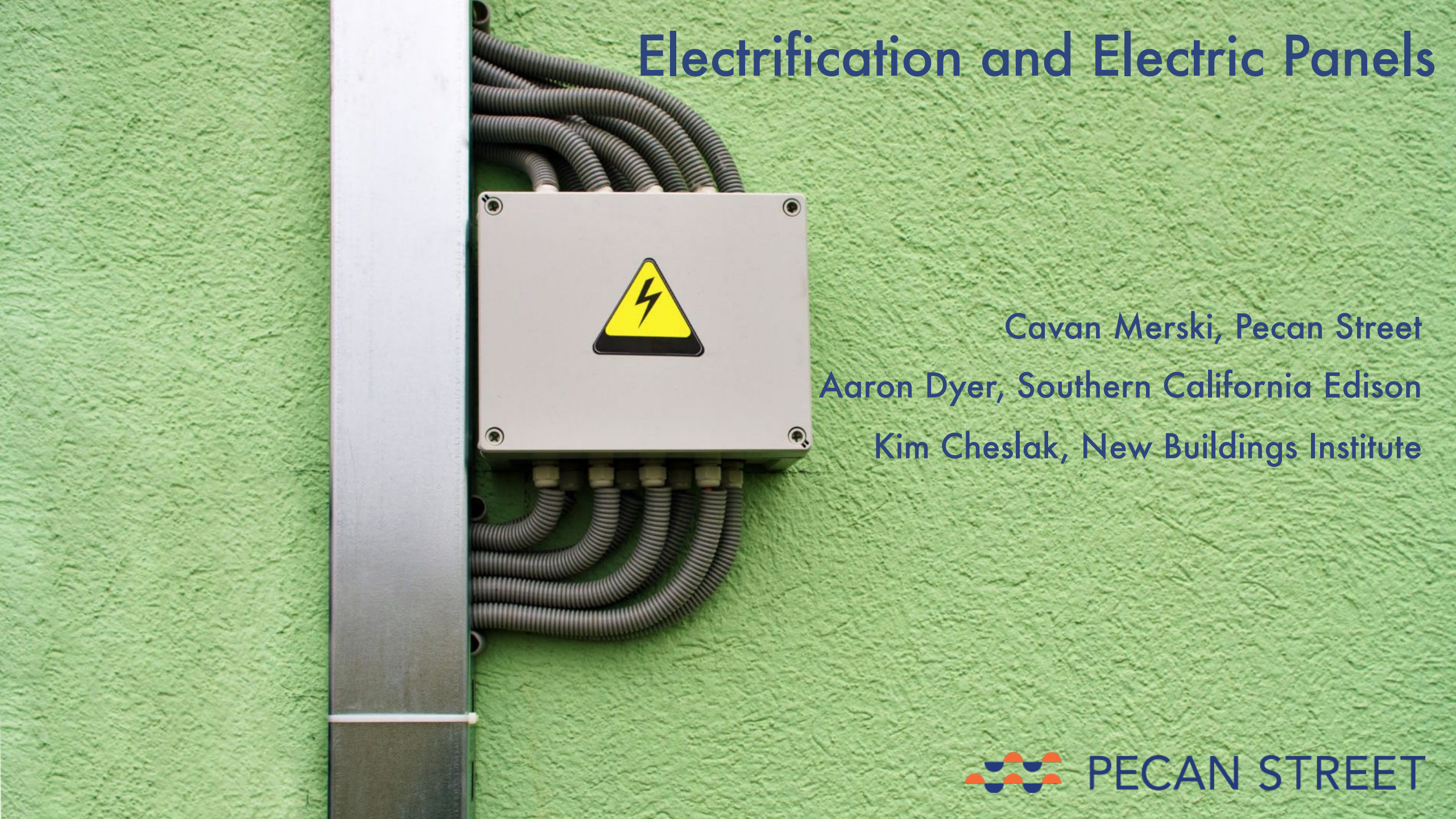

Electrification and Electric Panels

Cavan Merski, Pecan Street
Aaron Dyer, Southern California Edison
Kim Cheslak, New Buildings Institute

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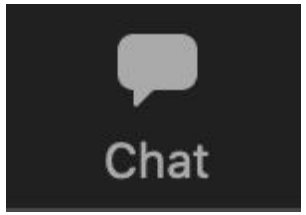

Question? Use the chat function.

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Cavan Merski, Pecan Street

Aaron Dyer, Southern California Edison

Kim Cheslak, New Buildings Institute

Cavan Merski

The Role of Electric Panels in Residential Electrification

Residential Electrification is a long-term strategy to lower GHG emissions by powering homes with carbon free electricity.

Electric Panel Relevance

Homes that are gas assisted are frequently built with electric panels that are too small for a home to fully electrify. Thousands more will be built this way in 2023.

Strategies for Remediation

Tens of millions of electrical panel upgrades are likely required across the country to scale residential electrification.

Energy and building codes must be amended to ensure all new homes are built to be ‘electric ready’.

Air / Water Heating and Cooling

Electric heat pumps used for heating air and water instead of natural gas / fuel oil / propane

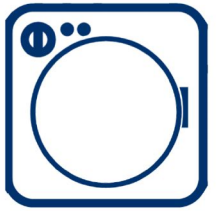
EV Charging

Electric vehicles replace gas and diesel vehicles and can be charged at home

Cooking

Electric ranges, ovens and cooktops instead of natural gas

Clothes Drying



Electric clothes dryers instead of natural gas dryers

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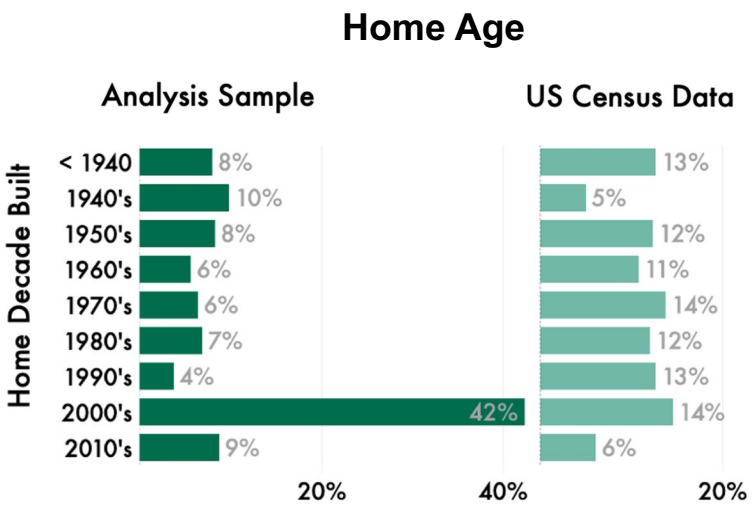
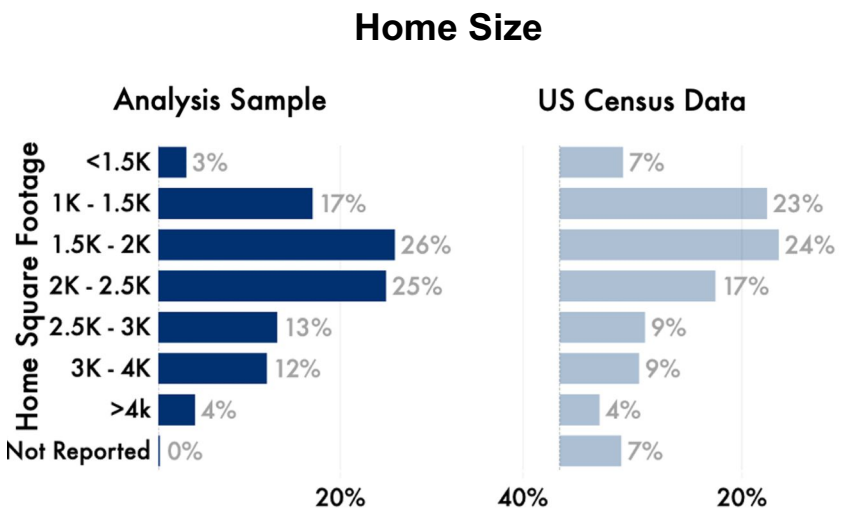
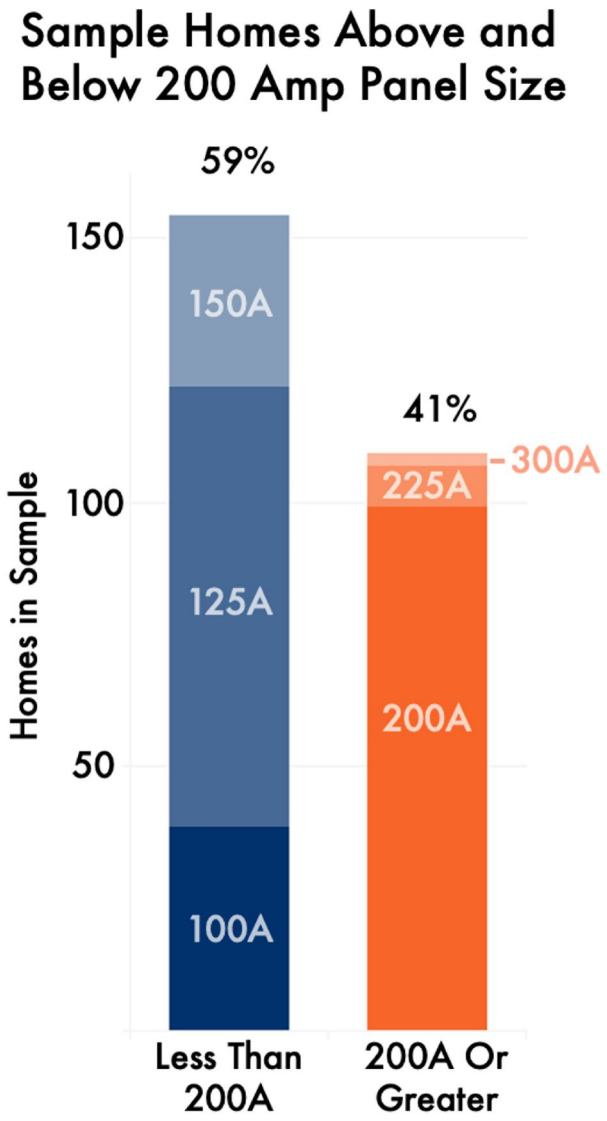
Pecan Street Electric Panel Research Study

