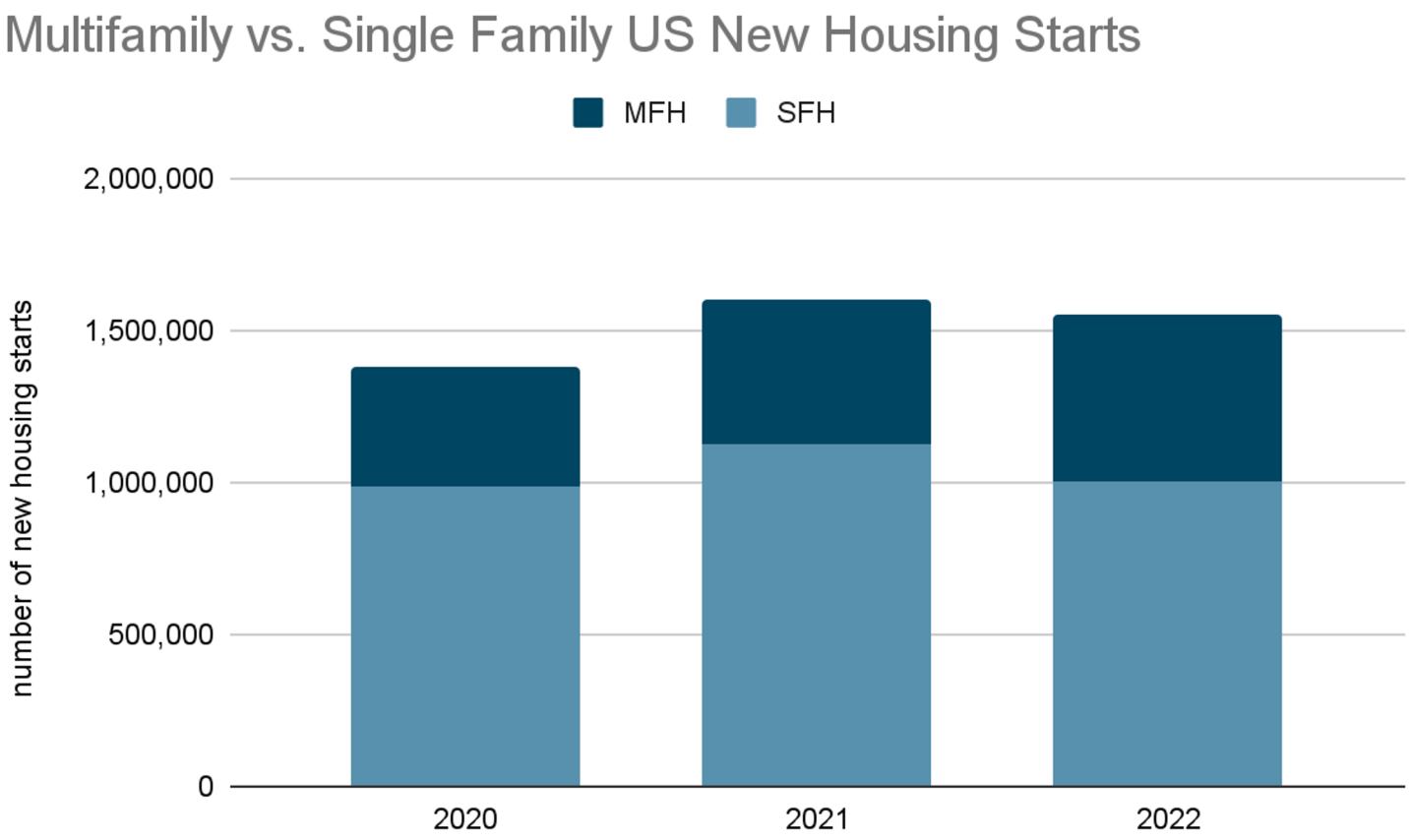
Every Year, 1.5M Potential New US Charging Stations



