



Lovejoy Office Building | Portland, OR *Credit: Opsis Architecture*

nbi new buildings
institute

Pathways to Zero Carbon Policies

Metropolitan Washington COG March 2021



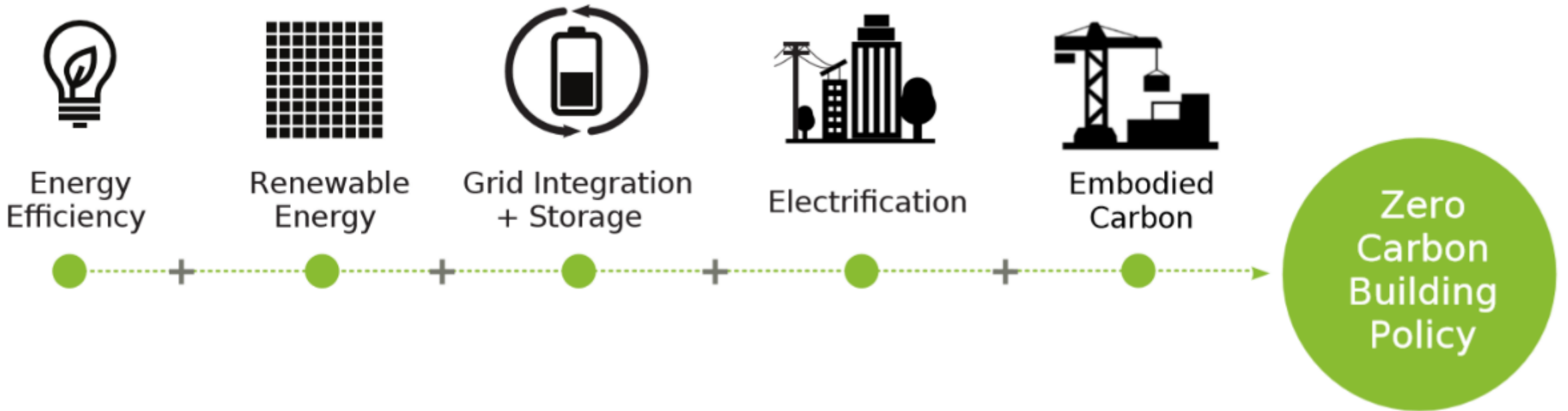
California Lottery Santa Fe Springs | Santa Fe Springs, CA Credit: LPAS Architecture + Design

nbi new buildings
institute

Mission

To achieve better buildings that are zero energy, zero carbon, and beyond – through research, policy, guidance and market transformation – to protect people and the planet.

Five Foundations of Zero Carbon Building Policies



Definitions/Lexicon

Zero Energy

(aka Net Zero Energy, Zero Net Energy)

A zero energy building combines energy efficiency and renewable energy generation to consume only as much energy as can be produced onsite through renewable resources over a specified time period. (Source: [U.S. Department of Energy](#))

Zero Carbon

(aka Net Zero Carbon, Zero Net Carbon)

A zero carbon building is defined as one that is highly energy-efficient and produces onsite, or procures, carbon-free renewable energy in an amount sufficient to offset the annual carbon emissions associated with operations.

***(Source: [Zero Carbon Building Standard](#)
[Canada Green Building Council](#))***

Electrification

Electrification refers to replacing direct fossil fuel use (e.g., propane, heating oil, gasoline) with electricity [use] in a way that reduces overall emissions and potentially energy costs while lowering other air pollutants.

(Source: [Environmental and Energy Study Institute](#))

Building-Grid Integration

(aka Grid-Enabled Buildings, Grid Harmonization)

Building-grid integration refers to the integration and optimization of homes and commercial buildings with the nation's energy grid. (Source: [Department of Energy](#))

Policy Landscape



Building Policy Landscape

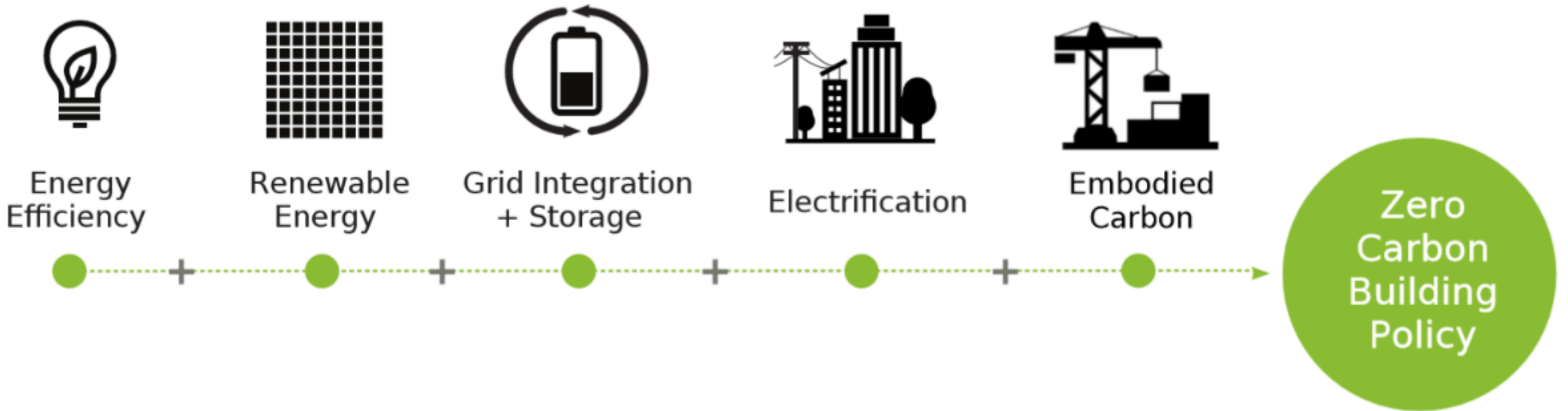
- New Construction : **CODES**, Zoning
- Existing Buildings : Benchmarking, Retro-commissioning, Building performance standards
- Municipal Policies : Zoning, Incentives, Gas moratoriums, various other sustainability actions (green roofs, stormwater, EE upzoning)
- State Policies : Utility regulation (RPS, fuel switching), **CODES**