Sample of homes in Texas shows that 59% of the homes are below 200A.

The homes match the national profile for size, however newer homes are overrepresented.







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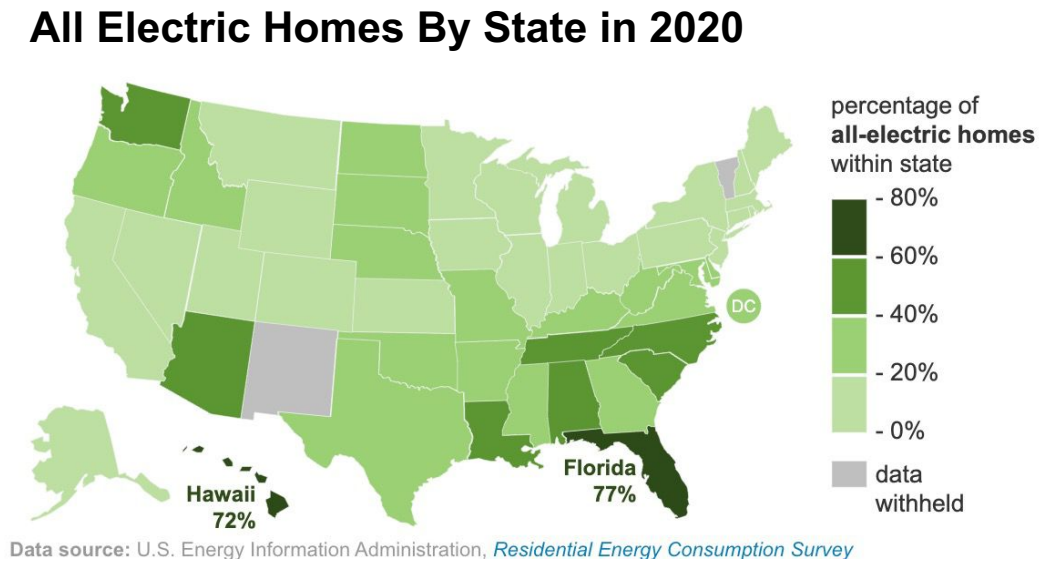
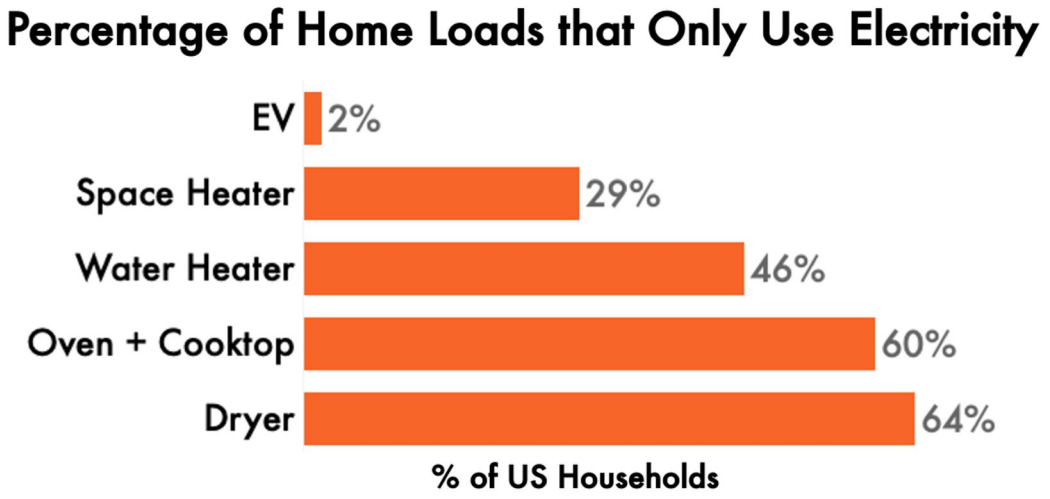
Residential Electrification Varies Widely Across the US

Prevailing reasons for homes to be built with all electric or mixed energy sources are:

- Climate
- Natural Gas Infrastructure
- Era when building occurred



Homes will be electrified in many different configurations and triggers for new electric panels could come from a variety of appliance upgrades or other home improvements.