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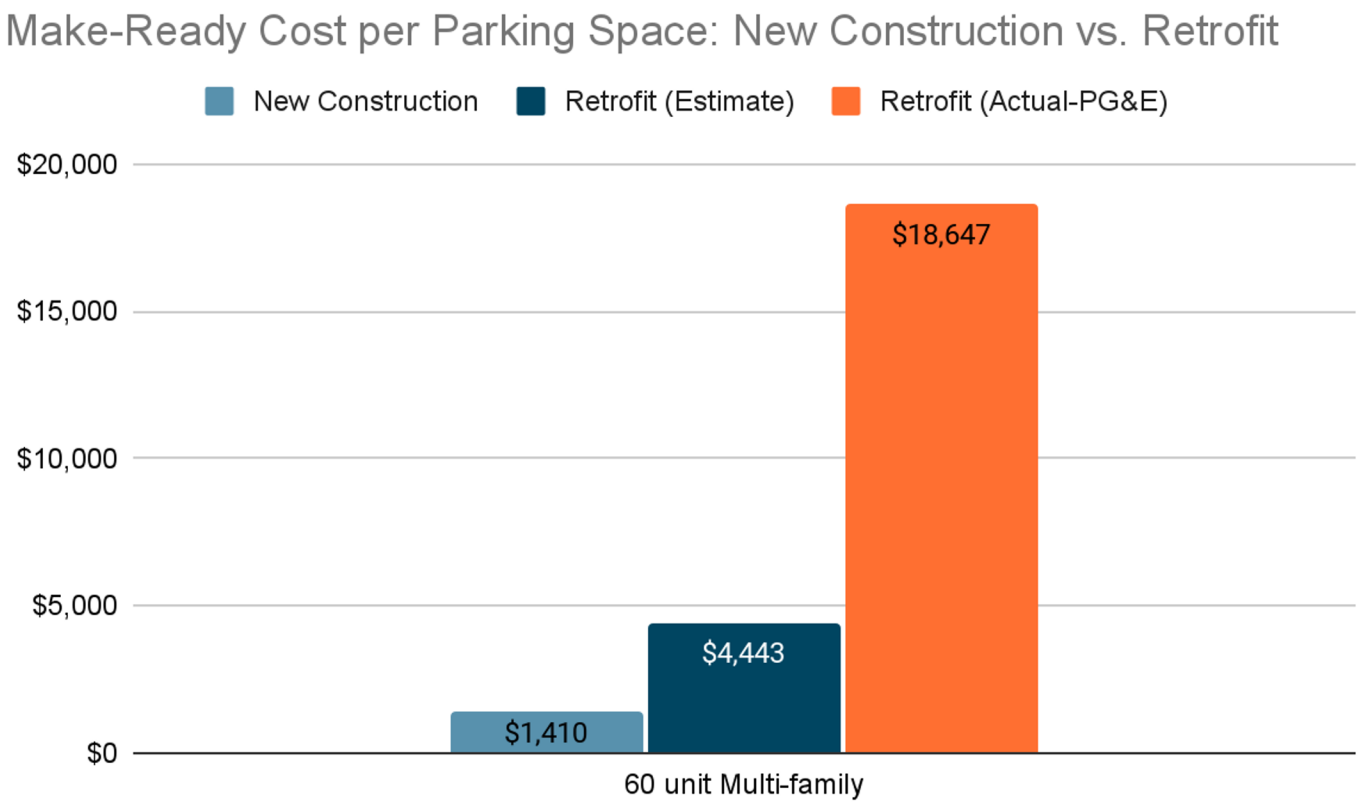
New Construction Is Least Cost Option



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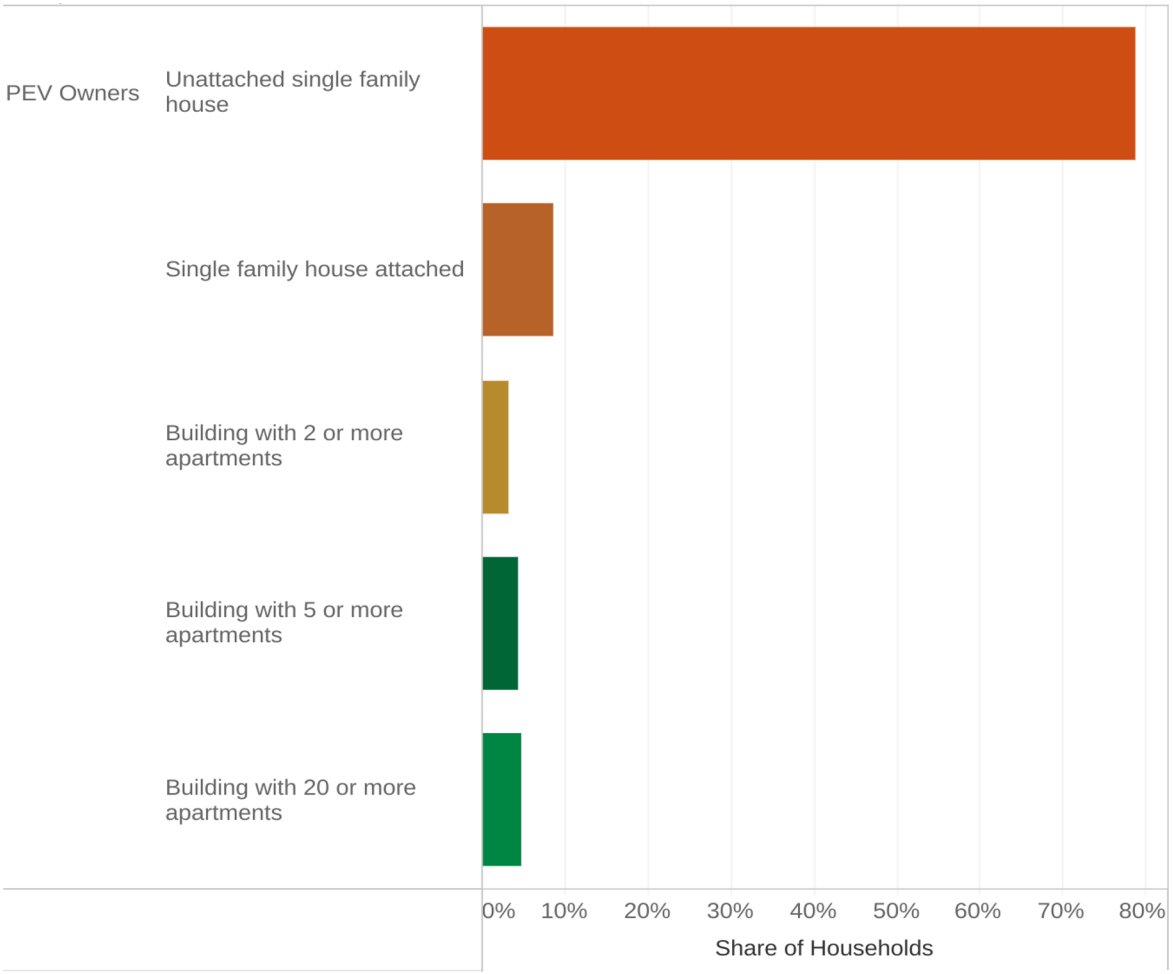
California PEV Owners by Housing Type



EV CHARGING FOR ALL COALITION

How California Is Keeping Electric Vehicles Out ...