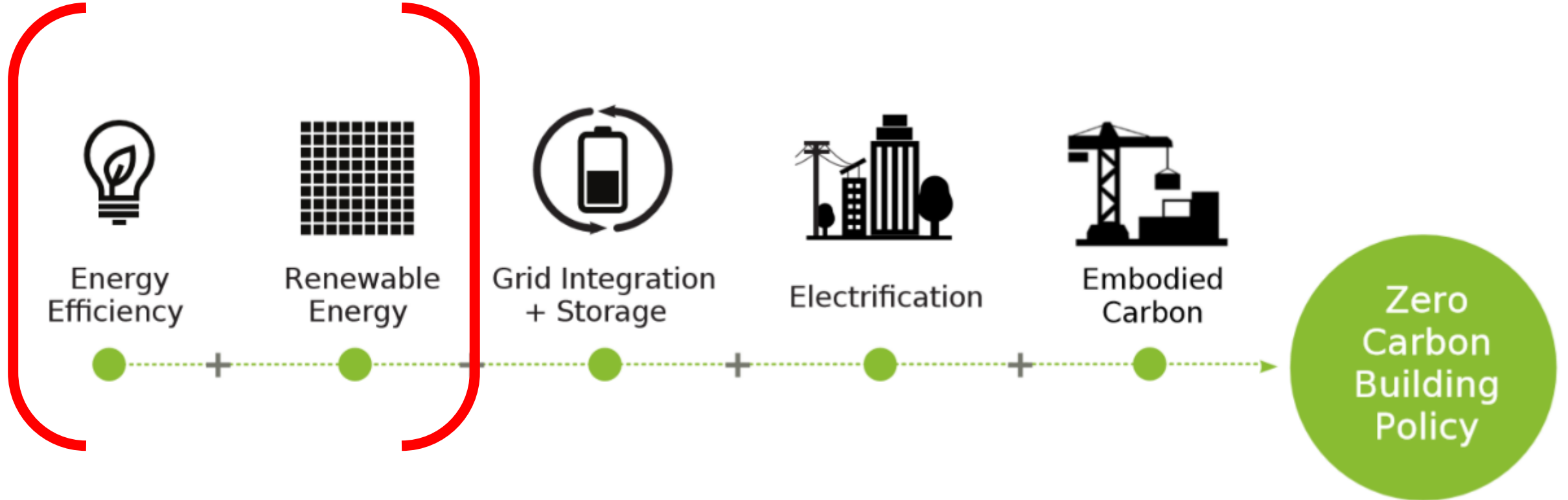
Building Policy Landscape Gaps

- Codes impact existing buildings as well – just at a different scale
- Municipal ordinances can be underutilized
- Incentives and pairing with utility programs can help start change and show progress to code updates mandatory for all

