Behind the Light Switch: Transforming Energy Policies

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NYStretch Energy Code — 2020

An Overlay of the 2018 International Energy Conservation Code and ASHRAE Standard 90.1-2016

Version 1.0 | July 2019

NEW YORK STATE OF OPPORTUNITY. | NYSERDA

PREFACE

The NYStretch Energy Code 2020 project was undertaken by NYSERDA to develop a pivotal tool for New York jurisdictions to support the State's energy and climate goals by accelerating the savings obtained through their local building energy codes. Authorities having jurisdiction have the legal ability to voluntarily adopt NYStretch-Energy.

The NYStretch Code was developed as a statewide model code to save more energy than New York's minimum code and to be readily adopted as a more stringent local standard to the ECCCNYS. It was developed with the following goals:

- Technically sound
- Thoroughly reviewed by stakeholders
- Written in code enforceable language
- Fully consistent with the 2018 IECC, ASHRAE 90.1-2016, and uniform codes

For communities that adopt it, the NYStretch Code will provide greater savings over the ECCCNYS for both residential and commercial buildings.

Marginal Markings

Solid vertical lines in the margins of Parts 1, 2, and 3 indicate a technical change from the requirements of 2018 IECC and ASHRAE 90.1-2016. Black, right-facing arrows in the left-hand margin indicate a deletion from the requirements.

Unaffected Provisions

The chapters, sections, tables, and other provisions in the 2018 IECC and ASHRAE 90.1-2016 not amended by NYStretch Code shall continue in full force and effect. Nothing in the NYStretch Code shall be construed as deleting all or part of any unaffected provision.

Severability

If any portion of the NYStretch Energy Code 2020, the 2018 IECC or ASHRAE 90.1-2016 is held by a court of a competent jurisdiction to be illegal or void, such holding shall not affect the validity of any other portion of the NYStretch Code, the 2018 IECC or ASHRAE 90.1-2016

Implied license / Use of NYStretch

While a jurisdiction may adopt one or both of the Commercial and Residential provisions, it is NYSERDA's desire, but not a rule, that the NYStretch be adopted as written. Changes to or deletions of the provisions contained herein may affect energy savings, cost savings, and enforceability. Jurisdictions are encouraged to contact NYSERDA codes@nyserda.ny.gov before considering any changes to the NYStretch.

DISCLAIMER

Version 1 of NYStretch Energy Code-2020 (NYStretch) is an overlay of the 2018 International Energy Conservation Code (2018 IECC) and ASHRAE Standard 90.1-2016 (ASHRAE). It does not reflect changes the New York State Fire Prevention and Code Council may adopt for the 2020 New York State Energy Conservation Construction Code (2020 NYS ECCC). Visit https://www.dos.ny.gov/DCEA/CodeUpdate.html for updates on the 2020 NYS ECCC.

Furthermore this version of NYStretch does not contain changes to it that New York City may adopt for the 2020 Energy Conservation Code of New York City (2020 ECC NYC). Visit https://www1.nyc.gov/site/buildings/codes/energy-conservation-code.page for updates on the 2020 ECC NYC.

It is NYSERDA's intent to release a version of NYStretch that will overlay the 2020 NYS ECCC upon release of that code by New York State Department of State.

Stringency of NYStretch

NYSERDA recognizes that there are differentials between the requirements of the IECC and ASHRAE paths in NYStretch. It is NYSERDA's intent to create two separate inclusive code books, one for the IECC paths and another for the ASHRAE paths and find and correct the differentials between those code provisions such that they are consistent with the intent and stringency of NYStretch. Until that time, where there is a differential between the paths, the more stringent of the requirements will prevail.

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PART 1

1 Amendments to 2018 International Energy Conservation Construction Code Commercial Provisions

1.1 Amendments to Section C401.2 Application

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

1. ASHRAE Compliance Path (prescriptive): The requirements of ASHRAE 90.1-2016 (as amended) Section 4.2.1.1(a). The building shall also comply with the following:
    a. The *building thermal envelope* opaque assembly requirements of Section C402.1.4.

       EXCEPTION: *Semi-heated spaces* in compliance with ASHRAE 90.1-2016 (as amended) are not required to comply with Section C402.1.4.
    b. The *fenestration* requirements of Section C402.4.

       EXCEPTION: Semi-heated spaces in compliance with ASHRAE 90.1-2016 (as amended) are not required to comply with Section C402.4.3.
    c. The interior and exterior lighting power allowance requirements of Section C405.3.2 and Section C405.4.2, respectively.
    d. The requirements of Section C406 and tenant spaces shall comply with the requirements of Section C406.1.1.
    e. The requirements of Section C408 (note: in lieu of Section C408.4, the requirements of 5.9.2 prevail) and, if mandated by local ordinance, Appendix CC.
2. ASHRAE Compliance Path (Section 11): The requirements of ASHRAE 90.1-2016 (as amended) Section 4.2.1.1(b). The building shall also comply with Section C408 (note: in lieu of Section C408.4, the requirements of 5.9.2 prevail) and, if mandated by local ordinance, Appendix CC.
3. ASHRAE Compliance Path (Appendix G): The requirements of ASHRAE 90.1-2016 (as amended) 4.2.2.1(c). The building shall also comply with Section C408 (note: in lieu of Section C408.4, the requirements of 5.9.2 prevail) and, if mandated by local ordinance, Appendix CC.
4. Prescriptive Compliance Path: The requirements of Sections C402 through C406 and C408, and, if mandated by local ordinance, Appendix CC.

1.2 Amendments to Section C402.1 General (Prescriptive)

C402.1 General (Prescriptive). Building thermal envelope assemblies for buildings that are intended to comply with the code on a prescriptive basis in accordance with the compliance path described in Item 4 of Section C401.2, shall comply with the following:

1. The opaque portions of the building thermal envelope shall comply with the specific insulation requirements of Section C402.2 and the thermal requirements of the *U-, C- and F-factor*-based method of Section C402.1.4, or the component performance alternative of section C402.1.5.
2. Roof solar reflectance and thermal emittance shall comply with Section C402.3.
3. Fenestration in building envelope assemblies shall comply with Section C402.4.
4. Air leakage of building envelope assemblies shall comply with Section C402.5.

Alternatively, where buildings have a *vertical fenestration* area or skylight area exceeding that allowed in Section C402.4, the building and building thermal envelope shall comply with Section C401.2, Item 1 or Section C401.2, Item 2 or Section C401.2, Item 3.

Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with Section C403.10.1 or C403.10.2.

1.3 Replace Section C402.1.3 Insulation Component R-Value-Based Method

C402.1.3 (Reserved for jurisdictions choosing to allow the provisions of Appendix CB)

1.4 Amendments to Table C402.1.4 Opaque Thermal Envelope Assembly Maximum Requirements: U-Factor Method

Table C402.1.4
Opaque Thermal Envelope Assembly Maximum Requirements, U-Factor Method[a,b]

CLIMATE ZONE	4		5		6	
	All other	Group R	All other	Group R	All other	Group R
Roofs						
Insulation Entirely above roof deck	U-0.030	U-0.030	U-0.030	U-0.030	U-0.029	U-0.029
Metal buildings	U-0.035	U-0.035	U-0.035	U-0.035	U-0.028	U-0.026
Attic and other	U-0.020	U-0.020	U-0.020	U-0.020	U-0.019	U-0.019
Walls, above grade						
Mass[e]	U-0.099	U-0.086	U-0.086	U-0.076	U-0.076	U-0.067
Metal building	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048
Metal framed	U-0.061	U-0.061	U-0.052	U-0.052	U-0.047	U-0.044
Wood framed and other[c]	U-0.061	U-0.061	U-0.048	U-0.048	U-0.048	U-0.046
Walls, below grade						
Below-grade wall[c]	C-0.119	C-0.092	C-0.119	C-0.092	C-0.092	C-0.063
Floors						
Mass[d]	U-0.057	U-0.051	U-0.057	U-0.051	U-0.051	U-0.051
Joist/framing	U-0.033	U-0.033	U-0.033	U-0.033	U-0.027[f]	U-0.027[f]
Slab-on-grade floors						
Unheated slabs	F-0.52	F-0.52	F-0.52	F-0.51	F-0.51	F-0.434
Heated slabs	F-0.63	F-0.63	F-0.63	F-0.63	F-0.63	F-0.63
Opaque doors						
Swinging	U-0.50	U-0.50	U-0.37	U-0.37	U-0.37	U-0.37
Garage door <14% glazing	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly U-factors, C-factors, and F-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
b. Where U-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The R-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
c. Where heated slabs are below grade, below-grade walls shall comply with the U-factor requirements for above-grade mass walls.
d. "Mass floors" shall be in accordance with Section C402.2.3.
e. "Mass walls" shall be in accordance with Section C402.2.2.

1.5 Addition of New Section C402.1.4.2 Thermal Resistance of Mechanical Equipment Penetrations (Mandatory)

C402.1.4.2 Thermal resistance of mechanical equipment penetrations (Mandatory). When the total area of penetrations from mechanical equipment listed in Table C403.2.3(3) exceeds 1 percent of the opaque above-grade wall area, the mechanical equipment penetration area shall be calculated as a separate wall assembly with a default U-factor of 0.5.

Exception: Where mechanical equipment has been tested in accordance with testing standards approved by the authority having jurisdiction, the mechanical equipment penetration area may be calculated as a separate wall assembly with the U-factor as determined by such test.

1.6 Amendments to Section C402.2 Specific Building Thermal Envelope Insulation Requirements (Prescriptive)

C402.2 Specific building thermal envelope insulation requirements (Prescriptive). Insulation in building thermal envelope opaque assemblies shall comply with Sections C402.2.1 through C402.2.8 and Table C402.1.4.

1.7 Addition of New Section C402.2.8 Continuous Insulation (Mandatory)

C402.2.8 Continuous insulation (Mandatory). In new construction, structural elements of balconies and parapets that penetrate the *building thermal envelope*, shall comply with one of the following:

1. Structural elements penetrating the *building thermal envelope* shall be insulated with *continuous insulation* having a minimum thermal resistance of R-3.
2. Structural elements of penetrations of the *building thermal envelope* shall incorporate a minimum R-3 thermal break where the structural element penetrates the *building thermal envelope*.

1.8 Amendments to Section C402.4 Fenestration (Prescriptive)

C402.4 Fenestration (Prescriptive). Fenestration shall comply with Sections C402.4.1 through C402.4.5 and Table C402.4. Daylight responsive controls shall comply with this section and Section C405.2.3.

1.9 Amendments to Table C402.4 Building Envelope Fenestration Maximum U-Factor and SHGC Requirements

Table C402.4
Building Envelope Fenestration Maximum U-Factor and SHGC Requirements

CLIMATE ZONE	4	5	6
Vertical Fenestration			
U-Factor			
Fixed fenestration	0.36	0.36	0.34
Operable fenestration	0.43	0.43	0.41
All other vertical fenestration			
All fenestration	0.30	0.27	0.27
Entrance doors	0.77	0.77	0.77
SHGC			
PF < 0.2	0.36	0.38	0.40
0.2 ≤ PF < 0.5	0.43	0.46	0.48
PF ≥ 0.5	0.58	0.61	0.64
Skylights			
U-Factor	0.48	0.48	0.48
SHGC	0.38	0.38	0.38
PF = Projection Factor. a. U-factor and SHGC shall be rated in accordance with NFRC 100.			

1.10 Amendments to Section C402.5 Air Leakage--Thermal Envelope (Mandatory)

C402.5 Air leakage--thermal envelope (Mandatory). The *thermal envelope* of buildings shall comply with Section C402.5.9 or shall comply with Sections C402.5.1 through C402.5.8 and C408.4. New buildings not less than 25,000 square feet and not greater than 50,000 square feet, and less than or equal to 75 feet in height, shall show compliance through testing in accordance with Section C402.5.9.

1.11 Addition of New Section C402.5.9. Air Barrier Testing

C402.5.9 Air Barrier Testing. The *building thermal envelope* shall be tested in accordance with ASTM E779 at a pressure differential of 0.3 inch water gauge (75 Pa) or an equivalent method approved by the code official and shall be deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope is not greater than 0.40 cfm/ft^2 (2.0 L/s * m^2). Where the

compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6, and C402.5.7. A report that includes the tested surface area, floor area, air by volume, stories above grade, and leakage rates shall be submitted to the code official and the building owner.

1.12 Amendments to Section C403.7.4 Energy Recovery Ventilation Systems (Mandatory)

C403.7.4 Energy recovery ventilation systems (Mandatory). Where the supply airflow rate of a fan system exceeds the values specified in Tables C403.7.4(1) and C403.7.4(2), the system shall include an energy recovery ventilation system. The energy recovery ventilation system shall be configured to provide a change in the enthalpy of the outdoor air supply of not less than 50 percent of the difference between the outdoor air and return air enthalpies, at design conditions. Where an air economizer is required, the energy recovery ventilation system shall include a bypass or controls that permit operation of the economizer as required by Section C403.5.

Exception: An energy recovery ventilation system shall not be required in any of the following conditions:

1. Where energy recovery systems are prohibited by the *International Mechanical Code*.
2. Laboratory fume hood systems that include not fewer than one of the following features:
   - 2.1 Variable-air-volume hood exhaust and room supply systems configured to reduce exhaust and makeup air volume to 50 percent or less of design values.
   - 2.2 Direct makeup (auxiliary) air supply equal to or greater than 75 percent of the exhaust rate, heated not warmer than 2°F (1.1°C) above room setpoint, cooled to not cooler than 3°F (1.7°C) below room setpoint, with no humidification added, and no simultaneous heating and cooling used for dehumidification control.
3. Systems serving spaces that are heated to less than 60°F (15.5°C) and that are not cooled.
4. Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site-solar energy.
5. Heating energy recovery in Climate Zones 1 and 2.
6. Cooling energy recovery in Climate Zones 3C, 4C, 5B, 5C, 6B, 7, and 8.
7. Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
8. Where the largest source of air exhausted at a single location at the building exterior is less than 75 percent of the design ventilation outdoor air flow rate. Multiple exhaust fans or outlets located within a 30-foot radius from the *outdoor air* supply unit shall be considered a single exhaust location.
9. Systems expected to operate less than 20 hours per week at the *outdoor air* percentage covered by Table C403.7.4(1).
10. Systems exhausting toxic, flammable, paint or corrosive fumes, or dust.
11. Commercial kitchen hoods used for collecting and removing grease vapors and smoke.

1.13 Amendments to Section C403.8.1 Allowable Fan Horsepower

C403.8.1 Allowable fan horsepower (Mandatory). Each HVAC system having a total fan system motor nameplate horsepower exceeding 5 hp (3.7 kW) at fan system design conditions shall not exceed the allowable *fan system motor nameplate hp* (Option 1) or *fan system bhp* (Option 2) shown in Table C403.8.1(1). This includes supply fans, exhaust fans, return/relief fans, and fan-powered terminal units associated with systems providing heating or cooling capability. Single-zone variable air volume systems shall comply with the constant volume fan power limitation.

Exceptions:

1. Hospital, vivarium and laboratory systems that utilize flow control devices on exhaust or return to maintain space pressure relationships necessary for occupant health and safety or environmental control shall be permitted to use variable volume fan power limitation.
2. Individual exhaust fans with motor nameplate horsepower of 1 hp (0.746 kW) or less are exempt from the allowable fan horsepower requirement.
3. Fans supplying air to active chilled beams.

1.14 Amendments to Table C403.8.1(1) Fan Power Limitation

Table C403.8.1(1)
Fan Power Limitation

	Limit	Constant volume	Variable volume
Option 1: Fan system motor nameplate hp	Allowable nameplate motor hp	hp $\leq$ CFM_s*0.0009	hp $\leq$ CFM_s* 0.0011
Option 2: Fan system bhp	Allowable fan system bhp	bhp $\leq$ CFM_s X 0.00088 + A	bhp $\leq$ CFM_s X 0.0010 + A

For SI: 1 bhp = 735.5 W, 1 hp = 745.5 W, 1 cfm = 0.4719 L/S
Where:
CFM_s = The maximum design supply airflow rate to conditioned spaces served by the system in cubic feet per minute.
hp = The maximum combined motor nameplate horsepower.
bhp = The maximum combined fan brake horsepower.
A = Sum of [PD X CFM_D/4131]
Where:
PD = Each applicable pressure drop adjustment from Table C403.8.1 (2) in. w.c.
CFM_D = The design airflow through each applicable device from Table C403.8.1(2) in cubic feet per minute.

1.15 Amendments to Section C405.2.1 Occupant Sensor Controls

C405.2.1 Occupant sensor controls. Occupant *sensor controls* shall be installed to control lights in the following space types:

1. Classrooms/lecture/training rooms.
2. Conference/meeting/multipurpose rooms.

3. Copy/print rooms.
4. Corridor/transition areas.
5. Dining areas.
6. Lounges/breakrooms.
7. Enclosed offices.
8. Open plan office areas.
9. Restrooms.
10. Storage rooms.
11. Locker rooms.
12. Other spaces 300 square feet (28 m^2) or less that are enclosed by floor-to-ceiling height partitions.
13. Warehouse storage areas.

1.16 Addition of New Section C405.2.1.4 Occupant Sensor Control Function for Egress Illumination

C405.2.1.4 Occupant sensor control function for egress illumination. In new buildings, luminaires serving the exit access and providing means of egress illumination required by Section 1008.1 of the *International Building Code*, including luminaires that function as both normal and emergency means of egress illumination shall be controlled by a combination of listed emergency relay and occupancy sensors, or signal from another building control system that automatically reduces the lighting power by 50 percent when unoccupied for longer than 15 minutes.

Exceptions:

1. Means of egress illumination serving the exit access that does not exceed 0.02 watts per square foot of building area is exempt from this requirement.
2. Emergency lighting designated to meet Section 1008.3 of the *International Building Code.*

1.17 Amendments to Section C405.2.3 Daylight Responsive Controls

C405.2.3 Daylight responsive controls. *Daylight-responsive controls* complying with Section C405.2.3.1 shall be provided to control the electric lights within *daylight zones* in the following spaces:

1. Spaces with a total of more than 100 watts of general lighting within sidelit zones complying with Section C405.2.3.2. General lighting does not include lighting that is required to have specific application control in accordance with Section C405.2.4.
2. Spaces with a total of more than 100 watts of general lighting within toplit zones complying with Section C405.2.3.3.

Exceptions: Daylight responsive controls are not required for the following:

1. Spaces in health care facilities where patient care is directly provided.

2. Lighting that is required to have specific application control in accordance with Section C405.2.4.
3. Sidelit zones on the first floor above grade in Group A-2 and Group M occupancies.
4. New buildings where the total connected lighting power calculated in accordance with Section C405.3.1 is not greater than the adjusted interior lighting power allowance (LPA_{adj}) calculated in accordance with Equation 4-9:

$$LPA_{adj} = [LPA_{norm} \times (1.0 - 0.4 \times UDZFA / TBFA)] \quad \textbf{(Equation 4-9)}$$

Where:

LPA_{adj} = Adjusted building interior lighting power allowance in watts.

LPA_{norm} = Normal building lighting power allowance in watts calculated in accordance with Section C405.3.2 and reduced in accordance with Section C406.3 where Option 2 of Section C406.1 is used to comply with the requirements of Section C406.

UDZFA = Uncontrolled daylight zone floor area is the sum of all sidelit and toplit zones, calculated in accordance with Sections C405.2.3.2 and C405.2.3.3, that do not have daylight responsive controls.

TBFA = Total building floor area is the sum of all floor areas included in the lighting power allowance calculation in Section C405.3.2.

1.18 Amendments to Section C405.2.3.2 Sidelit Zone

C405.2.3.2 Sidelit zone. The sidelit zone is the floor area adjacent to vertical *fenestration* that complies with all of the following:

1. Where the fenestration is located in a wall, the sidelit zone shall extend laterally to the nearest full-height wall, or up to 1.0 times the height from the floor to the top of the fenestration, and longitudinally from the edge of the fenestration to the nearest full-height wall, or up to 2 feet (610 mm), whichever is less, as indicated in Figure C405.2.3.2.
2. The area of the fenestration is not less than 24 square feet (2.23 m^2).
3. The distance from the fenestration to any building or geological formation that would block *access* to daylight is no greater than one-half of the height from the bottom of the fenestration to the top of the building or geologic formation.
4. The visible transmittance of the fenestration is not less than 0.20.

1.19 Amendments to Section C405.2.6 Exterior Lighting Controls

C405.2.6 Exterior lighting controls. Exterior lighting systems shall be provided with controls that comply with Sections C405.2.6.1 through C405.2.6.5. Decorative lighting systems shall comply with Sections C405.2.6.1, C405.2.6.2, and C405.2.6.4.

Exceptions:

1. Lighting for covered vehicle entrances and exits from buildings and parking structures where required for eye adaptation.
2. Lighting controlled from within dwelling units.

C405.2.6.1 (Daylight shutoff) is unchanged.

C405.2.6.2 (Decorative lighting shutoff) is unchanged.

C405.2.6.3 Lighting setback. Lighting not controlled in accordance with Section C405.2.6.2 shall be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent by selectively switching off or dimming luminaires at one of the following times:

1. From not later than midnight to not earlier than 6 a.m.
2. From not later than one hour after business closing to not earlier than one hour before business opening.
3. During any time where activity has not been detected for 15 minutes or more.

C405.2.6.4 (Exterior time-switch control function) is unchanged.

1.20 Addition of New Section C405.2.6.5 Outdoor parking area lighting control

C405.2.6.5 Outdoor parking area lighting control. Outdoor parking area luminaires mounted 24' or less above the ground shall be controlled to automatically reduce the power of each luminaire by a minimum of 50 percent when no activity has been detected for at least 15 minutes. No more than 1500 W of lighting power shall be controlled together.

Exception: Outdoor parking areas with less than 1,000 watts of lighting.

1.21 Amendments to Table C405.3.2(1) Interior Lighting Power Allowances: Building Area Method

TABLE C405.3.2(1)
Interior Lighting Power Allowances: Building Area Method

BUILDING AREA TYPE	LPD (w/ft^2)
Automotive facility	0.64
Convention center	0.70
Courthouse	0.74
Dining: bar lounge/leisure	0.69
Dining: cafeteria/fast food	0.66
Dining: family	0.61
Dormitory [a, b]	0.52
Exercise center	0.65
Fire station [a]	0.50
Gymnasium	0.67
Health care clinic	0.68
Hospital [a]	0.86
Hotel/motel [a, b]	0.70
Library	0.78
Manufacturing facility	0.60
Motion picture theater	0.62
Multifamily [c]	0.49
Museum	0.68
Office	0.69
Parking garage	0.12
Penitentiary	0.67
Performing arts theater	0.85
Police station	0.68
Post office	0.62
Religious building	0.72
Retail	0.91
School/university	0.67
Sports arena	0.76
Town hall	0.72
Transportation	0.51

TABLE C405.3.2(1)

Interior Lighting Power Allowances: Building Area Method (continued)

BUILDING AREA TYPE	LPD (w/ft^2)
Warehouse	0.41
Workshop	0.83

a. Where sleeping units are excluded from lighting power calculations by application of Section R405.1, neither the area of the sleeping units nor the wattage of lighting in the sleeping units is counted.
b. Where dwelling units are excluded from lighting power calculations by application of R405.1, neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.
c. Dwelling units are excluded. Neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.

1.22 Amendments to Table C405.3.2(2) Interior Lighting Power Allowances: Space-By-Space Method

Table C405.3.2(2)
Interior Lighting Power Allowances: Space-by-Space Method

COMMON SPACE TYPES [a]	LPD (w/ft^2)
Atrium	
Less than 40 feet in height	0.023 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	0.65
In a gymnasium	0.43
In a motion picture theater	0.64
In a penitentiary	0.28
In a performing arts theater	1.34
In a religious building	0.98
In a sports arena	0.42
Otherwise	0.40
Banking activity area	0.79
Breakroom (See Lounge/Breakroom)	
Classroom/lecture hall/training room	
In a penitentiary	1.06
Otherwise	0.74
Computer room	1.16
Conference/meeting/multipurpose room	0.93
Confinement cells	0.52
Copy/print room	0.50
Corridor	
In a facility for the visually impaired (and not used primarily by the staff) [b]	0.81
In a hospital	0.81
In a manufacturing facility	0.28
In a primary or secondary school (and not used primarily by the staff)	0.74
Otherwise	0.58
Courtroom	1.06

COMMON SPACE TYPES [a]	LPD (w/ft^2)
Dining area	
In bar/lounge or leisure dining	0.62
In cafeteria or fast food dining	0.53
In a facility for the visually impaired (and not used primarily by the staff) [b]	1.48
In family dining	0.54
In a penitentiary	0.72
Otherwise	0.53
Electrical/mechanical room	0.39
Emergency vehicle garage	0.41
Food preparation area	0.92
Guestroom [c, d]	0.75
Laboratory	
In or as a classroom	1.04
Otherwise	1.32
Laundry/washing area	0.43
Loading dock, interior	0.51
Lobby	
For an elevator	0.52
In a facility for the visually impaired (and not used primarily by the staff) [b]	2.03
In a hotel	0.68
In a motion picture theater	0.38
In a performing arts theater	0.82
Otherwise	0.9
Locker room	0.45
Lounge/breakroom	
In a healthcare facility	0.53
Otherwise	0.44
Office	
Enclosed	0.85
Open plan	0.78
Parking area, interior [i]	0.11
Pharmacy area	1.23
Restroom	
In a facility for the visually impaired (and not used primarily by the staff) [b]	0.81

COMMON SPACE TYPES [a]	LPD (w/ft^2)
Otherwise	0.75
Sales area	1.06
Seating area, general	0.38
Stairway (See space containing stairway)	
Stairwell	0.50
Storage room	0.43
Vehicular maintenance area	0.53
Workshop	1.09

BUILDING TYPE SPECIFIC SPACE TYPES [a]	LPD (w/ft^2)
Automotive (See Vehicular Maintenance Area above)	
Convention Center—exhibit space	0.69
Dormitory—living quarters [c, d]	0.46
Facility for the visually impaired [b]	
In a chapel (and not used primarily by the staff)	0.89
In a recreation room (and not used primarily by the staff)	1.53
Fire Station—sleeping quarters [c]	0.19
Gymnasium/fitness center	
In an exercise area	0.50
In a playing area	0.75
Healthcare facility	
In an exam/treatment room	1.16
In an imaging room	0.98
In a medical supply room	0.54
In a nursery	0.94
In a nurse's station	0.75
In an operating room	1.87
In a patient room [c]	0.45
In a physical therapy room	0.84
In a recovery room	0.89
Library	
In a reading area	0.77
In the stacks	1.20

BUILDING TYPE SPECIFIC SPACE TYPES [a]	LPD (w/ft^2)
Manufacturing facility	
In a detailed manufacturing area	0.86
In an equipment room	0.61
In an extra-high-bay area (greater than 50' floor-to-ceiling height)	0.73
In a high-bay area (25-50' floor-to-ceiling height)	0.58
In a low-bay area (less than 25' floor-to-ceiling height)	0.61
Museum	
In a general exhibition area	0.61
In a restoration room	0.77
Performing arts theater—dressing room	0.35
Post Office—Sorting Area	0.66
Religious buildings	
In a fellowship hall	0.54
In a worship/pulpit/choir area	0.98
Retail facilities	
In a dressing/fitting room	0.49
In a mall concourse	0.79
Sports arena—playing area	
For a Class I facility [e]	2.26
For a Class II facility [f]	1.45
For a Class III facility [g,j]	1.08
For a Class IV facility [h,j]	0.72
Transportation facility	
In a baggage/carousel area	0.40
In an airport concourse	0.31
At a terminal ticket counter	0.48
Warehouse—storage area	
For medium to bulky, palletized items	0.27
For smaller, hand-carried items	0.65

a. In cases where both a common space type and a building area specific space are listed, the building area specific space type shall apply.

b. A 'Facility for the Visually Impaired' is a facility that is licensed or will be licensed by local or state authorities for senior long-term care, adult daycare, senior support or people with special visual needs.

c. Where sleeping units are excluded from lighting power calculations by application of Section R405.1, neither the area of the sleeping units nor the wattage of lighting in the sleeping units is counted.

