

Electrical, HVAC, DHW

What to expect in the 2024 CBES

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2024 CBES based on the following:

- 2020 CBES which is based on 2018 IECC (*International Energy Conservation Code*)
- Elements of 2021 IECC
- Select language updates and additional more stringent Vermont requirements
- 2019 ASHRAE 90.1 *Energy Standard for Buildings Except Low-Rise Residential Buildings*



Target Effective Date

July 1, 2024

Do RBES and CBES have the same code version trigger?

- CBES: Building Permit application date
- RBES: Construction start date

CBES caveat: For buildings permitted under 2020 CBES: construction must start prior to December 31, 2024



Source: R. Edwards & Co. Architects

Chapter 4

Commercial Energy Efficiency: General



C402.4.6 Operable openings interlocking

Openings greater than 40 ft² – interlock with heating and cooling systems....for doors open for 10 minutes

- Raise cooling to 90°F
- Lower heating to 55 °F

Exceptions:

- Separately zoned areas associated with food prep
- Warehouses utilizing overhead doors
- “1st entrance of vestibules located in exterior wall”. This effectively means that openings with vestibules are exempt

C402.5 Solar-ready zone

Located on roof

- Buildings oriented between 110° and 270° of true north; or
 - Low slope roofs
-
- Not less than 40% of roof area
-
- Can be single area or smaller, separated sub-zones

C402.5 Solar-ready zone

Construction drawings indicate

- Roof loads specified: not less than 5psf
- Drawings show interconnection pathways for conduit etc
- Electrical energy storage system-ready floor area

Main panel shall have reserve space to allow installation of

- Dual-pole circuit breaker for future solar electric
- Dual-pole circuit breaker for future electrical energy storage system installation

C402.5 Solar-ready zone

Exceptions:

- On-site renewable energy system pre-exists
- Solar-ready zone is shaded 70% of daylight hours
- Incident solar radiation available is not suitable
- Extensive rooftop equipment, skylights, vegetation, other obstructions (certified by licensed professional)

Chapter 4

Building Mechanical Systems

Efficiency
Vermont



C403.2.2 Ventilation

Meet ASHRAE 62.1

Exceptions?

- All Residential occupancies. See the ventilation requirements of Section 304 of the *Vermont Residential Building Energy Standards*.

C403.2.4 Fault detection and diagnostics

Buildings >100,000sf require monitoring of HVAC performance and identifying faults. Systems must include

- Permanently installed sensors, sampling every 15 minutes
- Automatically ID faults and notify personnel
- Automatically provide recommendations for repair
- Ability to transmit repair recommendations to remote authorized personnel

Exceptions? Group R-1 and R-2 occupancies

C403.1.3 HVAC total system performance ratio

Creates alternative compliance method for some HVAC systems

C403.3.1 Equipment sizing

Heat pump equipment shall not be sized greater than the calculated peak heating and cooling loads

C403.3.2 Equipment Efficiency Tables

General Themes

Equipment efficiencies adjusted to meet federal standards as per IECC 2021

- AC & heat pump cooling efficiencies now reported in SEER2
- Heat pump heating efficiencies now reported in HSPF2
- Increase in efficiencies:
 - PTACs, PTHPs, Room AC units and similar
 - Non-ducted furnaces, slight increase (example 80% TE to 81% TE)
 - Floor-Mounted AC and condensing units serving computer rooms

C403.3.2 Equipment Efficiency Tables

Most equipment efficiency requirements remaining the same:

- Chillers, boilers
- Heat rejection equipment
- VRF AC and Heat Pumps

C403.3.2 Equipment Efficiency Tables

A few new tables

TABLE C403.3.2(12)
ELECTRICALLY OPERATED DX-DOAS UNITS, SINGLE-PACKAGE AND REMOTE CONDENSER,
WITHOUT ENERGY RECOVERY– MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE ^a
Air cooled (dehumidification mode)	-	4.0 ISMRE	AHRI 920
Air-source heat pumps (dehumidification mode)	-	4.0 ISMRE	AHRI 920
Water cooled (dehumidification mode)	Cooling tower condenser water	4.9 ISMRE	AHRI 920
	Chilled water	6.0 ISMRE	
Air-source heat pump (dehumidification mode)	-	2.7 ISCOP	AHRI 920
Water-source heat pump (dehumidification mode)	Ground source, closed loop	4.8 ISMRE	AHRI 920
	Groundwater source	5.0 ISMRE	
	Water source	4.0 ISMRE	
Water-source heat pump (heating mode)	Ground source, closed loop	2.0 ISCOP	AHRI 920

C403.3.2 Equipment Efficiency Tables

A few new tables

**TABLE C403.3.2(16)
CEILING-MOUNTED COMPUTER-ROOM AIR CONDITIONERS-MINIMUM EFFICIENCY
REQUIREMENTS**

EQUIPMENT TYPE	STANDARD MODEL	NET SENSIBLE COOLING CAPACITY	MINIMUM NET SENSIBLE COP	RATING CONDITIONS RETURN AIR (Dry bulb/dew point)	TEST PROCEDURE
Air cooled with free air discharge condenser	Ducted	<29,000 Btu/h	2.05	75°F/52°F (Class 1)	AHRI 1360
		≥29,000 Btu/h and <65,000 Btu/h	2.02		
		≥65,000 Btu/h	1.92		
		<29,000 Btu/h	2.08		
	Non ducted	≥29,000 Btu/h and <65,000 Btu/h	2.05		
		≥65,000 Btu/h	1.94		
		<29,000 Btu/h	2.01		
		≥29,000 Btu/h and <65,000 Btu/h	1.97		
		≥65,000 Btu/h	1.87		
		<29,000 Btu/h	2.04		
	≥29,000 Btu/h and <65,000 Btu/h	2.00			
	≥65,000 Btu/h	1.89			

C403.3.3 Hot gas bypass

Cooling systems shall not use hot gas bypass or other evaporator pressure control systems unless the system is designed with multiple steps of unloading or continuous capacity modulation

Table C403.3.3
MAXIMUM HOT GAS BYPASS CAPACITY

<u>RATED CAPACITY</u>	<u>MAXIMUM HOT GAS BYPASS CAPACITY</u> <u>(% of total capacity)</u>
<u>≤ 240,000 Btu/h</u>	<u>50</u>
<u>> 240,000 Btu/h</u>	<u>25</u>

C403.4.1.1 Heat pump supplementary heat

Supplemental electric resistance heat operation shall be controlled to only those times when one of the following applies:

1. The vapor compression cycle cannot provide the necessary heating energy to satisfy the thermostat setting.
2. The heat pump is operating in defrost mode.
3. Only for buildings that require heat for health and safety:
 - the vapor compression cycle malfunctions
 - the thermostat malfunctions.

Electric Resistance Heating Equipment

Allowed under the following circumstances:

Cold-climate heat pumps are primary heating system

- Supplemental electric resistance heat operates only at temperatures 5F or lower
- The building has tested air leakage of less than 0.15cfm50/sf

Multifamily buildings with heating loads ≤ 6.0 Btu/hr/sf at design temperature

Note: Need prior approval from BED to install electric resistance heating!

C403.4.2.3 Automatic start (and stop)

2020 CBES language:

HVAC controls shall be configured to automatically adjust the daily start time of the HVAC system in order to bring each space to the desired occupied temperature immediately prior to scheduled occupancy.

C403.4.2.3 Automatic start (and stop)

2024 CBES adds the following:

Automatic stop controls shall be provided for each HVAC system with direct digital control of individual zones

Reduce heating and increase cooling setpoints by at least 2°F before scheduled unoccupied periods based on the thermal lag and acceptable drift in space temperature that is within comfort limits

C403.4.3.3.3 Two-Position Valves

2020: Two-position valve must be installed at each heat pump

2024: Each heat pump two-way valve shall be interlocked to shut off water flow when the compressor is off

C403.5 Economizers

New Exception: VRF systems installed with a dedicated outdoor air system.

