

U.S. DEPARTMENT OF  
**ENERGY**

Office of  
ENERGY EFFICIENCY &  
RENEWABLE ENERGY

# Buildings, the Final Frontier: Advanced Technology and the Role of Building Codes

National Energy Codes Conference Seminar Series

Building Technologies Office

Fall 2020



# NECC Seminar Series Lineup

Catch the entire lineup of sessions weekly—Thursdays @ 1p ET:

- 10/01: Kickoff to the Series
- 10/08: Electronic Permitting
- 10/15: HVAC for Low-Load Homes
- 10/22: Performance-Based Compliance
- 10/29: 2021 IECC Commercial
- 11/05: Remote and Virtual Inspections
- 11/12: New for ASHRAE Standard 90.1
- 11/19: 2021 IECC Residential
- 11/24: Energy Codes Around the World
- **12/03: Advanced Technology and Codes**
- 12/10: Policies for EE + Resilience
- 12/17: Field Studies in the NW Region

> Learn more: [energycodes.gov/2020-building-energy-code-webinar-series](https://energycodes.gov/2020-building-energy-code-webinar-series)





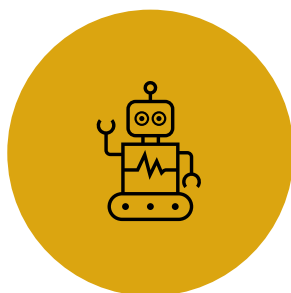
# Buildings, the Final Frontier: Advanced Tech and the Role of Building Codes

December 3, 2020



# Agenda

12:00pm-1:30pm



Introductions



Speaker Panel



Discussion

In what region are you located? (Single Choice)

- West
- Southwest
- Midwest
- Northeast
- Southeast

Which most closely aligns with your profession? (Single Choice)

- Architect/Engineer
- Builder/Trades
- Code Official/Plan Reviewer/3rd Party Verifier
- NGO/Non-Profit/Consultant
- University/Federal/State/Local Govt.

# Buildings, the Final Frontier: Advanced Tech and the Role of Building Codes



# Our Speakers



Scott V. Prisco  
Chief Building Official,  
Denver, CO



Christopher Perry  
Research Manager,  
ACEEE



Beth Tubbs  
Senior Staff Engineer,  
International Code Council

# Presentation Panel

# "Buildings, the Final Frontier: Advanced Tech and the Role of Building Codes"

## Electric Vehicles/Renewables in Denver

*Scott Prisco, AIA LEED AP, Engineer/Architect Director | Chief Building Official*





# DENVER

COMMUNITY PLANNING  
& DEVELOPMENT

## Agenda

### Electric Vehicles and Renewables:

Climate Work in Denver	1
EV Charging Stations	2
Renewable Energy	3
Additional Resources	4

# Climate Work in Denver

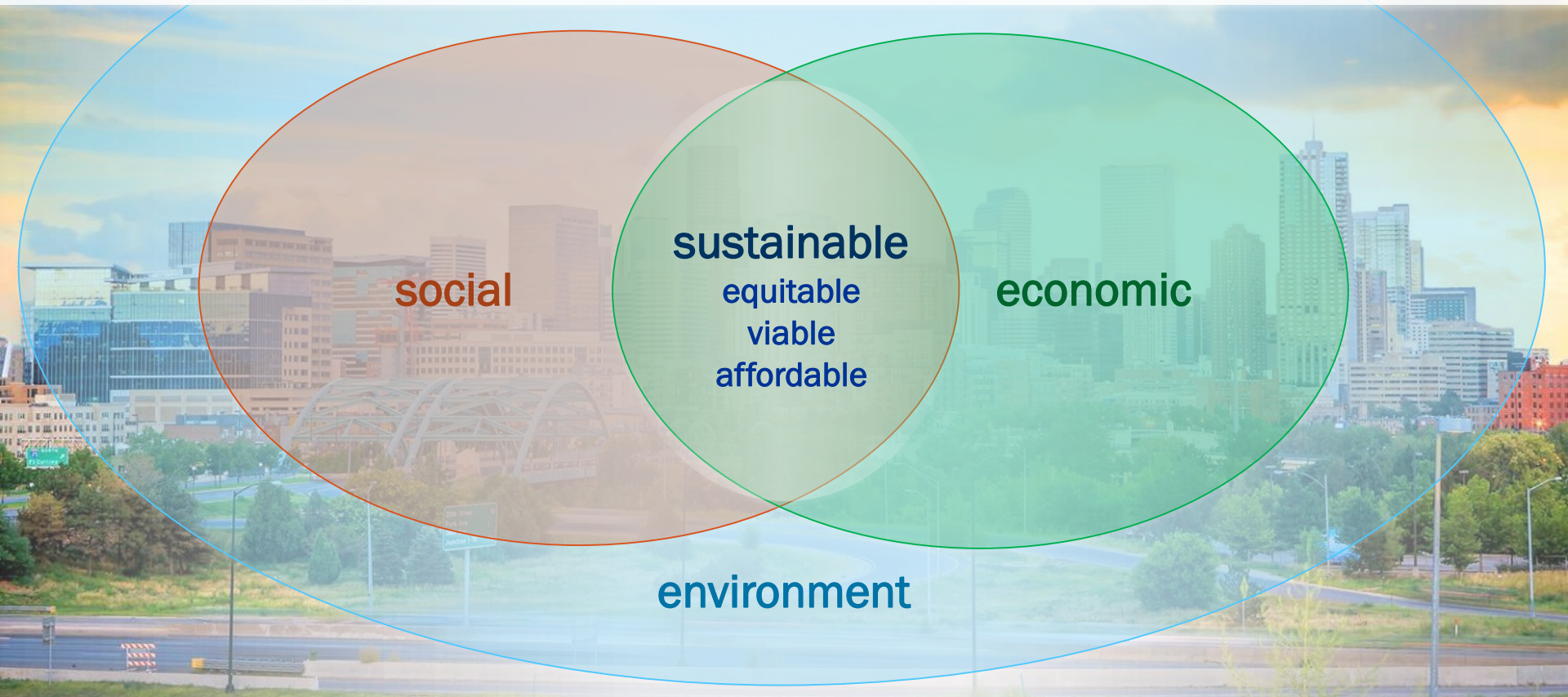


# Denver Community Goals + Priorities

A background image of the Denver skyline at sunset, with various skyscrapers and a large park area in the foreground featuring a blue arched bridge structure and green trees.

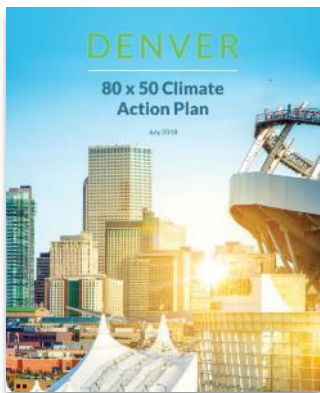
Equity  
Respond to Climate Change  
Affordability  
Resiliency  
Health  
Inclusive  
Connected  
Safe  
Accessible  
Economically vibrant  
Active  
Authentic neighborhoods

# Context of Building Performance Goals: Denver's Long Term Viability



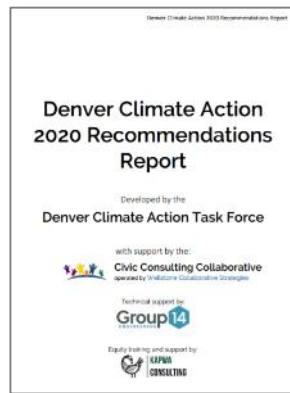
# Denver's long-term climate goal

*2018 commitment from the Mayor*



Reduce GHG emissions **80%**  
by 2050 from 2005 baseline

*Even bolder recommendations from the public*



Reduce GHG emissions **100%**  
by 2040 from 2005 baseline

**We can reduce greenhouse gas emissions AND advance equity and racial justice.**

# Supporting Denver Community Goals

Community speaks ->  
City responds

Stakeholder Committees +  
Community Engagement ->

## Plans

*Denver 80x50 Plan*

*Denver Climate Action  
2020 Recommendations*

*Net Zero Energy New  
Buildings Implementation  
Plan 2035*

*Denver Electric Vehicles  
(EV) Action Plan*



Code Amendments  
Ordinances  
Regulations  
Policies  
Guidelines

*Energize Denver  
Benchmarking Ordinance*

*I-Code Amendments*

*Green Buildings Ordinance*

*Denver Green Code*

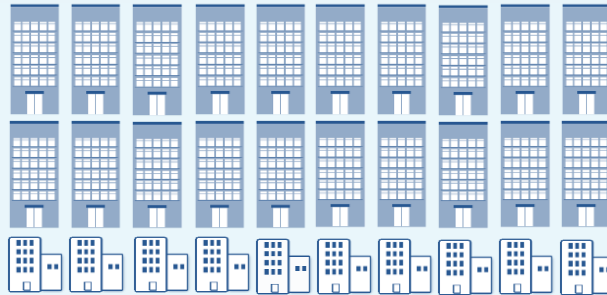
*Executive Order 123*

# GHG Emissions: Transportation + Buildings

Homes + buildings = 63% of Denver's GHG Emissions; 40% new by 2050  
Transportation = 30% of Denver's GHG Emissions