BUILDING TYPE SPECIFIC SPACE TYPES [a]	LPD (w/ft^2)
d. Where dwelling units are excluded from lighting power calculations by application of Section R405.1, neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted. e. Class I facilities consist of Professional facilities; and Semi-professional, Collegiate, or Club facilities with seating for 5,000 or more spectators. f. Class II facilities consist of Collegiate and Semi-professional facilities with seating for fewer than 5,000 spectators; Club facilities with seating for between 2,000 and 5,000 spectators; and Amateur League and High School facilities with seating for more than 2,000 spectators. g. Class III facilities consist of Club, Amateur League, and High School facilities with seating for 2,000 or fewer spectators. h. Class IV facilities consist of Elementary School and Recreational facilities, and Amateur League and High School facilities without provisions for spectators. i. The wattage of lighting in daylight transition zones and ramps without parking is excluded. j. Pool surfaces are excluded. Neither the surface area of the swimming or spa pool nor the wattage of the lighting serving them shall be counted.	

1.23 Amendments to Table C405.4.2(2) Lighting power allowances for building exteriors

Table C405.4.2(2)
Lighting Power Allowances for Building Exteriors

	LIGHTING ZONES			
	Zone 1	**Zone 2**	**Zone 3**	**Zone 4**
Base Site Allowance	350 W	400 W	500 W	900 W
Uncovered Parking Areas				
Parking areas and drives	0.03 W/ft^2	0.04 W/ft^2	0.05 W/ft^2	0.05 W/ft^2
Building Grounds				
Walkways and ramps less than 10 feet wide	0.5 W/linear foot	0.5 W/linear foot	0.6 W/linear foot	0.7 W/linear foot
Walkways and ramps 10 feet wide or greater, plaza areas special feature areas	0.10 W/ft^2	0.10 W/ft^2	0.11 W/ft^2	0.14 W/ft^2
Dining areas	0.65 W/ft^2	0.65 W/ft^2	0.75 W/ft^2	0.95 W/ft^2
Stairways	0.6 W/ft^2	0.7 W/ft^2	0.7 W/ft^2	0.7 W/ft^2
Pedestrian tunnels	0.12 W/ft^2	0.12 W/ft^2	0.14 W/ft^2	0.21 W/ft^2
Landscaping	0.03 W/ft^2	0.04 W/ft^2	0.04 W/ft^2	0.04 W/ft^2
Building Entrances and Exits				
Pedestrian and vehicular entrances and exits	12.6 W/linear foot of opening width	12.6 W/linear foot of opening width	20 W/linear foot of opening width	20 W/linear foot of opening width
Entry canopies	0.20 W/ft^2	0.25 W/ft^2	0.4 W/ft^2	0.4 W/ft^2
Loading docks	0.35 W/ft^2	0.35 W/ft^2	0.35 W/ft^2	0.35 W/ft^2
Sales Canopies				
Free-standing and attached	0.40 W/ft^2	0.40 W/ft^2	0.6 W/ft^2	0.7 W/ft^2
Outdoor Sales				
Open areas (including vehicle sales lots)	0.20 W/ft^2	0.20 W/ft^2	0.35 W/ft^2	0.50 W/ft^2
Street frontage for vehicle sales lots in addition to “open area” allowance	No allowance	7 W/linear foot	7 W/linear foot	21 W/linear foot

For SI: 1 foot = 304.8 mm, 1 watt per square foot = 1 W/0.0929 m^2.
W = watts

1.24 Addition of New Section C405.8.1.1 Power conversion system

C405.8.1.1 Power conversion system. New traction elevators with a rise of 75 feet or more in new buildings shall have a power conversion system that complies with Sections 405.8.1.1.1 through 405.8.1.1.3.

C405.8.1.1.1 Motor. Induction motors with a Class IE2 efficiency ratings, as defined by IEC EN 60034-30, or alternative technologies, such as permanent magnet synchronous motors that have equal or better efficiency, shall be used.

C405.8.1.1.2 Transmission. Transmissions shall not reduce the efficiency of the combined motor/transmission below that shown for the Class IE2 motor for elevators with capacities below 4,000 lbs. Gearless machines shall be assumed to have a 100 percent transmission efficiency.

C405.8.1.1.3 Drive. Potential energy released during motion shall be recovered with a regenerative drive that supplies electrical energy to the building electrical system.

1.25 Addition of New Section C405.9 Commercial Kitchen Equipment

C405.9 Commercial Kitchen Equipment. Commercial kitchen equipment shall comply with the minimum efficiency requirements of Tables C405.9(1) through table C405.9(5).

Table C405.9(1)
Minimum Efficiency Requirements: Commercial Fryers

	Heavy-Load Cooking Energy Efficiency	Idle Energy Rate	Test Procedure
Standard Open Deep-Fat Gas Fryers	≥ 50%	≤ 9,000 Btu/hr	ASTM Standard F1361-17
Standard Open Deep-Fat Electric Fryers	≥ 83%	≤ 800 watts	
Large Vat Open Deep-Fat Gas Fryers	≥ 50%	≤ 12,000 Btu/hr	ASTM Standard F2144-17
Large Vat Open Deep-Fat Electric Fryers	≥ 80%	≤ 1,100 watts	

Table C405.9(2)
Minimum Efficiency Requirements: Commercial Hot Food Holding Cabinets

Product Interior Volume (Cubic Feet)	Maximum Idle Energy Consumption Rate (Watts)	Test Procedure
0 < V < 13	≤ 21.5 V	ASTM Standard F2140-11
13 ≤ V < 28	≤ 2.0 V + 254.0	
28 ≤ V	≤ 3.8 V + 203.5	

Table C405.9(3)
Minimum Efficiency Requirements: Commercial Steam Cookers

Fuel Type	Pan Capacity	Cooking Energy Efficiency[a]	Idle Rate	Test Procedure
Electric Steam	3-pan	50%	400 watts	ASTM Standard F1484-18
	4-pan	50%	530 watts	
	5-pan	50%	670 watts	
	6-pan and larger	50%	800 watts	
Gas Steam	3-pan	38%	6,250 Btu/h	
	4-pan	38%	8,350 Btu/h	
	5-pan	38%	10,400 Btu/h	
	6-pan and larger	38%	12,500 Btu/h	

a. Cooking Energy Efficiency is based on heavy load (potato) cooking capacity

Table C405.9(4)
Minimum Efficiency Requirements: Commercial Dishwashers

Machine Type	High Temp Efficiency Requirements		Low Temp Efficiency Requirements		Test Procedure
	Idle Energy Rate[a]	Water Consumption[b]	Idle Energy Rate[a]	Water Consumption[b]	
Under Counter	≤ 0.50 kW	≤ 0.86 GPR	≤ 0.50 kW	≤ 1.19 GPR	ASTM Standard F1696-18
Stationary Single Tank Door	≤ 0.70 kW	≤ 0.89 GPR	≤ 0.60 kW	≤ 1.18 GPR	
Pot, Pan, and Utensil	≤ 1.20 kW	≤ 0.58 GPSF	≤ 1.00 kW	≤ 0.58 GPSF	
Single Tank Conveyor	≤ 1.50 kW	≤ 0.70 GPR	≤ 1.50 kW	≤ 0.79 GPR	
Multiple Tank Conveyor	≤ 2.25 kW	≤ 0.54 GPR	≤ 2.00 kW	≤ 0.54 GPR	ASTM Standard F1920-15
Single Tank Flight Type	Reported	GPH ≤ 2.975x + 55.00	Reported	GPH ≤ 2.975x + 55.00	
Multiple Tank Flight Type	Reported	GPH ≤ 4.96x + 17.00	Reported	GPH ≤ 4.96x + 17.00	

a. Idle results shall be measured with the door closed and represent the total idle energy consumed by the machine including all tank heater(s) and controls. Booster heater (internal or external) energy consumption should not be part of this measurement unless it cannot be separately monitored per US EPA Energy Star Commercial Dishwasher Specification Version 2.0.

b. GPR = gallons per rack; GPSF = gallons per square foot of rack; GPH = gallons per hour; x = sf of conveyor belt (i.e., W*L)/min (maximum conveyor speed).

Table C405.9(5)
Minimum Efficiency Requirements: Commercial Ovens

Fuel Type	Classification	Idle Rate	Cooking-Energy Efficiency, %	Test Procedure
Convection Ovens				
Gas	Full-Size	≤ 12,000 Btu/h	≥ 46	ASTM F1496 - 13
Electric	Half-Size	≤ 1.0 Btu/h	≥ 71	
	Full-Size	≤ 1.60 Btu/h		
Combination Ovens				
Gas	Steam Mode	≤ 200P[a]+6,511 Btu/h	≥ 41	ASTM F2861 - 17
	Convection Mode	≤ 150P[a]+5,425 Btu/h	≥ 56	
Electric	Steam Mode	≤ 0.133P[a]+0.6400 kW	≥ 55	
	Convection Mode	≤ 0.080P[a]+0.4989 kW	≥ 76	
Rack Ovens				
Gas	Single	≤ 25,000 Btu/h	≥ 48	ASTM F2093 - 18
	Double	≤ 30,000 Btu/h	≥ 52	

a. P = Pan Capacity: The number of steam table pans the combination oven is able to accommodate as per the ASTM F – 1495 – 05 standard specification.

1.26 Addition of New Section C405.10 Electric Vehicle Charging Station Capable

C405.10 Electric vehicle charging station capable. New parking garages and new parking lots powered by the energy services for a building, and with 10 or greater parking spaces, shall provide either:

1. Panel capacity and conduit for the future installation of minimum 208/240V 40-amp outlets for 5 percent of the total parking spaces and not less than two parking spaces; or
2. Minimum 208/240V 40-amp outlets for 5 percent of the total parking spaces and not less than two parking spaces.

1.27 Addition of New Section C405.11 Solar-Ready Zone

C405.11 Solar-ready zone (Mandatory). New *buildings* shall comply with the provisions of Appendix CA.

1.28 Addition of Section C405.12 Whole Building Energy Monitoring

C405.12 Whole building energy monitoring. Measurement devices shall be installed in new buildings to individually monitor energy use of each of the following types of energy supplied by a utility, energy provider, or plant that is not within the building:

1. Natural gas
2. Fuel oil
3. Propane
4. Steam
5. Chilled Water
6. Hot Water

Exceptions:

1. Buildings less than 25,000 square feet (2,325 m^2).
2. Group R buildings with less than 10,000 square feet of common area (930 m^2).
3. Fuel use for on-site emergency equipment.

1.29 Addition of Section C405.13 Whole Building Electrical Monitoring

C405.13 Whole building electrical monitoring. Each new building shall have a measurement device capable of recording electrical energy use every 60 minutes and the capability to report use on an hourly, daily, monthly, and annual basis. The measurement device shall be capable of retaining the recorded data for 36 months.

Exceptions:

1. Buildings less than 25,000 square feet (2,325 m^2).
2. *Group R* buildings with less than 10,000 square feet of common area (930 m^2).
3. Fuel use for on-site emergency equipment.

1.30 Replacement of Section C406.1 Requirements

C406.1 Requirements. Buildings shall comply with at least one of the following Sections.

1. More efficient HVAC equipment in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced digital lighting controls in accordance with Section C406.4.
4. Dedicated outdoor air systems with energy recovery ventilation in accordance with Section C406.5.
5. Enhanced envelope performance in accordance with Section C406.6.
6. Reduced air infiltration in accordance with Section C406.7.

1.31 Amendment to Section C406.1.1 Tenant Spaces

C406.1.1. Tenant spaces. Tenant spaces shall comply with Section C406.2, C406.3, C406.4 or C406.7. Alternatively, tenant spaces shall be in compliance with Section C406.5 or C406.6 where the entire building is in compliance.

Exception: Previously occupied tenant spaces that comply with this code using Section C501.

1.32 Replacement and Renaming of Section C406.5 On-Site Renewable Energy

C406.5 Dedicated outdoor air system. Buildings containing equipment or systems regulated by Section C403.3.4, C403.4.3, C403.4.4, C403.4.5, C403.6, C403.8.4, C403.8.5, C403.8.5.1, C403.9.1, C403.9.2, C403.9.3 or C403.9.4 shall be equipped with an independent ventilation system designed to provide not less than the minimum 100-percent outdoor air to each individual occupied space, as specified by the International Mechanical Code. The ventilation system shall be equipped with an energy recovery system meeting the requirements of Section C403.7.4, without exception (Note: C406.5 cannot be selected where ERV is prohibited by the *International Mechanical Code* or otherwise prohibited.) The HVAC system shall include supply-air temperature controls that automatically reset the supply-air temperature in response to representative building loads, or to outdoor air temperatures. The controls shall reset the supply-air temperature not less than 25 percent of the difference between the design supply-air temperature and the design room-air temperature.

1.33 Replacement and Renaming of Section C406.6 Dedicated Outdoor Air System

C406.6 Enhanced envelope performance. The thermal performance of the envelope shall demonstrate a 15 percent improvement compared to the requirements of Section C402.1.5.

1.34 Replacement and Renaming of Section C406.7 Reduced Energy Use in Service Water Heating

C406.7 Reduced air infiltration. Air infiltration shall be verified by whole building pressurization testing conducted in accordance with Section C402.5.9. The measured air leakage rate of the building envelope shall not exceed 0.25 cfm/ft^2 (2.0 L/s x m^2) under a pressure differential of 0.3 in. water (75 Pa), with the calculated surface area being the sum of the above and below grade building envelope. A report that includes the tested surface area, floor area, air by volume, stories above grade, and leakage rates shall be submitted to the code official and the building owner.

Exception: For buildings with more than 250,000 square feet (25 000 m^2) of conditioned floor area, air leakage testing need not be conducted on the whole building where testing is conducted on representative above-grade sections of the building. Tested areas shall total not less than 25 percent of the conditioned floor area and shall be tested in accordance with this section.

1.35 Replacement of Section C407 Total Building Performance

Section C407
Total Building Performance

C407.1 Scope. This section establishes criteria for compliance using total building performance. Buildings following the total building performance path must comply with ASHRAE 90.1-2016 (as amended), demonstrating compliance under Section 11 or Appendix G of such standard.

1.36 Amendments to Section C408.2 Mechanical Systems and Service Water-Heating Systems Commissioning and Completion Requirements

C408.2 Mechanical, renewable energy, and service water heating systems commissioning and completion requirements. This section is required when one of the following conditions is met:

1. The *building* is not less than 25,000 square feet (2,325 m^2).
2. The total mechanical equipment capacity being installed is greater than 480,000 Btu/h (140.7 kW) cooling capacity.
3. The combined *service water-heating* and space-heating capacity is greater than 600,000 Btu/h (175.8 kW).

Prior to passing the final mechanical and plumbing inspections, the *registered design professional or approved agency* shall provide evidence of systems *commissioning* and completion in accordance with the provisions of this section.

Construction document notes shall clearly indicate provisions for *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.

Mechanical systems, renewable energy, and *service water heating* systems shall include, at a minimum, the following systems (mechanical and/or passive) and associated controls:

1. Heating, cooling, air handling and distribution, ventilation, and exhaust systems, and their related air quality monitoring systems.
2. Air, water, and other energy recovery systems.
3. Manual or automatic controls, whether local or remote, on energy using systems including but not limited to temperature controls, setback sequences, and occupancy-based control, including energy management functions of the building management system.
4. Plumbing, including insulation of piping and associated valves, domestic and process water pumping, and mixing systems.
5. Mechanical heating systems and service water heating systems.
6. Refrigeration systems.

7. Renewable energy and energy storage systems where installed generating capacity is not less than 25kW.
8. Other systems, equipment and components that are used for heating, cooling or ventilation, and affect energy use.

C408.2.1 Commissioning Plan is unchanged.

1.37 Amendments to Section C408.2.2 Systems Adjusting and Balancing

C408.2.2 Systems adjusting and balancing. HVAC systems shall be balanced in accordance with ANSI/ASHRAE 111, "Testing, Adjusting, and Balancing of Building HVAC Systems" or other approved engineering standards.

C408.2.2.1 Air systems balancing is unchanged.

C408.2.2.2 Hydronic systems balancing is unchanged.

1.38 Addition of New Section C408.4 Air Barrier Commissioning

C408.4 Air barrier commissioning. Prior to passing final inspection, the registered design professional or approved agent shall provide evidence of air barrier commissioning and substantial completion in accordance with the provisions of sections C408.4.1 through C408.4.3.

C408.4.1 Documentation. Construction documents shall include documentation of the continuous air barrier components included in the design and a field inspection checklist that includes all requirements necessary for maintaining air barrier continuity and durability in accordance with Section C402.5.1.

C408.4.2 Field inspections. Reports from field inspections during project construction showing compliance with continuous air barrier requirements including proper material handling and storage, use of approved materials and material substitutes, proper material and surface preparation, and air barrier continuity shall be provided to the owner and, upon request, to the code official. Air barrier continuity shall be determined by testing or inspecting each type of unique air barrier joint or seam in the building envelope for continuity and defects.

C408.4.3 Report. A final commissioning report indicating compliance with the continuous air barrier requirements shall be provided to the building owner and, upon request, to the code official**.**

1.39 Addition of New Section C502.2.3.1 Commissioning

C502.2.3.1 Commissioning. New heating, cooling, and duct system components that are part of the addition and the controls that serve them shall comply with Sections C408.2.2, C408.2.3 and C408.2.5.

Exception: Mechanical systems in additions where the total mechanical equipment capacity of the building is less than 480,000 Btu/h (140.7 kW) cooling capacity and 600,000 Btu/h (175.8 kW) combined service water heating and space heating capacity.

1.40 Addition of New Section C502.2.4.1 Commissioning

C502.2.4.1 Commissioning. New service hot water system components that are part of the addition and the controls that serve them shall comply with Sections C408.2.2, C408.2.3, and C408.2.5.

Exception: Service hot water systems in additions where the combined service water heating and space heating capacity of the building is less than 600,000 Btu/h (175.8 kW).

1.41 Addition of New Section C502.3 Air Barriers

C502.3 Air barriers. The thermal envelope of additions shall comply with Sections C402.5.1 through C402.5.8.

1.42 Addition of New Section C503.3.4 Air Barriers

C503.3.4 Air barriers. The thermal envelope of alterations shall comply with Sections C402.5.1 through C402.5.8.

1.43 Addition of New Section C503.4.2 Commissioning

C503.4.2 Commissioning. New heating, cooling and duct system components that are part of the alteration and the controls that serve them shall comply with Sections C408.2.2, C408.2.3, and C408.2.5.

Exceptions: Mechanical systems in alterations where the total mechanical equipment capacity of the building is less than 480,000 Btu/h (140.7 kW) cooling capacity and 600,000 Btu/h (175.8 kW) combined service water heating and space heating capacity.

1.44 Addition of New Section C503.5.1 Commissioning

C503.5.1 Commissioning. New service hot water system components that are part of the alteration and the controls that serve them shall comply with Sections C408.2.2, C408.2.3, and C408.2.5.

> **Exception:** Service hot water systems in alterations where the combined service water heating and space heating capacity of the building is less than 600,000 Btu/h (175.8 kW).

1.45 Addition of New Appendix CB
Rated R-value of Insulation—Commercial

Appendix CB
Rated *R*-Value of Insulation – Commercial

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

Section CB101
Scope

CB101.1 General. These provisions shall be applicable for new construction where an Insulation R-value based method is required.

Section CB102
Insulation Component *R*-Value-Based Method

CB102.1 General. The opaque portions of the building thermal envelope shall comply with the specific insulation requirements of Section C402.2 and the thermal requirements of the R-value-based method of Section CB102.2.

CB102.2 Insulation component *R*-value-based method. *Building thermal envelope* opaque assemblies shall comply with the requirements of Sections C402.2 and C402.4 based on the *climate zone* specified in Chapter 3. For opaque portions of the *building thermal envelope* intended to comply on an insulation component *R-value* basis, the *R*-values for insulation shall be not less than that specified in Table CB102.2. Commercial buildings or portions of commercial buildings enclosing *Group R* occupancies shall use the R values from the "*Group R*" column of Table CB102.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than *Group R* shall use the *R*-values from the "All other" column of Table CB102.2.

Table CB102.2

Opaque Thermal Envelope Insulation Component Minimum Requirements, R-Value Method[a, h]

CLIMATE ZONE	4 EXCEPT MARINE		5 AND MARINE 4		6	
	All other	Group R	All other	Group R	All other	Group R
Roofs						
Insulation Entirely above roof deck	R-33ci	R-33ci	R-33ci	R-33ci	R-33ci	R-33ci
Metal buildings[b]	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS
Attic and other	R-53	R-53	R-53	R-53	R-53	R-53
Walls, above grade						
Mass[f]	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci
Metal building	R-13 + R-13ci	R-13+ R-19.5ci	R-13+ R-19.5ci	R-13+ R-19.5ci	R-13+ R-19.5ci	R-13+ R-19.5ci

Metal framed	R-13 + R-8.5ci	R-13 + R-8.5ci	R-13 + R-11ci	R-13 + R-11ci	R-13+ R13.5ci	R-13+ R14.5ci
Wood framed and other	R-13 + R-4.5ci or R-19 + R-1.5ci	R-13 + R-4.5ci or R-19 + R-1.5ci	R-13 + R-9ci or R-19 + R-5ci	R-13 + R-9ci or R-19 + R-5ci	R-13 + R-9ci or R-19 + R-5ci	R-13 + R-9.5ci or R-19 + R-6ci
Walls, below grade						
Below-grade wall[c]	R-7.5ci	R-10ci	R-7.5ci	R-10ci	R-10ci	R-15ci
Floors						
Mass[d]	R-15ci	R-16.7ci	R-15ci	R-16.7ci	R-16.7ci	R-16.7ci
Joist/framing	R-30	R-30[e]	R-30[e]	R-30[e]	R-38	R-38
Slab-on-grade floors						
Unheated slabs	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below
Heated slabs[g]	R-20 for 48" below + R-5 full slab	R-20 for 48" below + R-5 full slab	R-20 for 48" below + R-5 full slab	R-20 for 48" below + R-5 full slab	R-20 for 48" below + R-5 full slab	R-20 for 48" below + R-5 full slab
Opaque doors						
Non-Swinging	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/ m^2, 1 pound per cubic foot = 16 kg/m^3.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table C402.1.4.

c. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

d. "Mass floors" shall be in accordance with Section C402.2.3.

e. Steel floor joist systems shall be insulated to R-38.

f. "Mass walls" shall be in accordance with Section C402.2.2.

g. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.

h. Not applicable to garage doors. See Table C402.1.4.

1.46 Addition of New Appendix CC
Additional Power Distribution System Packages—Commercial

Appendix CC
Additional power distribution system packages – Commercial

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

Section CC101
Scope

CC101.1 General. These provisions shall be applicable for new construction where additional power distribution system packages are required.

Section CC102
Additional Power Distribution System Packages

CC102.1 General (Mandatory). New buildings shall comply with at least one of the following:

1. Additional *on-site renewable energy* in accordance with Section CC102.2.
2. Electrical energy monitoring in accordance with Section CC102.3.
3. Interoperable automated demand-response (AutoDR) infrastructure in accordance with Section CC102.4.
4. Electric vehicle charging stations in accordance with Section CC102.5.
5. Automatic receptacle controls in accordance with CC102.6.

CC102.2 On-site renewable energy. The total minimum rating of *on-site renewable energy* systems shall be one of the following:

1. Not less than 1.71 Btu/hr/ft^2 (5.4 w/m^2) or 0.50 w/ft^2 of conditioned floor area.
2. Not less than 3 percent of energy use within the building for mechanical, service hot water heating, and lighting regulated in Chapter 4 [CE].

CC102.3 Electrical energy monitoring. Buildings shall comply with Sections CC102.3.1 through CC102.3.4. Buildings shall be equipped to measure, monitor, record, and report electricity consumption data for each end-use category listed in Table CC102.3.1. For buildings with tenants, the end-uses in Table CC102.3.1 shall be separately monitored for the total building load and (excluding shared systems) for each individual tenant.

Exception:

1. Up to 10 percent of the load for each of the end uses shall be allowed to be from other electrical loads.
2. Individual tenant spaces that have their own utility services and meters and have less than 5,000 square feet (465 m^2) of conditioned floor area.

CC102.3.1 End-use metering categories. Meters or other approved measurement devices shall be provided to collect energy use data for each end-use category specified in Table CC102.3.1. These meters shall have the capability to collect energy consumption data for the whole building or for each separately metered portion of the building. Where multiple meters are used to measure any end-use category, the data acquisition system shall total all the energy used by that category. Not more than 5 percent of the measured load for each end-use category specified in Table CC102.3.1 shall be from a load not within that category.

TABLE CC102.3.1
ENERGY USE CATEGORIES

LOAD CATEGORY
HVAC systems
Interior lighting
Exterior lighting
Receptacle circuits
Total electrical energy

CC102.3.2 Meters. Meters and other measurement devices required by this Section shall be configured to automatically communicate energy consumption data to the data acquisition system required by Section CC102.3.3. Source meters shall be any digital-type meter. Lighting, HVAC, and other building systems that can monitor their energy consumption shall not require meters. Current sensors are an alternative to meters, provided they have a tested accuracy of +/-2 percent. Required metering systems and equipment shall be able to provide not less than hourly data that is fully integrated into the data acquisition system and produce a graphical energy report in accordance with Sections CC102.3.3 and CC102.3.4.

CC102.3.3 Data acquisition systems. A data acquisition system shall have the capability to store data from the required meters and other sensing devices for not less than 36 months. The data acquisition system shall be able to store real-time energy consumption data and provide hourly, daily, monthly, and yearly logged data for each end-use category required by Table CC102.3.1.

CC102.3.4 Graphical energy report. A permanent reporting mechanism shall be provided in the building that can be accessed by building operation and management personnel. The reporting mechanism shall be able to graphically provide the energy consumption data for each end-use category required by Table CC102.3.1 for not less than every hour, day, month and year for the previous 36 months.

CC102.4 Interoperable automated demand-response (AutoDR) infrastructure. The building controls shall be designed with automated demand-response (Auto-DR) infrastructure capable of receiving demand-response requests from the utility, electrical system operator, or third-party DR program provider, and of automatically implementing load adjustments to the HVAC and lighting-systems.

Buildings shall comply with the following:

1. HVAC systems shall be programmed to allow automatic centralized demand reduction in response to a signal from a centralized contact or software point.
2. HVAC equipment with variable speed control shall be programmed to allow automatic adjustment of the maximum speed of the equipment.
3. Lighting systems with central control shall be programmed to allow automatic reduction of total connected lighting power.

CC102.5 Electric vehicle charging stations. Not less than two electric vehicle charging stations at minimum 208/240V 40 amp shall be provided on the *building site*.

