Getting to *Net-Zero*: Lessons from California's Aggressive Building Energy Codes

Benjamin Montalbano & Olivia Parker-Swenson
NRG Compliance, a SETTY company
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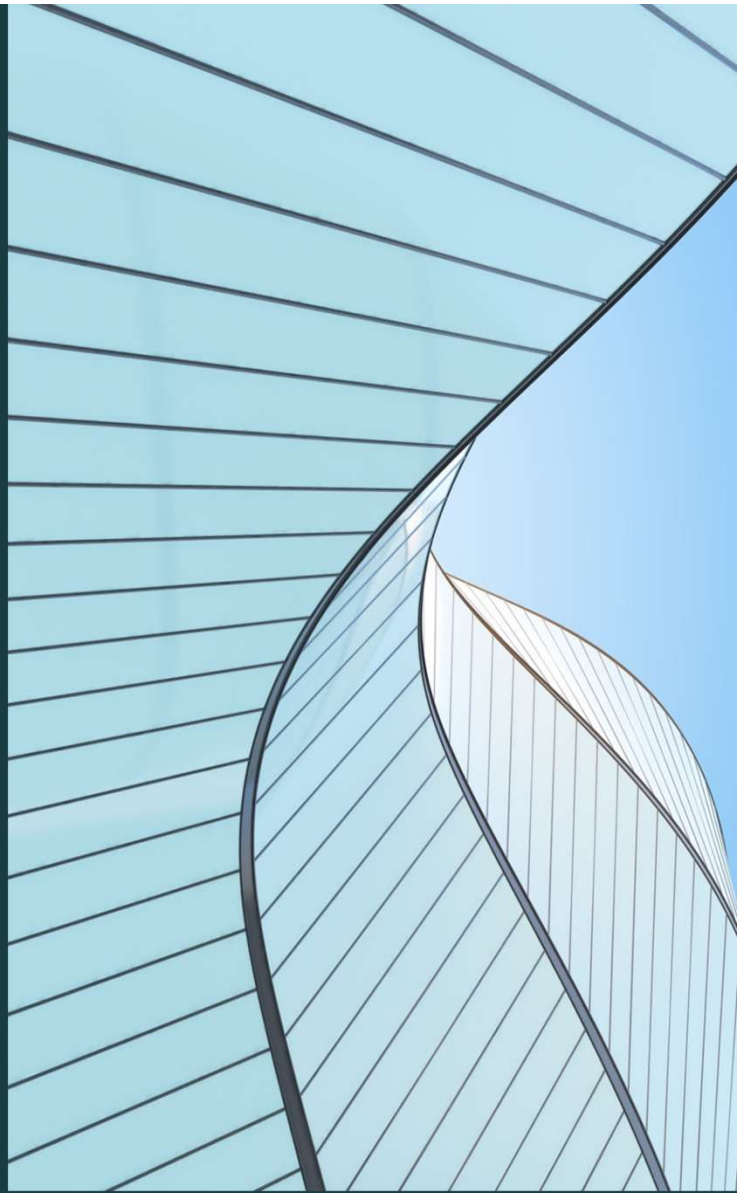


Our *team*

Benjamin Montalbano

LEAD ENERGY ANALYST

Formally trained as a mechanical engineer from Rice University, Ben leads the team at NRG, working on both residential and commercial Title 24 projects. Ben previously spent three years at Setty & Associates as a Mechanical Engineer.