12% GHG



51% GHG



30% GHG

Electric vehicles = GHG emissions affected through regulations including building codes

# EV Charging Stations

2

# Denver Electric Vehicle (EV) Action Plan



City and County of Denver

## Denver Electric Vehicle (EV) Action Plan

April 2020

### Goals

2025

15% Denver vehicle registrations electric

2030

30% Denver vehicle registrations electric

2050

100%

Denver light duty vehicles electric

### Challenges

Adoption rates of EV vehicles too low

Chargers unavailable

(April 2020)

# Plug In America EV City Award

[ABOUT US](#) | [GET EQUIPPED](#) | [PRESS ROOM](#)



[JOIN US](#)

[DONATE](#)

**Plug In  
America.**

[WHY GO PLUG-IN?](#)

[VEHICLES](#)

[SHOP FOR EVS](#)

[TAKE ACTION](#)

[POLICY](#)



[Home](#) | [About Us](#) | [Drive Electric Awards](#)

## Drive Electric Awards

### EV City Award: Denver

Denver, led by Mayor Michael Hancock, is advancing electric vehicle adoption through several methods. City leaders have set a goal of having 30% of the vehicles on Denver's roads be electric by 2030, are expanding the city's EV charging infrastructure, and are adding 200 EVs to the city's fleet. They have also implemented a new building code that requires all new buildings to be ready for EV charging, created an electric car sharing program in underserved communities, and are expanding outreach efforts.

**September 2020**

**Meaningful Plans**

**Leadership  
Recognition**

# *Mandatory 2018 IECC 2019 DBCA*

## **Electric Vehicle Definitions:**

### **EV Ready:**

A parking space provided with dedicated conduit and conductors for future EVSE, terminated at a junction box or outlet box, receptacle, or EVSE equipment at parking space

### **EV Capable:**

A parking space provided with conduit from the panelboard to the parking space, and space in the panelboard, but wire is not run to space

### **EVSE Installed:**

A parking space with EV supply equipment installed at the parking space

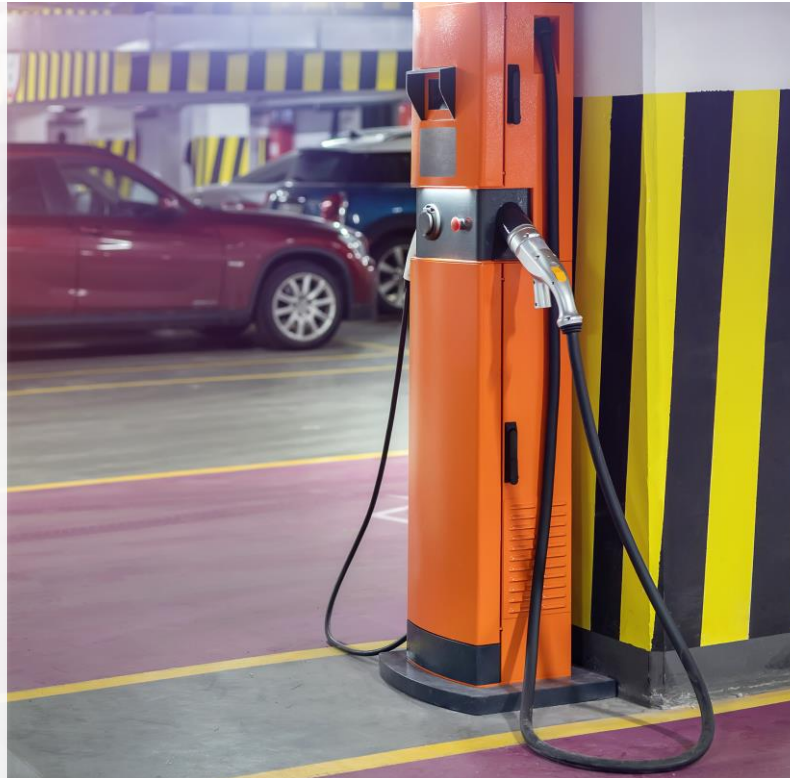


# *Mandatory 2018 IECC 2019 DBCA:*

## When are EV parking spaces required?

### Commercial + Multi-Family

- 1 New construction
- 2 Level 3 alternations (remodel 50% GFA)
- 3 Parking spaces added or modified
- 4 When both new EVSE installed and/or EV ready space + new accessible provided, at least one accessible = EVSE installed or EV ready



### One + Two Family Dwellings + IRC Townhouses

Each dwelling unit with dedicated attached or detached parking garage or on-site parking space = provided with **at least one EV ready space**

# Mandatory 2018 IECC 2019 DBCA

## Building Electric Vehicle Requirements:

**MULTI-FAMILY BUILDINGS**  
and all other R Occupancies  
To comply with Table C405.10.1

(One and two family dwellings,  
townhouses with on site garage or  
parking space require one EV ready  
space)

	NUMBER OF LEVEL 2 EV READY SPACES	NUMBER OF LEVEL 2 EV CAPABLE SPACES	NUMBER OF LEVEL 2 EVSE INSTALLED SPACES
1 Space	1	None	None
2 to 9 spaces	1	20% of spaces	None
10 or more spaces	15% of spaces	Remainder of spaces	5% of spaces

**COMMERCIAL BUILDINGS**  
Group A, B, E, I, M, S-2 Occupancies  
to comply with Table C405.10.1

(Assembly bldgs., offices, schools,  
Medical clinics & hospitals, mercantile,  
Parking garages)

	NUMBER OF LEVEL 2 EV READY SPACES	NUMBER OF LEVEL 2 EV CAPABLE SPACES	NUMBER OF LEVEL 2 EVSE INSTALLED SPACES
1 Space	1	None	None
2 to 9 spaces	1	1	None
10 or more spaces	10% of spaces	10% of spaces	5% of spaces

# *Errata: Mandatory 2018 IECC 2019 DBCA:*

## How are EV parking spaces calculated?



Total new + existing  
parking spaces

70% minimum required  
EV spaces = amongst  
50% closest to intended  
entrance

# Renewable Energy

3

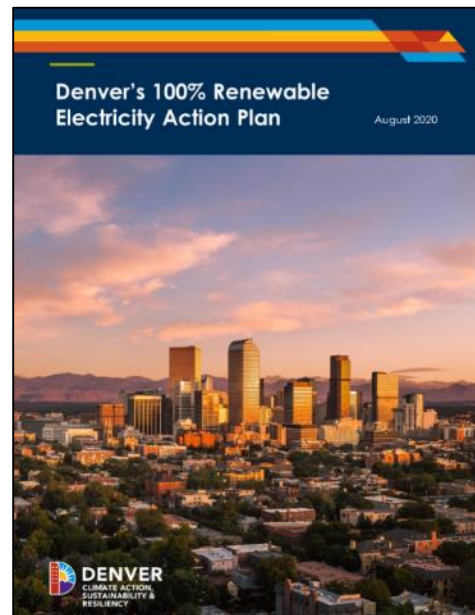
# Denver's Renewable Electricity Goals

**Denver's renewable vision is to enable a rapid and equitable transition to a 100% renewable electric system in Colorado.**

*By 2030, 100% of Denver's community-wide electricity use will contribute to this vision.*

## **Priorities:**

1. Maximize investments in local renewable energy sources.  
(including by creating and transferring additive RECs to Xcel Energy)
2. Produce co-benefits such as workforce development, utility bill savings, and more resilient public facilities.



