Expanded C406 Energy and Demand Response Credits

Modify the 2021 International Energy Conservation Code as follows:

Delete and substitute as follows:

~~SECTIONC406ADDITIONAL EFFICIENCY REQUIREMENTS~~SECTIONC406ADDITIONAL EFFICIENCY, RENEWABLE, and LOAD MANAGEMENT REQUIREMENTS

Add new text as follows:

C406.1Compliance.
New buildings and changes in space conditioning, change of occupancy and building additions in accordance with Chapter 5 exceeding 500 square feet of floor area shall comply with the requirements of Section C406.1.1. Alterations shall comply with C406.1.3.

C406.1.1Additional energy efficiency credit requirements.

Projects shall comply with sufficient measures from C406.2 to achieve the minimum number of required efficiency credits from Table C406.1.1 based on building occupancy group and climate zone. Projects with multiple *occupancies*, unconditioned parking garages, alterations, and buildings with separate shell-and-core and initial build-out *construction* permits shall comply as follows:

1. Where a project contains multiple occupancies, credits in Table C406.1.1 from each building occupancy shall be weigh area to determine the weighted average project energy credits required.

2. Where separate permits are used for *building* core/shell and initial build-out construction then compliance shall be in ac Section C406.1.1.1.

3. Substantial *alterations* as described in Section C406.1.3 that are not initial build-out *construction* shall achieve half the the *building* occupancy.

4. Unconditioned parking garages shall achieve half the credits required for use groups S-1 and S-2 in Table C406.1.1.

Exceptions to C406.1.1:

1. Utility buildings, and miscellaneous use buildings up to 1000 ft² (90 m²) that are not occupied except for maintenance.

2. Industrial and manufacturing portions of factory use areas within buildings, not including office areas.

3. Where the core/shell complied in accordance with C407, the initial build-out alterations do not need to achieve any ene

Table C406.1.1 Energy Credit Requirements by Building Occupancy Group

Building Occupancy Group	Climate Zone																			
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R-2, R-4,and I-1	85	85	91	100	100	100	100	100	100	94	100	100	93	100	100	100	100	100	100
I-2	50	49	47	46	46	48	44	44	45	48	48	49	54	55	56	55	56	58	59
R-1	59	57	60	60	62	62	65	67	68	67	70	73	78	75	82	86	82	94	100
B	66	63	65	68	64	63	67	68	68	70	73	74	83	83	84	95	92	94	100
A-2	74	74	75	76	79	79	77	80	87	73	78	82	100	98	100	100	100	100	100
M	95	94	95	93	94	97	87	85	97	82	75	68	79	94	83	100	98	100	87

	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E	67	68	68	70	72	71	72	76	77	77	83	79	83	86	89	90	89	88	89
S-1 and S-2	90	89	95	92	93	91	66	83	95	38	62	90	100	93	87	100	100	100	98
All Other	37	36	37	38	38	39	37	38	41	34	37	39	42	43	44	47	46	47	47

C406.1.1.1 Building Core/Shell and Initial Build-Out Construction.

Where separate permits are used for *building* core/shell and initial build-out construction compliance shall be in accordance with the following requirements.

1. The building core and shell permit(s) shall achieve at least half the energy credits required in Table C406.1.1.

2. The *building envelope, equipment,* and *systems* in initial build-out construction exceeding 500 square feet of floor area the *alteration* did not have final lighting or HVAC systems installed under a prior building permit shall be deemed to con C406.1 where either:

    2.1 The energy credits achieved under the project plus the energy credits achieved under a prior core and shell permit credits required in Table C406.1.1 or

    2.2 The project achieves not less than one half of the credits required in Table C406.1.1.

C406.1.2 Additional renewable and load management credit requirements.

Projects in new buildings and *additions* that are greater than 5000 square feet (500 m^2) shall comply with sufficient measures from C406.3 to achieve the minimum number of required renewable and load management credits from Table C406.1.2 based on building occupancy group and climate zone.

Table C406.1.2 Renewable and Load Management Credit Requirements by Building Occupancy Group

Building Occupancy Group	Climate Zone																		
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R-2, R-4, and I-1	64	59	70	69	73	89	76	91	96	63	93	70	51	79	66	52	63	50	47
I-2	31	32	33	32	33	40	36	40	34	32	44	32	29	37	34	34	33	28	24
R-1	41	44	48	49	49	63	55	66	68	50	66	52	42	60	51	46	52	41	36
B	63	64	78	75	78	89	87	100	100	77	100	86	69	93	83	72	86	73	59
A-2	8	8	9	9	9	11	9	11	11	8	11	9	8	9	9	8	9	8	5
M	71	70	84	84	95	100	100	100	100	87	100	99	83	100	96	83	90	78	61
E	50	56	64	61	69	87	77	96	97	72	100	79	62	90	79	70	77	65	52
S-1 and S-2	100	100	100	100	100	100	100	100	100	98	100	100	78	100	100	69	94	70	60
All Other	55	55	66	63	69	81	72	87	89	61	87	69	53	75	67	54	63	52	43

C406.1.3 Substantial Alterations to Existing Buildings.

The *building envelope, equipment,* and *systems* in *alterations* to *buildings* exceeding 5000 square feet of *gross conditioned floor area* shall comply with the requirements of Section C406.1.1 and C406.1.2 where the alteration includes replacement of two or more of the following:

1. HVAC unitary systems or HVAC central heating or cooling equipment serving the alteration area, not including ductwor

2. 80% or more of the lighting fixtures in the *alteration* area

3. Building envelope components in the *alteration* area including new exterior cladding, fenestration, or insulation.

Table C406.1.2(8) Base Energy Credits for Group S-1 and S-2 Occupancies

ID	Energy Credit Abbreviated Title	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	1	2	1	1	1	2	25	2	0	62	11	14	74	21	6	75	57	56	21
E03	Envelope leak reduction	C406.2.1.3	2	2	1	2	1	3	31	3	x	77	14	17	92	25	8	95	71	69	26
E04	Add R-5 Roof Insulation	C406.2.1.4	8	7	6	6	6	7	12	10	4	8	11	10	8	12	13	5	8	7	11
E05	Add R-10 Roof Insulation	C406.2.1.4	13	12	10	11	10	11	18	17	7	14	19	18	14	20	22	10	14	12	19
E06	Add R-2.5ci Wall Insulation	C406.2.1.5	12	14	8	13	4	6	11	7	2	6	7	8	5	7	7	4	5	5	4
E07	Add R-5.0ci Wall Insulation	C406.2.1.5	19	23	13	21	7	10	15	12	3	10	12	13	9	12	12	7	9	9	8
E08	Fenestration U-0.45	C406.2.1.6	0	0	0	0	0	0	x	x	x	x	x	x	x	x	x	x	x	x	x
E09	Fenestration U-0.33	C406.2.1.6	x	x	x	x	0	0	0	0	0	0	0	0	x	x	x	x	x	x	x
E10	Fenestration U-0.31	C406.2.1.6	x	x	x	x	x	x	x	x	x	4	0	5	8	0	5	6	3	x	x
E11	Fenestration U-0.45	C406.2.1.6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	3	3	10	12
H01	HVAC Performance	C406.2.2.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H02	Heating efficiency	C406.2.2.2	x	x	x	x	x	x	16	3	1	33	17	22	41	31	21	44	38	43	43
H03	Cooling efficiency	C406.2.2.3	7	7	4	5	3	3	1	1	1	1	1	1	1	1	1	x	x	x	x
H04	Residential HVAC control	C406.2.2.4	8	9	6	6	4	5	21	8	2	44	38	30	50	57	26	42	48	36	34
H05	DOAS/fan control	C406.2.2.5	35	37	26	33	24	27	77	35	14	141	83	96	168	132	90	180	157	177	178
W01	SHW preheat recovery	C406.2.3.1a	8	7	9	8	10	10	8	10	12	5	8	8	4	6	9	3	4	3	3
W02	Heat pump water heater	C406.2.3.1b	2	2	2	2	2	2	2	2	3	1	2	2	1	2	2	1	1	1	1
W03	Efficient gas water heater	C406.2.3.1c	4	4	5	4	5	5	4	5	6	3	4	4	2	3	5	2	2	2	2
W04	SHW pipe insulation	C406.2.3.2	3	3	4	3	3	3	2	3	4	2	2	3	1	2	3	1	1	1	1
W05	Point of use water heaters	C406.2.3.3a	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W06	Thermostatic bal. valves	C406.2.3.3b	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

ID	Measure	Section																			
W07	SHW heat trace system	C406.2.3.3c	4	4	4	3	4	4	3	4	5	2	3	3	2	2	4	2	2	2	2
W08	SHW submeters	C406.2.3.4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W09	SHW distribution sizing	C406.2.3.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W10	Shower heat recovery	C406.2.3.6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
P01	Energy monitoring	C406.2.4	5	5	6	6	6	6	5	6	6	5	5	5	5	5	6	5	5	5	5
L01	Lighting Performance	C406.2.5.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	C406.2.5.2	10	10	12	11	12	14	9	12	14	6	9	9	3	6	9	3	5	3	2
L03	Increase occp. sensor	C406.2.5.3	12	12	14	13	15	14	12	14	17	7	11	11	5	7	11	4	6	3	3
L04	Increase daylight area	C406.2.5.4	15	14	18	16	18	17	13	16	21	7	12	11	5	8	10	4	6	6	5
L05	Residential light control	C406.2.5.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	C406.2.5.7	14	14	17	16	17	17	13	17	19	8	13	12	5	8	12	4	6	4	2
Q01	Efficient elevator	C406.2.7.1	15	14	18	16	18	18	15	18	21	9	14	14	7	10	14	5	7	5	5
Q02	Commercial kitchen equip.	C406.2.7.2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	C406.2.7.3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q04	Fault detection	C406.2.7.4	3	3	2	3	2	2	3	2	1	5	3	3	5	4	3	6	5	6	6

x indicates measure is not available for building occupancy in that climate zone

Energy credits achieved for the project shall be the sum of measure energy credits for individual measures included in the project. Credits are available for the measures listed in Section C406.2. Base energy credits are shown in Tables C406.1.2(1) through C406.1.2(9) based on building occupancies and climate zones. Measure energy credits achieved shall be determined in one of three ways, depending on the measure:

1. The measure energy credit shall be the base energy credit for the measure where no adjustment factor or formula is sl description in Section C406.2.

2. The measure energy credit shall be the base energy credit for the measure adjusted by a factor or formula as stated in description in Section C406.2. Where adjustments are applied, each measure energy credit shall be rounded to the ne

3. The measure energy credit shall be by direct formula as stated in the measure description in Section C406.2, where ea measure credit shall be rounded to the nearest whole number.

Table C406.1.2(1) Base Energy Credits for Group R-2, R-4, and I-1 Occupancies

ID	Energy Credit Title	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
			|— Climate Zone —|																		
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	8	13	7	11	6	8	9	6	1	24	8	9	30	15	5	32	28	31	36
E03	Envelope leak reduction	C406.2.1.3	15	10	12	8	6	16	13	5	1	47	7	9	65	16	x	73	43	52	26
E04	Add R-5 Roof Insulation	C406.2.1.4	1	0	0	1	1	1	2	2	1	3	2	2	3	3	0	4	4	3	4
E05	Add R-10 Roof Insulation	C406.2.1.4	1	1	1	1	1	1	4	3	1	5	3	4	6	5	0	7	7	6	8
E06	Add R-2.5ci Wall Insulation	C406.2.1.5	6	6	3	5	3	4	5	2	1	5	2	2	6	4	0	8	7	7	7
E07	Add R-5.0ci Wall Insulation	C406.2.1.5	10	10	6	8	5	6	8	4	1	8	3	4	11	7	0	14	12	13	13
E08	Fenestration U-0.45	C406.2.1.6	0	0	0	0	14	17	x	x	x	x	x	x	x	x	x	x	x	x	x
E09	Fenestration U-0.33	C406.2.1.6	x	x	x	x	7	9	15	6	0	0	7	2	x	x	x	x	x	x	x
E10	Fenestration U-0.31	C406.2.1.6	x	x	x	x	x	x	x	x	x	5	0	1	16	0	0	16	10	x	x
E11	Fenestration U-0.45	C406.2.1.6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	42	35	25	14
H01	HVAC Performance	C406.2.2.1	20	19	16	17	14	13	11	11	5	13	10	8	15	12	7	18	14	17	19
H02	Heating efficiency	C406.2.2.2	x	x	x	x	x	x	3	1	1	6	2	3	10	5	2	14	10	13	16
H03	Cooling efficiency	C406.2.2.3	7	6	4	4	3	3	1	1	1	1	1	1	1	1	x	x	x	x	x
H04	Residential HVAC control	C406.2.2.4	9	10	8	22	20	25	16	17	32	21	24	17	23	27	16	21	24	18	18
H05	DOAS/fan control	C406.2.2.5	32	31	27	28	23	23	28	21	12	42	24	24	56	36	19	73	54	70	79
W01	SHW preheat recovery	C406.2.3.1 a	61	63	74	74	85	88	101	100	121	103	109	122	102	111	130	93	106	99	96
W02	Heat pump water heater	C406.2.3.1 b	50	52	62	61	72	74	86	85	104	88	94	106	88	96	112	81	92	87	84
W03	Efficient gas water heater	C406.2.3.1 c	38	39	46	46	53	55	63	62	76	64	68	76	64	69	81	58	66	62	60

ID	Energy Credit Abbreviated Title	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
W04	SHW pipe insulation	C406.2.3.2	7	7	8	7	8	8	8	9	10	8	9	9	7	8	9	6	7	6	6
W05	Point of use water heaters	C406.2.3.3 a	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W06	Thermostatic bal. valves	C406.2.3.3 b	3	3	3	3	3	3	3	3	4	3	3	4	3	3	4	3	3	3	2
W07	SHW heat trace system	C406.2.3.3 c	12	12	13	13	14	15	15	15	18	14	15	16	13	14	16	11	13	11	10
W08	SHW submeters	C406.2.3.4	11	11	13	13	15	16	18	18	22	19	20	22	19	20	24	17	20	18	18
W09	SHW distribution sizing	C406.2.3.5	45	46	55	54	63	65	74	73	89	75	80	89	74	81	95	68	77	72	70
W10	Shower heat recovery	C406.2.3.6	15	16	19	19	22	23	26	26	32	27	29	32	27	29	34	25	28	27	26
P01	Energy monitoring	C406.2.4	3	3	2	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3
L01	Lighting Performance	C406.2.5.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	C406.2.5.2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
L03	Increase occp. sensor	C406.2.5.3	3	3	4	4	4	4	3	4	3	2	3	2	1	2	2	1	1	1	1
L04	Increase daylight area	C406.2.5.4	5	5	5	5	5	5	4	4	4	4	4	3	3	4	3	2	3	3	2
L05	Residential light control	C406.2.5.5	8	8	9	9	9	9	8	8	10	6	8	7	4	6	8	3	5	4	3
L06	Light power reduction	C406.2.5.7	2	2	2	2	2	2	2	2	2	1	2	1	1	1	1	1	1	1	1
Q01	Efficient elevator	C406.2.7.1	4	4	4	4	5	5	5	5	5	4	5	5	4	4	5	4	4	4	3
Q02	Commercial kitchen equip.	C406.2.7.2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	C406.2.7.3	15	15	17	16	17	18	17	18	20	16	17	18	15	16	18	13	15	13	12
Q04	Fault detection	C406.2.7.4	3	3	2	3	2	2	2	2	1	2	2	1	2	2	1	3	2	3	3

x indicates measure is not available for building occupancy in that climate zone

Table C406.1.2(2) Base Energy Credits for Group I-2 Occupancies

ID	Energy Credit Abbreviated Title	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	6	11	6	11	7	9	6	6	2	3	3	3	4	3	7	5	5	17	3