POLITICS 05/27/2021 05:45 am ET | Updated May 31, 2021

How California Is Keeping Electric Vehicles Out Of Reach For Apartment-Dwellers

Even in the nation's most EV-friendly state, inertia and business interests are delaying the energy transition and leaving the working class behind.

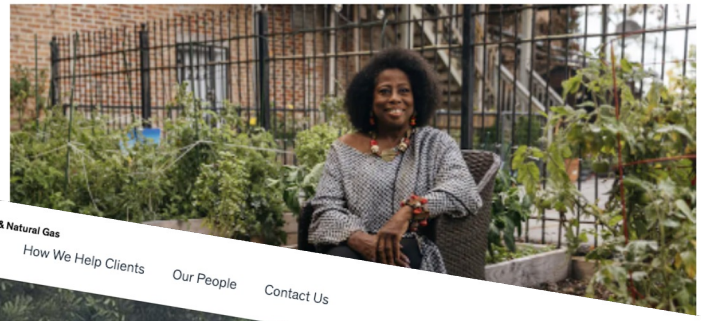
By Alexander C. Kaufman

The Washington Post
Democracy Dies in Darkness

BUSINESS

Without access to charging stations, Black and Hispanic communities may be left behind in the era of electric vehicles

By Will Englund
December 9, 2021 at 7:00 a.m. EST

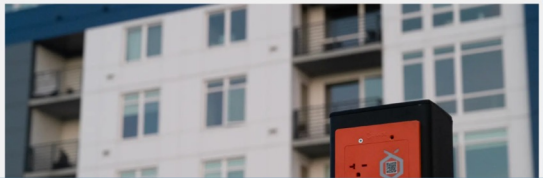


Grist

Follow

Why the slowest EV chargers may be the fastest way to get people into EVs

Apartments need EV charging. Supporters of trickle-slow "Level 1" chargers argue that access is more important than speed.



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How charging in buildings can power up the electric-vehicle industry

January 5, 2021 | Article

EV Infrastructure: Definitions

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Definitions: Charging Equipment

EV Supply Equipment (EVSE)

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Definitions: Charging Equipment

Portable EVSE Cordset

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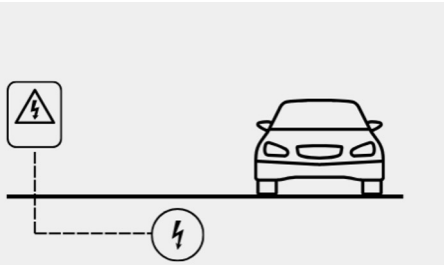
Definitions: EV Readiness

Make-Ready ≠ EV Ready

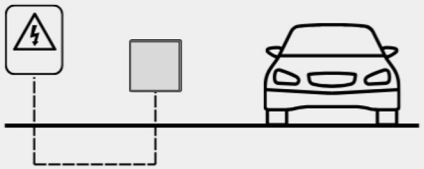
EV CHARGING FOR ALL COALITION

Definitions: EV Readiness



EV Capable

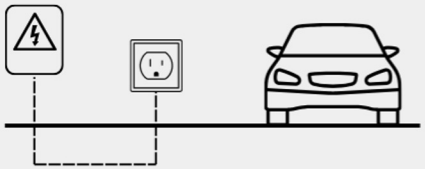
- ✅ Sufficient electric panel space & load capacity for future EV charging
- ✅ Raceways for a branch Circuit to the EV space



EV Capable +

EV Capable, plus:

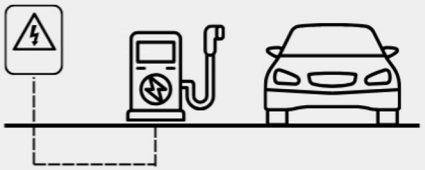
- ✅ Circuit breaker and wiring, terminating in a junction box



EV Ready

EV Capable+, plus:

- ✅ Circuit terminates in a receptacle



EVSE Installed

EV Capable+, plus:

- ✅ Installed charging station

EV CHARGING FOR ALL COALITION

Definitions: Power Delivery

Level 1 (L1)

Standard household outlet 20 Amp, 120v AC
Driving distance added: 3-4 miles/hour

Low-Power Level 2 (LPL2)

20 Amp, 208/240v AC
Driving distance added: 10-13 miles/hour

Full Level 2 (L2)

Similar to a dryer outlet. 40+ Amp, 208/240v AC
Driving distance added: 25-30 miles/hour

DC Fast Charging (DCFC)