C403.6.3 Supply-Air Temp Reset Controls

Nothing New: Supply-air temperature reset controls. Multiple-zone HVAC systems shall include controls

New:

Controls based on zone humidity are allowed.

HVAC zones that are expected to experience relatively constant loads, shall have maximum airflow designed to accommodate the fully reset supply-air temperature

C403.7.1 Demand control ventilation

DCV is required for spaces with less occupants than in VT CBES 2020. Occupant load reduced from 25 to 15 people per 1,000sf

Exceptions language more clearly defined

C403.7.2 Enclosed parking garage ventilation

Sensors must detect NO_x in addition to CO

Exceptions for garage ventilation systems that do not utilize heating or cooling:

- Total exhaust capacity less than 4,000 cfm
- Garage area to ventilation system motor nameplate power ratio that exceeds 1,125 cfm/hp

C403.7.3 Ventilation air heating control

C403.7.4.1 Nontransient dwelling units shall have ERVs

- 60% enthalpy recovery efficiency at cooling design condition
- 70% recovery efficiency at heating design condition

C403.7.6.1 Temperature Setback Controls

Unrented and unoccupied guestroom mode shall be initiated within 16 hours of the guestroom being continuously occupied or where a networked guestroom control system indicates that the guestroom is unrented and the guestroom is unoccupied for more than ~~30~~ **20** minutes.

When the guestroom is occupied, HVAC setpoints shall return to their occupied setpoints once occupancy is sensed

C403.7.6.1 Ventilation Controls

Unoccupied guest rooms: ventilation turnoff time decreased from 30 minutes to 20 minutes

C403.8.2 Motor Nameplate Horsepower

Exceptions:

1. Fans equipped with electronic speed control devices to vary the fan airflow as a function of load.
2. Fans with a fan nameplate electrical input power of less than 0.89 kW.
3. Systems complying with Section C403.8.1 fan system motor nameplate hp (Option 1).
4. Fans with motor nameplate horsepower less than 1 hp (746 W)

C403.8.3 Fan efficiency

A new fan energy index rating was introduced per IECC 2021

Each fan and fan array shall have a fan energy index (FEI) of not less than 1.00 at the design point.

Exceptions are expanded to include specialty end uses

Low-capacity ventilation fans (<1/12hp) minimum efficiency requirement was added per IECC 2021

C403.8.5 Low-capacity ventilation fans

TABLE C403.8.5 LOW-CAPACITY VENTILATION FAN EFFICACY^a			
<u>FAN LOCATION</u>	<u>AIRFLOW RATE MINIMUM (CFM)</u>	<u>MINIMUM EFFICACY (CFM/WATT)</u>	<u>AIRFLOW RATE MAXIMUM (CFM)</u>
<u>HRV or ERV</u>	<u>Any</u>	<u>1.2 cfm/watt</u>	<u>Any</u>
<u>In-line fan</u>	<u>Any</u>	<u>3.8 cfm/watt</u>	<u>Any</u>
<u>Bathroom, utility room</u>	<u>10</u>	<u>2.8 cfm/watt</u>	<u><90</u>
<u>Bathroom, utility room</u>	<u>90</u>	<u>3.5 cfm/watt</u>	<u>Any</u>

Exceptions:

1. Where ventilation fans are a component of a listed heating or cooling appliance
2. Dryer exhaust duct power ventilators, domestic range hoods, and domestic range booster fans that operate intermittently

C403.10 Refrigeration equipment performance

Applies to commercial refrigerators, freezers, refrigerator-freezers, walk-in coolers, walk-in freezers and refrigeration equipment

New efficiency requirement tables updated to reflect IECC 2021

C403.12.1 Duct and plenum insulation and sealing

Supply and return air ducts and plenums shall be insulated with not less than:

- R-12 insulation where located in unconditioned spaces
 - (2020 CBES = R-8)
- R-20 insulation where located outside the building
 - (2020 CBES = R-12)

C404 Service water heating

C404.2.1 High input service water-heating system equipment size now defined as per IECC 2021:

1,000,000 Btu/h (293 kW) or greater

C404 Service water heating

~~C404.7 Demand recirculation controls.~~

~~Demand recirculation water systems shall have controls that comply with both of the following:~~

- ~~1. The controls shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.~~
- ~~2. The controls shall limit the temperature of the water entering the cold water piping to not greater than 104°F (40°C).~~

Chapter 4

Electrical Power and Lighting Systems



C405.1.1 Lighting for dwelling and sleeping units

Dwelling and Sleeping Units required to have 100% high-
efficacy lighting (essentially LED)

C405.2.1 Occupant sensor controls

Now required for Corridors:

- occupancy sensors, reduce lighting power by at least 50%

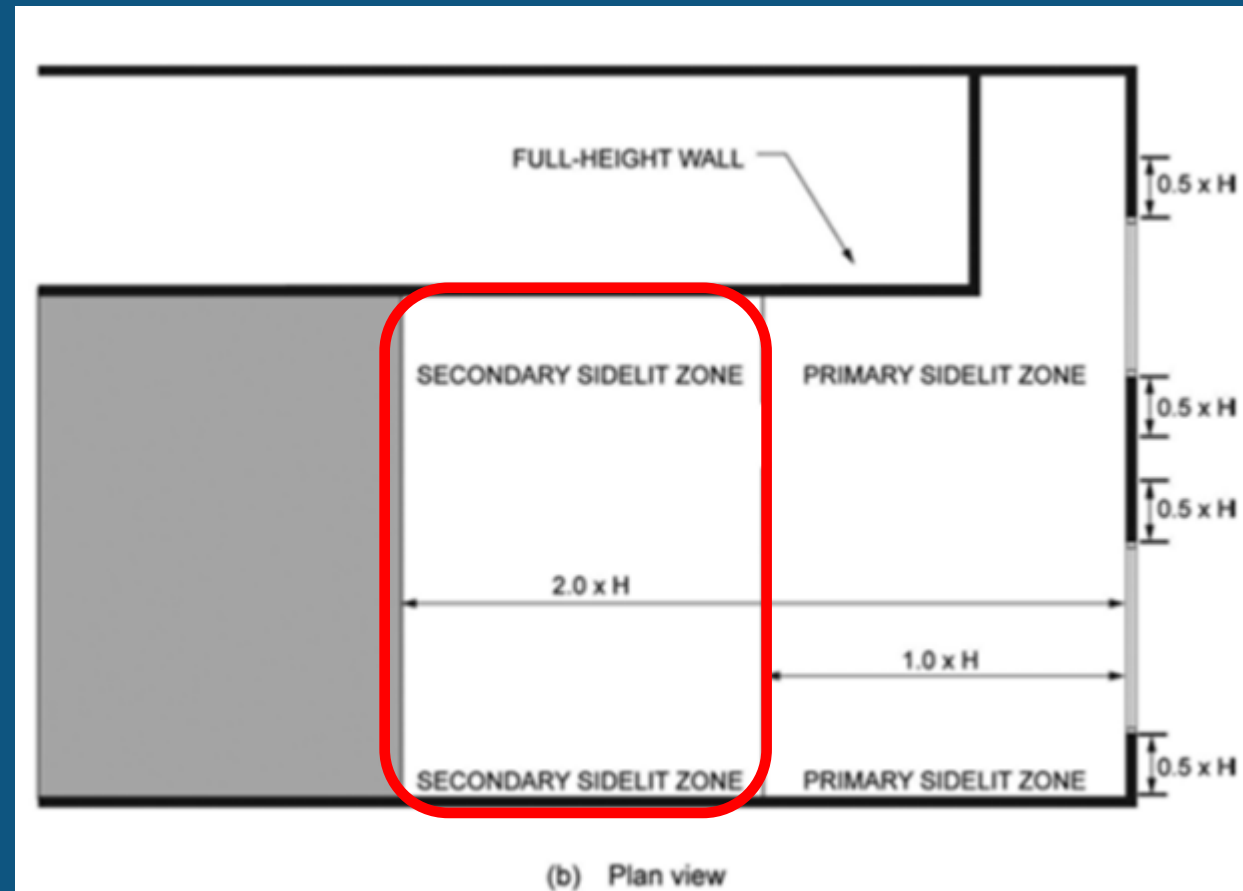
C405.2.1 Occupant sensor controls

General theme with many of the occupancy sensor controls requirements:

- 20-minute window for light reduction to occur
- Additionally many areas require manual on/off switch

C405.2.3 Daylight Zones

Some formulas have adjusted slightly



C405.2.8 Parking Garage Lighting Control

Fixtures controlled by occupant sensor or timeswitch

Lighting power of each luminaire shall be automatically reduced by at least 30 percent

Lighting zones for this requirement shall be <3,600 sf

There are many nuances and exceptions

TABLE C405.3.2

INTERIOR LIGHTING POWER ALLOWANCES: BUILDING AREA METHOD

BUILDING AREA TYPE	LPD (w/sf)	
	2020 CBES	2023 CBES
Automotive facility	0.60	0.56
Convention center	0.70	0.55
Courthouse	0.76	0.64
Dining: bar lounge/leisure	0.76	0.64
Dining: cafeteria/fast food	0.67	0.59
Dining: family	0.69	0.58
Dormitory	0.47	0.41
Exercise center	0.59	0.54
Fire station	0.48	0.43
Gymnasium	0.64	0.58
Health care clinic	0.69	0.62
Hospital	0.84	0.74
Hotel/Motel	0.65	0.50
Library	0.78	0.66
Manufacturing facility	0.82	0.68
Motion picture theater	0.64	0.44

BUILDING AREA TYPE	LPD (w/sf)	
	2020 CBES	2023 CBES
Multifamily	0.48	0.38
Museum	0.83	0.55
Office	0.64	0.53
Parking garage	0.14	0.13
Penitentiary	0.62	0.54
Performing arts theater	1.02	0.77
Police station	0.67	0.55
Post office	0.61	0.52
Religious building	0.77	0.60
Retail	0.92	0.73
School/university	0.67	0.57
Sports arena	0.71	0.61
Town hall	0.67	0.56
Transportation	0.52	0.42
Warehouse	0.43	0.36
Workshop	0.83	0.72

TABLE C405.4.2(2)

LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS

EXCERPT

	LIGHTING ZONES		
	Zone 1	Zone 2	Zone 3
Base Site Allowance	250 175 W	300 200 W	375 250 W
Uncovered Parking Areas			
Parking areas and drives	0.02 W/ft ²	0.03 0.02 W/ft ²	0.05 0.03 W/ft ²
Building Grounds			
Walkways less than 10 feet wide	0.35 0.25 W/linear foot	0.35 0.25 W/linear foot	0.40 0.30 W/linear foot
Walkways, 10 feet wide or greater, plaza areas, special feature areas	0.07 0.25 W/ft ²	0.07 0.25 W/ft ²	0.08 0.06 W/ft ²

C405.5.2.1 ADDITIONAL EXTERIOR LIGHTING POWER

Additional exterior lighting power allowances are available for Specific lighting applications

	LIGHTING ZONES		
	Zone 1	Zone 2	Zone 3
Building façades	No allowance	0.038 W/ft ² of gross above-grade wall area	0.057 W/ft ² of gross above-grade wall area
Automated teller machines (ATM) and night depositories	70 W per location plus 25 W per additional ATM per location	70 W per location plus 25 W per additional ATM per location	70 W per location plus 25 W per additional ATM per location
Entrances and gatehouse inspection stations at guarded facilities	0.25 W/ft ² of <u>covered</u> and uncovered area	0.25 W/ft ² of <u>covered</u> and uncovered area	0.25 W/ft ² of covered and uncovered area
Loading areas for law enforcement, fire, ambulance and other emergency service vehicles	0.20 W/ft ² of <u>covered</u> and uncovered area	0.20 W/ft ² of <u>covered</u> and uncovered area	0.20 W/ft ² of covered and uncovered area
Drive-up windows/doors	100 W per drive-through	100 W per drive-through	100 W per drive-through
Parking near 24-hour retail entrances	200 W per main entry	200 W per main entry	200 W per main entry

C405.6 Dwelling electrical meter

Nothing new: Each dwelling unit located in a Group R-2 building shall have a separate electrical meter

New Exception:

Buildings constructed and/or operated by non-profit affordable house organizations.

- Future electrical metering must be considered and planned for in the electrical layout of the buildings

C405.11. Automatic receptacle control

Automatic Receptacle Control: 50% of electrical receptacles in

- offices
- conference rooms
- copy/print rooms
- breakrooms
- classrooms
- individual workstations

C405.11.1 Automatic receptacle control function

Split controlled receptacles shall be provided with the top receptacle controlled, or a controlled receptacle shall be located within 12 inches of each uncontrolled receptacle. Options:

- A scheduled basis using a time-of-day operated control device. The occupant shall be able to manually override an area for not more than 2hrs
- An occupant sensor control or other automated signal

Plug-in devices shall not comply

C405.12 Energy monitoring.

Buildings > 25,000sf shall be equipped to monitor, record and report electrical energy consumption to building operation and management personnel

Exception: R-2 occupancies and individual tenant spaces provided that each space

- has its own utility services and meters
- and has <5,000 square feet of conditioned floor area

C405.12 Energy monitoring

Exceptions:

- HVAC & DHW equipment serving an individual dwelling unit
- Fire pumps, stairwell pressurization fans or any system that operates only during testing or emergency

C405.12 Energy monitoring – End Uses

- Total HVAC system
- Interior and Exterior Lighting
- Plug loads
- EVSE
- Process Load
- Building Operations and other misc loads

C405.13 Electric Vehicle Power Transfer Infrastructure

A few definitions:

Level 1 charger: with a charge rate of 1-2 kVA this is no longer permitted under 2024 CBES

Level 2 charger: 2024 CBES minimum charge rates specified effectively make this the minimum requirement

Electric Vehicle Fast Charger: Also referred to as a Level 3 charger

C405.13 Electric Vehicle Power Transfer Infrastructure

EVSE space: An *automobile parking space* that is provided with a dedicated *EVSE* connection

EV ready spaces: An *automobile parking space* that is provided with a branch circuit and either an outlet, junction box or receptacle, that will support an installed *EVSE*.

EV capable spaces: A designated *automobile parking space* that is provided with all the requisite infrastructure in place within five feet to allow installation of electrical wiring and connection to power for *EVSE*

C405.13 Electric Vehicle Power Transfer Infrastructure

Quantity

COMMERCIAL BUILDING OCCUPANCY	EVSE SPACES	EV READY SPACES	EV CAPABLE SPACES
Groups A, M	2%	0%	20%
Group B	6%	0%	30%
Group E	4%	0%	20%
Groups F, H, S	2%	0%	10%
Groups I, R-3, R-4	3%	0%	10%
Group R-1	8%	7%	50%
Group R-2	0%	0%	Determined in Equation 4-11

Equation 4-11: $R2EVC = D/SU + 0.25 * (APS - D/SU)$

R2EVC = Total requirement for EV Capable Spaces

D/SU = Total number of dwelling and sleeping units

APS = Total number of *automobile parking spaces* provided

C405.13 Electric vehicle Power Transfer Infrastructure

COMMERCIAL BUILDING OCCUPANCY	EVSE SPACES	EV READY SPACES	EV CAPABLE SPACES
Groups A, M	2%	0%	20%
Group B	6%	0%	30%
Group E	4%	0%	20%
Groups F, H, S	2%	0%	10%
Groups I, R-3, R-4	3%	0%	10%
Group R-1	8%	7%	50%
Group R-2	0%	0%	Determined in Equation 4-11



