



2021 IECC

CE218: C406 Points Option

Modifications to the “Choose One” Approach

The C406 Option Package was introduced into the IECC in 2012 as part of the prescriptive method to achieve an additional 4% energy savings over the prescriptive requirements of the code. The original proposal included three additional options (reduced lighting power density, increased HVAC efficiency and renewables). The 2018 version of the IECC has eight options (with sub-options) that are all considered equal.

In 2018, energy modeling analysis by PNNL found significant differences in the energy savings potential for each of the eight options. Savings varies across options, but also as a result of climate zone and occupancy type. As written now, C406 results in significant inconsistency across options, location and building type.

The **CE218: C406 Points Option** proposal aims to remedy these shortcomings by assigning points relative to building energy cost savings, occupancy and climate zone. The points option promotes flexibility and choice for designers and building owners. It will

also reward savings measures appropriate to the type and location of the building, and more fairly across options.

CE218 is the base proposal that converts section C406 from a “pick any one” approach to a “achieve a certain number of credits” approach. The credits for each option are based on analysis across all climate zones and for various occupancy types. Look up tables by occupancy group show the number of points by option and climate zone or by type of kitchen equipment. A point represents a savings of approximately 0.25% of annual building energy cost, based on modeling and best practices by PNNL (See FAQs for more information on estimated energy savings and costs).

To fulfill C406 under the CE218 modifications, the building must achieve 10 points. This represents about a 2.5% energy cost savings. Design teams and owners can choose by selecting one option with many points or several options with fewer points, as long as at least 10 credits are achieved.

Additional Options for C406

Instead of allowing one master proposal with options, the ICC recommended that the proponents separate this C406 points package into multiple code change proposals for consideration. CE218 is the overarching framework modification. Five other proposals (CE226, CE229, CE232, CE232, CE235) add or adjust six C406 options, as highlighted in the table below.

In addition, if CE218 does not pass, these same new or modified options for C406 are also included as separate code change proposals that are designed to fit the current format. These proposals have the same technical requirements, but they can be considered separately in the absence of CE218. These corresponding option packages are included for reference in the table below.

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C406 Options With New Proposals Highlighted

Code Change Proposal	Proponent	Code Section	Topic	Proposal if CE218 is not approved
CE218	Makela	C406	New C406 Credit Option Framework	
		C406.1.1	Tenant Spaces	n/a
		C406.2	More Efficient HVAC Equipment Performance	n/a
		C406.2.1	More Efficient HVAC Heating Performance.	n/a
		C406.2.2	More Efficient HVAC Cooling Performance.	n/a
		C406.2.3	High Efficiency HVAC Heating Performance.	n/a
		C406.2.4	High Efficiency HVAC Cooling Performance.	n/a
		C406.3.1	Reduced Lighting Power By More Than 10%.	n/a
CE226	Starr	C406.3.2	Reduced Lighting Power By More Than 15%.	CE228
CE226	Starr	C406.3.3	Lamp Efficacy	CE228
CE229	McHugh	C406.4	Enhanced Digital Lighting Controls	CE230
		C406.5	On-Site Renewable Energy	n/a
		C406.5.1	Basic Renewable Credit	n/a
		C406.5.2	Enhanced Renewable Credits	n/a
		C406.6	Dedicated Outdoor Air System	n/a
		C406.7	Reduced Energy Use In Service Water Heating	n/a
		C406.7.1	Building Type	n/a
		C406.7.2	Recovered Or Renewable Water Heating	n/a
		C406.7.3	Efficient Fossil Fuel Water Heater	n/a
		C406.7.4	Heat Pump Water Heater	n/a
		C406.8	Enhanced Envelope Performance	n/a
		C406.9	Reduced Air Infiltration	n/a
CE232	Denniston	C406.10	Controlled Receptacles	CE234
CE235	Edelson	C406.11	Extra Area Daylight Responsive Controls	CE236
CE240	O'Neil	C406.12	Efficient Kitchen Equipment	CE241

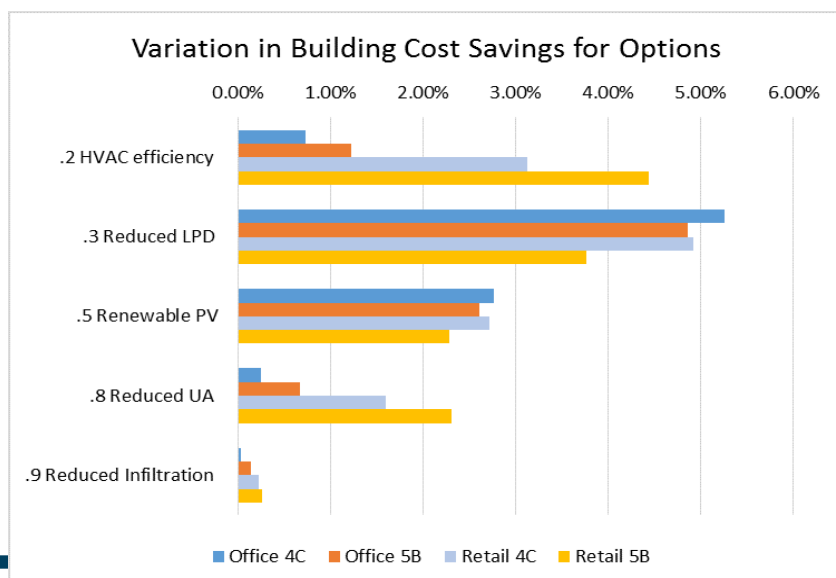
Frequently Asked Questions on CE218: C406 Points Option