24-350kW
Driving distance added: 72-1,200 miles/hour

EV CHARGING FOR ALL COALITION

Best Practices for Equitable EV Ready Multi-Family Housing

EV CHARGING FOR ALL COALITION

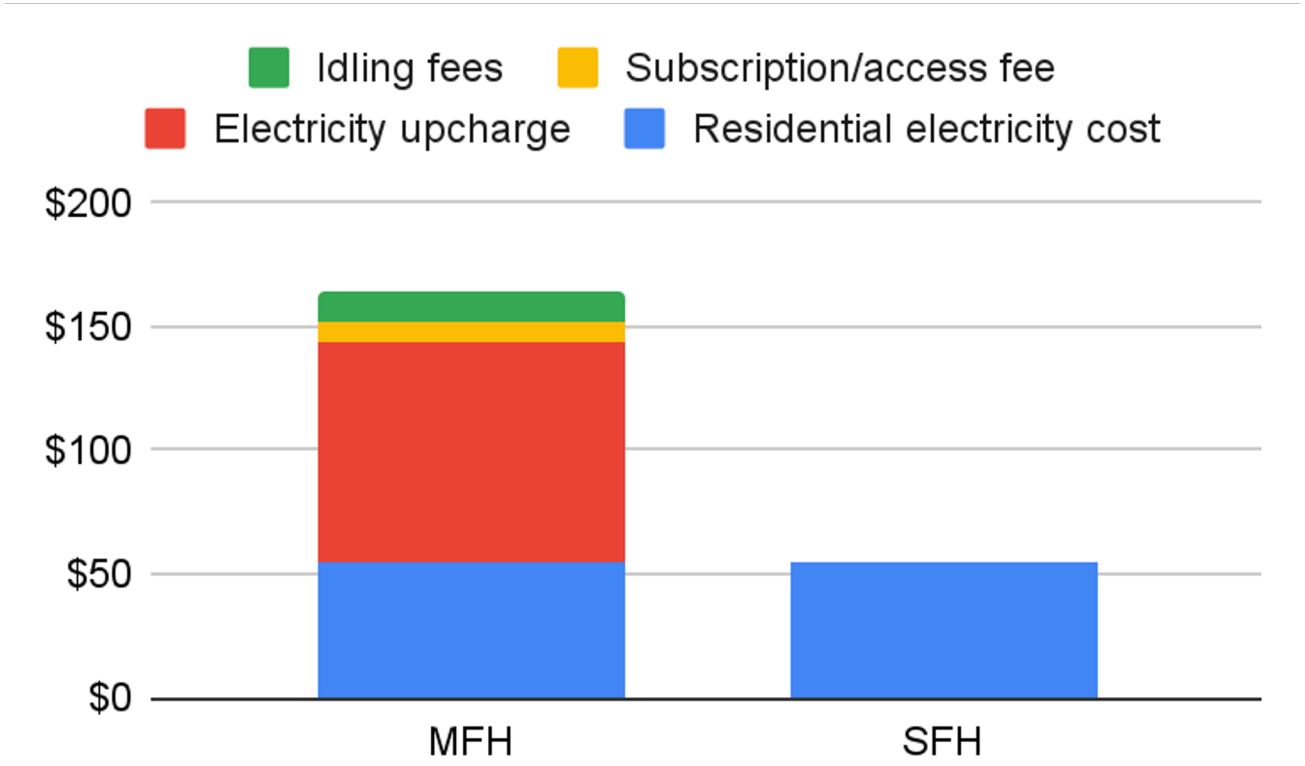
Types of Charging Access: EV Ready is sweet spot

	Sufficient panel space & load capacity for EV charging	A branch circuit & raceways	Wiring, circuit breaker & charging receptacle	Installed charging station	Can it be used by resident to charge now?
EV Capable or Capable+: actually INcapable! (Also required by code to be 40A)	✅	✅			No, first must get HOA or manager's approval, hire electrician, pull permit & pay for the upgrade.
EV Ready: ready to charge! (can be L1 or L2)	✅	✅	✅		Yes, by using the cordset that comes with their EV (or EVSE if provided).
EVSE or EVCS: Electric Vehicle Service Equipment / Electric Vehicle Charging Station	✅	✅	✅	✅	Yes, by using the provided charging equipment from an ESVP (Electric Vehicle Service Provider).

Levels of Charging Power: LPL2 is sweet spot

	Type of Outlet	Typical Circuit Breaker Size (Amps)	Voltage	Kilo-Watt Output (kW)	Miles added per hour of charging	Miles added over 10 hours
Level 1	Standard household outlet	15	120	1.4	~5.6	42-56
Low-Power Level 2	EV charging in MFH	20	208/240	3.8	~15	114-150
Level 2	Stove outlet, EV charging	40	240	7.6	30	220-300
Non-residential: Direct Current Fast Charging (DCFC)	Public & fleet charging	Varies	Varies	24-350	72-1200	N.A.

A Tale of Two EV Drivers



EV CHARGING FOR ALL COALITION

Direct wiring… Key to equitable rates & resilience

California's Intervening Code Cycle (taking effect on July 1), requires direct wiring!

*"EV charging receptacles in multifamily parking facilities at **assigned parking spaces** shall be provided with a **dedicated branch circuit connected to the dwelling unit's electrical panel**, unless determined as infeasible by the project builder or designer and subject to concurrence of the local enforcing agency."*

EV CHARGING FOR ALL COALITION

FOUR PRINCIPLES OF EQUITY-CENTERED EV CHARGING FOR MULTI-FAMILY HOUSING

1. **Provide each household unit that has parking with at least one EV Ready charging space.**
   Vs. requiring a certain percentage of parking spaces to be EV Ready or EV "Capable"

2. **Require at least low-power Level 2** (not full L2) **and EV receptacles** (not necessarily EVSE).
   This minimizes cost to builders while providing adequate power and access to residents.

3. **Wire receptacle or EVSE directly to corresponding household's panel or meter.**
   This allows residents to access utility rates, avoid monopolistic third-party markups, and enjoy the resilience benefits of bidirectional charging.
   It requires parking to be **assigned**; this parking can be **unbundled**–paid for separately

4. **Install prominent signage at each EV Ready and EV Capable space.**
   This ensures awareness of the availability of charging so it's not hidden.