benjamin.montalbano@setty.com

Olivia Parker-Swenson

ENERGY SOLUTIONS SPECIALIST

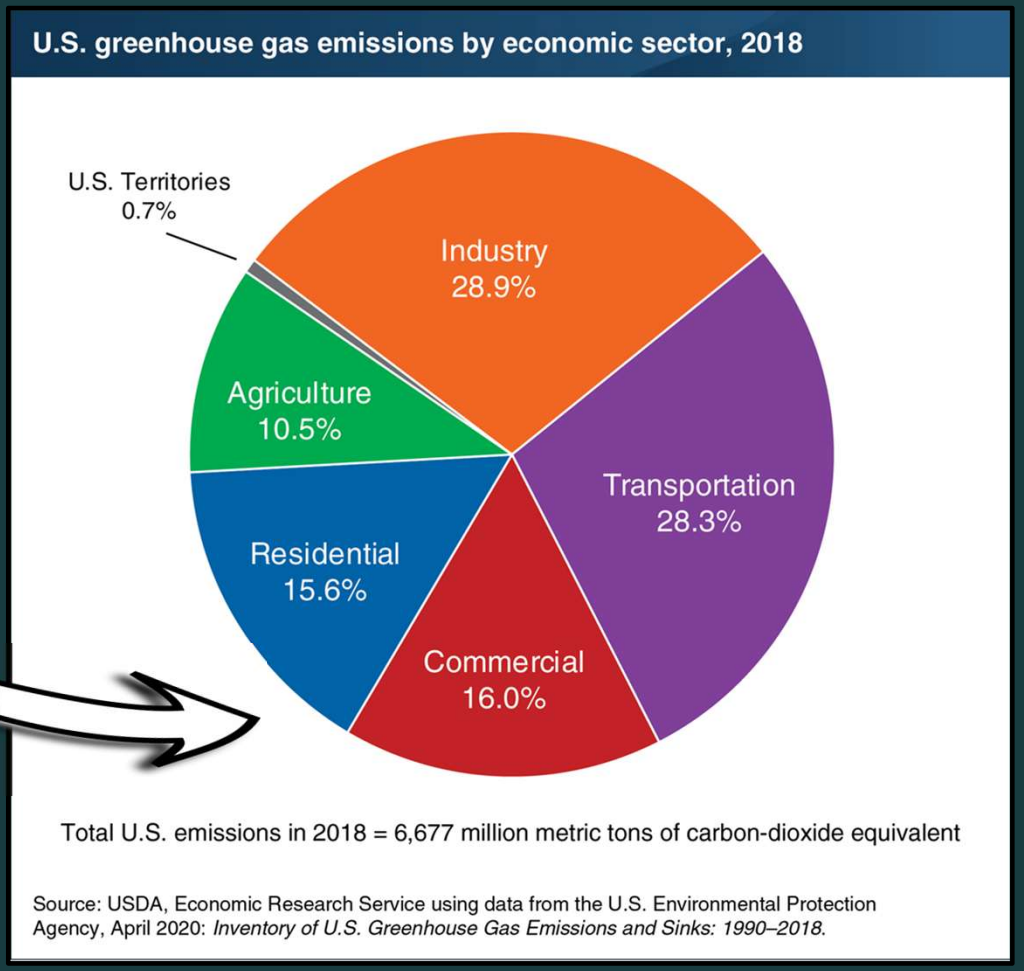
Olivia supports the team in creating quality Title 24 reports, ensuring our customers find the best solution to fit their needs while also passing the code. She holds a B.S. in Sustainability from Arizona State University.