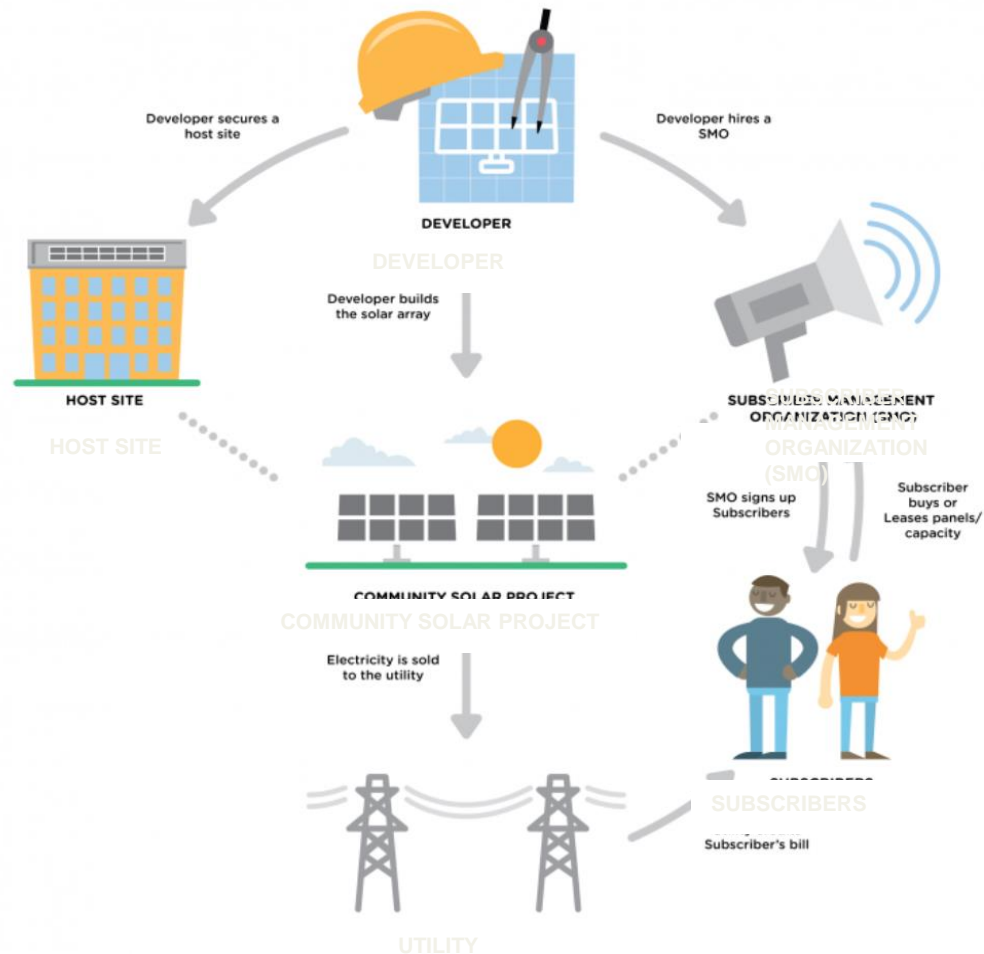
# Community solar advances Denver's climate and community objectives

Community solar is **shared** solar.

Community solar means the solar can be located anywhere in the community – like a field, a building, or a parking lot – and be attributed to any Xcel Energy customer.

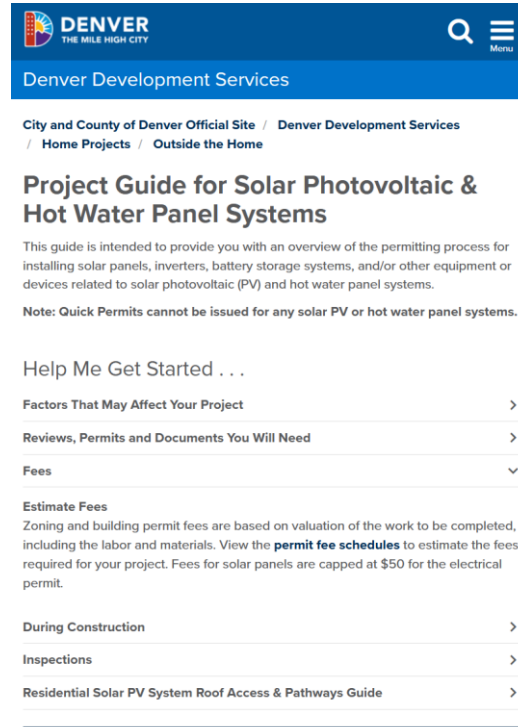
Community solar provides the benefits of renewable energy to those who do not own their home, are solar limited, or simply do not want a solar array.

Image Source: [Elevate Energy](#)



# Permit Fees for Solar Panels

Permit fees for solar panels are capped at \$50 for the electrical permit



The screenshot shows the Denver Development Services website. At the top is a blue header with the Denver logo and navigation icons. Below the header is a breadcrumb trail: "City and County of Denver Official Site / Denver Development Services / Home Projects / Outside the Home". The main heading is "Project Guide for Solar Photovoltaic & Hot Water Panel Systems". A paragraph explains the guide's purpose: "This guide is intended to provide you with an overview of the permitting process for installing solar panels, inverters, battery storage systems, and/or other equipment or devices related to solar photovoltaic (PV) and hot water panel systems." A note states: "Note: Quick Permits cannot be issued for any solar PV or hot water panel systems." Below this is a "Help Me Get Started . . ." section with a list of links: "Factors That May Affect Your Project", "Reviews, Permits and Documents You Will Need", "Fees", "Estimate Fees", "During Construction", "Inspections", and "Residential Solar PV System Roof Access & Pathways Guide". The "Fees" link is highlighted with a blue arrow pointing to the text on the right.

DENVER  
THE MILE HIGH CITY

Denver Development Services

City and County of Denver Official Site / Denver Development Services  
/ Home Projects / Outside the Home

## Project Guide for Solar Photovoltaic & Hot Water Panel Systems

This guide is intended to provide you with an overview of the permitting process for installing solar panels, inverters, battery storage systems, and/or other equipment or devices related to solar photovoltaic (PV) and hot water panel systems.

Note: Quick Permits cannot be issued for any solar PV or hot water panel systems.

Help Me Get Started . . .

- Factors That May Affect Your Project
- Reviews, Permits and Documents You Will Need
- Fees
- Estimate Fees
- During Construction
- Inspections
- Residential Solar PV System Roof Access & Pathways Guide

Project Guide for solar photovoltaic and hot water panel systems available at [denvergov.org/ds](https://denvergov.org/ds)

# 2018 IECC Appendix RA - Solar Ready Zones

**Requires sections of the roof reserved for the future installation of solar photovoltaic or solar thermal systems**

**Applicability:**

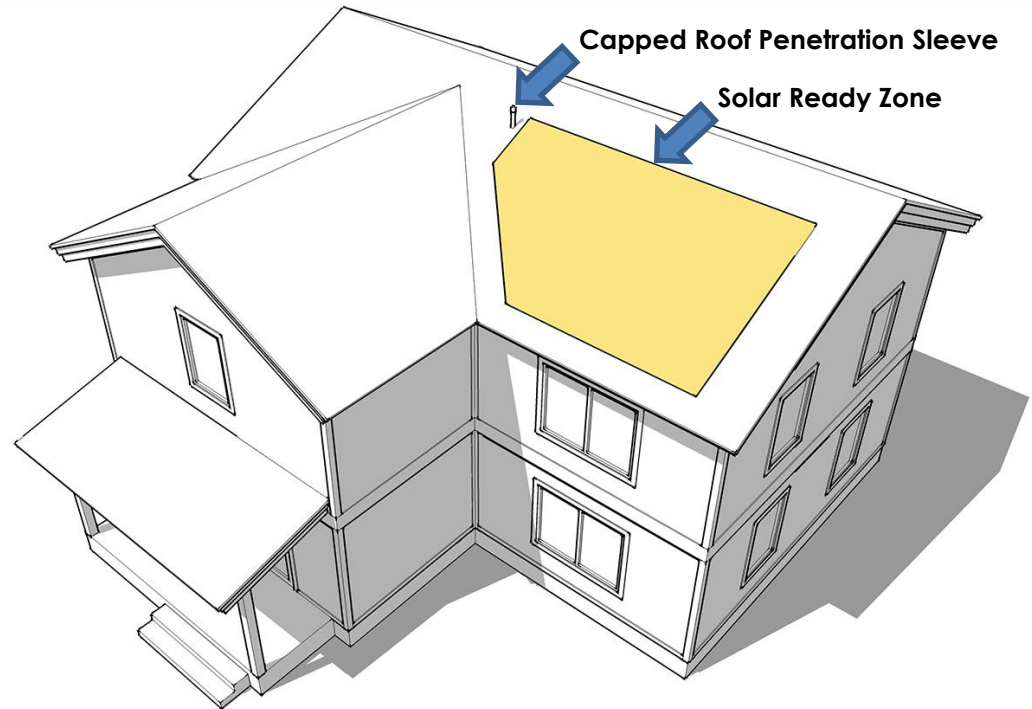
For new detached one- and two-family dwellings and townhouses with not less than 600-square feet of roof area oriented between 90 degrees and 270 degrees of true north

**Minimum size:**

Solar ready zone area shall be not less than 300-square feet and free from obstructions