EV CHARGING FOR ALL COALITION

Case Studies:
Three Code Policy Levers

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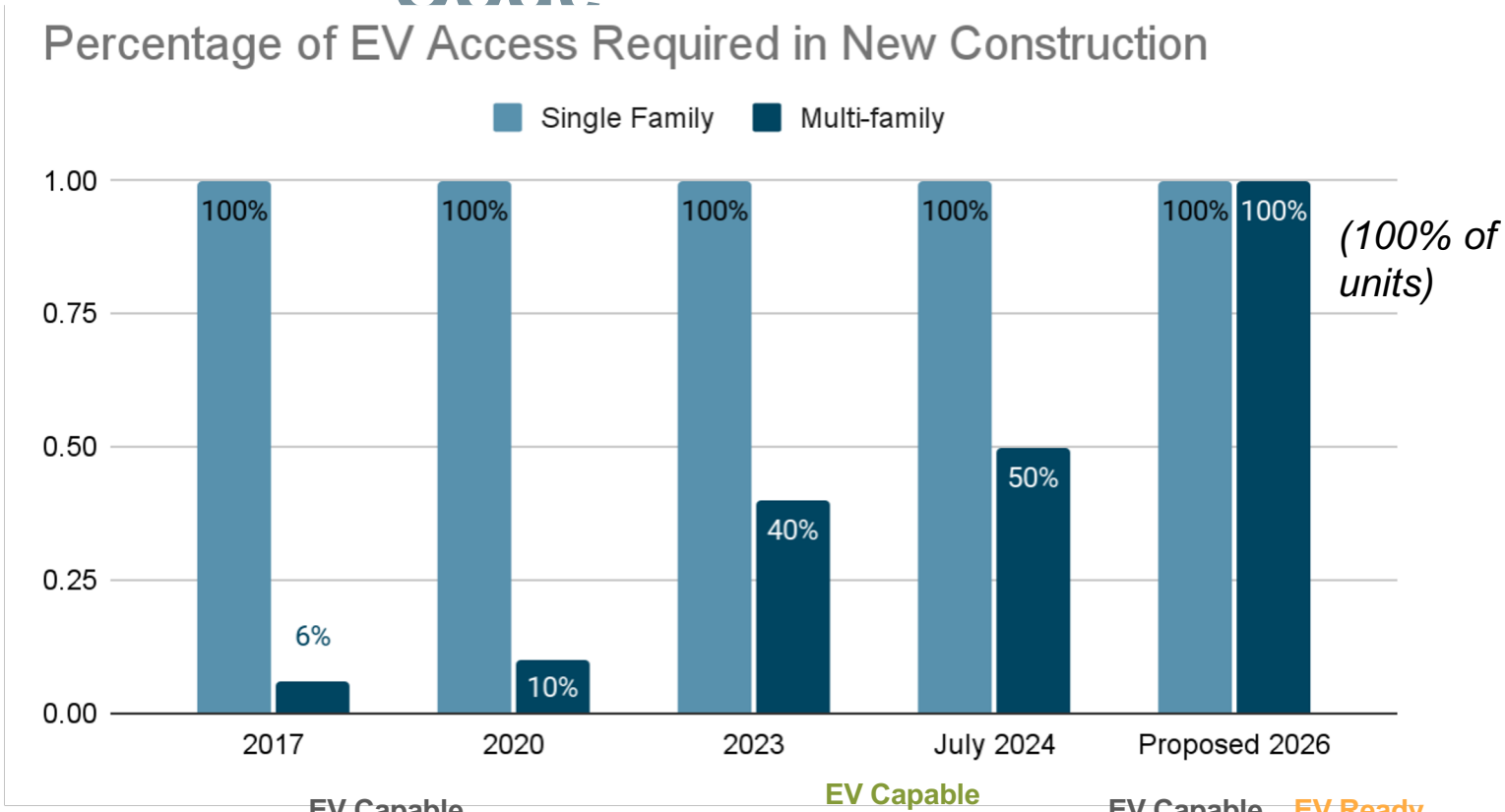
Regulatory lever: CALGreen

EV CHARGING FOR ALL COALITION

Evolution of CALGreen Building Code



EV CHARGING FOR ALL COALITION

Local Policy Lever:
City of San Jose Reach Code

EV CHARGING FOR ALL COALITION

San José's new EV reach code for new MFH

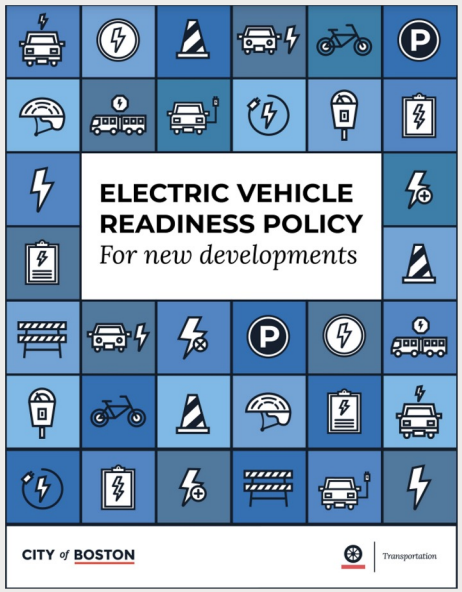
- Boosts the % of residential parking that is EV ready from 30 to 100%;
- Removes an obsolete exemption for parking lifts
- Requires all assigned parking to be directly wired to the unit's electrical meter
- Allows an inequitable exemption from the direct-wiring requirement for unbundled parking