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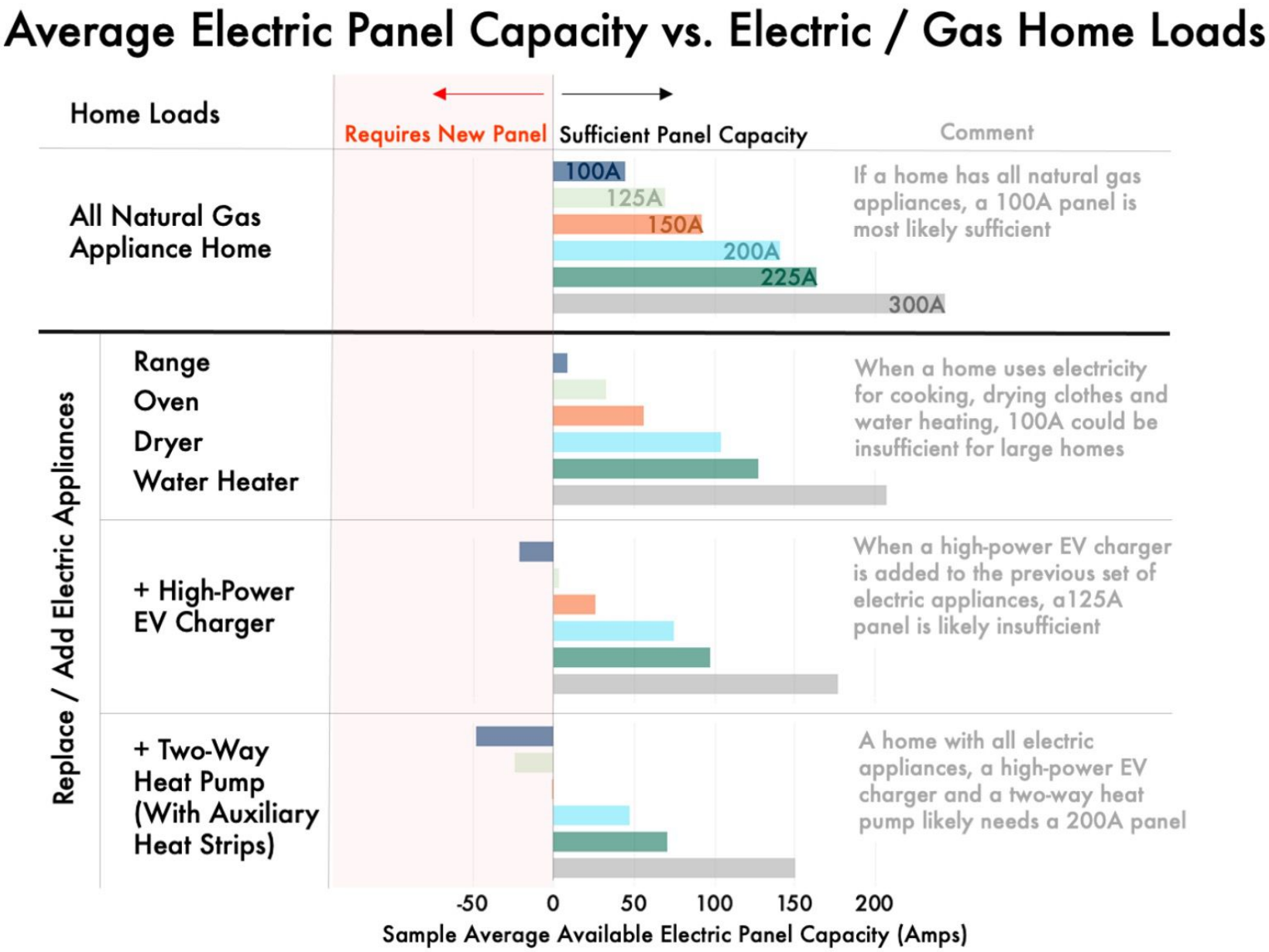
Potential Residential Electrification Scenarios



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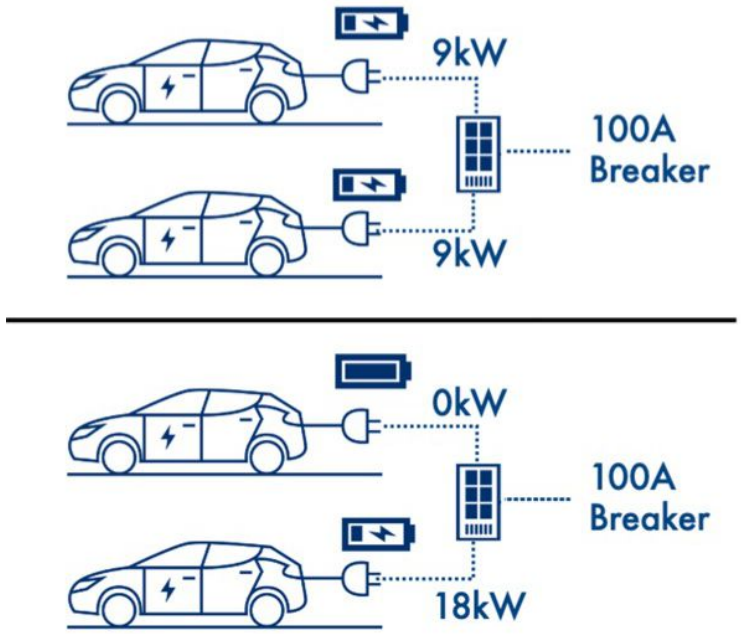
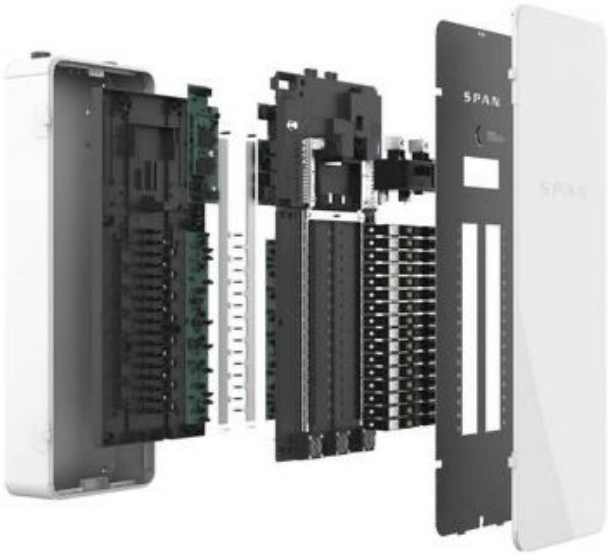
Alternative Solutions to Electric Panel Upgrades

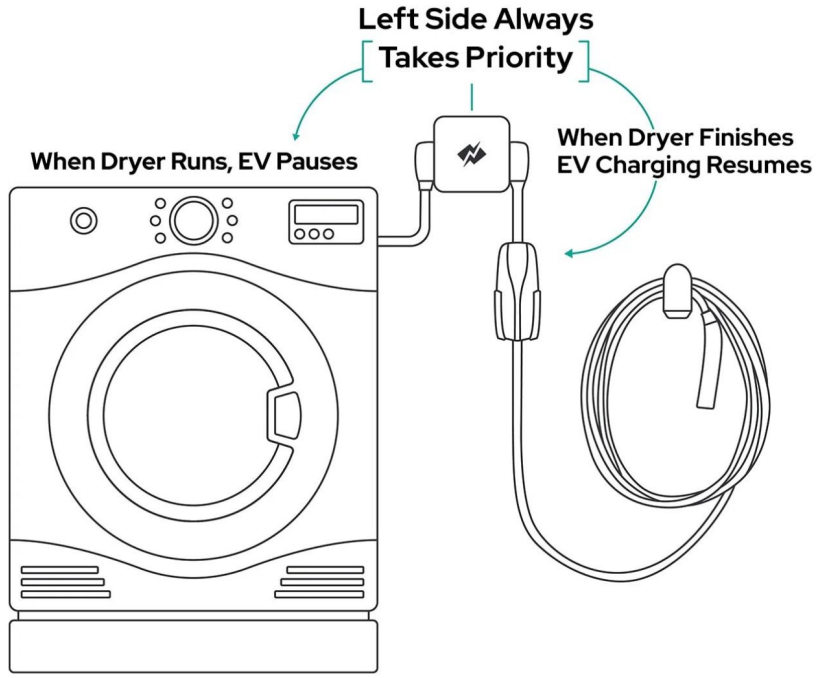
EV Automatic Load Management System



Smart Panels



Smart Splitters



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Inflation Reduction Act (2022) Impact on Electrification

Buying	Up-front discount, low-income	Up-front discount, moderate-income	Tax credit
Clean electricity			
Electrical wiring (pre-wire outlets early!)	100% up to $2,500 (HEEHRA)	50% up to $2,500 (HEEHRA)	
Electrical panel (if under 100-amps)	100% up to $4,000 (HEEHRA)	50% up to $4,000 (HEEHRA)	30% up to $600 (25C) or 30% uncapped (25D), depending on the corresponding upgrade[9]
Weatherization	100% up to $1,600 (HEEHRA)	50% up to $1,600 (HEEHRA)	30% up to $1,200 (25C)
Heat pump	100% up to $8,000 (HEEHRA)	50% up to $8,000 (HEEHRA)	30% up to $2,000 (25C)
Heat pump water heater	$100% up to $1,750 (HEEHRA)	50% up to $1,750 (HEEHRA)	30% up to $2,000 (25C)
Electric/induction stove	100% up to $840 (HEEHRA)	50% up to $840 (HEEHRA)	
Heat pump clothes dryer	100% up to $840 (HEEHRA)	50% up to $840 (HEEHRA)	
New EV	$7,500 (30D)[10]		
Used EV	30% up to $1,000 (30C)[11]		

Source: Rewiring America

PECAN STREET

Aaron Dyer

Residential Electrical Service: a gateway, or barrier, to decarbonization

"Electrify everything" is the best way to achieve net-zero emissions, but doing so often requires more electrical capacity than available in older housing stock

200A Electrical Service was not mandated in building codes before 1978, and older homes are often equipped with only 100A or 125A service.