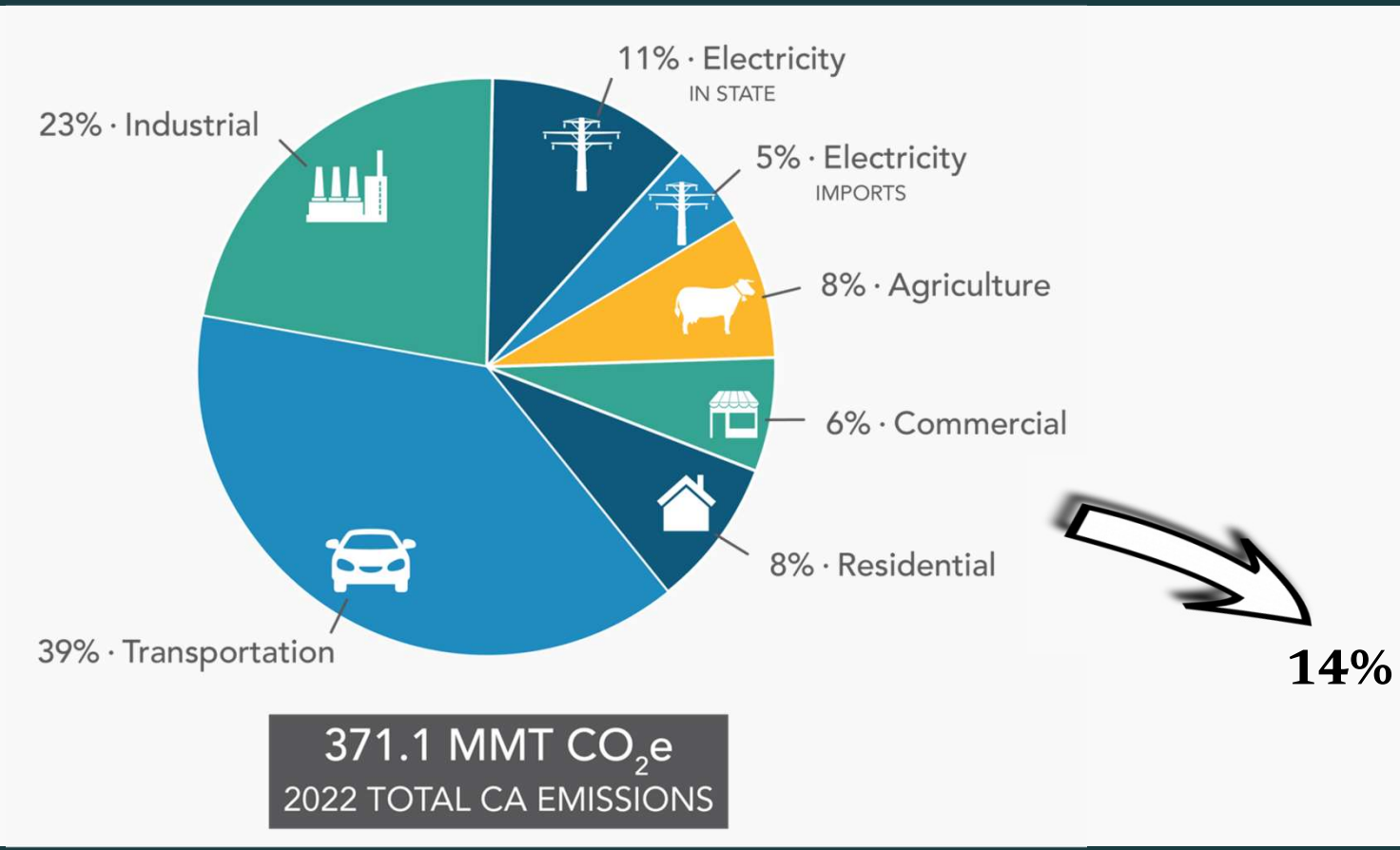
olivia.parker@setty.com

Why Does Net-Zero Matter?

The built environment creates a lot of greenhouse gas emissions

Over 31%



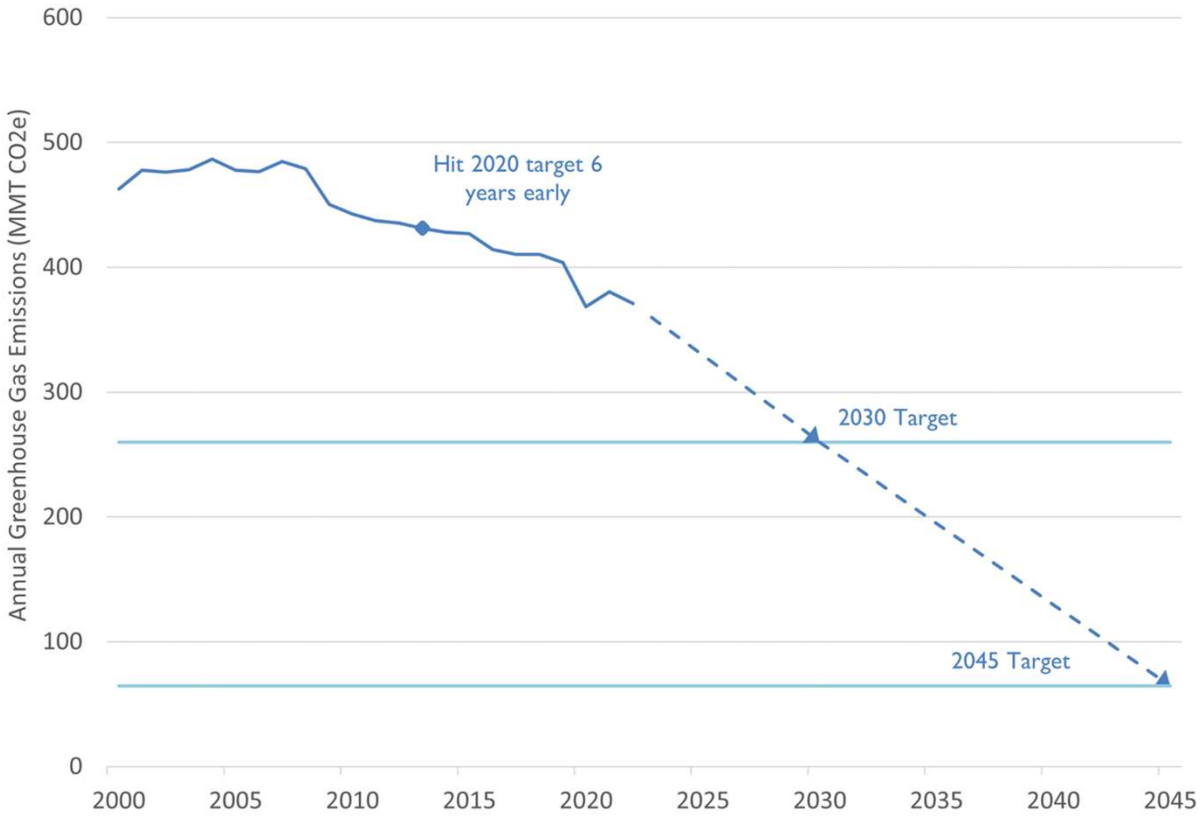


California's greenhouse gas emissions in 2022 broken out by economic sector
MMT CO_2e = Million metric tons of carbon dioxide equivalent