CC102.6 Automatic receptacle controls. The following receptacles shall be automatically controlled in accordance with Section CC102.6.1:

1. At least 50 percent of all 125 V, 15- and 20-amp receptacles in all private offices, conference rooms, rooms used primarily for printing and/or copying functions, break rooms, classrooms, and individual workstations.
2. At least 25 percent of branch circuit feeders installed for modular furniture not shown on the construction documents.

All controlled receptacles shall be permanently marked to visually differentiate them from uncontrolled receptacles and are to be uniformly distributed throughout the space. Plug-in devices shall not be used to comply with Section CC102.6.1.

Exceptions:

1. Receptacles specifically designated for equipment intended for continuous operation (24 hours/day, 365 days/year).
2. Spaces where an automatic shutoff would endanger occupant safety or security.

CC102.6.1 Automatic receptacle control function. Automatic receptacle controls shall comply with one of the following:

1. Automatically turn receptacles off at specific programmed times, and the occupant shall be able to manually override the control device for up to two hours. An independent program schedule shall be provided for controlled areas of not more than 5000 square feet and not more than one floor.
2. Be an occupant sensor to automatically turn receptacles off within 20 minutes of all occupants leaving a space.
3. Be an automated signal from another control or alarm system to automatically turn receptacles off within 20 minutes of all occupants leaving a space.

PART 2

2 Amendments to ASHRAE 90.1-2016

2.1 Addition to Section 3.2 Definitions

Baseline building source energy: the annual *source energy* use in units of BTU for a *building* design intended for use as a baseline for rating above-standard design or when using the *performance rating method* as an alternative path for minimum standard compliance in accordance with Section 4.2.1.1.

***On-site electricity generation systems*:** systems located at the *building* site that generate electricity, including but not limited to generators, combined heat and power systems, fuel cells, and *on-site renewable energy* systems.

Proposed building source energy: the annual *source energy* use in units of BTU for a *proposed design*.

Site Energy: The amount of fuel that is consumed on-site to operate a building.

Source Energy: the total amount of primary fuel that is required to operate a building incorporating transmission, delivery, and production losses. Source Energy is calculated by multiplying site energy of each fuel type by the conversion factors in Table 4.2.1.2.

2.2 Amendments to Section 4.2.1.1 New Buildings

4.2.1.1 New Buildings

New *buildings* shall comply with either the provisions of

a. Section 5, "*Building Envelope*"; Section 6, "Heating, Ventilating, and Air Conditioning"; Section 7, "*Service Water Heating*"; Section 8, "Power"; Section 9, "Lighting"; and Section 10, "*Other Equipment*," or
b. Section 11, "*Energy Cost Budget* Method,", or
c. Appendix G, "*Performance Rating Method*", using <u>one</u> of the following methods:

1. Performance Cost Index Method. When using Appendix G, the Performance Cost Index (PCI) shall be less than or equal to the Performance Cost Index Target (PCIt) when calculated in accordance with the following:

$$PCI_t = [BBUEC + (BPF_{cost} \times BBREC)]/BBP$$

Where

PCI = Performance Cost Index calculated in accordance with Section G1.2.

BBUEC = Baseline *Building* Unregulated *Energy* Cost, the portion of the annual *energy*

cost of a *Baseline building design* that is due to *unregulated energy use*.

BBREC = Baseline *Building* Regulated *Energy* Cost, the portion of the annual *energy* cost of a *Baseline building design* that is due to *regulated energy use*.

BPF_{cost} = *Building* Performance Factor from Table 4.2.1.1. For *building* area types not listed in Table 4.2.1.1 use "All others." Where a *building* has multiple *building* area types, the required BPF_{cost} shall be equal to the area-weighted average of the *building* area types.

BBP = *Baseline Building Performance*.

Regulated *energy* cost shall be calculated by multiplying the total *energy* cost by the ratio of *regulated energy* use to total *energy* use for each *fuel* type. Unregulated *energy* cost shall be calculated by subtracting regulated *energy* cost from total *energy* cost.

2. **Performance Source Energy Index Method.** When using Appendix G, the Performance *Source Energy* Index (PSEI) shall be less than or equal to the Performance Source Energy Index Target (PSEIt) when calculated in accordance with the following:

$$PSEIt = [BBUSE + (BPF_{source} \times BBRSE)]/BBSE$$

Where

PSEI = Performance Source Energy Index calculated in accordance with Section G1.2

BBUSE = Baseline building unregulated source energy use in units of BTU, the portion of the annual site energy of a baseline building design that is due to unregulated energy use multiplied by the site to source conversion ratios in Table 4.2.1.2 for each fuel type.

BBRSE = Baseline building regulated source energy use in units of BTU, the portion of the annual site energy of a baseline building design that is due to regulated energy use multiplied by the site to source conversion ratios in Table 4.2.1.2 for each fuel type.

BPF_{source} = Building Performance Factor from Table 4.2.1.3. For building area types not listed in Table 4.2.1.3 use "All others." Where a building has multiple building area types, the required BPF_{source} shall be equal to the area-weighted average of the building area types.

BBSE = *Baseline building source energy.*

2.3 Replacement of Table 4.2.1.1 *Building* Performance Factor

Table 4.2.1.1 *Building* Performance Factor (Cost) (BPF_{cost})

Building Area Type	4A	5A	6A
Office	.54	.54	.55
Retail	.45	.42	.44
School	.45	.46	.46
Hotel/motel	.62	.56	.56
Multifamily	.67	.67	.64
Healthcare/hospital	.54	.54	.51
Restaurant	.56	.55	.55
Warehouse	.42	.42	.46
All others	.53	.52	.52

2.4 Addition of Table 4.2.1.2 Site to Source Energy Conversion Ratios

Table 4.2.1.2 Site to Source Energy Conversion Ratios

Energy Type	New York Ratio
Electricity (Grid Purchase)	2.55
Electricity (*On-site Renewable Energy* Installation)	1.00
Natural Gas	1.05
Fuel Oil	1.01
Propane & Liquid Propane	1.01
Steam	1.20
Hot Water	1.20
Chilled Water, Coal, Wood, Other	1.00

2.5 Addition of Table 4.2.1.3 Building Performance Factor (Source) (BPF_{source})

Table 4.2.1.3 Building Performance Factor (BPF_{source})

Building Area Type	4A	5A	6A
Office	.55	.55	.56
Retail	.45	.42	.43
School	.45	.45	.45
Hotel/motel	.62	.56	.54
Multifamily	.68	.68	.65
Healthcare/hospital	.56	.56	.54
Restaurant	.63	.64	.63
Warehouse	.44	.46	.49
All others	.55	.54	.54

2.6 Addition of New Section 5.2.3 Additional Requirements to Comply with Section 11 and Appendix G

5.2.3 Additional Requirements to Comply with Section 11 and Appendix G

The *building* envelope in new buildings 50,000 square feet and greater shall comply with either:

1. Section 5.5, "Prescriptive Building Envelope Option," or
2. An envelope performance factor shall be calculated in accordance with 90.1 Appendix C, and buildings shall comply with one of the following:

   i. For multifamily, hotel/motel and dormitory building area types, the margin by which the *proposed envelope performance factor* exceeds the *base envelope performance factor* shall not be greater than 15 percent. For compliance with this requirement, the *base envelope performance factor* shall be calculated using metal framing operable windows. In *buildings* with window area accounting for 40 percent or more of the *gross wall* area, the SHGC of the *vertical fenestration* on east and west oriented façade may be reduced by the following multiplier to account for the permanent site shading from existing buildings or infrastructure.

   $M_{West} = 0.18 + 0.33/WWR$

   $M_{East} = 0.35 + 0.26/WWR$

   Where:

   M_{West} = SHGC multiplier for the West façade

   M_{East} = SHGC multiplier for the East façade

   WWR = the ratio of the proposed *vertical fenestration* area to the *gross wall* area in consistent units.

   The multiplier may be applied to the rated SHGC of the *vertical fenestration* which has at least 50 percent of the area located directly opposite of the shading surfaces and no higher from the street level than the difference between the shading surface height and the shading surface distance from the façade. *Orientation* must be determined following Section 5.5.4.5, Fenestration Orientation.

   ii. For all other *building* area types, the margin by which the proposed *envelope performance factor* exceeds the *base envelope performance factor* shall be not greater than 7 percent. For compliance with this requirement, the *base envelope performance factor* shall be calculated using metal framing fixed windows.

   iii. For mixed-use *buildings* the margin shall be calculated as the *gross wall area*-weighted average of i and ii.

2.7 Addition of New Section 5.4.1.1 Continuous Insulation

5.4.1.1 Continuous Insulation

In new construction, structural elements of balconies and parapets that penetrate the *building envelope*, shall comply with one of the following:

1. Structural elements penetrating the *building* thermal *envelope* shall be insulated with *continuous insulation* having a minimum thermal resistance of R-3.
2. Structural elements of penetrations of the *building* thermal *envelope* shall incorporate a minimum R-3 thermal break where the structural element penetrates the *building* thermal *envelope*.

2.8 Amendments to Section 5.4.3.1.3 Testing, Acceptable Materials, and Assemblies

5.4.3.1.3 Testing, Acceptable Materials, and Assemblies

The *building* shall comply with whole-*building* pressurization testing in accordance with Section 5.4.3.1.3(a) or with the *continuous air barrier* requirements in Section 5.4.3.1.3(b) or 5.4.3.1.3(c). New *buildings* not less than 25,000 square feet and not greater than 50,000 square feet, and less than or equal to 75 feet in height, must show compliance through testing in accordance with Section 5.4.3.1.3(a).

The remainder of 5.4.3.1.3 is unchanged.

2.9 Amendments to Section 5.5.3 Opaque Areas

5.5.3 Opaque Areas.

For all *opaque* surfaces except *doors*, compliance shall be demonstrated by one of the following two methods:

a. Minimum rated *R-value* of insulation for the *thermal resistance* of the added insulation in framing cavities and *continuous insulation* only. Specifications listed in Normative Appendix A for each *class of construction* shall be used to determine compliance.
b. Maximum *U-factor, C-factor, or F-factor* for the entire assembly. The values for typical *construction* assemblies listed in Normative Appendix A shall be used to determine compliance.

Exceptions to 5.5.3

1. For assemblies significantly different than those in Appendix A, calculations shall be performed in accordance with the procedures required in Appendix A.

2. For multiple assemblies within a single *class of construction* for a single *space-conditioning category*, compliance shall be shown for either (a) the most restrictive requirement or (b) an area-weighted average *U-factor, C-factor, or F-factor*.
3. When the total area of penetrations from mechanical equipment listed in Table 6.8.1-4 exceeds 1 percent of the *opaque above-grade wall* area, the mechanical equipment penetration area shall be calculated as a separate wall assembly with a default *U-factor* of 0.5, and compliance shall be shown with method b. Where mechanical equipment has been tested in accordance with testing standards, approved by the *authority having jurisdiction*, the mechanical equipment penetration area may be calculated as a separate wall assembly with the *U-factor* as determined by such test.

2.10 Amendments to Section 5.6.1.1 Subsection to 5.6 Building Envelope Trade-Off Option

5.6.1.1

All components of the *building envelope* shown on architectural drawings or installed in *existing buildings* shall be modeled in the *proposed design*. The *simulation program* model *fenestration* and *opaque building* envelope types and area shall be consistent with the *construction documents*. Any *building envelope* assembly that covers less than 5 percent of the total area of that assembly type (e.g., *exterior walls*) need not be separately described, provided it is similar to an assembly being modeled. If not separately described, the area of a *building envelope* assembly shall be added to the area of an assembly of that same type with the same *orientation* and thermal properties. When the total area of penetrations from mechanical equipment listed in Table 6.8.1-4 exceeds 1 percent of the *opaque above-grade wall* area, the mechanical equipment penetration area shall be calculated as a separate wall assembly with a default *U-factor* of 0.5.

Exception to 5.6.1.1

Where mechanical equipment has been tested in accordance with testing standards approved by the *authority having jurisdiction*, the mechanical equipment penetration area may be calculated as a separate wall assembly with the *U-factor* as determined by such test.

2.11 Amendments to Section 6.5.3.1.1 Allowable Fan Horsepower

6.5.3.1.1 Allowable Fan Horsepower**.**

Each *HVAC system* having a total *fan system motor nameplate horsepower* exceeding 5 hp at *fan system design conditions* shall not exceed the allowable *fan system motor nameplate horsepower* (Option 1) or fan *system* bhp (Option 2) as shown in Table 6.5.3.1-1. This includes supply fans, return/relief fans, exhaust fans, and fan-powered *terminal* units associated with *systems* providing heating or cooling capability that operate at *fan system design conditions*. Single-zone *VAV systems* shall comply with the constant-volume fan power limitation.

Exceptions to 6.5.3.1.1

1. Hospital, vivarium, and laboratory *systems* that use flow *control devices* on exhaust and/or return to maintain *space* pressure relationships necessary for occupant health and safety or environmental *control* may use variable-volume fan power limitation.
2. Individual exhaust fans with motor *nameplate horsepower* of 1 hp or less.
3. Fans supplying air to active chilled beams.

2.12 Amendments to Table 6.5.3.1-1 Fan Power Limitation

Table 6.5.3.1-1 Fan Power Limitation

	Limit	Constant volume	Variable volume
Option 1: Fan system motor nameplate hp	Allowable nameplate motor hp	hp $\leq$ CFM_S*0.0009	hp $\leq$ CFM_S* 0.0011
Option 2: Fan system bhp	Allowable fan system bhp	bhp $\leq$ CFM_S X 0.00088 + A	bhp $\leq$ CFM_S X 0.0010 + A

For SI: 1 bhp = 735.5 W, 1 hp = 745.5 W, 1 cfm = 0.4719 L/S

Where:

CFM_S = The maximum design supply airflow rate to conditioned spaces served by the system in cubic feet per minute.

hp = The maximum combined motor nameplate horsepower.

Bhp = The maximum combined fan brake horsepower.

A = Sum of [PD X CFM_D/4131]

Where:

PD = Each applicable pressure drop adjustment from Table 6.5.3.1-2 in in. of water

CFM_D = The design airflow through each applicable device from Table 6.5.3.1-2 in cubic feet per minute.

2.13 Amendments to Section 6.5.6.1 Exhaust Air Energy Recovery

6.5.6.1 Exhaust Air Energy Recovery.

Each fan *system* shall have an *energy* recovery *system* when the design supply fan airflow rate exceeds the value listed in Tables 6.5.6.1-1 and 6.5.6.1-2, based on the climate zone and percentage of *outdoor air* at design airflow conditions. Table 6.5.6.1-1 shall be used for all *ventilation systems* that operate less than 8,000 hours per year, and Table 6.5.6.1-2 shall be used for all ventilation systems that operate 8,000 or more hours per year.

Energy recovery *systems* required by this section shall result in an *enthalpy recovery ratio* of at least 50 percent. A 50 percent *enthalpy recovery ratio* shall mean a change in the enthalpy of the *outdoor air* supply equal to 50 percent of the difference between the *outdoor air* and entering exhaust air enthalpies at *design conditions*. Provision shall be made to bypass or *control* the *energy* recovery *system* to permit *air economizer* operation as required by Section 6.5.1.1.

Exceptions

1. Laboratory *systems* meeting Section 6.5.7.3.
2. *Systems* serving *spaces* that are not cooled and that are heated to less than 60°F.

3. Where more than 60 percent of the *outdoor air* heating *energy* is provided from *site-recovered energy* or *site-solar energy.*
4. Heating *energy* recovery in Climate Zones 0, 1, and 2.
5. Cooling *energy* recovery in Climate Zones 3C, 4C, 5B, 5C, 6B, 7, and 8.
6. Where the largest source of air exhausted at a single location at the building exterior is less than 75 percent of the design ventilation outdoor air flow rate, multiple exhaust fans or outlets located within a 30-foot radius from the outdoor air supply unit shall be considered a single exhaust location.
7. *Systems* requiring dehumidification that employ *energy* recovery in series with the cooling coil.
8. *Systems* expected to operate less than 20 hours per week at the *outdoor air* percentage covered by Table 6.5.6.1-1.

2.14 Addition of New Section 10.4.3.5 Power Conversion System

10.4.3.5 Power Conversion System

New traction elevators with a rise of 75 feet or more in new buildings shall have a power conversion system that complies with Sections 10.4.3.5.1 through 10.4.3.5.3.

10.4.3.5.1 Motor

Induction motors with a Class IE2 efficiency ratings, as defined by IEC EN 60034-30, or alternative technologies, such as permanent magnet synchronous motors that have equal or better efficiency, shall be used.

10.4.3.5.2 Transmission

Transmissions shall not reduce the efficiency of the combined motor/transmission for the Class IE2 motor for elevators with capacities below 4,000 lbs. Gearless machines shall be assumed to have a 100 percent transmission efficiency.

10.4.3.5.3 Drive

Potential energy released during motion shall be recovered with a regenerative drive that supplies electrical energy to the building electrical system.

2.15 Addition of New Section 10.4.6 Commercial Kitchen Equipment

10.4.6 Commercial Kitchen Equipment

Commercial kitchen equipment shall comply with the minimum efficiency requirements of Tables 10.4.6-1 through Table 10.4.6-5.

Table 10.4.6-1: Minimum Efficiency Requirements: Commercial Fryers

	Heavy-Load Cooking Energy Efficiency	Idle Energy Rate	Test Procedure
Standard Open Deep-Fat Gas Fryers	≥50%	≤ 9,000 Btu/hr	ASTM Standard F1361-17
Large Vat Open Deep-Fat Gas Fryers	≥ 50%	≤ 12,000 Btu/hr	
Standard Open Deep-Fat Electric Fryers	≥ 83%	≤ 800 watts	ASTM Standard F2144-17
Large Vat Open Deep-Fat Electric Fryers	≥ 80%	≤ 1,100 watts	

Table 10.4.6-2: Minimum Efficiency Requirements: Commercial Hot Food Holding Cabinets

Product Interior Volume (Cubic Feet)	Maximum Idle Energy Consumption Rate (Watts)	Test Procedure
0 < V < 13	≤ 21.5 V	ASTM Standard F2140-11
13 ≤ V < 28	≤ 2.0 V + 254.0	
28 ≤ V	≤ 3.8 V + 203.5	

Table 10.4.6-3: Minimum Efficiency Requirements: Commercial Steam Cookers

Fuel Type	Pan Capacity	Cooking Energy Efficiency[a]	Idle Rate	Test Procedure
Electric Steam	3-pan	50%	400 watts	ASTM Standard F1484-18
	4-pan	50%	530 watts	
	5-pan	50%	670 watts	
	6-pan and larger	50%	800 watts	
Gas Steam	3-pan	38%	6,250 Btu/h	
	4-pan	38%	8,350 Btu/h	
	5-pan	38%	10,400 Btu/h	
	6-pan and larger	38%	12,500 Btu/h	

a. Cooking Energy Efficiency is based on heavy load (potato) cooking capacity

Table 10.4.6-4: Minimum Efficiency Requirements: Commercial Dishwashers

Machine Type	High Temp Efficiency Requirements		Low Temp Efficiency Requirements		Test Procedure
	Idle Energy Rate[a]	Water Consumption[b]	Idle Energy Rate[a]	Water Consumption[b]	
Under Counter	≤ 0.50 kW	≤ 0.86 GPR	≤ 0.50 kW	≤ 1.19 GPR	ASTM Standard F1696-18 ASTM Standard F1920-15
Stationary Single Tank Door	≤ 0.70 kW	≤ 0.89 GPR	≤ 0.60 kW	≤ 1.18 GPR	
Pot, Pan, and Utensil	≤ 1.20 kW	≤ 0.58 GPSF	≤ 1.00 kW	≤ 0.58 GPSF	
Single Tank Conveyor	≤ 1.50 kW	≤ 0.70 GPR	≤ 1.50 kW	≤ 0.79 GPR	
Multiple Tank Conveyor	≤ 2.25 kW	≤ 0.54 GPR	≤ 2.00 kW	≤ 0.54 GPR	
Single Tank Flight Type	Reported	GPH ≤ 2.975x + 55.00	Reported	GPH ≤ 2.975x + 55.00	
Multiple Tank Flight Type	Reported	GPH ≤ 4.96x + 17.00	Reported	GPH ≤ 4.96x + 17.00	

a. Idle results shall be measured with the door closed and represent the total idle energy consumed by the machine including all tank heater(s) and controls. Booster heater (internal or external) energy consumption should not be part of this measurement unless it cannot be separately monitored per US EPA Energy Star Commercial Dishwasher Specification Version 2.0

b. GPR = gallons per rack; GPSF = gallons per square foot of rack; GPH = gallons per hour; x = sf of conveyor belt (i.e., W*L)/min (maximum conveyor speed).

Table 10.4.6-5: Minimum Efficiency Requirements: Commercial Ovens

Fuel Type	Classification	Idle Rate	Cooking-Energy Efficiency, %	Test Procedure
Convection Ovens				
Gas	Full-Size	≤ 12,000 Btu/h	≥ 46	ASTM F1496 - 13
Electric	Half-Size	≤ 1.0 Btu/h	≥ 71	
	Full-Size	≤ 1.60 Btu/h		
Combination Ovens				
Gas	Steam Mode	≤ 200P[a] +6,511 Btu/h	≥ 41	ASTM F2861 - 17
	Convection Mode	≤ 150P[a] +5,425 Btu/h	≥ 56	
Electric	Steam Mode	≤ 0.133P[a] +0.6400 kW	≥ 55	
	Convection Mode	≤ 0.080P[a] +0.4989 kW	≥ 76	
Rack Ovens				
Gas	Single	≤ 25,000 Btu/h	≥ 48	ASTM F2093 - 18
	Double	≤ 30,000 Btu/h	≥ 52	

a. P = Pan Capacity: The number of steam table pans the combination oven is able to accommodate as per the ASTM F – 1495 – 05 standard specification.

2.16 Addition of New Section 10.4.7 Electric Vehicle Charging Station Capable

10.4.7 Electric vehicle charging station capable**.**

New parking garages and new parking lots powered by the energy services for a building, and with 10 or more parking spaces, shall provide either:

1. Panel capacity and conduit for the future installation of minimum 208/240V 40-amp outlets for 5 percent of the total parking spaces and not less than two parking spaces; or
2. Minimum 208/240V 40-amp outlets for 5 percent of the total parking spaces and not less than two parking spaces.

2.17 Addition of New Section 10.4.8 Solar-Ready Zone

10.4.8 Solar-ready zone (Mandatory)

Comply with the provisions of Appendix CA of 2018 IECC (as amended).

2.18 Amendments to Section 11.2 Compliance

11.2 Compliance**.**

Compliance with Section 11 will be achieved if

a. All requirements of Sections 5.4, 6.4, 7.4, 8.4, 9.4, and 10.4, and Section C408 and Appendix CC (if mandated by local ordinance) of the 2018 IECC (as amended) are met;
b. The *design energy cost*, as calculated in Section 11.5, does not exceed the building *energy use budget,* as calculated by the *simulation program* described in Section 11.4, and
c. The *energy efficiency* level of components specified in the *building* design meet or exceed the *efficiency* levels used to calculate the design energy cost; and
d. In new buildings 50,000 square feet and greater, an envelope performance factor shall be calculated in accordance with 90.1 Appendix C, and buildings shall comply with one of the following:

    i. For multifamily, hotel/motel and dormitory building area types, the margin by which the *proposed envelope performance factor* exceeds the *base envelope performance factor* shall not be greater than 15 percent. For compliance with this requirement, the *base envelope performance factor* shall be calculated using metal framing operable windows. In buildings with window area accounting for 40 percent or more of the wall area, the SHGC of the *vertical fenestration* on east and west oriented façade may be reduced by the following multiplier to account for the permanent site shading from existing buildings or infrastructure.

$M_{West} = 0.18 + 0.33/WWR$
$M_{East} = 0.35 + 0.26/WWR$
Where:
M_{West} = SHGC multiplier for the West facade
M_{East} = SHGC multiplier for the East facade
WWR = the ratio of the proposed *vertical fenestration* area to the *gross wall area* in consistent units.

The multiplier may be applied to the rated SHGC of the *vertical fenestration* which has at least 50 percent of the area located directly opposite of the shading surfaces and no higher from the street level than the difference between the shading surface height and the shading surface distance from the façade. Orientation must be determined following Section 5.5.4.5.

ii. For all other buildings area types, the margin by which the proposed *envelope performance factor* exceeds the *base envelope performance factor* shall be not greater than 7 percent. For compliance with this requirement, the *base envelope performance factor* shall be calculated using metal framing fixed windows.

iii. For mixed-use buildings, the margin shall be calculated as the *gross wall area*-weighted average of options *a* and *b*.

2.19 Amendments to Section 11.4.3.2 Annual Energy Costs

11.4.3.2 Annual Energy Costs**.**

The *design energy cost* and *energy cost budget* shall be determined using rates for *purchased energy* (such as electricity, gas, oil, propane, steam, and chilled water) that are approved by the *adopting authority*. Where *on-site renewable energy* or *site-recovered energy* is used, the *budget building design* shall be based on the *energy* source used as the backup *energy* source, or electricity if no backup *energy* source has been specified. Where the proposed design includes electricity generated from sources other than *on-site renewable energy,* the baseline design shall include the same generation system.

2.20 Amendments to Table 11.5.1 Modeling Requirements for Calculating Design Energy Cost and Energy Cost Budget

Table 11.5.1 Modeling Requirements for Calculating Design Energy Cost and Energy Cost

Proposed Design **(Column A)** ***Design Energy Cost*** **(DEC)**	***Budget Building Design*** **(Column B)** ***Energy Cost Budget*** **(ECB)**
1. Design Model	
a. The simulation model of the *proposed design* shall be consistent with the design documents, including proper accounting of *fenestration* and *opaque* envelope types and area; interior lighting power and *controls*; *HVAC system* types, sizes, and *controls*; and *service water-heating systems* and *controls*. b. All *conditioned spaces* in the *proposed design* shall be simulated as being both heated and cooled, even if no cooling or heating *system* is being installed. Temperature and humidity *control set points* and schedules, as well as *temperature control throttling range*, shall be the same for *proposed design* and *baseline building design*. c. When the *Energy Cost Budget* Method is applied to *buildings* in which *energy*-related features have not yet been designed (e.g., a *lighting system*), those yet-to-be-designed features shall be described in the *proposed design* so that they minimally comply with applicable mandatory and prescriptive requirements from Sections 5 through 10. Where the *space* classification for a *building* is not known, the *building* shall be categorized as an office *building*.	The *budget building design* shall be developed by modifying the *proposed design* as described in this table. Except as specifically instructed in this table, all *building systems* and *equipment* shall be modeled identically in the *budget building design* and *proposed design*.
2. Additions and Alterations	
It is acceptable to demonstrate compliance using *building* models that exclude parts of the *existing building*, provided all of the following conditions are met: a. Work to be performed under the current permit application in excluded parts of the *building* shall meet the requirements of Sections 5 through 10. b. Excluded parts of the *building* are served by *HVAC systems* that are entirely separate from those serving parts of the *building* that are included in the *building* model. c. Design *space* temperature and *HVAC system* operating *set points* and schedules on either side of the boundary between included and excluded parts of the *building* are identical. d. If a declining block or similar utility rate is being used in the analysis and the excluded and included parts of the *building* are on the same utility meter, the rate shall reflect the utility block or rate for the *building* plus the addition.	Same as *proposed design*.