- Approximately 75% of single-family homes (SFH) in SCE's territory – roughly 3.3M homes – were built before 1978
- Many of these are also located in state-defined disadvantaged communities (DACs), and are subject to high levels of environmental and air pollution
- Most of SCE's customers – 74% - live in SFH

EVs and other decarbonization-focused appliances can be large energy consumers when active, and require higher-amp circuits than most other residential loads

- 11kW EV Charger = 60A Circuit (100A for a 19.2kW Charger)
- Heat Pump Water Heater = 30A Circuit
- Induction Cook Top = 40-50A Circuit

In additional to electrical limitations, many of these older panels are physically too small to accept an array of double-pole breakers

Do Single-Family Homes Address Equity?

There is a deserved focus on multifamily dwellings in the efforts to equitably deploy low-carbon technologies, but equitable solutions needs must be assessed region-by-region to be most effective.

While income-qualified customers living in SCE's territory are *more likely* to reside in a multifamily dwelling and *more likely* to rent their home, the majority do not.

	% Income-Qualified Customers	% Other Customers
Live in DAC	40%	17%
Live in SFH	66%	71%
Live in MFD	31%	17%
Own	58%	70%
Rent	41%	20%

Key Takeaway: don't assume that income-qualified customers are predominately renters that live in apartments!

SCE has proposed two near-term programs to facilitate SFH panel upgrades

Transitioning to electric vehicles and appliances currently involved high upfront costs, and not having adequate panel capacity can significantly increase those

In 2021, the California Self-Generation Incentive Program (SGIP) manual in 2021 listed the average cost for a 200A panel upgrade in California at **$3600**, and it has only gone up since then.

SCE proposed and was approved for two near-term customer programs to enable electrification of vehicles and residential appliances with upgrades to 200A electrical service panels at the core of the offerings:

Home Electrification Readiness – Coming Fall 2023

- Creates a network contractors that will perform residential panel upgrades and install a 240V EV-charging circuit within 25ft of an off-street parking location
- Covers 50% of the costs for customers living in DACs
- Covers 100% of the costs for income-qualified customers, regardless of location
- Income-qualification is based upon state-defined county income levels
- Customers must install an EV charger within 180-days of the completion of the electrical upgrades
- Currently budgeted for ~$53M over three years targeting 17,000-20,000 homes

ESA Building Electrification Pilot– Coming Q1 2023

- Direct install pilot: customers must replace both their HVAC and water heating systems with comparable HVAC heat pump and heat-pump water heaters
- Limited number of homes will also receive induction cooking equipment and/or efficient electric clothes dryers
- Electrical infrastructure (electric panel, circuits, etc.) and plumbing upgrades, as necessary
- Retrofit pilot targeting low-income, single-family homes in DACs
- Currently budgeted for ~$41M over 3-4 years, targeting ~2,200 homes

Concerns and Practices Considered in SCE's Program Design

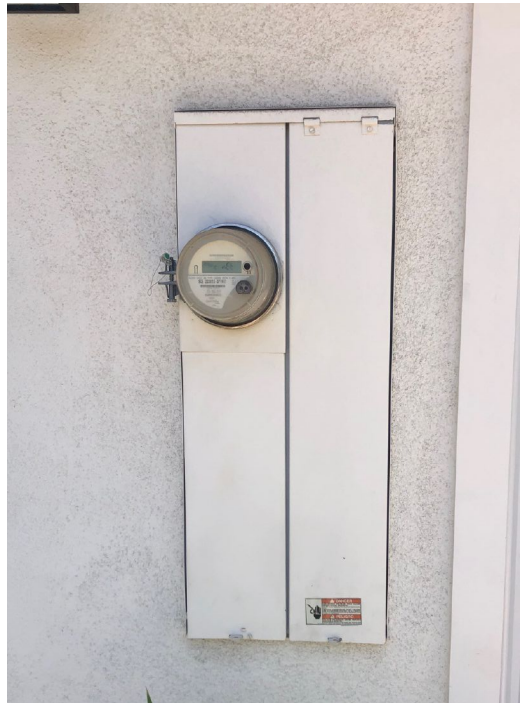
Many challenges exist in designing customer programs, particularly with an equity focus, but these same challenges are opportunities for innovation

Challenges	Opportunities
Are customers aware of the program / enrollment	• "People buy cars, not panels" – SCE plans to co-promote with its Pre-Owned EV Rebate which offers $4k for income-qualified customers, and other EV-touchpoints on its website • Interaction between the TE and BE programs: a customer that can benefit from a more efficient water heater can also benefit from EV fuel savings, and vice versa
Not everyone owns a home	• SCE has utilized landlord-authorization forms in an EE program in San Joaquin Valley and will translate those learnings to the Home Electrification Readiness Program and ESA BE Pilots
Invasiveness of contractors / time-off	• Time is more valuable for income-qualified customers. Coordination between similar programs can mean one-contractor / installation interface rather than many
Multiple program applications	• SCE already accepts income qualification from companion state programs; how much of other SCE program applications can be leveraged to minimize customer effort? Is SCE willing and able to allow third-parties (CBOs) to complete applications on a customer's behalf?
Can the customer wait for a rebate?	• Establishing a network of contractors that will bill SCE instead of the customer ensure income-qualified customers are not carrying the cost of the rebate while processing • Using best practices in utility billing and payments and expedite vendors/customer payment
Variations in installation costs	• Establishing a network of contractors may lead to some stabilization of program costs • Network contractors billing SCE-directly mitigates the impact to the customer of cost variations
Making sure the incentive goes to those most in need	• Targeting outreach through SCE's other income-qualified TE and BE programs • Working through CBOs and other community partners that are focused on electrification and cost savings for their constituents
Process complexity	• Develop a "what to expect" guide for both customers and utility representatives (see next slide)

Opportunity: Reducing complexity for customers by setting expectations

The work required to upgrade a home's electrical service varies home-by-home and city-by-city.

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



By using a network of contractors, SCE intends to simply this process for customers and develop better customer roadmaps that can inform them of all the steps necessary in their electrification journey

The Inflation Reduction Act brings Federal muscle to the electrification effort

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

Both Rebates and Tax Credits require some waiting period, and SCE's programs will continue to provide upfront cost mitigation for customers

- 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. Example: Used EV Tax Credit has a single-filer income cap of $75k (Santa Barbara and Orange County residents would be excluded at the Federal Level)