MOTHERS OUT FRONT Silicon Valley

Local Policy Lever:
City of Boston, MA

EV CHARGING FOR ALL COALITION

Local Policy Lever:
City of Boston, MA



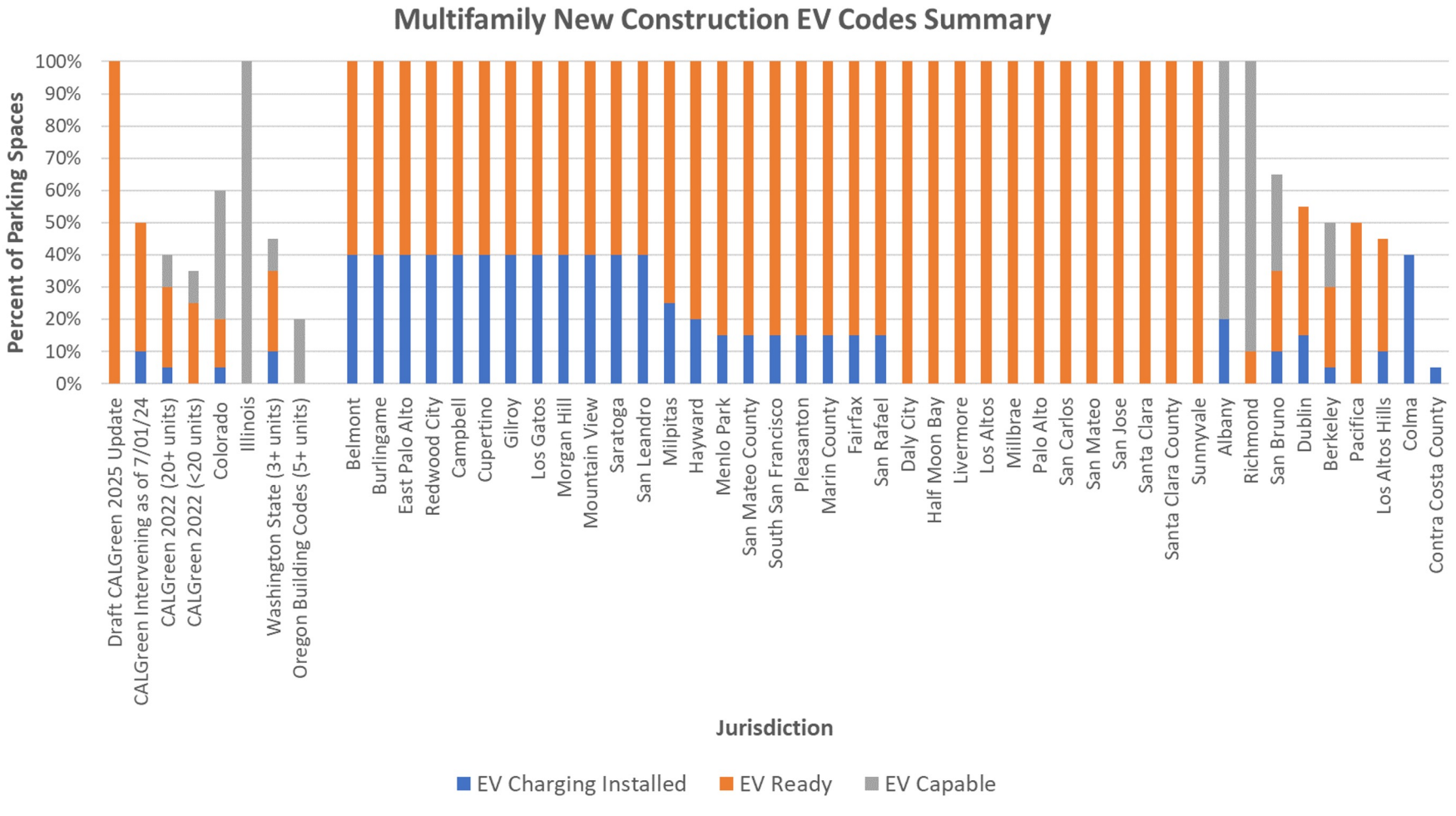
Requires EVSE-Installed L2 at 25% of parking spaces

Equivalency calculator allows for flexibility, with each parking spot equal to one point. May be offset by:

- **Level 1 Chargers**
- **DCFC (50kw, 125-150kw)**
- **EV Carshare**
- **Electric Bike Parking amenities.**

EV CHARGING FOR ALL COALITION

Multi-Family Residential Codes Landscape



Source: TRC

Legislative Lever:
Illinois EV Charging Act

EV CHARGING FOR ALL COALITION

Illinois EV Charging Act (2023)

- EV Capable for 100% of parking in ALL types of housing.
- Right to charge protections for MFH residents and renters

Environmental Defense Fund

Our work Our impact About us Get involved News and stories

Illinois' new EV Charging Act brings more equitable charging to renters

By EDF Blogs / Published: June 15, 2023

By Neda Deylami

UPDATE: *Since this blog's publication on June 15, 2023, the Chicago City Council has passed an ordinance aligning*

EV CHARGING FOR ALL COALITION

State Preemption Laws Are Proliferating…

Texas: HB 2127 (2023) *"Death Star Law" – fortunately doesn't affect building codes*

Missouri: HB 184 (2023) *Passed the House – died in the Senate*

Florida: SB 1084 (2024) *Passed and Approved by Governor last week*

EV CHARGING FOR ALL COALITION

Join EVCAC

- Join our Slack team: **bit.ly/EVCACslackMay2024**
- Read and share the toolkit: **bit.ly/EVcodestoolkit**
- Help us connect with funders and clients
- Join the National EV Codes Working Group
- Join our mailing list
- Introduce EVCAC to your networks

Email vwarheit@chargingforall.org

EV CHARGING FOR ALL COALITION

Thank you!

info@chargingforall.org

EV CHARGING FOR ALL COALITION

Equitable Transportation Electrification

May 8, 2024

Linda Khamoushian, Senior Clean Mobility Strategist

At GRID Alternatives, we envision a rapid, equitable transition to a world powered by renewable energy that benefits everyone.

We work to build community-powered solutions to advance economic and environmental justice through renewable energy.