ID	Measure	Reference																				
E03	Envelope leak reduction	C406.2.1.3	5	3	4	3	5	8	8	3	2	6	2	2	7	3	1	9	7	19	5
E04	Add R-5 Roof Insulation	C406.2.1.4	0	0	0	1	1	1	1	1	0	1	0	0	1	1	0	1	1	1	2
E05	Add R-10 Roof Insulation	C406.2.1.4	1	1	0	1	1	1	1	1	0	1	1	1	2	1	0	2	1	2	3
E06	Add R-2.5ci Wall Insulation	C406.2.1.5	0	3	0	2	1	2	8	3	1	3	0	1	2	1	0	2	1	2	2
E07	Add R-5.0ci Wall Insulation	C406.2.1.5	0	3	0	3	2	2	9	4	1	4	1	1	3	0	0	3	3	3	3
E08	Fenestration U-0.45	C406.2.1.6	0	0	0	0	1	2	x	x	x	x	x	x	x	x	x	x	x	x	x
E09	Fenestration U-0.33	C406.2.1.6	x	x	x	x	2	3	2	3	1	0	1	0	x	x	x	x	x	x	x
E10	Fenestration U-0.31	C406.2.1.6	x	x	x	x	x	x	x	x	3	1	2	2	1	1	1	0	x	x	x
E11	Fenestration U-0.45	C406.2.1.6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	6	5	1	0
H01	HVAC Performance	C406.2.2.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H02	Heating efficiency	C406.2.2.2	x	x	x	x	2	3	4	3	7	6	4	6	8	6	10	11	12	15	19
H03	Cooling efficiency	C406.2.2.3	6	6	4	4	3	3	2	2	1	1	1	1	1	1	1	x	x	x	x
H04	Residential HVAC control	C406.2.2.4	8	8	6	18	16	17	11	12	23	13	16	13	14	17	17	13	19	15	17
H05	DOAS/fan control	C406.2.2.5	41	41	40	40	42	36	42	37	39	49	40	46	56	46	61	65	68	82	93
W01	SHW preheat recovery	C406.2.3.1a	4	4	4	4	5	5	5	5	6	6	6	6	6	6	6	6	5	5	5
W02	Heat pump water heater	C406.2.3.1b	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
W03	Efficient gas water heater	C406.2.3.1c	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
W04	SHW pipe insulation	C406.2.3.2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
W05	Point of use water heaters	C406.2.3.3a	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W06	Thermostatic bal. valves	C406.2.3.3b	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W07	SHW heat trace system	C406.2.3.3c	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1
W08	SHW submeters	C406.2.3.4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W09	SHW distribution sizing	C406.2.3.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W10	Shower heat recovery	C406.2.3.6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
P01	Energy monitoring	C406.2.4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
L01	Lighting Performance	C406.2.5.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	C406.2.5.2	5	5	5	5	5	6	5	6	6	5	6	6	5	5	5	4	4	3	2
L03	Increase occp. sensor	C406.2.5.3	5	5	5	5	5	5	5	5	6	5	5	6	5	5	5	4	4	3	2
L04	Increase daylight area	C406.2.5.4	7	7	7	7	7	7	7	7	8	6	6	6	6	6	5	5	5	5	4

ID	Energy Credit Abbreviated Title	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
L05	Residential light control	C406.2.5.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	C406.2.5.7	7	7	7	7	7	7	7	7	9	7	7	8	6	7	7	5	5	4	3
Q01	Efficient elevator	C406.2.7.1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1
Q02	Commercial kitchen equip.	C406.2.7.2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	C406.2.7.3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q04	Fault detection	C406.2.7.4	3	3	3	3	3	3	3	3	2	3	3	2	3	3	3	3	3	4	4

x indicates measure is not available for building occupancy in that climate zone.

Table C406.1.2(3) Base Energy Credits for Group R-1 Occupancies

ID	Energy Credit Abbreviated Title	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	8	12	7	12	6	8	6	7	13	8	5	3	9	7	3	13	12	18	26
E03	Envelope leak reduction	C406.2.1.3	15	9	12	8	6	16	7	5	10	14	3	1	19	5	x	28	16	28	18
E04	Add R-5 Roof Insulation	C406.2.1.4	0	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	2
E05	Add R-10 Roof Insulation	C406.2.1.4	1	1	1	2	2	1	2	1	1	2	1	2	2	1	2	3	2	2	3
E06	Add R-2.5ci Wall Insulation	C406.2.1.5	14	19	8	19	2	3	3	2	0	4	1	3	4	2	2	5	3	4	3
E07	Add R-5.0ci Wall Insulation	C406.2.1.5	18	26	11	25	3	4	5	3	0	6	2	4	7	4	4	8	6	8	5
E08	Fenestration U-0.45	C406.2.1.6	2	2	1	2	2	3	x	x	x	x	x	x	x	x	x	x	x	x	x
E09	Fenestration U-0.33	C406.2.1.6	x	x	x	x	2	3	4	3	1	1	6	3	x	x	x	x	x	x	x
E10	Fenestration U-0.31	C406.2.1.6	x	x	x	x	x	x	x	x	x	4	1	3	6	1	3	6	4	x	x
E11	Fenestration U-0.45	C406.2.1.6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	13	8	5	2
H01	HVAC Performance	C406.2.2.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H02	Heating efficiency	C406.2.2.2	x	x	x	x	x	x	1	1	6	2	1	1	3	2	2	6	4	8	11
H03	Cooling efficiency	C406.2.2.3	7	6	4	4	3	2	1	2	1	1	2	1	1	1	1	x	x	x	x
H04	Residential HVAC control	C406.2.2.4	8	8	6	31	28	36	19	23	54	21	31	22	22	30	21	19	24	18	19
H05	DOAS/fan control	C406.2.2.5	32	30	26	28	25	23	24	22	28	26	22	20	30	26	19	41	34	48	62
W01	SHW preheat recovery	C406.2.3.1a	18	19	22	22	25	27	31	31	32	34	34	38	37	36	40	36	37	36	35
W02	Heat pump water heater	C406.2.3.1b	14	15	18	17	20	22	25	25	27	29	29	32	31	31	34	30	32	31	30
W03	Efficient gas water heater	C406.2.3.1c	11	12	14	14	16	17	19	19	20	21	21	24	23	23	25	22	23	23	22
W04	SHW pipe insulation	C406.2.3.2	3	3	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3
W05	Point of use water heaters	C406.2.3.3a	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

ID	Energy Credit Abbreviated Title	Section																			
W06	Thermostatic bal. valves	C406.2.3.3b	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	1	1
W07	SHW heat trace system	C406.2.3.3c	5	6	6	6	6	7	7	7	7	7	7	8	7	7	8	7	7	6	6
W08	SHW submeters	C406.2.3.4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W09	SHW distribution sizing	C406.2.3.5	13	14	16	16	18	20	22	22	23	25	25	28	27	26	29	26	27	26	25
W10	Shower heat recovery	C406.2.3.6	4	5	5	5	6	7	8	8	8	9	9	10	10	9	10	9	10	10	9
P01	Energy monitoring	C406.2.4	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
L01	Lighting Performance	C406.2.5.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	C406.2.5.2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
L03	Increase occp. sensor	C406.2.5.3	3	3	3	3	3	3	3	3	4	2	3	3	2	2	3	2	2	1	1
L04	Increase daylight area	C406.2.5.4	4	5	5	4	5	5	4	4	5	4	4	4	3	4	3	3	3	3	2
L05	Residential light control	C406.2.5.5	7	7	8	8	8	8	8	8	9	6	7	7	5	7	7	4	5	4	3
L06	Light power reduction	C406.2.5.7	1	1	2	2	2	2	2	2	2	1	2	2	1	1	2	1	1	1	1
Q01	Efficient elevator	C406.2.7.1	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	2	2	2	2
Q02	Commercial kitchen equip.	C406.2.7.2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	C406.2.7.3	9	9	10	10	10	11	11	11	11	11	11	12	11	11	12	10	11	10	9
Q04	Fault detection	C406.2.7.4	3	3	3	3	2	2	2	2	2	2	2	1	2	2	1	2	2	2	2

x indicates measure is not available for building occupancy in that climate zone

Table C406.1.2(4) Base Energy Credits for Group B Occupancies

ID	Energy Credit Abbreviated Title	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	4	7	4	7	3	4	7	2	0	7	2	3	10	6	4	12	9	19	11
E03	Envelope leak reduction	C406.2.1.3	5	3	4	2	2	2	5	1	0	8	0	2	13	4	0	18	9	18	7
E04	Add R-5 Roof Insulation	C406.2.1.4	1	1	1	1	1	1	2	1	0	2	1	1	2	2	1	3	3	4	5
E05	Add R-10 Roof Insulation	C406.2.1.4	2	2	2	2	2	2	3	2	1	3	1	2	3	2	2	3	3	2	3
E06	Add R-2.5ci Wall Insulation	C406.2.1.5	9	9	5	7	2	2	4	2	0	3	1	2	3	2	2	5	4	6	4
E07	Add R-5.0ci Wall Insulation	C406.2.1.5	13	14	8	11	4	4	7	4	0	5	2	4	6	4	3	9	7	10	8
E08	Fenestration U-0.45	C406.2.1.6	1	1	2	2	7	7	x	x	x	x	x	x	x	x	x	x	x	x	x
E09	Fenestration U-0.33	C406.2.1.6	x	x	x	x	4	4	8	3	0	0	0	0	x	x	x	x	x	x	x

ID	Measure	Section																			
E10	Fenestration U-0.31	C406.2.1.6	x	x	x	x	x	x	x	x	x	5	1	3	7	1	3	7	4	x	x
E11	Fenestration U-0.45	C406.2.1.6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	21	17	8	0
H01	HVAC Performance	C406.2.2.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H02	Heating efficiency	C406.2.2.2	x	x	x	x	x	x	1	1	0	3	2	2	5	4	3	9	7	8	12
H03	Cooling efficiency	C406.2.2.3	7	6	4	5	3	3	1	2	1	1	2	1	1	1	1	x	x	x	x
H04	Residential HVAC control	C406.2.2.4	8	9	7	9	7	8	5	7	7	7	9	6	9	11	7	11	12	8	10
H05	DOAS/fan control	C406.2.2.5	31	31	27	29	25	25	28	26	18	35	28	28	47	38	29	64	53	58	74
W01	SHW preheat recovery	C406.2.3.1a	8	9	10	9	11	11	12	12	14	13	13	14	13	13	15	12	13	14	14
W02	Heat pump water heater	C406.2.3.1b	3	3	3	3	4	4	5	4	5	5	5	6	5	5	6	5	5	6	6
W03	Efficient gas water heater	C406.2.3.1c	5	5	6	6	7	7	8	7	8	8	8	9	8	8	9	8	8	9	8
W04	SHW pipe insulation	C406.2.3.2	3	3	4	4	4	4	4	4	5	4	4	5	4	4	5	4	4	4	4
W05	Point of use water heaters	C406.2.3.3a	12	15	17	16	18	18	19	19	22	20	20	22	20	20	22	18	19	20	19
W06	Thermostatic bal. valves	C406.2.3.3b	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
W07	SHW heat trace system	C406.2.3.3c	4	4	4	4	5	5	5	5	6	5	5	6	5	5	6	5	5	5	5
W08	SHW submeters	C406.2.3.4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W09	SHW distribution sizing	C406.2.3.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W10	Shower heat recovery	C406.2.3.6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
P01	Energy monitoring	C406.2.4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
L01	Lighting Performance	C406.2.5.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	C406.2.5.2	5	5	6	6	6	6	6	6	7	6	6	6	5	5	6	4	5	3	2
L03	Increase occp. sensor	C406.2.5.3	5	6	6	6	6	6	6	6	8	6	6	6	5	5	6	4	5	4	3
L04	Increase daylight area	C406.2.5.4	7	7	8	8	8	8	8	8	9	6	7	7	6	6	6	6	6	7	5
L05	Residential light control	C406.2.5.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	C406.2.5.7	7	7	8	8	8	8	8	8	9	7	8	8	6	7	8	5	6	5	3
Q01	Efficient elevator	C406.2.7.1	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	4	5	4	4
Q02	Commercial kitchen equip.	C406.2.7.2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	C406.2.7.3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q04	Fault detection	C406.2.7.4	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	3	3	3	3

x indicates measure is not available for building occupancy in that climate zone

Table C406.1.2(5) Base Energy Credits for Group A-2 Occupancies

ID	Energy Credit Abbreviated Title	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	1	1	1	1	2	2	9	2	0	19	4	5	26	7	3	33	23	29	13
E03	Envelope leak reduction	C406.2.1.3	2	1	1	1	2	3	11	2	0	24	4	6	33	9	3	42	29	36	16
E04	Add R-5 Roof Insulation	C406.2.1.4	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1
E05	Add R-10 Roof Insulation	C406.2.1.4	1	1	0	1	1	1	2	1	1	1	1	1	2	2	1	2	2	1	2
E06	Add R-2.5ci Wall Insulation	C406.2.1.5	1	1	0	1	1	1	2	2	0	1	0	1	2	1	1	1	1	1	1
E07	Add R-5.0ci Wall Insulation	C406.2.1.5	1	1	0	1	1	2	3	3	1	2	1	2	2	2	2	2	2	2	2
E08	Fenestration U-0.45	C406.2.1.6	0	0	0	0	1	1	x	x	x	x	x	x	x	x	x	x	x	x	x
E09	Fenestration U-0.33	C406.2.1.6	x	x	x	x	1	2	3	2	1	0	0	0	x	x	x	x	x	x	x
E10	Fenestration U-0.31	C406.2.1.6	x	x	x	x	x	x	x	x	x	1	0	1	2	0	1	2	1	x	x
E11	Fenestration U-0.45	C406.2.1.6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	4	4	0	0
H01	HVAC Performance	C406.2.2.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H02	Heating efficiency	C406.2.2.2	x	x	x	x	1	1	6	3	3	10	6	8	15	11	10	19	15	23	28
H03	Cooling efficiency	C406.2.2.3	6	5	3	4	3	2	1	1	1	1	1	1	1	1	1	x	x	x	x
H04	Residential HVAC control	C406.2.2.4	7	7	5	24	23	29	20	21	39	26	34	24	30	38	25	27	32	26	28
H05	DOAS/fan control	C406.2.2.5	29	27	20	25	24	21	36	27	15	51	35	38	67	53	45	84	70	97	115
W01	SHW preheat recovery	C406.2.3.1 a	24	26	31	29	33	35	37	38	45	38	41	44	37	40	44	34	38	33	30
W02	Heat pump water heater	C406.2.3.1 b	15	16	19	18	21	23	25	25	29	26	28	30	26	28	31	25	27	24	22
W03	Efficient gas water heater	C406.2.3.1 c	15	16	19	18	21	22	23	24	28	24	25	27	23	25	27	21	24	21	18
W04	SHW pipe insulation	C406.2.3.2	2	3	3	3	3	3	3	3	3	3	3	3	2	3	3	2	2	2	2
W05	Point of use water heaters	C406.2.3.3 a	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W06	Thermostatic bal. valves	C406.2.3.3 b	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
W07	SHW heat trace system	C406.2.3.3 c	3	4	4	4	4	4	4	4	4	4	4	4	3	4	4	3	3	3	3
W08	SHW submeters	C406.2.3.4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W09	SHW distribution sizing	C406.2.3.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W10	Shower heat recovery	C406.2.3.6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
P01	Energy monitoring	C406.2.4	2	2	2	2	2	1	2	1	1	2	1	1	2	2	1	2	2	2	3
L01	Lighting Performance	C406.2.5.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