- 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

https://www.rewiringamerica.org/app/ira-calculator

Kim Cheslak

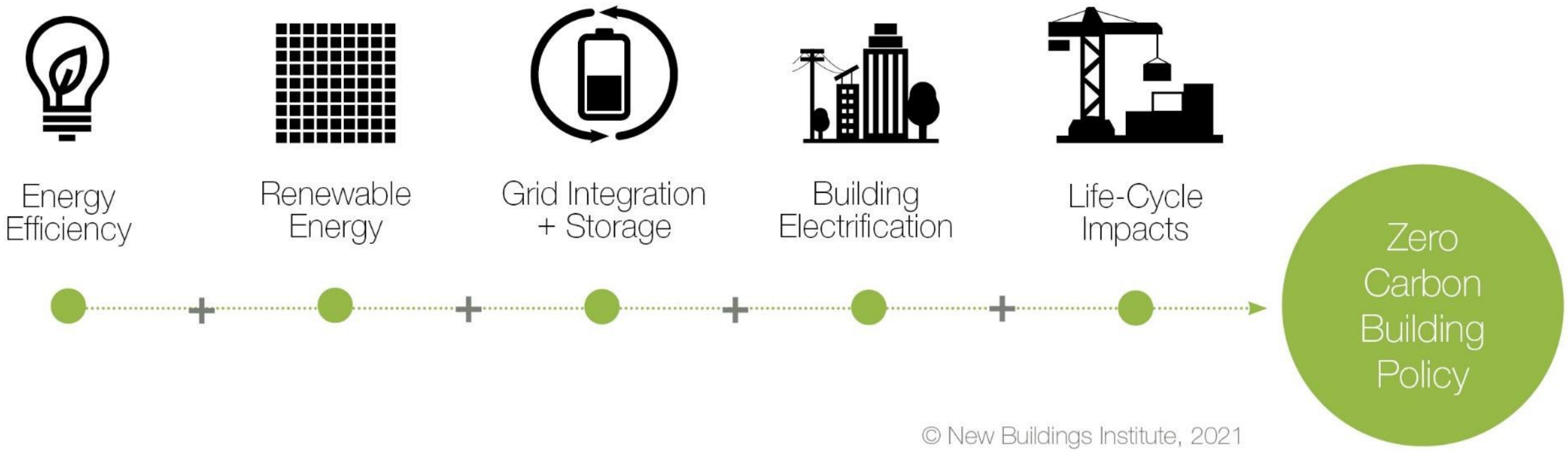
nbi new buildings institute

Electrifying Codes and Policies

February 2023

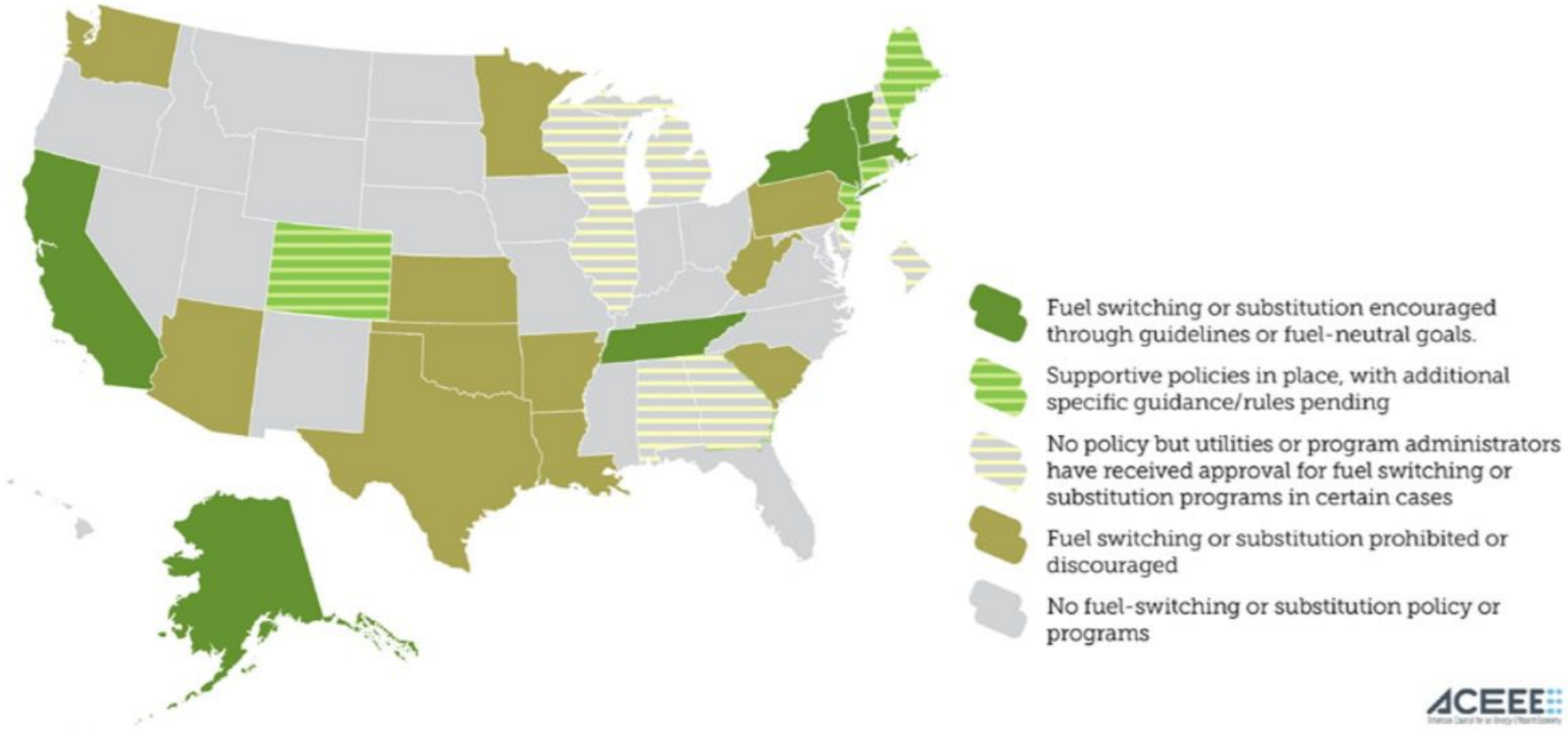
Photo by Gianandrea Villa on Unsplash

The Five Foundations of Zero Carbon Building Policies

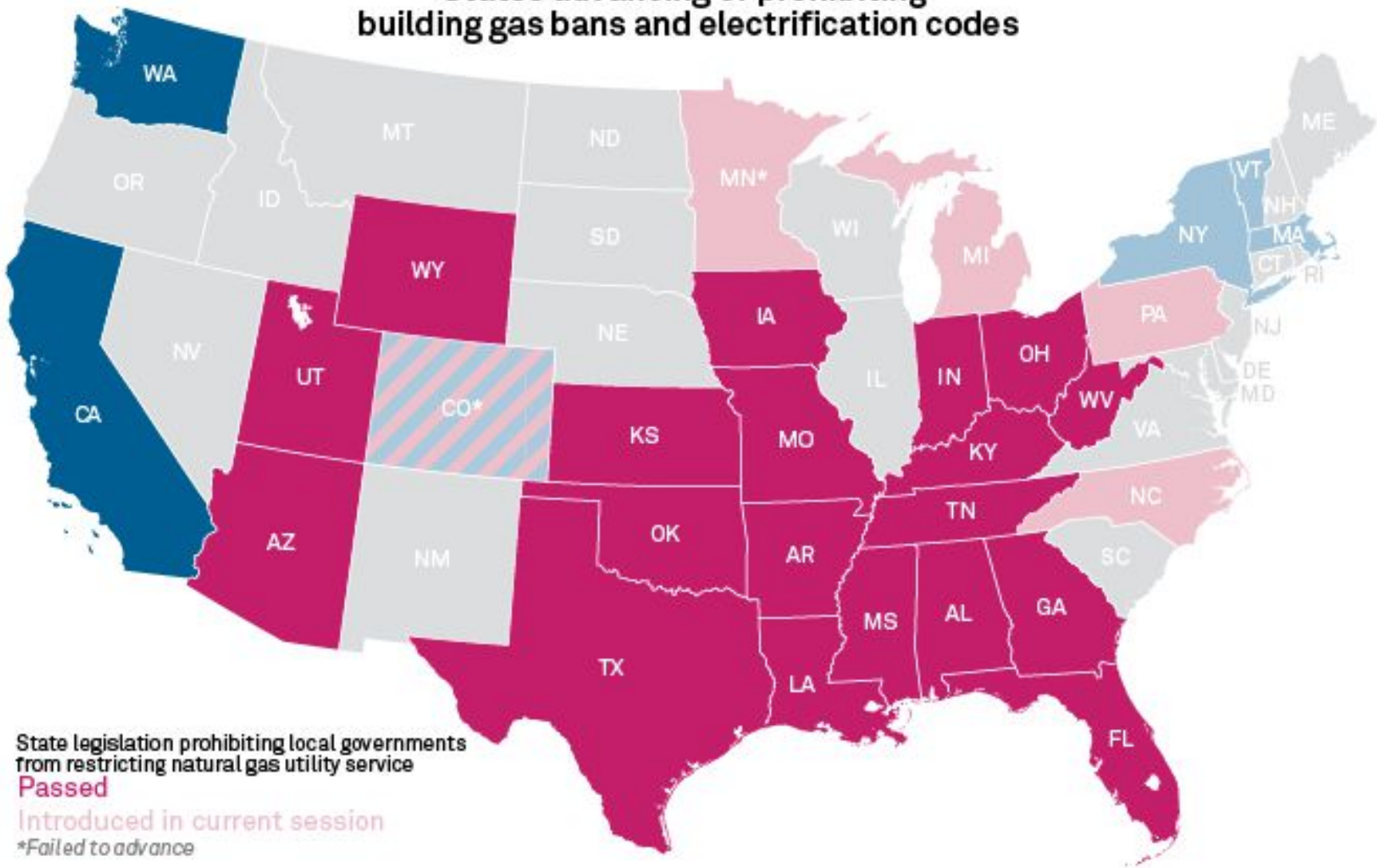


National Challenges

Figure 1. Fuel-switching policy status by state