People. Planet. Employment.

Underserved Communities

Fenceline communities

Under-resourced Communities

Frontline communities

Disadvantaged Communities (DAC)

Low-income communities

Environmental Justice communities

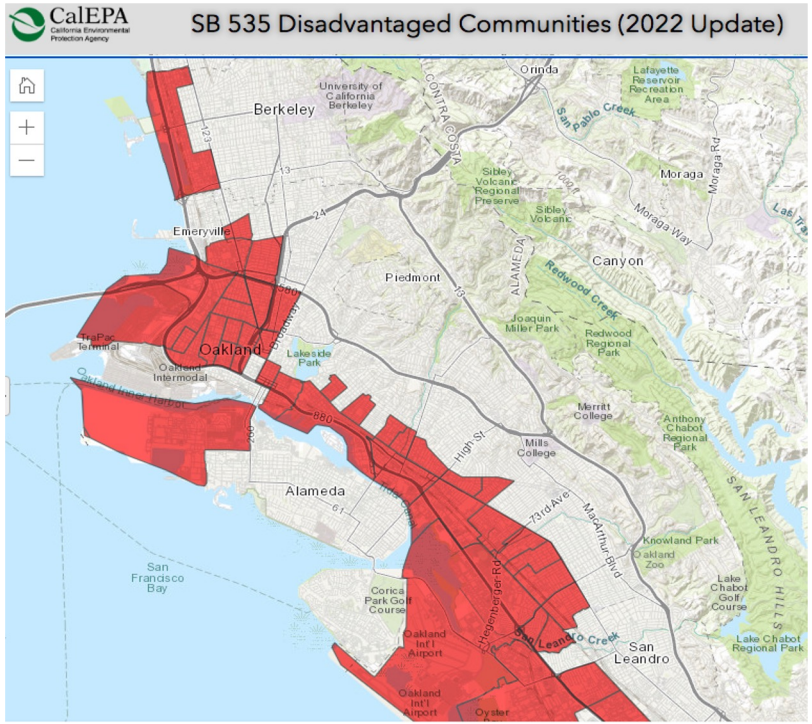
Communities of Concern

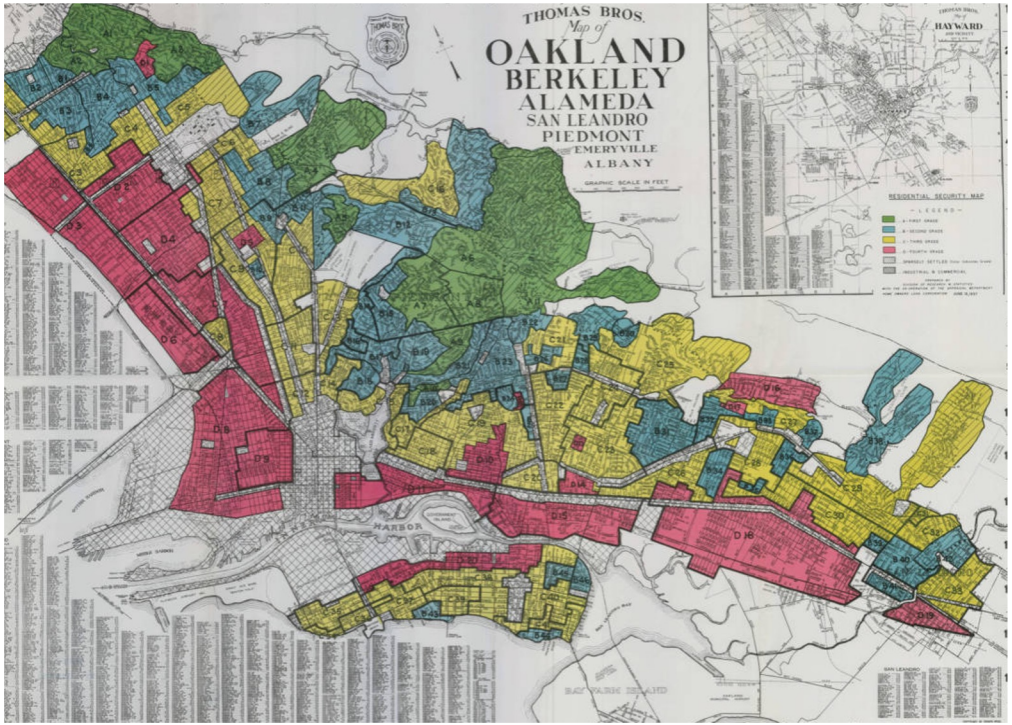
Communities of Color

BIPOC communities

Low-income Households

"Disadvantaged Communities" determinations directly tied to history of “Redlining” policies and siting of transportation infrastructure (highways) of the 1950s





GRID Alternatives' approach to equitable clean mobility

Prioritize capacity building and wealth building opportunities: community-powered solutions

Maximize savings from transitioning off of fossil fuels: using clean, cheap solar energy to charge

Move people, not cars: mobility justice means clean public transit, e-bikes, and more

Equitable transportation electrification prioritizes people over places

By focusing on the ways people actually use transportation, and prioritizing community needs, we can build a clean transportation future for everyone.

