Energy Code

Commercial and High-rise Residential Requirements

May 20, 2025

HAWAI'I STATE ENERGY OFFICE

Presentation Collaborators

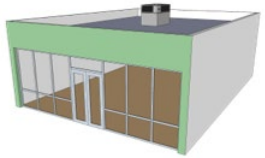
Hawai'i Energy · AIA Honolulu · ASHRAE Hawaii Chapter · AEE Hawaii Chapter

Hawai'i Energy

Incentives for Energy Efficiency in Commercial New Construction

Section 1
Introduction & Scope

Section 2
Compliance



Section 3
Electric vehicle infrastructure

Section 4
Solar readiness

Source: Deb Lastowka, NREL PIX14363

Section 5
Envelope

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Mechanical Systems

Section 7
Service Water Heating

Section 8
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Wrap Up

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AIA Honolulu

ASHRAE Hawaii Chapter

aee Association of Energy Engineers | Hawaii Chapter

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Credit(s) earned on completion of this course will be reported to AIA CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

COURSE DESCRIPTION

The State and Counties continue to follow the 2018 International Energy Conservation Code with amendments. The second of two sessions webinars covers the commercial building requirements, including high-rise multifamily buildings.

LEARNING OBJECTIVES

At the end of this course, participants will be able to:

1. Identify applicable requirements in the 2018 IECC
2. Choose an appropriate compliance path
3. Determine compliance with prescriptive envelope, lighting and HVAC requirements
4. Use energy code checklists to review designs for compliance

Introductions

Presenters

- Howard Wiig, State Energy Office
- Erik Kolderup, PE, Kolderup Consulting
- Eileen Stewart, Hawaii Energy

Acknowledgments

- Gail Suzuki-Jones, Hawaii State Energy Office
- Ron Chatterjee, Hawaii State Energy Office
- Karen Shishido, Hawaii Energy

Topics

Hawaii Energy

Introduction & Scope

Compliance

Electric vehicle infrastructure

Solar readiness

Envelope

Mechanical

Service Water Heating

Electrical & Lighting

Existing Building Compliance

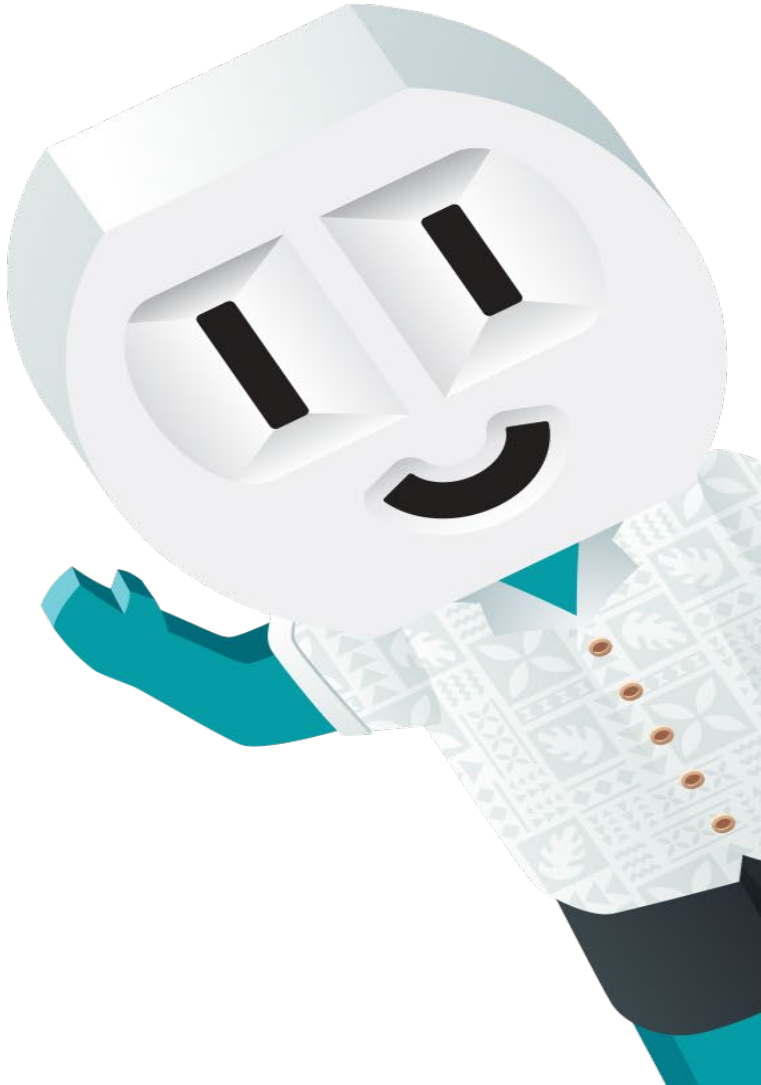
Q&A

Hawai‘i Energy

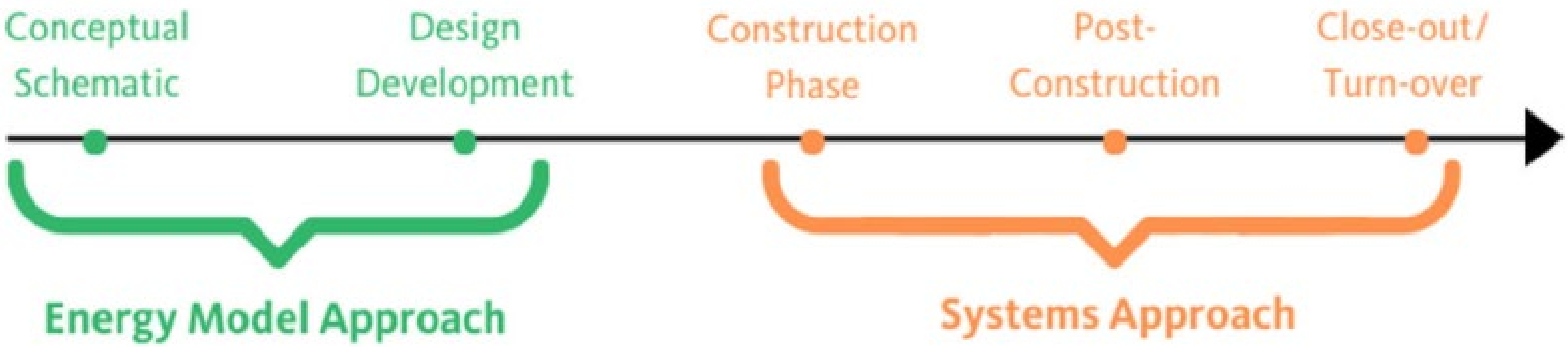
Incentives for Energy Efficiency in Commercial New Construction

How Hawaii Energy Can Help

- Rebates for energy efficiency projects
- Training and workshops
- Technical assistance
  - Electric bill analysis & benchmarking
  - Energy site walkthroughs
  - Project design review
  - Energy master plan & phased approach to building upgrades



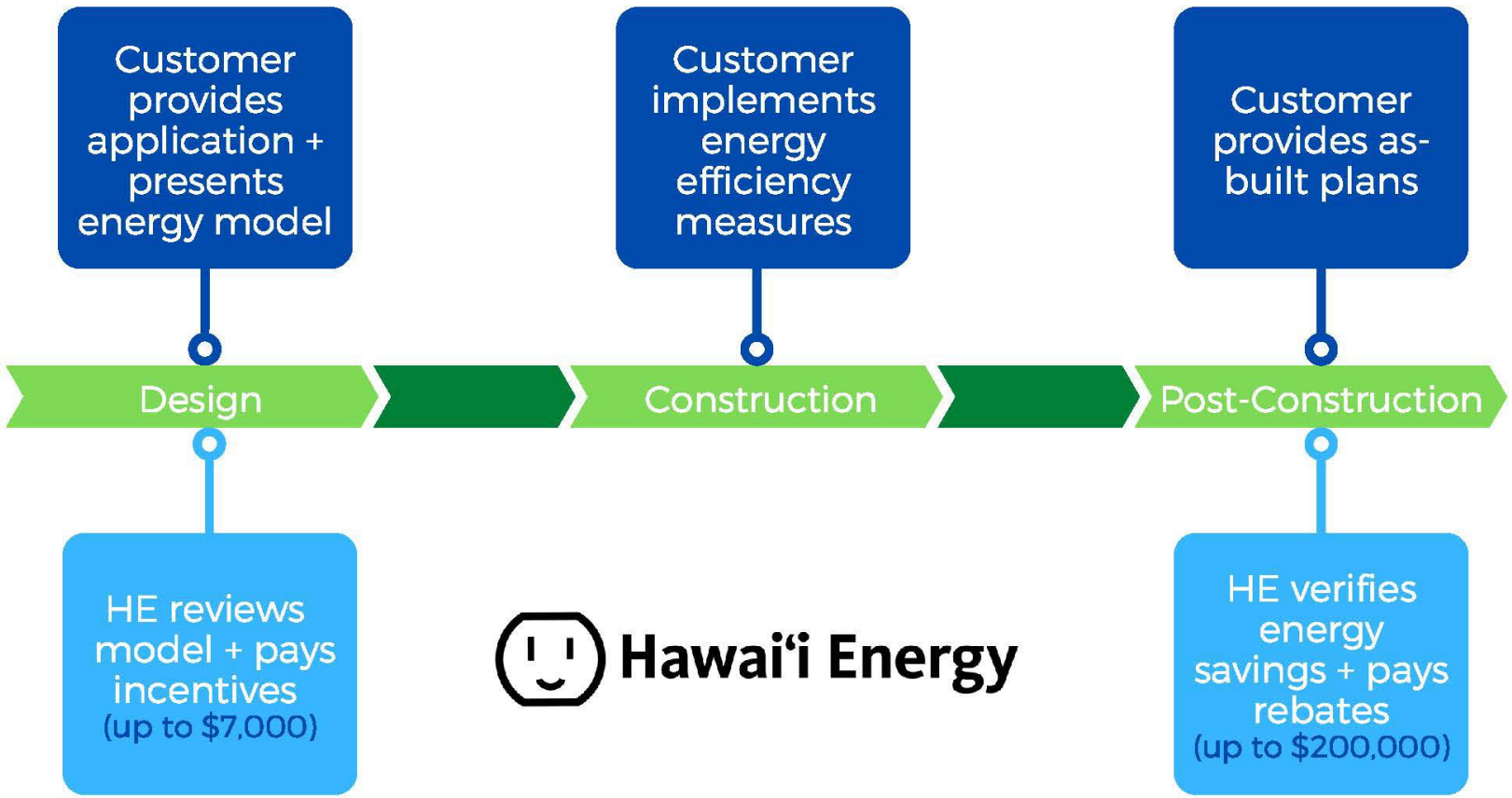
Two tracks for commercial new construction efficiency incentives



- Incentives capped at $200,000 per project
- Requires early engagement
- Assesses building performance as a whole

- Incentives capped at $150,000 per project
- Most common approach
- Assesses each system individually

Energy Model Approach



Energy Model Incentives

Design Phase Incentives

Up to $5,000 for producing an energy model

$1,000 to owner/developer for investing in an energy model

$1,000 to architect/design team for presenting the energy model to the client and Hawai‘i Energy

Post-Construction Incentives

Energy savings incentive at $0.12 per kilowatt-hour saved above code from energy model results, capped at $200,000

Energy Model Requirements

Inputs & Assumptions

- Building load profile
- Building shell parameters
- Airflow
- Space conditioning
- Appliance schedules
- Miscellaneous loads
- Lighting
- Power generation and energy storage

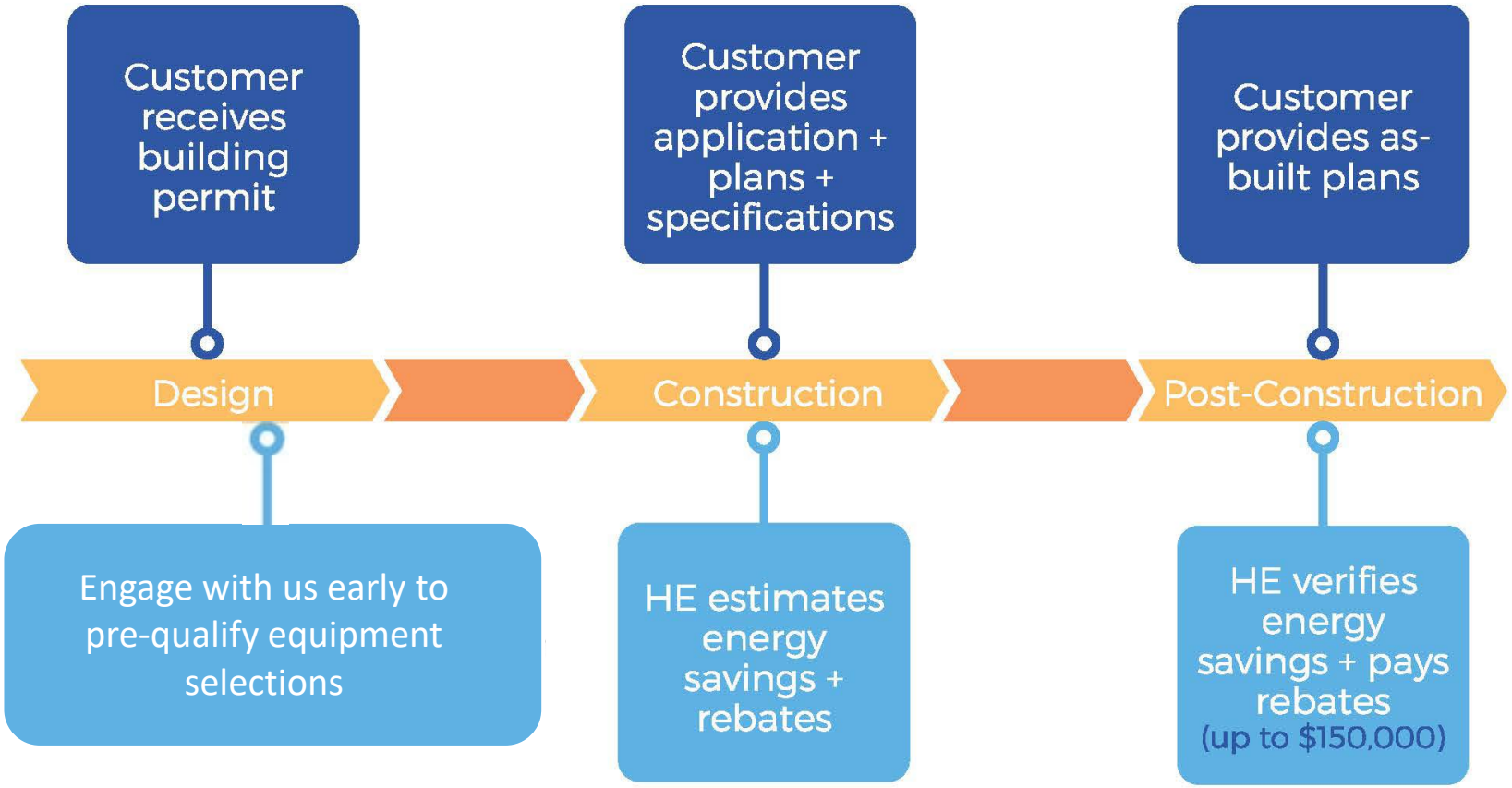
Report

- Baseline model (code)
- Proposed design
- Verifies that design is at least 10% more energy-efficient than baseline

Software

Models must simulate whole building performance showing design/floor plan, estimated electricity consumption, and energy and demand calculations with the source of input parameters. Reports are accepted from DOE2 eQUEST, EnergyPlus, OpenStudio, BEM Project Portfolio, Carrier HAP, Trane TRACE, and/or other Hawai‘i Energy-approved modeling software.

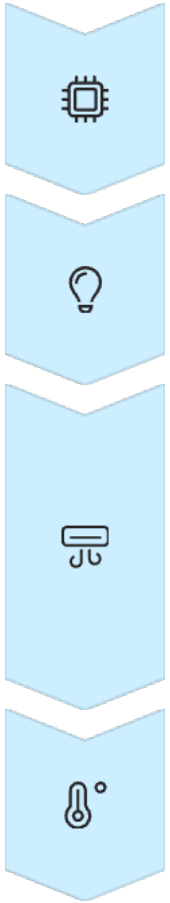
Systems Approach



Primary Systems Considered for Efficiency Incentives

System	Required Documentation	Incentives
Lighting	Electrical plans and specs COMcheck compliance report Operating hours	Calculated annual kWh usage above code baseline * $0.12/kWh
HVAC	Mechanical plans and specs Purchase orders or submittals	Prescriptive $/ton dependent on system type meeting minimum efficiency requirements, typically 10% better than code
Water Heating - Solar and Heat Pump	Plumbing plans and specs Purchase orders or submittals	Calculated annual kWh usage above code baseline * $0.12/kWh
Appliances	Purchase orders or submittals	Prescriptive $/unit dependent on type for ENERGY STAR certified models
Custom Equipment	Purchase orders or submittals	Calculated annual kWh usage above code baseline * $0.12/kWh

Multifamily In-Unit Systems Considered for Incentives



ENERGY STAR appliances: dishwasher, refrigerator/freezer, washer, dryer

LEDs

SEER 16+ Central Air Conditioning Models

SEER 18+ VRF Mini-Split Models

ENERGY STAR Window A/C units

ENERGY STAR smart thermostats

Residential New Construction Incentives: Single Family Homes (Up to $700)

Base Rebate: $250

50% of all installed appliances are ENERGY STAR rated

90% of all lighting is LED / High-efficiency

Public awareness campaigns encouraging sustainable practices.

Cooling Incentive (HVAC): Up to $400

SEER 16+ Central Air Conditioning Models = $250

SEER 18+ VRF Mini-Split Models = $400

OR $50 for ENERGY STAR rated Window A/C units

Smart Thermostat: $50

ENERGY STAR rated thermostats receive additional incentive

Systems Approach Example: Hale Kalele & Hale Hilinai

- Mixed-use with 201 low-income rentals, juvenile center and shelter
- Incentives for systems totaled $121,000:
  - LEDs
  - High-efficiency AC
  - ENERGY STAR appliances
  - Solar water heating
  - EV charging stations
- 787,000 annual kWh savings compared to code or baseline equipment

Energy Model Example: Luhauola

- Mixed-use commercial and 29 rental housing units ~36,500 SF
- PV and battery
- Predicted Energy Use Index (EUI) for Building A is 98.43 pEUI, 18% better than the baseline; Building B has a pEUI of 17.59, 77% better than the baseline
- Modeled energy savings of 194,000 kWh above code
  - Est. $23,300 energy savings incentive upon construction

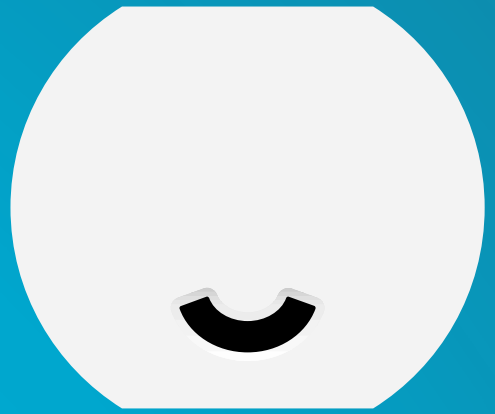
https://masonarch.com/luhauola

Energy Model Incentives by the Numbers

Project	SF	Baseline Code	Modeled kWh Better than Code	Est. Energy Savings Incentive
Luhauola Mixed-Use Commercial and Residential	36,500	ASHRAE 90.1-2013	194,000	$23,300
Hawaii Baptist Academy Elementary School	12,914	ASHRAE 90.1-2013	29,433	$3,500
University Campus Building Renovation	26,000	ASHRAE 90.1-2010	73,248	$8,790
Airport Building Renovation	24,609	ASHRAE 90.1-2016	316,426	$37,971

Future Incentive Program Design Considerations

- Elevated incentives for achieving higher tiers of efficiency
  - Align with 179D tax deduction for commercial buildings achieving at least 25% better than ASHRAE Standard 90.1
  - Align with 45L tax credit for ENERGY STAR homes
- Simplified energy model incentive requirements
- How else can we support better support energy modeling?



Mahalo!