States advancing or prohibiting building gas bans and electrification codes



State legislation prohibiting local governments from restricting natural gas utility service

Passed

Introduced in current session

**Failed to advance*

Local gas bans and electrification codes in new buildings

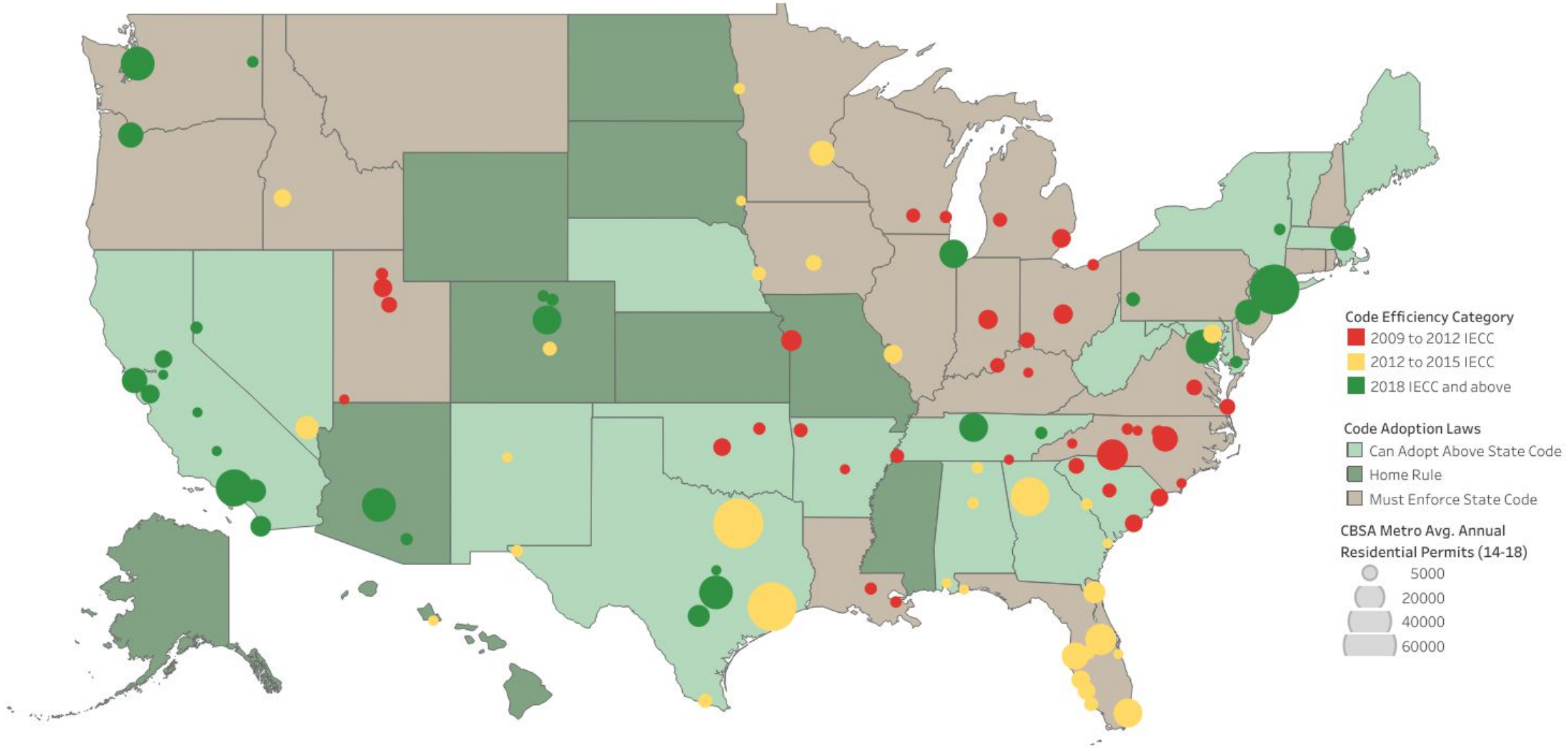
Adopted

In development

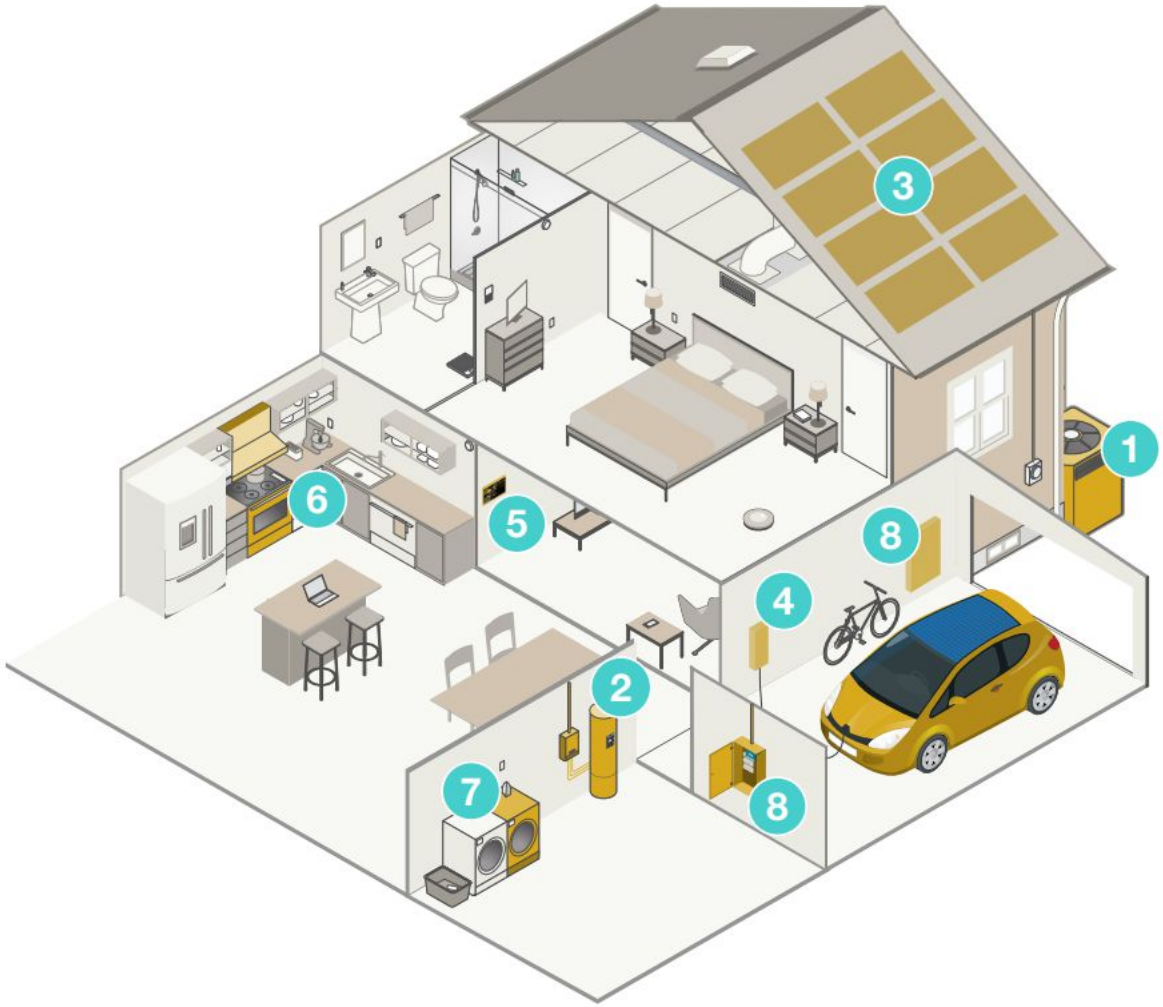
As of July 13, 2021.
Map credit: Joe Felizadio
Source: S&P Global Market Intelligence