State of California. (n.d.). California Climate Dashboard. CalEPA. https://calepa.ca.gov/climate-dashboard/

California Targets

- 2020- Return to 1990 levels
- 2030- 40% below 1990 levels
- 2045- Achieve carbon neutrality



State of California. (n.d.). California Climate Dashboard. CalEPA. https://calepa.ca.gov/climate-dashboard/

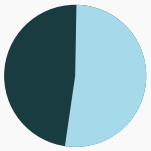
Health Impacts of Natural Gas

Carbon Monoxide Levels

9%

Formaldehyde Levels

53%



Nitrogen Dioxide Levels

62%

Above acute health-based standards in homes that use natural gas cooktop burners without use of venting range hood

Logue, J. M., Klepeis, N. E., Lobscheid, A. B., & Singer, B. C. (2014). Pollutant exposures from natural gas cooking burners: a simulation-based assessment for Southern California. Environmental health perspectives, 122(1), 43–50.

What is Title 24?

California's Building Energy Efficiency Standards

Commercial & Residential

Every 3 Years

16 CA Climate Zones

Mandatory Measures

Prescriptive vs Performance

2022 California Building Energy Efficiency Standards for Residential and Nonresidential Buildings, Title 24, Part 6

How Has It Changed?

Strengthening the Envelope

Focus on insulation, window, lighting, and HVAC performance.

2013

Building off 2013

Less changes overall than 2013 code, some minor adjustments to overall envelope of the building.

2016

Powering with Solar

First building energy code in the United States to require solar PV on new homes!

2019

Driving Decarbonization

Focus on heat pumps, electric- ready requirements, solar and battery expansion, and ventilation and demand response.

2022

Heat Pump Standard

Expands heat pump adoption, strengthens solar + battery storage requirements, and tightens building envelope and ventilation standards.

2025

Deep Dive 2022 Title 24 Code

HEAT PUMPS	Climate Zone 3, 4, 13, and 14 standard design is heat pump when water heater is gas-fired.
ELECTRIC-READY	Facilitate future installations of high efficiency electric equipment and minimize future retrofit costs when gas appliances are replaced with electric appliances.
ENERGY STORAGE	ESS ready equipment that can accommodate the connection of a distributed energy resource.
VENTILATION	For newly constructed buildings and additions greater than 1,000 sqft, IAQ fan is required.