Stay Connected

Oahu: 537-5577 (Residential) **839-8880** (Business)

Neighbor Islands: 1-877-231-8222 toll-free

www.hawaiienergy.com

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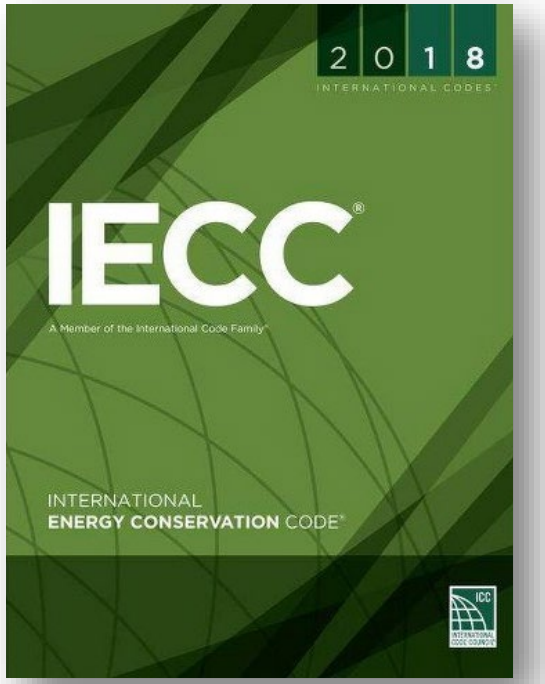
Section 1

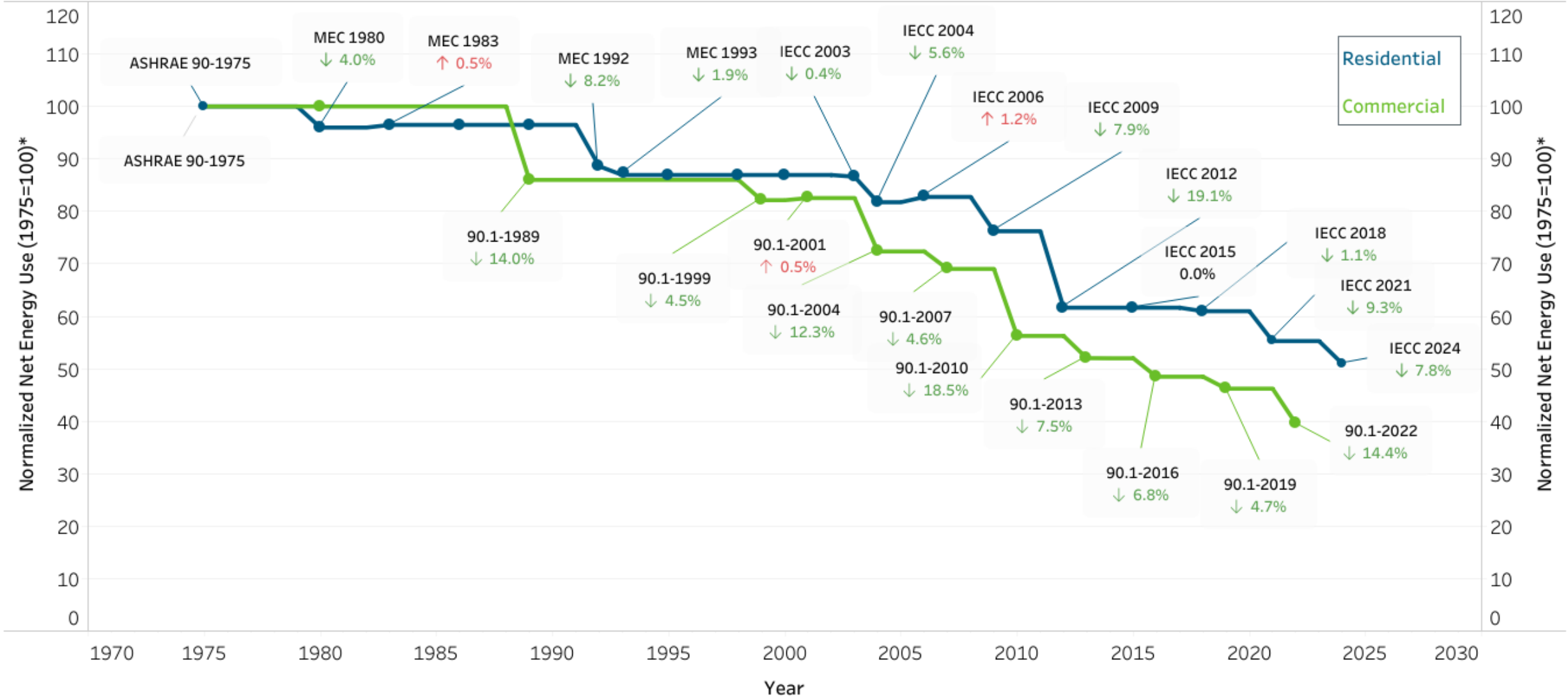
Introduction & Scope



U.S. DEPARTMENT OF ENERGY

Estimated Improvement in Residential & Commercial Energy Codes
(1975 - 2024)

Pacific Northwest NATIONAL LABORATORY



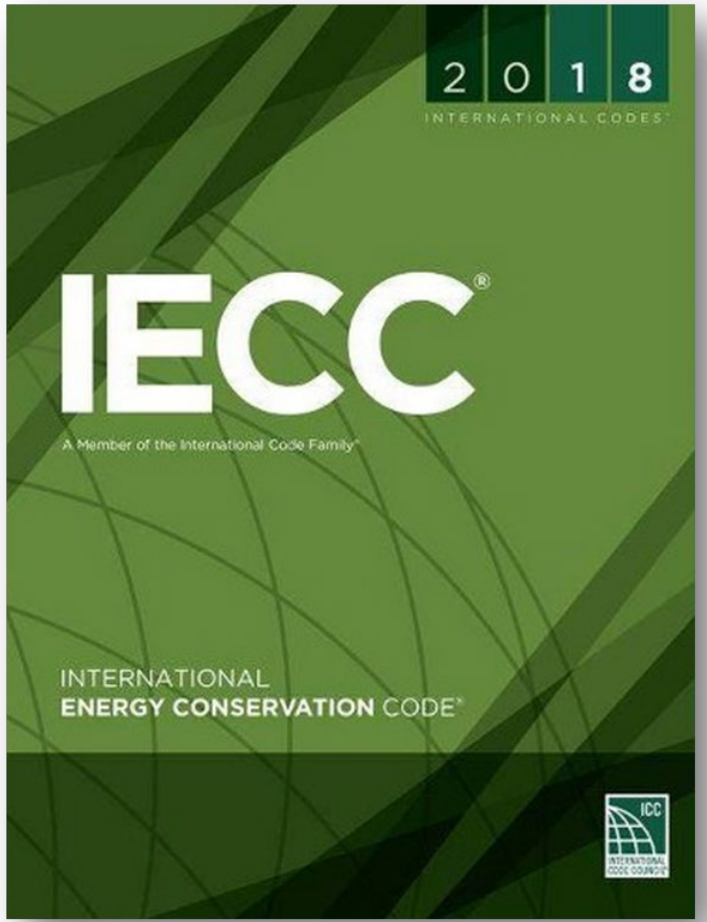
*Net energy use includes the contribution of renewable energy generation

Source: https://public.tableau.com/app/profile/doebecp/viz/HistoricalModelEnergyCodeImprovement/CombinedHistoricalCodeImprovement_1

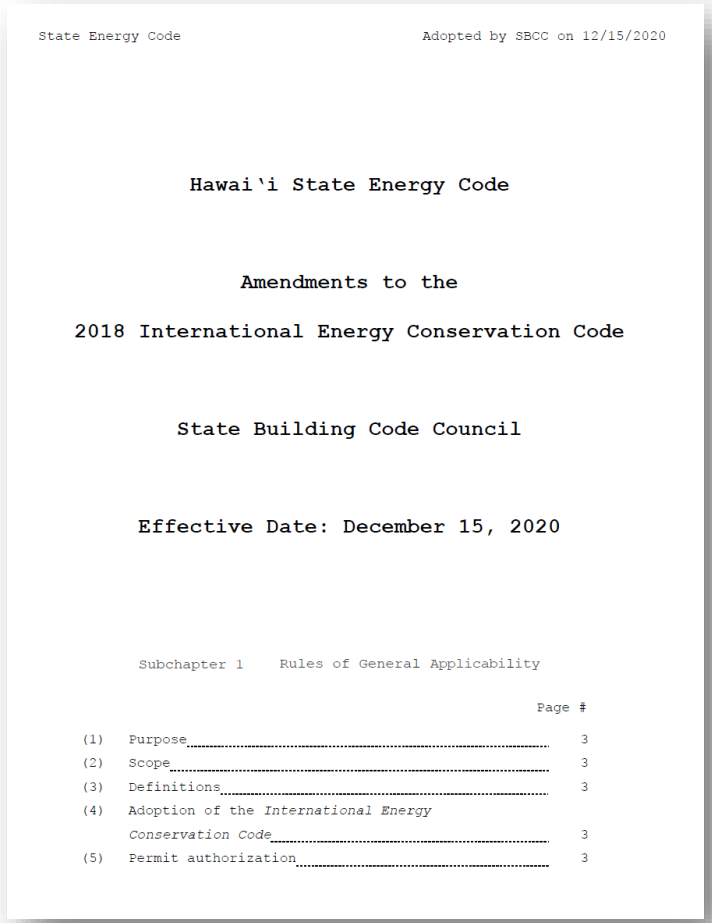
2018 IECC Adoption

Dec. 15, 2020 – State adoption

Hawaii:	(no County amendments)
Kauai:	Oct. 10, 2024
Maui:	Nov. 23, 2022
Honolulu:	Aug. 23, 2023 adoption, Nov. 23, 2023 effective



State amendments
12 pages



State Energy Code — Adopted by SBCC on 12/15/2020

Hawai`i State Energy Code

Amendments to the

2018 International Energy Conservation Code

State Building Code Council

Effective Date: December 15, 2020

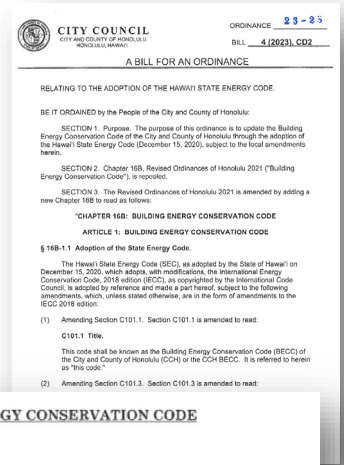
Subchapter 1 Rules of General Applicability

Page #

(1) Purpose 3
(2) Scope 3
(3) Definitions 3
(4) Adoption of the *International Energy Conservation Code* 3
(5) Permit authorization 3

County amendments

Honolulu
38 pages



CITY COUNCIL — ORDINANCE 23-25 — BILL 4 (2023), CD2

A BILL FOR AN ORDINANCE

RELATING TO THE ADOPTION OF THE HAWAI'I STATE ENERGY CODE.

BE IT ORDAINED by the People of the City and County of Honolulu:

SECTION 1. Purpose. The purpose of this ordinance is to update the Building Energy Conservation Code of the City and County of Honolulu through the adoption of the Hawai'i State Energy Code (December 15, 2020), subject to the local amendments herein.

SECTION 2. Chapter 16B, Revised Ordinances of Honolulu 2021 ("Building Energy Conservation Code"), is repealed.

SECTION 3. The Revised Ordinances of Honolulu 2021 is amended by adding a new Chapter 16B to read as follows:

"CHAPTER 16B: BUILDING ENERGY CONSERVATION CODE

ARTICLE 1: BUILDING ENERGY CONSERVATION CODE

§ 16B-1.1 Adoption of the State Energy Code.

The Hawai'i State Energy Code (SEC), as adopted by the State of Hawai'i on December 15, 2020, which adopts, with modifications, the International Energy Conservation Code, 2018 edition (IECC), as copyrighted by the International Code Council, is adopted by reference and made a part hereof, subject to the following amendments, which, unless stated otherwise, are in the form of amendments to the IECC 2018 edition:

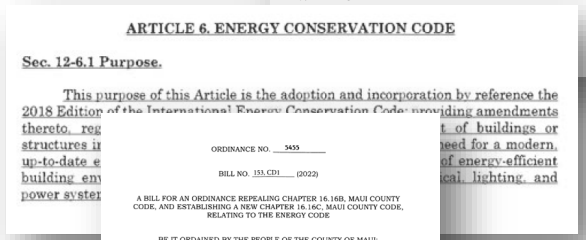
(1) Amending Section C101.1. Section C101.1 is amended to read:

C101.1 Title.

This code shall be known as the Building Energy Conservation Code (BECC) of the City and County of Honolulu (CCH) or the CCH BECC. It is referred to herein as "this code."

(2) Amending Section C101.3. Section C101.3 is amended to read:

Kauai
12 pages

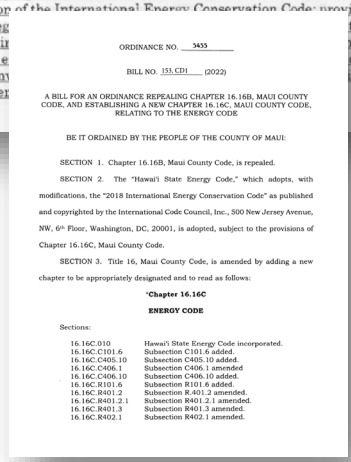


ARTICLE 6. ENERGY CONSERVATION CODE

Sec. 12-6.1 Purpose.

This purpose of this Article is the adoption and incorporation by reference the 2018 Edition of the International Energy Conservation Code; providing amendments thereto, reg... of buildings or structures i... need for a modern, up-to-date e... of energy-efficient building env... cal, lighting, and power syster...

Maui
13 pages



ORDINANCE NO. 5455

BILL NO. 153, CD1 (2022)

A BILL FOR AN ORDINANCE REPEALING CHAPTER 16.16B, MAUI COUNTY CODE, AND ESTABLISHING A NEW CHAPTER 16.16C, MAUI COUNTY CODE, RELATING TO THE ENERGY CODE

BE IT ORDAINED BY THE PEOPLE OF THE COUNTY OF MAUI:

SECTION 1. Chapter 16.16B, Maui County Code, is repealed.

SECTION 2. The "Hawai'i State Energy Code," which adopts, with modifications, the "2018 International Energy Conservation Code" as published and copyrighted by the International Code Council, Inc., 500 New Jersey Avenue, NW, 6th Floor, Washington, DC, 20001, is adopted, subject to the provisions of Chapter 16.16C, Maui County Code.

SECTION 3. Title 16, Maui County Code, is amended by adding a new chapter to be appropriately designated and to read as follows:

"Chapter 16.16C

ENERGY CODE

Sections:

16.16C.010	Hawai'i State Energy Code incorporated.
16.16C.C101.6	Subsection C101.6 added.
16.16C.C405.10	Subsection C405.10 added.
16.16C.C406.1	Subsection C406.1 amended
16.16C.C406.10	Subsection C406.10 added.
16.16C.R101.6	Subsection R101.6 added.
16.16C.R401.2	Subsection R.401.2 amended.
16.16C.R401.2.1	Subsection R401.2.1 amended.
16.16C.R401.3	Subsection R401.3 amended.
16.16C.R402.1	Subsection R402.1 amended.

https://codes.iccsafe.org/content/iecc2018

https://energy.hawaii.gov/hawaii-building-energy-code/

https://www.resilientoahu.org/energycode

https://www.mauicounty.gov/1308/Building-Plans-Review-Section

https://www.kauai.gov/Government/Departments-Agencies/Public-Works/Building-Division

Scope

Residential

- 1- and 2-family dwellings (R-3)
- Multi-family (R-2 ≤ 3 stories)
- Residential care/assisted living (R-4 ≤ 3 stories)

Courtesy Daniel Sandomire, Armstrong Builders

Today's topic

Commercial

- All other buildings
  - Including R-1 (hotels) and R-2 ≥ 4 stories

Scope

Mixed use buildings

- Commercial code for commercial portion
- Residential code for residential portion
  ≤ 3 stories

https://www.drhorton.com/hawaii/oahu/ewa-beach/kohina-at-hoopili

Does the project need to comply?

New construction

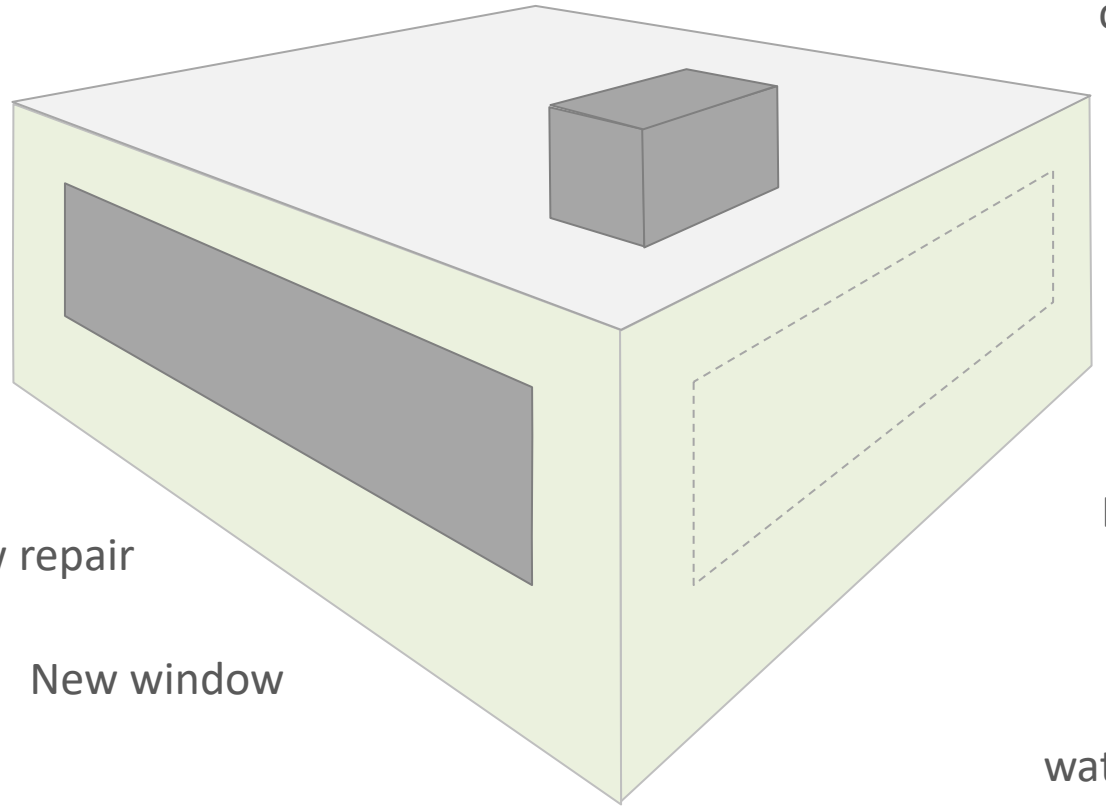
Roof replacement

AC replacement

Roof repair

Add PV system

Add AC to non-conditioned space



New interior lighting

Window replacement

Interior lighting retrofit

Exterior lighting retrofit

Window repair

New window

Replace hot water distribution

Repaint exterior walls

Replace water heater

Scope

New construction ➡

Additions (C502)

Alterations (C503)

- Change in space conditioning (C503.2)

Repairs (C504)

Change of occupancy (C505)

Applies to commercial buildings and the buildings' sites and associated systems and equipment.

- Building envelope
- Mechanical systems
- Commercial freezers and coolers
- Commercial kitchen exhaust
- Parking garage ventilation
- Interior and exterior lighting
- Water heating systems
- Transformers and motors
- Elevators and escalators

Not in scope

- Plug loads, office equipment, appliances
- Cooking equipment
- Fire alarm systems

Scope

New construction

Additions (C502) ➡

Alterations (C503)

Change in space conditioning (C503.2)

Repairs (C504)

Change of occupancy (C505)

Options

1. New construction requirements for addition
2. Performance method for existing + addition

Vertical fenestration area

Skylight area

Building mechanical systems

Service water heating systems

Pools and inground permanently installed spas

Lighting power and systems

Scope

New construction

Additions (C502)

Alterations (C503) ➡

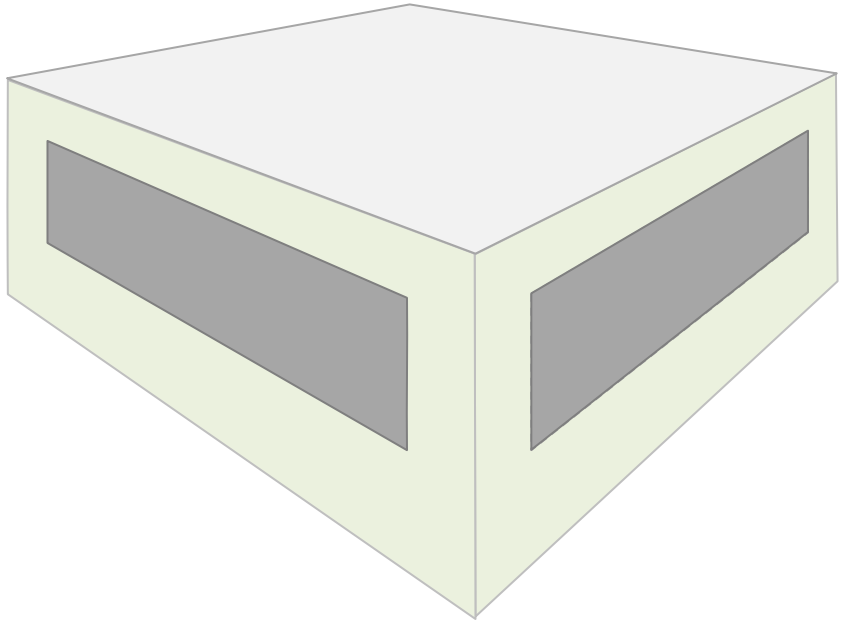
- Change in space conditioning (C503.2)

Repairs (C504)

Change of occupancy (C505)

New construction requirements for altered portions

Several exceptions (discussed later)



Scope

New construction

Additions (C502)

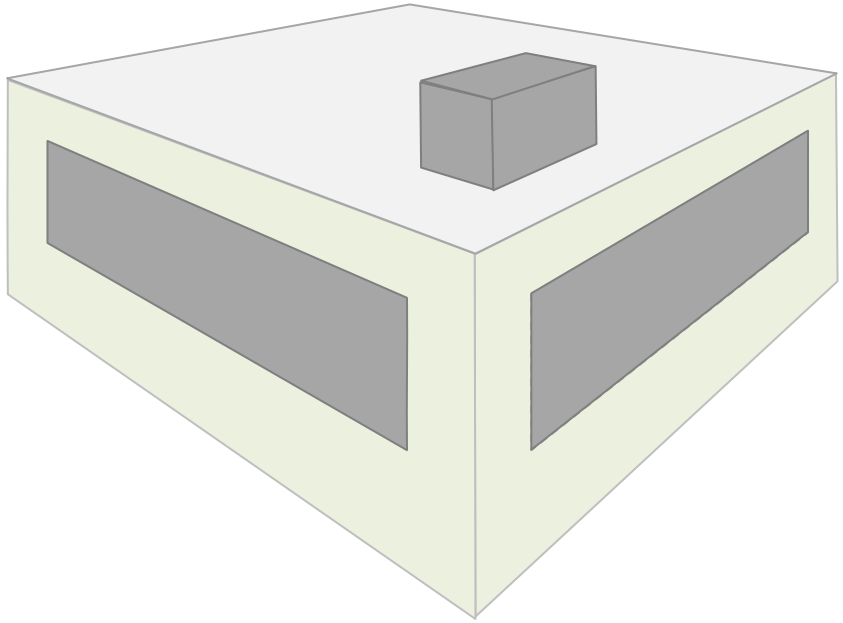
Alterations (C503)

Change in space conditioning (C503.2)

Repairs (C504)

Change of occupancy (C505)

Non-conditioned or low-energy space that is altered to become *conditioned space* shall be required to be brought into full compliance.