**Documentation:**

Construction documents shall indicate the solar-ready zone



# 2018 IRC Section R324.6 – Roof Access

**Requires roof access, pathways, and setbacks for firefighting operations when photovoltaic arrays are installed**

## **Pathways:**

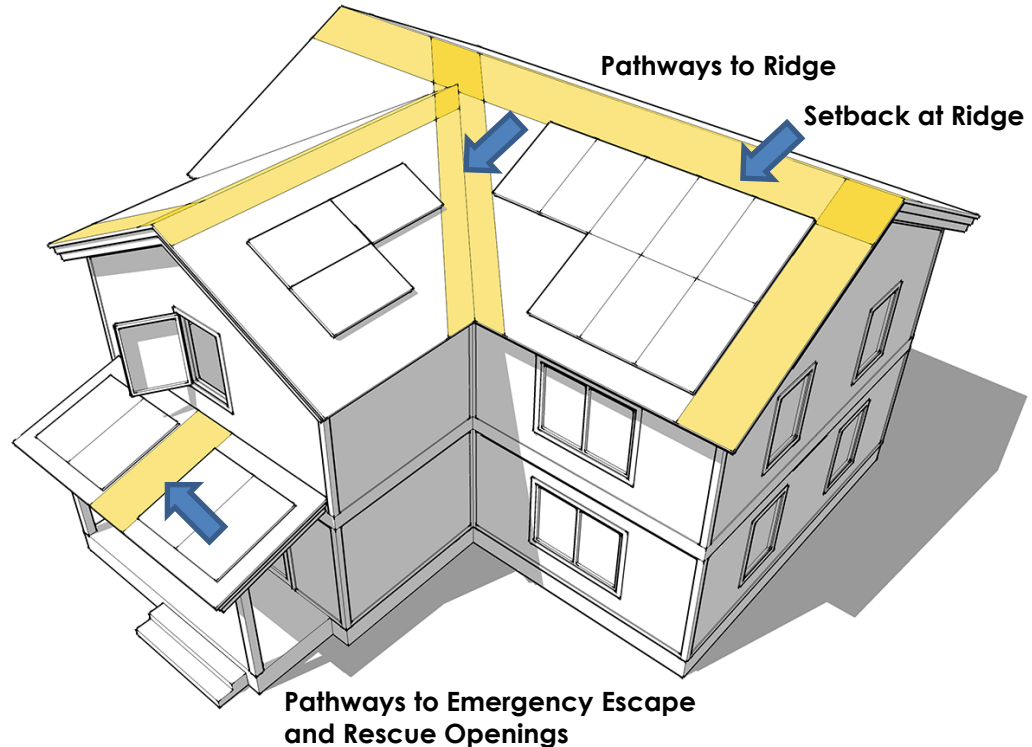
Not fewer than two pathways from lowest roof edge to ridge, and not fewer than one pathway for each roof plane with a photovoltaic array

## **Setback at Ridge:**

Clear setback required on both sides of a horizontal ridge

## **Emergency Escape and Rescue Openings:**

Panels and modules shall not be placed on the portion of a roof that is below an emergency escape and rescue opening



# 2018 GBO Options for New Buildings

## Green Space:



Green space on the roof, terraces, podiums, or at grade\*

\$ Payment for same amount of off-site green space

## Energy Conservation:



Solar production equal to 70% of roof area – onsite, community solar, or purchased from Xcel\*

A minimum of 12% energy savings above current codes

## Combination Approaches:



Green space and solar\*

Green space and 5% energy savings above codes

## Certifications:



Third-party green building certifications

\*Campus option

# 2018 GBO for Existing Buildings

## Green Space:



Green space on the roof, terraces, podiums, or at grade\*

\$ Payment for same amount of off-site green space

## Onsite Solar:



Install solar to cover 42% of the roof, 5% of GFA, or an area sufficient to meet 100% of the building's annual electricity consumption\*

## Energy Program:



Enroll in a flexible energy program to achieve similar greenhouse gas emission reductions as onsite solar

## Certifications:



Third-party green building certifications

\*Campus option

# 2019 Denver Green Code - Optional

## Commercial + Residential Compliance Options:

# 1

Denver  
Green Code



Photo Credit: International Code Council

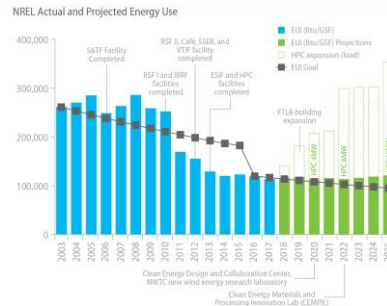
# 2

LEED  
Platinum



# 3

Net Zero  
Energy



# 4

Passive House +  
Non-energy DGC



# Future Code Amendment Proposals

## Commercial & Multifamily Renewable Energy

	<u>Renewable Energy</u>			
	2021	2024	2027	2030
Minimum renewable offset	50%	75%	100%	100%
Minimum % Roof Area	25%	50%	70%	70%

Possible 2021 IECC Amendments:

- Renewables requirements (per table above)
- Additional renewables can get points in C406

Renewable Options

- Onsite solar
- Proposed Renewable Denver Community Solar Fund

# Future Code Amendment Proposals

## Residential Renewable Energy

Building Type	ERI (Energy Rating Index)	
	2021	2024
Single family homes	Max ERI = 50 ERI w/PV = 40	Max ERI = 45 ERI w/PV = 0

Possible 2021 IECC Amendments:

- Renewable requirements (per table above)
- Specify PV for prescriptive path
- Calibration needed to ensure prescriptive/performance/ERI paths align

Renewable Options

- Onsite solar
- Proposed Renewable Denver Community Solar Fund

# Market + Regulations



Regulations

Accountability +  
defined  
responsibilities

Community /  
Market

# Resources

4

# Scott V. Prisco, AIA, LEED AP

Engineer/Architect Director | Chief Building Official

Community Planning and Development | City and County of Denver

O: 720.865.3206 C 303.349.1592 | [scott.prisco@denvergov.org](mailto:scott.prisco@denvergov.org)

[DenverGov.org/CPD](https://denvergov.org/CPD) | [Twitter](#) | [Instagram](#) | [Take our Survey](#)

CONNECT WITH US | [311](#) | [pocketgov.com](https://pocketgov.com) | [denvergov.org](https://denvergov.org) | [Denver 8 TV](#) | [Facebook](#)



**DENVER**  
THE MILE HIGH CITY

# Denver Community Planning + Development | Development Services Newsletter

Track I-Code Denver  
amendment process  
+ opportunities to  
engage

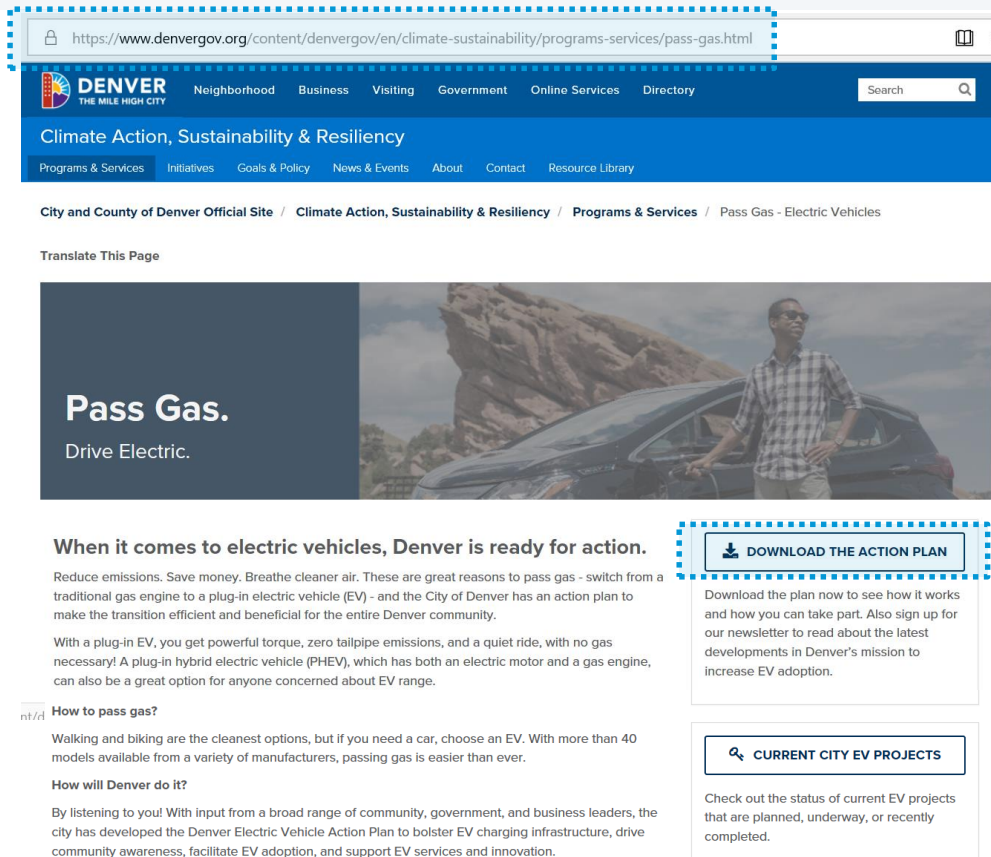
Sign up

The screenshot shows the Denver Development Services website. The URL in the browser is <https://www.denvergov.org/content/denvergov/en/denver-development-services.html>. The website header includes the Denver logo and navigation links: Neighborhood, Business, Visiting, Government, Online Services, and Directory. A search bar is also present. Below the header, the page title is "Denver Development Services". A secondary navigation bar lists: Home Projects, Commercial Projects, Small Business Services, Help Me Find..., Contractor Licenses, and Contact Us. A banner for "City and County of Denver Official Site / Denver Development Services" is displayed. A prominent orange and white alert box titled "Novel Coronavirus (COVID-19) Update" states: "To protect the health and well-being of our community, the Community Planning and Development permit counter is temporarily closed. All projects must apply and pay for permits online. Instructions for our online services". Below this, a large image of a city skyline with a construction crane is featured. Overlaid on the image is the text: "Denver Adopts a New Building and Fire Code. On December 26, Denver adopted an updated building and fire code which also included a 'Denver Green Code' designed to encourage more sustainable design and construction practices." To the right of the image, a vertical list of links is shown: "Apply by email", "Location and hours", "Permit counter services", "Make an appointment", "Sign up for our newsletter" (highlighted with a blue dashed border), and "Send us feedback". At the bottom right, a "Quick Links" dropdown menu is visible. The footer of the page repeats the URL: <https://www.denvergov.org/content/denvergov/en/denver-development-services.html>.