2022 California Building Energy Efficiency Standards for Residential and Nonresidential Buildings, Title 24, Part 6

$1.5 Billion

in consumer benefits over 30 years

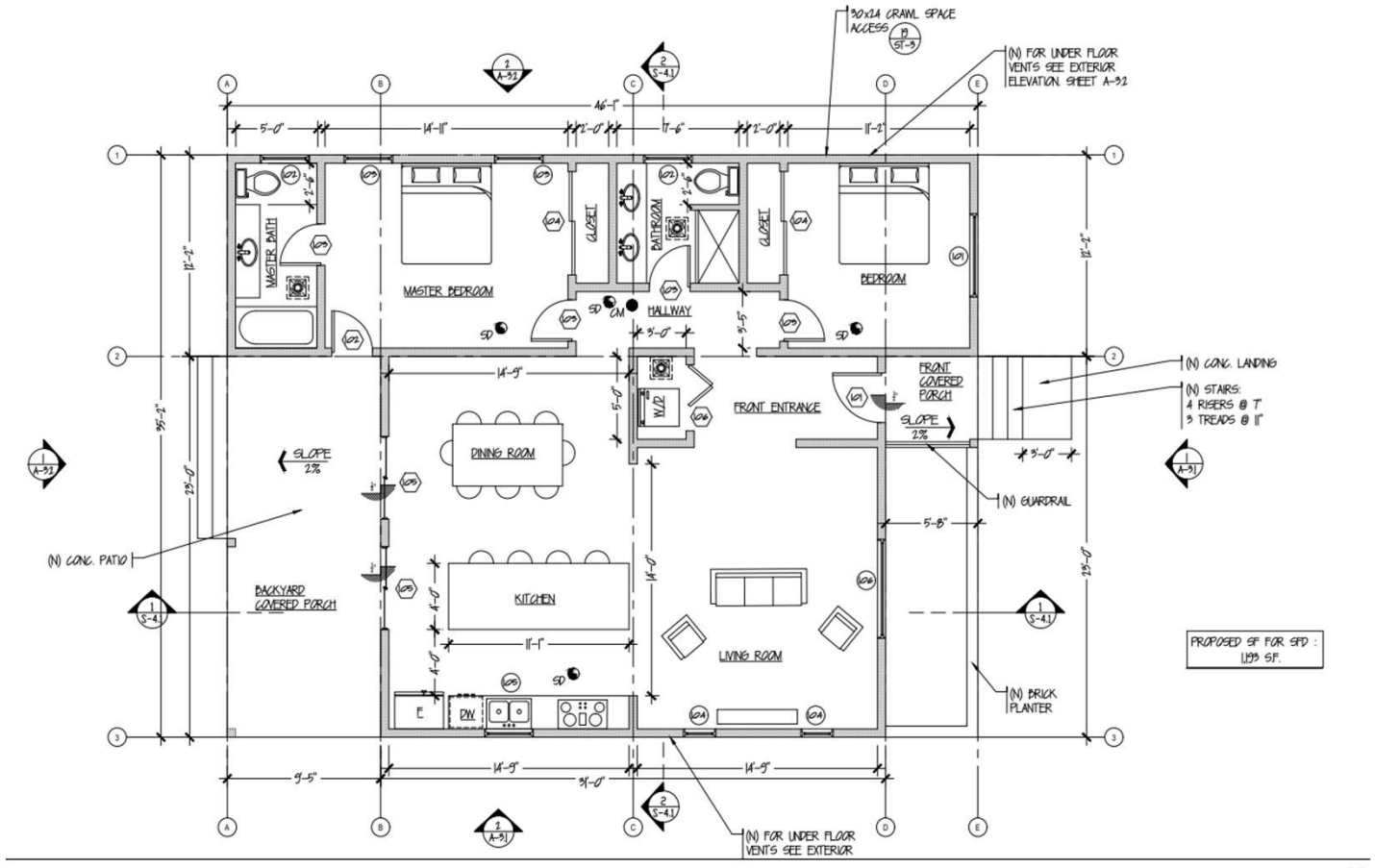
2022 California Building Energy Efficiency Standards for Residential and Nonresidential Buildings, Title 24, Part 6

10 million metric tons of GHG emissions

=

2 million cars off the road for a year

2022 California Building Energy Efficiency Standards for Residential and Nonresidential Buildings, Title 24, Part 6



Climate zone 9 fire rebuild, 1195 sq ft

What does the code say?

Single Family Title 24 Performance

Calculation	Heating	Cooling	Int Lighting	Ext Lighting	Appliances	Receptacle	PV	Batt	IAQ	DHW	EDRs	EDRe	EDRt
Standard	3.49	29.19	7.63	1.72	28.27	38.73	-60.02	0.00	3.93	17.89	35.3	39.0	27.5
Proposed	8.33	33.24	7.63	1.72	28.17	38.73	-59.32	0.00	3.93	24.95	52.5	50.8	34.2

All Gas

Single Family Title 24 Performance

Calculation	Heating	Cooling	Int Lighting	Ext Lighting	Appliances	Receptacle	PV	Batt	IAQ	DHW	EDRs	EDRe	EDRt
Standard	3.49	29.19	7.63	1.72	28.27	38.73	-60.02	0.00	3.93	17.39	35.3	39.0	27.5
Proposed	9.35	29.56	7.63	1.72	28.06	38.73	-59.67	0.00	3.93	12.21	34.7	39.7	28.0

Gas Appliances with Heat Pump Water Heater and HVAC

Single Family Title 24 Performance

Calculation	Heating	Cooling	Int Lighting	Ext Lighting	Appliances	Receptacle	PV	Batt	IAQ	DHW	EDRs	EDRe	EDRt
Standard	6.04	28.92	7.63	1.72	38.43	38.73	-61.05	0.00	3.93	17.89	29.2	30.7	26.1
Proposed	9.43	29.29	7.63	1.72	38.23	38.73	-60.74	0.00	3.93	12.22	28.3	30.0	25.7

All Electric

What is HERS?