Scope

New construction

Additions (C502)

Alterations (C503)

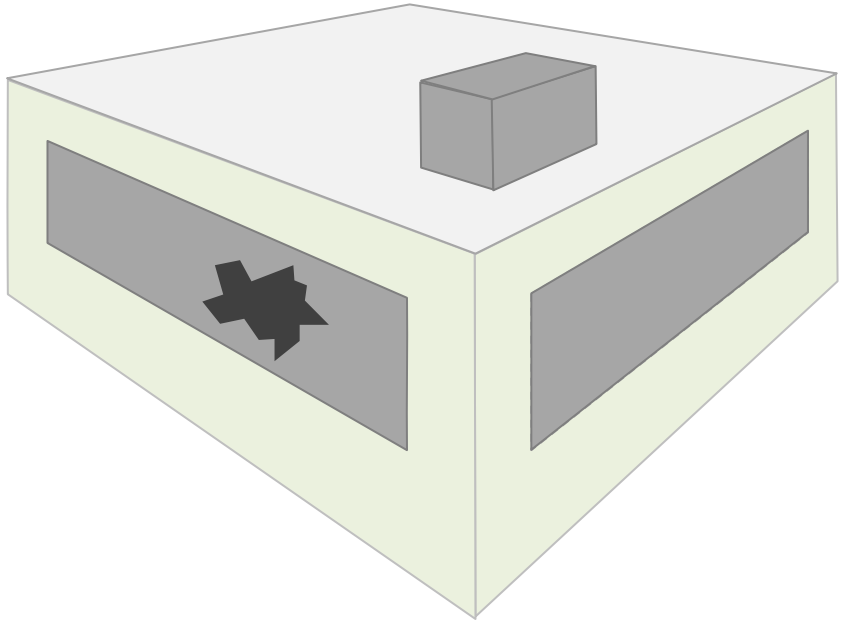
Change in space conditioning (C503.2)

Repairs (C504) ➡

Change of occupancy (C505)

Compliance not required

- Routine maintenance
- Repairs exempt from permit
- Glass-only replacement
- Roof repairs
- Bulb and ballast replacement, if energy does not increase



Scope

New construction

Additions (C502)

Alterations (C503)

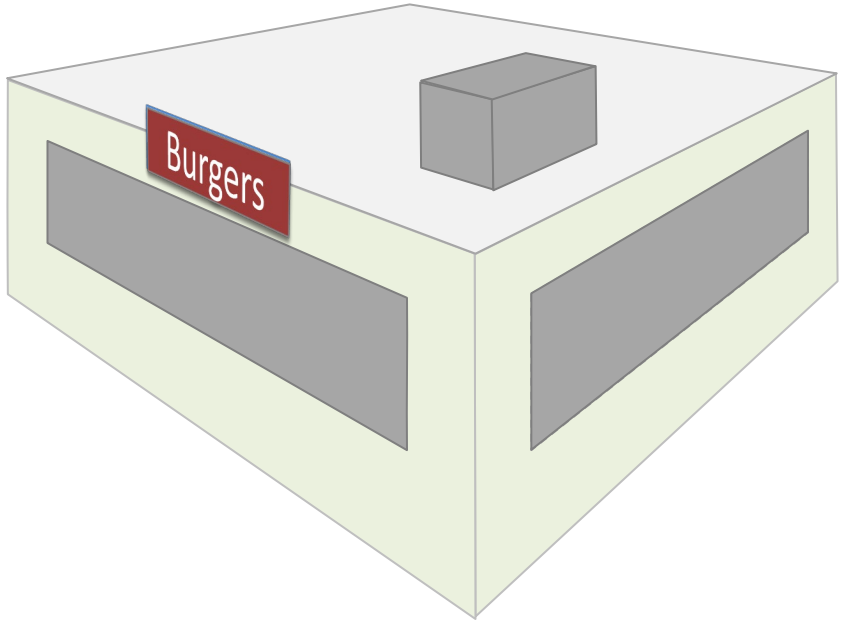
Change in space conditioning (C503.2)

Repairs (C504)

Change of occupancy (C505)

Compliance required

- When change in occupancy would result in an increase in demand for either fossil fuel or electrical energy



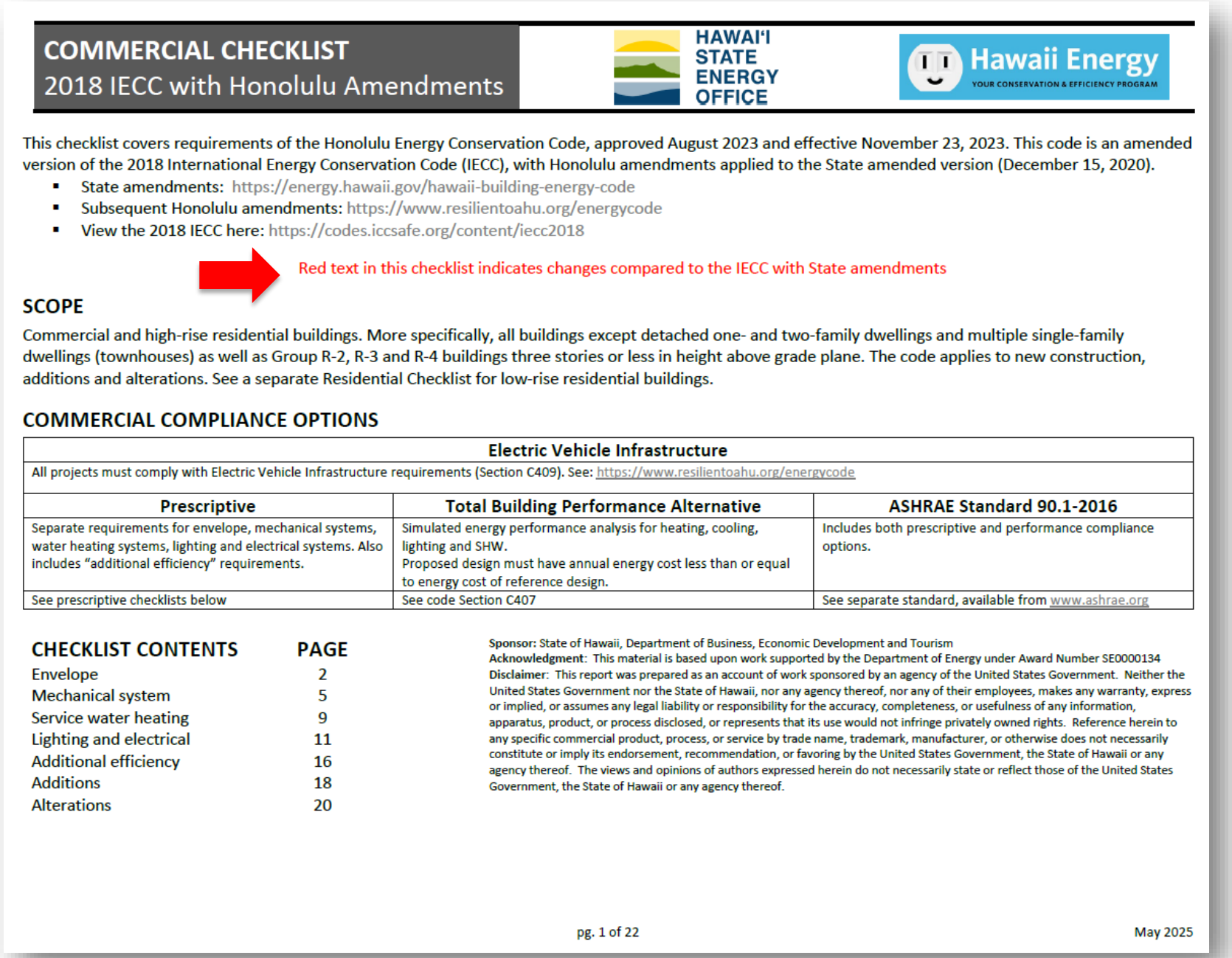
Resources

Checklist versions

1. State amendments
2. Honolulu amendments
3. Maui amendments

Checklists

- Envelope
- Mechanical
- Service water heating
- Lighting and electrical
- Additional efficiency
- Additions
- Alterations



COMMERCIAL CHECKLIST
2018 IECC with Honolulu Amendments

HAWAI'I STATE ENERGY OFFICE

Hawaii Energy
YOUR CONSERVATION & EFFICIENCY PROGRAM

This checklist covers requirements of the Honolulu Energy Conservation Code, approved August 2023 and effective November 23, 2023. This code is an amended version of the 2018 International Energy Conservation Code (IECC), with Honolulu amendments applied to the State amended version (December 15, 2020).

- State amendments: https://energy.hawaii.gov/hawaii-building-energy-code
- Subsequent Honolulu amendments: https://www.resilientoahu.org/energycode
- View the 2018 IECC here: https://codes.iccsafe.org/content/iecc2018

Red text in this checklist indicates changes compared to the IECC with State amendments

SCOPE

Commercial and high-rise residential buildings. More specifically, all buildings except detached one- and two-family dwellings and multiple single-family dwellings (townhouses) as well as Group R-2, R-3 and R-4 buildings three stories or less in height above grade plane. The code applies to new construction, additions and alterations. See a separate Residential Checklist for low-rise residential buildings.

COMMERCIAL COMPLIANCE OPTIONS

Electric Vehicle Infrastructure		
All projects must comply with Electric Vehicle Infrastructure requirements (Section C409). See: https://www.resilientoahu.org/energycode		
Prescriptive	**Total Building Performance Alternative**	**ASHRAE Standard 90.1-2016**
Separate requirements for envelope, mechanical systems, water heating systems, lighting and electrical systems. Also includes "additional efficiency" requirements.	Simulated energy performance analysis for heating, cooling, lighting and SHW. Proposed design must have annual energy cost less than or equal to energy cost of reference design.	Includes both prescriptive and performance compliance options.
See prescriptive checklists below	See code Section C407	See separate standard, available from www.ashrae.org

CHECKLIST CONTENTS

Sponsor: State of Hawaii, Department of Business, Economic Development and Tourism
Acknowledgment: This material is based upon work supported by the Department of Energy under Award Number SE0000134

Resources

Example checklist

COMMERCIAL CHECKLIST
2018 IECC with Honolulu Amendments
ENVELOPE REQUIREMENTS

HAWAIʻI STATE ENERGY OFFICE

Hawaii Energy — YOUR CONSERVATION & EFFICIENCY PROGRAM

Component/System	Requirement	Code Section	Plan Review Notes	Info on Pl...
ENVELOPE REQUIREMENTS				
Design professional certification	Form included on plans with signature of design professional	C103.2†	See the Honolulu amendm...	☐ Signature block included
Unconditioned space	Envelope requirements apply to unconditioned occupiable space	C202† C402.1.1†	The Honolulu amendment... this definition: *...PIABLE SPACE means enclosed space intended for ... ding those spaces intended ... rage rooms and ... equipment rooms, ... and for short periods of time.*	
Roof – insulation above deck	☐ **R-25** or **U-0.039** (group R) ☐ **R-20** or **U-0.048** (others) At least two insulation layers, with staggered edge joints	C402.1, C402.2.1	Typically foam board on the roof deck. If tapered, R-value in some areas can be lower than the requirement if designer shows that weighted-average U-factor complies. Two layers not required where insulation tapers to the roof deck, such as near a drain.	☐ Insulation location on plans ☐ Insulation R-value on plans
Roof – metal building	**R-19 + R-11** or **U-0.044** (with thermal block and liner system)	C402.1, C402.2	Typically two layers of batt insulation. One parallel to and between purlins supported by fabric liner. The second draped over purlins and compressed when roof deck is installed. Also with R-5 foam block between purlins and metal roof deck.	☐ Insulation R-value on plans ☐ Thermal block indicated on plans
Roof – attic or other	**R-38** or **U-0.027**	C402.1, C402.2	This category includes attics, cathedral ceilings, and insulation installed under the roof deck. Insulation on top of suspended ceiling is not allowed for compliance.	☐ Insulation location on plans ☐ Insulation R-value on plans
Roof – skylight curbs	**R-5** minimum	C402.2.1.1	Unit skylights with U-factor labeled per NFRC 100 do not nee... nsulated curb	☐ Insulation location on plans ☐ Insulation R-value on plans
Wall – mass (CMU or concrete)	**R-5.7** or **U-0.151** Insulation not required where: ▪ light reflectance ≥ 0.64, ▪ shading PF ≥ 0.3 ▪ thickness ≥ 6 inches and an unpainted finish with or without clear sealer	C402.1*, C402.2 C402.2.2†	in... Hono...ulu amendment provides exceptions.	☐ Insulation location on plans ☐ Insulation R-value on plans

Red text = change vs. State

† = County amendment

* = State amendment

pg. 2 of 22 May 2025

Resources

HSEO Website

Past training materials

https://energy.hawaii.gov/hawaii-building-energy-code/

TRAININGS

April 23 and 24, 2024 – Maui Energy Code Updates

This code update moves Maui from the 2015 to the 2018 International Energy Conservation Code, with updated County amendments. Join these sessions to learn how these changes will affect your projects.

Low-rise residential requirements

- Checklist: Residential 2018 IECC with Maui Amendments

Commercial and high-rise residential requirements

- Checklist: Commercial 2018 IECC with Maui Amendments

This workshop is approved by AIA for 1.5 LU (HSW).

December 5 and 6, 2023 – Honolulu Energy Code Updates

This code update moves Honolulu from the 2015 to the 2018 International Energy Conservation Code, with updated County amendments. Join these sessions to learn how these changes will affect your projects.

Low-rise residential requirements

- Presentation: Honolulu Energy Code Low-rise Residential Requirements
- Checklist: Residential 2018 IECC with Honolulu Amendments
- Video:

Commercial and high-rise residential requirements

- Presentation: Honolulu Energy Code Commerical and High-rise Residential Requirements
- Checklist: Commerical 2018 IECC with Honolulu Amendments
- Video:

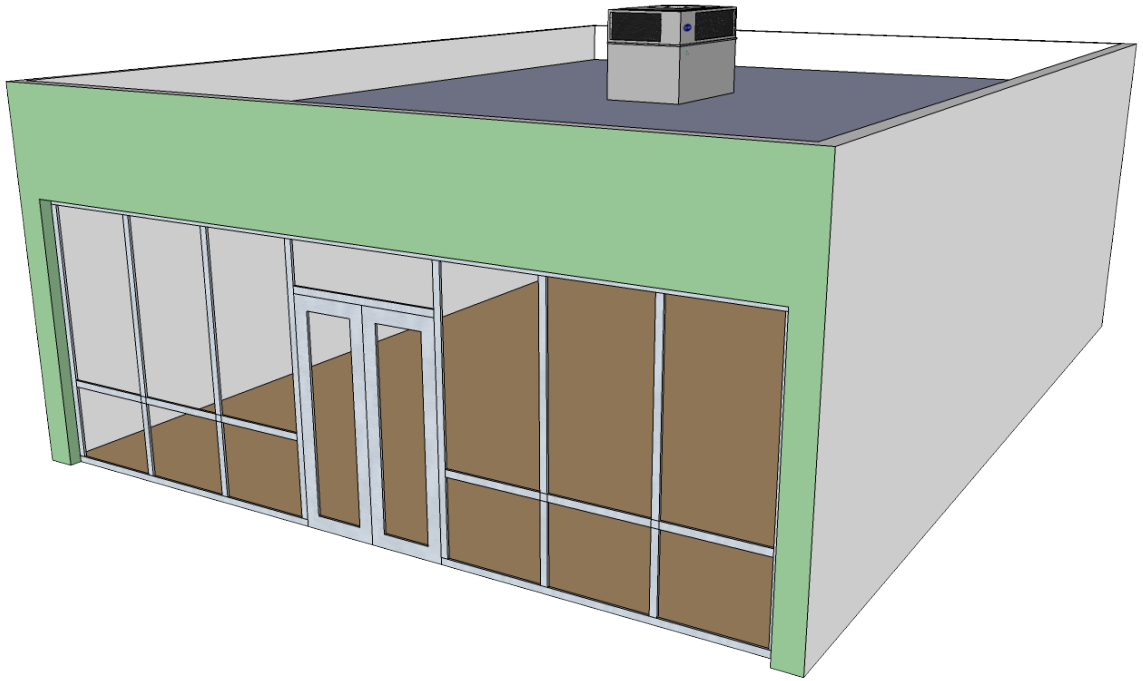
This workshop is approved by AIA for 1.5 LU (HSW).

October 12, 2022 – Energy Efficient Homes of the Future

Leading edge Hawai'i builders Castle & Cooke, D.R. Horton, Gentry Homes and Stanford Carr share their expertise in delivering efficient, comfortable and affordable homes. Take advantage of their experience and support the State's transition to 100% clean energy.

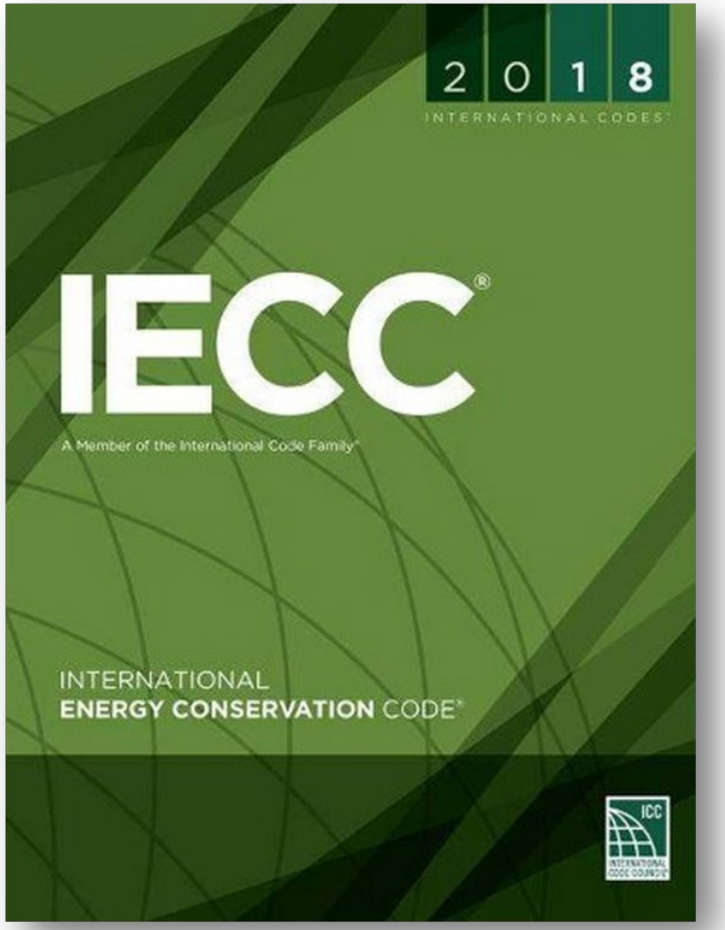
- Presentation: Energy Efficient Homes of the Future
- Video: Energy Efficient Homes of the Future