# Denver Office Climate Action, Sustainability + Resiliency **Electric Vehicle Page**

Track Denver **Electric Vehicle Action Plan** updates + opportunities to engage

Contact the CASR **Electric Vehicle team** (bottom of the webpage)



The screenshot shows the Denver Office Climate Action, Sustainability & Resiliency website. The URL in the browser is <https://www.denvergov.org/content/denvergov/en/climate-sustainability/programs-services/pass-gas.html>. The page features a blue header with the Denver logo and navigation links. The main content area includes a large image of a man standing next to a dark car, with the text "Pass Gas. Drive Electric." overlaid. Below this, there is a section titled "When it comes to electric vehicles, Denver is ready for action." which discusses the benefits of electric vehicles and provides information on how to pass gas. A sidebar on the right contains a "DOWNLOAD THE ACTION PLAN" button and a "CURRENT CITY EV PROJECTS" section.

**Pass Gas. Drive Electric.**

**When it comes to electric vehicles, Denver is ready for action.**

Reduce emissions. Save money. Breathe cleaner air. These are great reasons to pass gas - switch from a traditional gas engine to a plug-in electric vehicle (EV) - and the City of Denver has an action plan to make the transition efficient and beneficial for the entire Denver community.

With a plug-in EV, you get powerful torque, zero tailpipe emissions, and a quiet ride, with no gas necessary! A plug-in hybrid electric vehicle (PHEV), which has both an electric motor and a gas engine, can also be a great option for anyone concerned about EV range.

**How to pass gas?**

Walking and biking are the cleanest options, but if you need a car, choose an EV. With more than 40 models available from a variety of manufacturers, passing gas is easier than ever.

**How will Denver do it?**

By listening to you! With input from a broad range of community, government, and business leaders, the city has developed the Denver Electric Vehicle Action Plan to bolster EV charging infrastructure, drive community awareness, facilitate EV adoption, and support EV services and innovation.

**DOWNLOAD THE ACTION PLAN**

Download the plan now to see how it works and how you can take part. Also sign up for our newsletter to read about the latest developments in Denver's mission to increase EV adoption.

**CURRENT CITY EV PROJECTS**

Check out the status of current EV projects that are planned, underway, or recently completed.

# Denver Office Climate Action, Sustainability + Resiliency Climate Work Main Page

Track Denver climate action plans, initiatives, + opportunities to engage

Sign up for climate topic specific newsletters (bottom of the webpage)

Sign Up to Learn More about our Programs & Initiatives

First Name

Last Name

Organization

Email Address \*

\* indicates required

Programs & Initiatives

\* If you do not select a Program(s) or Initiative(s), you will still be subscribed to our main list for major updates.

☐ 100% Renewable Electricity

☐ Cannabis Sustainability

☐ Certifiably Green Denver

☐ Climate Action

☐ Electric Vehicles

☐ Sustainable Neighborhoods

High Performance Buildings & Homes

☐ Existing Buildings and Homes

☐ New Buildings and Homes

☐ Smart Leasing

https://www.denvergov.org/content/denvergov/en/climate-sustainability.html

**DENVER**  
THE MILE HIGH CITY

Neighborhood Business Visiting Government Online Services Directory

Search

Climate Action, Sustainability & Resiliency

Programs & Services Initiatives Goals & Policy News & Events About Contact Resource Library

City and County of Denver Official Site / Climate Action, Sustainability & Resiliency

Translate This Page

Climate Action, Sustainability and Resiliency

**Residents**

**Businesses**

**Partners**

# Colorado EV Plan 2020

https://energyoffice.colorado.gov/zero-emission-vehicles



[Coronavirus Disease 2019 \(COVID-19\) in Colorado: State & National Resources](#)



**COLORADO**  
Energy Office

Search

[Climate & Energy](#) > [Zero Emission Vehicles](#) > [Clean Energy Programs](#) > [Weatherization Assistance](#) > [About Us](#) >

[Home](#) > [Zero Emission Vehicles](#)

## Zero Emission Vehicles

Zero Emissions Vehicles

Colorado EV Plan 2020

[Alt Fuel Vehicle Tax Credits](#)

[Electric Vehicle Fast-Charging  
Corridors](#)

[EV Charging Station Grants](#)

[EV Coaching Services](#)



# Colorado EV Executive Order

 [https://www.colorado.gov/governor/sites/default/files/inline-files/b\\_2019-002\\_supporting\\_a\\_transition\\_to\\_zero\\_emissions\\_vehicles.pdf](https://www.colorado.gov/governor/sites/default/files/inline-files/b_2019-002_supporting_a_transition_to_zero_emissions_vehicles.pdf)



**COLORADO**

Gov. Jared Polis

**B 2019 002**

## **EXECUTIVE ORDER**


### **Supporting a Transition to Zero Emission Vehicles**

Pursuant to the authority vested in me by Article IV, Section 2 of the Colorado Constitution, I, Jared S. Polis, Governor of the State of Colorado, hereby issue this Executive Order supporting a transition to zero emission vehicles.


# Colorado GHG Pollution Reduction Roadmap

Accela Autr Green Buil Mail - Gree Join conver IECC-Mech GHG P Photograph Communic Climate Stz

← → ↺ 🏠 <https://energyoffice.colorado.gov/climate-energy/ghg-pollution-reduction-roadmap> 📖 ☆ ⌵ ⌵ ⌵ ⌵ ⌵

 **COLORADO**  
Official State Web Portal

Online Services State Agencies

 **COLORADO**  
Energy Office

Search 🔍

Climate & Energy > Zero Emission Vehicles > Clean Energy Programs > Weatherization Assistance > About Us >

263 Shares

Home > Climate & Energy > GHG Pollution Reduction Roadmap

## GHG Pollution Reduction Roadmap

Climate & Energy ▾

GHG Pollution Reduction Roadmap

Energy Policy >

Electricity >

Renewable Energy >

Traditional Energy >


Propane in Colorado

Local Government Resource Guide

On September 30, 2020, Colorado released a public comment draft of its [Greenhouse Gas Pollution Reduction Roadmap](#) which details early action steps the state can take toward meeting the near-term goals of reducing greenhouse gas (GHG) pollution 26% by 2025 and 50% by 2030 from 2005 levels. The state is seeking comment on additional action steps to reduce GHG pollution and reap the full benefits of swiftly and equitably transitioning to a clean energy economy. Comments are due by 5:00 p.m. MT on November 1, 2020. You may submit them via this [web form](#) or by emailing [climatechange@state.co.us](mailto:climatechange@state.co.us).

Findings show that meeting the 2025 and 2030 goals is achievable with existing cost effective technologies, but progressing toward these goals will require additional policies beyond the actions the state has taken already. The preliminary results show that Colorado will need to:

- Continue the transition to renewable energy
- Significantly expand adoption of electric cars, trucks and buses
- Change transportation and land use planning to reduce the need to drive



<https://energyoffice.colorado.gov/climate-energy/ghg-pollution-reduction-roadmap>

12:07 AM 10/6/2020 24

# More!

## Denver Community Goals + Future Code Cycle Targets

### Green Buildings Ordinance

### 2019 Denver Green Code + 2021 DGC Proposals

Christy Collins – Community Planning and Development | Development Services, Green Buildings Lead  
720.865.2766

[Christy.Collins@denvergov.org](mailto:Christy.Collins@denvergov.org)

### 2018 International Energy Conservation Code (IECC) +

### 2019 Denver Building Code Amendments (DBCA) +

### 2021 IECC + DBCA Proposals

Keith Fox – Community Planning and Development | Development Services, IECC Lead  
720.865.2816

[Keith.Fox@denvergov.org](mailto:Keith.Fox@denvergov.org)

# Grid-Interactive Efficient Buildings and the Role for Building Energy Codes

**Buildings, the Final Frontier: Advanced  
Technology and the Role of Building Codes**

**DOE Energy Codes Webinar Series**

**December 3, 2020**

**Chris Perry, PE**

[cperry@aceee.org](mailto:cperry@aceee.org)