Home
Energy
Rating
System

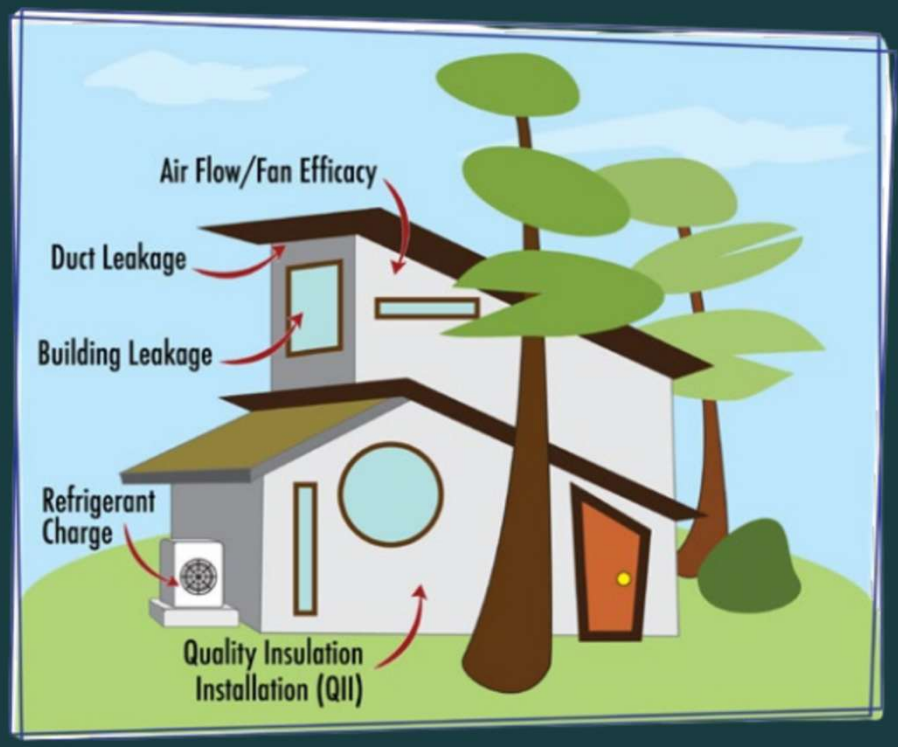


Figure 1: Example of HERS Measures in a Single- family Home

Energy Code Ace. (n.d.). *Example of HERS Measures in a Home*. Energy Code Ace.

HERS Example - Quality Insulation Installation (QII)

Single Family Title 24 Performance

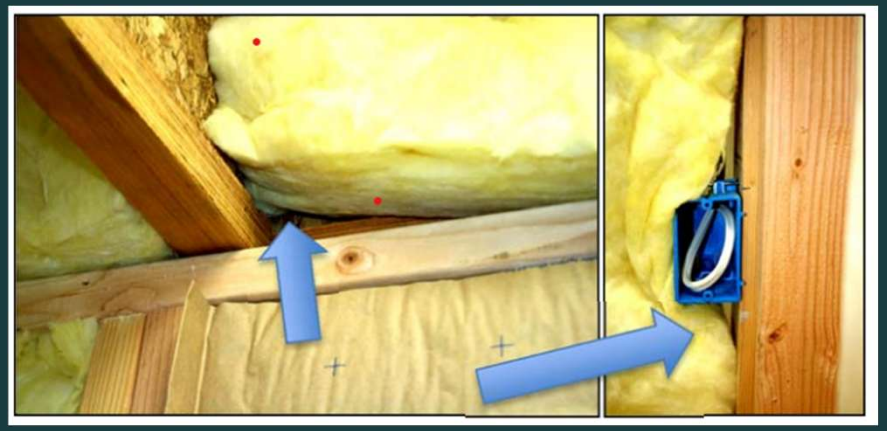
Calculation	Heating	Cooling	Int Lighting	Ext Lighting	Appliances	Receptacle	PV	Batt	IAQ	DHW	EDRs	EDRe	EDRt
Standard	43.85	33.95	6.56	1.66	10.26	14.06	-32.22	0.00	2.65	7.14	39.3	40.5	30.2
Proposed	39.33	48.22	6.56	1.66	10.32	14.06	-32.57	0.00	2.65	5.54	28.1	44.1	32.8

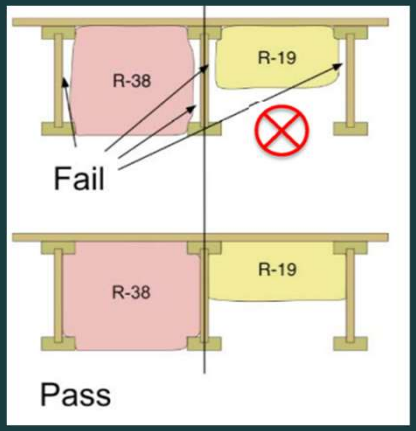
No QII Required

Single Family Title 24 Performance

Calculation	Heating	Cooling	Int Lighting	Ext Lighting	Appliances	Receptacle	PV	Batt	IAQ	DHW	EDRs	EDRe	EDRt
Standard	43.85	33.95	6.56	1.66	10.26	14.06	-32.22	0.00	2.65	7.14	39.3	40.5	30.2
Proposed	35.65	43.99	6.56	1.66	10.32	14.06	-32.51	0.00	2.65	5.53	26.3	40.5	30.1

QII Required





CalCERTS, Inc. (2017). Quality Insulation Installation (QII) Handbook. CalCERTS Inc.