Section 2
Compliance



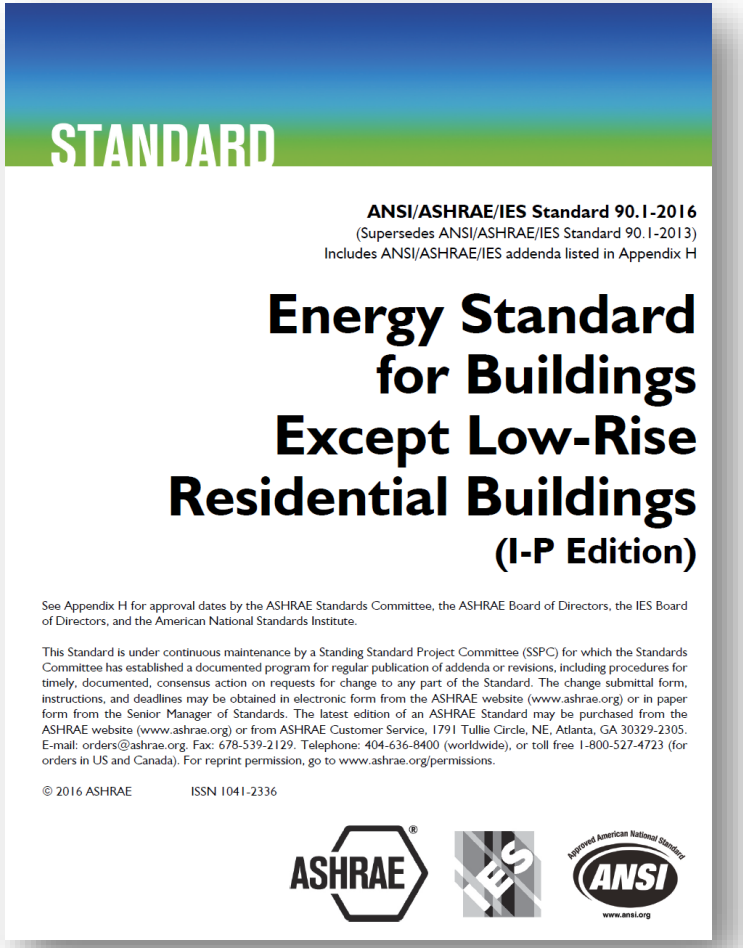
Commercial compliance

2018 IECC + amendments

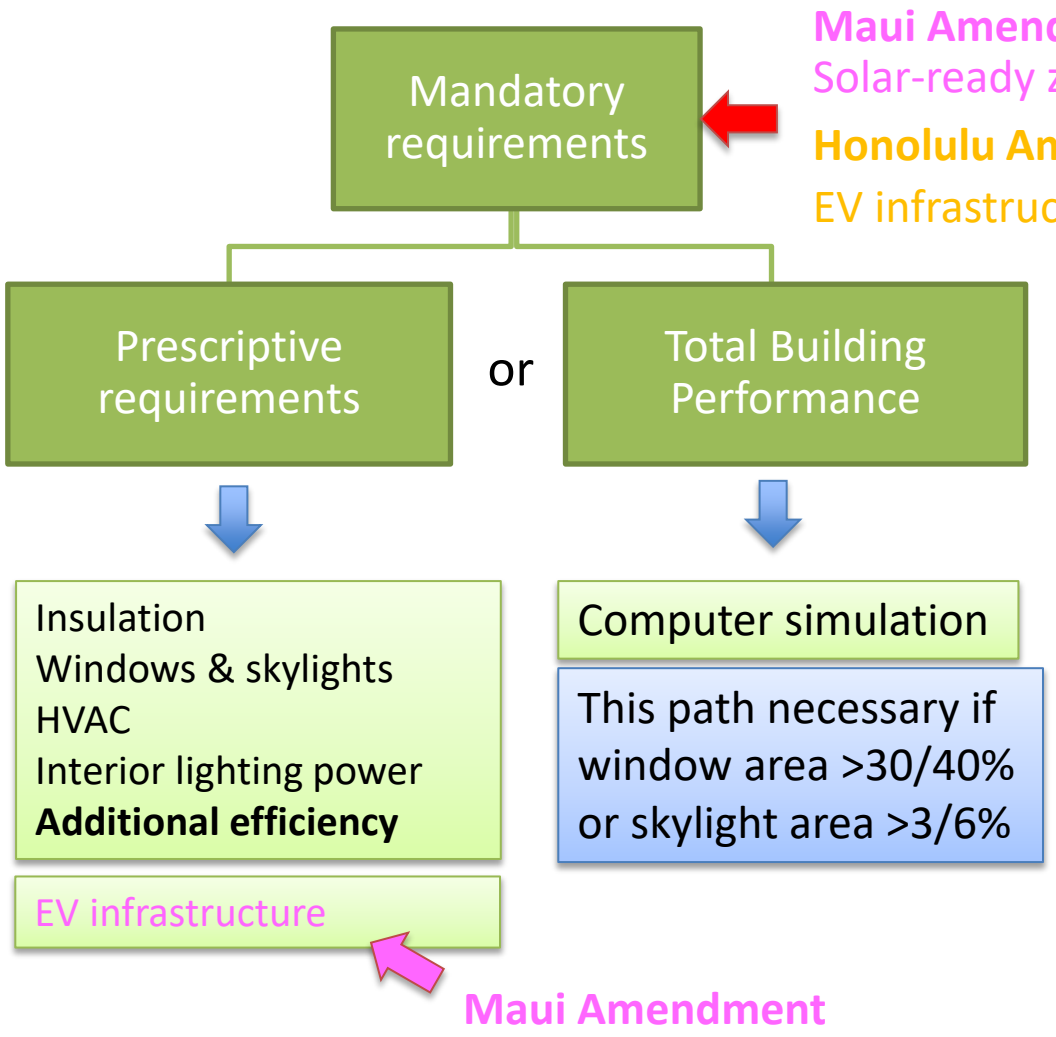


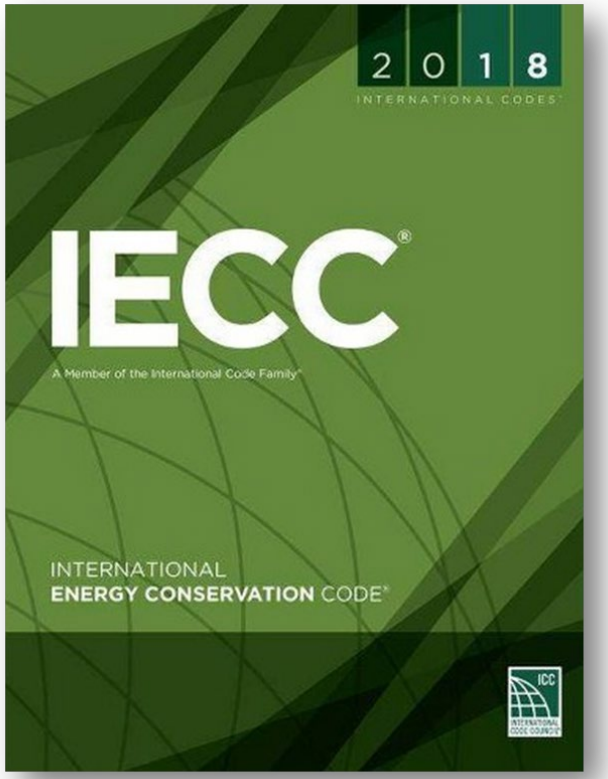
or

ASHRAE Standard 90.1-2016

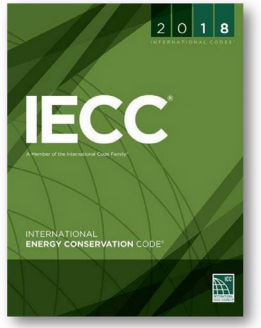


Commercial compliance





Commercial compliance



EV infrastructure

Section C409 and

Honolulu Amendment

C401.2 Application.
Commercial buildings shall comply with one of the following:

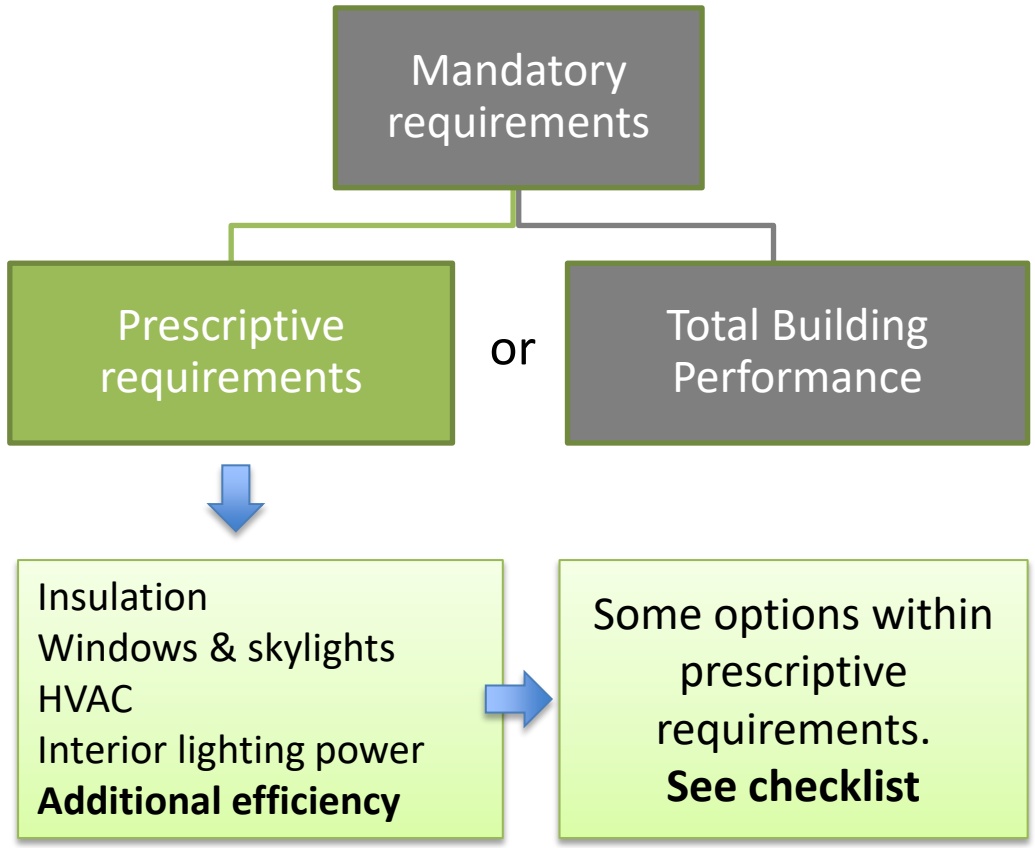
1. The requirements of ANSI/ASHRAE/IESNA 90.1.	ASHRAE Standard 90.1-2016
2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.	Mandatory + Prescriptive
3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.	Mandatory + Total Building Performance

Mandatory requirements

and

C407. Total Building Performance

Commercial compliance - prescriptive



Component/System	Requirement	Code Section
Wall – metal building	**R-13 + R6.5** or **U-0.079** (R-6.5 continuous insulation not required with light reflectance ≥0.64 or shading PF ≥ 0.3)*	C402.1, C402.2
Wall – metal frame	**R-13 + R-5** or **U-0.077** (R-5 continuous insulation not required with light reflectance ≥0.64 or shading PF ≥ 0.3)*	C402.1, C402.2*
Wall – wood frame and other	**R-13 + R3.8** or **R-20** or **U-0.064** (R-3.8 not required with light reflectance ≥0.64 or shading PF≥0.3)*	C402.1, C402.2*
Door - swinging	**U-0.61**	C402.1
Door – non-swinging	**R-4.75**	C402.1
Door – garage <14% glazing	**U-0.31**	C402.1
Low-slope roof membrane	**Aged solar reflectance ≥0.55 + aged emittance ≥0.75**, or **aged solar reflectance index ≥0.64** (exceptions available)	C402.3

Commercial compliance - prescriptive

Additional Efficiency Package Options (C406.1)

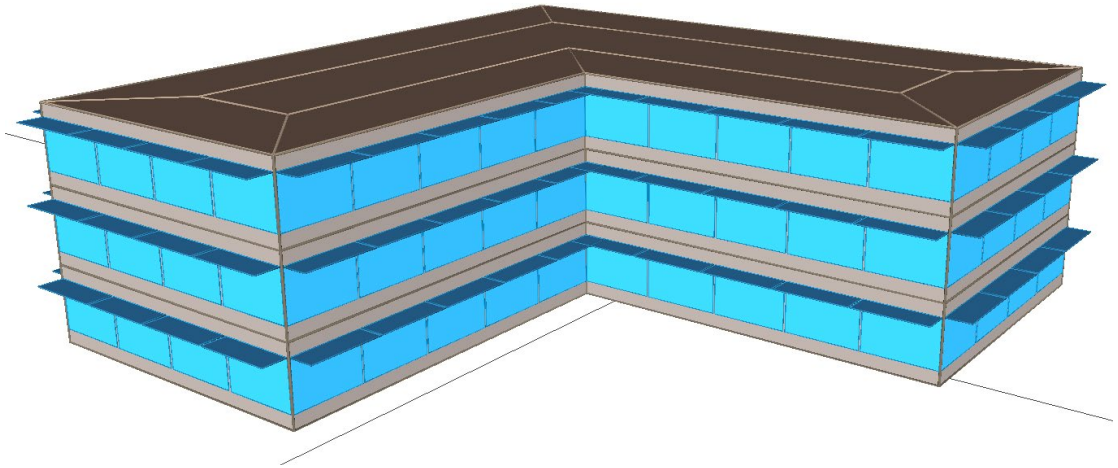
EV infrastructure requirements + at least one additional efficiency feature:

1. More efficient HVAC
2. Reduced lighting power density
3. Enhanced lighting controls
4. On-site renewable energy
5. Dedicated outdoor air system
6. High-efficiency SWH
7. Enhanced envelope performance
8. Reduced air infiltration

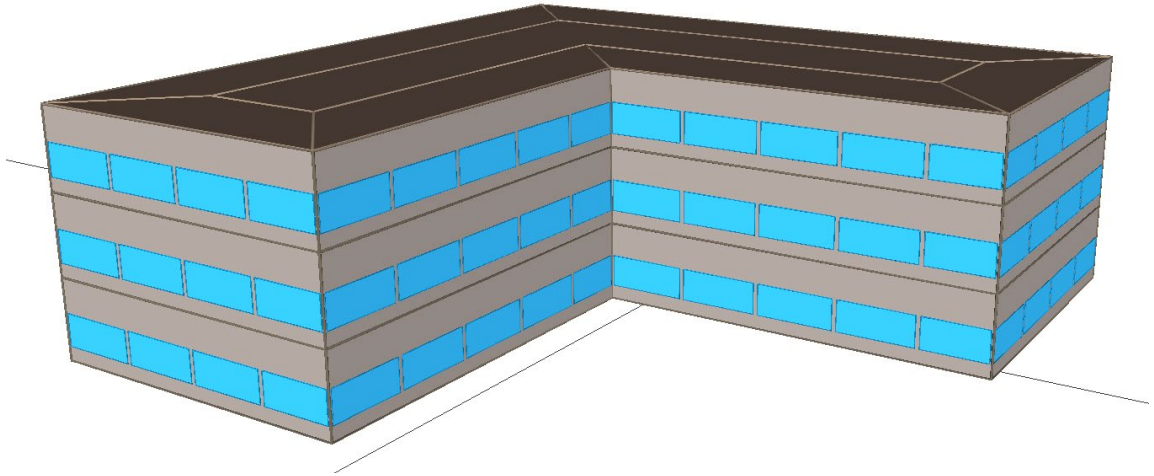
Maui Amendment

Total Building Performance (C407)

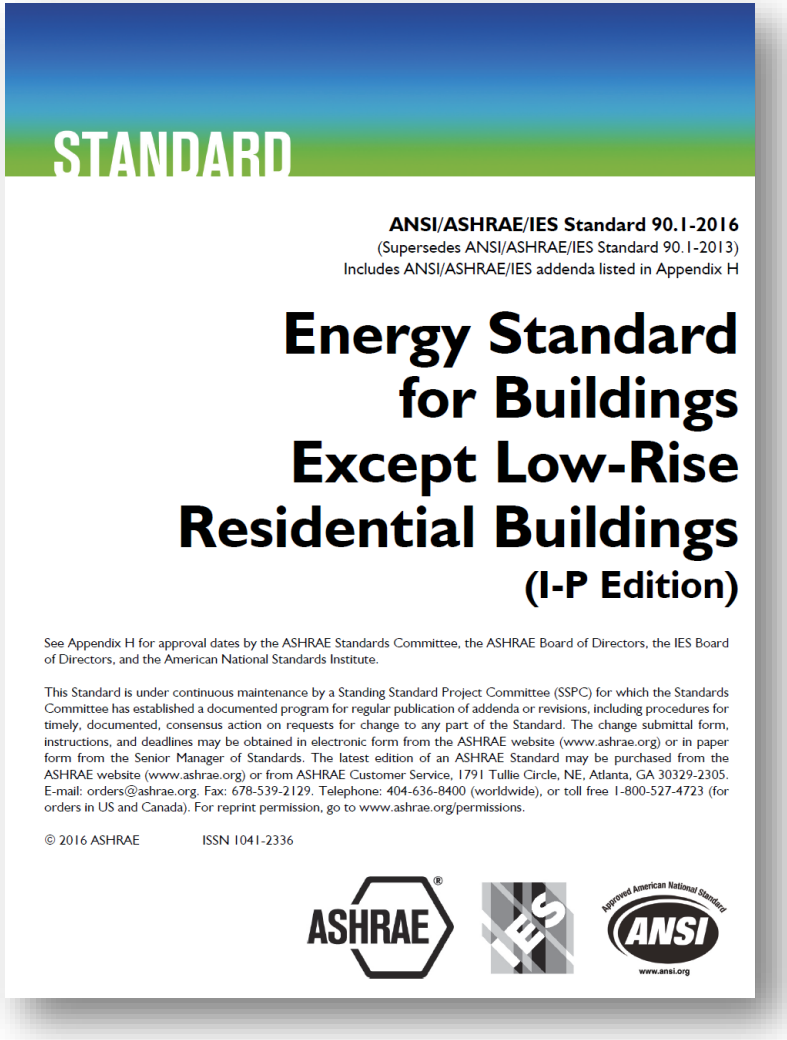
Proposed design model



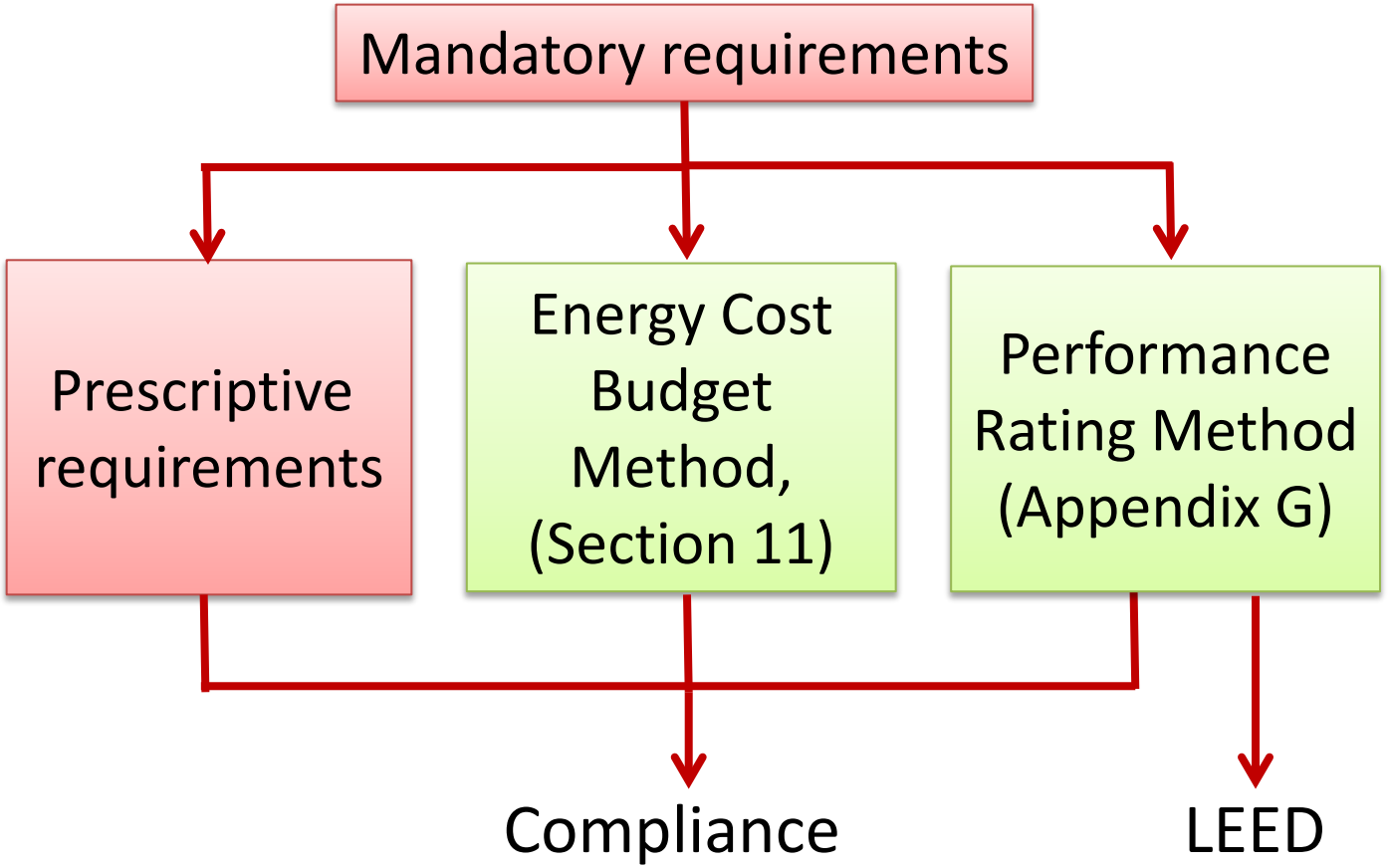
Standard reference design model



Proposed design $/year ≤ Standard reference design $/year x 0.85



ASHRAE Standard 90.1-2016 Compliance



Online preview available here:

https://www.ashrae.org/technical-resources/standards-and-guidelines/read-only-versions-of-ashrae-standards

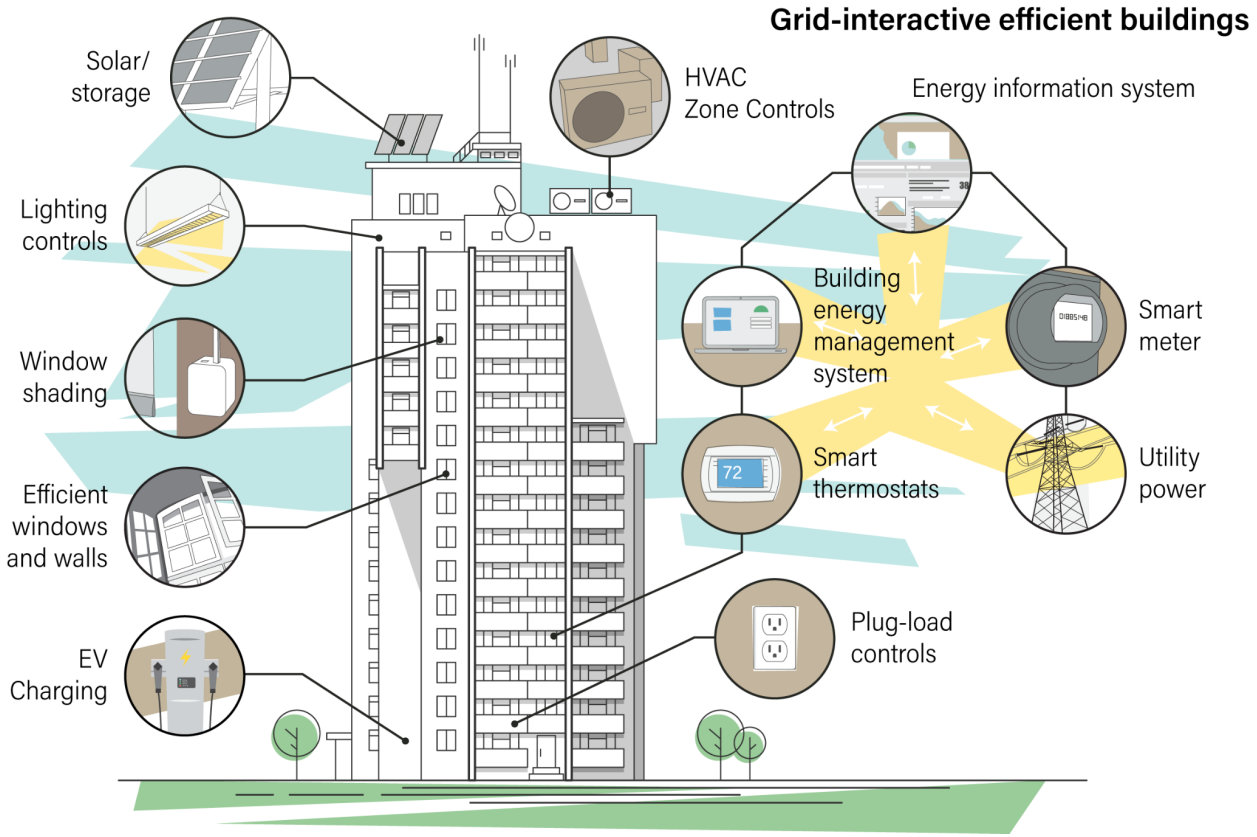
Voluntary stretch code (Appendix CB)

Focused on a building's ability to integrate to the electrical grid.