ID	Energy Credit Abbreviated Title	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
L02	Lighting dimming & tuning	C406.2.5.2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	1	1	0
L03	Increase occp. sensor	C406.2.5.3	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	0
L04	Increase daylight area	C406.2.5.4	3	3	3	3	3	3	2	2	2	2	2	2	1	2	1	1	1	1	1
L05	Residential light control	C406.2.5.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	C406.2.5.7	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	1	2	1	1
Q01	Efficient elevator	C406.2.7.1	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0
Q02	Commercial kitchen equip.	C406.2.7.2	24	26	28	27	28	29	27	29	32	26	28	29	24	26	28	21	23	19	17
Q03	Residential kitchen equip.	C406.2.7.3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q04	Fault detection	C406.2.7.4	3	2	2	2	2	2	2	2	1	2	2	1	2	2	2	3	2	3	4

x indicates measure is not available for building occupancy in that climate zone

Table C406.1.2(6) Base Energy Credits for Group M Occupancies

ID	Energy Credit Abbreviated Title	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	2	2	2	2	2	3	15	2	0	36	5	9	45	11	5	51	36	35	15
E03	Envelope leak reduction	C406.2.1.3	3	3	2	2	3	3	19	3	0	44	6	11	56	13	6	64	44	43	19
E04	Add R-5 Roof Insulation	C406.2.1.4	4	3	3	4	4	4	10	9	2	11	10	11	12	13	13	13	15	13	17
E05	Add R-10 Roof Insulation	C406.2.1.4	8	6	5	7	7	7	18	16	4	19	18	20	21	22	23	24	26	24	30
E06	Add R-2.5ci Wall Insulation	C406.2.1.5	46	47	34	45	8	9	14	11	3	16	13	16	15	14	14	13	14	14	9
E07	Add R-5.0ci Wall Insulation	C406.2.1.5	64	65	48	62	13	15	23	18	4	27	21	27	25	24	25	23	24	24	16
E08	Fenestration U-0.45	C406.2.1.6	0	0	0	0	0	0	x	x	x	x	x	x	x	x	x	x	x	x	x
E09	Fenestration U-0.33	C406.2.1.6	x	x	x	x	0	0	0	0	0	0	0	0	x	x	x	x	x	x	x
E10	Fenestration U-0.31	C406.2.1.6	x	x	x	x	x	x	x	x	x	5	4	5	4	3	5	4	3	x	x
E11	Fenestration U-0.45	C406.2.1.6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	10	10	0	0
H01	HVAC Performance	C406.2.2.1	31	30	26	28	23	21	23	20	14	27	21	22	29	25	23	32	28	30	33

ID	Measure	Section	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
H02	Heating efficiency	C406.2.2.2	x	x	x	x	x	x	10	3	1	19	8	15	26	17	18	29	24	27	31
H03	Cooling efficiency	C406.2.2.3	10	9	7	7	5	4	2	2	1	1	2	1	1	1	1	x	x	x	x
H04	Residential HVAC control	C406.2.2.4	11	12	9	18	15	17	19	15	19	31	27	26	35	38	27	31	35	25	27
H05	DOAS/fan control	C406.2.2.5	48	48	42	47	40	38	66	46	31	98	61	82	120	91	90	134	115	125	141
W01	SHW preheat recovery	C406.2.3.1a	12	13	16	15	18	20	19	21	26	17	21	21	16	19	21	13	16	15	13
W02	Heat pump water heater	C406.2.3.1b	3	3	4	3	4	5	5	5	7	5	6	6	4	5	6	4	4	4	4
W03	Efficient gas water heater	C406.2.3.1c	6	7	8	8	10	10	10	11	14	9	11	11	8	10	11	7	8	8	7
W04	SHW pipe insulation	C406.2.3.2	3	3	4	4	4	4	4	4	5	4	4	5	4	4	5	4	4	4	4
W05	Point of use water heaters	C406.2.3.3a	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W06	Thermostatic bal. valves	C406.2.3.3b	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
W07	SHW heat trace system	C406.2.3.3c	4	4	4	4	5	5	5	5	6	5	5	6	5	5	6	5	5	5	5
W08	SHW submeters	C406.2.3.4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W09	SHW distribution sizing	C406.2.3.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W10	Shower heat recovery	C406.2.3.6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
P01	Energy monitoring	C406.2.4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L01	Lighting Performance	C406.2.5.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	C406.2.5.2	9	9	11	10	12	13	11	13	15	9	12	11	7	9	10	5	7	5	3
L03	Increase occp. sensor	C406.2.5.3	9	9	11	10	12	13	12	13	15	10	12	11	7	10	11	6	8	5	4
L04	Increase daylight area	C406.2.5.4	12	13	15	14	16	17	15	16	20	11	14	13	9	12	11	8	10	10	8
L05	Residential light control	C406.2.5.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	C406.2.5.7	12	12	14	14	15	16	12	15	19	8	12	9	6	10	7	6	7	6	5
Q01	Efficient elevator	C406.2.7.1	3	3	4	3	4	4	4	4	5	3	4	4	3	4	4	3	3	3	2
Q02	Commercial kitchen equip.	C406.2.7.2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	C406.2.7.3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q04	Fault detection	C406.2.7.4	3	2	2	2	2	2	2	2	1	2	2	1	2	2	2	3	2	3	4

Table C406.1.2(7) Base Energy Credits for Group E Occupancies

ID	Energy Credit Abbreviated Title	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	9	22	8	20	9	12	5	11	3	4	9	2	3	6	0	4	3	4	3
E03	Envelope leak reduction	C406.2.1.3	4	3	3	3	2	5	2	1	0	0	0	0	1	0	0	2	0	1	1
E04	Add R-5 Roof Insulation	C406.2.1.4	4	5	2	5	2	5	8	4	0	7	4	6	11	7	11	13	14	12	15
E05	Add R-10 Roof Insulation	C406.2.1.4	8	8	4	9	5	7	16	7	0	14	7	10	18	13	13	23	25	22	28
E06	Add R-2.5ci Wall Insulation	C406.2.1.5	3	5	2	5	2	4	6	4	1	4	2	3	4	3	2	4	4	3	4
E07	Add R-5.0ci Wall Insulation	C406.2.1.5	5	7	4	8	3	6	8	6	2	6	3	6	5	5	6	7	6	7	8
E08	Fenestration U-0.45	C406.2.1.6	0	0	0	0	4	6	x	x	x	x	x	x	x	x	x	x	x	x	x
E09	Fenestration U-0.33	C406.2.1.6	x	x	x	x	1	5	15	8	0	1	2	4	x	x	x	x	x	x	x
E10	Fenestration U-0.31	C406.2.1.6	x	x	x	x	x	x	x	x	x	10	4	10	15	4	11	13	12	x	x
E11	Fenestration U-0.45	C406.2.1.6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	34	29	12	10
H01	HVAC Performance	C406.2.2.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H02	Heating efficiency	C406.2.2.2	x	x	x	x	x	x	4	3	3	5	5	10	9	11	6	15	11	18	26
H03	Cooling efficiency	C406.2.2.3	9	8	6	7	5	4	2	2	1	1	1	1	1	1	1	x	x	x	x
H04	Residential HVAC control	C406.2.2.4	10	11	8	14	11	14	11	12	17	12	20	18	16	28	13	18	20	18	23
H05	DOAS/fan control	C406.2.2.5	45	42	37	41	36	34	41	39	30	43	46	58	57	65	40	79	63	88	117
W01	SHW preheat recovery	C406.2.3.1a	7	7	9	8	10	11	13	13	15	14	15	15	15	14	17	13	15	14	12
W02	Heat pump water heater	C406.2.3.1b	4	4	6	5	7	7	9	9	10	10	10	11	11	10	12	10	11	10	9
W03	Efficient gas water heater	C406.2.3.1c	4	4	6	5	6	7	8	8	9	9	9	10	9	9	11	8	10	9	7
W04	SHW pipe insulation	C406.2.3.2	3	3	4	4	4	4	4	5	6	5	5	6	5	5	7	4	5	4	4
W05	Point of use water heaters	C406.2.3.3a	3	4	4	4	4	5	5	5	6	5	5	5	5	5	6	4	5	4	3
W06	Thermostatic bal. valves	C406.2.3.3b	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	1	2	1	1
W07	SHW heat trace system	C406.2.3.3c	4	4	4	4	5	5	5	6	7	6	6	7	6	6	8	5	7	5	5
W08	SHW submeters	C406.2.3.4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W09	SHW distribution sizing	C406.2.3.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W10	Shower heat recovery	C406.2.3.6	2	2	2	2	3	3	3	3	4	3	3	4	3	3	4	3	3	3	3

ID	Energy Credit Abbreviated Title	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
P01	Energy monitoring	C406.2.4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4
L01	Lighting Performance	C406.2.5.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	C406.2.5.2	5	5	5	6	6	6	5	6	7	6	6	6	5	5	6	4	4	3	2
L03	Increase occp. sensor	C406.2.5.3	4	4	5	5	5	6	6	6	7	6	6	5	4	4	5	3	4	3	2
L04	Increase daylight area	C406.2.5.4	6	6	7	7	7	7	7	7	8	6	6	6	5	5	6	5	5	5	4
L05	Residential light control	C406.2.5.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	C406.2.5.7	6	7	7	7	8	8	8	8	10	7	8	7	6	7	8	5	6	4	2
Q01	Efficient elevator	C406.2.7.1	3	4	4	4	4	5	5	5	5	5	5	5	5	5	5	4	5	4	3
Q02	Commercial kitchen equip.	C406.2.7.2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	C406.2.7.3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q04	Fault detection	C406.2.7.4	4	4	4	4	3	3	3	3	2	3	3	3	3	3	2	4	3	4	4

x indicates measure is not available for building occupancy in that climate zone

Table C406.1.2(9) Base Energy Credits for Other[a] Occupancies

ID	Energy Credit Abbreviated Title	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	5	9	5	8	5	6	10	5	2	20	6	6	25	10	4	28	22	26	16
E03	Envelope leak reduction	C406.2.1.3	6	4	5	4	3	7	12	3	2	28	5	6	36	9	3	41	27	33	15
E04	Add R-5 Roof Insulation	C406.2.1.4	2	2	2	2	2	3	5	4	1	4	4	4	5	5	6	5	6	5	7
E05	Add R-10 Roof Insulation	C406.2.1.4	4	4	3	4	4	4	8	6	2	7	6	7	9	8	9	9	10	9	12
E06	Add R-2.5ci Wall Insulation	C406.2.1.5	11	13	8	12	3	4	7	4	1	5	3	5	5	4	4	5	5	5	4
E07	Add R-5.0ci Wall Insulation	C406.2.1.5	16	19	11	17	5	6	10	7	2	9	6	8	9	7	7	9	9	10	8
E08	Fenestration U-0.45	C406.2.1.6	0	0	0	1	4	5	x	x	x	x	x	x	x	x	x	x	x	x	x
E09	Fenestration U-0.33	C406.2.1.6	x	x	x	x	2	3	6	3	0	0	2	1	x	x	x	x	x	x	x
E10	Fenestration U-0.31	C406.2.1.6	x	x	x	x	x	x	x	x	x	5	1	4	8	1	4	7	5	x	x
E11	Fenestration U-0.45	C406.2.1.6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	17	14	8	5
H01	HVAC Performance	C406.2.2.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H02	Heating efficiency	C406.2.2.2	x	x	x	x	x	x	6	2	3	11	6	8	15	11	9	18	15	19	23
H03	Cooling efficiency	C406.2.2.3	7	7	5	5	4	3	1	2	1	x	x	x	x	x	x	x	x	x	x
H04	Residential HVAC control	C406.2.2.4	9	9	7	18	16	19	15	14	24	22	25	20	25	31	19	23	27	21	22

ID	Measure	Section																		
H05	DOAS/fan control	C406.2.2.5	37	36	31	34	30	28	43	32	23	61	42	49	75	61	49	90	77	93	##
W01	SHW preheat recovery	C406.2.3.1a	18	19	22	21	25	26	28	29	34	29	31	34	29	31	35	26	29	27	26
W02	Heat pump water heater	C406.2.3.1b	12	12	15	14	17	17	20	20	24	21	22	25	21	23	26	20	22	21	20
W03	Efficient gas water heater	C406.2.3.1c	11	11	13	13	15	16	17	17	21	18	19	21	18	19	22	16	18	17	16
W04	SHW pipe insulation	C406.2.3.2	3	3	4	4	4	4	4	4	5	4	4	5	4	4	5	3	4	3	3
W05	Point of use water heaters	C406.2.3.3a	8	10	11	10	11	12	12	12	14	13	13	14	13	13	14	11	12	12	11
W06	Thermostatic bal. valves	C406.2.3.3b	1	1	1	1	1	1	1	1	2	1	1	2	1	1	2	1	1	1	1
W07	SHW heat trace system	C406.2.3.3c	5	5	5	5	6	6	6	6	7	6	6	7	5	6	7	5	5	5	5
W08	SHW submeters	C406.2.3.4	11	11	13	13	15	16	18	18	22	19	20	22	19	20	24	17	20	18	18
W09	SHW distribution sizing	C406.2.3.5	29	30	36	35	41	43	48	48	56	50	53	59	51	54	62	47	52	49	48
W10	Shower heat recovery	C406.2.3.6	6	6	7	7	8	9	10	10	11	10	11	12	10	11	12	10	11	10	10
P01	Energy monitoring	C406.2.4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4
L01	Lighting Performance	C406.2.5.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	C406.2.5.2	5	5	5	5	6	6	5	6	7	5	5	5	4	4	5	3	4	3	2
L03	Increase occp. sensor	C406.2.5.3	5	6	6	6	7	7	6	7	8	5	6	6	4	5	6	3	4	3	2
L04	Increase daylight area	C406.2.5.4	7	8	9	8	9	9	8	8	10	6	7	7	5	6	6	4	5	5	4
L05	Residential light control	C406.2.5.5	8	8	9	9	9	9	8	8	10	6	8	7	5	7	8	4	5	4	3
L06	Light power reduction	C406.2.5.7	7	7	8	7	8	8	7	8	9	5	7	6	4	5	6	4	4	3	2
Q01	Efficient elevator	C406.2.7.1	4	4	5	4	5	5	5	5	6	4	5	5	4	4	5	3	4	3	3
Q02	Commercial kitchen equip.	C406.2.7.2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	C406.2.7.3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q04	Fault detection	C406.2.7.4	3	3	3	3	3	2	3	2	2	3	3	2	3	3	2	4	3	4	4

x indicates measure is not available for building occupancy in that climate zone

a Other occupancy groups include all Groups except for Groups A-2, B, E, I, M, and R.

C406.2 Additional Energy Efficiency Credit Measures.
Each energy efficiency credit measure used to meet credit requirements for the project shall include efficiency that is greater than the energy efficiency required for the building type and configuration requirements in Sections C402 through C405. Measures installed in the project that meet the requirements in Sections C406.2.1 through C406.2.7 shall achieve the credits listed for the measure and occupancy type in Tables C406.1.2(1) through C406.1.2(9) or where calculations required by Sections

C406.2.1 through C406.2.7 create or modify the table credits, the credits achieved shall be based upon the section calculations.