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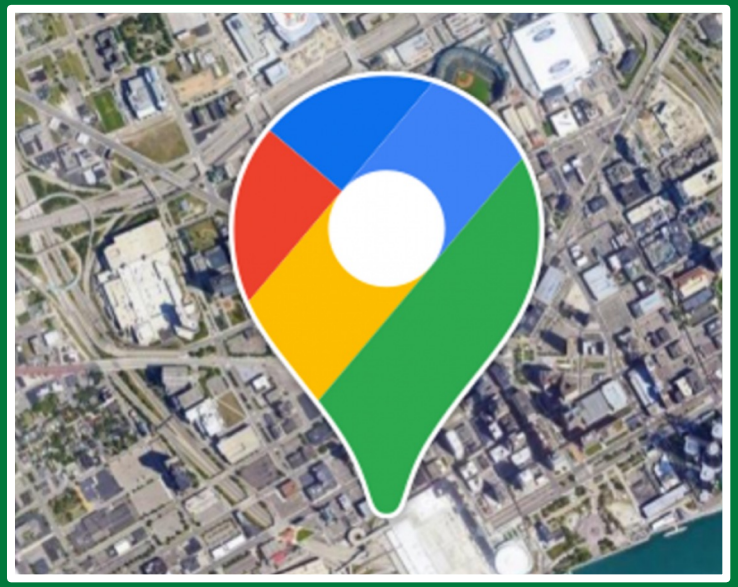


Some of GRID's Involvement with Clean Mobility Programs from 2017 - Present:

Access Clean California
Less pollution, more power

GFO-22-614 - Reliable, Equitable, and Accessible Charging for Multi-family Housing 2.0 (REACH 2.0)

Berkeley E-Bike Equity Project
Climate benefits to Berkeley residents

CLEAN CARS FOR ALL

COMMUNITIES IN CHARGE

DRIVING CLEAN
ASSISTANCE PROGRAM

CAL eVIP
BUILDING EV INFRASTRUCTURE

eTRUC
California's Electric Truck Utilization Center

CLEAN CARS 4 ALL
San Diego

Clean Mobility Options

clean vehicle assistance program

EnergIIZE
COMMERCIAL VEHICLES

Prioritizing Charging $ in EJ geographies ≠ Equity Benefits

Electric Vehicle Supply Equipment (EVSE)

At-Home Chargers

- Retrofit/upgrade existing site
- Incorporate into new building/site

Public Chargers

- Access, Safety, Reliability

EVSE not just the installation of equipment (ports), it also needs:

- Engineering
- Site Permitting
- Designated parking spaces
- Signage
- Electric supply upgrades (transformers, panels, trenching, etc.)
- Installation labor and materials
- Maintenance and Operations
- Network agreements
- Site compliance
- Outreach/engagement of tenants/public
- Data collection

The best time to incorporate EVSE installation, is when you build a new building, but most current EVSE funding programs don't work for new construction.

- **Funding often doesn't allow for EVSE in new buildings or doesn't work with long development timetables**
- **Funding is not 100 cents on the dollar, not receiving full reimbursement and will need to pull from other sources**
- **Funding has well-intended EVSE requirements that aren't flexible to the varied types of sites and what may be needed at each site - different parking setups, available electrical power, etc.**

Yes, we need energy and building codes that make for an easier transition to electrification. However, we have to also ask:

- **Who is this new development for? Low-income residents or market-rate tenants?**
- **How does the energy code/building code requirements deter building affordable housing or not?**
- **What other transportation amenities and enhancements will accelerate equitable transportation electrification at this site?**

A better approach - dedicated, additive public dollars to incorporate EVSE into new affordable housing development

A better approach - comprehensive equity programming that puts tangible benefits for people at the center

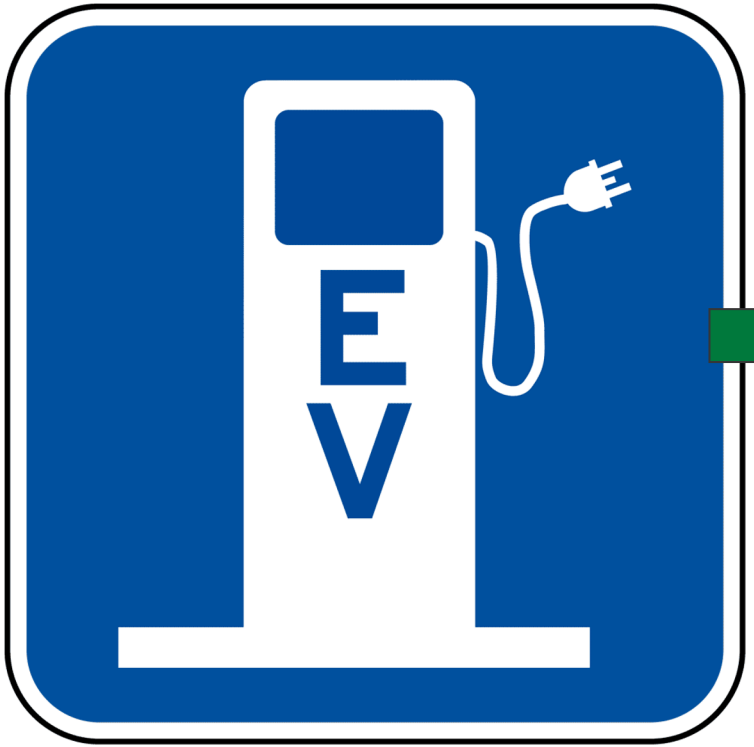
CHDC
Community Housing Development Corporation

DRIVING CLEAN
ASSISTANCE PROGRAM

míocar

Self-Help Enterprises

Case Study for GRID's "Maximizing Savings" Approach: Public Charging Program for Income-Qualified Drivers



Main takeaways:

- **Successful equitable transportation electrification policies and programs require provisions for both priority places and priority people and their specific needs**

- **Energy agencies should collaborate with housing agencies to fund EVSE in new affordable housing construction, both in general, and particularly if your state adopts EVSE building code requirements for new housing development**


GRID
ALTERNATIVES
Thank you!