Defines performance in terms of three key functions:

1. Avoiding energy use during system peak
2. Dynamically shifting building load to support grid needs
3. Overall building energy efficiency

Honolulu Amendment



Design professional certification (C103.2)

CITY AND COUNTY OF HONOLULU
REVISED ORDINANCES OF HONOLULU 2021
CHAPTER 16B

To the best of my knowledge, this project's design substantially conforms to the Building Energy Conservation Code for:

_____ Building Component Systems
_____ Electrical Component Systems
_____ Mechanical Component Systems

Signature: _____ Date: _____
Name: _____
Title: _____
License No.: _____

Include only those items that the signator is responsible for. This block shall be on the first sheet of the pertinent plan, e.g. architectural, electrical, and mechanical. The above may be submitted separately to the Code Official in a letter including the identification of the building.

Honolulu Amendment

Design professional certification (C103.2)

Sample Maui energy code certification block

Prescriptive

Total Building Performance

COUNTY OF MAUI
MAUI COUNTY CODE, CHAPTER 16.16C ENERGY CODE
COMMERCIAL PROVISIONS

COMPLIANCE METHOD
Check applicable method

☐	C401.2(1) ANSI/ASHRAE/IESNA 90.1
☐	C401.2(2) Sections C402 through C406 and C408
☐	C401.2(3) Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408
☐	C102.1 Alternative

To the best of my knowledge, this project's design substantially conforms to the Energy Code.

Signature: _____ Date: _____

Name: _____

Title: _____

License No.: _____

Design professional certification (C103.2)

Kauai statements

Envelope

COUNTY OF KAUA'I
CHAPTER 12, KAUA'I COUNTY BUILDING CODE
KAUA'I COUNTY CODE 1987, AS AMENDED

ARTICLE 6 – ENERGY CONSERVATION CODE

To the best of my knowledge, this project's design substantially conforms to:

Section 12-6.3 Adoption of the International Energy Conservation Code (IECC)
Section 12-6.4 Local Amendments to the IECC
For **building envelope components** (Section C402).

COMPLIANCE METHOD

- ☐ 2018 IECC as amended. Mandatory & Prescriptive
- ☐ 2018 IECC as amended. Mandatory & Total Building Performance
- ☐ ASHRAE Standard 90.1 Mandatory & Prescriptive
- ☐ ASHRAE Standard 90.1 Mandatory & Energy Cost Budget

INFORMATION IN CONSTRUCTION DOCUMENTS	**YES**	**N/A**
Roof insulation R-value	☐	☐
Roof insulation type and location	☐	☐
Roof membrane solar reflectance and thermal emittance	☐	☐
Wall insulation R-value	☐	☐
Wall insulation type and location	☐	☐
Window SHGC	☐	☐
Window U-factor	☐	☐
Skylight SHGC	☐	☐
Skylight U-factor	☐	☐

NOTES

SIGNATURE:

DATE:

NAME:

TITLE:

LICENSE NO.:

Mechanical

COUNTY OF KAUA'I
CHAPTER 12, KAUA'I COUNTY BUILDING CODE
KAUA'I COUNTY CODE 1987, AS AMENDED
ARTICLE 6 – ENERGY CONSERVATION CODE
To the best of my knowledge, this project's design substantially conforms to:
Section 12-6.3 Adoption of the International Energy Conservation Code (IECC)
Section 12-6.4 Local Amendments to the IECC
For **mechanical systems** (Section C403, C404, C406 and C408).

COMPLIANCE METHOD

- ☐ 2018 IECC as amended. Mandatory & Prescriptive
- ☐ 2018 IECC as amended. Mandatory & Total Building Performance
- ☐ ASHRAE Standard 90.1 Mandatory & Prescriptive
- ☐ ASHRAE Standard 90.1 Mandatory & Energy Cost Budget

INFORMATION IN CONSTRUCTION DOCUMENTS	**YES**	**N/A**
HVAC Systems		
Equipment capacity and efficiency. C403.3.2	☐	☐
Thermostatic controls. C403.4.1	☐	☐
Guest room door switches. C403.2.3	☐	☐
Ventilation rate. C403.2.2	☐	☐
Demand control ventilation controls. C403.7.4	☐	☐
Enclosed parking garage ventilation control. C403.7.2	☐	☐
Energy recovery ventilation system. C403.7.4	☐	☐
Kitchen exhaust systems. C403.7.5	☐	☐
Duct and plenum insulation thickness/R-value. C403.11.1	☐	☐
Duct and plenum sealing requirements. C403.11.1	☐	☐
Pipe insulation thickness/R-value. C403.11.3	☐	☐
Fan motor horsepower. C403.8.4	☐	☐
Fan efficiency. C403.8.3	☐	☐
Fan motor efficiency. C405.8.1	☐	☐
Pump motor efficiency. C403.4.1.1	☐	☐
Variable-flow fan control. C403.6.1	☐	☐
Zone thermostatic controls. C403.4.1.2	☐	☐
Setpoint overlap restriction. C403.4.1.3	☐	☐
Hot water boiler outdoor temperature control. C403.4.1.5	☐	☐
Off-hour controls. C403.4.2	☐	☐
Cooling tower fan control. C403.4.3	☐	☐
Terminal unit minimum and maximum airflow. C403.4.4	☐	☐
Commissioning requirements. C408.2	☐	☐
Refrigeration		
Refrigeration equipment efficiency. C403.10	☐	☐
Walk-in coolers and freezers. C403.10.1.2	☐	☐
Refrigerated warehouses. C403.10.1	☐	☐
Refrigerated display cases. C403.10.3	☐	☐
Service Water Heating C404		
Heat recovery for service water heating. C404.6	☐	☐
Equipment capacity and efficiency. C404.2	☐	☐
Pipe insulation. C404.4	☐	☐
Hot water pipe length/volume. C404.5	☐	☐
Hot water circulation controls. C404.6	☐	☐
Heated pool and spa covers. C404.9.3	☐	☐
Commissioning requirements. C408.2	☐	☐

C408.2 Mechanical systems and service water-heating systems commissioning and completion requirements. Prior to the final mechanical and plumbing inspections, the *registered design professional or approved agency* shall provide evidence of mechanical systems *commissioning* and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner or owner's authorized agent and made available to the *code official* upon request in accordance with Sections C408.2.4 and C408.2.5.

SIGNATURE:

DATE:

NAME:

TITLE:

LICENSE NO.:

Electrical

COUNTY OF KAUA'I
CHAPTER 12, KAUA'I COUNTY BUILDING CODE
KAUA'I COUNTY CODE 1987, AS AMENDED

ARTICLE 6 – ENERGY CONSERVATION CODE

To the best of my knowledge, this project's design substantially conforms to:

Section 12-6.3 Adoption of the International Energy Conservation Code (IECC)
Section 12-6.4 Local Amendments to the IECC
For **electrical and lighting systems** (Section C405 and C408).

COMPLIANCE METHOD

- ☐ 2018 IECC as amended. Mandatory & Prescriptive
- ☐ 2018 IECC as amended. Mandatory & Total Building Performance
- ☐ ASHRAE Standard 90.1 Mandatory & Prescriptive
- ☐ ASHRAE Standard 90.1 Mandatory & Energy Cost Budget

INFORMATION IN CONSTRUCTION DOCUMENTS	**YES**	**N/A**
Interior Lighting		
Occupant sensor controls. C405.2.1	☐	☐
Time switch controls. C405.2.2	☐	☐
Daylight responsive controls. C405.2.3	☐	☐
Daylight zones on plans. C405.2.3.2 & C405.2.3.3	☐	☐
Specific application controls. C405.2.4	☐	☐
Interior lighting fixture schedule		
Input power for interior lighting fixtures	☐	☐
Interior lighting fixture locations	☐	☐
Lighting control functional performance testing requirement. C408.3	☐	☐
Exterior lighting		
Exterior lighting controls. C405.2.6	☐	☐
Exterior lighting fixture schedule	☐	☐
Input power for exterior lighting fixtures	☐	☐
Exterior lighting fixture locations	☐	☐
Electrical		
Electrical transformer efficiency. C405.7	☐	☐
Tenant submetering. C405.10	☐	☐

FUNCTIONAL TESTING

C408.3.1 Functional testing. Prior to passing final inspection, the *registered design professional* shall provide evidence that the lighting control systems have been tested to ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the *construction documents* and manufacturer's instructions. Functional testing shall be in accordance with Sections C408.3.1.1 and C408.3.1.2 for the applicable control type.

NOTES

SIGNATURE:

DATE:

NAME:

TITLE:

LICENSE NO.:

Construction documents (C103.2)

2018 IECC Section C103.2

Information required in construction documents

2018 IECC Section C103.2

1. Insulation materials and their *R*-values.
2. Fenestration *U*-factors and solar heat gain coefficients (SHGCs).
3. Area-weighted *U*-factor and solar heat gain coefficient (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water heating systems and equipment types, sizes and efficiencies.
6. Economizer description.
7. Equipment and system controls.
8. Fan motor horsepower (hp) and controls.
9. Duct sealing, duct and pipe insulation and location.
10. Lighting fixture schedule with wattage and control narrative.
11. Location of *daylight* zones on floor plans.
12. Air sealing details.

Construction documents (C103.2)

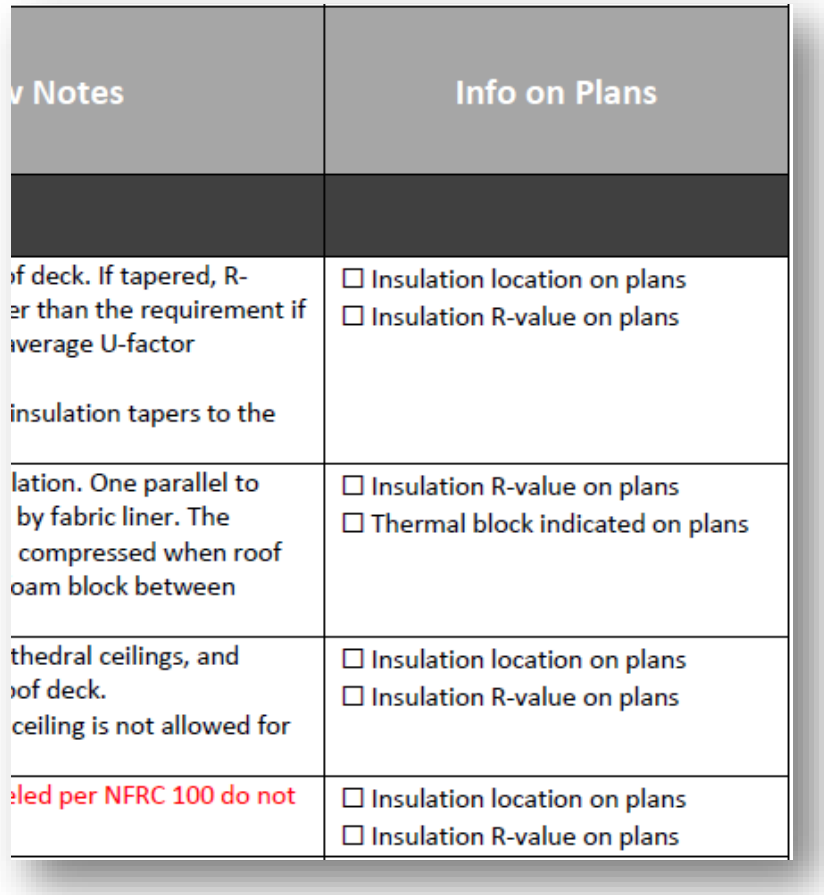
2018 IECC Section C103.2

- Information required on plans

Recommendations in energy code checklists →

Items often not on plans

- Insulation R-value
- Window SHGC
- Lighting fixture input power
- AC equipment efficiency and fan power



v Notes	Info on Plans
of deck. If tapered, R- er than the requirement if verage U-factor insulation tapers to the	☐ Insulation location on plans ☐ Insulation R-value on plans
lation. One parallel to by fabric liner. The compressed when roof oam block between	☐ Insulation R-value on plans ☐ Thermal block indicated on plans
thedral ceilings, and oof deck. ceiling is not allowed for	☐ Insulation location on plans ☐ Insulation R-value on plans
eled per NFRC 100 do not	☐ Insulation location on plans ☐ Insulation R-value on plans

Section 3

Electric vehicle infrastructure

Electric vehicle infrastructure

Honolulu amendment

- Adds Section C409
- Applies to all compliance paths

Two options:

1. Baseline percent of stalls
   - EV charger ready
2. Points-based
   - Dedicated EV ready stalls
   - Common area EV ready stalls
   - Common area EV charger installed

EV charger ready
Dedicated circuit in place

Maui amendment

- Adds C406.10
- Applies to prescriptive compliance path

One option:

- Percent of stalls
  - EV capable
  - EV charger ready
  - EV charger in place
- Can substitute 1 DC fast charger for 7 AC level two chargers

EV capable
Conduit installed

EV charger ready
Conduit, wire, panel capacity provided

Electric vehicle infrastructure

Honolulu Amendment C409

Baseline Compliance Path

Charge method:

208/240VAC/40-100A Minimum 32A

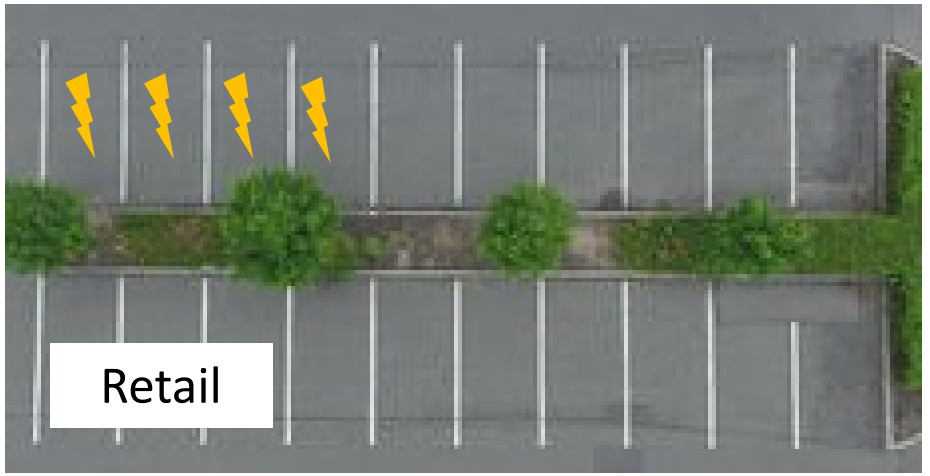
Minimum number of EV-ready stalls:

Building type	Number of new stalls	Minimum number of EV-ready stalls
Multi-unit residential	≥8	≥25%
Commercial	≥12	≥20%
Retail	≥8	≥25%
Affordable housing (for sale)	≥8	≥20%
Affordable housing (for rent)	NA	None

Electric vehicle infrastructure

Honolulu Amendment C409

Baseline Compliance Path Examples, 20 new parking stalls



Electric vehicle infrastructure

Maui Amendment C406.10

Building type	New stalls	Minimum Percentage of New Stalls		
		EV capable	EV charger ready	EV charger installed
Multi-unit residential	≥8	≥70%	≥20%	≥10%
Commercial	≥10	≥40%		≥10%
Retail	≥8	≥32%		≥8%
Affordable housing (100-140% median income)	≥8	≥35%	≥10%	≥5%
Affordable housing (≤100% median income)	NA	None	None	None

AC Level 2 charge method

- 208/240VAC/20-100A Minimum 30A (enclosed attached residential garages)
- 208/240VAC/40-100A Minimum 32A

Substitute 7 AC level 2 chargers with 1 DC fast charger ≥20kW

Electric vehicle infrastructure

Maui Amendment C406.10

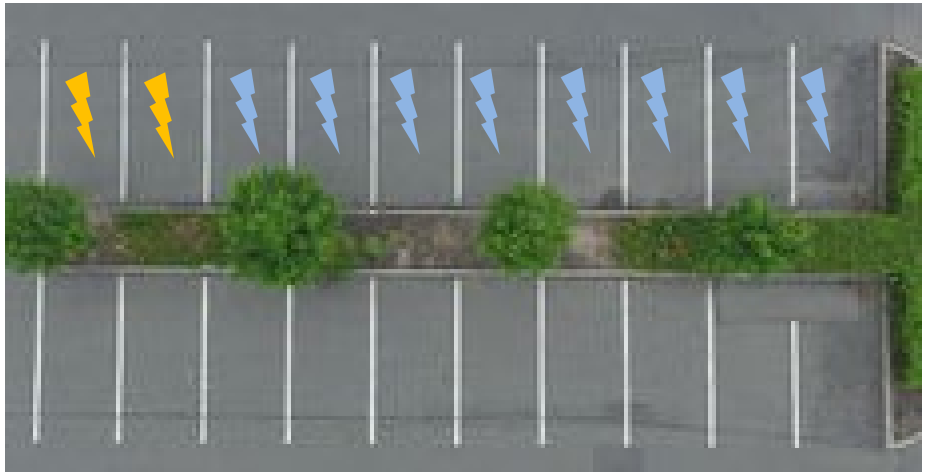
Examples with 20 new parking stalls

Charger installed

Charger ready

Charger capable

Multi-unit high-rise residential



Commercial

Retail

Affordable housing, 100-140% median income

Electric vehicle infrastructure

Maui Amendment C406.10

Requirements apply to altered buildings when:

- Work area >50% of building area, or
- >10 parking spaces are being substantially modified

Electric vehicle infrastructure

Honolulu Amendment C409

Points-based electric vehicle readiness path

Minimum number of points required

Building type	Number of new stalls	Minimum number of points
Multi-unit residential	≥8	# of new stalls ÷ 4
Commercial	≥12	# of new stalls ÷ 4
Retail	≥8	(# of new stalls ÷ 4) × 0.80
Affordable housing (for sale)	≥8	(# of new stalls ÷ 4) × 0.80
Affordable housing (for rent)	NA	None

Electric vehicle infrastructure

Honolulu Amendment C409

Points-based electric vehicle readiness path

Points calculation

Charger type			Compliance points earned per stall		
Electric Vehicle Charger Capacity Level	Charging rate (kW)	Time to charge 50 kW battery (hrs)	Dedicated EV-Ready Stalls	Common Area EV-Ready Stalls	Common Area Stall with EV Charging Equipment Installed
Level 2, Minimum 16A	3.4	14.7	1 (enclosed garage)	NA	NA
Level 2, Minimum 32A	6.7	7.5	1	4	7
Level 2, 64A to 80A	13.3	3.8	1	7	14
DCFC 50 kW (480/277 Vac 3-phase)	50	1	1	25	50

Points may be aggregated over multiple projects, with some restrictions

Section 4

Solar readiness

Source: Deb Lastowka, NREL PIX14363

Solar Readiness (C405.10 & Appendix CA)

Appendix CA Solar-Ready Provisions

- Area reserved for PV or solar thermal system
- Pathways for routing of conduit or plumbing
- Electric panel reserved space
- Permanent certificate near electrical panel

Maui Amendment

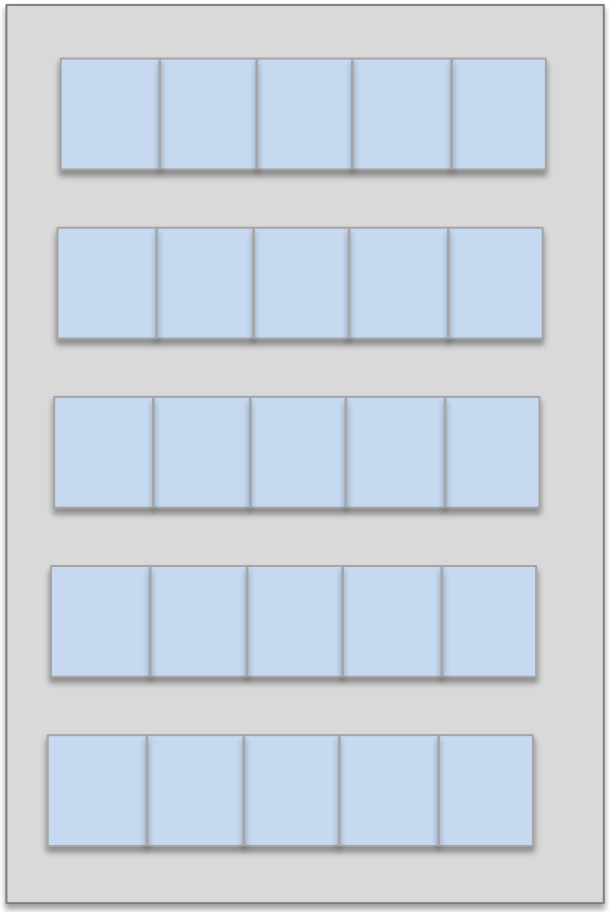
Source: Deb Lastowka, NREL PIX14363

Solar Readiness (C405.10 & Appendix CA)

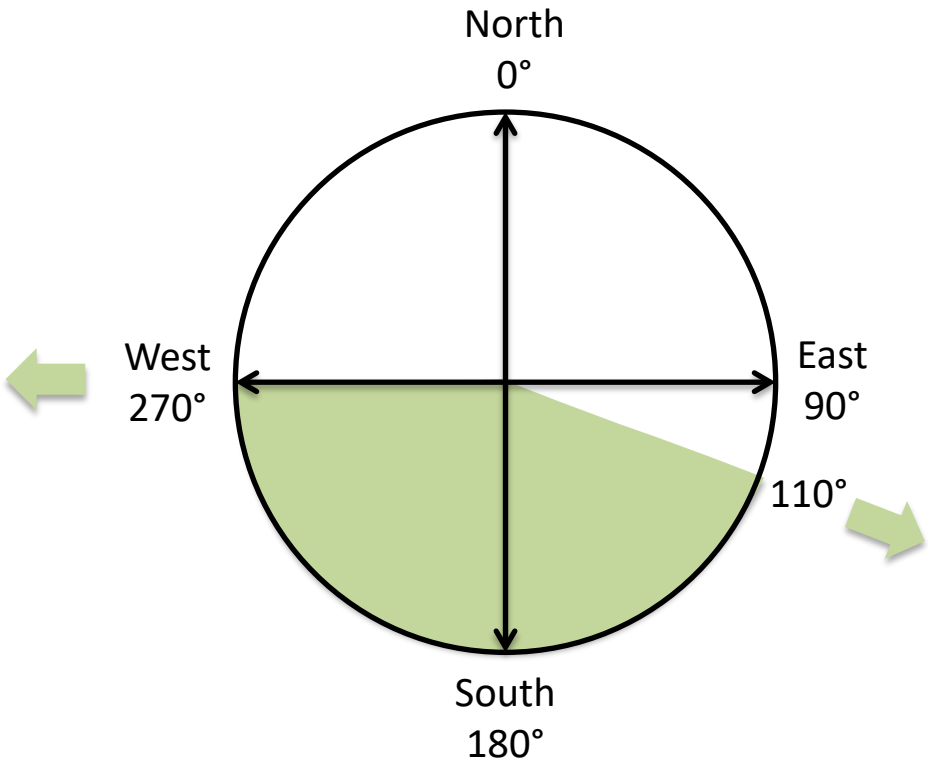
Maui Amendment

When is compliance required?