C406.2.1 More Efficient Building Envelope.
A project shall achieve credits for improved envelope performance through compliance with the requirements of one of the following:
1. Section C406.2.1.1 (E01)

2. Section C406.2.1.2 (E02)

3. Section C406.2.1.3 (E03)

4. Both EO2 and E03

5. Any combination of

    5.1 Section C406.2.1.3: E03A, E03B, or E03C

    5.2 Section C406.2.1.4: E04 or E05

    5.3 Section C406.2.1.5: E06 or E07

    5.4 Section C406.2.1.6: E08, E09, E10, or E11

C406.2.1.1EO1 Improved envelope performance 90.1 Appendix C.
To achieve this credit, building envelope measures shall be installed to improve the energy performance of the project. The allowable energy credits shall be determined using Equation 4-13.
$$EC_{env} = 1000 \times (EPF_B - EPF_P)/EPF_B$$

(Equation #)

where:

EC_{ENV} = E01 measure energy credits

EPF_B = base envelope performance factorcalculated in accordance with ASHRAE 90.1-2019 Appendix C.

EPF_P = proposed envelope performance factor calculated in accordance with ASHRAE 90.1-2019 Appendix C.

C406.2.1.2E02 Total UA envelope reduction..
Energy credits shall be achieved where the total UA of the building thermal envelope as designed is not less than 15 percent below the total UA of the building thermal envelope in accordance with Section C402.1.5.

C406.2.1.3E03 Reduced air infiltration.
Energy credits shall be achieved for tested air leakage less than thresholds in either section C406.2.1.3.1, C406.2.1.3.2, or C406.2.1.3.3 where tested in accordance with the following:Air infiltration shall be verified by whole-building pressurization testing conducted in accordance with ASTM E779 or ASTM E1827 by an independent third party. The measured air-leakage rate of the project envelope shall not exceed the required cfm/ft^2 (L/s · m^2) under a pressure differential of 0.3 inches water column (75 Pa), with the calculated surface area being the sum of the above- and below-grade project 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.

Alternate testing method: For projects having over 50,000 square feet (5 000 m^2) of conditioned floor area, air-leakage testing need not be conducted on the whole project where testing is conducted on

representative above-grade sections of the project. Tested areas shall total not less than 25 percent of the conditioned floor area and shall be tested in accordance with this section

C406.2.1.3.1E03A Reduced air leakage to 0.25..
The measured air-leakage rate of the project envelope shall not exceed 0.25 cfm/ft^2 (1.3 L/s × m^2) under a pressure differential of 0.3 inches water column (75 Pa), Multiply E03 Credits times 1.0.

C406.2.1.3.2E03B Reduced air leakage to 0.15..
The measured air-leakage rate of the project envelope shall not exceed 0.15 cfm/ft^2 (0.8 L/s × m^2) under a pressure differential of 0.3 inches water column (75 Pa), Multiply E03 Credits times 1.2.

C406.2.1.3.3E03C Reduced air leakage to 0.08..
The measured air-leakage rate of the project envelope shall not exceed 0.08 cfm/ft^2 (0.4 L/s × m^2) under a pressure differential of 0.3 inches water column (75 Pa), Multiply E03 Credits times 2.0.

C406.2.1.4Improved Roof Insulation.
Energy credits shall be achieved for improved insulation of all roof areas in the project meeting the requirements in either section C406.2.1.6.1 or C406.2.1.6.2. Such insulation shall be in addition to the required insulation in Table C402.1.3.

C406.2.1.4.1E04 Add R-5 Roof Insulation..
All roof area shall have additional R-5 continuous insulation included in the roof assembly. This can be achieved with 0.75 inches of polyisocyanurate, 1.25 inches of expanded polystyrene (EPS), or other insulation rated at R-10. For attics this is permitted to be achieved with fill or batt insulation rated at R-5 that is continuous and not interrupted by ceiling or roof joists. Where interrupted by joists, the added insulation shall be R-8 or more.

C406.2.1.4.2E05 Add R-10 Roof Insulation..
All roof area shall have additional R-10 continuous insulation included in the roof assembly. This can be achieved with 1.5 inches of polyisocyanurate or 2.5 inches of EPS or other insulation rated at R-10. For attics this is permitted to be achieved with fill or batt insulation rated at R-10 that is continuous and not interrupted by ceiling or roof joists. Where interrupted by joists, the added insulation shall be R-13 or more.

C406.2.1.5Improved Wall Insulation.
Energy credits shall be achieved for improved insulation applied to at least 90% of all opaque walls in the project meeting the requirements in either section C406.2.1.5.1 or C406.2.1.5.2. Such insulation shall be in addition to the required insulation in Table C402.1.3.

C406.2.1.5.1E06 Add R-2.5 to Walls..
Opaque walls shall have additional R-2.5 continuous insulation included in the wall assembly. This can be achieved with 0.375 inches of polyisocyanurate, 0.625 inches of EPS, or other continuous wall insulation rated at R-2.5.

C406.2.1.5.2E07 Add R-5 to Walls. .
Opaque walls shall have additional R-5 continuous insulation included in the wall assembly. This can be achieved with 0.75 inches of polyisocyanurate or 1.25 inches of EPS, or other continuous wall insulation rated at R-5.

C402.1.6Improved fenestration..
Energy credits for one selected fenestration energy credit ID shall be achieved for improved energy characteristics of all vertical fenestration in the project meeting of the requirements in one of the rows of Table C406.2.1.6. All vertical fenestration shall have both the U-factor and SHGC equal to or less than the value shown in the selected table row and have visible transmittance (VT) equal to or greater than the value shown in the selected table row.

Table C406.2.1.6 Vertical Fenestration Requirements for Energy Credits

Energy Credit ID	Applicable Climate Zones	Maximum U-Factor	Maximum SHGC	Minimum VT

E08	0-2	0.45	0.21	0.230
E09	2-4	0.33	0.23	0.253
E10	4-6	0.31	0.36	0.396
E11	6-7	0.26	0.38	0.418

C406.2.2More Efficient HVAC Equipment Performance.

All heating and cooling systems shall meet the minimum requirements of Section C403 and efficiency improvements shall be referenced to minimum efficiencies listed in Tables referenced by Section C403.3.2. Where multiple efficiency requirements are listed, equipment shall meet the seasonal efficiencies including SEER, EER/integrated energy efficiency ratio (IEER), integrated part load value (IPLV), or AFUE. Equipment that is larger than the maximum capacity range indicated in Tables referenced by Section C403.3.2 shall utilize the values listed for the largest capacity equipment for the associated equipment type shown in the table. Where multiple individual heating or cooling systems serve the project, the improvement shall be the weighted average improvement based on individual system capacity.

Systems are permitted to achieve energy credits by meeting the requirements of either:

1. C406.2.2.1 H01,

2. C406.2.2.2 H02,

3. C406.2.2.3 H03,

4. C406.2.2.4 H04,

5. C406.2.2.5 H05,

6. Any combination of H02, H03, H04 and H05.

C406.2.2.1H01 HVAC Performance (TSPR). Reserved..
[Reserved for future use; See Appendix B]

C402.2.2.2H02 More efficient HVAC equipment heating performance.

No less than 90 percent of the total HVAC capacity serving the total conditioned floor area of the entire building, or tenant space in accordance with Section C406.1.1, shall comply with the requirements of this Section.

1. 1.   Equipment installed shall be types that are listed in Tables referenced by Section C403.3.2 or air-to-water heat pu
resistance heating shall be limited to 20 percent of system capacity, with the exception of heat pump supplemental hea

2. Equipment shall exceed the minimum heating efficiency requirements listed in Tables referenced by Section C403.3.2 l
Where equipment exceeds the minimum annual heating efficiency requirements by more than 5 percent, energy efficier
shall be determined using Equation 4-14 rounded to the nearest whole number.

$EEC_{HEH} = EEC_{H5} \times (HEI / 5\%)$

(Equation #)

where:

EEC_{HEH} =   energy efficiency credits for heating efficiency improvement

EEC_5 =   C406.2.2.2 credits from Tables C406.1.2(1) through C406.1.2(9)

HEI = the lesser of: the improvement above minimum heating efficiency requirements, or 20 percent. Where heating efficiency varies by system, use the capacity weighted average percentage for all heating equipment combined.

Exception: In low energy spaces complying with Section C402.1.1, no less than 90 percent of the installed heating capacity is provided by electric infrared or gas-fired radiant heating equipment for localized heating applications. Such spaces shall only achieve energy credits for EEC_5.

C406.2.2.3H03 More efficient HVAC equipment cooling and fan performance..

No less than 90 percent of the total HVAC capacity serving the total conditioned floor area of the entire building, or tenant space in accordance with Section C406.1.1, shall comply with all of the requirements of this section. Where individual equipment efficiencies vary, weight them based on rated capacity.

1. Equipment installed shall be types that are listed in Tables referenced by Section C403.3.2 or air-to-water heat pumps. pumps do not have a requirement for minimum efficiency.

2. Equipment shall exceed the minimum cooling efficiency requirements listed in Tables referenced by Section C403.3.2 b Where equipment exceeds the minimum annual cooling efficiency and heat rejection efficiency requirements by more th efficiency credits for cooling shall be determined using Equation 4-15, rounded to the nearest whole number.

   $EEC_{HEC} = EEC_5 \times (CEI / 5\%)$

   where:

   EEC_{HEC} = energy efficiency credits for cooling efficiency improvement

   EEC_5 = C406.2.2.2 base energy credits from Tables C406.1.2(1) through C406.1.2(9)

   CEI = the lesser of: the improvement above minimum cooling and heat rejection efficiency requirements, or 20 pe efficiency varies by system, use the capacity weighted average percentage for all cooling equipment combined.

   Where fan energy is not included in packaged equipment rating or it is and the fan size has been increased from the as condition, fan power or horsepower shall be less than 95 percent of the allowed fan power in Section C403.8.1.

C406.2.2.4H04 Residential HVAC control..

HVAC systems serving dwelling units or sleeping units shall be controlled with a programmable thermostat that is configured to automatically activate a setback condition of at least 5°F (3°C) for both heating and cooling. The programmable thermostat shall be configured to provide setback during occupied sleep periods. The unoccupied setback mode shall be configured to operate in conjunction with one of the following:

1. A manual main control device by each dwelling unit main entrance that initiates setback and non-ventilation mode for a dwelling unit and is clearly identified as "Heating/Cooling Master Setback."

2. Occupancy sensors in each room of the dwelling unit combined with a door switch to initiate setback and non-ventilatio units in the dwelling within 20 minutes of all spaces being vacant immediately after a door switch operation. Where sep units are used, an individual occupancy sensor on each unit that is configured to provide setback shall meet this require

3. An advanced learning thermostat that senses occupant presence and automatically creates a schedule for occupancy a dynamic setback schedule based on when the spaces are generally unoccupied.

4. An automated control and sensing system that uses geographic fencing connected to the dwelling unit occupants' cell p the setback condition when all occupants are away from the building.

C406.2.2.5H05 Dedicated Outdoor Air System.

To achieve this credit, where single zone HVAC units are not required to have modulating fan control in accordance with Section C403.8.6.1, the base energy credits shown in Table 406.2 shall be prorated proportionately to the conditioned floor area served by single zone HVAC units with constant speed fans. HVAC controls and ventilation systems shall include all of the following:

1. Zone controls shall cycle the indoor fans with the load.

2. Outdoor air shall be supplied by an independent ventilation system designed to provide no more than 110% of the minimum outdoor air to each individual occupied zone, as specified by the International Mechanical Code.

3. The ventilation system shall have energy recovery with an enthalpy recovery ratio of 65% or more at heating design conditions in climate zones 3 through 8 and an enthalpy recovery ratio of 65% or more at cooling design conditions in climate zones 0, 1, 2, 3A, 3B, 4A, 4B, 5A, and 6A. In "A" climate zones, energy recovery shall include latent recovery.

4. Where the ventilation system serves multiple zones, an outdoor air bypass or wheel speed control shall automatically do one of the following:

    4.1 Set the energy recovery leaving-air temperature 55°F (13°C) or 100% outdoor air bypass when a majority of zones outdoor air temperature is below 70°F (21°C).

    4.2 The HVAC system shall include supply-air temperature controls that automatically reset the supply-air temperature representative building loads, or to outdoor air temperatures. The controls shall reset the supply-air temperature no percent of the difference between the design supply-air temperature and the design room-air temperature.

5. Ventilation systems providing mechanical dehumidification shall use recovered energy for reheat.

C406.2.3Reduced Energy Use In-service Water Heating.

Projects with service water-heating equipment that serves the whole building, a building addition or a tenant space shall achieve credits through compliance with the requirements of this section. Systems are permitted to achieve energy credits by meeting the requirements of either:

1. C406.2.6.1 by selecting one allowed measure W01, W02 or W03

2. C406.2.6.2

3. C406.2.6.3 by selecting one allowed measure W05, W06, or W07

4. C406.2.6.4 W08

5. C406.2.6.5 W09

6. C406.2.6.6 W10

7. Any combination of measures in C402.2.6.1 through C402.2.6.6 as long no more than one allowed measure from C406 C406.2.6.3 are selected.

C406.2.3.1Service water-heating system efficiency.

A project is allowed to claim energy credits from only one of the following water-heating system efficiency measures.

1. **W01 Recovered or renewable water heating.** The building service water-heating system shall have one or more of th
   sized to provide not less than 30 percent of the building's annual hot water requirements, or sized to provide 70 percen
   annual hot water requirements if the building is required to comply with Section C403.10.5:

   1.1 Waste heat recovery from SHW, heat recovery chillers, building equipment, or process equipment.

   1.2 A water-to-water heat pump that precools chilled water return for building cooling.

   1.3 On-site renewable energy water-heating systems.

2. **W02 Heat pump water heater.** To achieve this credit, air-source heat pump *water heater*s shall not draw conditioned a
   the *building*, except exhaust air that would otherwise be exhausted to the exterior. Any *recirculating system* and final he
   with a separate non-heat pump heating source. Requirements shall be in accordance with one of the following:

   2.1 For multifamily, dormitories, and health care occupancies with a *recirculating system*, at least 30% of design end-u
       heating requirements shall be met using heat pump preheat with a coefficient of performance (COP) of not less tha
       (10°C) entering air and 70°F (21°C) entering water in accordance with AHRI Standard 1300. A preheat storage tar
       peak demand shall be included in design.

   2.2 For office, restaurant and school *occupancies* with *piping* temperature maintenance, at least 30% of design end-us
       heating requirements shall be met using heat pump preheat with a combined input-capacity-weighted-average UE
       medium draw pattern for unitary *equipment* with either a *heat trace system* or a separate *water heater* in series for
       system and final heating.

   2.3 For retail, small office, and warehouse *occupancies* with no *recirculating system*, at least 30% of design end-use *s
       heating* requirements shall be met using the heat pump portion of a hybrid *water heater* with a combined input-cap
       average UEF of 3.0 with a medium draw pattern for unitary *equipment*, including *electric resistance* heating to mee

   Where the heat pump capacity at 50°F (10°C) entering air and 70°F (21°C) entering water exceeds 50% of the design e
   excluding *recirculating system* losses, the base credits from the Section C406.1 tables shall be prorated based on Equa

   WO2 credit = base W02 table credit X (HP_{LF} / 50%)

   where:

   HP_{LF} =   Heat pump capacity as a fraction of the design end-use SHW requirements excluding recirculating system los
   80%.

3. **W03 Efficient fossil fuel water heater**. The combined input-capacity-weighted-average equipment rating of all fossil fu
   equipment in the building shall be not less than 95% Et or 0.95 EF. This measure shall receive only half the listed energ
   required to comply with C404.2.1.

C406.2.3.3 Water-heating distribution temperature maintenance.
A project is allowed to claim energy credits from only one of the following SHW distribution temperature
maintenance measures.
1. **W05 Point of use water heaters**. Credits are available for office or school buildings larger than 10,000 ft² (930 m²). Fix
   water shall be supplied from a localized source of hot water with no recirculating system or heat trace piping. Supply pip
   heater to the termination of the fixture supply pipe shall be insulated to the levels shown in Table C403.12.3 without exc
   from the water heater to the termination of the fixture supply pipe shall be limited as follows:

   1.1 Non-residential lavatories: not more than 2 oz (60 mL)

   1.2 All other plumbing fixtures or appliances: not more than 0.25 gallons (0.95 L)

Exception: Where all remotely located hot water uses meet the requirements for measure W05, separate water heater
kitchens or showers in locker rooms shall be permitted to have a local recirculating system or heat trace piping.