Five Foundations of Zero Carbon Building Policies



Five Foundations of Zero Carbon Building Policies



The basis
of ZNE

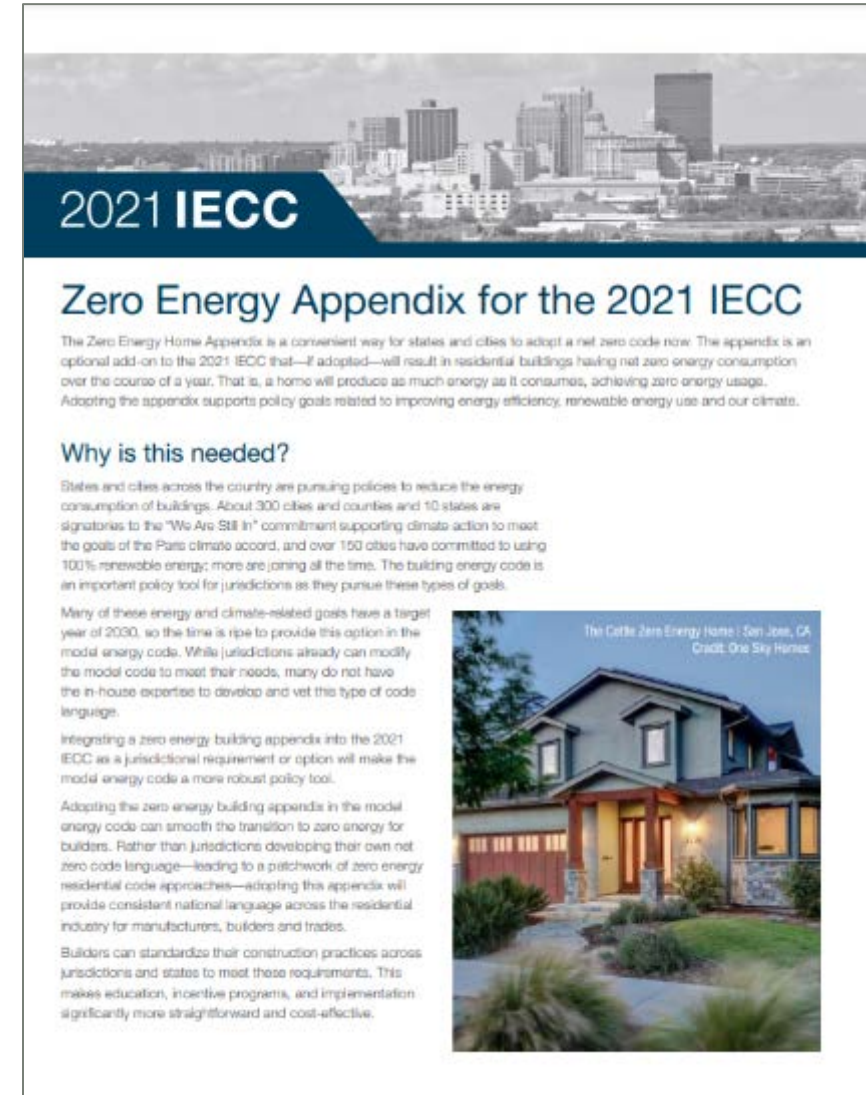


ZNE Policy Landscape

- Codes primary vehicle for EE
- Building Performance Standards
- FAR/Zoning incentives
- Utility incentives
- RECs
- Solar incentives/market
- Benchmarking and Retro-commissioning (limited)

Residential ZE Appendix to the 2021 IECC

- Collaboration between NBI and NRDC
- **Goal:** Codify a pathway to achieve residential NZE construction
- **Objectives:**
 - Show jurisdictions that NZE is within reach
 - Increase efficiency over base IECC
 - Establish a recognizable structure to move the code and the appendix forward in future cycles



2021 IECC

Zero Energy Appendix for the 2021 IECC

The Zero Energy Home Appendix is a convenient way for states and cities to adopt a net zero code now. The appendix is an optional add-on to the 2021 IECC that—if adopted—will result in residential buildings having net zero energy consumption over the course of a year. That is, a home will produce as much energy as it consumes, achieving zero energy usage. Adopting the appendix supports policy goals related to improving energy efficiency, renewable energy use and our climate.

Why is this needed?

States and cities across the country are pursuing policies to reduce the energy consumption of buildings. About 300 cities and counties and 10 states are signatories to the “We Are Still In” commitment supporting climate action to meet the goals of the Paris climate accord, and over 150 cities have committed to using 100% renewable energy; more are joining all the time. The building energy code is an important policy tool for jurisdictions as they pursue these types of goals.

Many of these energy and climate-related goals have a target year of 2030, so the time is ripe to provide this option in the model energy code. While jurisdictions already can modify the model code to meet their needs, many do not have the in-house expertise to develop and vet this type of code language.

Integrating a zero energy building appendix into the 2021 IECC as a jurisdictional requirement or option will make the model energy code a more robust policy tool.

Adopting the zero energy building appendix in the model energy code can smooth the transition to zero energy for builders. Rather than jurisdictions developing their own net zero code language—leading to a patchwork of zero energy residential code approaches—adopting this appendix will provide consistent national language across the residential industry for manufacturers, builders and trades.

Builders can standardize their construction practices across jurisdictions and states to meet these requirements. This makes education, incentive programs, and implementation significantly more straightforward and cost-effective.

The Gold Zero Energy Home | San Jose, CA
Credit: One Sky Homes

Building Performance Standards



Washington DC

Size: 50,000 sqft

Measuring: Energy

Metric: ENERGY STAR

Standard is recalculated
each compliance cycle



Washington State

Size: 50,000 sqft

Measuring: Energy

Metric: EUI

Targets under
development



New York City

Size: 25,000 sqft

Measuring: Carbon

Metric: kgCO₂e/sf

Standard is fixed
through 2034



St Louis, MO

Size: 50,000 sqft

Measuring: Energy

Metric: Site EUI

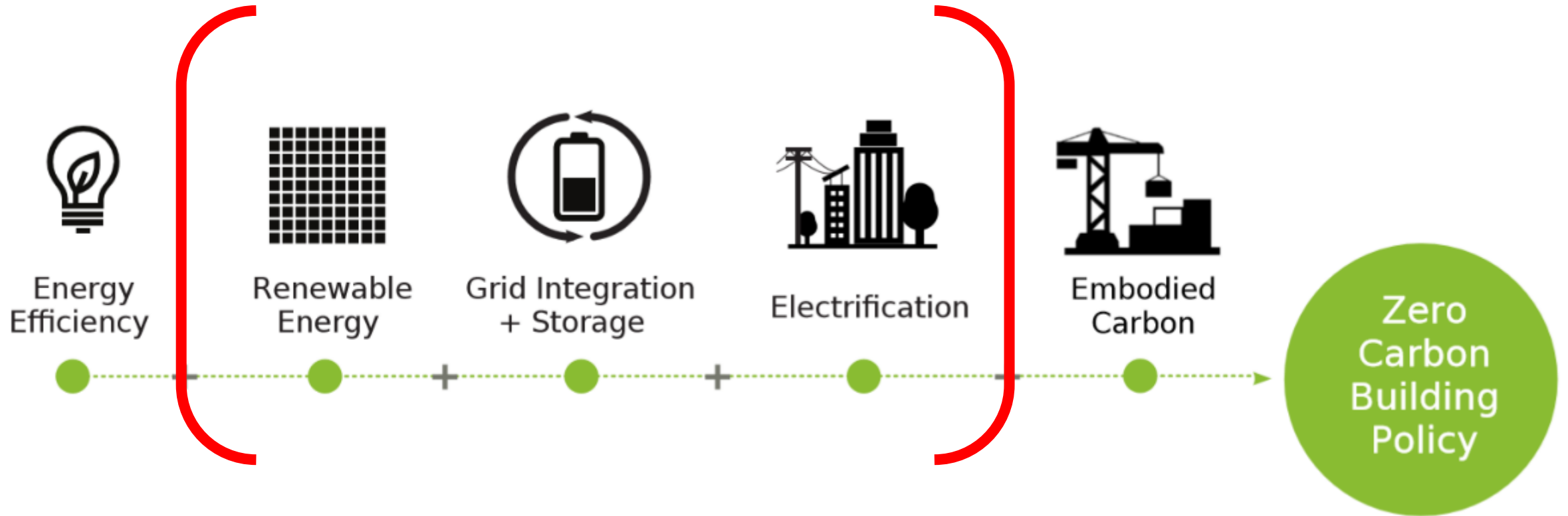
Standard is recalculated
each compliance cycle