Energy Conservation Code versus Title 24

- Prescriptive vs Performance
- Efficiency Improvements vs Push to Net-Zero
- New Buildings and Additions vs All Types
- No 3rd party inspections vs HERS Raters

District of Columbia. (2017). *2017 District of Columbia energy conservation code*. https://os.dc.gov/sites/default/files/dc/sites/os/publication/attachments/2017%20Energy%20Conservation%20Code.pdf

ECC versus T24- Window Requirements

Fenestration	DC 2017 ECC (Climate Zone 4A)	CA 2022 Title 24 (Climate-specific)
Residential Windows (above-grade walls)	U-factor ≤ 0.30; SHGC ≤ 0.40. *(up to 15 ft² of window area is exempt)*	U-factor ≤ 0.30; SHGC ≤ ~0.23 (SHGC varies by climate zone)
Residential Skylights	U-factor ≤ 0.55; SHGC ≤ 0.40.	U-factor ≤ 0.55; SHGC ≤ 0.30. (SHGC varies by climate zone)
Commercial Windows (Fixed)	U-factor ≤ ~0.38; SHGC ≤ 0.36.	U-factor ≤ 0.36 (fixed fenestration); SHGC requirements vary by climate zone
Commercial Windows (Operable)	U-factor ≤ ~0.45; SHGC ≤ 0.36.	U-factor ≤ 0.46 (operable); SHGC varies by climate zone
Commercial Storefront / Curtain Wall	U-factor ≤ ~0.41 for curtain wall/storefront glazing; SHGC ≤ 0.36.	U-factor ≤ 0.41 (curtain wall/storefront); SHGC varies by climate zone

District of Columbia. (2017). *2017 District of Columbia energy conservation code*. https://os.dc.gov/sites/default/files/dc/sites/os/publication/attachments/2017%20Energy%20Conservation%20Code.pdf

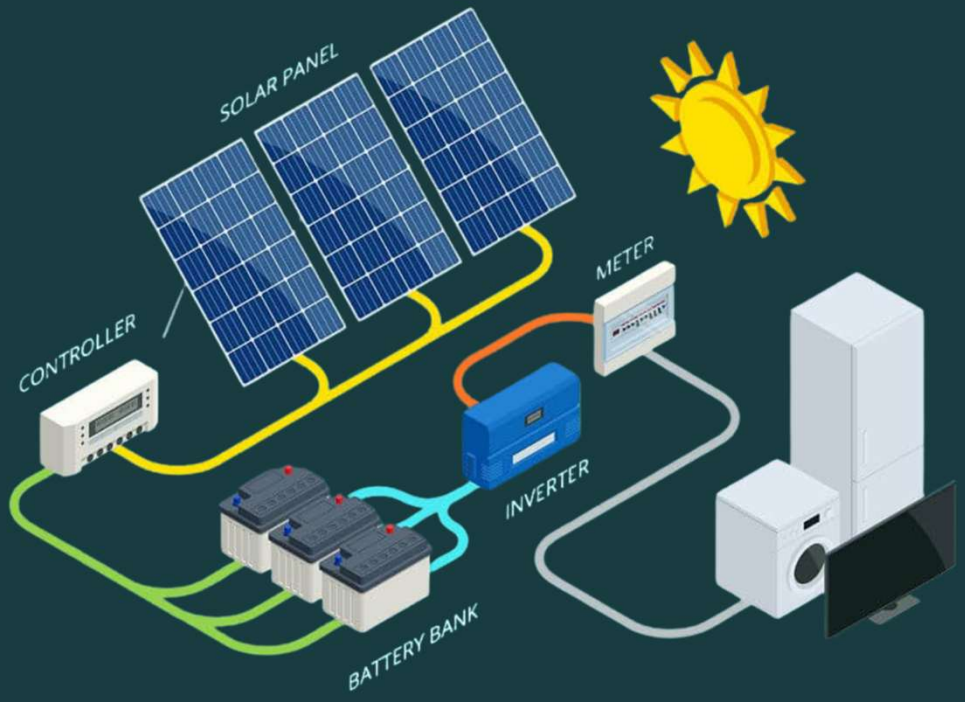
Solar PV & Battery Storage

Photovoltaic (PV) Requirements

- New construction requires PV
- Two equations:
  - Total SARAs x 14 W/ft^2
  - kW_{PVdc} = (CFA x A) / 1000