2. **W06 Thermostatic balancing valves.** Credits are available where service water heating is provided centrally and distr
building. Each recirculating system branch return connection to the main SHW supply piping shall have an automatic th
valve set to a minimal return water flow when the branch return temperature is greater than 115°F (46°C).

3. **W07 Heat trace system.** Credits are available for projects with gross floor area greater than 10,000 square feet and a
system. The energy credits achieved shall be from Tables C406.1.2(1) through C406.1.2(9). This system shall include
heat cables, connection kits, and electronic controls. The cable shall be installed directly on the hot water supply pipes
insulation to replace standby losses.

C406.2.3.4W08 Water-heating system submeters.

To achieve this credit, each individual dwelling unit in a Group R-2 occupancy served by a central service
water-heating system shall be provided with a SHW meter connected to a reporting system that provides
individual dwelling unit reporting of actual domestic hot water use. Preheated water serving the cold water
inlet to showers need not be metered. Where other codes or regulations require individual dwelling
unit hot water metering, energy credits for this measure shall not be allowed.

C406.2.3.5W09 Water heating distribution sizing.

To achieve this credit, where Group R-1 and R-2 occupancies are served by a central SHW system, the
distribution system serving dwelling units and guest rooms shall be sized using IAPMO/ANSI WE●Stand
– 2017 Water Efficiency and Sanitation Standard for the Built Environment. Plumbing fixtures in
residential spaces that are connected to the service water-heating system shall have a flow or
consumption rating ≤ the values shown in Table C406.2.3.5. Where other codes or regulations require
fixture flows to be equal to or less than listed in Table C406.2.3.5 only half the base energy credits shall
be achieved for this measure.

Note to adopting jurisdictions: Consider including the following informative note to clarify the requirements
of C406.2.3.5

Informative Note: Where low water supply pressures are anticipated, user satisfaction may be enhanced
if flow restrictors are specified to provide ≥80% of the rated flow at 20 psi (140 kPa).Where the distribution
sizing protocol is applied to other than multifamily residential buildings, a variance to the plumbing code
may be needed.

Table C406.2.3.5 Maximum Flow Rating for Residential Plumbing Fixtures with Heated Water

Plumbing Fixture	Maximum Flow Rate
Faucet for private lavatory,[a] hand sinks, or bar sinks	1.50 gpm at 60 psi (0.095 L/s at 410 kPa)
Faucet for residential kitchen sink [a,b, c]	1.8 gpm at 60 psi 0.11 L/s at 410 kPa)
Shower head (including hand-held shower spray) [a, b, d]	2.0 gpm at 80 psi (0.13 L/s at 550 kPa)

a. Showerheads, lavatory faucets and kitchen faucets are subject to U.S. Federal requirements listed in
10 CFR 430.32(o)-(p).

b. Maximum flow allowed is less than required by flow rates listed in U.S. 10 CFR 430.32(o)-(p) for
showerheads and kitchen faucets.

c. Residential kitchen faucet may temporarily increase the flow above the maximum rate, but not above
2.2 gallons per minute at 60 psi (0.14 L/s at 410 kPa) and must default to the maximum flow rate listed.

d. When a shower is served by multiple shower heads, the combined flow rate of all shower heads
controlled by a single valve shall not exceed the maximum flow rate listed or the shower shall be
designed to allow only one shower head to operate at a time.

C406.2.3.6W10 Shower drain heat recovery.

To achieve this credit, cold water serving building showers shall be preheated by shower drain heat recovery units that comply with CSA B55.2. Potable waterside pressure loss shall be less than 10 psi (69 kPa) at maximum design flow. The efficiency of drain heat recovery units shall be 54% or greater measured in accordance with CSA B55.1. Full credits are applicable to the following building use types: health clinic, hospital, hotel, motel, multifamily, retirement facility, dormitory, and schools with more than eight showers. Partial credits are applicable to buildings where all but ground floor showers are served where the base energy credit from Tables C406.1.2(1) through C406.1.2(9) is adjusted by Equation 4-17.

W10 credit = W10 base energy credit X (showers with drain heat recovery / total showers in building)
(Equation 4.17)

C406.2.4P01 Energy Monitoring.
A project not required to comply with C405.12 can claim energy credits for installing an energy monitoring system that complies with all the requirements of C405.12.1 through C405.12.

C406.2.5 Energy Savings in Lighting Systems.
Projects are permitted to achieve energy credits for increased lighting system performance by meeting the requirements of either:
1. C406.2.5.2 L02

2. C406.2.5.3 L03

3. C406.2.5.4 L04

4. C406.2.5.5 L05

5. C406.2.5.6 L06

6. Any combination of L03, L04, L05 and L06

7. Any combination of L02, L03 and L04

C406.2.5.1L01 Lighting system performance (reserved).
Reserved for future use

C406.*2.5.2*L02 Enhanced digital lighting controls..

Measure credits shall be achieved where no less than 50 percent of the gross floor area within the project shall comply with the requirements of this section.

1. Lighting controls function. Interior general lighting shall be located, scheduled and operated in accordance with Section C405.2 and shall be configured with the following enhanced control functions:

  1.1 Luminaires shall be configured for continuous dimming.

  1.2 Each luminaire shall be individually addressed.

    Exceptions to Item 1.2:

    1.   Multiple luminaires mounted on no more than 12 linear feet of a single lighting track and addressed as a sing

    2.   Multiple linear luminaires that are ganged together to create the appearance of a single longer fixture and ad luminaire, where the total length of the combined luminaires is not more than 12 feet.

  1.3 No more than eight luminaires within a *daylight zone* are permitted to be controlled by a single *daylight responsive*

2   Luminaires shall be controlled by a digital control system configured with the following capabilities:
.

   2.1   Scheduling and illumination levels of individual luminaires and groups of luminaires are capable of being reconfigur
       system.

   2.2   Load shedding.

   2.3   In open and enclosed offices, the illumination level of overhead general illumination luminaires are configured to be
       by occupants.

   2,4   Occupancy sensors and daylight responsive controls are capable of being reconfigured through the system.

3   Construction documents shall include submittal of a Sequence of Operations, including a specification
.   outlining each of the functions required by this section.

4   High-end trim.Luminaires shall be initially configured with the following:
.

   4.1   High-end trim, setting the maximum light output of individual luminaires or groups of luminaires to support visual ne
       area, shall be implemented and construction documents shall state that maximum light output or power of controlle
       initially reduced by at least 15 percent from full output. The average maximum light output or power of the controlle
       documented without high-end trim and with high-end trim to verify reduction of light output or power by at least 15 p

   4.2   Where lumen maintenance control is used, controls shall be configured to limit the initial maximum lumen output or
       power to 85 percent or less of full light output or full power draw and lumen maintenance controls shall be limited to
       power by 1 percent per year.

   4.3   High-end trim and lumen maintenance controls shall be accessible only to authorized personnel.

Where general lighting in more than 50 percent of the gross lighted floor area receives high-end trim, the
base credits from Tables C406.1.2(1) through C406.1.2(9) shall be prorated as follows:

[Tuned lighted floor area,%] × [Base energy credits for C406.2.5.2] / 50%

C406.2.5.3L03 Increase occupancy sensor.

To achieve this credit, automatic partial OFF or automatic full OFF occupancy sensors shall be installed in
all space types not required by C405.2.1 and shall be installed as follows:

1.   Automatic shutoff or light reduction shall occur within 15 minutes of all occupants leaving each control
    zone.

2.   For spaces with multiple control zones or automatic partial OFF control, automatic full shutoff shall
    occur within 15 minutes of all occupants leaving the space.

3.   For spaces with one control zone, automatic full OFF control shall be used.

4.   All areas of the project with automatic partial OFF or automatic full OFF control shall have one control
    device for every 600 ft^2 (60 m^2) of gross lighted area.

Exception: to automatic full OFF control requirement: Stairwells.

C406.2.5.4L04 Increase daylight area .

To achieve this credit, the total daylight area of the project (DLA$_{BLDG}$) with continuous daylight dimming
meeting the requirements of C405.2.4 shall be at least 5% greater than the typical daylit area (DLA$_{TYP}$).
Where the actual daylight area includes additional daylit areas beyond the primary sidelighted areas,
secondary sidelighted areas, daylight area under skylights, or daylight area under roof monitor then:

1. An analysis based on IES LM83 shall be submitted demonstrating that the spatial daylight autonomy (sDA) is at least 200, 60% for the additional actual daylight area (DLA_{BLDG}).

2. Additional daylit areas shall be separately controlled by automatic daylighting controls.

Credits for measure L04 shall be determined based on Equation 4-18:

$$EC_{DL} = EC_{DL5} \times 20 \times [(DLA_{BLDG}/GLFA) - DLA_{TYP}]$$

(Equation #)

where:

EC_{DL} = C406.2.5.4 L04 measure base energy credits

DLA_{BLDG} = The lesser of actual daylight area of the project with continuous daylight dimming, ft^2 or m^2 and DLA_{max} in Table C406.2.5.4

$GLFA$ = Project gross lighted floor area, ft^2 or m^2

DLA_{TYP} = Typical % of building area with daylight control (as a fraction) from Table C406.2.5.4:

EC_{DL5} = C406.2.5.4 L04 base energy credits from Tables C406.1.2(1) through C406.1.2(9)

Note to adopting jurisdictions: Consider including the following informative note to clarify the requirements of C406.2.5.4

Informative Note: In IES LM83, spatial daylight autonomy (sDA) means the amount of daylight received in a space over a portion of operating hours each year. It is written as sDA###,YY% where the ### indicates the desired lux provided by the daylight. The YY% indicates the portion of operating hours per year to receive that daylight. It also includes an area requirement or statement. For example, sDA200,60% for 30% of regularly occupied spaces means that 30% of regularly occupied spaces receive at least 200 lux for at least 60% of the operating hours each year.

Table C406.2.5.4 Added Daylighting Parameters

Building use type	DLA_{TYP}	DLA_{max}
Small Office ≤ 5000 ft^2 (460 m^2)	10%	20%
Office > 5000 ft^2 (460 m^2)	21%	31%
Single-floor retail ≤ 3000 ft^2 (280 m^2) or retail with ≤ 1000 ft^2 (900 m^2) *roof* area	0%	20%
Retail >3000 ft^2 (280 m^2) of single-floor area	60%	80%
School	42%	52%
Warehouse and semiheated	50%	70%
Medical, hotel, multifamily, dormitory, and other	NA	NA

C406.2.5.5 L05 Residential light control.

To achieve this credit, in buildings with nontransient residential spaces interior lighting systems shall comply with the following:

1. Restrooms, laundry rooms, storage rooms, utility rooms, and interior parking areas shall have automatic full OFF occupancy sensor controls that comply with the requirements of C405.2.1.1. Each additional control device shall control no more than 5,000sq.ft.

2. Stairwells, lobbies, and corridors shall have automatic partial OFF occupancy sensor controls that shall reduce general lighting power in the space by at least 66% of full lighting power within 15 minutes of all occupants leaving the space.

3. Each *dwelling unit* shall have a main control by the main entrance that turns off all the lights and all switched receptacles in the *dwelling unit*. Two switched receptacles shall be provided in living and sleeping rooms or areas and clearly identified. All switched receptacles shall be located within 12 inches (30 cm) of an unswitched receptacle. The main control shall be permitted to have two controls, one for permanently wired lighting and one for switched receptacles. The main controls should be clearly identified as "lights master off" and "outlets master off."

Where item 2 is not practicable, it is permitted to be excluded and measure credits shall be 85% of base credits from Tables C406.1.2(1) through C406.1.2(9) or EC_{rl} calculated using Equation 4-19.

Where automatic lighting controls similar to item 3 are required in some dwelling units by C405.2, base credits shall be prorated using Equation 4-19.

$$EC_{rl} = EC_t \times [0.8 \times (1-Area_{durl}/Area_{du}) + 0.2]$$

(Equation #)

where:

EC_{rl} = Residential lighting control measure energy credit achieved for the project

EC_t = C406.2.5.5 L05 base energy credit for building use type and Climate Zone

$Area_{durl}$ = Dwelling unit gross lighted floor area where similar controls are required by Section C405.2

$Area_{du}$ = Total project dwelling unit gross lighted floor area

C406.2.5.6L06 Reduced lighting power..

Interior lighting within the whole project shall achieve energy credits by complying with all the requirements of this section.

1. The net connected interior lighting power (LPn) shall be 95% or less than the net interior lighting power allowance (LPA accordance with Section C405.3.2.2. In R-1 and R-2 occupancies the credit is calculated for all common areas other th sleeping units. Energy credits shall be determined based on one of the following:

    1.1 Where $LP_n \leq 80\%$ of LPA_n, four times the C406.2.5.6 credits from Tables C406.1.2(1) through C406.1.2(9).

    1.2 Where $LP_n > 80\%$ of LPA_n and $LP_n \leq 95\%$ of LPA_n energy credits shall be determined using Equation 4-20 .

    $$EC_{LPA} = EC_5 \times 20 \times (LPA_n - LP_n)/LPA_n$$

    where:

    EC_{LPA} = additional energy credit for lighting power reduction

LP_n = net connected interior lighting power calculated in accordance with SectionC405.3.1, watts, less any additio allowed in Section C405.3.2.2.1

LPA_n = interior lighting power allowance calculated in accordance with the requirements of Section C405.3.2.2, wa additional interior lighting power allowed in Section C405.3.2.2.1

EC_5 = L06 base credit from Tables C406.1.2(1) through C406.1.2(9)

2. No less than 95 percent of the permanently installed light fixtures in *dwelling units* and *sleeping units* shall be provided lamps with a minimum efficacy of 90 lumens per watt.

C406.2.7 Efficient Equipment Credits

C406.2.7.1Q01 Efficient Elevator Equipment.

Qualifying elevators in the building shall be Energy efficiency class A per ISO 25745-2, Table 7. Only buildings 3 or more floors above grade may use this credit. Credits shall be prorated based on Equation 4-22, rounded to the nearest whole credit. Projects with a compliance ratio below 0.5 do not qualify for this credit.

$EC_e = EC_t \times CR_e$

(Equation #)

where:

EC_e = Elevator energy credit achieved for Building

EC_t = C406.2.7.1 Table energy credit

CR_e = Compliance Ratio = (F_A / F_B)

F_A = Sum of floors served by class A elevators

F_B = Sum of floors served by all building elevators and escalators

C406.2.7.2Q02 Efficient Commercial Kitchen Equipment..

For buildings and spaces designated as Group A-2, or facilities whose primary business type involves the use of a commercial kitchen with at least one gas or electric fryer, all fryers, dishwashers, steam cookers and ovens shall comply with all of the following:

1. Achieve performance levels in accordance with the equipment specifications listed in Tables C406.12 (1) through C40 accordance with the applicable test procedure.
2. Be installed before the issuance of the Certificate of Occupancy.
3. Have associated performance levels listed on the construction documents submitted for permitting.

C406.2.7.3Q03 Efficient Residential Kitchen Equipment. .