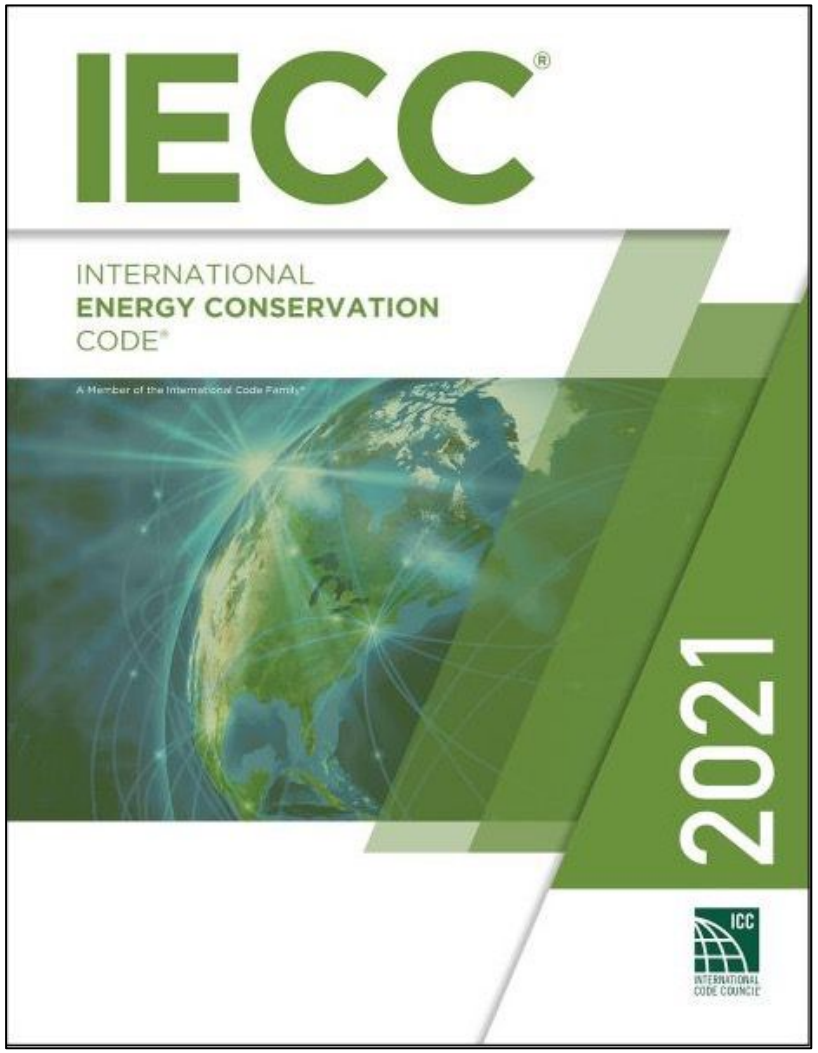
S&P Global
Market Intelligence

Who controls their own code destiny?