Equity Implications for NZE

- Balancing increased first cost with operational savings
- Considering impact of renovations and the split incentive
- Solar projects with individual electric metering
- Solar projects where RECs are sold
- Resiliency and survivability increases



Five Foundations of Zero Carbon Building Policies



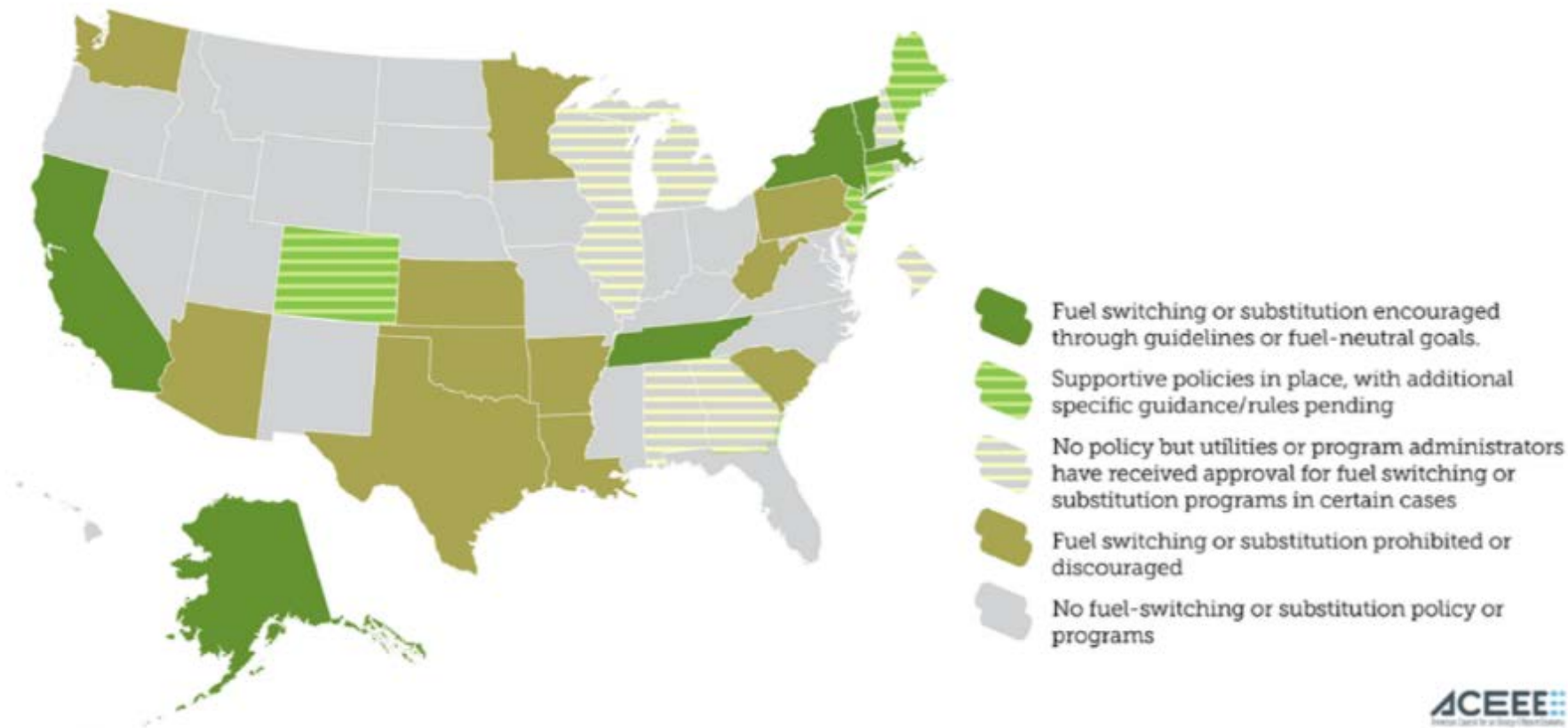
Operational
Carbon

Operational Carbon Policy Landscape

- Municipal “lead by example” ZC policy
- Gas moratoriums
- State preemption and fuel-switching policies
- Codes can be used to play a role
- BPS focused on carbon
- RECs/Solar market
- Utility ADR programs

Fuel-switching Policies

Figure 1. Fuel-switching policy status by state



ACEEE Policy Brief
National Center for Energy Efficiency

State Policies and Rules to Enable Beneficial Electrification in Buildings Through Fuel Switching
 May 2020