For projects with Group R-1 and R-2 occupancies, energy credits shall be achieved where all dishwashers, refrigerators, and freezers comply with all of the following:

1. Achieve the Energy Star Most Efficient 2021 label in accordance with the specifications current as of:

    1.1 Refrigerators and freezers 5.0, 9/15/2014

    1.2 Dishwashers 6.0, 1/29/2016

2. Be installed before the issuance of the certificate of occupancy.

For Group R-1 where only some guest rooms are equipped with both refrigerators and dishwashers, the table credits shall be prorated as follows:

[Tables C406.1.2(1) through C406.1.2(9) base credits] × [floor area of guest rooms with kitchens] / [total guest room floor area]

C406.2.7.4Q04 Fault detection and diagnostics system. .
A project not required to comply with C403.2.3 can claim energy credits for installing a fault detection and diagnostics system to monitor the HVAC system's performance and automatically identify faults. The installed system shall comply with items 1 through 6 in Section C403.2.3.

Table C406.2.7.2(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 F1361
Standard Open Deep-Fat Electric Fryers	≥ 83%	≤ 800 watts	
Large Vat Open Deep-Fat Gas Fryers	≥ 50%	≤ 12,000 Btu/hr	ASTM F2144
Large Vat Open Deep-Fat Electric Fryers	≥ 80%	≤ 1,100 watts	

For SI: BTU/h = 0.293W

Table C406.2.7.2(2) Minimum Efficiency Requirements: Commercial Steam Cookers

Fuel Type	Pan Capacity	Cooking Energy Efficiency[a]	Idle Energy Rate	Test Procedure
Electric Steam	3-pan	50%	-	ASTM F1484
	4-pan	50%	-	
	5-pan	50%	-	
	6-pan and larger	50%	-	
Gas Steam	3-pan	38%	-	
	4-pan	38%	-	
	5-pan	38%	-	
	6-pan and larger	38%	-	

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

Table C406.2.7.2(3) Minimum Efficiency Requirements: Commercial Dishwashers

Machine Type	High Temperature Efficiency Requirements		Low Temperature 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 F1696	
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 GPR	≤ 1.00 kW	≤ 0.58 GPSF	ASTM F1920	
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 should be measured with the door closed and represent the total idle energy consumed by the machine including all tank heaters and controls. Booster heater (internal or external) energy consumption shall not be part of this measurement unless it cannot be separately monitored.

b. GPR = gallons per rack, GPSF = gallons per square foot of rack, GPH = gallons per hour, x = maximum conveyor belt speed (feet/minute) x conveyor belt width (feet)

Table C406.2.7.2(4) 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
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
	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
	Double	≤ 30,000 Btu/h	≥ 52	

P = Pan Capacity: the number of steam table pans the combination oven is able to accommodate in accordance with ASTM F1495

C406.3 Renewable and Load Management Credits.

Renewable energy and load management measures installed in the building that meet the requirements in Sections C406.3.1 through C406.3.8 shall achieve the credits listed for the occupancy group in Tables C406.3(1) through C406.3(9) or where calculations required in Sections C406.3 create credits or modify the table credits, the credits achieved shall be based upon the Section C406.3 calculations.

The load management measures in Sections C406.3.2 through C406.3.7 require load management control sequences that are capable of and configured to automatically provide the load management operation specified based on a demand response signal from the controlling entity, such as a utility or service operator. When communications are disabled or unavailable, all demand responsive controls shall continue to perform all other control functions provided by the control and shall continue backup demand response based on a local schedule or building demand monitoring. The local building schedule shall be adjustable without programming and reflect the electric rate peak period dates and times The load management control sequences shall be activated by either:

1. A certified OpenADR 2.0a or OpenADR 2.0b Virtual End Node (VEN), as specified under Clause 11, Conformance, in OpenADR 2.0 Specification, or

2. A device certified by the manufacturer as being capable of responding to a demand response signal from a certified O[...] automatically implementing the control functions requested by the VEN for the equipment it controls, or

3. A device that complies with IEC 62726-10-1, an international standard for the open automated demand response syste[...] the smart appliance, system, or energy management system and the controlling entity, or

4. An interface that complies with the communication protocol required by a controlling entity, to participate in an automat[...] program, or

5. Where the controlling entity does not have a demand response program or protocol available, local demand response [...] provided based on either building demand management controls that monitor building electrical demand, or a local bui[...] reflects the electric rate peak period dates and times. In this case binary input(s) to the control system shall be provide[...] demand response sequence when connected in the future to an interface that receives a controlling entity demand res[...]

Table C406.3(1) Renewable and Load Management Credits for Multifamily/Dormitory

ID	Energy Credit Abbreviated Title	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R01	On-Site Renewable Energy	C406.3.1	9	15	11	17	18	20	19	21	13	10	13	9	9	11	10	9	10	9	7
G01	Lighting load management	C406.3.2	16	7	9	12	12	16	11	14	12	11	16	14	8	11	14	5	7	7	11
G02	HVAC load management	C406.3.3	42	41	21	35	23	37	30	28	28	17	33	24	20	22	23	10	13	15	17
G03	Automated shading	C406.3.4	11	x	7	18	10	13	5	13	12	2	14	7	10	13	11	1	8	8	16
G04	Electric energy storage	C406.3.5	10	10	10	11	10	13	13	14	17	16	13	17	14	13	17	14	14	14	15
G05	Cooling energy storage	C406.3.6	28	6	31	13	22	21	21	37	11	12	22	11	9	17	9	7	17	2	3
G06	SHW energy storage	C406.3.7	17	17	19	18	19	19	20	20	22	19	19	21	19	19	20	18	19	18	17
G07	Building thermal mass	C406.3.8	7	2	11	5	16	28	22	27	60	19	43	46	32	58	37	27	45	40	19

x = Credits excluded from this building use type and climate zone.

C406.3(2) Renewable and Load Management Credits for Health Care Buildings

ID	Energy Credit Abbreviated Title	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
												Climate Zone									
R01	On-Site Renewable Energy	C406.3.1	6	6	6	6	6	8	7	9	8	6	8	6	6	7	7	6	7	5	4
G01	Lighting load management	C406.3.2	11	12	13	13	13	12	12	12	6	13	16	12	13	14	15	14	14	12	12
G02	HVAC load management	C406.3.3	10	11	10	10	8	21	10	10	13	11	18	11	12	14	13	12	11	9	7
G03	Automated shading	C406.3.4	1	1	1	1	x	x	x	1	x	x	2	x	x	2	x	x	1	1	x
G04	Electric energy storage	C406.3.5	13	13	13	13	14	15	14	15	15	14	15	15	14	15	15	13	14	13	12
G05	Cooling energy storage	C406.3.6	25	6	33	14	25	19	27	37	27	16	22	19	14	18	11	11	20	2	3
G06	SHW energy storage	C406.3.7	4	4	4	4	4	4	4	4	4	4	4	5	4	4	4	4	4	4	4
G07	Building thermal mass	C406.3.8	6	2	10	4	15	25	20	24	57	18	39	44	31	53	33	26	40	34	14

x = Credits excluded from this building use type and climate zone.

Table C406.3(3) Renewable and Load Management Credits for Hotel/Motel

ID	Energy Credit Abbreviated Title	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
												Climate Zone									
R01	On-Site Renewable Energy	C406.3.1	9	8	12	9	11	11	10	12	13	9	12	8	9	11	9	8	9	7	5
G01	Lighting load management	C406.3.2	12	12	11	12	12	14	14	13	15	14	13	11	10	11	14	9	11	8	8
G02	HVAC load management	C406.3.3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
G03	Automated shading	C406.3.4	2	2	2	3	1	2	3	2	4	3	2	1	0	1	3	1	2	0	0
G04	Electric energy storage	C406.3.5	9	9	10	10	9	13	13	15	13	14	13	14	14	12	16	13	12	12	13
G05	Cooling energy storage	C406.3.6	31	7	38	17	29	24	31	44	26	18	26	16	15	21	11	12	24	2	4
G06	SHW energy storage	C406.3.7	25	25	28	26	28	29	29	30	31	29	30	31	28	29	31	26	28	25	24
G07	Building thermal mass	C406.3.8	6	1	10	4	14	24	19	23	53	17	38	41	30	52	33	26	42	37	17

x = Credits excluded from this building use type and climate zone.

Table C406.3(4) Renewable and Load Management Credits for Office Buildings

ID	Energy Credit Abbreviated Title	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
												Climate Zone									
R01	On-Site Renewable Energy	C406.3.1	14	14	17	15	17	19	18	22	24	17	22	16	14	18	18	14	17	14	11
G01	Lighting load management	C406.3.2	10	11	11	12	11	11	11	12	9	10	11	10	10	11	10	10	11	10	9

ID	Energy Credit	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
G02	HVAC load management	C406.3.3	x	10	10	9	9	3	8	12	7	12	8	11	9	10	12	8	9	10	2
G03	Automated shading	C406.3.4	4	7	7	8	7	8	5	6	6	4	6	5	4	5	5	5	5	4	7
G04	Electric energy storage	C406.3.5	14	15	14	14	16	16	17	16	18	17	16	18	17	17	18	16	15	17	18
G05	Cooling energy storage	C406.3.6	28	7	36	16	27	24	28	45	27	17	27	15	15	20	9	12	25	2	4
G06	SHW energy storage	C406.3.7	5	5	6	6	6	6	7	7	8	7	7	7	7	7	8	6	7	6	6
G07	Building thermal mass	C406.3.8	3	1	5	2	6	9	6	7	14	4	11	8	9	15	5	8	12	15	7

x = Credits excluded from this building use type and climate zone.

Table C406.3(5) Renewable and Load Management Credits for Restaurant Buildings

ID	Energy Credit Abbreviated Title	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R01	On-Site Renewable Energy	C406.3.1	2	2	2	2	2	2	3	4	2	3	2	2	3	2	2	2	2	1	
G01	Lighting load management	C406.3.2	4	4	5	5	4	5	5	5	5	4	5	5	4	4	5	4	5	4	1
G02	HVAC load management	C406.3.3	32	26	37	28	31	26	27	22	23	20	17	14	19	14	10	16	14	14	1
G03	Automated shading	C406.3.4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
G04	Electric energy storage	C406.3.5	4	4	4	4	5	5	5	5	4	4	4	4	3	4	4	4	3	3	2
G05	Cooling energy storage	C406.3.6	15	4	17	8	12	10	10	16	6	5	7	3	3	4	1	2	4	0	0
G06	SHW energy storage	C406.3.7	13	13	15	14	15	16	16	17	19	16	17	19	16	17	18	15	16	14	13
G07	Building thermal mass	C406.3.8	3	1	5	2	7	12	8	10	21	6	15	14	8	18	10	6	12	8	3

x = Credits excluded from this building use type and climate zone.

Table C403.6(6) Renewable and Load Management Credits for Retail Buildings

ID	Energy Credit Abbreviated Title	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R01	On-Site Renewable Energy	C406.3.1	8	8	12	9	11	12	12	17	17	11	13	9	10	11	10	9	10	9	6
G01	Lighting load management	C406.3.2	16	16	18	19	17	19	19	21	17	18	21	21	18	21	22	18	22	18	16
G02	HVAC load management	C406.3.3	x	15	16	15	15	6	15	21	13	23	15	23	17	19	26	14	17	18	3
G03	Automated shading	C406.3.4	7	11	11	12	11	13	10	11	11	7	11	11	8	10	11	8	9	8	12
G04	Electric energy storage	C406.3.5	6	10	8	10	11	12	11	10	14	11	10	12	10	11	12	11	9	10	8
G05	Cooling energy storage	C406.3.6	40	9	51	22	35	31	34	53	21	17	28	10	11	19	4	9	18	2	2
G06	SHW energy storage	C406.3.7	3	3	4	3	4	4	4	4	5	4	4	5	4	4	5	4	4	4	3
G07	Building thermal mass	C406.3.8	5	1	6	3	8	12	10	10	20	7	17	15	14	24	10	13	20	24	12

x = Credits excluded from this building use type and climate zone.

Table C406.3(7) Renewable and Load Management Credits for School/Education Buildings

ID	Energy Credit Abbreviated Title	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R01	On-Site Renewable Energy	C406.3.1	10	11	13	12	13	16	15	21	22	15	19	15	14	17	16	13	16	12	10
G01	Lighting load management	C406.3.2	7	12	12	13	13	15	14	16	13	12	16	16	10	14	18	16	13	14	14
G02	HVAC load management	C406.3.3	18	22	32	23	25	31	26	26	20	23	31	24	20	31	12	18	27	16	9
G03	Automated shading	C406.3.4	7	13	16	12	18	17	17	18	13	12	17	17	10	15	13	14	10	16	17
G04	Electric energy storage	C406.3.5	16	16	18	17	19	21	21	23	26	22	24	24	23	24	24	20	22	19	19
G05	Cooling energy storage	C406.3.6	36	9	46	21	36	32	39	62	39	24	37	22	20	28	13	16	31	3	4
G06	SHW energy storage	C406.3.7	5	5	6	5	6	6	7	7	8	7	7	8	7	7	8	7	7	7	6
G07	Building thermal mass	C406.3.8	7	2	11	5	17	28	23	27	63	21	44	48	37	60	38	31	50	47	21

x = Credits excluded from this building use type and climate zone.

Table C406.3(8) Renewable and Load Management Credits for Warehouse and Semiheated Building Areas

ID	Energy Credit Abbreviated Title	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R01	On-Site Renewable Energy	C406.3.1	38	37	55	45	53	53	49	58	66	36	56	38	29	41	36	24	32	23	16
G01	Lighting load management	C406.3.2	13	26	32	28	32	35	36	33	36	31	27	37	32	23	28	36	22	25	22
G02	HVAC load management	C406.3.3	18	46	37	37	28	36	29	26	22	23	17	12	16	13	5	14	8	10	3
G03	Automated shading	C406.3.4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
G04	Electric energy storage	C406.3.5	40	40	47	41	47	44	40	44	42	30	38	31	21	31	26	24	29	23	21
G05	Cooling energy storage	C406.3.6	20	5	21	11	14	14	11	21	5	5	9	2	2	5	1	1	3	x	x
G06	SHW energy storage	C406.3.7	3	3	3	3	4	3	4	4	4	3	4	4	3	3	4	2	2	2	2
G07	Building thermal mass	C406.3.8	7	2	12	5	17	29	23	28	66	18	44	47	28	56	37	20	39	29	13

x = Credits excluded from this building use type and climate zone.

Table C406.3(9) Renewable and Load Management Credits for Other Buildings

ID	Energy Credit Abbreviated Title	Section	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R01	On-Site Renewable Energy	C406.3.1	12	13	16	14	16	18	17	20	21	13	18	13	12	15	14	11	13	10	8
G01	Lighting load management	C406.3.2	11	13	14	14	14	16	15	16	14	14	16	16	13	14	16	14	13	12	12

ID	Measure	Section																			
G02	HVAC load management	C406.3.3	24	24	23	22	20	23	21	21	18	18	20	17	16	18	14	13	14	13	6
G03	Automated shading	C406.3.4	5	6	7	9	8	9	7	9	8	5	9	7	5	8	7	5	6	6	9
G04	Electric energy storage	C406.3.5	14	15	16	15	16	17	17	18	19	16	17	17	15	16	17	14	15	14	14
G05	Cooling energy storage	C406.3.6	28	7	34	15	25	22	25	39	20	14	22	12	11	17	7	9	18	2	3
G06	SHW energy storage	C406.3.7	9	9	11	10	11	11	11	12	13	11	12	13	11	11	12	10	11	10	9
G07	Building thermal mass	C406.3.8	6	2	9	4	13	21	16	20	44	14	31	33	24	42	25	20	33	29	13

x = Credits excluded from this building use type and climate zone.