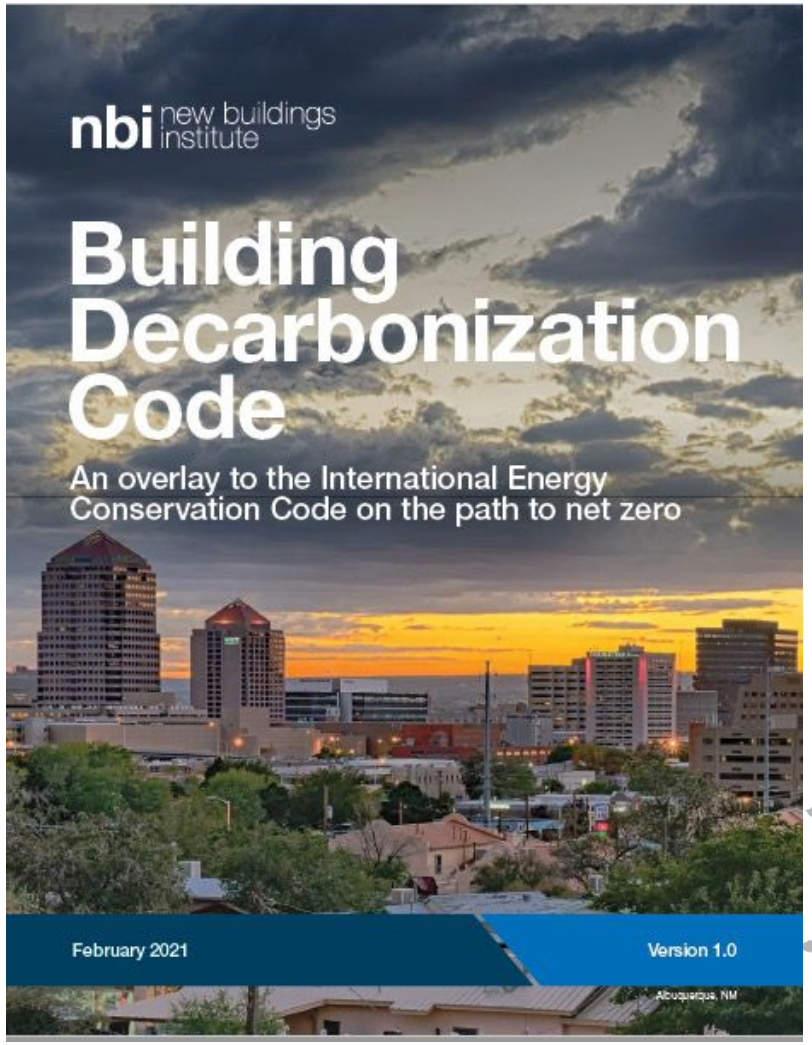


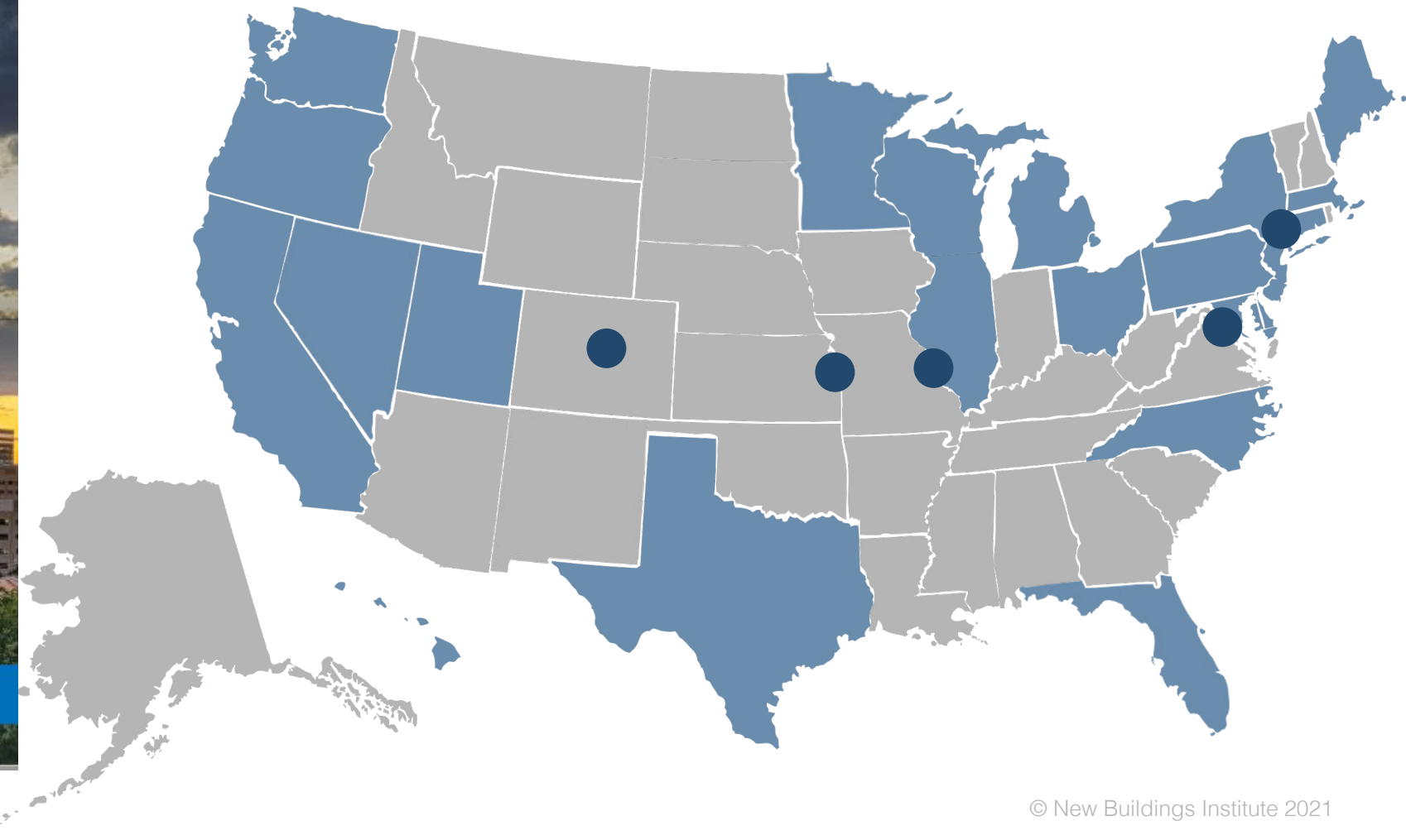
International Energy Conservation Code





Codes Developing through 2023





DOE/PNNL Cost analysis

Table ES.3. Energy Use and CO_2 Emissions of the 2021 IECC by Climate Zone

Climate Zone	Weight (%)	Site EUI (kBtu/ft^2-yr)	Source EUI (kBtu/ft^2-yr)	Energy Costs ($/residence-yr)	CO_2 Emissions (tons/residence-yr)
1	4.30	25.7	71.4	1,851	9.9
2	22.43	28.1	73.3	1,902	10.2
3	29.04	28.2	70.8	1,830	9.8
4	19.49	33.3	75.6	1,940	10.4
5	19.51	41.5	80.0	2,084	11.2
6	4.68	48.7	92.2	2,494	13.4
7	0.53	50.7	98.9	2,638	14.2
8	0.02	68.3	131.1	3,445	18.6
National	100.00	33.0	75.4	1,954	10.5

Education and Implementation Support

1 Electrification 101

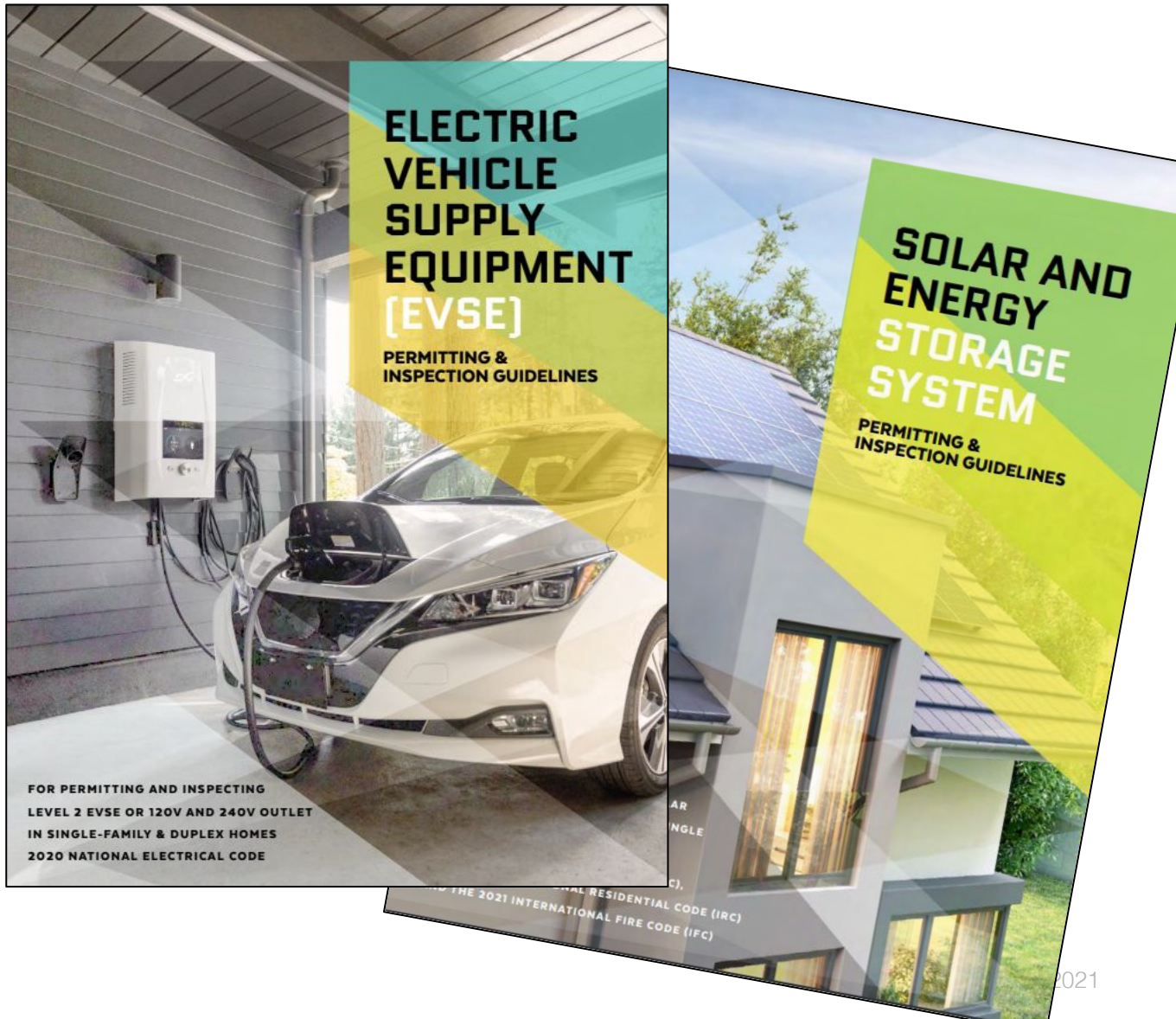
Understanding what it means to electrify building systems, why electrification is important and what technologies are available.

Topic A	Topic B	Topic C	Topic D	Educational Tools
Buildings represent a critical pathway to reducing GHG emissions. Comparison of fossil vs. electric. Reduces negative environmental impacts. Enables better grid management.	Both programs and regulations are moving to promote/require electric technologies. Outline pros/cons and specific changing codes and policies.	Topic C.	Matching electric technologies to building realities (new vs. existing, residential vs. commercial v. institutions, etc.).	• Briefs on available technologies (one pagers) • Recorded webinars on electrification basics • FAQ documents

Education and Implementation Support

Developing simplified permitting and inspection guidelines for major electrification and supportive measures including:

1. Heat Pumps
2. HPWH
3. Solar + Storage
4. Electric Vehicles



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