**Research Manager, Buildings Program**

# Agenda

## Brief GEB Overview

## Enabling Policies for GEBs

- CA Senate Bill 49
- FERC Order 2222

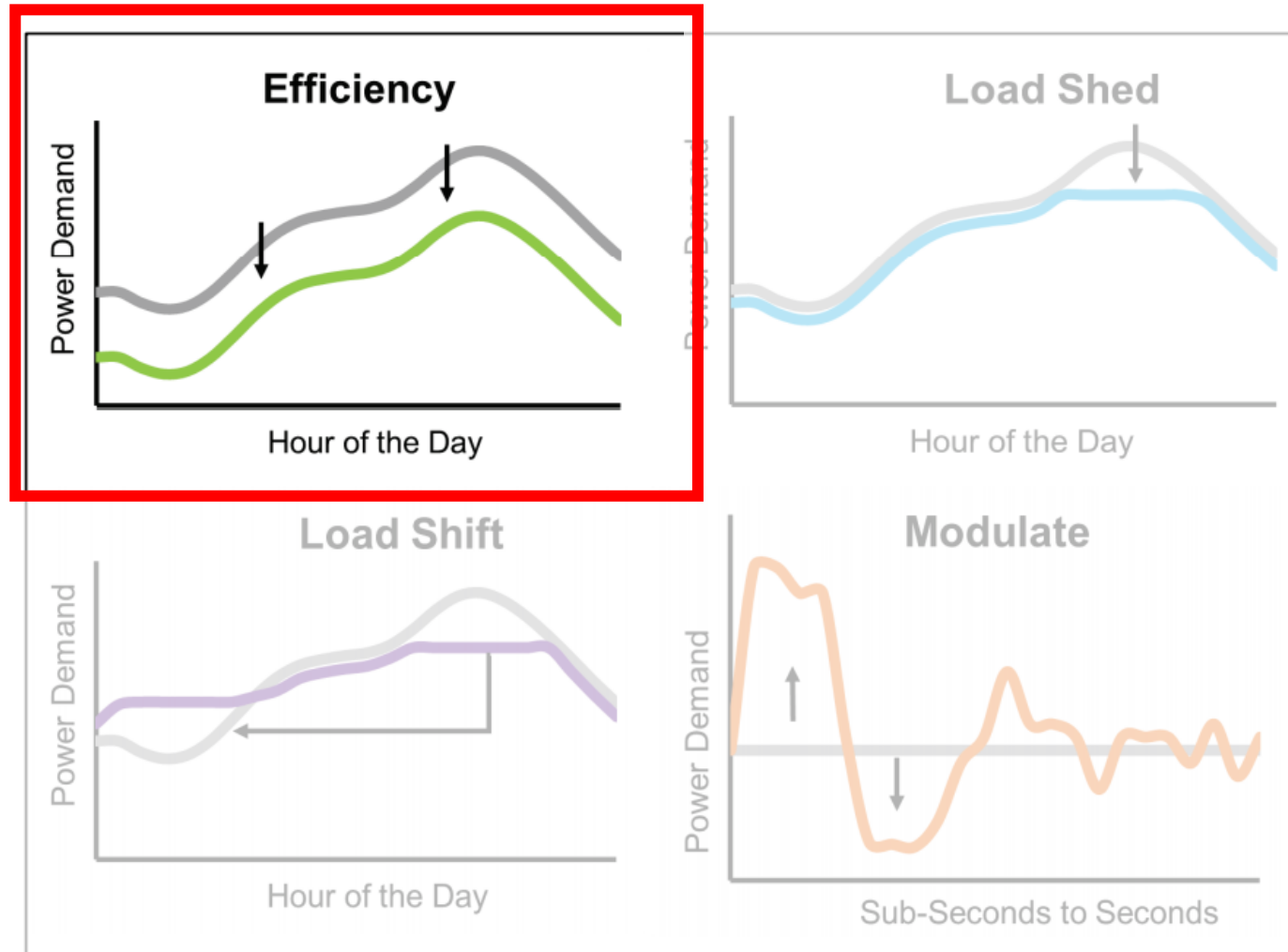
## Current Status of GEBs in Energy Codes

- ASHRAE
- IECC
- California and LEED
- Key Resources

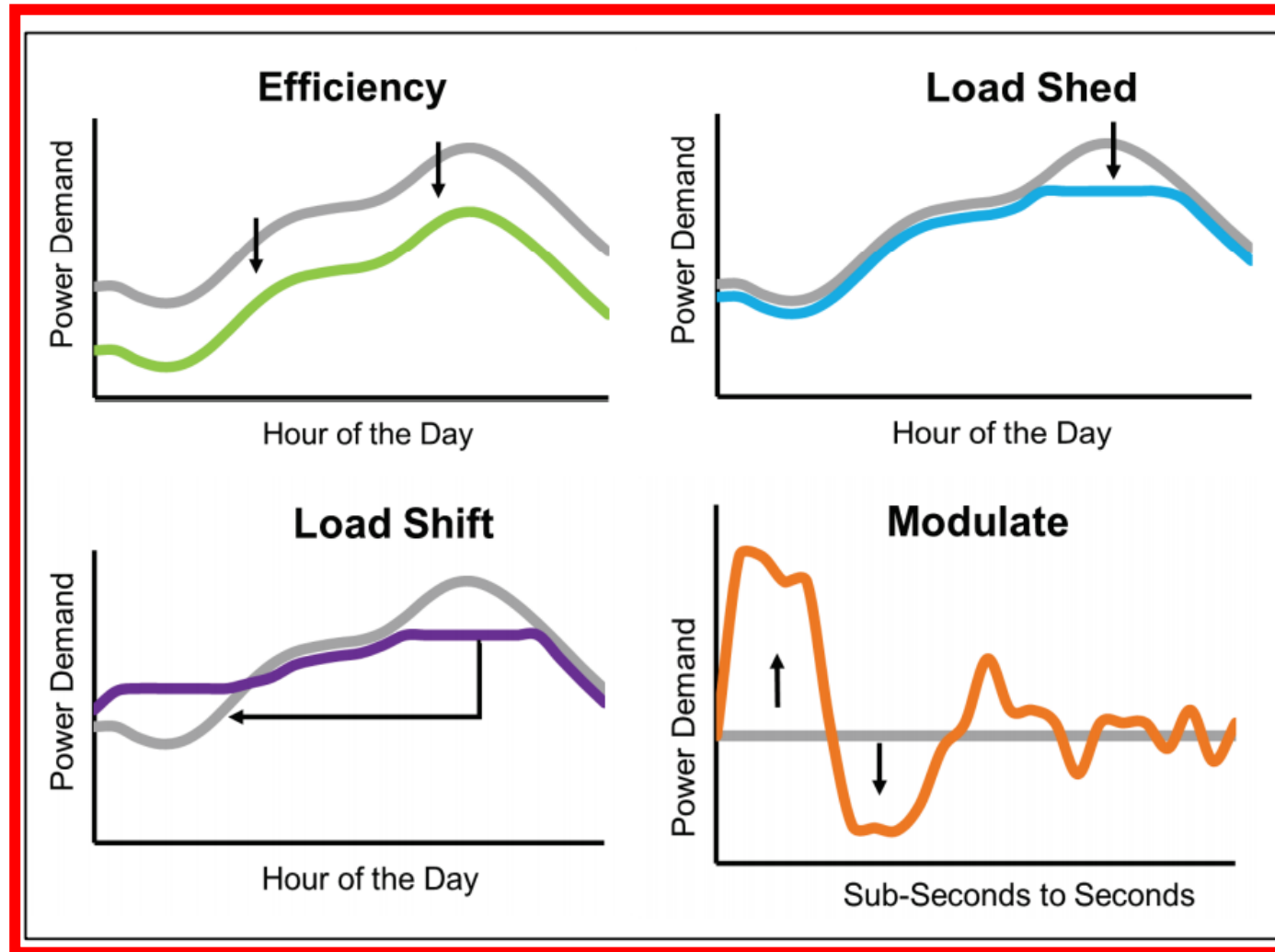
## Takeaways

# Brief GEB Overview

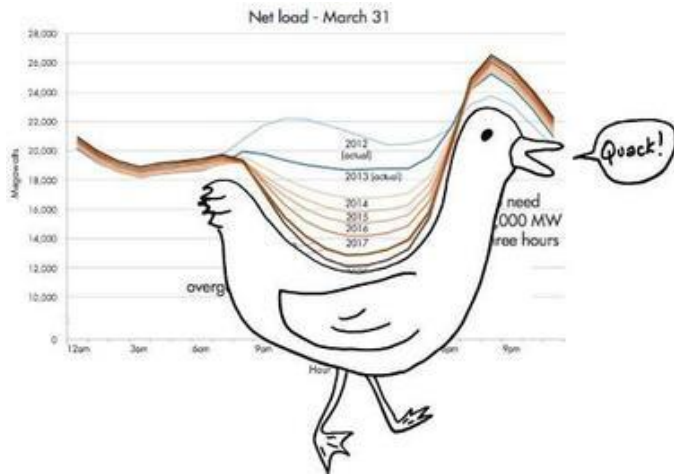
Historically, ACEEE's research focused on kWh, however we are increasingly interested in kW.