The most ambitious state goals to reduce greenhouse gas (GHG) emissions, particularly from buildings, are in several states and growing. Electrification of space and water heating is an important building decarbonization tool. Electrification has the potential to reduce buildings GHG emissions by displacing fossil-fuel heat and electricity use, especially where the electricity is generated by lower-carbon sources than those used today. Technological advancements continue to improve the performance and affordability of both air and ground source heat pumps, which have increased the feasibility of using these technologies in colder-weather regions and more cost-effective. A barrier to deployment is concerns over ensuring that electrification efforts are beneficial (i.e., that they reduce emissions and energy costs and are harmonized with existing energy efficiency policies aimed at reducing demand).¹

Building policies have typically considered fuel types or installation options considering the end use and particular beneficial fuel-switching technologies.² Fuel-switching programs are sometimes explicitly prohibited by state rules in other states, or certain aspects of state guidance have also impeded electrification efforts. Given the opportunity that fuel-switching creates to reduce emissions to a cost-effective manner, a number of states are increasingly motivated to update policies to enable beneficial electrification, particularly as these policies relate to energy efficiency and demand-side management programs.

This policy brief provides information on existing state policies related to rapidly changing and broad regulations and program administrators as they seek to design and deliver building programs that enable fuel-switching and meet their emissions potential to reduce emissions and GHG emissions. We gathered this information in part through data collection efforts associated with ACEEE's annual State Energy Efficiency Assessment and supplemented by additional interviews and correspondence with state utility regulators in order to clarify policy developments and state rules and guidelines. This policy area is dynamic and rapidly evolving.

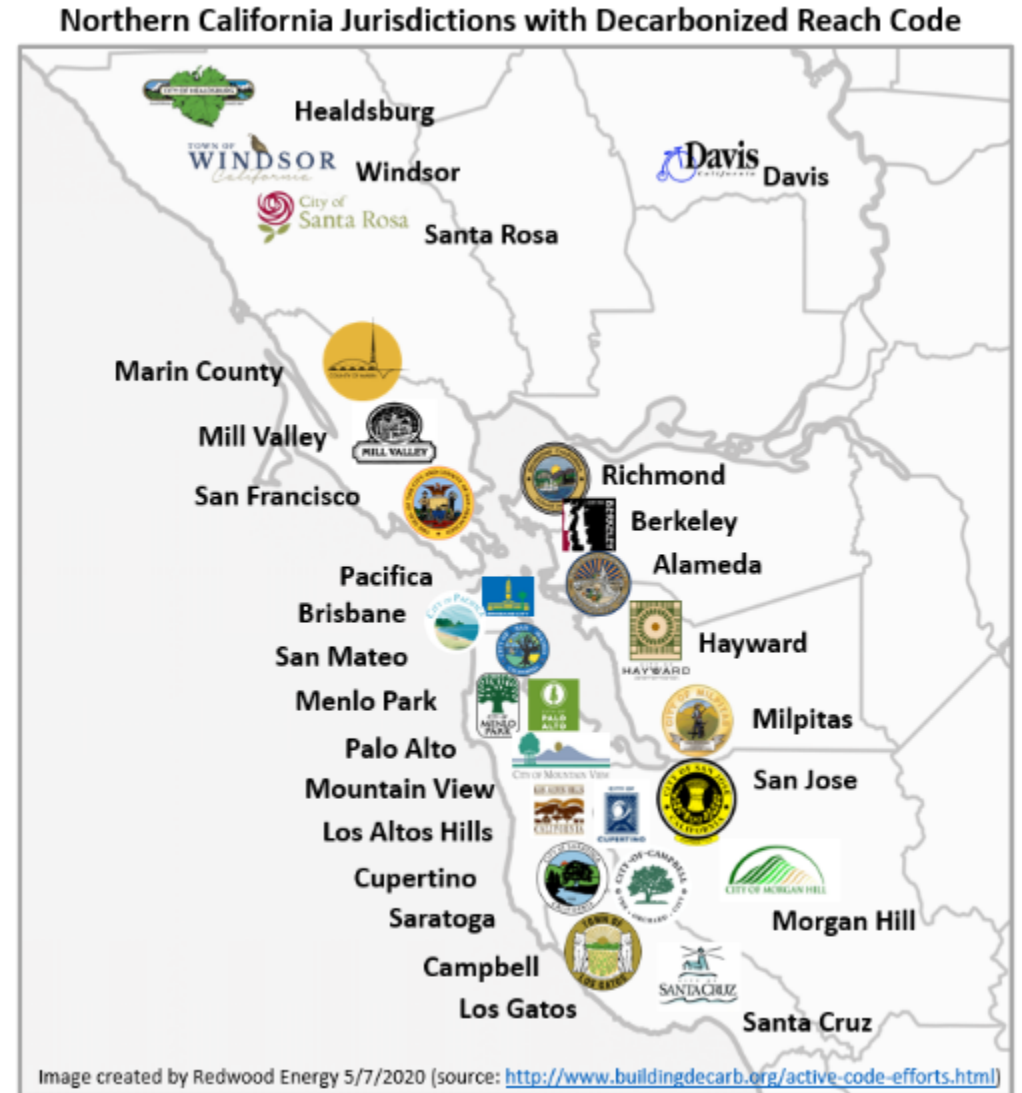
¹ Building and electrification are often discussed in ACEEE's decarbonization as a low-carbon efficiency when it comes energy use and emissions energy and related emissions. However, businesses that utilize energy efficiency programs or improve policy maintain, improve building and behavioral efficiency measures that reduce overall participant energy demand can reduce their the building and utility equipment needed to serve the building, which, in turn, can reduce their emissions. There may be additional building efficiency that would be necessary to meet an energy goal or to meet energy goals in these ways, other policy mechanisms that are not beyond the scope of this report, such as ASHRAE 90.1 energy codes or green building, or better geographic funding tools.