5 stories or less



Low-slope or oriented between 110° and 270°



Solar Readiness (C405.10 & Appendix CA)

Maui Amendment

Exceptions

- Permanently installed on-site renewable energy system
- Solar-ready zone is shaded >70% of daylight hours
- When a licensed design professional certifies that:
  - Incident solar radiation is not suitable, or
  - Extensive rooftop equipment, skylights, vegetative roof area or other obstructions

Solar Readiness (C405.10 & Appendix CA)

Maui Amendment

Solar-ready zone area requirements

40% of horizontal projected roof area

Excluding:

- Fire code setback or access areas
- Skylights
- Roof decks
- Vegetative areas

Multiple separate areas ok

With 5 ft minimum dimension

Solar Readiness (C405.10 & Appendix CA)

Maui Amendment

Other requirements

Shown on construction documents

Free from obstructions

Roof load documentation, ≥5 psf

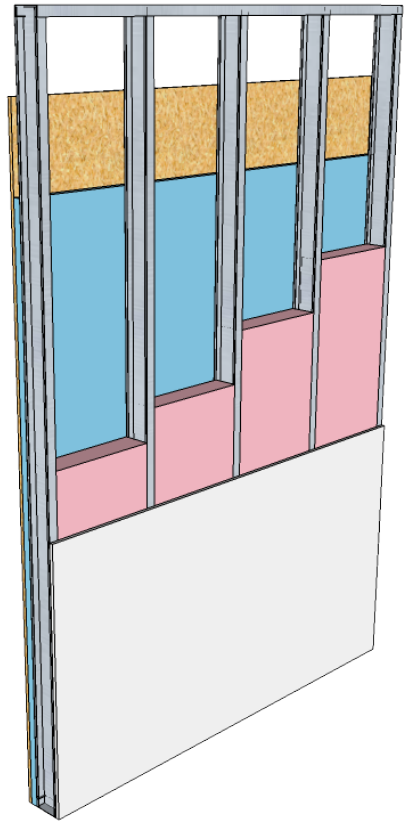
Interconnection pathway for conduit or plumbing

Electrical service reserved space

Construction documentation certificate

Section 5

Envelope



Envelope exemptions

C402.1.1 Low-energy buildings

Exempt from the envelope requirements (buildings or portions of buildings)

1. Peak design rate of energy usage <3.4 Btu/hr-ft^2 for space conditioning
2. Unconditioned space that does not include occupiable space
3. Greenhouses

OCCUPIABLE SPACE means enclosed space intended for human activities, excluding those spaces intended primarily for other purposes, such as storage rooms and equipment rooms, that are only occupied occasionally and for short periods of time

Honolulu Amendment

Unconditioned occupiable space must meet envelope requirements

C402.1.1 Low-energy buildings

Exempt from the envelope requirements (buildings or portions of buildings)

1. Peak design rate of energy usage <3.4 Btu/hr-ft^2 for space conditioning
2. Unconditioned space that does not include habitable space
3. Greenhouses

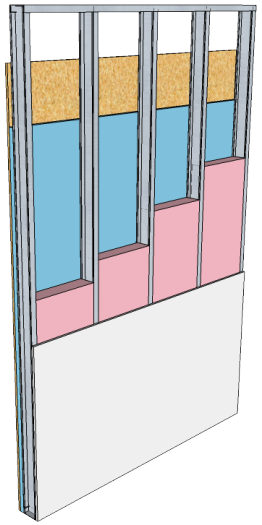
Kauai Amendment

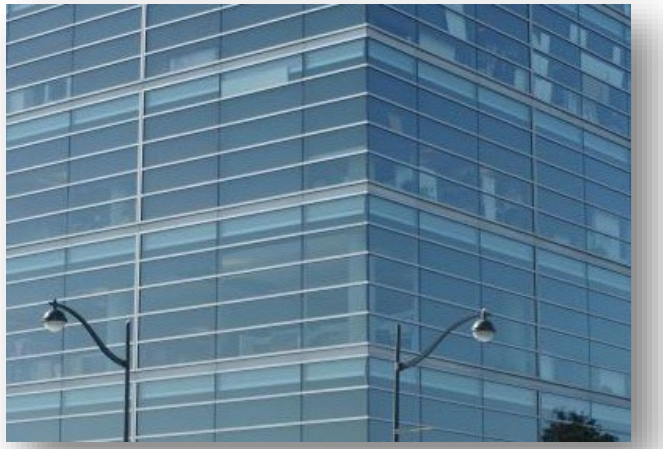
Unconditioned habitable space must meet envelope requirements

Envelope requirements

Envelope

- Roof
- Walls
- Doors
- Low-slope roof membrane
- Window area and performance
- Skylight area and performance
- Air leakage





Envelope prescriptive requirements

Roof insulation (Table C402.1.3)

	Type	Min. Insulation	
		Group R	Other
Roof	Insulation entirely above deck	R-25ci	R-20ci
	Metal building	R-19 + R-11 LS	R-19 + R-11 LS
	Attic and other	R-38	R-38

ci = continuous insulation
LS = layer system

Roof U-factor (Table C402.1.4)

	Type	Min. Insulation	
		Group R	Other
Roof	Insulation entirely above deck	U-0.039	U-0.048
	Metal building	U-0.035	U-0.035
	Attic and other	U-0.027	U-0.027

Envelope prescriptive requirements

Wall insulation (Table C402.1.3)

State Amendment

	Type	Min. Insulation
Walls	Mass	R-5.7ci
	Metal building	R-13 + R-6.5ci
	Metal framed	R-13+ R-5ci
	Wood framed and other	R-13+ R-3.8ci R-20

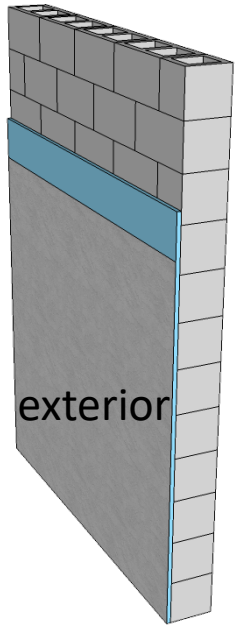
Exceptions allow R-0

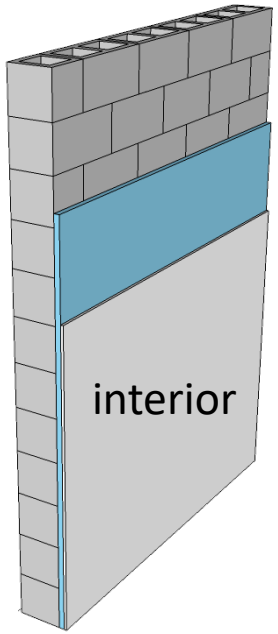
Exceptions allow R-13 alone

ci = continuous insulation

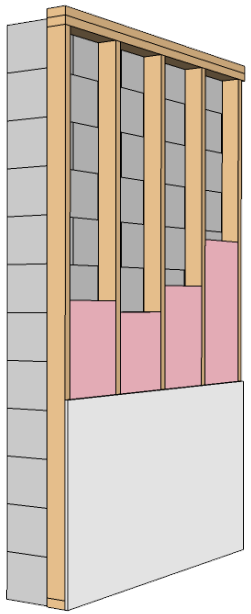
Envelope prescriptive requirements

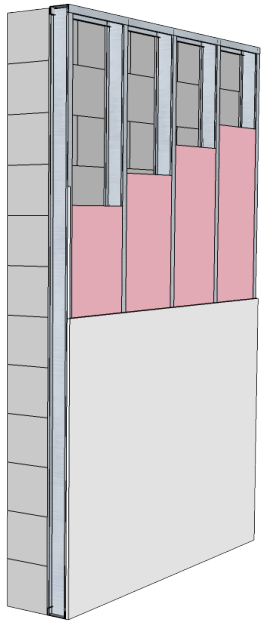
Commercial mass wall options



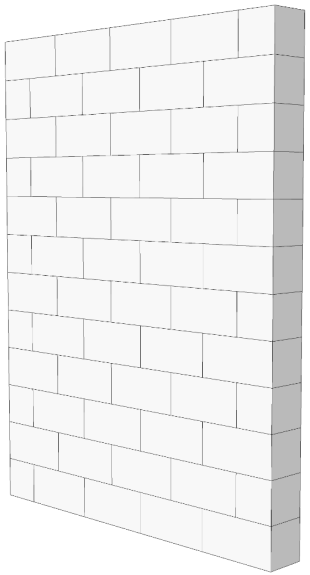


R-5.7 insulation
(1 in. polyisocyanurate or
1.25 in. polystyrene)



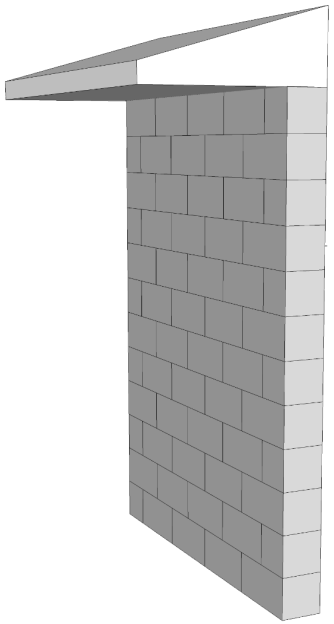


U-factor ≤ 0.151
Interior furring
R-6 in wood or **R-13** in metal



Reflectance
≥ 0.64

State Amendment



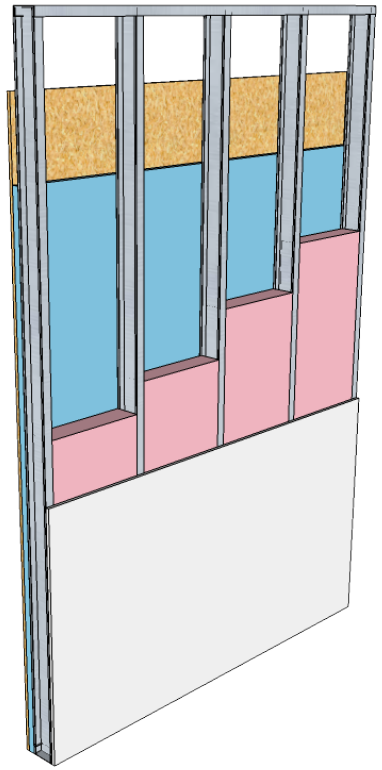
Overhang PF
≥ 0.3

Honolulu Amendment

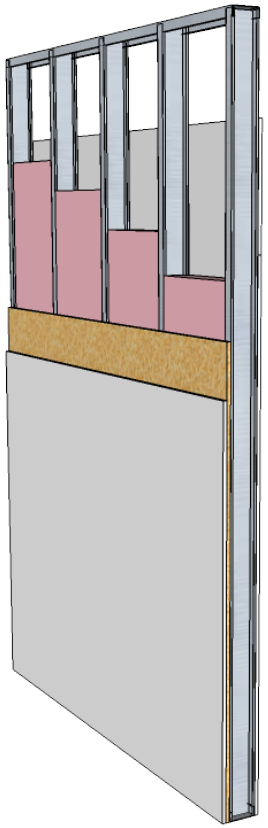
Thickness
≥ 6 inches +
unpainted
finish with or
without
clear sealer

Envelope prescriptive requirements

Commercial metal-framed wall options

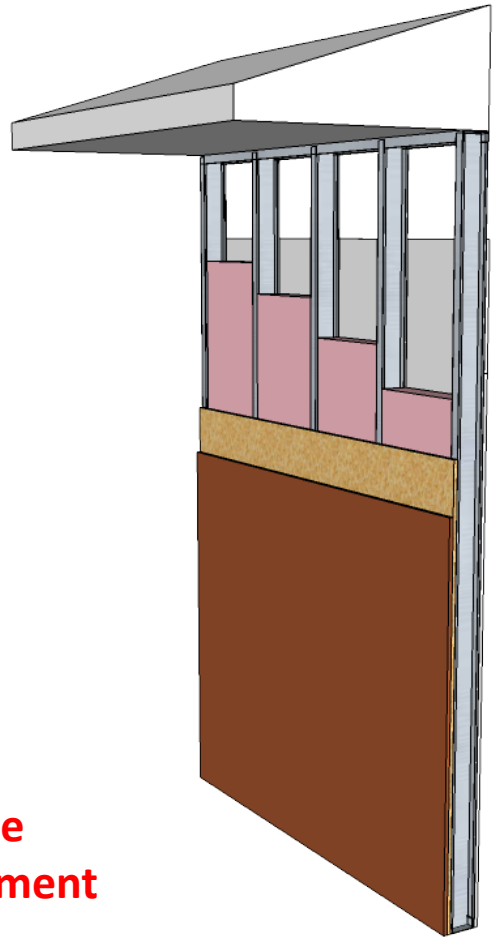


R-13 + **R-5** continuous



R-13+ Reflectance ≥ **0.64**

State Amendment

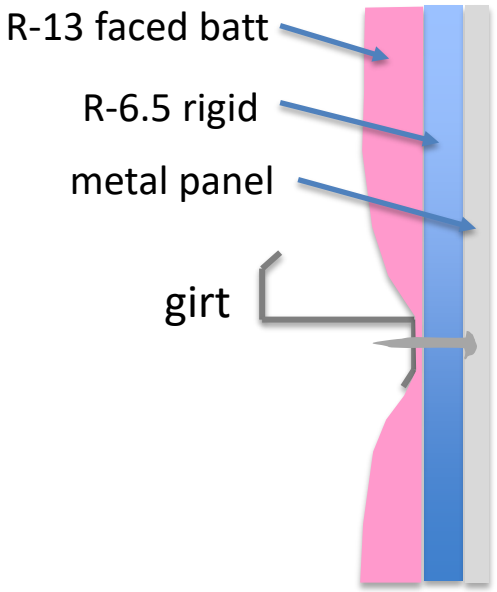


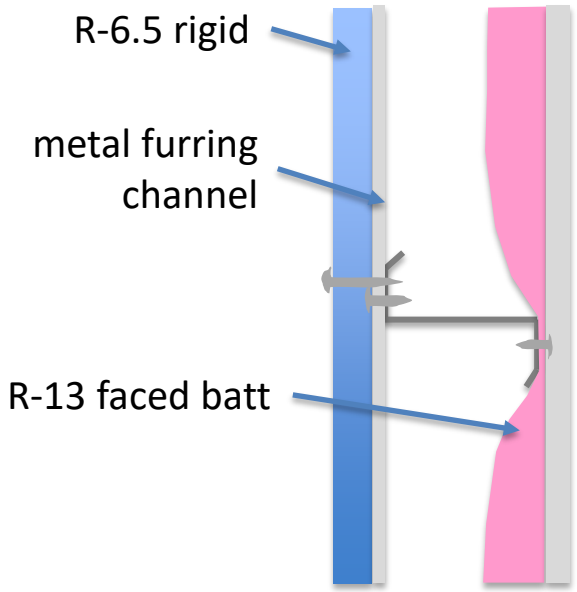
R-13 + Overhang **PF ≥ 0.3**

Envelope prescriptive requirements

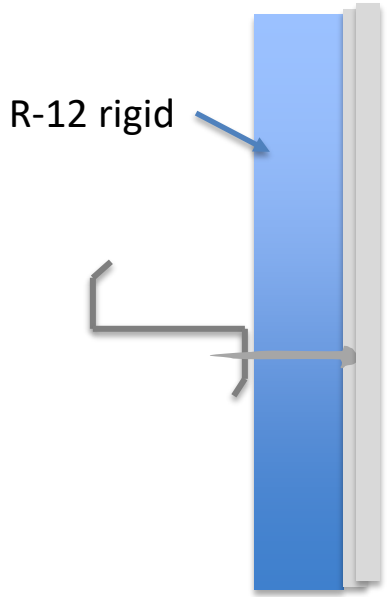
Commercial metal-building wall options

Source: http://armstrongsteel.com

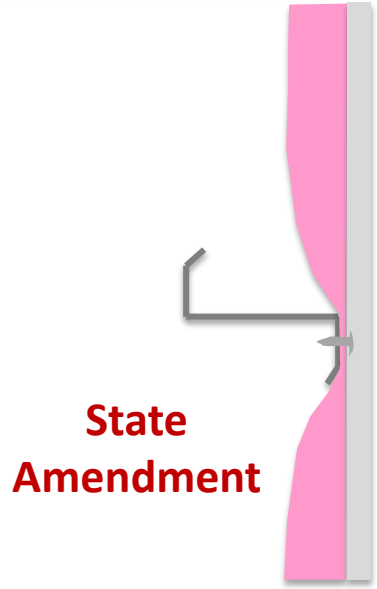




R-13 + **R-6.5** continuous



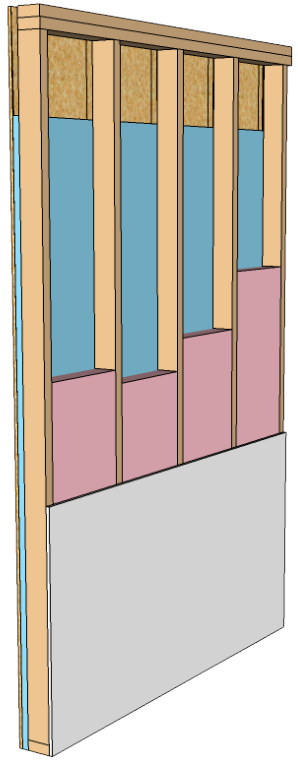
R-12 continuous



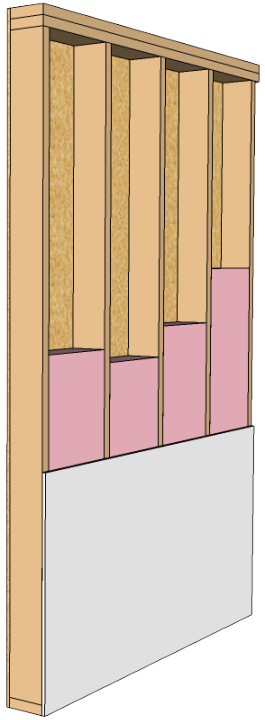
R-13
+ Reflectance ≥ **0.64**, or
+ Overhang **PF ≥ 0.3**

Envelope prescriptive requirements

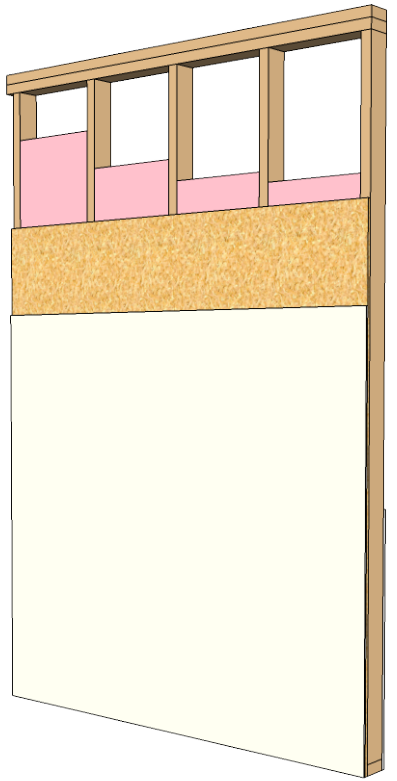
Commercial wood-framed wall options



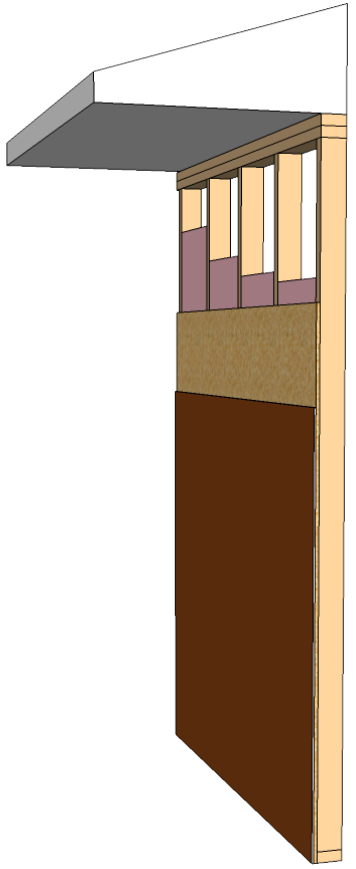
R-13 +
R-3.8 continuous



R-20



R-13 +
Reflectance ≥ **0.64**



R-13 +
Overhang PF ≥ **0.3**

State Amendment

Envelope prescriptive requirements

Roof solar reflectance and thermal emittance (C402.3)