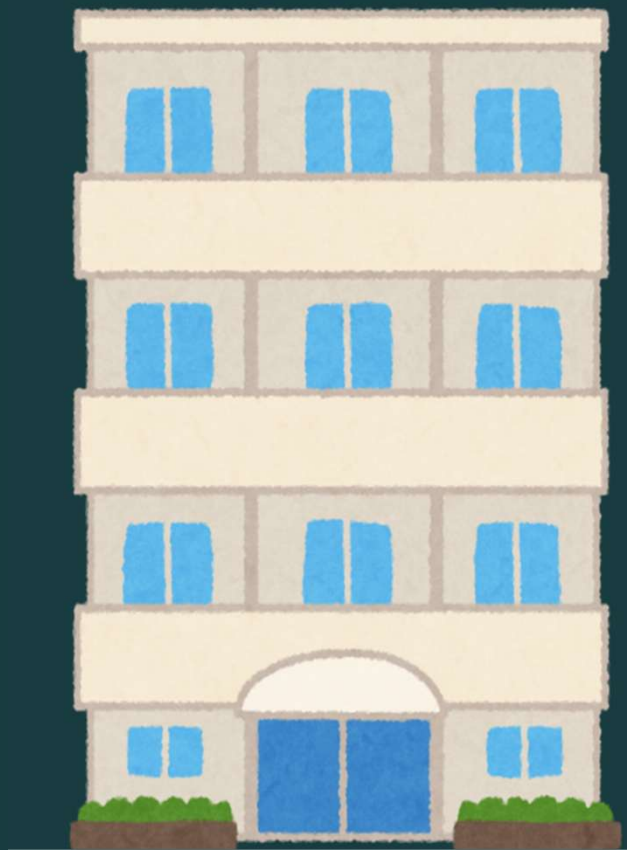
Battery Storage Requirements

- Commercial buildings that require PV require battery storage system



BEPS versus Title 24

- Existing Buildings vs All Types
- 50,000sf (private) or 10,000sf (district) vs Any Size
- Scored by Energy Star or Source EUI vs Energy Design Rating
- 3rd Party Verification Starting 2024 vs HERS Raters



Clean Energy DC Omnibus Amendment Act of 2018, (2024). https://code.dccouncil.gov/us/dc/council/code

What Are Reach Codes?

Building Electrification

Requiring heat pumps as the primary heating system or for any new air conditioning installation

Energy Efficiency

Implementing stricter requirements for energy efficiency in new buildings

EV Infrastructure

Mandating the installation of electric vehicle (EV) charging infrastructure or EV-capable parking spaces

Water Efficiency

Including measures for increased water efficiency and conservation

California Energy Codes & Standards. (n.d.-a). Statewide Reach Codes Program. https://localenergycodes.com/

Title 24 Challenges

Added Cost

Heat Pump WH = $2000 - $6000
VS
Gas Tanked WH = $500 - $2000

Solar on 2000 sqft home =
$20,000 - $30,000

Verification

- Added inspections not foreseen
- Title 24 must match exactly what is installed
- Added cost to complete inspections

TITLE 24 COMPLIANT

Equity & Access

- Energy Savings Assistance (ESA) program helps low-income customers receive energy-efficient upgrades

What Can We Learn?

Transferable Strategies

- 3-Track Structure (Mandatory, Prescriptive, Performance)
- 3rd Party Verification
- “Electric-Ready” Provisions

Adding Local Context

- Codes must match local climate and building stock realities (16 CA specific Climate Zones)
- Ability to create reach codes

Use of Testing Ground

- Watch how builders, manufacturers, and utilities respond to code updates
- Early adoption accelerates technology readiness and cost reduction

Useful Links

NRG Compliance:
https://nrgcompliance.com/

Energy Code Ace:
https://energycodeace.com/

California Local Reach Codes:
https://localenergycodes.com/

DC Energy Code Handbook:
https://dob.dc.gov/sites/default/files/dc/sites/dob/publication/attachments/2017%20DC%20Energy%20Code.pdf

California EPA Dashboard
https://calepa.ca.gov/climate-dashboard/

World Greenhouse Gas Emissions Charts
https://www.wri.org/insights/4-charts-explain-greenhouse-gas-emissions-countries-and-sectors

Thank you! Any Questions?

Connect with us on LinkedIn!

Contact- Benjamin Montalbano

benjamin.montalbano@setty.com

Any design & commissioning questions?

Contact **marketing@setty.com**

Contact- Olivia Parker-Swenson

olivia.parker@setty.com

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