² Particulate matter is the primary air quality concern in cooling technology as appliances with an electric or natural gas energy source (e.g., displacing oil and propane through the use of electric air source heat pumps) in the context of that point that the transition to the status of the existing state building efficiency programs to maintain a low-carbon building that is switching from fossil fuel with a carbon-free electricity source to electric heat.

https://www.aceee.org/sites/default/files/pdfs/fuel_switch_revised_5-14-20.pdf

US Electrification Policies

- **31 Total Local Policies:**
 - 30 Cities and 1 County in CA
 - MA and Utah
- **Policy types:**
 - Gas Moratoriums
 - All- Electric - required Reach Codes
 - Electric-preferred – additional requirements
 - Building Performance Standards



Building Electrification Technology Roadmap (BETR)

- Collaboration between NBI, BDC and EPRI
- **Goal:** Accelerate the development and adoption of advanced electric technologies
- **Objectives:**
 - Characterize the industry status of technology readiness for electrification including product optimization and site barriers to adoption.
 - Provide guidance that supports building electrification (BE), carbon reduction, energy efficiency and research programs over the next 10 years.

Concept Paper: Building Electrification Technology Roadmap (BETR)
A Roadmap for accelerating the development and adoption of advanced electric technologies that lead to decarbonization in residential and commercial buildings

Background and Context

Since the early 1980s, there have been significant and impactful efforts to improve the energy efficiency of buildings through codes, policies and programs. In today's context, the spotlight is focused on carbon emission reductions rather than solely saving **kWhs** or **therms** to support climate action plans and policies for greenhouse gas (GHG) reductions. This shift has put momentum behind renewable energy production, both distributed and at utility scale, to decarbonize the grid. While generation-side efforts are critical, the role of buildings' energy use remains an important intervention area for efficiency programs and jurisdictional activities. Building electrification - reducing or eliminating direct use of fossil fuels at the building through advanced electric technologies - is gaining interest as a key strategy to employ along with grid decarbonization.

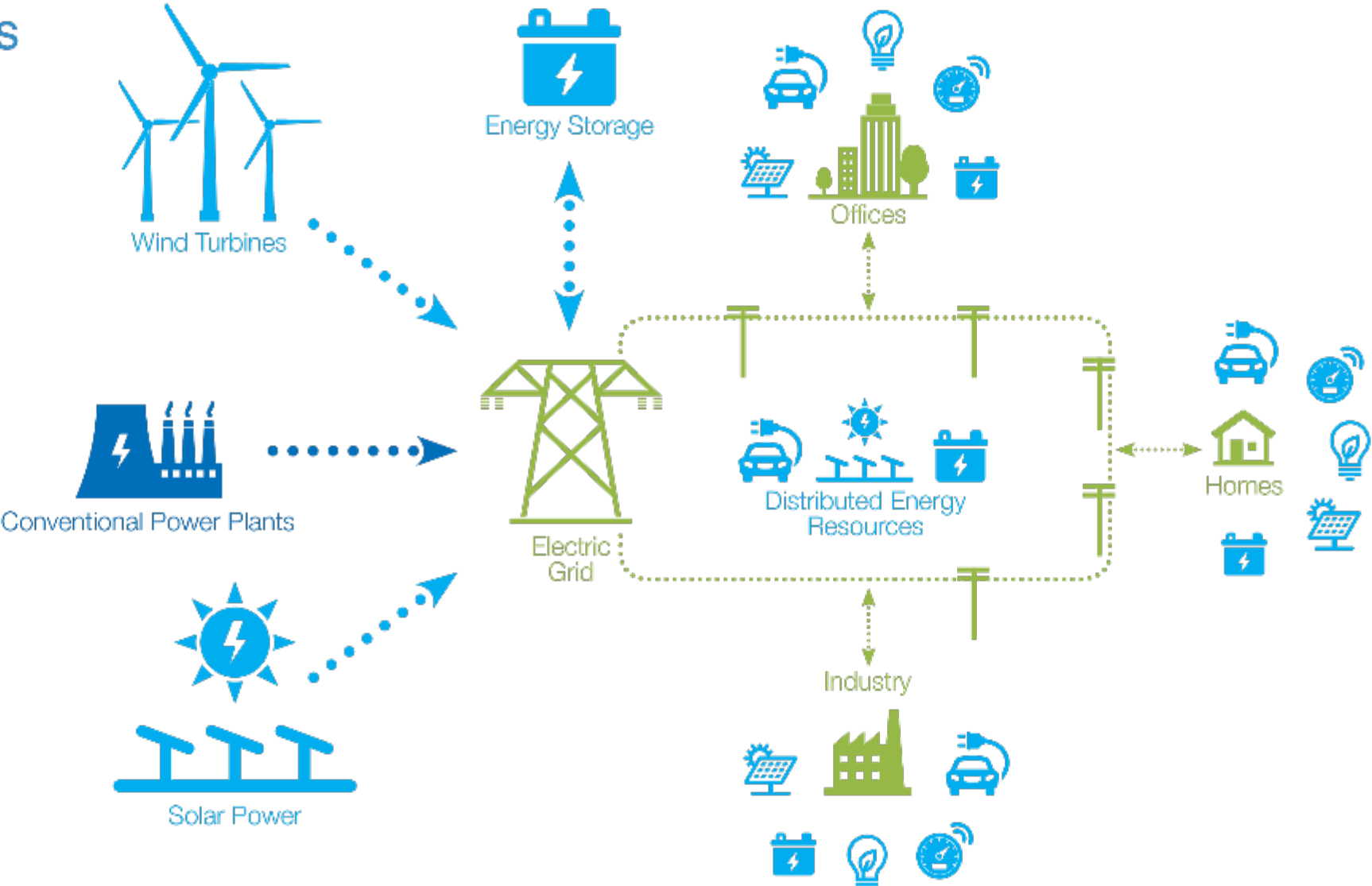
The Need for this Project. Nationally, natural gas accounts for an average of 44% of a home's total energy use varying regionally from 26-60%. For commercial buildings, the range varies more widely by sector from 20-60% of energy use as shown in the figure below¹. Direct site natural gas use, combined with leakage in delivery, can be responsible for as much as 60% of the CO₂ emissions of a mixed-fuel home with electricity that produced by natural gas fired generation while the same all-electric home has 45% lower carbon emissions².