Table 11.5.1 Modeling Requirements for Calculating Design Energy Cost and Energy Cost *(Continued)*

Proposed Design **(Column A)** ***Design Energy Cost*** **(DEC)**	***Budget Building Design*** **(Column B)** ***Energy Cost Budget*** **(ECB)**
3. Space Use Classification	
The *building* area type or *space* type classifications shall be chosen in accordance with Section 9.5.1 or 9.6.1. The user or designer shall specify the *space* use classifications using either the *building* area type or *space* type categories but shall not combine the two types of categories within a single permit application. More than one *building* area type category may be used for a *building* if it is a mixed-use facility.	Same as *proposed design*.
4. Schedules	
The schedule types listed in Section 11.4.1.1(b) shall be required input. The schedules shall be typical of the *proposed design* as determined by the designer and approved by the *authority having jurisdiction*. Required schedules shall be identical for the *proposed design* and *budget building design*.	Same as *proposed design*.

Table 11.5.1 Modeling Requirements for Calculating Design Energy Cost and Energy Cost *(Continued)*

Proposed Design **(Column A)** ***Design Energy Cost*** **(DEC)**	***Budget Building Design*** **(Column B)** ***Energy Cost Budget*** **(ECB)**
5. Building Envelope	
All components of the *building envelope* in the *proposed design* shall be modeled as shown on architectural drawings or as installed for *existing building envelopes*. **Exceptions:** The following *building* elements are permitted to differ from architectural drawings. 1. Any *building envelope* assembly that covers less than 5 percent of the total area of that assembly type (e.g., exterior walls) need not be separately described. If not separately described, the area of a *building envelope* assembly must be added to the area of the adjacent assembly of that same type. When the total area of penetrations from mechanical equipment listed in Table 6.8.1-4 exceeds 1 percent of the *opaque* above-grade wall area, the mechanical equipment penetration area shall be calculated as a separate wall assembly with a default U-factor of 0.5. Where mechanical equipment has been tested in accordance with testing standards approved by the *authority having jurisdiction*, the mechanical equipment penetration area may be calculated as a separate wall assembly with the U-factor as determined by such test. 2. Exterior surfaces whose azimuth *orientation* and tilt differ by no more than 45 degrees and are otherwise the same may be described as either a single surface or by using multipliers. 3. The exterior *roof* surface shall be modeled using the aged solar *reflectance* and thermal *emittance* determined in accordance with Section 5.5.3.1.1(a). Where aged test data are unavailable, the *roof* surface shall be modeled with a solar *reflectance* of 0.30 and a thermal *emittance* of 0.90. 4. Manually operated *fenestration* shading devices, such as blinds or shades, shall not be modeled. Permanent shading devices, such as fins, overhangs, and lightshelves, shall be modeled.	The *budget building design* shall have identical *conditioned floor area* and identical exterior dimensions and orientations as the *proposed design*, except as follows: a. *Opaque* assemblies, such as *roof, floors, doors*, and *walls*, shall be modeled as having the same *heat capacity* as the *proposed design* but with the minimum *U-factor* required in Table C402.1.4 for new buildings or additions and Section C503.3 for alterations. *Opaque* assemblies in semi-heated spaces shall be modeled as having the same *heat capacity* as the *proposed design* but with the minimum *U-factor* required in Section 5.5. b. The exterior *roof* surfaces shall be modeled with a solar *reflectance* and thermal *emittance* as required in Section 5.5.3.1.1(a). All other *roofs*, including *roofs* exempted from the requirements in Section 5.5.3.1.1, shall be modeled the same as the *proposed design*. c. No shading projections are to be modeled; *fenestration* shall be assumed to be flush with the *wall* or *roof*. If the *fenestration area* for new *buildings* or additions exceeds the maximum allowed by Section 5.5.4.2, the area shall be reduced proportionally along each exposure until the limit set in Section 5.5.4.2 is met. If the *vertical fenestration* area facing west or east of the *proposed design* exceeds the area limit set in Section 5.5.4.5 then the *energy cost budget* shall be generated by simulating the *budget building design* with its actual *orientation* and again after rotating the entire *budget building design* 90, 180, and 270 degrees and then averaging the results. *Fenestration* U-factor shall be equal to the criteria from Table C402.4 for the appropriate climate, and the *SHGC* shall be equal to the criteria from C402.4 for the appropriate climate. For portions of those tables where there are no *SHGC* requirements, the *SHGC* shall be equal to that determined in accordance with Section C3.6(c). The *VT* shall be equal to that determined in accordance with Section C3.6(c). The *fenestration* model for *building envelope alterations* shall reflect the limitations on area, *U-factor*, and *SHGC* as described in Section 5.1.3. **Exceptions:** When trade-offs are made between an addition and an *existing building*, as described in the exception to Section 4.2.1.2, the *building envelope* assumptions for the *existing building* in the *budget building design* shall reflect existing conditions prior to any revisions that are part of this permit.

Table 11.5.1 Modeling Requirements for Calculating Design Energy Cost and Energy Cost *(Continued)*

Proposed Design **(Column A)** ***Design Energy Cost*** **(DEC)**	***Budget Building Design*** **(Column B)** ***Energy Cost Budget*** **(ECB)**
6. Lighting	
Lighting power in the *proposed design* shall be determined as follows: a. Where a complete *lighting system* exists, the actual lighting power for each *thermal* block shall be used in the model. b. Where a *lighting system* has been designed, lighting power shall be determined in accordance with Sections 9.1.3 and 9.1.4. c. Where no lighting exists or is specified, lighting power shall be determined in accordance with the *Building* Area Method for the appropriate *building area type*. d. *Lighting system* power shall include all *lighting system* components shown or provided for on plans (including *lamps*, *ballasts*, task *fixtures*, and furniture-mounted *fixtures*). e. The lighting schedules in the *proposed design* shall reflect the mandatory *automatic* lighting *control* requirements in Section 9.4.1 (e.g., programmable *controls* or occupancy sensors) **Exception:** *Automatic* daylighting controls required by Section 9.4.1 shall be modeled directly in the proposed design or through schedule adjustments determined by a daylighting analysis approved by the building official. f. *Automatic* lighting *controls* included in the *proposed design* but not required by Section 9.4.1 may be modeled directly in the *building* simulation or be modeled in the building simulation through schedule adjustments determined by a separate analysis approved by the *authority having jurisdiction*. As an alternative to modeling such lighting controls, the *proposed design* lighting power may be reduced for each *luminaire* under *control* by dividing the rated lighting power of the *luminaire* by the factor (1 + ΣCF), where ΣCF indicates the sum of all applicable *control* factors (CF) per Section 9.6.3 and Table 9.6.3.	a. Lighting power in the *budget building design* shall be determined using the same categorization procedure (*Building* Area Method or Space-by-Space Method) and categories as the *proposed design* with lighting power set equal to the maximum allowed for the corresponding method and category in Tables C405.3.2(1) and C405.3.2(2). Additional interior lighting power for nonmandatory *controls* allowed under Section 9.6.3 shall not be included in the *budget building design*. b. Power for *fixtures* not included in the lighting power calculation shall be modeled identically in the *proposed design* and *budget building design*. c. Mandatory *automatic* lighting *controls* required by Section 9.4.1 shall be modeled the same as the *proposed design*.
7. Thermal Blocks – HVAC Zones Designed	
Where *HVAC zones* are defined on HVAC design drawings, each *HVAC zone* shall be modeled as a separate *thermal block*. **Exceptions:** Different *HVAC zones* may be combined to create a single *thermal block* or identical *thermal blocks* to which multipliers are applied, provided all of the following conditions are met: 1. The *space*-use classification is the same throughout the *thermal block*. 2. All *HVAC zones* in the *thermal* block that are adjacent to glazed *exterior walls* and glazed *semiexterior walls* face the same *orientation* or their orientations are within 45 degrees of each other. 3. All of the zones are served by the same *HVAC system* or by the same kind of *HVAC system*.	Same as *proposed design*.

Table 11.5.1 Modeling Requirements for Calculating Design Energy Cost and Energy Cost *(Continued)*

Proposed Design **(Column A)** ***Design Energy Cost*** **(DEC)**	***Budget Building Design*** **(Column B)** ***Energy Cost Budget*** **(ECB)**
8. Thermal Blocks – HVAC Zones Not Designed	
Where the *HVAC zones* and *systems* have not yet been designed, *thermal blocks* shall be defined based on similar internal load densities, occupancy, lighting, thermal and space temperature schedules, and in combination with the following: a. Separate *thermal blocks* shall be assumed for interior and perimeter *spaces*. Interior *spaces* shall be those located more than 15 ft from an *exterior wall* or *semiexterior* wall. Perimeter *spaces* shall be those located closer than 15 ft from an *exterior wall* or *semiexterior wall*. A separate thermal zone does not need to be modeled for areas adjacent to *semiexterior walls* that separate *semiheated space* from *conditioned space*. b. Separate *thermal blocks* shall be assumed for *spaces* adjacent to glazed *exterior walls* or glazed *semiexterior walls*; a separate zone shall be provided for each *orientation*, except that orientations that differ by no more than 45 degrees may be considered to be the same *orientation*. Each zone shall include all *floor* area that is 15 ft or less from a glazed perimeter *wall*, except that *floor* area within 15 ft of glazed perimeter *walls* having more than one *orientation* shall be divided proportionately between zones. c. Separate *thermal blocks* shall be assumed for *spaces* having *floors* that are in contact with the ground or exposed to ambient conditions from zones that do not share these features. d. Separate *thermal* blocks shall be assumed for *spaces* having *roof* assemblies from zones that do not share these features.	Same as *proposed design*.
9. Thermal Blocks – Multifamily *Residential Buildings*	
Residential spaces shall be modeled using one *thermal block* per *space* except that those facing the same orientations may be combined into one *thermal block*. Corner units and units with *roof* or *floor* loads shall only be combined with units sharing these features.	Same as *proposed design*.

Table 11.5.1 Modeling Requirements for Calculating Design Energy Cost and Energy Cost *(Continued)*

***Proposed Design* (Column A)** ***Design Energy Cost* (DEC)**	***Budget Building Design* (Column B)** ***Energy Cost Budget* (ECB)**
10. HVAC Systems	
The *HVAC system* type and all related performance parameters, such as *equipment* capacities and efficiencies, in *the proposed design* shall be determined as follows: a. Where a complete *HVAC system* exists, the model shall reflect the actual *system* type using actual component capacities and efficiencies. b. Where an *HVAC system* has been designed, the HVAC model shall be consistent with design documents. Mechanical *equipment* efficiencies shall be adjusted from actual *design conditions* to the standard rating conditions specified in Section 6.4.1 if required by the simulation model. Where *efficiency* ratings include supply fan energy, the *efficiency* rating shall be adjusted to remove the supply fan *energy* from the *efficiency* rating in the *budget building design*. The equations in Section 11.5.2 shall not be used in the *proposed design*. The *proposed design HVAC system* shall be modeled using *manufacturers'* full- and part- load data for the *HVAC system* without fan power. c. Where no heating *system* exists, or no heating *system* has been specified, the heating *system* shall be modeled as *fossil fuel*. The *system* characteristics shall be identical to the *system* modeled in the *budget building design*. *d.* Where no cooling *system* exists, or no cooling *system* has been specified, the cooling *system* shall be modeled as an air-cooled *single-zone system*, one unit per *thermal block*. The *system* characteristics shall be identical to the *system* modeled in the *budget building design.*	The *HVAC system* type and related performance parameters for the *budget building design* shall be determined from Figure 11.5.2, the *system* descriptions in Table 11.5.2-1 and accompanying notes, and in accord with rules specified in Section 11.5.2(a) through 11.5.2(k).

Table 11.5.1 Modeling Requirements for Calculating Design Energy Cost and Energy Cost *(Continued)*

Proposed Design **(Column A)** ***Design Energy Cost*** **(DEC)**	***Budget Building Design*** **(Column B)** ***Energy Cost Budget*** **(ECB)**
11. Service Water-Heating Systems	
The *service water-heating system* type and all related performance parameters, such as *equipment* capacities and *efficiencies*, in the *proposed design* shall be determined as follows: a. Where a complete *service water-heating system exists*, the model shall reflect the actual *system* type using actual component capacities and efficiencies. b. Where a *service water-heating system* has been designed, the *service water-heating model* shall be consistent with design documents. c. Where no *service water-heating system* exists or is specified, no *service water heating* shall be modeled.	The *service water-heating system* type in the *budget building design* shall be identical to the *proposed design*. The *service water-heating system* performance of the *budget building design* shall meet the requirements of Section C404.2, and where applicable the requirements of C404.2.1 and C404.2.2, without exception. **Exceptions:** 1. If the *service water heating system* type is not listed in Table C404.2, it shall be identical to the *proposed design*. 2. Where Section 7.5.1 or 7.5.2 applies, the *boiler* shall be split into a separate *space*-heating *boiler* and *hot-water heater*. 3. For 24-hour facilities that meet the prescriptive criteria for use of condenser heat recovery *systems* described in Section 6.5.6.2, a *system* meeting the requirements of that section shall be included in the *baseline building design*, regardless of the exceptions to Section 6.5.6.2. If a condenser heat recovery *system* meeting the requirements described in Section 6.5.6.2 cannot be modeled, the requirement for including such a *system* in the actual *building* shall be met as a prescriptive requirement in accordance with Section 6.5.6.2 and no heat recovery *system* shall be included in the *proposed design* or *budget building design*.
12. Miscellaneous Loads	
Receptacle, motor, and *process loads* shall be modeled and estimated based on the *building area type* or *space* type category and shall be assumed to be identical in the *proposed* and *budget building designs*. These loads shall be included in simulations of the *building* and shall be included when calculating the *energy cost budget* and *design energy cost*. All end-use load components within and associated with the *building* shall be modeled, unless specifically excluded by Sections 13 and 14 of Table 11.5.1, including exhaust fans, parking garage *ventilation* fans, exterior *building* lighting, swimming *pool* heaters and pumps, elevators and escalators, refrigeration *equipment*, and cooking *equipment*.	Receptacle, motor, and *process loads* shall be modeled and estimated based on the *building area type* or *space* type category and shall be assumed to be identical in the *proposed design* and *budget building design*. These loads shall be included in simulations of the *building* and shall be included when calculating the *energy cost budget* and *design energy cost*. All end-use load components within and associated with the *building* shall be modeled, unless specifically excluded by Sections 13 and 14 of Table 11.5.1, including exhaust fans, parking garage *ventilation* fans, exterior *building* lighting, swimming *pool* heaters and pumps, elevators and escalators, refrigeration *equipment*, and cooking *equipment*.

Table 11.5.1 Modeling Requirements for Calculating Design Energy Cost and Energy Cost *(Continued)*

Proposed Design **(Column A)** ***Design Energy Cost*** **(DEC)**	***Budget Building Design*** **(Column B)** ***Energy Cost Budget*** **(ECB)**
13. Modeling Exceptions	
All elements of the *proposed design building envelope*, HVAC, *service water heating*, lighting, and electrical *systems* shall be modeled in the *proposed design* in accordance with the requirements of Sections 1 through 12 of Table 11.5.1. **Exceptions:** Components and *systems* in the *proposed design* may be excluded from the simulation model provided that 1. component *energy* use does not affect the *energy* use of *systems* and components that are being considered for trade-off and 2. the applicable prescriptive requirements of Sections 5.5, 6.5, 7.5, and either 9.5 or 9.6 applying to the excluded components are met.	None
14. Modeling Limitations to the *Simulation Program*	
If the *simulation program* cannot model a component or *system* included in the *proposed design*, one of the following methods shall be used with the approval of the *authority having jurisdiction*: a. Ignore the component if the *energy* impact on the trade-offs being considered is not significant. b. Model the component substituting a thermodynamically similar component model. c. Model the *HVAC system* components or *systems* using the *budget building design*'s *HVAC system* in accordance with Section 10 of Table 11.5.1. Whichever method is selected, the component shall be modeled identically for both the *proposed design* and *budget building design*.	Same as *proposed design*.

2.21 Amendments to Section G1.2.1 Mandatory Provisions

G1.2.1 Mandatory Provisions.

This *performance rating method* requires conformance with the following provisions:

1. All requirements of Sections 5.4, 6.4, 7.4, 8.4, 9.4, 10.4, and Sections C408 and Appendix CC (if mandated by local ordinance) of the 2018 IECC (as amended) shall be met. These sections contain the mandatory provisions of the standard and are prerequisites for this rating method.
2. The interior lighting power shall not exceed the *interior lighting power allowance* determined using either Tables G3.7 or G3.8 and the methodology described in Sections 9.5.1 and 9.6.1.

2.22 Amendments to Section G1.2.2 Performance Rating Calculation

G1.2.2 Performance Rating Calculation**.**

The performance of the *proposed design* is calculated by either the provisions of G1.2.2.1 Performance Cost Index or G1.2.2.2 Performance Source Energy Index.

2.23 Addition of New Section G1.2.2.1 Performance Cost Index

G1.2.2.1 Performance Cost Index**.**

The performance of the proposed design is calculated in accordance with provisions of this appendix using the following formula:

Performance Cost Index =
Proposed building performance / *Baseline building performance*

Both the *proposed building performance* and the *baseline building performance* shall include all end-use load components within and associated with the building when calculating the Performance Cost Index.

2.24 Addition of New Section G1.2.2.2 Performance Source Energy Index

G1.2.2.2 Performance Source Energy Index**.**

The performance of the proposed design is calculated in accordance with provisions of this appendix using the following formula:

Performance Source Energy Index =
Proposed building source energy / *Baseline building source energy*

Both the *proposed building source energy* and the *baseline building source energy* shall include all end-use load components within and associated with the building when calculating the Performance Source Energy Index.

2.25 Amendments to Section G2.4.1 On-site Renewable Energy and Site-Recovered Energy

G2.4.1 On-site Renewable Energy and Site-Recovered Energy**.**

Site-recovered energy shall not be considered *purchased energy* and shall be subtracted from the *proposed design energy* consumption prior to calculating the *proposed building performance*. *On-site renewable energy* generated by *systems* included on the *building* permit used by the *building* shall be subtracted from the *proposed design energy* consumption prior to calculating the *proposed building performance* or *proposed building source energy*. The reduction in *proposed*

building performance or *proposed building source energy* associated with *on-site renewable energy* systems shall not exceed 5 percent of the calculated *baseline building performance* or *baseline building source energy*, respectively.

2.26 Amendments to Section G2.4.2 Annual Energy Costs

G2.4.2 Annual Energy Costs.

The *design energy cost* and baseline *energy* cost shall be determined using either actual rates for *purchased energy* or State average *energy* prices published by DOE's Energy Information Administration (EIA) for commercial *building* customers, but rates from different sources may not be mixed in the same project. Where *on-site renewable energy* or *site-recovered energy* is used, the *baseline building design* shall be based on the *energy* source used as the backup *energy* source, or the baseline *system energy* source in that category if no backup *energy* source has been specified. Where the proposed design includes electricity generated from sources other than *on-site renewable energy,* the baseline design shall include the same generation system.

2.27 Amendments to Table G3.1 Modeling Requirements for Calculating Proposed and Baseline Building Performance (No. 5 Building Envelope)

Table G3.1 Modeling Requirements for Calculating Proposed and *Baseline Building Performance*

No.	Proposed Building Performance	Baseline Building Performance
5. Building Envelope		
a.	All components of the *building envelope* in the *proposed design* shall be modeled as shown on architectural drawings or as built for *existing building envelopes*. **Exceptions:** The following *building* elements are permitted to differ from architectural drawings: 1. All uninsulated assemblies (e.g., projecting balconies, perimeter edges of intermediate *floor* stabs, concrete *floor* beams over parking garages, *roof* parapet) shall be separately modeled using either of the following techniques: a. Separate model of each of these assemblies within the *energy* simulation model. b. Separate calculation of the *U-factor* for each of these assemblies. The *U-factors* of these assemblies are then averaged with larger adjacent surfaces using an area-weighted average method. This average *U-factor* is modeled within the *energy* simulation model. Any other *building envelope* assembly that covers less than 5% of the total area of that assembly type (e.g., *exterior walls*) need not be separately described,	Equivalent dimensions shall be assumed for each *building envelope* component type as in the *proposed design*; i.e., the total gross area of *walls* shall be the same in the *proposed design* and *baseline building design*. The same shall be true for the areas of roofs, *floors,* and *doors,* and the exposed perimeters of concretes slabs on *grade* shall also be the same in the *proposed design* and *baseline building design*. The following additional requirements shall apply to the modeling of the *baseline building design*. a. ***Orientation.*** The *baseline building performance* shall be generated by simulating the *building* with its actual *orientation* and again after rotating the entire *building* 90, 180, and 270 degrees, then averaging the results. The *building* shall be modeled so that it does not shade itself. **Exceptions:** 1. If it can be demonstrated to the satisfaction of the *rating authority* that the *building orientation* is dictated by site considerations. 2. *Buildings* where the *vertical fenestration area* on each *orientation* varies by less than 5

provided that it is similar to an assembly being modeled. If not separately described, the area of a *building envelope* assembly shall be added to the area of an assembly of that same type with the same *orientation* and thermal properties. When the total area of penetrations from mechanical equipment listed in Table 6.8.1-4 exceeds 1% of the *opaque above-grade wall* area, the mechanical equipment penetration area shall be calculated as a separate wall assembly with a default *U-factor* of 0.5. Where mechanical equipment has been tested in accordance with testing standards approved by the *authority having jurisdiction*, the mechanical equipment penetration area may be calculated as a separate *wall* assembly with the *U-factor* as determined by such test.

2. Exterior surfaces whose azimuth *orientation* and tilt differ by less than 45 degrees and are otherwise the same may be described as either a single surface or by using multipliers.
3. The exterior *roof* surface shall be modeled using the aged solar *reflectance* and thermal *emittance* determined in accordance with Section 5.5.3.1.1(a). Where aged test data are unavailable, the *roof* surface may be modeled with a reflectance of 0.30 and a thermal *emittance* of 0.90.
4. *Manual fenestration* shading devices, such as blinds or shades, shall be modeled or not modeled the same as in the *baseline building design*. Automatically controlled *fenestration* shades or blinds shall be modeled. Permanent shading devices, such as fins, overhangs, and light shelves shall be modeled.
5. Automatically controlled *dynamic glazing* may be modeled. Manually controlled *dynamic glazing* shall use the average of the minimum and maximum *SHGC* and *VT*.

b. *Infiltration* shall be modeled using the same methodology, air leakage rate, and adjustments for weather and *building* operation in both the *proposed design* and the *baseline building design*. These adjustments shall be made for each simulation time step and must account for but not be limited to weather conditions and *HVAC system* operation, including strategies that are intended to positively pressurize the *building*. The air leakage rate of the *building envelope* (I_{75Pa}) at a *fixed building* pressure differential of 0.3 in. of water shall be 0.4 cfm/ft^2. The air leakage rate of the *building envelope* shall be converted to appropriate units for the *simulation program* using one of the methods in Section G3.1.1.4.

Exceptions: When whole-*building* air leakage testing, in accordance with ASTM E779, is specified during design and completed after *construction*, the *proposed design* air percent.

b. ***Opaque* Assemblies**. *Opaque* assemblies used for new *buildings, existing buildings, or* additions shall conform with assemblies detailed in Appendix A and shall match the appropriate assembly maximum *U-factors* in Tables G3.4-1 through G3.4-8:

- Roofs--Insulation entirely above deck (A2.2).
- *Above-grade walls*--Steel-*framed* (A3.3).
- *Below-grade walls*--Concrete block (A4).
- *Floors*--*Steel-joist* (A5.3).
- *Slab-on-grade floors* shall match the *F-factor* for unheated slabs from the same tables (A6).
- *Opaque door* types shall be of the same type of *constructions* as the *proposed design* and conform to the *U-factor* requirements from the same tables (A7).

c. ***Vertical Fenestration Areas.*** For *building* area types included in Table G3.1.1-1, *vertical fenestration areas* for new *buildings* and additions shall equal that in Table G3.1.1-1 based on the area of gross *above-grade walls* that separate *conditioned spaces* and *semiheated spaces* from the exterior. Where a *building* has multiple *building* area types, each type shall use the values in the table. The *vertical fenestration* shall be distributed on each face of the *building* in the same proportion as in the *proposed design*. For *building* areas not shown in Table G3.1.1-1, *vertical fenestration area* for new *buildings* and additions shall equal that in the *proposed design* or 40% of gross *above-grade wall* area, whichever is smaller, and shall be distributed on each face of the *building* in the same proportions in the *proposed design*. The *fenestration area* for an *existing building* shall equal the existing *fenestration area* prior to the proposed work and shall be distributed on each face of the *building* in the same proportions as the *existing building*. For portions of those tables where there are no *SHGC* requirements, the *SHGC* shall be equal to that determined in accordance with Section C3.6(c).

d. ***Vertical Fenestration* Assemblies.** *Fenestration* for new *buildings, existing buildings,* and additions shall comply with the following:

- *Fenestration U-factors* shall match the appropriate requirements in Tables G3.4-1 through G3.4-8 for the applicable glazing percentage for $\mathbf{U}_{all}$.
- *Fenestration SHGCs* shall match the appropriate requirements in Tables G3.4-1 through G3.4-8 using the value for $SHGC_{all}$ for the applicable

leakage rate of the *building envelope* shall be as measured.	vertical glazing percentage. • All *vertical fenestration* shall be assumed to be flush with the *exterior* wall, and no shading projections shall be modeled. • *Manual* window shading devices such as blinds or shades are not required to be modeled. e. ***Skylights* and Glazed Smoke Vents.** *Skylight* area shall be equal to that in the *proposed design* or #%, whichever is smaller. If the *skylight* area of the *proposed design* is greater than 3%, baseline *skylight* area shall be decreased by an identical percentage in all *roof* components in which *skylights* are located to reach 3%. *Skylight orientation* and tilt shall be the same as in the *proposed design*. *Skylight U-factor* and *SHGC* properties shall match the appropriate requirements in Tables G3.4-1 through G3.4-8 using the value and the applicable *skylight* percentage. f. ***Roof* Solar *Reflectance* and Thermal *Emittance.*** The exterior *roof* surfaces shall be modeled using a solar *reflectance* of 0.30 and a thermal *emittance* of 0.90. g. ***Roof* Albedo.** All *roof* surfaces shall be modeled with a reflectivity of 0.30.

PART 3

3 Amendments to 2018 International Energy Conservation Construction Code Residential Provisions

3.1 Amendments to Section 401.2

R401.2 Compliance**.** Projects shall comply with one of the following:

1. The provisions of Sections R401 through R404.
2. The provisions of Sections R401 through R404 and the provisions of Section R408 (passive house).
3. The provisions of Section R406 (ERI).
4. For *Group* R-2*, Group* R-3 *and Group* R-4 *buildings*, the provisions of Section R405 (simulated performance) and the provisions of Sections R401 through R404 labeled "Mandatory." The building energy cost shall be equal to or less than 80 percent of the standard reference design building.