Cool roof required for low-slope roofs

1. solar reflectance ≥0.55
   + thermal emittance ≥ 0.75, or
2. solar reflectance index ≥ 64

3-year aged values

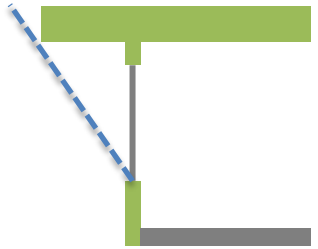
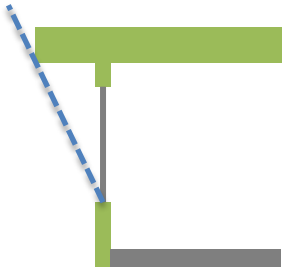
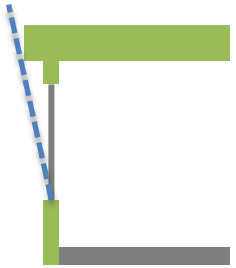
Low slope < 2-in-12

Some exceptions

Typical products
- Single-ply membrane
- Liquid applied

Envelope prescriptive requirements

Window maximum solar heat gain coefficient (SHGC) (C402.4)

	Large overhang  PF ≥ 0.5	Medium overhang  0.20 ≤ PF < 0.50	Small overhang  PF < 0.20
E/S/W	0.40	0.30	0.25
North	0.40	0.37	0.33

Area-weighted average SHGC allowed by Hawaii amendment

State Amendment

Jalousie windows exempt

https://breezway.com/

Envelope prescriptive requirements

Window maximum U-factor (C402.4)

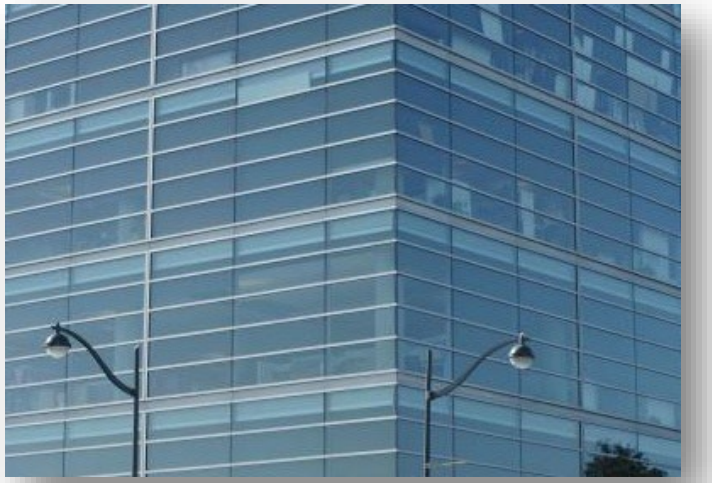
Maximum U-factor

- U-0.50 fixed windows
- U-0.65 operable windows

→ Dual-pane, low-e (typical)

- U-1.10 doors → Single-pane complies

Area-weighted average U-factor allowed



Envelope prescriptive requirements

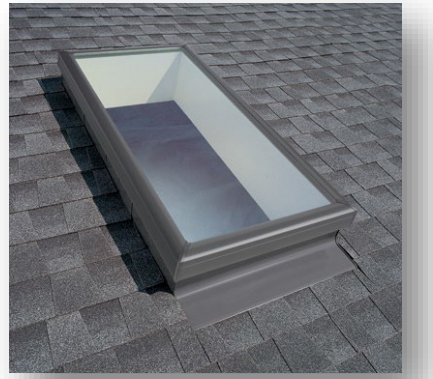
Skylight SHGC & U-factor (C402.4)

SHGC **≤ 0.35**

(or ≤ 0.60 with daylighting controls)

U-factor **≤ 0.75**

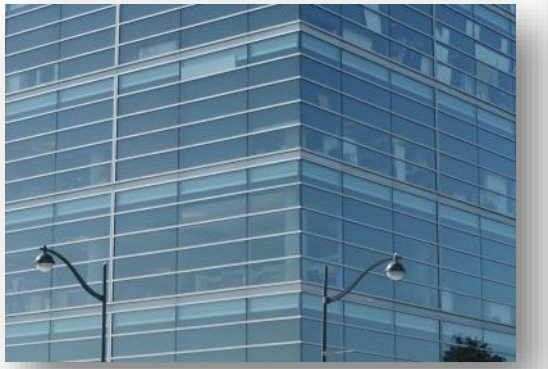
(or U-0.90 with daylighting controls)



www.veluxusa.com

Envelope prescriptive requirements

Maximum fenestration area (C402.4)



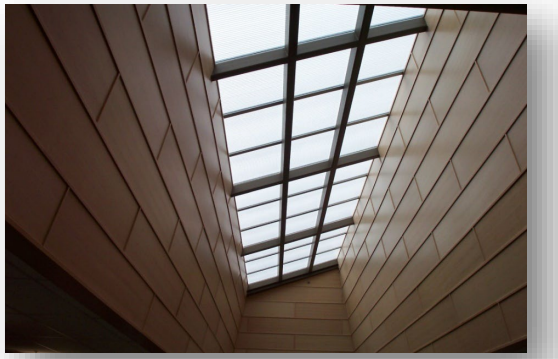
Window area **≤ 30%** of gross wall area

Up to 40% with daylighting controls

Skylight area **≤ 3%** of gross roof area

Up to 6% with daylighting controls
or reduced lighting power

Honolulu Amendment



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Otherwise, use
Total Building Performance
compliance option

Envelope prescriptive requirements

Skylight <u>minimum</u> area (C402.4)

For spaces under a roof where

- Floor area > 2,500 ft^2 and
- Ceiling height > 15 ft

Envelope prescriptive requirements

Skylight <u>minimum</u> area (C402.4)

For spaces under a roof where
- Floor area > 2,500 ft^2 and
- Ceiling height > 15 ft

≥50% of floor area must be daylighted by skylights

and

Minimum skylight area
1. 3% or roof, or
2. 1% effective aperture

Several exceptions apply, including lighting power < 0.5 W/ft^2

Space types
- office
- lobby
- atrium
- concourse
- corridor
- storage space
- gymnasium/exercise center
- convention center
- automotive service area
- manufacturing
- nonrefrigerated warehouse
- retail store
- distribution/sorting area
- transportation depot
- workshop

Envelope prescriptive requirements

Envelope air leakage (C402.5)

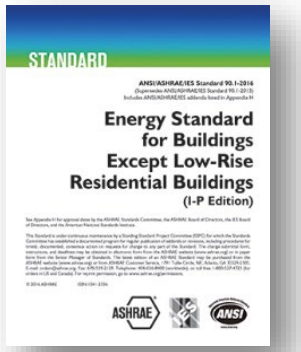
- Continuous air barrier
- Fenestration air leakage
- Openings to shafts, chutes, stairways and elevator lobbies
- Air intakes, exhaust openings, stairways, and shafts.
- Loading-dock weatherseals
- Recessed lighting in the thermal envelope

Envelope compliance option summary

1. Prescriptive requirements
   - Roof and wall thermal performance
     - R-value, U-factor, or component performance alternative
   - Low-slope roof solar reflectance and thermal emittance
   - Windows and skylights
     - Maximum area
     - Maximum U-factor
     - Maximum solar heat gain coefficient (SHGC)
   - Air leakage

2. Total Building Performance

3. ASHRAE Standard 90.1-2016



CLIMATE ZONE	1	
	All other	Group R
Insulation entirely above roof deck	R-20ci	R-25ci
Metal buildings[b]	R-19 + R-11 LS	R-19 + R-11 LS
Attic and other	R-38	R-38
Mass[g]	R-5.7ci[c]	R-5.7ci[c]
Metal building	R-13+ R-6.5ci	R-13 + R-6.5ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20
Below-grade wall[d]	NR	NR
Mass[e]	NR	NR
Joist/framing	NR	NR
Unheated slabs	NR	NR
Heated slabs[h]	R-7.5 for 12″ below + R-5 full slab	R-7.5 for 12″ below + R-5 full slab
Nonswinging	R-4.75	R-4.75

Section 6
Mechanical Systems

Mechanical requirements

Mechanical systems

- Commissioning
- Zone isolation
- Ventilation
- Equipment efficiency
- Hot gas bypass
- Thermostatic controls
- Hydronic part load controls
- Pump isolation
- Variable air volume system controls
- Demand control ventilation
- Parking garage ventilation
- Energy recovery
- Kitchen exhaust
- Door switches
- Guest room AC and ventilation controls
- Shutoff dampers

State Amendment

- Fan power
- Fan airflow control
- Cooling tower fan control
- Heat recovery for water heating
- Refrigeration
- Duct and plenum insulation and sealing
- Piping insulation

Small Commercial Example

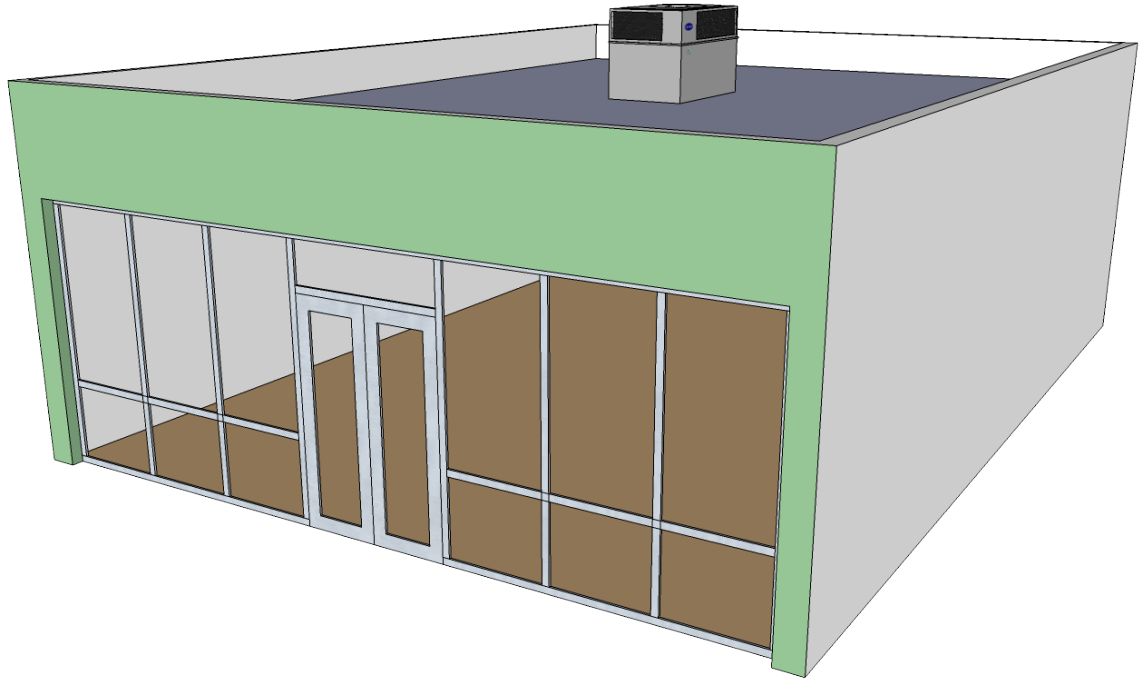
C403.1.1 **Cooling load calculations**
C403.3.1 **Equipment sizing**
C403.3.2 **Equipment efficiency**
- SEER 14

C403.4 **Controls**
- Programmable thermostat

C403.7.7 **Shutoff dampers**
C403.11 **Duct insulation and sealing**
- R-6 in unconditioned space

Maybe also:
C403.7.5 Kitchen exhaust
C403.8.5 Fan airflow control, if >5 tons
C403.10 Refrigeration equipment
C403.10.3 Refrigerated display cases

1,200 ft^2 floor area
4-ton rooftop unit



Mechanical systems

Door Switches (C403.2.3) **State Amendment**

- Space types
  - Hotel and motel sleeping units
  - Guest suites
  - Time-share condominiums
- Control operation
  - Disable cooling or reset to ≥90°F
  - < 5 minutes of opening

Mechanical systems

Automatic control of HVAC serving guestrooms (C403.7.6)

If >50 guestrooms

1. Temperature setpoint controls
   - Raise setpoint by 4°F within 30 minutes
   - Setpoint ≥80°F when unrented or unoccupied >16 hours
   - Some exceptions
2. Ventilation controls
   - Turn off ventilation and exhaust within 30 minutes
   - Automatic pre-occupancy purge allowed

Mechanical systems

Enclosed parking garage ventilation controls (C403.7.2)

Automatic exhaust fan control

- Contaminant sensors
- Automatically reduce flow
  1. Stage or modulate fans to 50% or less flow
  2. Operate intermittently for 20% or less of occupied time

Exceptions:
- < 22,500 cfm
- > 1,125 cfm/hp

Mechanical systems

Energy recovery ventilation systems (C403.7.4)

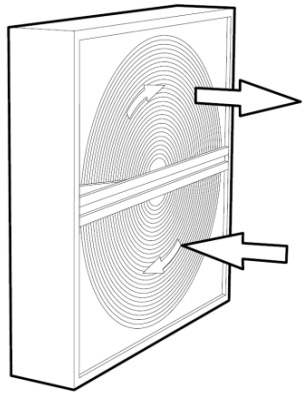
- Energy recovery effectiveness **≥ 50%**
- If design supply air flow exceeds limit (some exceptions)

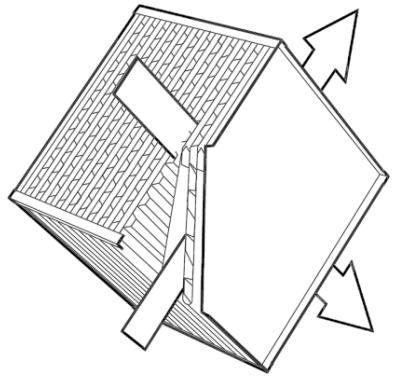
Table C403.7.4 (excerpt)

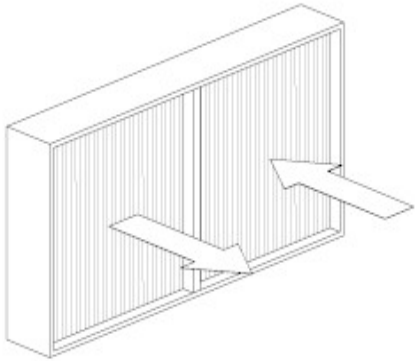
	Design supply air flow rate	
Design percent outdoor airflow rate	Fan Operates < 8,000 hrs/yr	Fan Operates ≥ 8,000 hrs/yr
≥ 10% and <20%	≥26,000 cfm	≥2,500 cfm
≥ 20% and <30%	≥16,000 cfm	≥2,000 cfm
≥ 30% and <40%	≥5,500 cfm	≥1,000 cfm
≥ 40% and <50%	≥4,500 cfm	≥500 cfm
≥ 50% and <60%	≥3,500 cfm	>140 cfm
≥ 60% and <70%	≥2,000 cfm	>120 cfm
≥ 70% and <80%	≥1,000 cfm	>100 cfm
≥ 80%	>120 cfm	>80 cfm

Common options

- Air-to-air heat exchanger
- Heat pipe
- Heat wheel
- Run-around coils







Mechanical systems

Kitchen exhaust systems (C403.7.5)

- ≤10% replacement air directly into hood
- Limit on conditioned supply air

If total exhaust flow > 5,000 cfm

- Factory-built hoods, UL listed
- Max. cfm/linear ft (Table C403.7.5)
- One of the following
  - transfer air ≥50%
  - demand-control ventilation
  - energy recovery

TABLE C403.7.5

MAXIMUM NET EXHAUST FLOW RATE, CFM PER LINEAR FOOT OF HOOD LENGTH

TYPE OF HOOD	LIGHT-DUTY EQUIPMENT	MEDIUM-DUTY EQUIPMENT	HEAVY-DUTY EQUIPMENT	EXTRA-HEAVY-DUTY EQUIPMENT
Wall-mounted canopy	140	210	280	385
Single island	280	350	420	490
Double island (per side)	175	210	280	385
Eyebrow	175	175	NA	NA
Backshelf/Pass-over	210	210	280	NA

For SI: 1 cfm = 0.4719 L/s; 1 foot = 305 mm.

NA = Not Allowed.

Mechanical systems

Fan airflow control (C403.8.5.1)

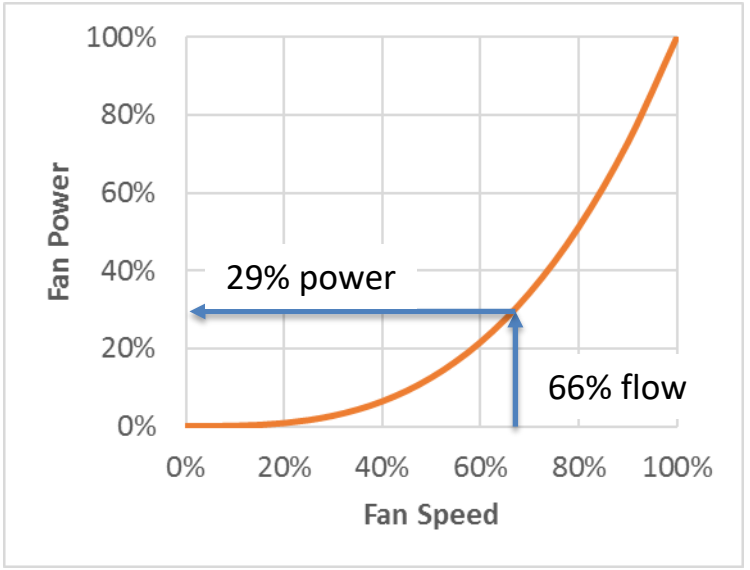
- DX systems with cooling capacity ≥65,000 Btu/hr
- Chilled water systems with fan power ≥0.25 hp

Variable airflow required

- Systems that vary cooling capacity to control space temperature
  - At least two stages of fan control
  - Low speed ≤66% flow and ≤ 40% fan power
- Systems that vary airflow to control space temperature
  - Variable speed control
  - Minimum speed ≤ 50% and power ≤ 30%

Some exceptions

Fan Laws



Mechanical systems

Heat recovery for service water heating (C403.9.5)

For buildings with

- 24-hour operation
- > 6,000,000 Btu/hr (500 tons) heat rejection
- Water heating load >1,000,000 Btu/hr

Requirement, the smaller of:

- Recover 60% of heat rejection
- Preheat water to 85F

Some exceptions

Mechanical systems

Refrigeration equipment performance (C403.10)

C403.10.1

- Walk-in coolers
- Walk-in freezers
- Refrigerated warehouse coolers
- Refrigerated warehouse freezers

} Not site assembled

C403.10.2

- Walk-in coolers and walk-in freezers, site assembled

C403.10.3

- Refrigerated display cases

C403.10.4

- Remote condensers & compressors

Mechanical systems

Mechanical systems commissioning and completion (C408.2)

Required when:

- ≥ 480,000 Btu/h cooling capacity, or
- ≥ 600,000 Btu/h heating capacity

} Typically ≥ 20,000 ft^2

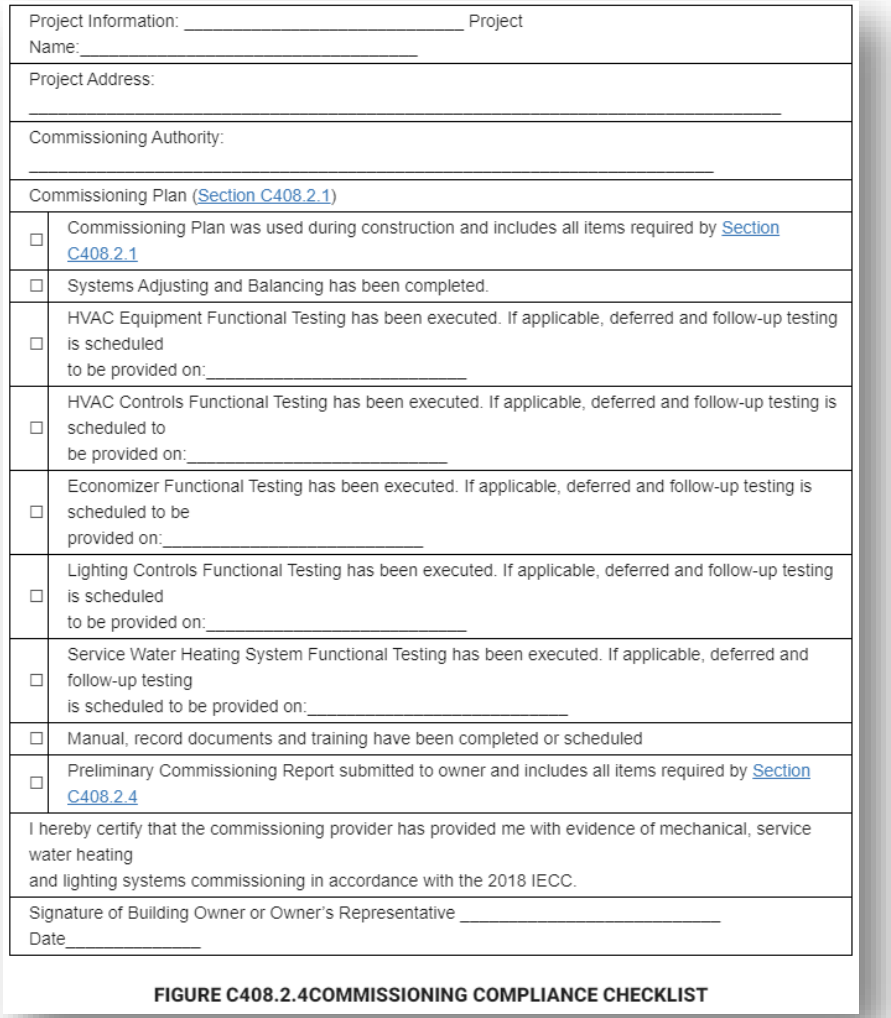
Requirements

- Notes on construction documents
- Commissioning plan → Developed by registered design professional or approved agency
- Systems adjusting and balancing
- Functional performance testing
- Preliminary commissioning report → Certified by registered design professional or approved agency
- Final commissioning report

↓

Letter from owner before certificate of occupancy

Honolulu Amendment



Project Information: _____ Project Name:_____
Project Address: _____
Commissioning Authority: _____
Commissioning Plan (Section C408.2.1)
☐ Commissioning Plan was used during construction and includes all items required by Section C408.2.1
☐ Systems Adjusting and Balancing has been completed.
☐ HVAC Equipment Functional Testing has been executed. If applicable, deferred and follow-up testing is scheduled to be provided on:_____
☐ HVAC Controls Functional Testing has been executed. If applicable, deferred and follow-up testing is scheduled to be provided on:_____
☐ Economizer Functional Testing has been executed. If applicable, deferred and follow-up testing is scheduled to be provided on:_____
☐ Lighting Controls Functional Testing has been executed. If applicable, deferred and follow-up testing is scheduled to be provided on:_____
☐ Service Water Heating System Functional Testing has been executed. If applicable, deferred and follow-up testing is scheduled to be provided on:_____
☐ Manual, record documents and training have been completed or scheduled
☐ Preliminary Commissioning Report submitted to owner and includes all items required by Section C408.2.4
I hereby certify that the commissioning provider has provided me with evidence of mechanical, service water heating and lighting systems commissioning in accordance with the 2018 IECC.
Signature of Building Owner or Owner's Representative _____ Date_____

FIGURE C408.2.4COMMISSIONING COMPLIANCE CHECKLIST

Section 7
Service Water Heating

What are the requirements?