C406.3.1 R01 On-Site Renewable Energy.
Where an unshaded flat plate collector oriented toward the equator and tilted at an angle from horizontal equal to the latitude receives an annual daily average incident solar radiation equal or greater than 1.1 kBtu/ft²·day (3.5 kWh/m²·day), projects installing on-site renewable energy systems with a capacity of at least 0.1 watts per gross square foot (1.08 W/m^2) of building area shall achieve energy credits for this measure, calculated as follows:

$$AEC_{RRa} = AEC_{0.1} \times (RR_t - RR_e)/(0.1 \times PGFA)$$

(Equation 4-23)

where:

AEC_{RRa} = C406.3.1 R01 energy credits achieved for this project

RR_t = actual total rating of on-site renewable energy systems (W)

$PGFA$ = Project gross floor area, ft^2

$AEC_{0.1}$ = C406.3.1 R01 base credits from Tables C406.3(1) through C406.3(9)

RR_e = rating (W) of on-site renewable energy systems excluded from credit calculated as follows:

$$RR_e = RR_r + \text{greater of } [\, 0 \text{ or } (RR_t - PFGA \times RA_L - ESC/3\,)\}$$

(Equation 4-24)

where:

RR_r = rating of on-site renewable energy systems required by other Sections of this code (W) plus the rating of any on-site renewable energy systems used to qualify for exceptions elsewhere in this code.

$PGFA$ = Project gross floor area, ft^2 (m^2)

RA_L = Limit of on-site renewable energy systems rating per gross floor area that exceed the rating per gross floor area in Table C406.3.1 without electrical storage installed in accordance with Section C406.3.5. For office and residential buildings, see RA_L adjustments in table footnotes.

ESC = Electric Storage Capacity in Watt·hours installed in the project in accordance with Section C406.3.5

Table 406.3.1 Renewable Capacity Limits (RA$_L$) without Electric Storage, W/ft^2

Building Occupancy Group	Climate Zone																		
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
RA$_{L1}$: R-2, R-4, and I-1 with gas water heat [a]	1.3	1.3	1.0	1.0	1.0	0.9	0.9	0.8	0.7	0.9	0.8	0.9	0.9	0.9	0.9	1.0	0.9	1.0	1.3
RA$_{L2}$: R-2, R-4, and I-1 with electric or solar water heat [a]	7.6	6.8	5.9	5.1	4.2	4.2	4.2	3.4	2.5	4.2	3.4	3.4	3.4	3.4	3.4	4.2	3.4	4.2	5.1
I-2	10.3	9.7	8.2	8.2	8.2	7.3	7.2	6.2	6.2	7.5	6.2	7.3	7.5	6.5	7.3	7.3	7.2	7.2	8.8
R-1	4.1	3.8	3.4	2.9	3.1	2.7	2.6	2.3	2.2	2.7	2.0	2.7	2.7	2.1	1.9	2.6	2.2	2.7	3.2
RA$_{L3}$: B with IT & phone equip. > 0.5 W/ft^{2b}	5.2	5.2	4.6	4.6	4.3	4.0	4.0	3.8	3.5	3.8	3.8	4.0	4.0	4.0	4.0	4.0	4.0	4.3	5.2
RA$_{L4}$: B with IT & phone equip. ≤ 0.5 W/ft^{2b}	2.7	2.7	2.1	2.1	2.1	1.9	1.9	1.6	1.6	1.8	1.6	1.8	1.8	1.8	1.8	1.9	1.9	2.0	2.6
A-2	26.9	26.3	19.4	20.0	18.0	14.9	14.9	13.9	12.7	14.8	12.5	14.0	13.7	13.1	13.2	14.4	13.6	14.4	16.5
M	6.5	6.4	4.5	4.8	4.3	3.5	3.5	3.0	2.9	3.2	2.9	3.2	3.2	2.9	2.8	3.1	2.9	3.1	3.3
E	3.9	4.2	2.8	3.0	2.6	2.1	2.0	1.7	1.6	1.9	1.4	1.9	1.9	1.9	1.9	1.9	1.9	1.9	2.4
S-1 and S-2	1.3	1.3	1.0	1.0	0.7	0.7	0.7	0.7	0.6	0.7	0.6	0.7	0.7	0.7	0.7	0.9	0.9	0.9	1.0
All Other	3.4	3.3	2.6	2.5	2.9	2.7	2.7	2.1	2.3	2.6	2.3	2.7	2.7	2.5	3.1	3.1	2.8	3.2	3.2

[a] For buildings that include residential occupancy (Group R-2, R-4 and I-1), RA$_L$ shall be adjusted as follows:

1. Where 70% or more of service water-heating capacity is gas, RA$_L$ = RA$_{L1}$

2. Where 70% or more of service water-heating capacity is electric resistance or solar water/pool heating is included with backup, use RA$_{L2}$

3. Where 70% or more of service water-heating capacity is heat pump water heating, adjust as follows: RA$_L$ = RA$_{L1}$ + { (R

4. Where solar water/pool heating is included with gas backup, prorate based on relative capacity as follows: RA$_L$ = [% ga RA$_{L1}$ + [% solar peak capacity] · RA$_{L2}$

5. Where electric water heating is mixed with gas water heating, prorate based on relative capacity as follows: RA_L = [% g RA_{L1} + [% electric peak capacity] · RA_{L2}

[b] Office (Group B) IT & phone equipment density is calculated based on total building area, not just server and equipment room area, and power for distributed computers or terminals in office areas is not included. Where the total building density of IT & phone equipment is greater than 0.5 W/sf, RA_L = RA_{L3}, otherwise RA_L = RA_{L4}.

Table C406.3.1 Renewable Capacity LImits (RA_L) without Electric Storage, W/m²

Building Occupancy Group	Climate Zone																		
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
RA_{L1}: R-2, R-4, and I-1 with gas water heat [a]	14	14	11	11	11	10	10	9	8	10	9	10	10	10	10	11	10	11	14
RA_{L2}: R-2, R-4, and I-1 with electric or solar water heat [a]	82	73	64	55	45	45	45	37	27	45	37	37	37	37	37	45	37	45	55
I-2	111	104	89	88	88	78	78	67	67	81	67	78	81	70	79	78	78	78	94
R-1	44	40	36	31	33	29	28	24	24	29	22	29	29	23	21	28	24	29	34
RA_{L3}: B with IT & phone equip. > 0.5 W/ft²[b]	56	56	50	50	46	43	43	41	38	41	41	43	43	43	43	43	43	46	56
RA_{L4}: B with IT & phone equip. ≤ 0.5 W/ft²[b]	29	29	23	23	23	20	20	17	17	19	17	19	19	19	19	20	20	22	27
A-2	289	283	209	215	193	160	160	150	136	159	135	150	147	141	142	155	147	155	178
M	70	68	48	51	46	38	38	32	31	35	31	35	35	31	30	34	31	33	36
E	42	45	31	32	28	23	22	18	17	21	15	21	21	21	20	21	20	20	26
S-1 and S-2	14	14	11	11	8	8	8	8	6	8	6	8	8	8	8	10	10	10	11
All Other	36	35	28	27	32	29	29	23	24	28	25	29	29	27	34	33	30	35	34

[same footnotes as IP version]

C406.3.2 G01 Lighting Load Management.
Luminaires shall have dimming capability and automatic load management controls that shall gradually reduce general lighting power during peak electric price periods coincident with high building loads. The load management controls shall reduce lighting power in 75% of the building area by at least 20% with continuous dimming over a period no longer than 15 minutes. F Where less than 75%, but at least 50% of the project general lighting is controlled, the credits from Tables C406.3 shall be prorated as follows:

[Area of building with lighting load management, %] x [table credits for C406.3.2] / 75%

Exception: Warehouse or retail storage building areas shall be permitted to achieve this credit by switching off at least 25% of lighting power in 75% of the building area without dimming.

**C406.3.3 G02 HVAC Load Management. **

Automatic load management controls shall be configured:
1. Where electric cooling is in use to gradually increase the cooling setpoint by at least 3°F over a minimum of three hours over the period coincident with high *building* electric load and high electric energy or demand price periods.

2. Where electric heating is in use to gradually decrease the heating setpoint by at least 3°F over a minimum of three hours over the period coincident with high building electric load and high electric energy or demand price periods.

3. Where HVAC systems are serving multiple zones and have less than 70% outdoor air required, include controls that provide excess *outdoor air* preceding the summer peak electric price period and reduce *outdoor air* by at least 30% during summer in the period of coincident high *building* load and summer peak electric price, in accordance with ASHRAE Standard 62.1 Section 6.2.5.2 Short Term Conditions.

C406.3.4 G03 Automated Shading Load Management.
Where fenestration on south and west exposures exceeds 20% of wall area, automatic controls shall be configured to operate movable exterior shading devices or dynamic glazing to reduce solar gain through sunlit fenestration on southern and western exposures by at least 50% during summer peak electric price periods.

Informative note:
This credit can be met by exterior roller, movable blind, or movable shutter shading devices; however fixed overhang, screen or shutter shading will not meet the requirement. Roller shades that reject solar gain but still allow a view are allowed as long as they provide an effective 50% reduction in net solar gain, e.g., have a shading coefficient of less than 0.5 for the shading material itself. Interior shading devices will not meet the requirement. Electrochromatic windows that achieve 50% of SHGC would qualify.

C406.3.4 G04 Electric Energy Storage.

Electric storage devices shall be charged and discharged by automatic load management controls to store energy during non-peak periods and use stored energy during peak periods to reduce building demand. Electric storage devices shall have a minimum capacity of 1.5 Wh/ft^2 (87 Wh/m^2) of gross building area. Base credits in Tables C406.3-1 through C406.3-8 are based on installed electric storage of 5 Wh/ft^2 (54 Wh/m^2) and shall be prorated for actual installed storage capacity between 1.5 and 15 Wh/ft^2 (16 to 160 Wh/m^2), as follows:

[Installed electric storage capacity, Wh/ft^2 (Wh/m^2)]] / 5 (54) × [C406.3.5 Credits from Tables]

Larger energy storage shall be permitted however, credits are limited to the range of 1.5 to 15 Wh/ft^2 value.

C403.3.6 G05 Cooling Energy Storage.
Automatic load management controls shall be capable of activating ice or chilled water storage equipment to reduce demand during summer peak electric price periods. To achieve this credit,
1. the storage tank shall be certified by the manufacturer to have no more than 2% of storage capacity standby loss over a 24 hour period, or

2. have tank insulation values that meet or exceed the following:

   a. R-9 (RSI-1.5): ice storage tank

   b. R-3 (RSI-0.5): above-ground chilled water tank

   c. None: below-ground chilled water tanks

Base credits in Tables C406.3-1 through C406.3-8 are for storage capacity of 1.0 ton-hours per design day ton of cooling load with a 1.15 sizing factor. Credits shall be prorated for installed storage systems sized between 0.5 and 4.0 ton-hours per design day ton (kWh/kW) of cooling load rounded to the nearest

whole credit. Larger storage shall be permitted but the associated credits are limited to the 4.0 ton-hours storage per ton of design day value. Energy credits shall be determined as follows:

ECs = EC1.0 x (1.44 X SR + 0.71) / 2.15

(Equation 4.25)

where:

G406.3.7 G06 SWH Energy Storage.
To achieve this credit, where SHW is heated by electricity, automatic load management controls comply with ANSI/CTA-2045-B shall preheat stored SHW before the electric peak price period and suspend electric water heating during the period of peak prices coincident with peak building load. Storage capacity shall be provided by either:

1. Preheating water above 140°F (60°C) delivery temperature with at least 1.34 kWh of energy storage per kW of water-heating capacity. Tempering valves shall be provided at the water heater delivery location.

2. Providing additional heated water tank storage capacity above peak SHW demand with equivalent peak storage capacity to item 1. Where heat pump water heating is used, the credits achieved shall be 1/3 of the credits in Tables C406.3(1) through C406.3(9).

C406.3.8 G07 Building Thermal Mass. The project shall have additional passive interior mass and a night flush control of the HVAC system. The credit is available to projects that have at least 80% of gross floor area unoccupied between midnight and 6:00 a.m.

1. Provide 10 pounds of passive thermal mass per square foot of building floor area. Locate the mass construction interior to the building, indoor-facing to the exterior wall or floor construction. Mass construction is allowed in direct contact with the air in conditioned spaces or directly attached to interior-facing gypsum board or interior-facing hard surface flooring. Mass with carpet or furred wallboard shall not be counted toward the building mass required. For integral insulated concrete block walls complying with ASTM C90 with an exterior face, only the mass of the interior face shall be counted toward the building mass required.

2. HVAC units that supply 80% or more of the airflow in the project shall be included in the night flush control sequence and be equipped with outdoor air economizers and fans that have variable or low speed capability to operate at 66% or lower design airflow.

3. Night flush controls shall be configured with the following sequence or alternative night flush strategy where demonstrated to be effective, avoids added morning heating, and is approved by the authority having jurisdiction.

    a. During active summer mode for hours that indoor average temperature is 5°F or more above outdoor temperature and p.m. and 6:00 a.m., automatic night flush controls shall operate outdoor air economizers at fan speed less than 66% the unoccupied period until the average indoor air temperature falls to the occupied heating setpoint.

Informative Note:
The simplified night flush sequence described will operate in "Summer Mode" below the 70F OA trigger temperature down until OA of 45F is hit when the "Summer Mode" is deactivated until the OA rises above 70F again. Other strategies may be implemented that cool the space below the heating setpoint and adjust the morning heating setpoint to avoid morning reheating.

Revise as follows:

C407.2 Mandatory requirements.

Compliance based on total building performance requires that a proposed design meet all of the following:

1. The requirements of the sections indicated within Table C407.2.

2. An annual energy cost that is less than or equal to 80 the percentage of the annual energy cost (PAEC) of the *standard design* calculated in Equation 4-23.. Energy prices shall be taken from a source *approved* by the *code official*, such as Energy, Energy Information Administration's *State Energy Data System Prices and Expenditures* reports. *Code officials* require time-of-use pricing in energy cost calculations. The reduction in energy cost of the proposed design associated *renewable energy* shall be not more than 5 percent of the total energy cost. The amount of renewable energy purchase sources shall be the same in the *standard reference design* and the *proposed design*.

Exception: Jurisdictions that require site energy (1 kWh = 3413 Btu) rather than energy cost as the metric of comparison.

PAEC = 100 x (0.85 + 0.025 - ECr/1000)

(Equation 4-23)

where:

PAEC = Percentage of annual energy cost applied to standard reference design

EC_r = Energy efficiency credits required for the building in accordance with Section C406.1 (do not include load management and renewable credits)

Informative note: The formula above allows adjustment for the current energy credits required in the IECC (2.5% or 0.025) and the new energy efficiency credit requirements that come from Section C406.1.1.

TABLE C407.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION [a]	TITLE
Envelope	
C402.5	Air leakage—thermal envelope
Mechanical	
C403.1.1	Calculation of heating and cooling loads
C403.1.2	Data centers
C403.2	System design
C403.3	Heating and cooling equipment efficiencies
C403.4, except C403.4.3, C403.4.4 and C403.4.5	Heating and cooling system controls
C403.5.5	Economizer fault detection and diagnostics
C403.7, except C403.7.4.1	Ventilation and exhaust systems
C403.8, except C403.8.6	Fan and fan controls
C403.9	Large-diameter ceiling fans
C403.11, except C403.11.3	Refrigeration equipment performance
C403.12	Construction of HVAC system elements
C403.13	Mechanical systems located outside of the building thermal envelope
C404	Service water heating
C405, except C405.3	Electrical power and lighting systems

C406.1.2	Additional renewable and load management credit requirements
C408	Maintenance information and system commisioning

a.   Reference to a code section includes all the relative subsections except as indicated in the table.