3.2 Amendments to Table R402.1.2 Insulation and fenestration requirements by component

Table R402.1.2
Insulation and Fenestration Requirements by Component[a]

Climate Zone	Fenestration U-factor[h]	Skylight U-factor[h]	Glazed fenestration SHGC[h]	Ceiling R-Value	Wood Frame Wall[b,c] R-Value	Mass Wall[d] R-Value	Floor R-Value	Basement Wall[e] R-Value	Slab[f] R-Value and Depth	Crawl Space Wall[e] R-Value
4	0.27	0.50	0.4	49	21 int. or 20+5 or 13+10	15/20	30[g]	15/19	10,4 ft	15/19
5	0.27	0.50	NR	49	21 int. or 20+5 or 13+10	15/20	30[g]	15/19	10,4 ft	15/19
6	0.27	0.50	NR	49	20+5 or 13+10	15/20	30[g]	15/19	10,4 ft	15/19

NR = Not Required
For SI: 1 foot = 304.8 mm.

a. R-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed R-value of the insulation shall be not less than the R-value specified in the table.
b. Int. (intermediate framings) denotes standard framing 16 inches on center. Headers shall be insulated with a minimum of R-10 insulation.
c. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+10" means R-13 cavity insulation plus R-10 continuous insulation.
d. Mass walls shall be in accordance with Section R402.2.5. The second R-value applies when more than half the insulation is on the interior of the mass wall.
e. 15/19 means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall.
f. R-10 continuous insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation R-value for slabs as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.
g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.
h. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

3.3 Amendments to Table R402.1.4 Equivalent U-factors

Table R402.1.4
Equivalent U-factors[a]

Climate Zone	Fenestration U-factor	Skylight U-factor	Ceiling U-factor	Frame Wall U-factor	Mass Wall U-factor[b]	Floor U-factor	Basement Wall U-factor	Crawl Space Wall U-factor
4	0.27	0.50	0.026	0.045	0.056	0.033	0.050	0.042
5	0.27	0.50	0.026	0.045	0.056	0.033	0.050	0.042
6	0.27	0.50	0.026	0.045	0.056	0.033	0.050	0.042

a. Nonfenestration U-factors shall be obtained from measurement, calculation or an approved source.
b. Mass wall shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall U-factor shall not exceed 0.056.

3.4 Amendments to Section R402.2.2 Ceilings without attic spaces

R402.2.2 Ceiling without attic spaces. Where Section R402.1.2 requires insulation R-values greater than R-38 in the ceiling and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation R-value for such roof/ceiling assemblies shall be R-38. Insulation shall extend over the top of the wall plate to the outer edge of such plate and shall not be compressed. This reduction of insulation from the requirements of Section R402.1.2 shall be limited to 500 square feet (46 m^2) or 20 percent of the total insulated ceiling area, whichever is less. This reduction shall not apply to the U-factor alternative approach in Section R402.1.4 and the Total UA alternative in Section R402.1.5.

3.5 Amendments to Section R402.4.1.1 Installation

R402.4.1.1 Installation. The components of the *building thermal envelope* as indicated in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instruction and the criteria indicated in Table R402.4.1.1 as applicable to the method of construction. An approved agency shall inspect all components and verify compliance. The inspection shall include an open wall visual inspection of all components included in Table R402.4.1.1 and shall be installed so that the insulation material uniformly fills each cavity side-to-side and top-to-bottom, without substantial gaps or voids around obstructions, and is split, installed, or fitted tightly around wiring and other penetrations in the cavity. No more than 2 percent of the total insulated area shall be compressed below the thickness required to attain the labeled R-value or contain gaps or voids in the insulation.

3.6 Amendments to Section R403.3 Ducts

R403.3 Ducts. All ducts and air handlers shall be installed in accordance with Section R403.3.1 through R403.3.8, where applicable. The duct system in new buildings and additions shall be located in a conditioned space in accordance with Sections R403.3.7 (1) and R403.3.7 (2).

3.7 Addition of New Section R403.3.8 Duct system sizing (Mandatory)

R403.3.8 Duct system sizing (Mandatory). Ducts shall be sized in accordance with ACCA Manual D based on calculations made in accordance with Sections R403.7 and R403.8.

3.8 Amendments to Section R403.5 Service hot water systems

R403.5 Service hot water systems. Energy conservation measures for service hot water systems shall be in accordance with Sections R403.5.1 through R403.5.5

3.9 Amendments to Section R403.5.4 Drain water heat recovery units

R403.5.4 Drain water heat recovery units. Drain water heat recovery units shall have a minimum efficiency of 40 percent if installed for equal flow or a minimum efficiency of 52 percent if installed for unequal flow. Vertical drain water heat recovery units shall comply with CSA B55.2 and be tested and labeled in accordance with CSA B55.1 or IAPMO 346. Sloped drain water heat recovery units shall comply with IAPMO PS 92 and be tested and labeled in accordance with IAPMO 346. Potable water-side pressure loss of drain water heat recovery units shall be less than 3 psi for individual units connected to one or two showers. Potable water-side pressure loss of drain water heat recovery units shall be less than 2 psi for individual units connected to three or more showers.

3.10 Addition of New Section R403.5.5 Supply of heated water

R403.5.5 Supply of heated water. In new *buildings*, heated water supply piping shall be in accordance with one of the following:

R403.5.5.1 Maximum allowable pipe length method. The maximum allowable pipe length from the nearest source of heated water to the termination of the fixture supply pipe shall be in accordance with the maximum pipe length in Table R403.5.5.1. Where the length contains more than one size of pipe, the largest size shall be used for determining the maximum allowable length of the piping in Table R403.5.5.1.

R403.5.5.2 Maximum allowable pipe volume method. The water volume in the piping shall be calculated in accordance with Section R403.5.5.2.1. The maximum volume of hot or tempered water in the piping to public lavatory faucets shall be 2 ounces. For fixtures other than public lavatory faucets, the maximum volume shall be 64 ounces for hot or tempered water from a water heater or boiler; and 24 ounces for hot or tempered water from a circulation loop pipe or an electrically heat-traced pipe. The water volume in the piping shall be calculated in accordance with Section R403.5.5.2.1.

R403.5.5.2.1 Water volume determination. The volume shall be the sum of the internal volumes of pipe, fittings, valves, meters and manifolds between the source of hot water and the termination of the fixture supply pipe. The volume shall be determined from the "Volume" column of Table R403.5.5.1. The volume contained within fixture shutoff valves, flexible water supply connectors to a fixture fitting, or within a fixture fitting shall not be included in the water volume determination. Where hot or tempered water is supplied by a circulation loop pipe or a heat-traced pipe, the volume shall include the portion of the fitting on the branch pipe that supplies water to the fixture.

Table R403.5.5.1
Pipe Volume and Maximum Piping Lengths

Nominal Pipe or Tube Size (inch)	VOLUME (Liquid Ounces Per Foot Length)	Maximum Pipe or Tube Length		
		System without a circulation loop or heat-traced line (feet)	System with a circulation loop or heat-traced line (feet)	Lavatory faucets – public (metering and nonmetering (feet)
1/4[a]	0.33	50	16	6
5/16[a]	0.5	50	16	4
3/8[a]	0.75	50	16	3
1/2	1.5	43	16	2
5/8	2	32	12	1
3/4	3	21	8	0.5
7/8	4	16	6	0.5
1	5	13	5	0.5
1 1/4	8	8	3	0.5
1 1/2	11	6	2	0.5
2 or larger	18	4	1	0.5

a. The flow rate for ¼-inch size pipe or tube is limited to 0.5 gallons per minute; for 5/16-inch size, it is limited to 1 gpm; for 3/8-inch size, it is limited to 1.5 gpm.

R403.5.5.3 Drain water heat recovery units. New buildings shall include a drain water heat recovery unit that captures heat from at least one shower, and such drain water heat recovery unit must have a minimum efficiency of 40 percent if installed for equal flow or a minimum efficiency of 52 percent if installed for unequal flow. Vertical drain water heat recovery units shall comply with CSA B55.2 and be tested and labeled in accordance with CSA B55.1 or IAPMO 346. Sloped drain water heat recovery units shall comply with IAPMO PS 92 and be tested and labeled in accordance with IAPMO 346. Potable water-side pressure loss of drain water heat recovery units shall be less than 3 psi for individual units connected to one or two showers.

Potable water-side pressure loss of drain water heat recovery units shall be less than 2 psi for individual units connected to three or more showers.

R403.5.5.4 Recirculation Systems. Projects shall include a recirculation system with no more than 0.5-gallon (1.9 liter) storage. The storage limit shall be measured from the point where the branch feeding the fixture branches off the recirculation loop to the fixture. Recirculation systems must be based on an occupant-controlled switch or an occupancy sensor, installed in each bathroom, which is located beyond a 0.5-gallon stored-volume range from the water heater.

3.11 Addition of New Section R403.6.2 Balanced and HRV/ERV systems (Mandatory)

R403.6.2 Balanced and HRV/ERV systems (Mandatory). In new buildings, every dwelling unit shall be served by a heat recovery ventilator (HRV) or energy recovery ventilator (ERV) installed per manufacturer's instructions. The HRV/ERV must be sized adequately for the specific application, which will include the building's conditioned area, and number of occupants.

Exception: In Climate Zone 4, a balanced *ventilation* system designed and installed according to the requirements of Section M1507.3 of the 2015 International Residential Code (IRC) that uses the return side of the building's heating and/or cooling system air handler to supply outdoor air, shall be permitted to comply with this section. When the outdoor air supply is ducted to the heating and/or cooling system air handler, the mixed air temperature shall not be less than that permitted by the heating equipment manufacturer's installation instructions. Heating and/or cooling system air handlers used to distribute outdoor air shall be field-verified to not exceed an efficacy of 45 W/CFM if using furnaces for heating and 58 W/CFM if using other forms of heating. In the balanced system design, an equivalent exhaust air flow rate shall be provided simultaneously by one or more exhaust fans, located remotely from the source of supply air. The balanced system's exhaust and supply fans shall be interlocked for operation, sized to provide equivalent air flow at a rate greater than or equal to that determined by IRC Table M1507.3.3(1) and shall have their fan capacities adjusted for intermittent run time per Table M1507.3.3(2). Continuous operation of the balanced *ventilation* system shall not be permitted.

3.12 Addition of New Section R403.6.3 Verification

R403.6.3 Verification. Installed performance of the mechanical *ventilation* system shall be tested and verified by an *approved agency* and measured using a flow hood, flow grid, or other airflow measuring device in accordance with Air Conditioning Contractors of America (ACCA) HVAC Quality Installation Verification Protocols – ANSI/ACCA 9QIvp-2016.

3.13 Amendments to Section R404.1 Lighting equipment (Mandatory)

R404.1 Lighting equipment (Mandatory). Not less than 90 percent of the permanently installed lighting fixtures shall use lamps with an efficacy of at least 65 lumens per watt or have a total luminaire efficacy of at least 45 lumens per watt.

R404.1.1 Lighting equipment (Mandatory). Fuel gas lighting systems shall not have continuously burning pilot lights.

3.14 Addition of New Section R404.2 Electrical power packages (Mandatory)

R404.2 Electrical power packages (Mandatory). New buildings shall comply with the following:

1. Solar-ready zone. Detached one and two-family dwellings and townhouses where the conditioned space is greater than 1,400 square feet shall comply with the requirements of Appendix RA.
2. Electrical Vehicle Service Equipment Capable. Detached one or two-family dwellings and townhouses with parking area provided on the *building site* shall provide a 208/240V 40-amp outlet for each dwelling unit or panel capacity and conduit for the future installation of such an outlet. Outlet or conduit termination shall be adjacent to the parking area. For residential occupancies where there is a common parking area, provide either:
   a. Panel capacity and conduit for the future installation of 208/240V 40-amp outlets for 5 percent of the total parking spaces, but not less than one outlet, or
   b. 208/240V 40-amp outlets for 5 percent of the total parking spaces, but not less than one outlet.

3.15 Amendments to Table R406.4 Maximum Energy Rating Index

Table R406.4
Maximum Energy Rating Index

Climate Zone	Energy Rating Index[a]
4	50
5	50
6	50

a. Where *on-site renewable energy* is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or R402.1.4 of the 2015 *International Energy Conservation Code.*

3.16 Addition of New Section R408 Passive House

Section R408
Passive House

R408.1 General**.** *Buildings* shall comply with either Section R408.1.1 or R408.1.2 and shall comply with Section R408.2.

R408.1.1. Passive House Institute US (PHIUS) Approved Software. PHIUS+. Passive Building Standard - North America, where Specific Space Heat Demand and (sensible only) Cooling Demand, as modeled and field-verified by a Certified Passive House Consultant, is less than or equal to 9kBTU/ft2/year. The *dwelling unit* shall also be tested with a blower door and found to exhibit no more than 0.05 CFM50/ft² or 0.08 CFM75/ft² of air leakage.

R408.1.2 Passive House Institute (PHI) Approved Software. Passive House Institute: Low Energy Building Standard, where Specific Space Heating and (sensible only) Cooling Demand is less than or equal to 9.5 kBTU/ft^2/year, as modeled and field-verified by a Certified Passive House Consultant. The *dwelling unit* shall also be tested with a blower door and found to exhibit an *infiltration* rate of no more than 1.0 air changes per hour under a pressure of 50 Pascals.

R408.2 Documentation

1. If using the PHIUS software:
    a. Prior to the issuance of a building permit, the following items must be provided to the *code official*:
        i. A list of compliance features; and
        ii. A statement that the estimated Specific Space Heat Demand is “based on plans.”
    b. Prior to the issuance of a certificate of occupancy, the following item must be provided to the *code official*:
        i. A copy of the final report submitted on a form that is approved to document compliance with PHIUS+ standards. Said report must indicate that the finished building achieves a Certified Passive House Consultant verified Specific Space Heat Demand of less than or equal to 9 kBTU/ft2/year.

2. If using the PHI software:

    a. Prior to the issuance of a building permit, the following items must be provided to the *code official*:

        i. A list of compliance features; and

        ii. A statement that the estimated Specific Space Heating and Cooling Demand is "based on plans."

    b. Prior to the issuance of a certificate of occupancy, the following item must be provided to the *code official*:

        i. A copy of the final report submitted on a form that is approved to document compliance with PHI standards. Said report must indicate that the finished building achieves a Certified Passive House Consultant verified Specific Space Heating or Cooling Demand is less than or equal to 9.5 kBTU/ft^2/year.

3.17 Amendments to "ACCA" in Chapter 6 Referenced Standards

Manual D—16: Residential Duct Systems

R403.3.8

Manual J—16: Residential Load Calculation Eighth Edition

R403.7

Manual S—14: Residential Equipment Selection

R403.7

3.18 Addition of a new entry for "IAPMO" to Chapter 6 Referenced Standards

IAPMO **International Association of Plumbing and Mechanical Officials**
4755 E. Philadelphia St.
Ontario, CA 91761

IAPMO IGC 346:2017 Test Method for Measuring the Performance of Drain Water Heat Recovery Units

R403.5.4.3

IAPMO PS 92-2013: Heat Exchangers and Indirect Water Heaters

R403.5.4.3

3.19 Addition of a new entry for "PHI" to Chapter 6 Referenced Standards

PHI **Passive House Institute**
Rheistrasse 44/46
64283 Darmstadt, Germany

PHI 2016: Low Energy Building Standard, Version 9f
R408.1

3.20 Addition of a New Entry for "PHIUS" to Chapter 6 Referenced Standards

PHIUS **Passive House Institute US**
116 West Illinois Street, Suite 5E
Chicago, IL 60654, USA

PHIUS+ 2015: Passive Building Standard – North America
R408.1

State of New York
Andrew M. Cuomo, Governor

New York State Energy Research and Development Authority
Richard L. Kauffman, Chair | Alicia Barton, President and CEO

September 2019

New York Battery Energy Storage System Guidebook

for Local Governments

NEW YORK STATE OF OPPORTUNITY. | NYSERDA

New York Battery Energy Storage System Guidebook

In December 2018, the New York Public Service Commission adopted Governor Cuomo's 1,500 MW energy storage target by 2025 and established a 3,000 MW target by 2030. Over $350 million in New York State incentives have been authorized to accelerate the adoption of energy storage systems in effort of building a self-sustaining industry. Energy storage systems will serve many critical roles to enable New York's clean energy future. As intermittent renewable power sources, such as wind and solar, provide a larger portion of New York's electricity, energy storage systems will be used to smooth and time-shift renewable generation, and minimize curtailment. As New York's grid becomes smarter and more decentralized, these systems will dispatch stored energy when and where it is needed the most. Further, energy storage systems will allow New York to meet its peak power needs without relying on its oldest and dirtiest peak generating plants, many of which are approaching the end of their useful lives.

As an important first step in protecting public and firefighter safety while promoting safe energy storage, the New York State Energy Research and Development Authority (NYSERDA) developed the first comprehensive set of guidelines for reviewing and evaluating battery energy storage systems. The Battery Energy Storage System Guidebook (Guidebook) helps local government officials, and Authorities Having Jurisdiction (AHJs), understand and develop a battery energy storage system permitting and inspection processes to ensure efficiency, transparency, and safety in their local communities. The Guidebook provides in-depth details about the permitting and inspection processes of battery energy systems that have (1) experienced the sharpest price declines, (2) are offered by a large number of manufacturers, and (3) are likely to comprise the largest number of battery energy storage system permits an AHJ may see.

The Guidebook contains the following chapters:

- **Battery Energy Storage System Model Law (Model Law):** The Model Law is intended to help local government officials and AHJs adopt legislation and regulations to responsibly accommodate battery energy storage systems in their communities. The Model Law lays out procedural frameworks and substantive requirements for residential, commercial, and utility-scale battery energy storage systems.
- **Battery Energy Storage System Model Permit (Model Permit):** The Model Permit is intended to help local government officials and AHJs establish the minimum submittal requirements for electrical and structural plan review that are necessary when permitting residential and small commercial battery energy storage systems.
- **Battery Energy Storage System Inspection Checklist (Checklist):** The Checklist is intended to be utilized as a guideline for field inspections of residential and small commercial battery energy storage systems. It can be used directly by local code enforcement officers or provided to a third-party inspection agency, where applicable.

When combined with all applicable provisions of the codes, regulations, and industry standards as referenced in the New York State Uniform Fire Prevention and Building Code, these resources create an all-encompassing process to safely permit all types of battery energy storage systems. The Guidebook is intended to create complementary review processes for battery energy storage systems separate from other technologies. For example, if a hybrid project contains both a battery energy storage system and solar photovoltaics, the proposed project would have to comply with both solar and battery energy storage system requirements.

This relatively new technology, and its subsequent variations, continues to face regulatory, policy and financial challenges. NYSERDA will continue to work with permitting authorities and the industry to test the processes outlined in the guide so they can be refined and updated as the codes and standards evolve.

The Guidebook is advisory only and not legally binding. These resources are not intended for adoption precisely as they are written, and each municipality should delete, modify, or add other provisions as appropriate to suit local conditions, comprehensive plans, and existing land use and zoning provisions. Neither NYSERDA, nor any of its employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information. AHJs and other entities are welcome to use and distribute the Guidebook.

NYSERDA offers continuing free technical assistance to local governments to help further understand the issues addressed in the Battery Energy Storage System Guidebook. Please contact the siting team at NYSERDA by emailing **cleanenergyhelp@nyserda.ny.gov** for additional help or questions.

You can download specific chapters of the New York Battery Energy Storage System Guidebook at nyserda.ny.gov/Energy-Storage-Guidebook.

NYSERDA offers objective information and analysis, innovative programs, technical expertise, and support to help New Yorkers increase energy efficiency, save money, use renewable energy, and reduce reliance on fossil fuels. NYSERDA professionals work to protect the environment and create clean energy jobs. A public benefit corporation, NYSERDA has been advancing innovative energy solutions since 1975.

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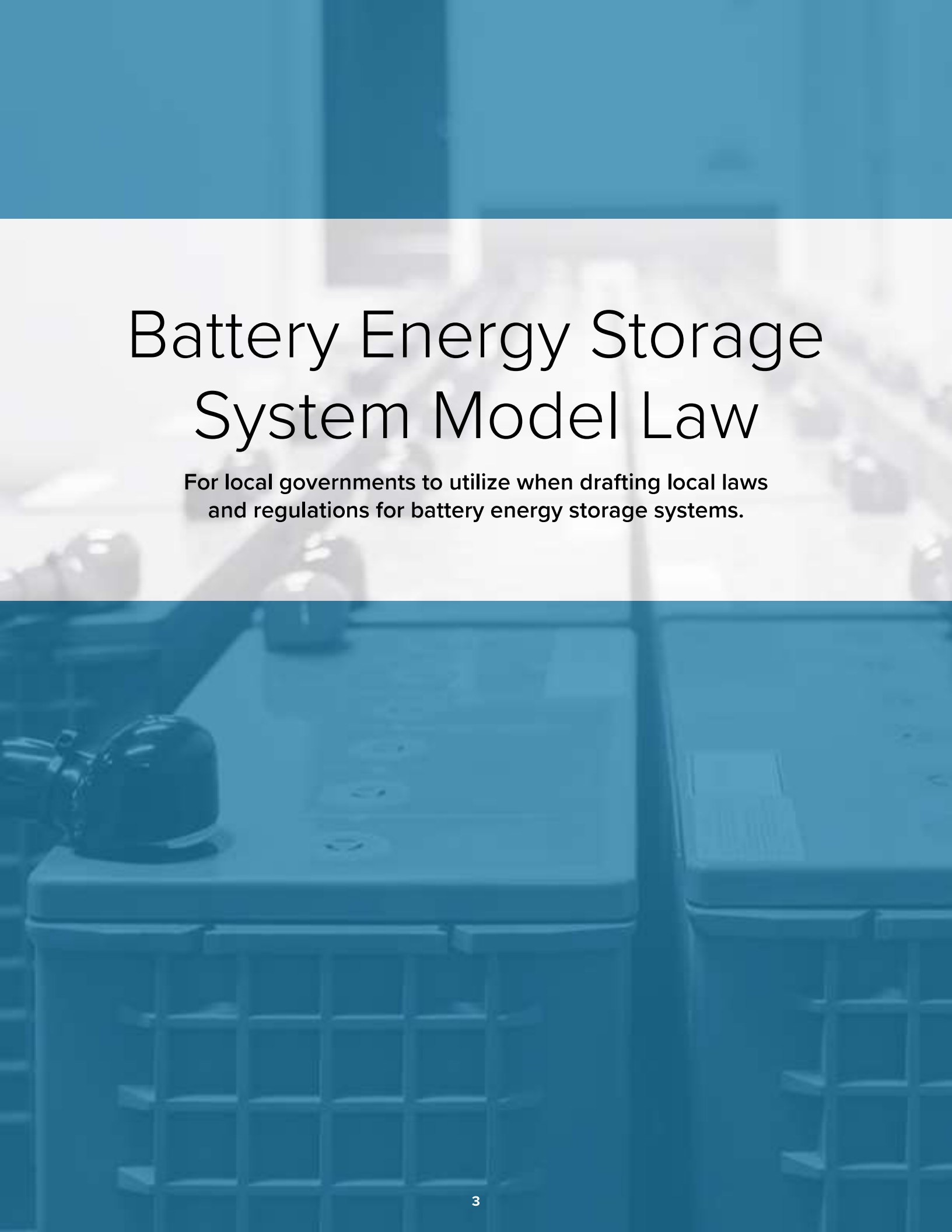

Battery Energy Storage System Model Law

For local governments to utilize when drafting local laws and regulations for battery energy storage systems.

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Overview

The Model Law is intended to help local government officials and AHJs adopt legislation and regulations to responsibly accommodate battery energy storage systems in their communities. The Model Law lays out procedural frameworks and substantive requirements for residential, commercial, and utility-scale battery energy storage systems.

The workable version of this document can be found at nyserda.ny.gov/Energy-Storage-Guidebook, under Battery Energy Storage System Model Law tab.

1. Instructions

1. This Model Law can be adopted by the governing board of cities, towns, and villages (hereinafter "local governments" or "municipalities") to regulate the installation, operation, maintenance, and decommissioning of battery energy storage systems. The Model Law is intended to be an "all-inclusive" local law, regulating the subject of battery energy storage systems under typical zoning and land use regulations and it includes the process for compliance with the State Environmental Quality Review Act. Municipalities should review this Model Law, examine their local laws and regulations and the types, size range and number of battery energy storage system projects proposed, and adopt a local law addressing the aspects of battery energy storage system development that make the most sense for each municipality, deleting, modifying, or adding other provisions as appropriate.
2. This Model Law references a "Battery Energy Storage System Model Permit" that is available as part of NYSERDA's Battery Energy Storage Guidebook. The Model Permit is intended to help local government officials and AHJs establish the minimum submittal requirements for electrical and structural plan review that are necessary when permitting residential and small commercial battery energy storage systems.
3. In some cases, there may be multiple approaches to regulate a certain aspect of battery energy storage systems. The word "OR" has been placed in the text of the model law to indicate these options. Municipalities should choose the option that works best for their communities. The content provided in brackets and highlighted is optional. Depending on local circumstances, a municipality may want to include this content or choose to adopt a different standard.
4. The Model Law is not intended for adoption precisely as it is written. It is intended to be advisory only, and users should not rely upon it as legal advice. A municipality is not required to adopt this Model Law. Municipal officials are urged to seek legal advice from their attorneys before enacting a battery energy storage system law. Municipalities must carefully consider how the language in this Model Law may be modified to suit local conditions, comprehensive plan, and existing land use and zoning provisions.

5. Before enacting this Model Law, a comprehensive plan outlining the goals and policies for the installation, operation, maintenance, and decommissioning of battery energy storage systems must be adopted by the local governing board (city or common council, town board, village board of trustees). Some local governing boards can satisfy this requirement by updating an existing comprehensive plan while others must adopt a new comprehensive plan. Suggestions on how local governing boards can develop and adopt in their existing or new comprehensive plans battery energy storage system friendly policies and plans that provide local protection are listed below:

   A. Adopt a resolution or policy statement that outlines a strategy for municipal-wide battery energy storage system development. The chief executive officer of a local government (like a town supervisor or city or village mayor) may choose to issue in accordance with its local charter or other valid local law or regulations an executive order, proclamation or other declaration to advance battery energy storage system development.

   B. Appoint a Battery Energy Storage Task Force ("Task Force") that represents all interested stakeholders, including residents, businesses, interested non-profit organizations, the battery energy storage industry, utilities, and relevant municipal officials and staff to prepare an action plan, adopt a new or amend the comprehensive plan to include battery energy storage system planning goals and actions, and develop local laws and/or other regulations to ensure the orderly development of battery energy storage system projects.

   C. Charge the Task Force with conducting meetings on a communitywide basis to involve all key stakeholders, gather all available ideas, identify divergent groups and views, and secure support from the entire community. The Task Force also should conduct studies and should determine whether existing policies, plans, and land use regulations require amendments to remove barriers to and facilitate battery energy storage system development goals.

   D. Establish a training program for local staff and land use boards. Municipalities are encouraged to utilize State and Federal technical assistance and grants for training programs when available.

   E. Partner with adjacent communities to adopt compatible policies, plan components, and zoning provisions for battery energy storage system projects. County or regional planning agencies may also advise participating local governments on locally addressing these issues.

2. Model Law

1. Authority

This Battery Energy Storage System Law is adopted pursuant to Article IX of the New York State Constitution, §2(c)(6) and (10), New York Statute of Local Governments, § 10 (1) and (7); [Select one: sections 261-263 of the Town Law / sections 7-700 through 7-704 of the Village Law / sections 19 and 20 of the City Law and section 10 of the Municipal Home Rule Law] of the State of New York, which authorize the [Village/Town/City] to adopt zoning provisions that advance and protect the health, safety and welfare of the community.