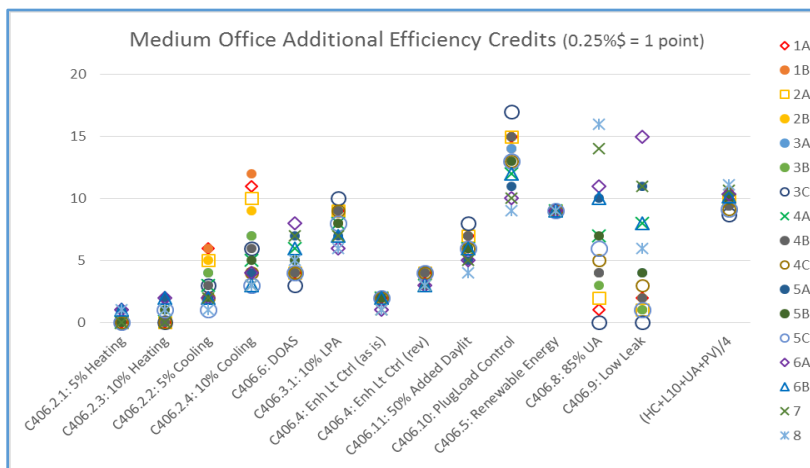
Why have points as opposed to a “pick one” approach in C406? The CE218 Section 406 Points Option improves flexibility and makes the different options more equal in energy savings. The extra efficiency points approach allows for designer and builder flexibility. While it is slightly more complicated to select multiple items and add up points, in many cases points are given for measures that are often included in buildings. Furthermore, using points rather than just “pick one” puts the options on more of a level consideration and better accounts for the impact of climate.

How was it determined that options in the C406 “choose one” approach were unequal? PNNL conducted energy modeling analysis for four building prototypes (medium office, primary school, midrise apartment, and stand-alone retail). EnergyPlus™ was used to evaluate each measure in the four prototypes across all climate zones, except where there is not a strong interaction with building HVAC systems, where standard engineering calculations were used (for example, service hot water and renewable energy systems). The Variation in Building Cost Savings for Options figure below shows the variation in savings from the modeling results.

Why is the efficiency points method superior to other approaches? The Medium Office Additional Efficiency results in the Figure on the following page show how the climate zone impact is fairly broad, especially for cooling efficiency and building envelope measures. The spread is also broad for lighting reduction and plug load controls, as the reduced heat load must be made up by the heating system in colder climates, while in warmer climates there is added savings in the cooling system. Assigning points relative to the building energy cost savings and climate zone will reward savings measures appropriate to the location of the building, and more fairly across options.

The points resulting from averaging four typical C406 measures (10 % HVAC, 10 % LPA, Renewable and 85% UA) are shown as the last item on the right side of the Medium Office Figure on the next page. These four average around 10 points across climate zones, while lighting power allowance—a popular option selection—averages around 8 points across climate zones. Selecting 10 points or 2.5% savings of building energy cost as the target of a point-based system makes sense as being slightly ahead or roughly equal to the approach followed in the 2018 IECC.





Where can I find out more about the technical analysis on C406 Options?

The analysis is available in a technical brief called "Relative Credits for Extra Efficiency Measures" available at

<https://www.osti.gov/servlets/purl/1490280> or https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-28370rev.1.pdf.

What is the cost impact of the C406 Points Option?

The code change proposal will not increase or decrease the cost of construction. The current proposal does not require more investment but rather expands existing options permitted under C406. The intention is to assess relative savings equity amongst current options, and identify additional options to increase flexibility and more effectively utilize new technologies and construction practices. This is not expected to increase costs, as several of the evaluated options are included in current code. In some cases, cost may be reduced, as the outlined approach provides partial credit for selected items as well as credit for items that may have previously been included in the building design without credit. Costs, and cost effectiveness, are not evaluated for individual measures due to the vast number of potential combinations amongst building types, climate zones and selected options. Actual costs will vary based on the items selected by the building owner, design and construction team based on the needs and goals of the individual project.

Are there existing codes and standards that take a similar approach?

The outlined approach is based on the structure currently employed in the IECC for commercial buildings. This is also similar to packages of measures that have been

utilized in both residential and commercial energy codes, particularly in the Pacific Northwest. The Washington code has successfully used such a structure to balance energy performance, design flexibility, and evolving technologies.