Service water heating

- Commissioning
- Equipment efficiency
- Heat traps for storage tanks
- Pipe insulation
- Maximum pipe length
- Circulation system controls
- Demand recirculation system controls
- Pools and spas

Courtesy Daniel Sandomire, Armstrong Builders

Section 8

Electrical & Lighting

Lighting requirements

Functional testing

Dwelling unit lighting

Interior lighting controls

- Occupant sensor
- Time switch
- Light reduction
- Daylight responsive
- Display and accent
- Sleeping and dwelling units

Interior lighting power

Exterior lighting control

Exterior lighting power

Gas lighting

Other electrical requirements

Electricity meters

Electrical transformers

Electrical motors

Elevators and escalators

Voltage drop in feeders and branch circuits

Electrical sub-metering (State amendment)

Solar ready zone (Maui amendment)

Electric vehicle infrastructure (Honolulu & Maui amendments)

Courtesy Rocky Mould

Interior lighting

Dwelling and sleeping unit compliance (C405.1)

	≥90% lamps high efficacy (R404.1)	Interior lighting power allowance (C405.3)	Controls (C405.2.4)
1. Dwelling unit in multifamily building	Required	NA	NA
2. Dwelling unit in other buildings	Choose		Occupancy sensor or multi-level control
3. Sleeping unit	Choose		Auto-off control for permanent lights and switched receptacles

DWELLING UNIT. A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

Honolulu amends this definition

SLEEPING UNIT. A room or space in which people sleep, that can include permanent provisions for living, eating, and either sanitation or kitchen facilities but not both. Such rooms and spaces that are part of a dwelling unit are not sleeping units.

Interior lighting

Dwelling and sleeping unit compliance (C405.1)

High efficacy lighting option (R404.1)

- ≥90% lamps high efficacy

Lamp Wattage	Efficacy
> 40 watts	60 lumens/watt
15-40 watts	50 lumens/watt
< 15 watts	40 lumens/watt

Honolulu Amendment

HIGH-EFFICACY LIGHTING means an efficacy of not less than 70 lumens per watt for lamps and 55 lumens per watt for fixtures.

Source: DOE/NREL PIX20307

LED

Interior lighting

Dwelling and sleeping unit compliance (C405.1)

Interior lighting power allowance option (C405.3)

Building Area Method

Building Area Type	Lighting Power Density (W/ft^2)
Dormitory	0.61
Hotel/motel	0.75

Space-by-space Method

Space Type	Lighting Power Density (W/ft^2)
Dormitory living quarters	0.54
Guestroom	0.77

Interior lighting

Lighting Controls (C405.2) (covered on following slides)

- Occupant sensor controls
- Time switch controls
- Light reduction controls
- Daylight-responsive controls
- Specific application controls

Exceptions

- Security or emergency areas
- Exit stairways, ramps and passageways
- Egress lighting that is normally off

Honolulu Amendment

Exception for corridors, passageways, lobbies and other circulation spaces within multi-family buildings that must remain lighted for egress.

Interior lighting

Occupant Sensor Controls (C405.2.1)

Required space types

- Classrooms/lecture/training rooms
- Conference/meeting/multipurpose
- Copy/print rooms
- Lounges/break rooms
- Enclosed offices
- Open plan office areas
- Restrooms
- Storage rooms
- Locker rooms
- Other spaces ≤300 ft^2 with floor-to-ceiling partitions
- Warehouse storage areas

Warehouse storage areas

- Each aisle separately
- Reduce to 50% or less

Open office areas

- Control zones ≤600 ft^2
- Reduce to 80% or less

All other spaces

1. Manual on, or
2. Auto-on to ≤50% power

Interior lighting

Required for each area without occupant sensor

Time-switch controls (C405.2.2)

- Exceptions
  - Patient care
  - Safety or security
  - Lighting for continuous operation
  - Shop and laboratory classrooms
  - Spaces with lighting power ≤80% of allowance

Honolulu Amendment

Light reduction controls (C405.2.2.2)

- Manual control to 50% or less power
- Uniform illumination
- Exception
  - Daylight-responsive controls

Interior lighting

Daylight-responsive controls (C405.2.3)

- Required in spaces with >150W of general lighting in:
  - Sidelit daylight zones
  - Toplit daylight zones
- Exceptions
  - Patient care
  - Dwelling units & sleeping units
  - Display and accent lighting
  - Display case lighting
  - First floor sidelight zone in A-2 and M occupancies
  - Spaces with lighting power ≤80% of allowance
  - Total building lighting power ≤ LPD_{adj}

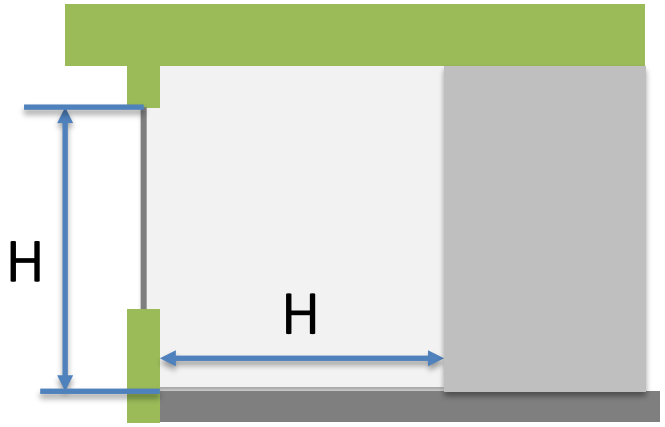
Honolulu Amendment

$$LPA_{adj} = LPA_{norm} \times \left(1 - \frac{0.4 \times Uncontrolled\ daylight\ zone\ floor\ area}{Total\ floor\ area}\right)$$

1.0 to 0.6

Interior lighting

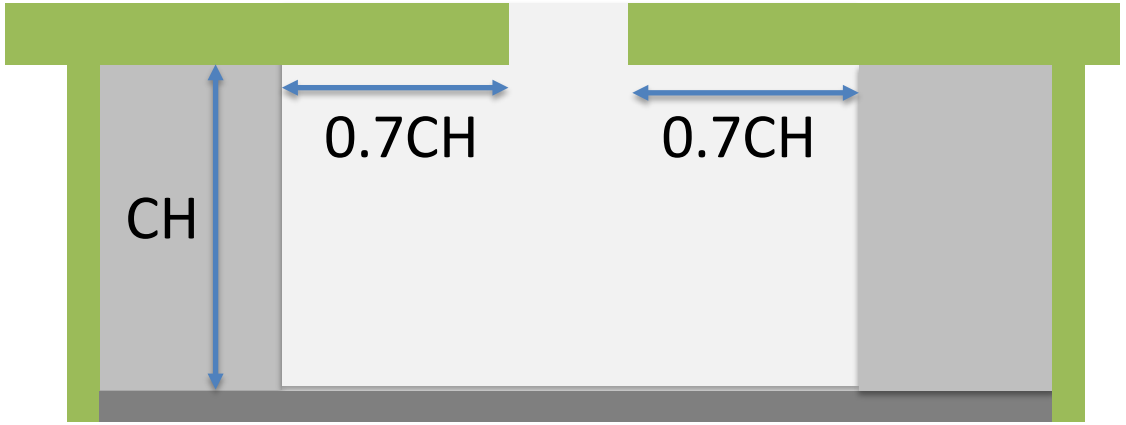
Sidelit daylight zone



Window area ≥24 ft^2

Glazing light transmission ≥0.20

Toplight daylight zone



More details in the code

Interior lighting

Specific application controls (C405.2.4)

Separate manual control + either occupant sensor or time-switch control

- Display and accent lighting
- Lighting in display cases
- Supplemental task lighting
- Lighting equipment for sale or demonstration in lighting education

Sleeping unit (e.g. guestroom)

- Auto-off for permanently installed lights and switched receptacles

Dwelling unit (not in multi-family building)

- Occupant sensor or light reduction

Non-visual applications (e.g. plant growth or food warming)

- Time-switch control

Interior lighting

Connected lighting power (C405.3.1)

- Screw-in lamps
  - Rated lamp wattage
- Luminaires with ballast or transformer
  - Rated input wattage
- LED
  - Rated input wattage
- Track lighting options
  1. Luminaire wattage, not less than 8W/linear ft
  2. Current-limiting device rating
  3. Transformer limit
- Manufacturer data for other luminaires

Interior lighting

Connected lighting power (C405.3.1)

Exceptions

1. Television broadcast lighting for playing areas in sports arenas.
2. Emergency lighting automatically off during normal building operation.
3. Occupants with special lighting needs, including those with visual impairment and other medical and age-related issues.
4. Casino gaming areas.
5. Mirror lighting in dressing rooms.
6. Task lighting for medical and dental purposes that is in addition to general lighting and controlled by an independent control device.
7. Display lighting for exhibits in galleries, museums and monuments that is in addition to general lighting and controlled by an independent control device.
8. Lighting for theatrical purposes, including performance, stage, film production and video production.
9. Lighting for photographic processes.
10. Lighting integral to equipment or instrumentation and installed by the manufacturer.
11. Task lighting for plant growth or maintenance.
12. Advertising signage or directional signage.
13. Lighting for food warming.
14. Lighting equipment that is for sale.
15. Lighting demonstration equipment in lighting education facilities.
16. Lighting approved because of safety considerations.
17. Lighting in retail display windows, provided that the display area is enclosed by ceiling-height partitions.
18. Furniture-mounted supplemental task lighting that is controlled by automatic shutoff.
19. Exit signs.

Interior lighting

TABLE C405.3.2(1)
INTERIOR LIGHTING POWER ALLOWANCES: BUILDING AREA METHOD

BUILDING AREA TYPE	LPD (w/ft^2)
Automotive facility	0.71
Convention center	0.76
Courthouse	0.90
Dining: bar lounge/leisure	0.90
Dining: cafeteria/fast food	0.79
Dining: family	0.78
Dormitory[a, b]	0.61
Exercise center	0.65
Fire station[a]	0.53
Gymnasium	0.68
Health care clinic	0.82
Hospital[a]	1.05
Hotel/Motel[a, b]	0.75
Library	0.78
Manufacturing facility	0.90
Motion picture theater	0.83
Multifamily[c]	0.68
Museum	1.06
Office	0.79
Parking garage	0.15
Penitentiary	0.75
Performing arts theater	1.18
Police station	0.80
Post office	0.67
Religious building	0.94
Retail	1.06
School/university	0.81
Sports arena	0.87
Town hall	0.80
Transportation	0.61
Warehouse	0.48
Workshop	0.90

Interior lighting

Partial table

TABLE C405.3.2(2)
INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD

COMMON SPACE TYPES[a]	LPD (watts/sq.ft)
Atrium	
Less than 40 feet in height	0.03 per foot in total height
Greater than 40 feet in height	0.40 + 0.02 per foot in total height
Audience seating area	
In an auditorium	0.63
In a convention center	0.82
In a gymnasium	0.65
In a motion picture theater	1.14
In a penitentiary	0.28
In a performing arts theater	2.03
In a religious building	1.53
In a sports arena	0.43
Locker room	0.48
Lounge/breakroom	
In a healthcare facility	0.78
Otherwise	0.62
Office	
Enclosed	0.93
Open plan	0.81
Parking area, interior	0.14
Pharmacy area	1.34
Restroom	
In a facility for the visually impaired (and not used primarily by the staff[b]	0.96
Otherwise	0.85
Sales area	1.22
Seating area, general	0.42
Stairway (see Space containing stairway)	
Stairwell	0.58
Storage room	0.46
Vehicular maintenance area	0.56
Workshop	1.14

Extra allowances for

1. Sales areas
2. Decorative lighting or highlight art or exhibits

Exterior lighting

Exterior lighting controls (C405.2.6)

- Daylight shutoff
- Façade and landscape decorative lighting
  - Off ≤1 hour after closing
  - On ≤ 1 hour before opening
- Setback for other lighting by ≥30%
  1. Midnight to 6am
  2. 1 hour after closing to 1 hour before opening
  3. When activity not detected for 15 minutes
- Time-switch function
  - 7-day program
  - Holidays
  - 10+ hours backup

https://cltc.ucdavis.edu/project/adaptive-led-wall-packs

Exterior lighting

Total connected exterior building lighting power (C405.4.1)

- Max. rated wattage of all lighting powered through the energy service for the building
- Exceptions
  - Lighting approved because of safety considerations.
  - Emergency lighting automatically off during normal business operation.
  - Exit signs.
  - Specialized signal, directional and marker lighting associated with transportation.
  - Advertising signage or directional signage.
  - Integral to equipment or instrumentation and installed by its manufacturer.
  - Theatrical purposes, including performance, stage, film production and video production.
  - Athletic playing areas.
  - Temporary lighting.
  - Industrial production, material handling, transportation sites and associated storage areas.
  - Theme elements in theme/amusement parks.
  - Used to highlight features of art, public monuments, and the national flag.
  - Lighting for water features and swimming pools.
  - Lighting controlled from within dwelling units, where the lighting complies with Section R404.1.

Exterior lighting

Exterior lighting power allowance (C405.4.2)

1. Base site allowance
2. Power allowances for building exteriors
3. Additional exterior lighting power

   Limited to the fixtures serving specific applications

Varies by exterior lighting zone

TABLE C405.4.2(1) EXTERIOR LIGHTING ZONES

LIGHTING ZONE	DESCRIPTION
1	Developed areas of national parks, state parks, forest land, and rural areas
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed-use areas
3	All other areas not classified as lighting zone 1, 2 or 4
4	High-activity commercial districts in major metropolitan areas as designated by the local land use planning authority

Functional testing of lighting controls

Functional testing of lighting controls (C408.3)

- Applies to:
  - Occupancy sensor controls
  - Time-switch controls
  - Daylight responsive controls
- Calibrated, adjusted, programmed and in proper working condition per the design and manufacturer's instructions
  - Prior to passing final inspection
  - Registered design professional provides evidence
- Documentation
  - Equipment location in construction documents
  - O&M manuals provided
  - Report of test results provided

Sub-Metering

Sub metering (C405.10)

- Metering for new buildings with tenants
  1. Entire building, and
  2. Each tenant occupying ≥1,000 ft²
- Tenants shall have access to data collected for their space

State Amendment

C405.10 Sub-metering. In new buildings with tenants, metering shall be collected for the entire building and individually for each tenant occupying 1,000 ft^2 (total enclosed and unenclosed) (93 m^2) or more. Tenants shall have access to data collected for their space. A tenant is defined as "one who rents or leases from a landlord."

Section 9

Existing Building Compliance

Additions (C502)

Two options

- Addition alone
- Addition + existing

New construction requirements apply

- Window & skylight area
- Window & skylight thermal performance
- Wall & roof thermal performance
- Mechanical systems
- Service water heating
- Pools and spas
- Interior lighting
- Exterior lighting

Alterations (C503)

Change in space conditioning (C503.2)

Nonconditioned or low-energy space that is altered to become *conditioned space* shall be required to be brought into full compliance.

Alterations (C503)

Roof

Meet new construction insulation requirements

Exceptions

- Roof repair – no requirement
- Roof recover – no requirement
- Roof replacement - amendment

***ROOF REPLACEMENT**. The process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.*

Options (State amendment)

1. New construction requirements
2. Initial solar reflectance ≥85% and aged reflectance ≥63%
3. At least one of:
    1. EnergyStar compliant covering
    2. Radiant barrier
    3. Attic ventilation via solar fan(s), ridge ventilation or gable vents
    4. One or more exceptions in Section C402.3

1. Portions covered by:
    - Photovoltaic systems or components.
    - Solar air or water-heating systems or components.
    - Roof gardens or landscaped roofs.
    - Above-roof decks or walkways.
    - Skylights.
    - HVAC systems and components, and other opaque objects mounted above the roof.
2. Portions shaded during summer solstice
3. Portions ballasted with stone 17 lb/sf

Alterations (C503)

Walls

R-value or U-factor for new construction

Exceptions

- Wall cavity is not exposed
- Wall cavity is filled with insulation

Alterations (C503)

Windows & skylights

- New construction performance for new windows and replacement windows or skylights
  (Area weighted average allowed)
- Maximum area limit

Exception

- Glazing-only repairs of existing windows and skylights

Alterations (C503)

Heating and cooling systems (C503.4**)**

New systems and components meet new construction requirements

Service hot water systems (C503.5)

New systems and components meet new construction requirements

Lighting systems (C503.6)

New systems meet new construction requirements

Exception:

- <10% of luminaires in a space are replaced and lighting power does not increase

Section 10

Wrap Up

Q&A

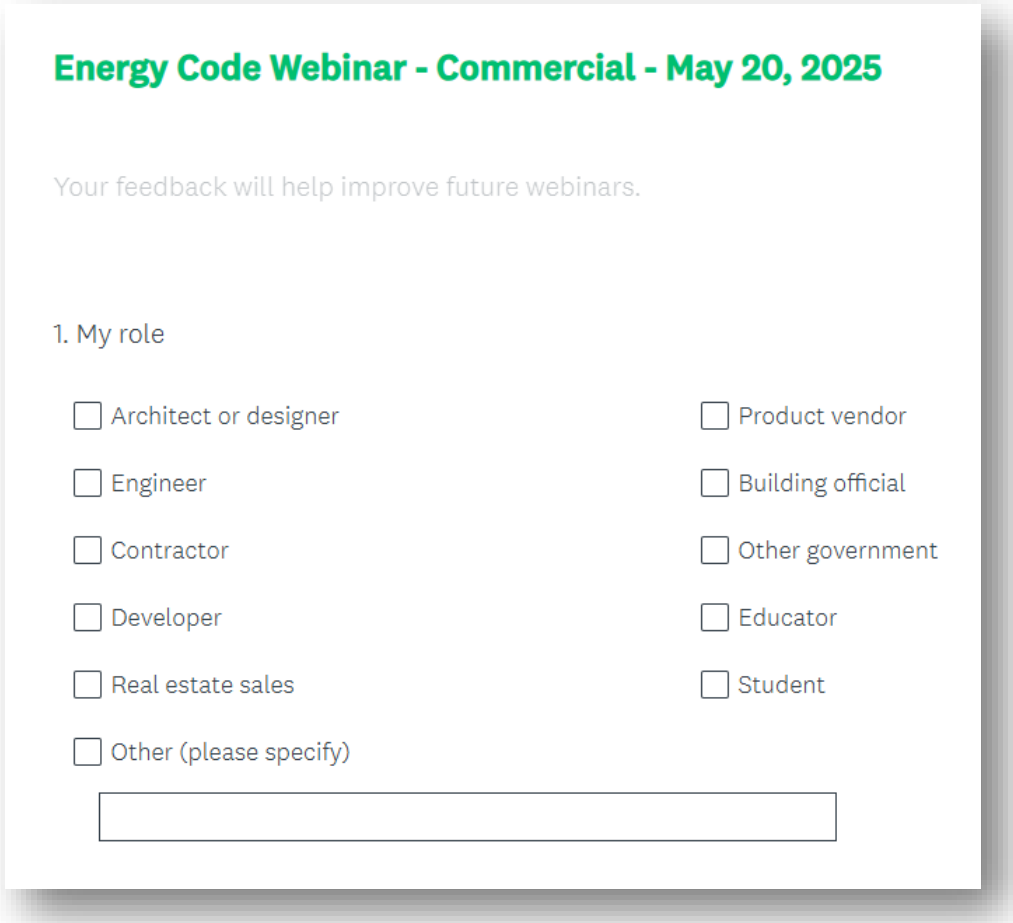
Howard Wiig, State Energy Office

Erik Kolderup, PE, Kolderup Consulting

Eileen Stewart, Hawaii Energy

Evaluation Survey

https://www.surveymonkey.com/r/6GRBB3D



For more energy code information

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2018 IECC available:

- http://iccsafe.org/publications
- https://codes.iccsafe.org/content/iecc2018

State Energy Code Website: https://energy.hawaii.gov/hawaii-building-energy-code

Honolulu : https://www.resilientoahu.org/energycode

Maui: https://www.mauicounty.gov/1308/Building-Plans-Review-Section

Kauai: https://www.kauai.gov/Government/Departments-Agencies/Public-Works/Building-Division