2. Statement of Purpose

This Battery Energy Storage System Law is adopted to advance and protect the public health, safety, and welfare of [Village/Town/City] by creating regulations for the installation and use of battery energy storage systems, with the following objectives:

A. To provide a regulatory scheme for the designation of properties suitable for the location, construction and operation of battery energy storage systems;

B. To protect the health, welfare, safety, and quality of life for the general public;

C. To ensure compatible land uses in the vicinity of the areas affected by battery energy storage systems;

D. To mitigate the impacts of battery energy storage systems on environmental resources such as important agricultural lands, forests, wildlife and other protected resources; and

E. To create synergy between battery energy storage system development and [other stated goals of the community pursuant to its Comprehensive Plan].

3. Definitions

ANSI: American National Standards Institute

BATTERY: A single Cell or a group of Cells connected together electrically in series, in parallel, or a combination of both, which can charge, discharge, and store energy electrochemically. For the purposes of this law, batteries utilized in consumer products are excluded from these requirements.

BATTERY ENERGY STORAGE MANAGEMENT SYSTEM: An electronic system that protects storage batteries from operating outside their safe operating parameters and generates an alarm and trouble signal for off normal conditions.

BATTERY ENERGY STORAGE SYSTEM: A rechargeable energy storage system consisting of electrochemical storage batteries, battery chargers, controls, , power conditioning systems, and associated electrical equipment designed to provide electrical power to a building. The system is typically used to provide standby or emergency power, an uninterruptable power supply, load shedding, load sharing, or similar capabilities. A battery energy storage system is classified as a Tier 1, Tier 2, or Tier 3 Battery Energy Storage System as follows:

A. Tier 1 Battery Energy Storage Systems include either:

a) Battery energy storage systems for one to two family residential dwellings within or outside the structure with an aggregate energy capacity that shall not exceed:

1. 40 kWh within utility closets and storage or utility spaces
2. 80 kWh in attached or detached garages and detached accessory structures
3. 80 kWh on exterior walls
4. 80 kWh outdoors on the ground

b) Other battery energy storage systems with an aggregate energy capacity less than or equal to the threshold capacity listed in Table 1

B. Tier 2 Battery Energy Storage Systems include battery energy storage systems that are not included in Tier 1, have an aggregate energy capacity greater than the threshold capacity listed in Table 1, and have an aggregate energy capacity less than 600 kWh

TABLE 1 BATTERY ENERGY STORAGE SYSTEM TIER 2 THRESHOLD QUANTITIES

Battery Technology	Capacity
Flow batteries	20 kWh
Lead acid, all types	70 kWh
Lithium, all types	20 kWh
Nickel cadmium (Ni-Cd)	70 kWh
Nickel metal hydride (Ni-MH)	70 kWh
Other battery technologies	10 kWh

C. Tier 3 Battery Energy Storage Systems include all the following:

a) Battery energy storage systems with an aggregate energy capacity greater than or equal to 600kWh

b) Battery energy storage systems with more than one storage battery technology is provided in a room or indoor area

COMMISSIONING: A systematic process that provides documented confirmation that a battery energy storage system functions according to the intended design criteria and complies with applicable code requirements.

DEDICATED-USE BUILDING: A building that is built for the primary intention of housing battery energy storage system equipment and is classified as Group F-1 occupancy as defined in the International Building Code. It is constructed in accordance with the Uniform Code, and it complies with the following:

1) The building's only permitted primary use is for battery energy storage, energy generation, and other electrical grid-related operations.

2) Occupants in the rooms and areas containing battery energy storage systems are limited to personnel that operate, maintain, service, test, and repair the battery energy storage system and other energy systems.

3) No other occupancy types are permitted in the building.

4) Administrative and support personnel are permitted in incidental-use areas within the buildings that do not contain battery energy storage system, provided the following:

a. The areas do not occupy more than 10 percent of the building area of the story in which they are located.

b. A means of egress is provided from the incidental-use areas to a public way that does not require occupants to traverse through areas containing battery energy storage systems or other energy systems.

DWELLING UNIT: One or more rooms arranged for complete, independent housekeeping purposes with space for eating, living, and sleeping; facilities for cooking; and provisions for sanitation.

ENERGY CODE: The New York State Energy Conservation Construction Code adopted pursuant to Article 11 of the Energy Law, as currently in effect and as hereafter amended from time to time.

FIRE CODE: The fire code section of the New York State Uniform Fire Prevention and Building Code adopted pursuant to Article 18 of the Executive Law, as currently in effect and as hereafter amended from time to time.

FLOW BATTERY: A type of rechargeable Battery that uses typically large, separated liquid reservoirs of electrolytes that flow through a reaction zone to store, charge, and discharge energy. These electrolytes are typically non-flammable.

LEAD-ACID BATTERY: A rechargeable Battery that is comprised of lead electrodes immersed in sulphuric acid electrolyte. These batteries may be flooded, vented, sealed, or may come in other form factors. They may produce hazardous gases during normal operations.

LITHIUM-ION BATTERY: A storage Battery with lithium ions serving as the charge carriers of the Battery. The electrolyte is typically a mixture of organic solvents with an inorganic salt and can be in a liquid or a gelled polymer form.

NATIONALLY RECOGNIZED TESTING LABORATORY (NRTL): A U.S. Department of Labor designation recognizing a private sector organization to perform certification for certain products to ensure that they meet the requirements of both the construction and general industry OSHA electrical standards.

NEC: National Electric Code.

NFPA: National Fire Protection Association.

NICKEL-BASED BATTERY: A rechargeable Battery in which the positive active material is nickel oxide, the negative contains either cadmium (Nickel-cadmium, Ni-Cd), hydrogen ions stored in a metal-hydride structure (Nickel-metal hydride, Ni-MH), or zinc (Nickel-zinc, Ni-Zn) as the electrode and the electrolyte is potassium hydroxide.

NON-DEDICATED-USE BUILDING: All buildings that contain a battery energy storage system and do not comply with the dedicated-use building requirements, including all other occupancy types such as, but not limited to, commercial, industrial, offices, and multifamily housing.

NON-PARTICIPATING PROPERTY: Any property that is not a Participating property.

OCCUPIED COMMUNITY BUILDING: Any building in Occupancy Group A, B, E, I, R, as defined in the International Building Code, including but not limited to schools, colleges, daycare facilities, hospitals, correctional facilities, public libraries, theaters, stadiums, apartments, hotels, and houses of worship.

ONE-TO-TWO-FAMILY DWELLING: A building that contains not more than two dwelling units with independent cooking and bathroom facilities.

PARTICIPATING PROPERTY: A battery energy storage system host property or any real property that is the subject of an agreement that provides for the payment of monetary compensation to the landowner from the battery energy storage system owner (or affiliate) regardless of whether any part of a battery energy storage system is constructed on the property.

SPECIAL FLOOD HAZARD AREA: The land area covered by the floodwaters of the base flood is the Special Flood Hazard Area (SFHA) on NFIP maps. The SFHA is the area where the National Flood Insurance Program's (NFIP's) floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies.

UNIFORM CODE: the New York State Uniform Fire Prevention and Building Code adopted pursuant to Article 18 of the Executive Law, as currently in effect and as hereafter amended from time to time.

4. Applicability

A. The requirements of this Local Law shall apply to all battery energy storage systems permitted, installed, or modified in [Village/Town/City] after the effective date of this Local Law, excluding general maintenance and repair.

B. Battery energy storage systems constructed or installed prior to the effective date of this Local Law shall not be required to meet the requirements of this Local Law.

C. Modifications to, retrofits or replacements of an existing battery energy storage system that increase the total battery energy storage system designed discharge duration or power rating shall be subject to this Local Law.

5. General Requirements

A. A Building permit, and an electrical permit shall be required for installation of all battery energy storage systems.

B. Issuance of permits and approvals by the [Reviewing Board] shall include review pursuant to the State Environmental Quality Review Act [ECL Article 8 and its implementing regulations at 6 NYCRR Part 617 ("SEQRA")].

C. All battery energy storage systems, all Dedicated Use Buildings, and all other buildings or structures that (1) contain or are otherwise associated with a battery energy storage system and (2) subject to the Uniform Code and/or the Energy Code shall be designed, erected, and installed in accordance with all applicable provisions of the Uniform Code, all applicable provisions of the Energy Code, and all applicable provisions of the codes, regulations, and industry standards as referenced in the Uniform Code, the Energy Code, and the [Village/Town/City] Code.

6. Permitting Requirements for Tier 1 Battery Energy Storage Systems

A. Tier 1 Battery Energy Storage Systems shall be permitted in all zoning districts and shall be subject to the "Battery Energy Storage System Permit" and exempt from site plan review.

7. Permitting Requirements for Tier 2 Battery Energy Storage Systems

A. Tier 2 Battery Energy Storage Systems shall be permitted in all zoning districts, shall be subject to the Uniform Code (referenced in Appendix 2) and the "Battery Energy Storage System Permit," and are exempt from site plan review.

8. Permitting Requirements for Tier 3 Battery Energy Storage Systems

Tier 3 Battery Energy Storage Systems are permitted through the issuance of a [special use permit] within the [XXXXXXXXXXXX, XXXXXXXXX, XXXXXXXXX] zoning districts, and subject to the Uniform Code and site plan application requirements set forth in this Section.

A. Applications for the installation of Tier 3 Battery Energy Storage System shall be:

1) reviewed by the [Code Enforcement/Zoning Enforcement Officer or Reviewing Board] for completeness. An application shall be complete when it addresses all matters listed in this Local Law including, but not necessarily limited to, (i) compliance with all applicable provisions of the Uniform Code and all applicable provisions of the Energy Code and (ii) matters relating to the proposed battery energy storage system and Floodplain, Utility Lines and Electrical Circuitry, Signage, Lighting, Vegetation and Tree-cutting, Noise, Decommissioning, Site Plan and Development, Special Use and Development, Ownership Changes, Safety, Permit Time Frame and Abandonment. Applicants shall be advised within [10] business days of the completeness of their application or any deficiencies that must be addressed prior to substantive review.

2) subject to a public hearing to hear all comments for and against the application. The [Reviewing Board] of the [Village/Town/City] shall have a notice printed in a newspaper of general circulation in the [Village/Town/City] at least [5] days in advance of such hearing. Applicants shall have delivered the notice by first class mail to adjoining landowners or landowners within [200] feet of the property at least [10] days prior to such a hearing. Proof of mailing shall be provided to the [Reviewing Board] at the public hearing.

3) referred to the [County Planning Department] pursuant to General Municipal Law § 239-m if required.

4) upon closing of the public hearing, the [Reviewing Board] shall take action on the application within 62 days of the public hearing, which can include approval, approval with conditions, or denial. The 62-day period may be extended upon consent by both the [Reviewing Board] and Applicant.

B. Floodplain. The Applicant of battery energy storage systems shall obtain necessary local floodplain development permits if proposed within Special Flood Hazard Areas.

C. Utility Lines and Electrical Circuitry. All on-site utility lines shall be placed underground to the extent feasible and as permitted by the serving utility, with the exception of the main service connection at the utility company right-of-way and any new interconnection equipment, including without limitation any poles, with new easements and right-of-way.

D. Signage.

1) The signage shall be in compliance with ANSI Z535 and shall include the type of technology associated with the battery energy storage systems, any special hazards associated, the type of suppression system installed in the area of battery energy storage systems, and 24-hour emergency contact information, including reach-back phone number.

2) As required by the NEC, disconnect and other emergency shutoff information shall be clearly displayed on a light reflective surface. A clearly visible warning sign concerning voltage shall be placed at the base of all pad-mounted transformers and substations.

E. Lighting. Lighting of the battery energy storage systems shall be limited to that minimally required for safety and operational purposes and shall be reasonably shielded and downcast from abutting properties.

F. Vegetation and tree-cutting. Areas within [10] feet on each side of Tier 3 Battery Energy Storage Systems shall be cleared of combustible vegetation and other combustible growth. Single specimens of trees, shrubbery, or cultivated ground cover such as green grass, ivy, succulents, or similar plants used as ground covers shall be permitted to be exempt provided that they do

not form a means of readily transmitting fire. Removal of trees should be minimized to the extent possible.

G. Noise. The [1-hour] average noise generated from the battery energy storage systems, components, and associated ancillary equipment shall not exceed a noise level of [60] dBA as measured at the outside wall of any Non-participating Residence and Occupied Community Building. Applicants may submit equipment and component manufacturers noise ratings to demonstrate compliance. The applicant may be required to provide Operating Sound Pressure Level measurements from a reasonable number of sampled locations at the perimeter of the battery energy storage system to demonstrate compliance with this standard.

H. Decommissioning.

1) Decommissioning Plan. The applicant shall submit a decommissioning plan, developed in accordance with the Uniform Code, containing a narrative description of the activities to be accomplished for removing the energy storage system from service, and from the facility in which it is located. The decommissioning plan shall also include: (i) the anticipated life of the battery energy storage system; (ii) the estimated decommissioning costs; (iii) how said estimate was determined; (iv) the method of ensuring that funds will be available for decommissioning and restoration; (v) the method that the decommissioning cost will be kept current; (vi) the manner in which the battery energy storage system will be decommissioned, and the Site restored; and (vii) a listing of any contingencies for removing an intact operational energy storage system from service, and for removing an energy storage system from service that has been damaged by a fire or other event.

2) Decommissioning Fund. The applicant, or successors, shall continuously maintain a fund or bond payable to the [Village/Town/City], in a form approved by the [Village/Town/City] for the removal of the battery energy storage system, in an amount to be determined by the [Village/Town/City], for the period of the life of the facility. This fund may consist of a letter of credit from a State of New York licensed-financial institution. All costs of the financial security shall be borne by the applicant.

I. Site plan application. For a Tier 3 Battery Energy Storage System requiring a Special Use Permit, site plan approval shall be required. Any site plan application shall include the following information:

1) Property lines and physical features, including roads, for the project site.

2) Proposed changes to the landscape of the site, grading, vegetation clearing and planting, exterior lighting, and screening vegetation or structures.

3) A [one- or three-line] electrical diagram detailing the battery energy storage system layout, associated components, and electrical interconnection methods, with all National Electrical Code compliant disconnects and over current devices.

4) A preliminary equipment specification sheet that documents the proposed battery energy storage system components, inverters and associated electrical equipment that are to be installed. A final equipment specification sheet shall be submitted prior to the issuance of building permit.

5) Name, address, and contact information of proposed or potential system installer and the owner and/or operator of the battery energy storage system. Such information of the final system installer shall be submitted prior to the issuance of building permit.

6) Name, address, phone number, and signature of the project Applicant, as well as all the property owners, demonstrating their consent to the application and the use of the property for the battery energy storage system.

7) Zoning district designation for the parcel(s) of land comprising the project site.

8) Commissioning Plan. Such plan shall document and verify that the system and its associated controls and safety systems are in proper working condition per requirements set forth in the Uniform Code (referenced in Appendix 1). Battery energy storage system commissioning shall be conducted by a New York State (NYS) Licensed Professional Engineer or NYS Registered Architect after the installation is complete but prior to final inspection and approval. A corrective action plan shall be developed for any open or continuing issues that are allowed to be continued after commissioning. A report describing the results of the system commissioning and including the results of the initial acceptance testing required in the Uniform Code (referenced in Appendix 1) shall be provided to [Reviewing Board] prior to final inspection and approval and maintained at an approved on-site location.

Energy storage system commissioning shall not be required for lead-acid and nickel-cadmium battery systems at

facilities under the exclusive control of communications utilities that comply with NFPA 76 and operate at less than 50 VAC and 60 VDC.

9) Fire Safety Compliance Plan. Such plan shall document and verify that the system and its associated controls and safety systems are in compliance with the Uniform Code (referenced in Appendix 2).

10) System and Property Operation and Maintenance Manual. Such plan shall describe continuing battery energy storage system maintenance and property upkeep, as well as design, construction, installation, testing and commissioning information and shall meet all requirements set forth in the Uniform Code (referenced in Appendix 3).

11) Erosion and sediment control and storm water management plans prepared to New York State Department of Environmental Conservation standards, if applicable, and to such standards as may be established by the Planning Board.

12) Prior to the issuance of the building permit or final approval by the [Reviewing Board], but not required as part of the application, engineering documents must be signed and sealed by a NYS Licensed Professional Engineer or NYS Registered Architect.

13) An Emergency Operation Plan per requirements set forth in Appendix 4.

J. Special Use Permit Standards.

1) Setbacks. Tier 3 Battery Energy Storage Systems shall comply with the setback requirements of the underlying zoning district for principal structures.

2) Height. Tier 3 Battery Energy Storage Systems shall comply with the building height limitations for principal structures of the underlying zoning district.

3) Fencing Requirements. Tier 3 Battery Energy Storage Systems, including all mechanical equipment, shall be enclosed by a [7-foot-high] fence with a self-locking gate to prevent unauthorized access unless housed in a dedicated-use building and not interfering with ventilation or exhaust ports.

4) Screening and Visibility. Tier 3 Battery Energy Storage Systems shall have views minimized from adjacent properties to the extent reasonably practicable using architectural features, earth berms, landscaping, or other screening methods that will harmonize with the character of the property and surrounding area and not interfering with ventilation or exhaust ports.

K. Ownership Changes. If the owner of the battery energy storage system changes or the owner of the property changes, the special use permit shall remain in effect, provided that the successor owner or operator assumes in writing all of the obligations of the special use permit, site plan approval, and decommissioning plan. A new owner or operator of the battery energy storage system shall notify the zoning enforcement officer (ZEO) of such change in ownership or operator within [30] days of the ownership change. A new owner or operator must provide such notification to the ZEO in writing. The special use permit and all other local approvals for the battery energy storage system would be void if a new owner or operator fails to provide written notification to the ZEO in the required timeframe. Reinstatement of a void special use permit will be subject to the same review and approval processes for new applications under this Local Law.

9. Safety

A. System Certification. Battery energy storage systems and Equipment shall be listed by a Nationally Recognized Testing Laboratory to UL 9540 or CAN 9540 (Standard for battery energy storage systems and Equipment) with subcomponents meeting each of the following standards that are applicable based on the storage type (electrochemical, thermal, mechanical):

1) UL 1973 (Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail Applications),

2) UL 1642 (Standard for Lithium Batteries),

3) UL 1741 or UL 62109 (inverters and power converters),

4) Certified under the applicable electrical, building, and fire prevention codes as required.

5) Alternatively, field evaluation by an approved testing laboratory for compliance with UL 9540 and applicable codes, regulations and safety standards may be used to meet system certification requirements.

Lead-acid and nickel-cadmium battery systems installed in facilities under the exclusive control of communications utilities and operating at less than 50 VAC and 60 VDC in accordance with NFPA 76 are not required to be listed.

B. Site Access. Battery energy storage systems shall be maintained in good working order and in accordance with industry standards. Site access shall be maintained, including snow removal at a level acceptable to the local fire department and, if the Tier 3 Battery Energy Storage System is located in an ambulance district, the local ambulance corps.

C. Battery energy storage systems, components, and associated ancillary equipment shall have required working space clearances, and electrical circuitry shall be within weatherproof enclosures marked with the environmental rating suitable for the type of exposure in compliance with NFPA 70.

10. Permit Time Frame and Abandonment

A. The Special Use Permit and site plan approval for a battery energy storage system shall be valid for a period of [24] months, provided that a building permit is issued for construction [and/or] construction is commenced. In the event construction is not completed in accordance with the final site plan, as may have been amended and approved, as required by the [Reviewing Board], within [24] months after approval, the Applicant or the [Village/Town/City] may extend the time to complete construction for [180] days. If the owner and/or operator fails to perform substantial construction after [36] months, the approvals shall expire.

B. If the owner and/or operator fails to comply with decommissioning upon any abandonment, the [Village/Town/City] may, at its discretion, utilize the available bond and/or security for the removal of a Tier 3 Battery Energy Storage System and restoration of the site in accordance with the decommissioning plan.

11. Enforcement

Any violation of this Battery Energy Storage System Law shall be subject to the same enforcement requirements, including the civil and criminal penalties, provided for in the zoning or land use regulations of [Village/Town/City].

12. Severability

The invalidity or unenforceability of any section, subsection, paragraph, sentence, clause, provision, or phrase of the aforementioned sections, as declared by the valid judgment of any court of competent jurisdiction to be unconstitutional, shall not affect the validity or enforceability of any other section, subsection, paragraph, sentence, clause, provision, or phrase, which shall remain in full force and effect.

APPENDIX 1: Commissioning Plan

The battery energy storage system commissioning plan shall comply with the Uniform Code and include, at a minimum, the following information:

1. A narrative description of the activities that will be accomplished during each phase of commissioning including the personnel intended to accomplish each of the activities.
2. A listing of the specific BESS and associated components, controls and safety related devices to be tested, a description of the tests to be performed and the functions to be tested.
3. Conditions under which all testing will be performed, which are representative of the conditions during normal operation of the system.
4. Documentation of the owner's project requirements and the basis of design necessary to under-stand the installation and operation of the BESS.
5. Verification that required equipment and systems are installed in accordance with the approved plans and specifications.
6. Integrated testing for all fire and safety systems.
7. Testing for any required thermal management, ventilation or exhaust systems associated with the BESS installation.
8. Preparation and delivery of operation and maintenance documentation.
9. Training of facility operating and maintenance staff.
10. Identification and documentation of the requirements for maintaining system performance to meet the original design intent during the operation phase.
11. Identification and documentation of personnel who are qualified to service, maintain and decommission the BESS, and respond to incidents involving the BESS, including documentation that such service has been contracted for.

APPENDIX 2: Supplemental Guidance for Developing the Fire Safety Compliance Plan

Disclaimer: *Appendix 2 is primarily based on the 2019 Energy Storage System Supplement containing amendments to the New York State Uniform Fire Prevention and Building Code, published by the New York State Department of State. The 2019 Energy Storage System Supplement can be found on the July 17, 2019 edition of the State Register, available at https://www.dos.ny.gov/info/register/2019.html. NYSERDA will continue to update this Guidebook as these codes and standards evolve.*

Appendix 2 is not exhaustive and is intended for general reference only. Prior to the design or installation of any system, please refer to the Uniform Code and always consult with the Authority Having Jurisdiction. NYSERDA makes no representation or warranty as to whether following this guide will satisfy any rule or requirement. Should any conflicts exist between Appendix 2 and the Uniform Code, the Uniform Code requirements shall prevail.

1. **Hazard mitigation analysis.** A failure modes and effects analysis (FMEA) or other approved hazard mitigation analysis shall be provided under any of the following conditions:
   - Where BESS technologies not specifically identified in Table 1: Battery Energy Storage System Tier 2 Threshold Quantities are provided.
   - More than one BESS technology is provided in a room or enclosed area where there is a potential for adverse interaction between technologies.
   - Where allowed as a basis for increasing maximum allowable quantities outlined in Table 2: Maximum Allowable Quantities

1.1. **Fault condition.** The hazard mitigation analysis shall evaluate the consequences of the following failure modes. Only single failure modes shall be considered.
   - A thermal runaway condition in a single BESS rack, module or unit.
   - Failure of any battery (energy) management system.
   - Failure of any required ventilation or exhaust system.
   - Voltage surges on the primary electric supply.
   - Short circuits on the load side of the BESS.
   - Failure of the smoke detection, fire detection, fire suppression, or gas detection system.
   - Required spill neutralization not being provided or failure of a required secondary containment system.

1.2. **Analysis approval.** The fire code official is authorized to approve the hazardous mitigation analysis provided the consequences of the hazard mitigation analysis demonstrate:
   - Fires will be contained within unoccupied BESS rooms or areas for the minimum duration of the fire-resistance rated separations identified in Section 7.4.
   - Fires in occupied work centers will be detected in time to allow occupants within the room or area to safely evacuate.
   - Toxic and highly toxic gases released during fires will not reach concentrations in access of Immediately Dangerous to Life or Health (IDLH) level in the building or adjacent means of egress routes during the time deemed necessary to evacuate occupants from any affected area.
   - Flammable gases released from BESS during charging, discharging and normal operation will not exceed 25 percent of their lower flammability limit (LFL).
   - Flammable gases released from BESS during fire, overcharging and other abnormal conditions will be controlled through the use of ventilation of the gases preventing accumulation or by deflagration venting.

1.3. **Additional protection measures.** Construction, equipment and systems that are required for the BESS to comply with the hazardous mitigation analysis, including but not limited to those specifically described in this Appendix shall be installed, maintained and tested in accordance with nationally recognized standards and specified design parameters.

2. **Fire Safety.** BESS installations shall comply with the requirements of this section.

2.1. **Large Scale Fire Test.** Where required elsewhere in Appendix 2, large scale fire testing shall be conducted on a representative energy storage system in accordance with UL 9540A or approved equivalent. The testing shall be conducted or witnessed and reported by an approved testing laboratory and show that a fire involving one energy storage system will not propagate to an adjacent energy storage system. In addition, the testing shall demonstrate that, where the energy storage system is installed within a room, enclosed area or walk-in energy storage system unit, a fire will be contained within the room, enclosed area or walk-in energy storage system unit for a duration equal to the fire-resistance rating of the room assemblies as specified in Section 8.4. The test report shall be provided to the fire code official for review and approval.

2.2 **Fire remediation.** Where a fire or other event has damaged the BESS and ignition or re-ignition of the BESS is possible, the system owner, agent, or lessee shall take the following actions, at their expense, to mitigate the hazard or remove damaged equipment from the premises to a safe location.

2.2.1 **Fire mitigation personnel.** Where, in the opinion of the fire code official, it is essential for public safety that trained personnel be on site to respond to possible ignition or re-ignition of a damaged BESS, the system owner, agent or lessee shall immediately dispatch one or more fire mitigation personnel to the premise, as required and approved, at their expense. These personnel shall remain on duty continuously after the fire department leaves the premise until the damaged energy storage equipment is removed from the premises, or earlier if the fire code official indicates the public safety hazard has been abated. On-duty fire mitigation personnel shall have the following responsibilities:

- Keep diligent watch for fires, obstructions to means of egress and other hazards.
- Immediately contact the fire department if their assistance is needed to mitigate any hazards or extinguish fires.
- Take prompt measures for remediation of hazards in accordance with the decommissioning plan
- Take prompt measures to assist in the evacuation of the public from the structures.

2.2.2 **Peer Review.** Where required by the Authority Having Jurisdiction, the owner or the owner's authorized agent shall be responsible for retaining and furnishing the services of a registered design professional or special expert, who will perform as a peer reviewer, subject to the approval of the fire code official. The costs of special services shall be borne by the owner or the owner's authorized agent.

2.2.2.1. **Special expert**. Where the scope of work is limited or focused in an area that does not require the services of a registered design professional or the special knowledge and skills associated with the practice of architecture or engineering, an approved special expert may be employed by the owner or the owner's authorized agent as the person in responsible charge of the limited or focused activity. The scope of work of a special expert shall be limited to the area of expertise as demonstrated in the documentation submitted to the fire code official for review and approval. Special experts are those individuals who possess the following qualifications:

1. Has credentials of education and experience in an area of practice that is needed to evaluate risks and safe operations associated with the design, operation and special hazards of energy storage systems.
2. Licensing or registration, when required by any other applicable statute, regulation, or local law or ordinance.

3. **Battery energy storage management system.** Where required by the BESS listing an approved energy storage management system shall be provided that monitors and balances cell voltages, currents and temperatures within the manufacturer's specifications. The system shall disconnect electrical connections to the BESS or otherwise place it in a safe condition if potentially hazardous temperatures or other conditions such as short circuits, over voltage or under voltage are detected.