Have any of the existing options been modified?

Yes, a number of existing measures have been modified to better fit within the points option and to provide more flexibility. For example: C406.2 has been modified to respond to industry concerns that both heating and cooling equipment must apply. The modified language allows either heating or cooling or both to comply.

- C406.3 keeps the 10% lighting power allowance threshold and adds a 15% threshold. Lighting designers can further reduce lighting power allowances by using a calculation approach (using equation 4-12) to achieve even more points.

- C406.5 allows for additional credit from increased system size over the base level requirement

- C406.7.1 allow for credit to high efficiency gas and electric water heaters in addition to heat recovery.

Is an energy model necessary under the new C406 Points Option? As it stands under the 2018 IECC, the only way to achieve savings from a combination of options is to do a building energy model. In the new C406 Points Options, tables show the number of points for options in various building occupancy types and for different climate zones. This bypasses the need for full energy modeling, which can be expensive relative to cost savings for smaller buildings. The end result is a performance-based approach that can be applied with the simplicity of a prescriptive approach.

Is this approach more stringent than 2018 IECC? When the options in the 2018 IECC are compared (See Figure 2), the stringency is about the same or slightly higher. If you look at the credits assigned to four typical C406 measures (10 % HVAC, 10 % LPA, Renewable and 85% UA) the assigned credits average around 10 points across climate zones, the selected target. The 10 point target was selected to be roughly equal or slightly higher than the old credit. The goal here is not to make a great change in stringency, but to get a more flexible system in place for this cycle that can be expanded in future cycles.

How do you meet the new points requirement? To fulfill C406 under this new approach, teams must achieve 10 points. This can be from one requirement that has many points or from several requirements that have fewer points. Each building design team can choose the points that make sense for the individual building, as long as at least 10 points are achieved.

What do the points represent? The points for each option are based on technical modeling analyses across climate zones and by building occupant type. One point represents a savings of about 0.25% of annual building energy cost. So 10 points represents about a 2.5% energy cost savings.

Why are the HVAC efficiency credits split? One common complaint with the current HVAC efficiency option was that heating efficiency was difficult to match with standard packaged equipment. This approach splits the credits for heating and cooling and provides for both 5% and 10% improvements. This allows improvements appropriate for each climate, rather than requiring all HVAC efficiency to be improved.

Why was the renewable credit capacity requirement reduced? Analysis of the 2018 renewable capacity option found it to be nearly double the energy value of other options, so it was cut in half. In addition, proponents added an option to include more on a prorated basis.

Why are some options not listed in the tables? Most of the points are found look up tables based on occupancy group. Each table shows the number of points for different options by climate zones for that particular occupancy group. However, two options (C406.3.2 and C406.12) are calculated using a simple formula. For example, kitchen equipment points (C406.12) are calculated based on the kitchen floor area related to the whole building area. In C406.3.2, additional points for more than a 15% lighting power reduction are based on the actual LPD and adjust the table credits for 10% lighting power reduction accordingly.

What about other proposals with no credits this cycle? While this represents a change in approach for C406, it also more fairly compares different options. A few other new ideas for C406 do not have credits calculated. PNNL is available to work with proponents of those proposals to arrive at reasonable credits for the public comment phase of the 2021 IECC update. It is probably best to vote on these based on their merits, and then get the credits for the Public Comment Hearings.

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Why are there only four building types?

The aim was to get started with the main building types to get the C406 Points Option in place. An “other” type can be a proxy, and in future years, other types can be added.

What does it take to achieve 10 points?

This depends on the building type and climate zone (CZ), but here are some examples:

Office achieves 10 or more points with any of these:

- 10% lighting reduction and 85% UA improved insulation
- 15% lighting reduction
- 10% lighting reduction and 10% cooling efficiency improvement in warm to moderate climate zones
- 10% lighting reduction and low leakage air barrier in cold to moderate CZ
- Plug load control;
- Renewable: PV at 0.28 Watts/square foot (W/sf) of floor area

Retail achieves 10 or more points with any of these:

- 10% lighting reduction
- 10% cooling efficiency improvement and DOAS or 85% UA in warm CZ
- 10% heating efficiency improvement, 85% UA and Low leakage air barrier in colder CZ

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- 10% lighting reduction and low leakage air barrier in cold to moderate CZ
- Renewable: PV at 0.32 W/sf of floor area in warm climate zones 0.36 W/sf in colder CZ

Apartment achieves 10 or more points with any of these:

- Condensing water heater with residential lamp efficacy in colder climate zones
- Condensing water heater with 10% cooling efficiency improvement in warmer climate zones
- Heat pump water heater with 10% cooling improvement and either lighting item in warm climate zones
- Heat pump water heater with DOAS in colder climate zones
- 10% cooling efficiency and 85% UA in warm climate zones
- 85% UA and Low leakage air barrier in half the climate zones; add lighting for the others
- Renewable: PV at 0.32 W/SF of floor area in warm climate zones; 0.36 W/sf in colder CZ