- Installed EVSE spaces that exceed minimum requirements may be used to meet EV Ready and EV capable spaces requirement
- Installed EV Ready spaces that exceed minimum requirements may be used to meet EV capable spaces requirement
- Each installed EVSE space with an EV fast charger shall count as 4 EVSE spaces

C405.13 Electric Vehicle Power Transfer Infrastructure

Exceptions:

1. Parking facilities, serving occupancies other than R-2 with fewer than 10 automobile parking spaces
2. Stand-alone retail stores with fewer than 50 spaces
 - Still required to provide EV Ready and EV Capable spaces in if there are ≥ 10 automobile parking spaces
3. Motor liquid fuel-dispensing facilities

C405.13.2 EV Capable Spaces

Exception: R-2 Occupancies with Multifamily building garage or covered parking, should provide:

- on electrical drawings the appropriately sized pathway to the building electrical room to accommodate a future electrical upgrade for Level 2 EVSE electric vehicle charging;
- adequate wall and floor space in the building electrical room for future EV charging related electrical equipment;
- the appropriately sized pathways to exterior on-grade surface parking spaces for future Level 2 EVSE electric vehicle charging;
- a line diagram on the electrical drawings demonstrating a pathway for future Level 2 EVSE electric vehicle charging

C405.14 Additional electric infrastructure

Buildings that contain combustion equipment and end-uses shall be required to install electric infrastructure

Exception: Buildings with R-2 Occupancies

C405.14 Additional electric infrastructure

Buildings with low-capacity combustion space heating (<225 kbtu/h furnaces, <400 kbtu/h boilers)

- Condensate drains installed within 3' of heating equipment
- Dedicated branch circuit installed and labeled "For Future Heat Pump Space Heater" (unless large enough circuit already exists to serve cooling equip.)

C405.14 Additional electric infrastructure cont.

Buildings with high-capacity combustion space heating:

- Conduit only between junction box located <3' away from space heating equipment and an electrical panel
- Junction box, conduit, bus bar in electrical panel shall be rated and sized to accommodate a future branch circuit with sufficient capacity for equivalent electric equipment
- Box and panel shall have labels stating "For Future Electric Space Heating Equipment"

C405.14 Additional electric infrastructure cont.

Other combustion systems with similar circuit and signage requirements as for combustion heating systems:

- Service water heating
- Commercial cooking appliances
- Commercial clothes drying
- Residential clothes drying equipment serving multiple dwelling units

Chapter 4

Additional Efficiency, Renewable and Load Management Requirements



C406.1.1 Compliance

Buildings shall comply as follows:

1. Buildings >1,000 s.f.:

comply with Additional Energy Credits Requirement:

2. Buildings >2,500 s.f.:

comply with Additional Energy Credits Requirement AND

comply with Additional Renewable & Load Management Credits

Chapter 4

Additional Efficiency, Renewable and Load Management Requirements



C406.1.1 Additional Energy Efficiency Credit Requirements

How many points does my building need?

	Building Occupancy Group								
	R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
Energy Credit Requirements	79	46	83	30	60	75	90	65	36

What about mixed occupancy?

Calculate weighted average of credit requirements based on square footage of floor area

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group	
		R-2, R-4, and I-1	De
E01	Envelope Performance		
E02	UA Reduction	19	
E03	Envelope Leak Reduction	13	
E04	Add Roof Insulation	7	
E05	Add Wall Insulation	13	
E06	Improve Fenestration	42	
H01	HVAC Performance	6	
H02	Heating Efficiency	14	
H03	Cooling Efficiency	3	
H04	Residential HVAC Control	21	
H05	Energy Recovery	46	
W01	Recovered/Renewable Water Heat	93	
W02	Heat Pump Water Heater	81	
W03	SWH Pipe Insulation	6	
W04	Point of Use Water Heaters		
W05	Thermostatic Balance Valves	3	

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group									
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other	
W06	SWH Heat Trace System	11	1	7	5	3	5	5	2	5	
W07	SWH Submeters	17								17	
W08	SWH Distribution Sizing	68		26						47	
W09	Shower Heat Recovery	25	1	9						10	
P01	Energy Monitoring	3	3	2	3	2	5	3	5	3	
L01	Lighting Performance										
L02	Enhanced Digital Lighting Controls	1	4	1	4	1	5	4	3	3	
L03	Increase Occupancy Sensors	1	4	2	4	1	6	3	4	3	
L04	Increase Daylight Area	2	5	3	6	1	8	5	4	4	
L05	Residential Light Control	3									
L06	Reduced Lighting Power	1	5	1	5	1	6	5	4	4	
Q01	Efficient Elevator Equipment	4	2	2	4	0	3	4	5	3	
Q02	Commercial Kitchen Equipment					21					
Q03	Residential Kitchen Equipment	13		10							
Q04	Fault Detection	3	3	2	3	3	3	4	6	4	

C406.1.2 Additional Energy Efficiency Credit Requirements

AEECR Exceptions:

1. Core & shell buildings and build-out construction that does not have final lighting or HVAC systems installed under a prior building permit have reduced credit requirements
2. Unconditioned parking garages that achieve 50% of credits required for use groups S-1 and S-2
3. Portions of buildings devoted to manufacturing or industrial use

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
E01	Envelope Performance	Determined in accordance with Section C406.2.1.1								
E02	UA Reduction	19	5	13	20	33	28	25	37	28
E03	Envelope Leak Reduction	13	9	28	6	42	13	8	68	41
E04	Add Roof Insulation	7	2	3	3	2	24	23	10	9
E05	Add Wall Insulation	13	3	5	8	2	16	7	7	9
E06	Improve Fenestration	42	6	13	21	4	10	34	6	17
H01	HVAC Performance	6	6	6	6		9	8		8
H02	Heating Efficiency	14	11	6	9	19	29	15	44	18
H03	Cooling Efficiency	3			1		7	4		
H04	Residential HVAC Control	21								
H05	Energy Recovery	46	65	41	114	84	242	43	180	90
W01	Recovered/Renewable Water Heat	93	6	36	12	34	13	13	3	26
W02	Heat Pump Water Heater	81	3	30	5	25	4	10	1	20
W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1

More Efficient HVAC Equipment Performance:

For systems using Total System Performance Ratio (TSPR)

TSPR exceeds minimum TSPR requirement by 5%

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
E01	Envelope Performance	Determined in accordance with Section C406.2.1.1								
E02	UA Reduction	19	5	13	20	33	28	25	37	28
E03	Envelope Leak Reduction	13	9	28	6	42	13	8	68	41
E04	Add Roof Insulation	7	2	3	3	2	24	23	10	9
E05	Add Wall Insulation	13	3	5	8	2	16	7	7	9
E06	Improve Fenestration	42	6	13	21	4	10	34	6	17
H01	HVAC Performance	6	6	6	6		9	8		8
H02	Heating Efficiency	14	11	6	9	19	29	15	44	18
H03	Cooling Efficiency	3			1		7	4		
H04	Residential HVAC Control	21								
H05	Energy Recovery	46	65	41	114	84	242	43	180	90
W01	Recovered/Renewable Water Heat	93	6	36	12	34	13	13	3	26
W02	Heat Pump Water Heater	81	3	30	5	25	4	10	1	20
W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1

More Efficient HVAC Equipment HEATING:

- Equipment shall be 5% more efficient than requirement
- Extra credit if $\geq 5\%$. Use formula to calculate
- Electric resistance heating capacity limited to 20% of system capacity (exception: HP supplemental heating)

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
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E04	Add Roof Insulation	7	2	3	3	2	24	23	10	9
E05	Add Wall Insulation	13	3	5	8	2	16	7	7	9
E06	Improve Fenestration	42	6	13	21	4	10	34	6	17
H01	HVAC Performance	6	6	6	6		9	8		8
H02	Heating Efficiency	14	11	6	9	10	20	15	11	18
H03	Cooling Efficiency	3			1		7	4		
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W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1

More Efficient HVAC Equipment COOLING:

- Equipment shall be 5% more efficient than requirement
- Extra credit if $\geq 5\%$. Use formula to calculate
- Fan power shall be 95% of allowed fan power (if fan energy not included in packaged equipment rating)

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
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E05	Add Wall Insulation	13	3	5	8	2	16	7	7	9
E06	Improve Fenestration	42	6	13	21	4	10	34	6	17
H01	HVAC Performance	6	6	6	6		9	8		8
H02	Heating Efficiency	14	11	6	9	19	29	15	44	18
H03	Cooling Efficiency	3			1		7	4		
H04	Residential HVAC Control	21								
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W01	Recovered/Renewable Water Heat	93	6	36	12	34	13	13	3	26
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W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1

Residential HVAC Control:

Automatic setback of at least 5°F for heating and cooling for dwelling and sleeping units

Several control strategies to select from

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
E01	Envelope Performance	Determined in accordance with Section C406.2.1.1								
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E04	Add Roof Insulation	7	2	3	3	2	24	23	10	9
E05	Add Wall Insulation	13	3	5	8	2	16	7	7	9
E06	Improve Fenestration	42	6	13	21	4	10	34	6	17
H01	HVAC Performance	6	6	6	6		9	8		8
H02	Heating Efficiency	14	11	6	9	19	29	15	44	18
H03	Cooling Efficiency	3			1		7	4		
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W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1

Energy Recovery:

Only for areas where single-zone HVAC units are not required to have variable speed fan control. Shall include:

- 75% Enthalpy recovery (or 75% Sensible if no cooling)
- Auto economizing
- Systems providing mechanical dehumidification: Recovered energy used for reheat

C406.2 Energy Efficiency Measures and Credits

Reduced Energy Use In-Service Water Heating:

Broken into 3 sections

- System Efficiency

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
W01	Recovered/Renewable Water Heat	93	6	36	12	34	13	13	3	26
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W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1
W06	SWH Heat Trace System	11	1	7	5	3	5	5	2	5
W07	SWH Submeters	17								17
W08	SWH Distribution Sizing	68		26						47
W09	Shower Heat Recovery	25	1	9						10

C406.2 Energy Efficiency Measures and Credits

Reduced Energy Use In-Service Water Heating:

Broken into 3 sections

- System Efficiency
- Distribution temperature maintenance

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
W01	Recovered/Renewable Water Heat	93	6	36	12	34	13	13	3	26
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W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1
W06	SWH Heat Trace System	11	1	7	5	3	5	5	2	5
W07	SWH Submeters	17								17
W08	SWH Distribution Sizing	68		26						47
W09	Shower Heat Recovery	25	1	9						10

C406.2 Energy Efficiency Measures and Credits

Reduced Energy Use In-Service Water Heating:

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
W01	Recovered/Renewable Water Heat	93	6	36	12	34	13	13	3	26
W02	Heat Pump Water Heater	81	3	30	5	25	4	10	1	20
W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1
W06	SWH Heat Trace System	11	1	7	5	3	5	5	2	5
W07	SWH Submeters	17								17
W08	SWH Distribution Sizing	68		26						47
W09	Shower Heat Recovery	25	1	9						10

Broken into 3 sections

- System Efficiency
- Distribution temperature maintenance
- Other

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
W01	Recovered/Renewable Water Heat	93	6	36	12	34	13	13	3	26
W02	Heat Pump Water Heater	81	3	30	5	25	4	10	1	20
W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1
W06	SWH Heat Trace System	11	1	7	5	3	5	5	2	5
W07	SWH Submeters	17								17
W08	SWH Distribution Sizing	68		26						47
W09	Shower Heat Recovery	25	1	9						10

Reduced Energy Use In-Service Water Heating:

Achieve points by selecting one of the following:

- 1) Pick W01 or W02
- 2) Pick W04, W05, or W06
- 3) Pick W03, W07, W08, or W09
 - Can be combined
 - Can be combined with either option 1 or 2 above

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and L1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
W01	Recovered/Renewable Water Heat	93	6	36	12	34	13	13	3	26
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W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1
W06	SWH Heat Trace System	11	1	7	5	3	5	5	2	5
W07	SWH Submeters	17								17
W08	SWH Distribution Sizing	68		26						47
W09	Shower Heat Recovery	25	1	9						10

Recovered or Renewable Water Heating:

Meet 30% of annual hot water requirements by one of the following means:

- Waste heat recovery (off of SHW, heat recovery chiller, etc.)
- Air-to-Water heat pump that precools chilled water return
- On-site renewables

Meet 70% of annual hot water requirements if required to comply with C403.10.5

C406.2 Energy Efficiency Measures and Credits

Heat Pump Water Heater:

Meet 30% of demand without backup at ambient condition of 67.5°F

If supplemental electric resistance heating: Heat pump capacity = 40% of 1st hour draw

A host of other design-related conditions

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
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W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1
W06	SWH Heat Trace System	11	1	7	5	3	5	5	2	5
W07	SWH Submeters	17								17
W08	SWH Distribution Sizing	68		26						47
W09	Shower Heat Recovery	25	1	9						10

C406.2 Energy Efficiency Measures and Credits

Heat Pump Water Heater:

Meet 30% of demand without backup at ambient condition of 67.5°F

If supplemental electric resistance heating: Heat pump capacity = 40% of 1st hour draw

A host of other design-related conditions

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ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
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W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1
W06	SWH Heat Trace System	11	1	7	5	3	5	5	2	5
W07	SWH Submeters	17								17
W08	SWH Distribution Sizing	68		26						47
W09	Shower Heat Recovery	25	1	9						10

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
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W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1
W06	SWH Heat Trace System	11	1	7	5	3	5	5	2	5
W07	SWH Submeters	17								17
W08	SWH Distribution Sizing	68		26						47
W09	Shower Heat Recovery	25	1	9						10

Reduced Energy Use In-Service Water Heating:

Pick W01 or W02.....

Except C406.2.3.1.3

Combination Service Water Heating Systems says:

“Where SWH employs both, W01 and W02 may be combined and receive the sum of both credits”

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
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W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1
W06	SWH Heat Trace System	11	1	7	5	3	5	5	2	5
W07	SWH Submeters	17								17
W08	SWH Distribution Sizing	68		26						47
W09	Shower Heat Recovery	25	1	9						10

Pipe Insulation Increase:

Increase insulation thickness by 1.5x required

Insulation installed from source to fixture shutoff

Prorate credit if less than 50% of pipe insulation does not meet the 1.5x requirement

C406.2 Energy Efficiency Measures and Credits

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		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
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W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1
W06	SWH Heat Trace System	11	1	7	5	3	5	5	2	5
W07	SWH Submeters	17								17
W08	SWH Distribution Sizing	68		26						47
W09	Shower Heat Recovery	25	1	9						10

Point of Use Water Heater:

- Building is > 10,000sf
- No recirc or heat trace piping
- 100% of base pipe insulation requirements met, from WH to fixture termination
- <0.25 gallons of water in pipe between WH and termination of fixture pipe

- Local recirc or heat trace piping allowed for separate WHs serving commercial kitchens or showers in locker rooms.