4. **Enclosures.** Enclosures of BESS shall be of noncombustible construction.

5. **General installations requirements.** BESS shall comply with the requirements of Sections 5.1 through 5.12.

5.1. **Electrical disconnects.** Where the BESS disconnecting means is not within sight of the main electrical service disconnecting means, placards or directories shall be installed at the location of the main electrical service disconnecting means indicating the location of stationary storage battery system disconnecting means in accordance with NFPA 70.

Exception: Electrical disconnects for lead acid and nickel cadmium battery systems at facilities under the exclusive control of communications utilities and operating at less than 50 VAC and 60 VDC shall be permitted to have electrical disconnects signage in accordance with NFPA 76.

5.2. **Working clearances.** Access and working space shall be provided and maintained about all electrical equipment to permit ready and safe operation and maintenance of such equipment in accordance with NFPA 70 and the manufacturer's instructions.

5.3. **Fire-resistance rated separations.** Rooms and other indoor areas containing BESS shall be separated from other areas of the building in accordance with Section 8.4. BESS shall be permitted to be in the same room with the equipment they support.

5.4. **Seismic and structural design.** Stationary BESS shall comply with the seismic design requirements in Chapter 16 of the International Building Code, and shall not exceed the floor loading limitation of the building.

5.5. **Vehicle impact protection.** Where BESS are subject to impact by a motor vehicle, including fork lifts, vehicle impact protection shall be provided in accordance with Fire Code Section 312.

5.6. **Combustible storage.** Combustible materials shall not be stored in BESS rooms, areas, or walk-in units. Combustible materials in occupied work centers covered by Section 5.10 shall be stored at least 3 feet (914 mm) from BESS cabinets.

5.7. **Toxic and highly toxic gases.** BESS that have the potential to release toxic and highly toxic gas during charging, discharging and normal use conditions shall be provided with a hazardous exhaust system in accordance with Section 502.8 of the International Mechanical Code.

5.8. **Signage.** Approved signs shall be provided on or adjacent to all entry doors for BESS rooms or areas and on enclosures of BESS cabinets and walk-in units located outdoors, on rooftops or in open parking garages. Signs designed to meet both the requirements of this section and NFPA 70 shall be permitted. The signage shall include the following or equivalent.

- "Energy Storage System", "Battery Storage System", "Capacitor Energy Storage System", or the equivalent.
- The identification of the electrochemical BESS technology present.
- "Energized electrical circuits"
- If water reactive electrochemical BESS are present the signage shall include "APPLY NO WATER"
- Current contact information, including phone number, for personnel authorized to service the equipment and for fire mitigation personnel required by Section 2.2.

Exception: Existing electrochemical BESS shall be permitted to include the signage required at the time they were installed.

5.9. **Security of installations.** Rooms, areas and walk-in units in which electrochemical BESS are located shall be secured against unauthorized entry and safe-guarded in an approved manner. Security barriers, fences, landscaping, and other enclosures shall not inhibit the required air flow to or exhaust from the electrochemical BESS and its components.

5.10. **Occupied work centers.** Electrochemical BESS located in rooms or areas occupied by personnel not directly involved with maintenance, service and testing of the systems shall comply with the following.

- Electrochemical BESS located in occupied work centers shall be housed in locked noncombustible cabinets or other enclosures to prevent access by unauthorized personnel.
- Where electrochemical BESS are contained in cabinets in occupied work centers, the cabinets shall be located within 10 feet (3048 mm) of the equipment that they support.
- Cabinets shall include signage complying with Section 5.8.

5.11. **Open rack installations.** Where electrochemical BESS are installed in a separate equipment room and only authorized personnel have access to the room, they shall be permitted to be installed on an open rack for ease of maintenance.

5.12. **Walk-in units.** Walk-in units shall only be entered for inspection, maintenance and repair of BESS units and ancillary equipment, and shall not be occupied for other purposes.

6. **Electrochemical BESS Protection.** The protection of electrochemical BESS shall be in accordance with 6.1 through 6.8 where required by Sections 8 through 10.

6.1. **Size and separation.** Electrochemical BESS shall be segregated into groups not exceeding 50 kWh (180 Mega joules). Each group shall be separated a minimum three feet (914 mm) from other groups and from walls in the storage room or area. The storage arrangements shall comply with Fire Code Chapter 10.

Exceptions:

- Lead acid and nickel cadmium battery systems in facilities under the exclusive control of communications utilities and operating at less than 50 VAC and 60 VDC in accordance with NFPA 76.
- The fire code official is authorized to approve larger capacities or smaller separation distances based on large scale fire testing.

6.2. **Mixed electrochemical energy systems**. Where rooms, areas and walk-in units contain different types of electrochemical energy technologies, the total aggregate quantities of the systems shall be determined based on the sum of percentages of each technology type quantity divided by the maximum allowable quantity of each technology type. The sum of the percentages shall not exceed 100 percent of the maximum allowable quantity.

6.3. **Elevation.** Electrochemical BESS shall not be located in the following areas:

- Where the floor is located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access, or
- Where the floor is located below the lowest level of exit discharge.

Exceptions:

- Lead acid and Nickel cadmium battery systems less than 50 VAC and 60 VDC installed in facilities under the exclusive control of communications utilities in accordance with NFPA 76.
- Where approved, installations shall be permitted in underground vaults complying with NFPA 70, Article 450, Part III.
- Where approved by the fire code official, installations shall be permitted on higher and lower floors.

TABLE 2 MAXIMUM ALLOWABLE QUANTITIES

Technology	Maximum Allowable Quantities [a]
Lead-acid, all types	Unlimited
Nickel-cadmium (Ni-Cd)	Unlimited
Nickel metal hydride (Ni-MH)	Unlimited
Lithium-ion	600 kWh
Flow batteries [b]	600 kWh
Other battery technologies	200 kWh

a. For electrochemical energy storage system units rated in Amp-Hours, kWh shall equal rated voltage times the Amp-hour rating divided by 1000
b. Shall include vanadium, zinc-bromine, polysulfide-bromide, and other flowing electrolyte type technologies

6.4. **Fire detection.** An approved automatic smoke detection system or radiant energy–sensing fire detection system complying with Fire Code Section 907 shall be installed in rooms, indoor areas, and walk-in units containing electrochemical BESS. An approved radiant energy–sensing fire detection system shall be installed to protect open parking garage and rooftop installations. Alarm signals from detection systems shall be transmitted to a central station, proprietary or remote station service in accordance with NFPA 72, or where approved to a constantly attended location.

6.4.1. **System status.** Where required by the fire code official, visible annunciation shall be provided on cabinet exteriors or in other approved locations to indicate that potentially hazardous conditions associated with the BESS exist.

6.5. **Fire suppression systems.** Rooms and areas within buildings and walk-in units containing electrochemical BESS shall be protected by an automatic fire suppression system designed and installed in accordance with one of the following:

- An automatic sprinkler system designed and installed in accordance with Fire Code Section 903.3.1.1 with a minimum density of 0.3 gpm/ft.2based on the fire area or 2,500 ft.2 design area, whichever is smaller.
- Where approved, an automatic sprinkler system designed and installed in accordance with Fire Code Section 903.3.1.1 with a sprinkler hazard classification based on large scale fire testing.
- The following alternate automatic fire extinguishing systems designed and installed in accordance with Fire Code Section 904, provided the installation is approved by the fire code official based on large scale fire testing
  - NFPA 12, Standard on Carbon Dioxide Extinguishing Systems
  - NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection
  - NFPA 750, Standard on Water Mist Fire Protection Systems
  - NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems
  - NFPA 2010, Standard for Fixed Aerosol Fire-Extinguishing Systems

Exception: Fire suppression systems for lead acid and nickel cadmium battery systems at facilities under the exclusive control of communications utilities that operate at less than 50 VAC and 60 VDC shall be provided where required by NFPA 76.

6.5.1. **Water reactive systems.** Electrochemical BESS that utilize water reactive materials shall be protected by an approved alternative automatic fire-extinguishing system in accordance with Fire Code Section 904, where the installation is approved by the fire code official based on large scale fire testing.

6.6. **Maximum enclosure size.** Outdoor walk-in units housing BESS shall not exceed 53 feet by 8 feet by 9.5 feet high, not including bolt-on HVAC and related equipment, as approved. Outdoor walk-in units exceeding these limitations shall be considered indoor installations and comply with the requirements in Section 8.

6.7. **Vegetation control.** Areas within 10 feet (3 m) on each side of outdoor BESS shall be cleared of combustible vegetation and other combustible growth. Single specimens of trees, shrubbery, or cultivated ground cover such as green grass, ivy, succulents, or similar plants used as ground covers shall be permitted to be exempt provided that they do not form a means of readily transmitting fire.

6.8. **Means of egress separation.** BESS located outdoors and in open parking garages shall be separated from any means of egress as required by the fire code official to ensure safe egress under fire conditions, but in no case less than 10 feet (3048 mm).

Exception: The fire code official is authorized to approve a reduced separation distance if large scale fire testing is provided that shows that a fire involving the BESS will not adversely impact occupant egress.

7. **Electrochemical BESS technology specific protection.** Electrochemical BESS installations shall comply with the requirements of this section in accordance with the applicable requirements of Table 3.

TABLE 3 ELECTROCHEMICAL BESS TECHNOLOGY SPECIFIC

Compliance Required [b]	Battery Technology				Other BESS and Battery Technologies [b]
	Lead-acid	Ni-Cad & Ni-MH	Lithium-ion	Flow	
7.1 Exhaust ventilation	Yes	Yes	No	Yes	Yes
7.2 Spill control and neutralization	Yes [c]	Yes [c]	No	Yes	Yes
7.3 Explosion control	Yes [a]	Yes [a]	Yes	Yes	Yes
7.4 Safety Caps	Yes	Yes	No	Yes	Yes
7.5 Thermal runaway	Yes [d]	Yes	Yes [e]	Yes	Yes [e]

a. Not required for lead-acid and nickel cadmium batteries at facilities under the exclusive control of communications utilities that comply with NFPA 76 and operate at less than 50 VAC and 60 VDC.
b. Protection shall be provided unless documentation acceptable to the fire code official is provided that provides justification why the protection is not necessary based on the technology used.
c. Applicable to vented (i.e. flooded) type nickel cadmium and lead acid batteries.
d. Not required for vented (i.e. flooded) type lead acid batteries.
e. The thermal runaway protection is permitted to be part of a battery management system that has been evaluated with the battery as part of the evaluation to UL 1973.

7.1. **Exhaust ventilation.** Where required by Table 3 or elsewhere in this code, exhaust ventilation of rooms, areas, and walk-in units containing electrochemical BESS shall be provided in accordance with the International Mechanical Code and Section 7.1.1 or 7.1.2.

7.1.1. **Ventilation based upon LFL.** The exhaust ventilation system shall be designed to limit the maximum concentration of flammable gas to 25 percent of the lower flammable limit (LFL) of the total volume of the room, area, or walk-in unit during the worst-case event of simultaneous charging of batteries at the maximum charge rate, in accordance with nationally recognized standards.

7.1.2. **Ventilation based upon exhaust rate.** Mechanical exhaust ventilation shall be provided at a rate of not less than 1 ft3/min/ft2(5.1 L/sec/m2) of floor area of the room, area, or walk-in unit. The ventilation shall be either continuous or shall be activated by a gas detection system in accordance with Section 7.1.2.4.

7.1.2.1. **Standby power.** Mechanical exhaust ventilation shall be provided with a minimum of two hours of standby power in accordance with Fire Code Section 604.2.17.

7.1.2.2. **Installation instructions.** Required mechanical exhaust ventilation systems shall be installed in accordance with the manufacturer's installation instructions and the International Mechanical Code.

7.1.2.3. **Supervision.** Required mechanical exhaust ventilation systems shall be supervised by an approved supervising station in accordance with NFPA 72.

7.1.2.4. **Gas detection system.** Where required by Section 7.1.2, rooms, areas, and walk-in units containing BESS shall be protected by an approved continuous gas detection system that complies with Fire Code Section 916 and with the following:

- The gas detection system shall be designed to activate the mechanical ventilation system when the level of flammable gas in the room, area, or walk-in unit exceeds 25 percent of the LFL.
- The mechanical ventilation system shall remain on until the flammable gas detected is less than 25 percent of the LFL.
- The gas detection system shall be provided with a minimum of 2 hours of standby power in accordance with Fire Code Section 916.
- Failure of the gas detection system shall annunciate a trouble signal at an approved supervising station in accordance with NFPA 72.

7.2. **Spill control and neutralization.** Where required by Table 3 or elsewhere in this code, areas containing free-flowing liquid electrolyte or hazardous materials shall be provided with spill control and neutralization in accordance with this section.

7.2.1. **Spill control.** Spill control shall be provided to prevent the flow of liquid electrolyte or hazardous materials to adjoining rooms or areas. The method shall be capable of containing a spill from the single largest battery or vessel.

7.2.2. **Neutralization.** An approved method to neutralize spilled liquid electrolyte shall be provided that is capable of neutralizing a spill from the largest battery or vessel to a pH between 5.0 and 9.0.

Exceptions: The requirements of Section 7.2 only apply where the aggregate capacity of multiple vessels exceeds 1,000 gallons (3785 L) for lead-acid and nickel-cadmium battery systems operating at less than 50 VAC and 60 VDC that are located at facilities under the exclusive control of communications utilities and those facilities comply with NFPA 76 in addition to applicable requirements of this code.

7.3. **Explosion control.** Where required by Table 3 or elsewhere in this code, explosion control complying with Fire Code Section 911 shall be provided for rooms, areas or walk-in units containing electrochemical BESS technologies.

Exceptions:

- Where approved, explosion control is permitted to be waived by the fire code official based on large scale fire testing which demonstrates that flammable gases are not liberated from electrochemical BESS cells or modules.
- Where approved, explosion control is permitted to be waived by the fire code official based on documentation provided that demonstrates that the electrochemical BESS technology to be used does not have the potential to release flammable gas concentrations in excess of 25 percent of the LFL anywhere in the room, area, walk-in unit or structure under thermal runaway or other fault conditions.

7.4. **Safety caps.** Where required by Table 3 or elsewhere in this code, vented batteries and other BESS shall be provided with flame-arresting safety caps.

7.5. **Thermal runaway.** Where required by Table 3 or elsewhere in this code, batteries and other BESS shall be provided with a listed device or other approved method to prevent, detect and minimize the impact of thermal runaway.

8. **Indoor installations.** Indoor BESS installations shall be in accordance with Sections 8.1 through 8.4.

8.1. **Dedicated use buildings.** For the purpose of Table 4 dedicated use BESS buildings shall be classified as Group F-1 occupancies and comply with all the following:

- The building shall only be used for BESS, electrical energy generation, and other electrical grid related operations.
- Occupants in the rooms and areas containing BESS are limited to personnel that operate, maintain, service, test and repair the BESS and other energy systems.
- No other occupancy types shall be permitted in the building.
- Administrative and support personnel shall be permitted in areas within the buildings that do not contain BESS, provided:
  - The areas do not occupy more than 10 percent of the building area of the story in which they are located.
  - A means of egress is provided from the incidental use areas to the public way that does not require occupants to traverse through areas containing BESS or other energy system equipment.

8.2. **Non-dedicated use buildings.** For the purpose of Table 4 non-dedicated use buildings include all buildings that contain BESS and do not comply with 8.1 dedicated use building requirements.

TABLE 4 INDOOR BESS INSTALLATIONS

Compliance Required	Dedicated Use Buildings [a]	Non-Dedicated Use Buildings [b]
5. General Installation Requirements	Yes	Yes
6.1. Size and separation	Yes	Yes
6.3. Elevation	Yes	Yes
6.4. Smoke and automatic fire detection	Yes [c]	Yes
6.5. Fire suppression systems	Yes [d]	Yes
8.3. Dwelling units and sleeping units	NA	Yes
8.4. Fire-resistance rated separations	Yes	Yes
7. Technology specific protection	Yes	Yes

a. See Section 8.1.
b. See Section 8.2.
c. Where approved by the fire code official, alarm signals are not required to be transmitted to a central station, proprietary or remote station service in accordance with NFPA 72, or a constantly attended location where local fire alarm annunciation is provided and trained personnel are always present.
d. Where approved by the fire code official, fire suppression systems are permitted to be omitted in dedicated use buildings located more than 100 feet (30.5 M) from buildings, lot lines, public ways, stored combustible materials, hazardous materials, high piled stock and other exposure hazards.

8.3. **Dwelling units and sleeping units.** BESS shall not be installed in sleeping units or in habitable spaces of dwelling units.

8.4. **Fire-resistance rated separations.** Rooms and areas containing BESS shall include fire-resistance rated separations as follows:

- In dedicated use buildings, rooms and areas containing BESS shall be separated from areas in which administrative and support personnel are located.
- In non-dedicated use buildings, rooms and areas containing BESS shall be separated from other areas in the building.

Separation shall be provided by 2 hour rated fire barriers constructed in accordance with Section 707 of the International Building Code and 2 hour rated horizontal assemblies constructed in accordance with Section 711 of the International Building Code, as appropriate.

9. **Outdoor installations.** Outdoor installations shall be in accordance with Sections 9.1 through 9.3. Exterior wall installations for individual BESS units not exceeding 20 kWh shall be in accordance with 9.4.

9.1. **Remote outdoor installations.** For the purpose of Table 5, remote outdoor installations include BESS located more than 100 feet (30.5 M) from buildings, lot lines, public ways, stored combustible materials, hazardous materials, high piled stock and other exposure hazards.

9.2. **Installations near exposures.** For the purpose of Table 5, installations near exposures include all outdoor BESS installations that do not comply with 9.1 remote outdoor location requirements.

TABLE 5 OUTDOOR BESS INSTALLATIONS

Compliance Required	Remote Installations [a]	Installations Near Exposures [b]
5. General Installation Requirements	Yes	Yes
6.1 Size and separation	No	Yes [c]
6.4. Smoke and automatic fire detection	Yes	Yes
6.5. Fire suppression systems	Yes [d]	Yes
6.6. Maximum enclosure size	Yes	Yes
6.7. Vegetation control	Yes	Yes
6.8. Means of egress separation	Yes	Yes
9.3. Clearance to exposures	Yes	Yes
7. Technology specific protection	Yes	Yes

a. See Section 9.1.
b. See Section 9.2.
c. In outdoor walk-in units, spacing is not required between BESS units and the walls of the enclosure.
d. Where approved by the fire code official, fire suppression systems are permitted to be omitted.

9.3. **Clearance to exposures.** BESS located outdoors shall be separated by a minimum ten feet (3048 mm) from the following exposures:

- Lot lines
- Public ways
- Buildings
- Stored combustible materials
- Hazardous materials
- High-piled stock
- Other exposure hazards

Exceptions:

- Clearances are permitted to be reduced to 3 feet (914 mm) where a 1-hour free standing fire barrier, suitable for exterior use, and extending 5 feet (1.5 m) above and extending 5 feet (1.5 m) beyond the physical boundary of the BESS installation is provided to protect the exposure.
- Clearances to buildings are permitted to be reduced to 3 feet (914 mm) where noncombustible exterior walls with no openings or combustible overhangs are provided on the wall adjacent to the BESS and the fire-resistance rating of the exterior wall is a minimum 2 hours.
- Clearances to buildings are permitted to be reduced to 3 feet (914.4 mm) where a weatherproof enclosure constructed of noncombustible materials is provided over the BESS, and it has been demonstrated that a fire within the enclosure will not ignite combustible materials outside the enclosure based on large scale fire testing.

9.4. **Exterior wall installations.** BESS shall be permitted to be installed outdoors on exterior walls of buildings when all of the following conditions are met:

- The maximum energy capacity of individual BESS units shall not exceed 20 kWh.
- The BESS shall comply with applicable requirements in this Appendix.
- The BESS shall be installed in accordance with the manufacturer's instructions and their listing.
- Individual BESS units shall be separated from each other by at least three feet (914 mm).
- The BESS shall be separated from doors, windows, operable openings into buildings, or HVAC inlets by at least five feet (1524 mm)

Exception: Where approved smaller separation distances in items 4 and 5 shall be permitted based on large scale fire testing.

10. **Special installations**. Rooftop and open parking garage BESS installations shall comply with Sections 10.1 through 10.6.

10.1. **Rooftop installations.** For the purpose of Table 6, rooftop BESS installations are those located on the roofs of buildings.

10.2. **Open parking garage installations.** For the purpose of Table 6, open parking garage BESS installations are those located in a structure or portion of a structure that complies with Section 406.5 of the International Building Code.

TABLE 6 SPECIAL BESS INSTALLATIONS

Compliance Required	Rooftops [a]	Open Parking Garages [b]
5. General Installation Requirements	Yes	Yes
6.1. Size and separation	Yes	Yes
6.4. Smoke and automatic fire detection	Yes	Yes
6.6. Maximum enclosure size	Yes	Yes
6.8. Means of egress separation	Yes	Yes
10.3. Clearance to exposures	Yes	Yes
10.4. Fire suppression systems	Yes	Yes
10.5. Rooftop installations	Yes	No
10.6. Open parking garage installations	No	Yes
7. Technology specific protection	Yes	Yes

a. See Section 10.1.
b. See Section 10.2.

10.3. **Clearance to exposures.** BESS located on rooftops and in open parking garages shall be separated by a minimum ten feet (3048 mm) from the following exposures:

- Buildings, except the building on which rooftop BESS is mounted
- Any portion of the building on which a rooftop system is mounted that is elevated above the rooftop on which the system is installed
- Lot lines
- Public ways
- Stored combustible materials
- Locations where motor vehicles can be parked
- Hazardous materials
- Other exposure hazards

Exceptions:

- Clearances are permitted to be reduced to 3 feet (914 mm) where a 1-hour free standing fire barrier, suitable for exterior use, and extending 5 feet (1.5 m) above and extending 5 feet (1.5 m) beyond the physical boundary of the BESS installation is provided to protect the exposure.
- Clearances are permitted to be reduced to 3 feet (914.4 mm) where a weatherproof enclosure con-structed of noncombustible materials is provided over the BESS and it has been demonstrated that a fire within the enclosure will not ignite combustible materials outside the enclosure based on large scale fire testing.

10.4. **Fire suppression systems.** BESS located in walk-in units on rooftops or in walk-in units in open parking garages shall be provided with automatic fire suppression systems within the BESS enclosure in accordance with Section 6.5. Areas containing BESS other than walk-in units in open parking structures on levels not open above to the sky shall be provided with an automatic fire suppression system complying with Section 6.5.

Exception: A fire suppression system is not required in open parking garages if large scale fire testing is provided that shows that a fire will not impact the exposures in Section 10.3.

10.5. **Rooftop installations.** BESS and associated equipment that are located on rooftops and not enclosed by building construction shall comply with the following:

- Stairway access to the roof for emergency response and fire department personnel shall be provided either through a bulkhead from the interior of the building or a stairway on the exterior of the building.
- Service walkways at least 5 feet (1524 mm) in width shall be provided for service and emergency personnel from the point of access to the roof to the system.
- BESS and associated equipment shall be located from the edge of the roof a distance equal to at least the height of the system, equipment, or component but not less than 5 feet (1.5 m).
- The roofing materials under and within 5 feet (1524 mm) horizontally from a BESS or associated equipment shall be noncombustible or shall have a Class A rating when tested in accordance with ASTM E108 or UL 790.
- A Class I standpipe outlet shall be installed at an approved location on the roof level of the building or in the stairway bulkhead at the top level.
- The BESS shall be the minimum of 10 feet from the fire service access point on the roof top.
- The BESS shall not be located within 50 feet (15,240 mm) of air inlets for building HVAC systems.

  Exception: This distance shall be permitted to be reduced to 25 feet (7,620 mm) if the automatic fire alarm system monitoring the radiant-energy sensing detectors deenergizes the ventilation system connected to the air intakes upon detection of fire.

10.6. **Open parking garages.** BESS and associated equipment that are located in open parking garages shall comply with all of the following:

- BESS shall not be located within 50 feet (15,240 mm) of air inlets for building HVAC systems.

  Exception: This distance shall be permitted to be reduced to 25 feet (7,620 mm) if the automatic fire alarm system monitoring the radiant-energy sensing detectors de-energizes the ventilation system connected to the air intakes upon detection of fire.
- BESS shall not be located within 25 feet (7,620 mm) of exits leading from the attached building where located on a covered level of the parking structure not directly open to the sky above.
- An approved fence with a locked gate or other approved barrier shall be provided to keep the general public at least five feet (1,024 mm) from the outer enclosure of the BESS.

APPENDIX 3: Operation and Maintenance Manual

The Operation and Maintenance Manual shall be provided to both the BESS owner and their operator before the battery energy storage system is put into operation. The energy storage system shall be operated and maintained in accordance with the manual and a copy of the documentation shall be retained at an approved onsite location to be accessible to facility personnel, fire code officials, and emergency responders.

In addition to complying with the Uniform Code, the battery energy storage system Operation and Maintenance Manual shall, at a minimum, include design, construction, installation, testing and commissioning information associated with the battery energy storage system as initially approved after being commissioned, as well as the following information:

1. Manufacturer's operation manuals and maintenance manuals for the entire BESS or for each component of the system requiring maintenance, that clearly identify the required routine maintenance actions.
2. Name, address and phone number of a service agency that has been contracted to service the BESS and its associated safety systems.
3. Maintenance and calibration information, including wiring diagrams, control drawings, schematics, system programming instructions and control sequence descriptions, for all energy storage control systems.
4. Desired or field-determined control set points that are permanently recorded on control drawings at control devices or, for digital control systems in system programming instructions.
5. A schedule for inspecting and recalibrating all BESS controls.
6. A service record log form that lists the schedule for all required servicing and maintenance actions and space for logging such actions that are completed over time and retained on site.
7. Inspection and testing records

APPENDIX 4: Emergency Operations Plan

An emergency operations plan shall include the following information:

a. Procedures for safe shutdown, de-energizing, or isolation of equipment and systems under emergency conditions to reduce the risk of fire, electric shock, and personal injuries, and for safe start-up following cessation of emergency conditions.

b. Procedures for inspection and testing of associated alarms, interlocks, and controls.

c. Procedures to be followed in response to notifications from the Battery Energy Storage Management System, when provided, that could signify potentially dangerous conditions, including shutting down equipment, summoning service and repair personnel, and providing agreed upon notification to fire department personnel for potentially hazardous conditions in the event of a system failure.

d. Emergency procedures to be followed in case of fire, explosion, release of liquids or vapors, damage to critical moving parts, or other potentially dangerous conditions. Procedures can include sounding the alarm, notifying the fire department, evacuating personnel, de-energizing equipment, and controlling and extinguishing the fire.

e. Response considerations similar to a safety data sheet (SDS) that will address response safety concerns and extinguishment when an SDS is not required.

f. Procedures for dealing with battery energy storage system equipment damaged in a fire or other emergency event, including maintaining contact information for personnel qualified to safely remove damaged battery energy storage system equipment from the facility.

g. Other procedures as determined necessary by the [Village/Town/City] to provide for the safety of occupants and emergency responders.

h. Procedures and schedules for conducting drills of these procedures.

Questions?

If you have any questions about the Battery Energy Storage System Model Law, please email questions to cleanenergyhelp@nyserda.ny.gov or request free technical assistance at nyserda.ny.gov/Energy-Storage-Guidebook. The NYSERDA team looks forward to partnering with communities across the State.