Commercial Sector	Energy Use (%)
Manufacturing	~55
Food and Beverage	~45
Chemical and Allied Products	~40
Textile, Apparel and Leather Goods	~35
Transportation and Equipment	~30
Other	~25
Healthcare	~20
Education	~15
Government	~10
Retail	~5
Professional Services	~5
Finance	~5
Information	~5
Real Estate	~5
Construction	~5
Other	~5

To significantly reduce building site carbon emissions requires broad adoption of efficient electric technologies that are available today but not yet widely adopted, as well as adoption of newer products that can provide the same or improved level of service as incumbent technologies. In response to this need, New Buildings Institute (NBI), the Building Decarbonization Coalition (BDC) and the Electric Power Research Institute (EPRI) identified a set of research tasks to provide information, data and direction on electric technologies that will support efficiency programs and policy makers. Most importantly, the proposed research recognizes, leverages and builds on existing studies and efforts underway on assessing and advancing electric technologies that improve both energy and emissions performance in buildings. The Building Electrification Technology Roadmap (BETR)² will put this good work together, fill gaps, and translate it into meaningful results and technical pathways³ that support decarbonizing the built environment.

¹ EIA Residential Data and CBECS Commercial data. [Statistic](#) on homes with natural gas (~50% of U.S. homes) from the American Gas Association Commercial Sector [Summary](#) is slightly higher.
² E3 2019 [Study on Residential Building Electrification in California](#)

GridOptimal empowers players on both sides of the meter to actively support the transition to a carbon free grid



GridOptimal Technologies and Strategies:

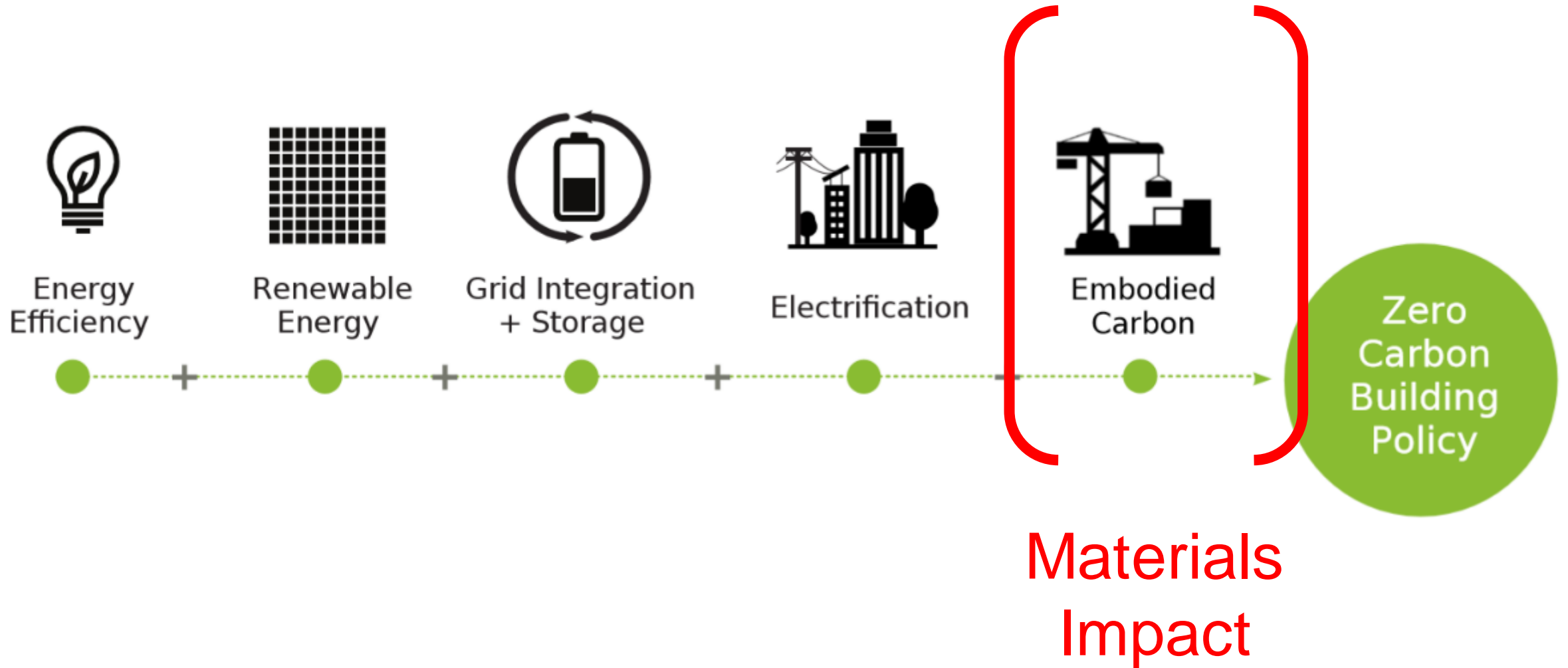
- renewable energy
- energy efficiency
- electric vehicle
- energy storage
- smart connected controls