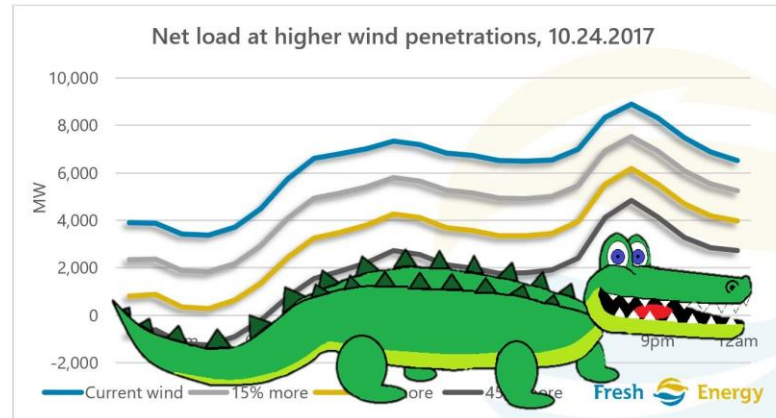
Historically, ACEEE's research focused on kWh, however we are increasingly interested in kW.



GEBs help mitigate grid strain caused by rapid adoption of technologies (e.g., solar PV) and policies (e.g., electrification).

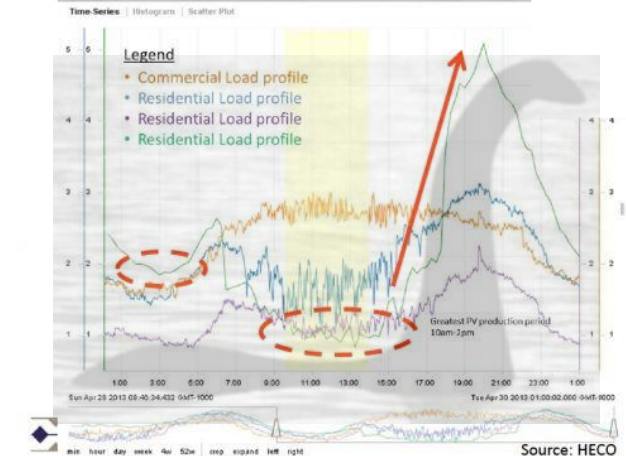


California 'Duck' Curve



Midwest 'Gator' Curve

Trending Hi-Pen Circuits (12kV) – Loch Ness Profile



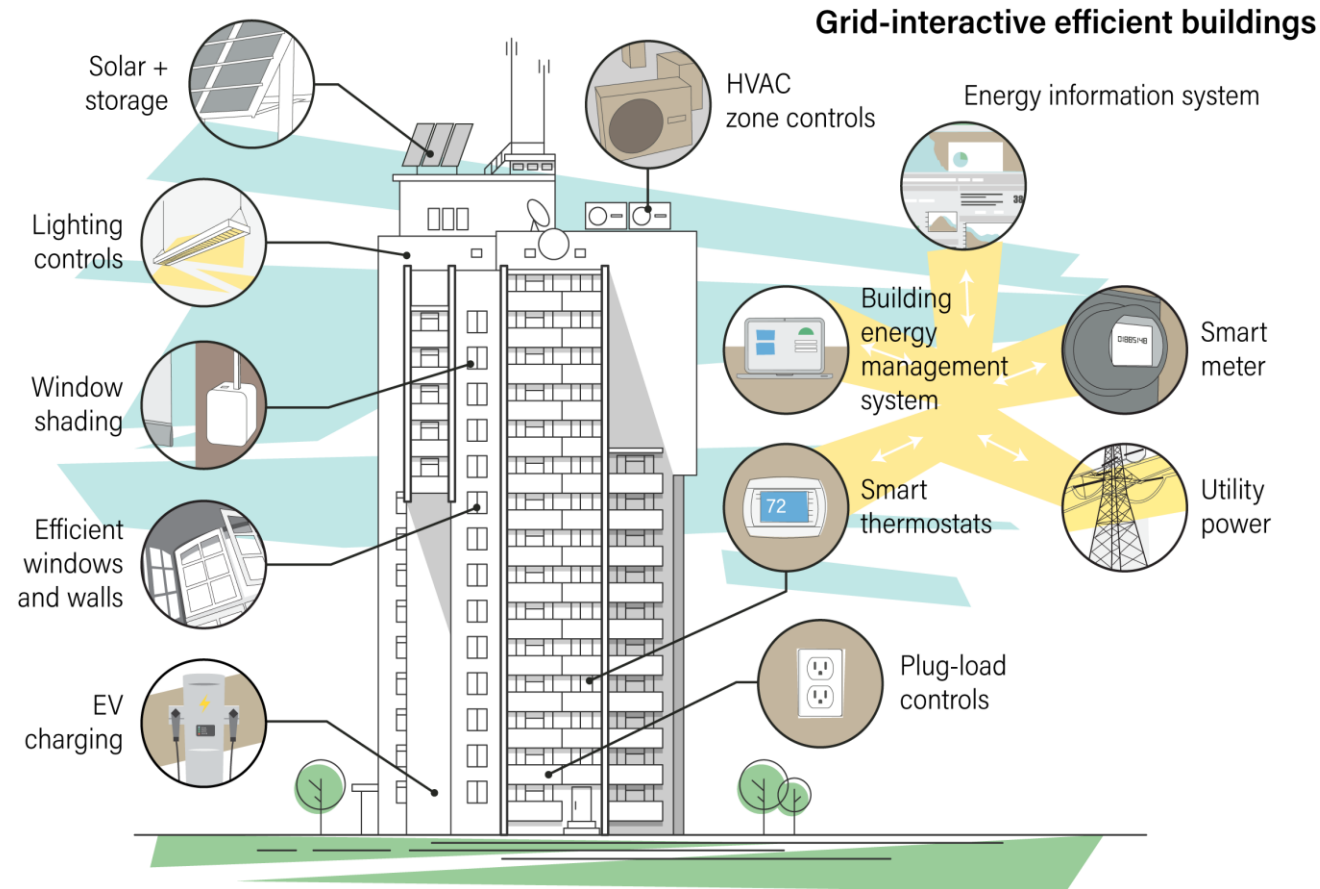
Hawaii 'Nessy' Curve

[insideenergy.org/2014/10/02/ie-questions-why-is-california-trying-to-behead-the-duck/](https://insideenergy.org/2014/10/02/ie-questions-why-is-california-trying-to-behead-the-duck/)

[www.greentechmedia.com/articles/read/renewables-integration-in-the-midwest-is-a-whole-other-animal](http://www.greentechmedia.com/articles/read/renewables-integration-in-the-midwest-is-a-whole-other-animal)

<https://www.greentechmedia.com/articles/read/hawaii-solar-grid-landscape-and-the-nessie-curve>

# Grid-interactive efficient buildings (GEBs) are highly-efficient buildings that can communicate with and serve as a resource for the grid (e.g., shift or shed loads).



# Enabling Policies for GEBs

# California Senate Bill 49 is one example of a GEB-enabling policy.

(1) Adopt, by regulation, and periodically update, standards for appliances to facilitate the deployment of flexible demand technologies. These regulations may include labeling provisions to promote the use of appliances with flexible demand capabilities. The flexible demand appliance standards shall be based on feasible and attainable efficiencies or feasible improvements that will enable appliance operations to be scheduled, shifted, or curtailed to reduce emissions of greenhouse gases associated with electricity generation. The standards shall become effective no sooner than one year after the date of their adoption or updating.

# FERC Order 2222 aims to open the wholesale market to distributed energy resources (DERs) as grid resources.

- Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs) take the lead in convening stakeholders
- Stakeholder group includes utilities, DER aggregators, and regulators
- RTOs and ISOs compliance filings are due July 19, 2021
- Not directly related to codes, but may represent a larger shift in the energy industry to encourage DERs as grid resources



# Current Status of GEBs in Energy Codes

# ASHRAE is starting to make strides on recognizing the value of GEBs.

## Standard 90.1

- In February 2020, the 90.1 committee voted in favor of considering time-of-use rates in the cost-effectiveness test for new proposals
- Energy storage working group evaluating measures for 90.1-2022

## Standard 189.1

- Automated Demand Response measure in 189.1-2020
- Exploring multiple opportunities for 189.1-2023 like expanded DR requirements, protocols, TOU metrics, and more

# The ICC overturned\* three proposed changes with demand flexibility components for the 2021 IECC.

- **High Efficiency and Grid-connected Water Heating Systems:** *rejected due to federal preemption concerns*
- **Electric Vehicle-Ready Requirements:** *rejected for being outside Scope & Intent*
- **Electrification-Ready Requirements:** *rejected for being outside Scope & Intent*



# California Title 24 and LEED can also provide helpful examples of GEB measures.

- **Title 24-2019:** includes automatic demand shed controls, demand responsive controls, and demand responsive electronic message control center
- **Title 24-2022:** considering demand responsive lighting systems, heat pump water heaters, and thermal energy storage systems
- **LEED Grid Harmonization pilot credit:** uses NBI's GridOptimal metrics for valuing grid flexibility (up to 3 points)

# Takeaways

# Takeaways

1. GEBs can help mitigate grid strain and provide energy, emissions, and utility bill savings.
2. Building energy codes have traditionally valued energy efficiency, but not demand flexibility.
3. ASHRAE is starting to embrace the benefits of distributed energy resources, while ICC has not (yet).
4. California's Title 24, stretch codes, and certification programs like LEED can also provide helpful examples of GEB measures.
5. **Recognizing the value of demand flexibility in building energy codes is a key first step to the inclusion of GEBs.**