Add new references as follows:

CTA
Consumer Technology Association Technology & Standards Department
1919 S Eads Street
Arlington, VA 22202
ANSI/CTA-2045-B – 2018: Modular Communications Interface for Energy Management
                    C406.3

IEC
IEC Regional Centre for North America
446 Main Street 16th Floor
Worcester, MA 01608
IEC 62746-10-1 - 2018 Systems interface between customer energy management system and the power management system - Part 10-1: Open automated demand response
                    C406.3

OpenADR
OpenADR Alliance
111 Deerwood Road
Suite 200
San Ramon, CA 94583
OpenADR 2.0a and 2.0b – 2019: Profile Specification Distributed Energy Resources
                    C406.3

Add new Appendix CD that describes additional enhancements to the energy credits in Section C406.

<div align="center">

Appendix CD Energy Credits

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CD101 Scope.
This Appendix describes additional enhancements to Section C406 that can be considered by the adopting authority.

CD102 Code Language for Advanced Package.
Section CD102 includes the sample code language adjustments necessary if a more aggressive advanced requirement for energy credits is desired by the jurisdiction. The measure selections for the demonstration advanced package and expected savings are described in Sections 1.6 and 1.7.2.1. To use the advanced package and increase the savings requirements, simply replace the values in Section 3.0, Tables C406.1 with the following values:

If even greater advanced savings are desired, then increase the renewable plus load management requirements to represent increased renewable credits where possible or added load management credits. Such increases will have to be reviewed for applicability to particular climate zones and building types.

Table CD102.1 Energy Credit Requirements by Building Occupancy Group

Building Occupancy Groups	Climate Zone																		
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R-2, R-4, and I-1	179	174	188	197	200	200	200	200	200	200	200	200	193	200	200	200	200	200	200
I-2	78	75	73	71	80	90	100	85	90	97	83	90	99	90	96	107	106	130	117
R-1	106	100	110	105	109	122	123	125	131	137	129	136	157	139	147	171	158	180	176
B	114	110	112	115	108	107	116	111	114	126	118	123	135	125	125	152	142	153	141
A-2	83	81	82	82	86	86	108	91	97	126	99	111	147	117	113	160	143	163	151
M	113	113	121	118	123	127	116	116	133	109	100	92	99	134	125	171	146	150	137
E	91	95	91	100	96	100	105	104	101	113	110	110	120	117	122	131	132	126	131
S-1 and S-2	108	106	111	109	109	108	89	106	108	134	100	130	200	143	123	200	190	189	148
All Other	54	53	55	56	57	60	61	60	63	68	60	65	73	68	69	84	79	84	78

CD103 Code Language for H01 HVAC Performance.
Section CD103 includes the code language adjustments necessary if the jurisdiction wishes to add the HVAC System Performance method as a more flexible HVAC energy credit measure. This is an alternate to the simplified efficiency measures H02 and H03, and also is an alternative to measure H05, DOAS. Those measures can remain in the energy credits, so they can be used alternatively for a project without using the HVAC Performance Method. To add the HVAC Performance Method as an energy credit measure, take these two actions:

1. Incorporate the HVAC Performance Method as a requirement in the code. Language for this measure can be found in a separate technical brief:

Goel S, R Hart, M Tillou, M Rosenberg, J Gonzalez, K Devaprasad, and J Lerond. 2021. HVAC System Performance for Energy Codes. Pacific Northwest National Laboratory, Richland WA.

2. Make the following changes to the sample code language in Section 3.0:

C406.2.2 More Efficient HVAC Equipment Performance
All heating and cooling systems shall meet the minimum requirements of Section C403 and efficiency improvements shall be referenced to minimum efficiencies listed in Tables referenced by Section C403.3.2. Where multiple efficiency requirements are listed, equipment shall meet the seasonal efficiencies including SEER, EER/integrated energy efficiency ratio (IEER), integrated part load value (IPLV), or AFUE. Equipment that is larger than the maximum capacity range indicated in Tables referenced by Section C403.3.2 shall utilize the values listed for the largest capacity equipment for the associated equipment type shown in the table. Where multiple individual heating or cooling systems serve the project, the improvement shall be the weighted average improvement based on individual system capacity.

For occupancies and systems required to comply with Section C403.1.1, credits shall be achieved by meeting the requirements of C406.2.2.1. Other systems are permitted to achieve credits by meeting the requirements of either:

1. C406.2.2.1 H01,
2. C406.2.2.2 H02,
3. C406.2.2.3 H03,
4. C406.2.2.3 H04,

5.   C406.2.2.5 H05,

6.   Any combination of H02, H03, H04 and H05, or

7.   The combination of H01 and H04.

C406.2.2.1 H01 HVAC System Performance.
~~Reserved for future use.~~For systems required to comply with Section C403.1.1, HVAC total system performance ratio, the TSPR shall exceed the minimum requirement by 5 percent. If improvement is greater, base energy credits from Table C406.1.2(1) through C406.1.2(9) are permitted to be prorated up to a 20 percent improvement using Equation 4-14. Energy credits for H01 may not be combined with energy credits from HVAC measures H02, H03 and H05.

H01 energy credit = H01 base energy credit x TSPR% / 5%

(Equation 4-14)

where:

TSPR%   = Percentage by which TSPR of proposed design exceeds minimum TSPR requirement. The value of TSPR% cannot exceed 20% for purposes of calculating H01 energy credits.

Update the base energy credits for measure H01 in Tables C406.1.2(1) through C406.1.2(9) as follows:

Portions of table not shown remain unchanged.

Table C406.1.2(1)

H01	HVAC Performance (TSPR)	C406.2.2.1	20	19	16	17	14	13	11	11	5	13	10	8	15	12	7	18	14	17	19

Portions of table not shown remain unchanged.

Table C406.1.2(2)

H01	HVAC Performance (TSPR)	C406.2.2.1	23	22	21	21	20	19	19	18	16	19	18	16	19	18	18	21	21	24	26

Portions of table not shown remain unchanged.

Table C406.1.2(3)

H01	HVAC Performance (TSPR)	C406.2.2.1	21	20	17	18	16	13	12	12	11	11	11	8	11	11	8	13	11	14	16

Portions of table not shown remain unchanged.

Table C406.1.2(4)

H01	HVAC Performance (TSPR)	C406.2.2.1	22	22	19	20	17	17	15	15	11	15	15	11	16	15	11	19	17	18	20

Portions of table not shown remain unchanged.

Table C406.1.2(5)

H01	HVAC Performance (TSPR)	C406.2.2.1	18	17	13	15	13	10	12	10	6	14	11	10	16	14	11	20	17	22	25

Portions of table not shown remain unchanged.

Table C406.1.2(6)

H01	HVAC Performance (TSPR)	C406.2.2.1	31	30	26	28	23	21	23	20	14	27	21	22	29	25	23	32	28	30	33

Portions of table not shown remain unchanged.

Table C406.1.2(7)

H01	HVAC Performance (TSPR)	C406.2.2.1	30	28	25	26	23	21	20	18	15	19	18	17	19	20	15	23	20	25	29

Portions of table not shown remain unchanged.

Table C406.1.2(8)

H01	HVAC Performance (TSPR)	C406.2.2.1	20	21	14	18	12	13	20	13	6	31	21	22	36	30	20	39	34	38	38

Portions of table not shown remain unchanged.

Table C406.1.2(9)

H01	HVAC Performance (TSPR)	C406.2.2.1	23	22	19	20	17	16	17	15	11	19	16	14	20	18	14	23	20	24	26

Notes to adopting authority:

When adding energy credit H01 HVAC System Performance:

1. Confirm renumbering of equations throughout C406.
2. Confirm that section references are correct.

Reason:

In the 2021 IECC, energy credit measures were expanded from 8 alternate options to 15 measures that can be flexibly selected to achieve a 2.5% level of building energy cost savings. A similar package of measures has been proposed for ASHRAE Standard 90.1-2022, with 32 energy efficiency, renewable energy, and load management measures available. Building-type-specific targets were developed with a goal of 5% total energy cost savings.

This proposal includes 40 energy efficiency measures and builds on the former energy credit approaches with a base goal of around 7% energy savings. The energy efficiency credits here are based on site energy use and each credit represents 1/10 of 1% building energy use. Renewable and Load Management measures add cost savings based on grid cost impact represented by a time-of-use electric price structure. While measure goals vary by building type and climate zone, a national weighted goal is as follows:

- The package of cost effective measures achieves a weighted national average of 7.0% site energy savings
- The package of cost effective load management and renewable measures achieves an average of 7.3% utility cost savings

If these measures were adopted nationally into building codes, potential national savings for expected new construction using various metrics would be as given in Table 1 while the impact of renewable and selected load management measures is shown in Table 2.

Table 1. Impact of Energy Credit Measures

Metric[a]	Units	Base Package
National Annual Site Energy Savings	million Btu	7,760,000
Consumer Annual Energy Cost Savings	million $US	$154.0m
Annual Emission Reductions, CO_2	metric tons	995,000

(a) The values shown here are based on national average values. Custom results can be generated for states and local jurisdictions to support adoption of advanced code concepts.

Table 2. Impact of Renewable and Load Management Credit Measures

Metric	Units	Base Package
Consumer Annual Energy Cost Savings	million $US	$158.2m

1. The Code Approach

Energy codes include mandatory requirements that all buildings must fulfill prescriptive requirements that can be used without following a performance path, or whole-building performance paths where equivalent energy performance to the prescriptive path is demonstrated. To fit into the existing code structure, additional energy credits constitute a new prescriptive requirement; however, instead of all measures being required, the building designer can select from various options to achieve a defined level of energy performance. To maintain equivalent energy impact, whole-building performance paths must be adjusted to reflect the impact of the required energy credits.

2. Energy Credit Development

Energy credits have been developed from typical measures used in green building programs, new construction utility incentive programs, and Advanced Energy Design Guidelines (ASHRAE 2019b). More detail is included in Section 1.4.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

While baseline prescriptive requirements usually undergo individual review for cost effectiveness, the approach to energy credit measures is different. Each measure can be selected for a particular building; however, not all measures are required, so the approach is to find at least one package of measures that are shown to be cost effective.
The energy credit requirements are justified based on a selection of a package of measures that meet the requirement and are cost effective for each building use type and climate zone. About one quarter of the measures were selected for inclusion in the cost effectiveness analysis, based on their general applicability and reliable savings. Two requirement packages were determined for evaluation of cost effectiveness:·   The package included standard efficiency measures with a cap of 10% for required credits to allow for measure selection flexibility. While the energy credits are limited to 10% whole-building savings, in many cases the selected measures that were cost effective exceeded that savings level. Table 8 provides an overview of measures selected for inclusion in the package. Measures are selected with the goal of 7% savings or 70 credits for this package. Measure selection may be climate zone specific. For example, cooling efficiency only makes sense in warm climate zones. The climate zones (CZ) or application of measures is shown along with individual measure lives shown for determining cost effectiveness.

Based on this selection of measures, the scalar value or payback for each building type for the selected group of measures is given in Table 9. This represents the cost for all measures included in the package divided by the annual consumer energy cost savings. Note that for multifamily buildings and hotels, the SHW distribution redesign results in a significant cost reduction, so the overall package cost is less than the baseline and the "CE" indicates that the packages in those buildings are immediately cost effective. A scalar limit or threshold is developed for each combination of climate zone and building type based on the individual measure lives shown in Table 7, weighted by the measure cost savings. The measures included in the base package and therefore credits required are adjusted so that all building types in all climate zones have a consumer payback that is less than the scalar limit, indicating cost effectiveness for the efficiency credit requirements.

Table 7. Scalar Ratio Method Economic Parameters and Scalar Ratio Limit

Input Economic Variables	Heating (gas) SRh	Cooling (electricity) SRc
Economic Life – Years (example)	40	40
Down Payment - $	0.00	0.00
Energy Escalation Rate - %[a]	2.90	2.25
Nominal Discount Rate - %[b]	8.1	8.1
Loan Interest Rate - %	5.0	5.0
Federal Tax Rate - %[b]	NA[b]	NA[b]
State Tax Rate - %[b]	NA[b]	NA[b]
Heating – Natural Gas Price, $/therm	0.983	
Cooling - Electricity Price $/kWh		0.1099
Scalar Ratio Limit (weight: 0.25/0.75)	25.4	22.0

(a) The energy escalation rate used in the scalar calculation for 90.1-2022 includes inflation, so it is a nominal rather than a real escalation rate.
(b) Beginning with addenda for 90.1-2016, SSPC 90.1 eliminated tax analysis from the Scalar Method by using a pre-tax discount rate.

Table 8. Matrix of Base Package Efficiency Measures

ID	Energy Credit Abbreviated Title	Measure Life, yr	Multifamily /Dormitory	Health Care	Hotel/Motel	Office	Restaurant	Retail	School/ Education	Warehouse/ Semiheated
E01	Glazing U & SHGC reduction	40	CZ 0A-1A	all CZ	all CZ	all CZ			all CZ	
E02	UA Reduction (15%)	40						All CZ		
H02	Heating efficiency	18		CZ 5-8	CZ 5-8	CZ 5-8	CZ 5-8	CZ 5B-8	CZ 5-8	CZ 4C-8
H03	Cooling efficiency.	15	CZ 0-2	CZ 0-2	CZ 0-3B	CZ 0-3B	CZ 0-3B	CZ 0-3B	CZ 0-3B	CZ 0-3B
H04	Residential HVAC control.	15	CZ 0-3, 6-8							
W02	Heat pump water heater	19					30% all CZ	CZ0, 4B-5		
W03	Efficient gas water heater	15	all CZ	all CZ	all CZ	all CZ	70% all CZ		all CZ	
W06	Thermostatic balancing valves	15	all CZ	all CZ	all CZ	all CZ			all CZ	
W08	SHW distribution sizing	15	all CZ		all CZ					
L03	Increase occupancy sensor	15		all CZ						all CZ
L04	Increase daylighting area	15						CZ 0-5		all CZ
L06	Light power reduction	20	5% all CZ	15% all CZ	15% all CZ	15% all CZ	10% all CZ	10% all CZ	15% all CZ	10-15% all CZ
Q02	Efficient kitchen equipment	15	(a)		(a)		all CZ		(a)	
Q04	Fault detection	15		all CZ	all CZ	CZ 0-4			all CZ	

a Dining areas and kitchens in dormitories, hotels, and schools treated as a separate area where efficient kitchen equipment credits apply

Table 9. Scalar Ratios for Base Package Efficiency Measures by Climate Zone and Building Type

Building Use Type	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
Multifamily/Dormitory	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE
Health Care	3.0	3.3	3.3	3.3	3.2	3.6	2.7	2.8	2.4	2.5	2.6	2.3	2.6	2.6	2.0	2.6	2.5	2.3	2.3
Hotel/Motel	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE	CE
Office	11.7	12.1	13.1	12.7	13.2	13.6	13.3	13.1	12.6	11.0	10.7	11.7	10.9	10.7	11.8	9.6	10.0	9.8	9.1
Restaurant	3.2	3.5	4.2	3.9	4.3	4.7	4.9	4.9	4.9	4.7	4.7	4.7	3.5	3.8	4.0	3.1	3.4	2.8	2.4
Retail Buildings	4.0	4.3	4.8	4.6	5.4	5.5	6.1	6.2	4.9	4.4	5.0	5.3	4.3	4.6	5.2	3.4	4.5	5.1	5.0
School/Education	6.5	7.3	8.5	7.8	8.8	9.8	9.1	9.0	8.0	7.1	7.1	7.8	6.6	6.1	7.2	5.4	6.1	5.2	4.4
Warehouse	8.3	8.1	9.4	8.9	9.8	9.5	8.0	7.7	2.7	2.8	2.7	2.9	1.8	2.4	3.0	1.4	1.8	1.5	1.5

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