Equity Implications for Op. Carbon

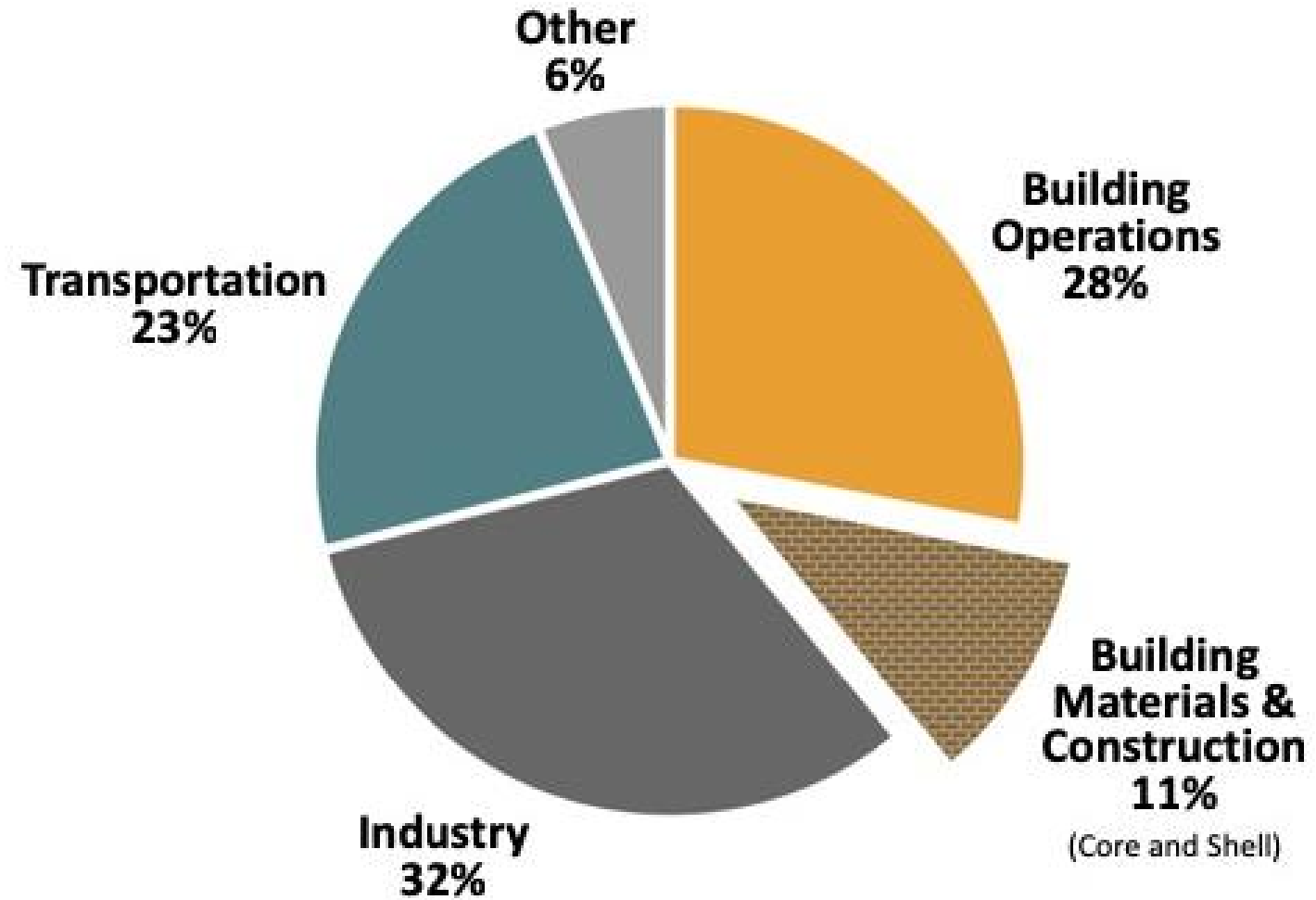
- Cost of electric heating without weatherization or proper EE upgrades (existing buildings)
- Cost of stranded assets and infrastructure
- Societal costs and health impacts of combustion appliances
- Increased need to pair incentives with targeted use in affordable housing and community businesses to avoid free-ridership



Five Foundations of Zero Carbon Building Policies



Global CO₂ Emissions



Embodied Carbon Policy Landscape

- Buy-Clean
- Materials based codes
- EC disclosure
- Incentives
- Recycling/Reuse municipal policy

Equity Implications for Embodied Carbon

- Balance impacts of reuse with cost and considerations for long term energy and operational carbon savings
- High potential for greenwashing attention





Save the Date!

GETTING TO
zero
FORUM 2021

October 27-29, 2021

New York City

Join building and energy industry leaders at the premier global event dedicated to defining a low-energy, low-carbon future for the built environment.

nbi new buildings
institute



Questions?

Kim Cheslak
Director Codes
kim@newbuildings.org

nbi new buildings
institute

www.newbuildings.org