Battery Energy Storage System Model Permit

Understanding the permitting requirements of residential and small commercial battery energy storage systems.

Section Contents

1. Battery Energy Storage System Model Permit 29

Overview

The Model Permit is intended to help local government officials and AHJs establish the minimum submittal requirements for electrical and structural plan review that are necessary when permitting residential and small commercial battery energy storage systems.

Additionally, battery energy storage systems shall comply with all applicable provisions of the codes, regulations, and industry standards as referenced in the New York State Uniform Fire Prevention and Building Code.

The Battery Energy Storage System Model Permit is based on the 14th Edition of the National Electric Code (NEC), which is anticipated to be adopted by New York State in 2020. NYSERDA will continue to update the Guidebook as these codes and standards evolve.

The workable version of this document can be found at nyserda.ny.gov/Energy-Storage-Guidebook, under Battery Energy Storage System Model Permit tab.

PERMIT APPLICATION

Battery Energy Storage System Model Permit

Note: Language in [ALL CAPS] below indicates where local jurisdictions need to provide information specific to the jurisdiction. Language in italics indicates explanatory notes from the authors of this document that may be deleted from the distributed version.

SUBMITTAL INSTRUCTIONS

This application and the following attachments will constitute the Battery Energy Storage System Permitting Package.

- This application form, with all fields completed and bearing relevant signatures.
- Permitting fee of $[ENTER FEE HERE], payable by [ENTER VALID PAYMENT METHODS, If checks are allowed INCLUDING WHO CHECKS SHOULD BE MADE PAYABLE TO]
- Required Construction Documents for the battery energy storage system being installed, including required attachments.

Completed permit applications can be submitted electronically to [EMAIL ADDRESS] or in person at [BUILDING DEPARTMENT ADDRESS] during business hours [INDICATE BUSINESS HOURS].

APPLICATION REVIEW TIMELINE

Permit determinations will be issued within [TIMELINE] calendar days upon receipt of complete and accurate applications. The municipality will provide feedback within [TIMELINE] calendar days of receiving incomplete or inaccurate applications.

FOR FURTHER INFORMATION

Questions about this permitting process may be directed to [MUNICIPAL CONTACT INFORMATION].

PROPERTY OWNER

Property Owner's First Name | Last Name | Title

Property Address

City | State | Zip

Section | Block | Lot Number

EXISTING USE

❑ Residential ❑ Commercial

PROVIDE THE TOTAL SYSTEM CAPACITY RATING

Total System Capacity Rating:_____ kWh Power Rating:_____ kW (Select One) ❑ AC or ❑ DC

SELECT SYSTEM CONFIGURATION

❑ AC Coupled ❑ DC Coupled ❑ Standalone

SELECT BATTERY TYPE

❑ Lithium-ion, all types ❑ Lead-acid, all types ❑ Nickel-cadmium (Ni-Cd) ❑ Flow batteries ❑ Other: _____

SELECT INSTALLATION TYPE

❑ Indoor ❑ Outdoor ❑ Attached/Detached/Open Garage ❑ Rooftop ❑ Dedicated Use Building

BATTERY ENERGY STORAGE SYSTEM INSTALLATION CONTRACTOR

Contractor Business Name

Contractor Business Address | City | State | Zip

Contractor Contact Name | Phone Number

Contractor License Number(s) | Contractor Email

Electrician Business Name

Electrician Business Address | City | State | Zip

Electrician Contact Name | Phone Number

Electrician License Number(s) | Electrician Email

Please sign below to affirm that all answers are correct and that you have met all the conditions and requirements to participate in this unified process.

Property Owner's Signature | Date

Battery Energy Storage System Company Representative Signature | Date

PERMITS AND APPROVALS REQUIRED

The following permits are the minimum requirements for battery energy storage systems installed with an aggregate energy capacity up to 600 kWh.

1. Battery Energy Storage System Permit
2. [redacted].

SUBMITTAL REQUIREMENTS

In order to submit a complete permit application for a new battery energy storage system, the applicant must include:

a) Completed Application form on page 2.

b) Construction Documents, with listed attachments. Construction Documents must be stamped and signed by a New York State Registered Architect or New York State Licensed Professional Engineer.

General Requirements

- Minimum plan size is 11"x17" with a minimum font of 10.
  - Include 4 full sets of plans and 2 sets of supporting documents.
- Include the applicable codes on the cover sheet for the project.
- Include the complete scope of work on the cover sheet for the project.
- All battery energy storage systems, all dedicated use buildings, and all other buildings or structures that (1) contain or are otherwise associated with a battery energy storage system and (2) subject to the NYS Uniform Fire Prevention and Building Code (Uniform Code) and/or the NYS Energy Conservation Construction Code(Energy Code) shall be designed, erected, and installed in accordance with all applicable provisions of the Uniform Code, all applicable provisions of the Energy Code, and all applicable provisions of the codes, regulations, and industry standards as referenced in the Uniform Code, the Energy Code, and the [redacted] Code.

Site Plan and Floor Plan Requirements

- Include a legend or key for the site and floor plan with equipment symbols.
- The site plan shall include:
  - The location of the structure and the location where the system is to be installed.
  - Show conduit/cable routing of battery energy storage system.
  - Include underground trench detail, if applicable.
  - Show overhead runs, if applicable.
  - Show method and location of required ventilation equipment (if required) for indoor installations.
- Identify the total number of batteries.
- The floor plan shall include:
  - New equipment for the battery energy storage system.
  - Existing equipment for interconnection.
  - Show required working clearances for all existing/new electrical equipment.
  - Show whether the equipment is to be installed indoors or outdoors.
  - Show method and location of requirement ventilation equipment (if required) for indoor installations.
  - Show method of protection from physical damage for the battery energy storage system.
  - Show means of access to battery energy storage system.
  - Denote whether conductors are routed indoors or outdoors.
- Provide an elevation drawing of the system equipment and specify elevation in relation to flood plains.
  - If the building is in a flood zone, it shall be above base flood elevation.
- Provide supporting documents from manufacturer if equipment is subject to physical damage.

Electrical

- Installations shall be in compliance with the Battery Energy Storage System Inspection Checklist. The Battery Energy Storage System Inspection Checklist provides an overview of common points of inspection that the applicant should be prepared to show compliance.
- Plans shall include a note that a plug-in type back-fed circuit breakers connected to an interconnected supply shall be secured in in accordance with (NEC 408.36(D)).
- Provide a permanent plaque or directory denoting all electric power sources on or in the premises, which shall be installed at the main service panel and at locations of all electric power production sources capable of being interconnected (2017 NEC 706.11).
- One or Three-Line Diagram
  - Show grounding and bonding for the battery energy storage system, including the ground return path.
  - Show method of interconnection.
  - Show overcurrent protection method and rating when required.
  - Include detailed wiring information for all new circuits, including:
    - > Conductor size/type
    - > Number of conductors
    - > Conduit size
    - > Conduit type
  - Show all disconnection means.
  - Show ratings (voltage, ampacity, environmental, etc) for new and existing service equipment.
- Specifications and installation instructions

• Specifications and installation instructions
  - Prepackaged and pre-engineered battery energy storage systems shall be installed in accordance with their listing and the manufacturer's instructions. Energy storage systems listed and labeled solely for utility or commercial use shall not be used for residential applications.
    > Exceptions:
    • Where approved, repurposed unlisted battery systems from electric vehicles are allowed to be installed outdoors or in detached dedicated cabinets located not less than 5 feet (1524 mm) from exterior walls, property lines and public ways.
    • Energy storage systems less than 1 kWh (3.6 megajoules).
  - Provide specification sheets and installation instructions for the following equipment:
    > Batteries
    > Inverter
    > Transformer or autotransformer
    > Transfer switch(es)
    > ESS support or racking
    > Converters
    > Interconnecting cables and connectors
    > Management system, including charge controller(s)
    > Panelboards
    > HVAC/thermal management system
    > Fire rated material
  - Storage batteries and battery storage systems shall comply with the following:
    > BESS shall be listed in accordance with UL 9540.
    > Chargers, inverters, and energy storage management systems shall be covered as part of the UL 9540 listing or shall be listed separately.
  - An approved energy storage management system shall be provided for battery technologies other than lead-acid and nickel cadmium for monitoring and balancing cell voltages, currents, and temperatures within the manufacturer's specifications. The system shall transmit an alarm signal to an approved location if potentially hazardous temperatures or other conditions such as short circuits, over voltage or under voltage are detected.

Fire Requirements

  - BESS installations in one to two family residential dwellings must comply with the following:
    > Individual BESS units shall have a maximum rating of 20kWh.
    > Individual BESS units shall be separated from each other by a minimum of 3 feet unless smaller separation distances are allowed per manufacturer's instructions and based on large scale fire testing complying with requirements set forth in the applicable fire code.
    > Individual BESS units installed outdoors on exterior walls shall be located a minimum 3 feet from doors and windows.
    > Interconnected smoke alarms shall be installed throughout areas where BESS are installed. Where BESS are installed in an area where smoke alarms cannot be installed in accordance with their listing, an interconnected listed heat alarm shall be installed and be connected to the smoke alarm system.
    > Indoor installations of BESS that include batteries that produce hydrogen or other flammable gases during charging shall meet the exhaust ventilation requirements set forth in the applicable fire code.
    > BESS that have the potential to release toxic or highly toxic gas during charging, discharging, and normal use conditions shall be installed outdoors.
    > Rooms and areas containing energy storage systems shall be protected on the system side by fire-resistant construction.
    > Energy storage systems installed in a location subject to vehicle damage shall be protected by approved barriers.

Structural Requirements

- If the battery energy storage system is wall mounted and its weight is 200 lbs (or more), provide structural details in the drawings and calculations as a separate document (Uniform Code).
- If multiple battery energy storage systems are installed and the combined weight is 400 lbs or more, provide structural details in the drawings and calculations as a separate document (Uniform Code).

PLAN REVIEW

Permit applications can be submitted to [ ] in person at [ ] and [ ] electronically through: [ ].

FEES

[ ]

DEPARTMENTAL CONTACT INFORMATION

Once all permits to construct the battery energy storage system installation have been issued and the system has been installed, it must be inspected before final approval is granted for the battery energy storage system. On-site inspections can be scheduled by contacting [ ] by telephone at [ ] or electronically at [ ].

Inspection requests received within business hours are typically scheduled for the next business day. If next business day is not available, inspection should happen within a five-day window. [ ].

In order to receive final approval, the following inspection is required:

[ ] The applicant must contact [ ] when ready for a final inspection. During this inspection, the inspector will review the complete installation to ensure compliance with codes and standards, as well as confirming that the installation matches the records included with the permit application. The applicant must have ready, at the time of inspection, the following materials and make them available to the inspector:

- Copies of as-built drawings and equipment specifications, if different than the materials provided with the application.
- Photographs of key hard to access equipment.

[ ] has adopted a standardized "Battery Energy Storage System Inspection Checklist", which can be found here: [ ].

DEPARTMENTAL CONTACT INFORMATION

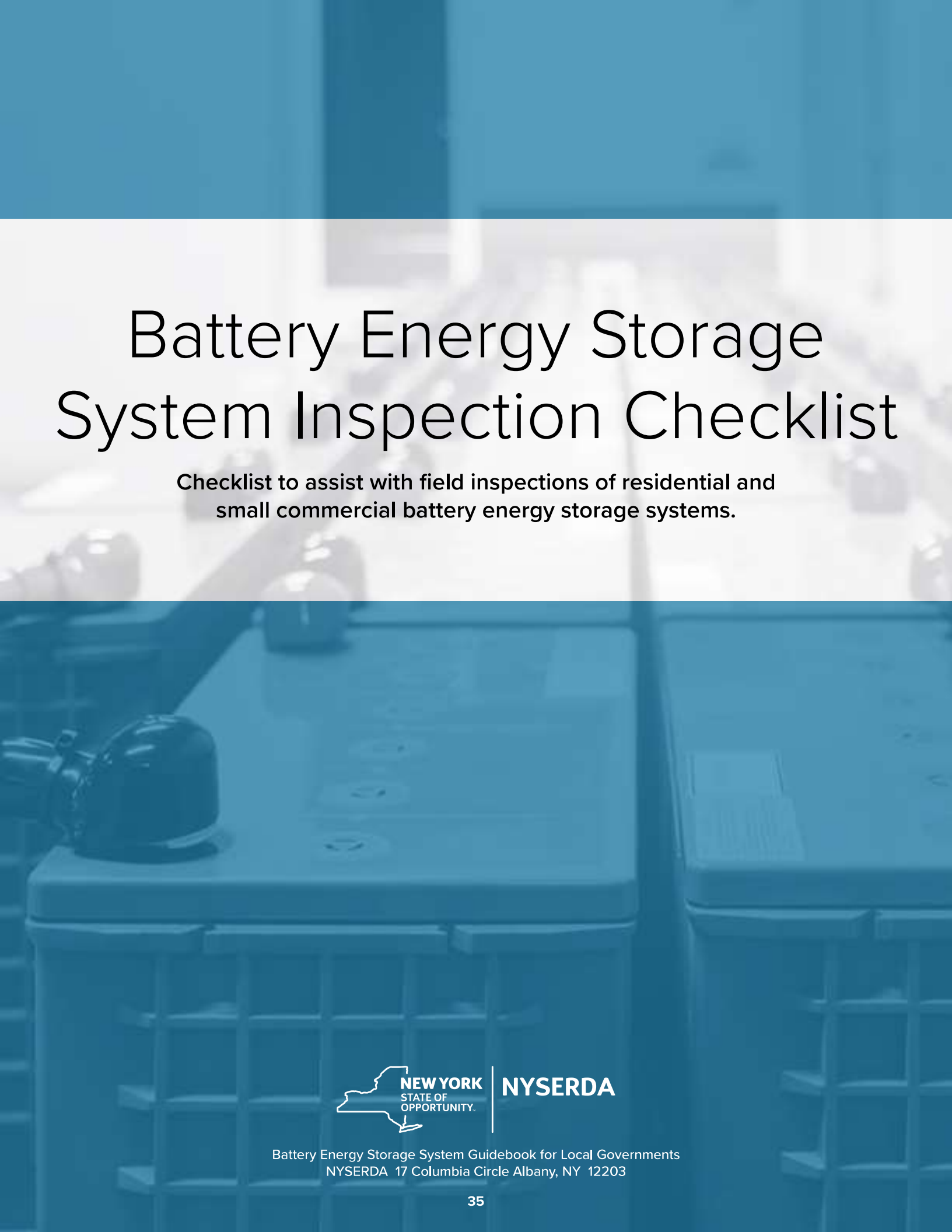
For additional information regarding this permit process, please consult our departmental website at [ ] or contact [ ] at [ ].

Questions?

If you have any questions about the Battery Energy Storage System Model Permit, please email questions to cleanenergyhelp@nyserda.ny.gov or request free technical assistance at nyserda.ny.gov/Energy-Storage-Guidebook. The NYSERDA team looks forward to partnering with communities across the State.

Battery Energy Storage System Inspection Checklist

Checklist to assist with field inspections of residential and small commercial battery energy storage systems.



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Section Contents

1. Inspection Checklist 37

Overview

The Checklist is intended to be utilized as a guideline for field inspections of residential and small commercial battery energy storage systems. It can be used directly by local code enforcement officers or provided to a third-party inspection agency, where applicable.

The Battery Energy Storage System Inspection Checklist is based on the 14th Edition of the National Electric Code (NEC), which is anticipated to be adopted by New York State in 2020. NYSERDA will continue to update the Guidebook as these codes and standards evolve.

The workable version of this document can be found at nyserda.ny.gov/Energy-Storage-Guidebook, Battery Energy Storage System Inspection Checklist tab.

1. Inspection Checklist

Applicable Codes: NEC 2017, [add any additional local codes required]

The information provided in this document is general and intended as a guide only. Each project is unique and additional requirements may be enforced as deemed appropriate.

Project Information

Permit Number	
Primary Contractor	
Project Address	
Date	

Pre-Inspection

	De-energize electrical panels prior to removing the dead-front. All equipment shall be open and ready for inspection
	The approved plans, permit, and installation instructions shall be on site at time of inspection
	Major changes, including revisions, to the installation shall be submitted to the AHJ for review and approval prior to inspection

Inspection

General

	Exact match of component product number and rating with plan
	All equipment shall bear the appropriate listing mark of a Nationally Recognized Testing Laboratory where such marking is required as part of the listing, and installed in accordance with its listing (NEC Article 110.3(B))
	Battery energy storage system includes a manual (system description, operating and safety instructions, maintenance requirements, safe battery handling requirements/recommendations)
	A personnel door(s) intended for entrance to and egress from rooms designed as BESS rooms shall open in the direction of egress and shall be equipped with listed panic hardware, (NEC 706.10(D))
	Provide sufficient working spaces and clearances for batteries. Working space shall be measured from the edge of the battery cabinet, racks, or trays, (NEC 480.9, 110.26)
	Spaces about the ESS shall comply with NEC 110.26. Working space shall be measured from the edge of the ESS modules, battery cabinets, racks, or trays, (NEC 706.10(C)) • For battery racks, there shall be a minimum clearance of 1 inch between a cell container and any wall or structure on the side not requiring access for maintenance. • ESS modules, battery cabinets, racks, or trays shall be permitted to contact adjacent walls or structures, provided that the battery shelf has a free air space for not less than 90% of its length. • Pre-engineered and self-contained ESSs shall be permitted to have working space between components within the system in accordance with the manufacturer's recommendations and listing of the system.

Equipment

	Flexible Battery DC conductors are listed as hard service use and/or moisture resistant, (NEC 690.74, 706.32)
	Fine stranded flexible cables (if used) terminated in accordance with NEC 110.14, (NEC 110.14, 690.74, 706.32)
	Ungrounded conductor is not marked using white, grey, or white striped conductors to avoid confusion with grounded conductor markings, (NEC 200.7)
	Electrochemically dissimilar metals are not in direct physical contact, (NEC 110.14)
	All connections shall be secure, (NEC 110.14, 706.31)
	All metallic raceways and equipment shall be bonded and electrically continuous, (NEC 110.3(B), 250.8)
	Unused opening shall be close with protection equivalent to the wall of enclosure, (NEC 110.3(B), 408.7)
	The selected wiring methods are appropriate for the location and installed in accordance with their intended use, (NEC 310, 706)
	All live parts of batteries must be guarded regardless of voltage or battery type, (NEC 706.10(B))
	Batteries' live parts shall be guarded in accordance with (NEC 110.27, 480.10(B))
	Verify that the attachment of the battery storage unit to the wall or floor is per the approved plans. If the wall or floor construction differs from the approved plans, a revision is required prior to inspection

Grounding

	Any conductive battery racks, cases or trays must be connected to an equipment grounding conductor. (NEC 250.110)
	Equipment grounding conductor is properly identified as either bare, green, or green with continuous yellow stripe(s), (NEC 250.119)
	If there is no existing AC grounding electrode, the ESS contractor shall install (2) ground rods at the main electrical service. If there Is only (1) ground rod, a second one shall be installed. Ground rods shall be a minimum of 6' apart, (NEC Exhibit 250.25, Article 250.53, 706)

Main Electric Service

	Circuit breakers shall be of the same manufacturer as the main service panel, (NEC 110.3)

Ventilation

	Provide adequate ventilation for batteries per manufacturer's requirements. (NEC 706.10(A))
	Batteries/enclosures contain ventilation equipment to prevent excessive accumulation of gas pressure and/or gas ignition, (NEC 706.10)

Connections and Terminations

	Cell terminations have measures taken to prevent corrosion
	Electrical connections do not put mechanical strain on battery terminals, (NEC 706.31, 110.14(A))
	Overcurrent protection of ungrounded conductors shall have overcurrent protection device(s) located as close as practicable to the battery terminals in an unclassified location, (NEC 480.5, 706.7)
	Battery circuit and equipment shall be protected by overcurrent protective devices as close as practicable to the storage battery terminals in accordance with the requirements of NEC Article 240, (NEC 240.21(H), 705.65(A))
	Unless the short-circuit currents from all sources do not exceed the ampacity of the conductors, storage battery inverters shall be protected by overcurrent protective devices from all other sources, (NEC 705.65(A))
	A listed current-limiting overcurrent protective device shall be installed adjacent to the ESS for each dc output circuit, (NEC 706.21(C))
	In an ac-coupled system, the plug-in type circuit breaker connected to the output of the storage battery or multimode inverter is required to be secured, (NEC 408.36(D), 710.15(E))
	Storage battery, multimode, and utility-interactive inverter output circuit breakers that are marked "Line" and "Load" are not permitted to be back-fed, (NEC 710.15(E), 110.3(B), 705.12(B)(4))
	Single 120-volt inverter in ac coupled systems should not supply back-up loads containing multiwire branch circuit or any 240 volt outlets. Such action can overload the common neutral in such a wiring method, (NEC 710.15(C))

Monitoring and Charge Control

	Charge controllers shall be compatible with the battery or ESS manufacturer's electrical ratings and charging specifications, (NEC110.3(B))
	Charge controller is properly installed to prevent overcharging or damaging batteries, (NEC 690.72, 706.23)
	Diversionary charge controllers with utility-interactive and multimode inverters shall have a second independent controller to prevent battery overcharge in the event the diversion loads are unavailable or the diversion charge controller fails, (NEC 706.23(B)(3)(b))

Disconnecting Means

	A disconnecting means is provided for all ungrounded conductors derived from a dc stationary battery system with a voltage of over 60 volts dc, (NEC 480.7)
	A disconnecting means shall be provided for all ungrounded conductors derived from an ESS. A disconnecting means shall be readily accessible and located within sight of the ESS, (NEC 706.7(A))
	Battery circuits subject to field servicing where exceeding 240 volts nominal between conductors or to ground, shall have provisions to disconnect the series-connected strings into segments not exceeding 240 volts nominal for maintenance by qualified persons. Non-load-break bolted, or plug-in disconnects shall be permitted, (NEC 706.30(B))
	ESS exceeding 100 volts between conductors or to ground shall have a disconnecting means, accessible only to qualified persons, that disconnects ungrounded and grounded circuit conductor(s) in the electrical storage system for maintenance. This disconnecting means shall not disconnect the grounded circuit conductor(s) for the remainder of any other electrical system. A non-load-break-rated switch shall be permitted to be used as a disconnecting means, (NEC 706.30(C))
	Where battery energy storage system input and output terminals are more than 5ft from the connected equipment, or where these terminals pass through a wall or partition must comply with all of NEC 706.7(E)) (1) A disconnecting means shall be provided at the energy storage system end of the circuit. Fused disconnecting means or circuit breakers shall be permitted to be used. (2) A second disconnecting means located at the connected equipment shall be installed where the disconnecting means required by 706.7(E)(1) is not within sight of the connected equipment. (3) Where fused disconnecting means are used, the line terminals of the disconnecting means shall be connected toward the energy storage system terminals. (4) Disconnecting means shall be permitted to be installed in energy storage system enclosures where explosive atmospheres can exist if listed for hazardous locations. (5) Where the disconnecting means in (1) is not within sight of the disconnecting means in (2), placards or directories shall be installed at the locations of all disconnecting means indicating the location of all other disconnecting means. (NEC 706.7(E))
	Where a disconnecting means, located in accordance with NEC 480.7(A) (out of sight of the battery storage system), is provided with remote controls to activate the disconnecting means and the controls for the disconnecting means are not located within sight of the stationary battery system, the disconnecting means shall be capable of being locked in the open position, (NEC 480.7(B))
	The equipment grounding lug shall be as specified by the manufacturer, (NEC 110.3(B))
	Remove any insulating finish, such as paint, under the equipment grounding lug prior to installation (NEC 250.8, 250.12)
	Maximum height requirements for disconnects applies to integrated disconnect (e.g., Tesla PowerWalls or similar applications)

Interconnection

	The interconnection methods comply with NEC Article 705.12 (if connected to other energy sources)

Signage

	The signage shall be in compliance with ANSI Z535 and shall include the following information 1. Labeled “Energy Storage Systems” with symbol of lightning bolt in a triangle 2. Type of technology associated with the ESS 3. Special hazards associated 4. Type of suppression system installed in the area of the ESS 5. Emergency contact information
	A permanent plaque or directory denoting the location of all electric power source disconnecting means on or in the premises shall be installed at each service equipment location and at the location(s) of the system disconnect(s) for all electric power production sources capable of being interconnected. The marking shall comply with NEC 110.21(B) (NEC 706.11)
	Equipment containing overcurrent devices in circuits supplying power to a busbar or conductors supplied from multiple sources shall be marked to indicate the presence of all sources. (NEC 705.12(B)(3))
	PV system output circuit conductors shall be marked to indicate the polarity where connected to battery energy storage systems. (NEC 690.55)
	DC system conductors of 4 AWG or larger shall be identified using colored marking tape, (NEC 210.5(C)(2))
	Where controls to activate the disconnecting means of a battery are not located within sight of a stationary battery system, the location of the controls shall be field marked on the disconnecting means. (NEC 480.7(B))
	Where controls to activate the disconnecting means of an ESS are not located within sight of the system, the disconnecting means shall be capable of being locked in the open position, in accordance with 110.25, and the location of the controls shall be field marked on the disconnecting means. (NEC 706.7(B))
	Where the sum of the ampere ratings of all overcurrent devices on panelboards, both load and supply devices, excluding the rating of the overcurrent device protecting the busbar, shall not exceed the ampacity of the busbar. The rating of the overcurrent device protecting the busbar shall not exceed the rating of the busbar. Permanent warning labels shall be applied to distribution equipment displaying the following or equivalent wording: (NEC 705.12(B)(2)(3)(c)): **WARNING:** **THIS EQUIPMENT FED BY MULTIPLE SOURCES.** **TOTAL RATING OF ALL OVERCURRENT DEVICES,** **EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE,** **SHALL NOT EXCEED AMPACITY OF BUSBAR**
	Where two sources, one a primary power source and the other another power source, are located at opposite ends of a busbar that contains loads, the sum of 125 percent of the power source(s) output circuit current and the rating of the overcurrent device protecting the busbar shall not exceed 120 percent of the ampacity of the busbar. The busbar shall be sized for the loads connected in accordance with Article 220. A permanent warning label shall be applied to the distribution equipment adjacent to the back-fed breaker from the power source that displays the following or equivalent wording: (NEC 705.12(B)(2)(3)(b)): **WARNING:** **INVERTER OUTPUT CONNECTION;** **DO NOT RELOCATE THIS OVERCURRENT DEVICE.**
	All battery and battery management equipment and associated switchgear are marked and labeled according to all applicable codes including arc flash incident calculations for the safety of operation and maintenance personnel required by the National Electrical Code and OSHA: (NEC 110.16)
	If a battery dc disconnecting means is not provided at the batteries, the disconnecting means shall be legibly marked in the field. The marking shall be of sufficient durability to withstand the environment involved and shall include the following (NEC 480.7(D)): • Nominal battery voltage • Maximum available short-circuit current derived from the stationary battery system • Date the calculation was performed for the value above • The battery disconnecting means shall be marked in accordance with 110.16

Questions?

If you have any questions about the Battery Energy Storage System Inspection Checklist, please email questions to cleanenergyhelp@nyserda.ny.gov or request free technical assistance at nyserda.ny.gov/Energy-Storage-Guidebook. The NYSERDA team looks forward to partnering with communities across the State.

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State of New York
Andrew M. Cuomo, Governor

New York State Energy Research and Development Authority
Richard L. Kauffman, Chair | Alicia Barton, President and CEO