# Thank you!



**Chris Perry**

**[cperry@aceee.org](mailto:cperry@aceee.org)**

**Research Manager, Buildings Program**



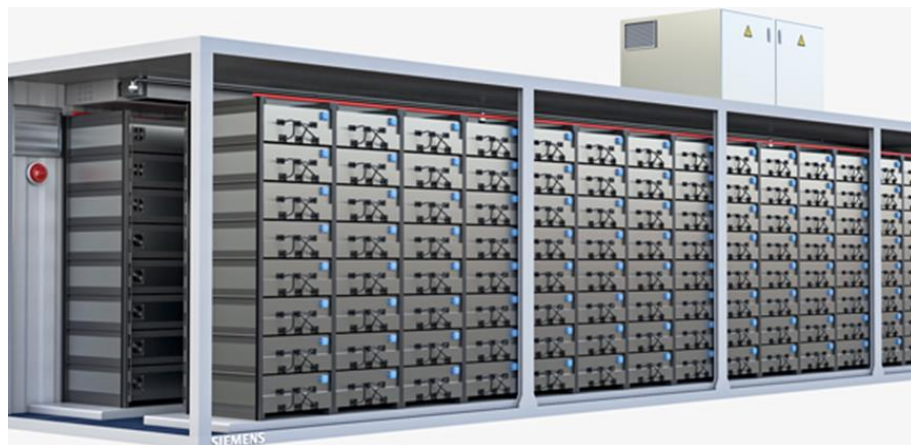
INTERNATIONAL  
CODE  
COUNCIL®

Emerging Energy  
Technologies and Fire Safety

Beth Tubbs, P.E. FSFPE  
Senior Staff Engineer

# Overview

- Why fire safety is important for emerging energy technologies
- Exploring safety requirements and energy



# Fire Safety and Energy

- Fire safety is an important factor in successful implementation of energy technologies
- Balancing of objectives is necessary to prevent failures



&



# Grenfell Tower London

Combustible  
exterior Cladding  
fire

- June 14, 2017
- 72 people died
- 70 other injured
- 223 people escaped



# Surprise Arizona

## Energy Storage System Incident

- April 19, 2019
- 2 MW/2.16 MWh Lithium-Ion Battery ESS
- 4 firefighters (Peoria HAZMAT teams) seriously injured
- 4 firefighters (Surprise E304) held overnight for suspected exposure to HCN



# Key I-Code Requirements

- Energy Storage Systems (ESS)
- Stationary Fuel Cells
- PV technologies
- Combustible exterior wall requirements



## Energy Storage Systems

- IFC Section 1207 and IRC R328
- IFC provisions
  - Listed to UL 9540
  - Hazard mitigation analysis
  - Commissioning & decommissioning included
  - Operation and maintenance
  - Consistent with NFPA 855
  - Array still limited to 50 kWh or UL 9540A



# Stationary Fuel Cells

## Stationary Fuel Cells

- IFC Section 1206 & IRC R330
- Prepacked and pre-engineered CSA FC 1
- Compliance with NFPA 70 and NFPA 853



# Photovoltaics (PV)

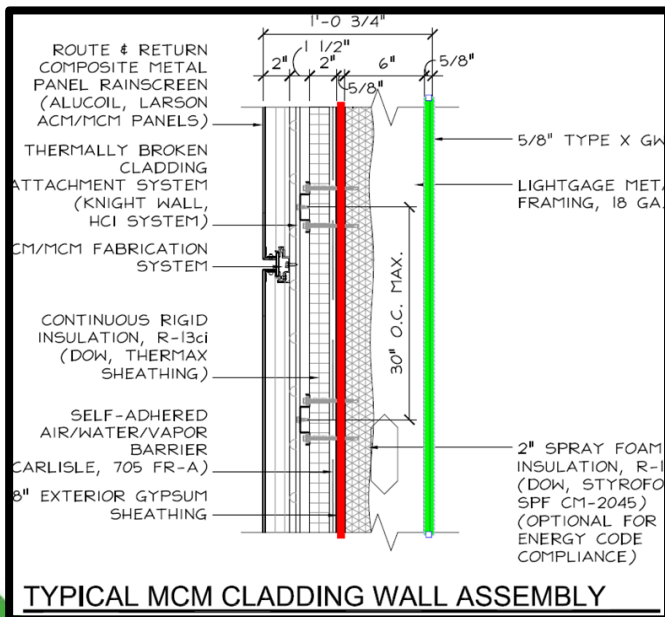
## PV technologies

- IFC Section 1205 & IRC R324
- Compliance with NFPA 70
- Access for fire fighting
- BIPV addressed
- Ground mounted also addressed



# Exterior Wall Envelope

- Combustible exterior walls
  - IBC Ch 14 and Ch 26
  - Key Test NFPA 285



# Links

- Surprise Arizona Report UL Fire Fighter Safety Institute <https://ulfirefightersafety.org/posts/four-firefighters-injured-in-lithium-ion-battery-energy-storage-system-explosion.html>
- NFPRF Fire Safety Challenges of Green Buildings and Attributes  
<https://www.nfpa.org/~media/Files/News%20and%20Research/Fire%20statistics%20and%20reports/Building%20and%20life%20safety/RFGreenBuildings2020.pdf>

# Thank you!



Beth Tubbs

[btubbs@iccsafe.org](mailto:btubbs@iccsafe.org)

International Code Council

Contact Information



# Thank You!

**Building Energy Codes Program**

[www.energycodes.gov/training](http://www.energycodes.gov/training)

**BECP help desk**

<https://www.energycodes.gov/HelpDesk>



# NECC Seminar Series Lineup

Catch the entire lineup of sessions weekly—Thursdays @ 1p ET:

- 10/01: Kickoff to the Series
- 10/08: Electronic Permitting
- 10/15: HVAC for Low-Load Homes
- 10/22: Performance-Based Compliance
- 10/29: 2021 IECC Commercial
- 11/05: Remote and Virtual Inspections
- 11/12: New for ASHRAE Standard 90.1
- 11/19: 2021 IECC Residential
- 11/24: Energy Codes Around the World
- 12/03: Advanced Technology and Codes
- **12/10: Policies for EE + Resilience**
- 12/17: Field Studies in the NW Region

> Learn more: [energycodes.gov/2020-building-energy-code-webinar-series](https://energycodes.gov/2020-building-energy-code-webinar-series)

# THANKS

## Building Energy Codes Seminar Series

Brought to you by the National Energy Codes Conference



Join us every Thursday @ 1:00 pm (eastern)



Participate LIVE or listen on-demand on [energycodes.gov](https://energycodes.gov)



Thanks for being part of the conversation!



**Building Energy Codes**

U.S. DEPARTMENT OF ENERGY

# UPCOMING EVENTS

The NECC may be on hold, but the discussion continues!

Participate LIVE in upcoming sessions:

- 12/10 New State & Local Policies for Energy Efficiency + Resilience
- 12/17 Energy Code Field Studies in the Northwest Region

Find the full lineup of upcoming sessions at [energycodes.gov](https://energycodes.gov)



# What's Next?

## Evolving Building Policies for a Resilient, Efficient Future

Thursday, December 10<sup>th</sup> @ 1:00 pm ET (12 CT / 11 MT / 10 PT)

Host: Northeast Energy Efficiency Partnerships (NEEP)

- Andy Winslow, NEEP
- Kathryn Wright, USDN
- Leah Louis-Prescott, RMI
- Jim Meyers, SWEEP

Learn more about upcoming events at [energycodes.gov](https://energycodes.gov)



# PAST EVENTS

The NECC may be on hold, but the discussion continues!

Listen to past events on-demand at [energycodes.gov/training](https://energycodes.gov/training)

- |                                     |   |
|-------------------------------------|---|
| -10/08 Electronic Permitting        | -11/05 Remote and Virtual Inspections     |
| -10/15 HVAC for Low-Load Homes      | -11/12 What's in Store for Standard 90.1? |
| -10/22 Performance-Based Compliance | -11/19 2021 IECC – Residential            |
| -10/29 2021 IECC – Commercial       | -11/24 Energy Codes Around the World      |

Find the full lineup of sessions at [energycodes.gov](https://energycodes.gov)



# CONTRIBUTORS

A big THANKS to everyone who's helped make our NECC Seminar Series possible!

- Pacific Northwest National Laboratory (PNNL)
- International Code Council (ICC)
- National Association of State Energy Officials (NASEO)
- Regional Energy Efficiency Organizations (MEEA / NEEA / NEEP / SEEA / SPEER / SWEEP)
- Our many presenters, speakers, session leaders and discussion panelists

And to all our participants!

# WANT TO LEARN MORE?

Today's presentation will be posted next week.

For more information on today's topic, as well as a range of additional training materials and technical assistance resources, visit:

> [energycodes.gov](https://energycodes.gov)