C406.2 Energy Efficiency Measures and Credits

Thermostatic Balancing Valves (TBV):

Each recirc branch return shall have a TBV set to minimal return water flow when return temperature is > 120°F

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ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
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W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1
W06	SWH Heat Trace System	11	1	7	5	3	5	5	2	5
W07	SWH Submeters	17								17
W08	SWH Distribution Sizing	68		26						47
W09	Shower Heat Recovery	25	1	9						10

C406.2 Energy Efficiency Measures and Credits

Heat Trace System:

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
W01	Recovered/Renewable Water Heat	93	6	36	12	34	13	13	3	26
W02	Heat Pump Water Heater	81	3	30	5	25	4	10	1	20
W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1
W06	SWH Heat Trace System	11	1	7	5	3	5	5	2	5
W07	SWH Submeters	17								17
W08	SWH Distribution Sizing	68		26						47
W09	Shower Heat Recovery	25	1	9						10

- Building is > 10,000sf
- Central water system
- Self-regulating
 - Electric heat cables
 - Connection kits
 - Electronic controls
- Installed directly on hot water supply pipes underneath insulation

This replaces standby losses

C406.2 Energy Efficiency Measures and Credits

Water Heating System Submeters:

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
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W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1
W06	SWH Heat Trace System	11	1	7	5	3	5	5	2	5
W07	SWH Submeters	17								17
W08	SWH Distribution Sizing	68		26						47
W09	Shower Heat Recovery	25	1	9						10

Central DHW systems

Dwelling units provided with hot water meter connected to reporting system

Reports actual DHW use

C406.2 Energy Efficiency Measures and Credits

SHW Flow Reduction:

Flow or consumption rating less than the following:

1.2 gpm lavatory sinks

1.5 gpm kitchen sinks

1.5 gpm showerheads

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
W01	Recovered/Renewable Water Heat	93	6	36	12	34	13	13	3	26
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W04	Point of Use Water Heaters				18			4		11
W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1
W06	SWH Heat Trace System	11	1	7	5	3	5	5	2	5
W07	SWH Submeters	17								17
W08	SWH Distribution Sizing	68		26						47
W09	Shower Heat Recovery	25	1	9						10

C406.2 Energy Efficiency Measures and Credits

Shower Drain Heat Recovery:

≥54% recovery efficiency

Group E if more than 8 showers

Partial credit for buildings where all but ground floor showers are served

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
W01	Recovered/Renewable Water Heat	93	6	36	12	34	13	13	3	26
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W03	SWH Pipe Insulation	6	1	4	4	2	4	4	1	3
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W05	Thermostatic Balance Valves	3	0	2	1	1	1	1	1	1
W06	SWH Heat Trace System	11	1	7	5	3	5	5	2	5
W07	SWH Submeters	17								17
W08	SWH Distribution Sizing	68		26						47
W09	Shower Heat Recovery	25	1	9						10

C406.2 Energy Efficiency Measures and Credits

Energy Monitoring:

Buildings required to install Energy Monitoring per C405.12 cannot achieve credits

To achieve points, comply with section C405.12

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
P01	Energy Monitoring	3	3	2	3	2	5	3	5	3
L01	Lighting Performance									
L02	Enhanced Digital Lighting Controls	1	4	1	4	1	5	4	3	3
L03	Increase Occupancy Sensors	1	4	2	4	1	6	3	4	3
L04	Increase Daylight Area	2	5	3	6	1	8	5	4	4
L05	Residential Light Control	3								
L06	Reduced Lighting Power	1	5	1	5	1	6	5	4	4
Q01	Efficient Elevator Equipment	4	2	2	4	0	3	4	5	3
Q02	Commercial Kitchen Equipment					21				
Q03	Residential Kitchen Equipment	13		10						
Q04	Fault Detection	3	3	2	3	3	3	4	6	4

C406.2 Energy Efficiency Measures and Credits

Energy Savings in Lighting Systems:

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
P01	Energy Monitoring	3	3	2	3	2	5	3	5	3
L01	Lighting Performance									
L02	Enhanced Digital Lighting Controls	1	4	1	4	1	5	4	3	3
L03	Increase Occupancy Sensors	1	4	2	4	1	6	3	4	3
L04	Increase Daylight Area	2	5	3	6	1	8	5	4	4
L05	Residential Light Control	3								
L06	Reduced Lighting Power	1	5	1	5	1	6	5	4	4
Q01	Efficient Elevator Equipment	4	2	2	4	0	3	4	5	3
Q02	Commercial Kitchen Equipment					21				
Q03	Residential Kitchen Equipment	13		10						
Q04	Fault Detection	3	3	2	3	3	3	4	6	4

Meet one of the following:

- Pick any measure ID
- Pick any combo of L03, L04, L05 and L06
- Pick any combo of L02, L03, and L04

C406.2 Energy Efficiency Measures and Credits

Lighting Performance:

Reserved for future use

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
P01	Energy Monitoring	3	3	2	3	2	5	3	5	3
L01	Lighting Performance									
L02	Enhanced Digital Lighting Controls	1	4	1	4	1	5	4	3	3
L03	Increase Occupancy Sensors	1	4	2	4	1	6	3	4	3
L04	Increase Daylight Area	2	5	3	6	1	8	5	4	4
L05	Residential Light Control	3								
L06	Reduced Lighting Power	1	5	1	5	1	6	5	4	4
Q01	Efficient Elevator Equipment	4	2	2	4	0	3	4	5	3
Q02	Commercial Kitchen Equipment					21				
Q03	Residential Kitchen Equipment	13		10						
Q04	Fault Detection	3	3	2	3	3	3	4	6	4

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
P01	Energy Monitoring	3	3	2	3	2	5	3	5	3
L01	Lighting Performance									
L02	Enhanced Digital Lighting Controls	1	4	1	4	1	5	4	3	3
L03	Increase Occupancy Sensors	1	4	2	4	1	6	3	4	3
L04	Increase Daylight Area	2	5	3	6	1	8	5	4	4
L05	Residential Light Control	3								
L06	Reduced Lighting Power	1	5	1	5	1	6	5	4	4
Q01	Efficient Elevator Equipment	4	2	2	4	0	3	4	5	3
Q02	Commercial Kitchen Equipment					21				
Q03	Residential Kitchen Equipment	13		10						
Q04	Fault Detection	3	3	2	3	3	3	4	6	4

Enhanced Digital Lighting Controls:

- $\geq 50\%$ of gross floor area complies
- Located, scheduled, and operated per C405.2
- Controlled by DDC
- Sequence of operations on construction drawings
- High-end Trim requirements
- Can be prorated

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
P01	Energy Monitoring	3	3	2	3	2	5	3	5	3
L01	Lighting Performance									
L02	Enhanced Digital Lighting Controls	1	4	1	4	1	5	4	3	3
L03	Increase Occupancy Sensors	1	4	2	4	1	6	3	4	3
L04	Increase Daylight Area	2	5	3	6	1	8	5	4	4
L05	Residential Light Control	3								
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Q01	Efficient Elevator Equipment	4	2	2	4	0	3	4	5	3
Q02	Commercial Kitchen Equipment					21				
Q03	Residential Kitchen Equipment	13		10						
Q04	Fault Detection	3	3	2	3	3	3	4	6	4

Increase Occupancy Sensor:

Must comply with all:

- List of required spaces
- 10-minute turn-off after occupants have left space
- If lighting power reduced, not turned off: 20% of full power

C406.2 Energy Efficiency Measures and Credits

Increase Daylight Area:

5% more area served than base code requirement

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
P01	Energy Monitoring	3	3	2	3	2	5	3	5	3
L01	Lighting Performance									
L02	Enhanced Digital Lighting Controls	1	4	1	4	1	5	4	3	3
L03	Increase Occupancy Sensors	1	4	2	4	1	6	3	4	3
L04	Increase Daylight Area	2	5	3	6	1	8	5	4	4
L05	Residential Light Control	3								
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Q01	Efficient Elevator Equipment	4	2	2	4	0	3	4	5	3
Q02	Commercial Kitchen Equipment					21				
Q03	Residential Kitchen Equipment	13		10						
Q04	Fault Detection	3	3	2	3	3	3	4	6	4

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
P01	Energy Monitoring	3	3	2	3	2	5	3	5	3
L01	Lighting Performance									
L02	Enhanced Digital Lighting Controls	1	4	1	4	1	5	4	3	3
L03	Increase Occupancy Sensors	1	4	2	4	1	6	3	4	3
L04	Increase Daylight Area	2	5	3	6	1	8	5	4	4
L05	Residential Light Control	3								
L06	Reduced Lighting Power	1	5	1	5	1	6	5	4	4
Q01	Efficient Elevator Equipment	4	2	2	4	0	3	4	5	3
Q02	Commercial Kitchen Equipment					21				
Q03	Residential Kitchen Equipment	13		10						
Q04	Fault Detection	3	3	2	3	3	3	4	6	4

Residential Light Control:

Occ sensor, automatic full OFF for common restrooms, laundry rooms, storage & utility rooms

Dwelling units have main controls that turns off all lights and switched receptacles

Minimum 2 switched receptacles installed & ID'd

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
P01	Energy Monitoring	3	3	2	3	2	5	3	5	3
L01	Lighting Performance									
L02	Enhanced Digital Lighting Controls	1	4	1	4	1	5	4	3	3
L03	Increase Occupancy Sensors	1	4	2	4	1	6	3	4	3
L04	Increase Daylight Area	2	5	3	6	1	8	5	4	4
L05	Residential Light Control	3								
L06	Reduced Lighting Power	1	5	1	5	1	6	5	4	4
Q01	Efficient Elevator Equipment	4	2	2	4	0	3	4	5	3
Q02	Commercial Kitchen Equipment					21				
Q03	Residential Kitchen Equipment	13		10						
Q04	Fault Detection	3	3	2	3	3	3	4	6	4

Reduced Lighting Power:

LPD for interior spaces:

- 95% or less of required LPD
 - R-1 & R-2: common areas only

In unit requirements:

- Fixtures: ≥ 80 lumens per watt
- Lamps: ≥ 90 lumens per watt

Formula to determine credits

C406.2 Energy Efficiency Measures and Credits

Other:

Pick any combination

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
P01	Energy Monitoring	3	3	2	3	2	5	3	5	3
L01	Lighting Performance									
L02	Enhanced Digital Lighting Controls	1	4	1	4	1	5	4	3	3
L03	Increase Occupancy Sensors	1	4	2	4	1	6	3	4	3
L04	Increase Daylight Area	2	5	3	6	1	8	5	4	4
L05	Residential Light Control	3								
L06	Reduced Lighting Power	1	5	1	5	1	6	5	4	4
Q01	Efficient Elevator Equipment	4	2	2	4	0	3	4	5	3
Q02	Commercial Kitchen Equipment					21				
Q03	Residential Kitchen Equipment	13		10						
Q04	Fault Detection	3	3	2	3	3	3	4	6	4

C406.2 Energy Efficiency Measures and Credits

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
P01	Energy Monitoring	3	3	2	3	2	5	3	5	3
L01	Lighting Performance									
L02	Enhanced Digital Lighting Controls	1	4	1	4	1	5	4	3	3
L03	Increase Occupancy Sensors	1	4	2	4	1	6	3	4	3
L04	Increase Daylight Area	2	5	3	6	1	8	5	4	4
L05	Residential Light Control	3								
L06	Reduced Lighting Power	1	5	1	5	1	6	5	4	4
Q01	Efficient Elevator Equipment	4	2	2	4	0	3	4	5	3
Q02	Commercial Kitchen Equipment					21				
Q03	Residential Kitchen Equipment	13		10						
Q04	Fault Detection	3	3	2	3	3	3	4	6	4

Efficient Elevator Equipment:

Buildings 3 or more stories

Elevators: Energy Efficiency class A per ISO 25745-2

Use formula to determine if equipment qualifies

C406.2 Energy Efficiency Measures and Credits

Fault Detection:

Projects not required to comply with C403.2.3

Install fault detection and diagnostics system to monitor HVAC and comply with C403.2.3

**TABLE C406.2.1
ENERGY EFFICIENCY MEASURES AND CREDITS BY OCCUPANCY GROUP**

ID	Energy Credit Measure	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
P01	Energy Monitoring	3	3	2	3	2	5	3	5	3
L01	Lighting Performance									
L02	Enhanced Digital Lighting Controls	1	4	1	4	1	5	4	3	3
L03	Increase Occupancy Sensors	1	4	2	4	1	6	3	4	3
L04	Increase Daylight Area	2	5	3	6	1	8	5	4	4
L05	Residential Light Control	3								
L06	Reduced Lighting Power	1	5	1	5	1	6	5	4	4
Q01	Efficient Elevator Equipment	4	2	2	4	0	3	4	5	3
Q02	Commercial Kitchen Equipment					21				
Q03	Residential Kitchen Equipment	13		10						
Q04	Fault Detection	3	3	2	3	3	3	4	6	4

C406.1.2 Renewable & Load Management Credit Requirements

How many points does my building need?

**TABLE C406.1.2
RENEWABLE AND LOAD MANAGEMENT CREDIT REQUIREMENTS BY BUILDING
OCCUPANCY GROUP**

	Building Occupancy Group								
	R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
Renewable and Load Management Credit Requirements	16	11	14	24	4	25	22	20	17

C406.3 Renewable and Load Management Credit Requirements

**TABLE C406.3.1
Renewable and Load Management Credit Requirements by Building Occupancy Group**

ID	Renewable and Load Management Credit	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
R01	On-Site Renewable Energy	9	6	8	14	2	9	13	24	11
G01	Lighting Load Management	5	14	9	10	4	18	16	36	14
G02	HVAC Load Management	10	12		8	16	14	18	14	13
G03	Automated Shading	1		1	5		8	14		5
G04	Electric Energy Storage	14	13	13	16	4	11	20	24	14
G05	Cooling Energy Storage	7	11	12	12	2	9	16	1	9
G06	SHW Energy Storage	18	4	26	6	15	4	7	2	10
G07	Building Thermal Mass	27	26	26	8	6	13	31	20	20
C01	Insulation Embodied Carbon	5	3	4	8	1	8	7	6	5
E01	Additional Electric Infrastructure	16								

C406.3 Renewable & Load Management Credit Requirements

TABLE C406.3.1

Renewable and Load Management Credit Requirements by Building Occupancy Group

ID	Renewable and Load Management Credit	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
R01	On-Site Renewable Energy	9	6	8	14	2	9	13	24	11
G01	Lighting Load Management	5	14	9	10	4	18	16	36	14
G02	HVAC Load Management	10	12		8	16	14	18	14	13
G03	Automated Shading	1		1	5		8	14		5
G04	Electric Energy Storage	14	13	13	16	4	11	20	24	14
G05	Cooling Energy Storage	7	11	12	12	2	9	16	1	9
G06	SHW Energy Storage	18	4	26	6	15	4	7	2	10
G07	Building Thermal Mass	27	26	26	8	6	13	31	20	20
C01	Insulation Embodied Carbon	5	3	4	8	1	8	7	6	5
E01	Additional Electric Infrastructure	16								

Note:

Measures highlighted at left require controls to respond to:

- High, short-term electric prices; or
- Grid condition; or
- Peak building load

C406.3 Renewable & Load Management Credit Requirements

TABLE C406.3.1

Renewable and Load Management Credit Requirements by Building Occupancy Group

ID	Renewable and Load Management Credit	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
R01	On-Site Renewable Energy	9	6	8	14	2	9	13	24	11
G01	Lighting Load Management	5	14	9	10	4	18	16	36	14
G02	HVAC Load Management	10	12		8	16	14	18	14	13
G03	Automated Shading	1		1	5		8	14		5
G04	Electric Energy Storage	14	13	13	16	4	11	20	24	14
G05	Cooling Energy Storage	7	11	12	12	2	9	16	1	9
G06	SHW Energy Storage	18	4	26	6	15	4	7	2	10
G07	Building Thermal Mass	27	26	26	8	6	13	31	20	20
C01	Insulation Embodied Carbon	5	3	4	8	1	8	7	6	5
E01	Additional Electric Infrastructure	16								

On-Site Renewable Energy:

To qualify:

- 0.1 watts per gross square foot; or
- Secure off-site renewable energy

Use formula to determine total credits

C406.3 Renewable & Load Management Credit Requirements

TABLE C406.3.1

Renewable and Load Management Credit Requirements by Building Occupancy Group

ID	Renewable and Load Management Credit	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
R01	On-Site Renewable Energy	9	6	8	14	2	9	13	24	11
G01	Lighting Load Management	5	14	9	10	4	18	16	36	14
G02	HVAC Load Management	10	12		8	16	14	18	14	13
G03	Automated Shading	1		1	5		8	14		5
G04	Electric Energy Storage	14	13	13	16	4	11	20	24	14
G05	Cooling Energy Storage	7	11	12	12	2	9	16	1	9
G06	SHW Energy Storage	18	4	26	6	15	4	7	2	10
G07	Building Thermal Mass	27	26	26	8	6	13	31	20	20
C01	Insulation Embodied Carbon	5	3	4	8	1	8	7	6	5
E01	Additional Electric Infrastructure	16								

Lighting Load Mgmt:

Luminaires have dimming ability and automatic load management tools:

- Reduce load in 75% of building
- Reduce load by 20% or more
- Period no longer than 15 minutes

Prorate credits based on formula for projects where 50-75% of fixtures are controlled

C406.3 Renewable & Load Management Credit Requirements

TABLE C406.3.1

Renewable and Load Management Credit Requirements by Building Occupancy Group

ID	Renewable and Load Management Credit	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
R01	On-Site Renewable Energy	9	6	8	14	2	9	13	24	11
G01	Lighting Load Management	5	14	9	10	4	18	16	36	14
G02	HVAC Load Management	10	12	8	8	16	14	18	14	13
G03	Automated Shading	1		1	5		8	14		5
G04	Electric Energy Storage	14	13	13	16	4	11	20	24	14
G05	Cooling Energy Storage	7	11	12	12	2	9	16	1	9
G06	SHW Energy Storage	18	4	26	6	15	4	7	2	10
G07	Building Thermal Mass	27	26	26	8	6	13	31	20	20
C01	Insulation Embodied Carbon	5	3	4	8	1	8	7	6	5
E01	Additional Electric Infrastructure	16								

HVAC Load Management:

Cooling & Electric Heating:

- Gradually increase/decrease cooling setpoint by 3°F for minimum of 3 hours: OR
- Reduce capacity to 60% of installed capacity during peak event

HVAC serving multiple zones, with < 70% outdoor air:

Reduce outdoor air by 30% during peak event

C406.3 Renewable & Load Management Credit Requirements

TABLE C406.3.1

Renewable and Load Management Credit Requirements by Building Occupancy Group

ID	Renewable and Load Management Credit	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
R01	On-Site Renewable Energy	9	6	8	14	2	9	13	24	11
G01	Lighting Load Management	5	14	9	10	4	18	16	36	14
G02	HVAC Load Management	10	12	8	8	16	14	18	14	13
G03	Automated Shading	1		1	5		8	14		5
G04	Electric Energy Storage	14	13	13	16	4	11	20	24	14
G05	Cooling Energy Storage	7	11	12	12	2	9	16	1	9
G06	SHW Energy Storage	18	4	26	6	15	4	7	2	10
G07	Building Thermal Mass	27	26	26	8	6	13	31	20	20
C01	Insulation Embodied Carbon	5	3	4	8	1	8	7	6	5
E01	Additional Electric Infrastructure	16								

Automated Shading:

Exterior devices: Reduce solar heat gain by 50%

Interior devices: minimum solar reflectance of 0.50 receive 40% of the credits

Exterior & Interior devices:

- 90% coverage of E, S and W fenestration exposures
- Automatically controlled
- Manual override locked out during peak events

C406.3 Renewable & Load Management Credit Requirements

**TABLE C406.3.1
Renewable and Load Management Credit Requirements by Building Occupancy Group**

ID	Renewable and Load Management Credit	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
R01	On-Site Renewable Energy	9	6	8	14	2	9	13	24	11
G01	Lighting Load Management	5	14	9	10	4	18	16	36	14
G02	HVAC Load Management	10	12		8	16	14	18	14	13
G03	Automated Shading	1		1	5		8	14		5
G04	Electric Energy Storage	14	13	13	16	4	11	20	24	14
G05	Cooling Energy Storage	7	11	12	12	2	9	16	1	9
G06	SHW Energy Storage	18	4	26	6	15	4	7	2	10
G07	Building Thermal Mass	27	26	26	8	6	13	31	20	20
C01	Insulation Embodied Carbon	5	3	4	8	1	8	7	6	5
E01	Additional Electric Infrastructure	16								

Electric Energy Storage:

Automatically Charge during non-peak periods, discharge during peak events

Minimum capacity of 1.5 Watt-hour/s.f. of gross building area. Credits shown based on 5 Wh/sf

Actual credits based on formula. Limited to 1.5-15 Wh/sf

C406.3 Renewable & Load Management Credit Requirements

TABLE C406.3.1

Renewable and Load Management Credit Requirements by Building Occupancy Group

ID	Renewable and Load Management Credit	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
R01	On-Site Renewable Energy	9	6	8	14	2	9	13	24	11
G01	Lighting Load Management	5	14	9	10	4	18	16	36	14
G02	HVAC Load Management	10	12		8	16	14	18	14	13
G03	Automated Shading	1		1	5		8	14		5
G04	Electric Energy Storage	14	13	13	16	4	11	20	24	14
G05	Cooling Energy Storage	7	11	12	12	2	9	16	1	9
G06	SHW Energy Storage	18	4	26	6	15	4	7	2	10
G07	Building Thermal Mass	27	26	26	8	6	13	31	20	20
C01	Insulation Embodied Carbon	5	3	4	8	1	8	7	6	5
E01	Additional Electric Infrastructure	16								

Cooling Energy Storage:

Automatically activate Ice or chilled water storage during summer peak periods

Actual credits based on formula

C406.3 Renewable & Load Management Credit Requirements

TABLE C406.3.1

Renewable and Load Management Credit Requirements by Building Occupancy Group

ID	Renewable and Load Management Credit	Building Occupancy Group								
		R-2, R-4, and I-1	I-2	R-1	B	A-2	M	E	S-1 and S-2	All Other
R01	On-Site Renewable Energy	9	6	8	14	2	9	13	24	11
G01	Lighting Load Management	5	14	9	10	4	18	16	36	14
G02	HVAC Load Management	10	12		8	16	14	18	14	13
G03	Automated Shading	1		1	5		8	14		5
G04	Electric Energy Storage	14	13	13	16	4	11	20	24	14
G05	Cooling Energy Storage	7	11	12	12	2	9	16	1	9
G06	SHW Energy Storage	18	4	26	6	15	4	7	2	10
G07	Building Thermal Mass	27	26	26	8	6	13	31	20	20
C01	Insulation Embodied Carbon	5	3	4	8	1	8	7	6	5
E01	Additional Electric Infrastructure	16								

SWH Energy Storage:

Electric Service Water Heating

Suspend water heating during peak period. Either:

- 1) Preheat water above 140°F
 - Install tempering valves at delivery location
- 2) Provide additional storage capacity
 - 1/3 credits available where Heat Pump water heating is used

C406.3 Renewable & Load Management Credit Requirements

R&LM Exceptions:

1. Building achieves additional 70% of Energy Efficiency Credits from Table C406.1.1:
only 50% of R&LM credits required
2. Building achieves additional 120% of Energy Efficiency Credits from Table C406.1.1:
Zero R&LM credits required
3. Buildings 1,000-2,500 s.f. do not need to achieve R&LM Credits (only have to comply with Energy Credits Requirement)

C406.1.2 Renewable & Load Management Credit Requirements

R&LM Exceptions:

1. Building achieves additional 70% of Energy Efficiency Credits from Table C406.1.1:
only 50% of R&LM credits required
2. Building achieves additional 120% of Energy Efficiency Credits from Table C406.1.1:
Zero R&LM credits required
3. Buildings 1,000-2,500 s.f. do not need to achieve R&LM Credits (only have to comply with Energy Credits Requirement)



Questions?

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