

"Theme and Variations – The IECC as an Expandable Code"

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ABSTRACT

The draft 2024 IECC will be out for public comment shortly after the 2022 ACEEE Summer Study. This new edition of the code is intended to serve a range of state and city policies, with the typical prescriptive and performance paths supplemented by a zero-energy path, a “glide path to 2030,” and other appendices available for local adoption. This framework will permit states and jurisdictions to “choose their own adventure,” one that conforms to their legislated policies and targets for energy efficiency and carbon reduction while still allowing use of national model code language. In this paper, the chair of the IECC Commercial Code Consensus Committee highlights the significant changes and innovations in the draft code and its development process.

Introduction

This paper represents the observations and opinions of the author, and does not necessarily represent the views of the International Code Council or its Commercial Energy Code Consensus Committee, or of the City of Seattle.

Amid a great deal of controversy, the International Code Council (ICC) changed the code development procedure for the International Energy Conservation Code, beginning with the 2024 code edition that is now under development. Traditionally, each code development cycle had involved a pair of week-long meetings during which hundreds of code change proposals were debated by stakeholders in cavernous convention halls for twelve hours a day, followed months later with a nation-wide vote by local building officials on each of the surviving proposals. By contrast, the new system establishes two large standing committees, commercial and residential, with membership selected to represent a wide range of interest groups. Each committee has several subcommittees that include additional members selected to maintain a similar balance of interests. Together with designated alternate members, consultants from Pacific Northwest National Laboratory, and ICC staff, there are over a hundred individuals with official roles serving each committee. However, the final version of the code will no longer be decided by a national vote of building officials – the ultimate decisions will be made by the committee members selected by ICC.

Structure of the Commercial Committee – the E4C

The IECC is now being developed by two committees, with 48 members on the residential and 45 members on the commercial committee, selected according to ANSI rules to represent a balance of stakeholder groups. Each member of the Commercial Code Consensus Committee, known as the E4C, also sits on one of four subcommittees:

- Envelope & Embodied Energy
- Power, Light & Renewables
- HVAC/R & Water Heating
- Modeling & Whole Building Metrics

Each subcommittee includes 11 E4C members plus 11 additional voting members, for a total of 22. The bulk of the debate and refinement of the code change proposals takes place within these subcommittees. Proponents each have an opportunity to present their proposals to the relevant subcommittee, and everyone involved is given an opportunity to comment. On a number of occasions where multiple proposals were interrelated, separate working groups were formed to work out differences, and this process frequently resulted in a consensus proposal combining the best features of each. This point should not be lightly passed over – some of these working groups met numerous times over a period of months, providing extensive problem-solving and rewriting between meetings, to eventually bring fully-resolved proposals to the E4C for final vote. This negotiated process results in a more effective, enforceable, and buildable code.

The subcommittee recommendations were each presented at subsequent E4C meetings with yet another opportunity for debate and refinement before voting. The great majority of subcommittee recommendations were upheld by the E4C, while several were returned to their subcommittees for additional work and only a handful were reversed. At the time of this writing, the E4C has concluded its initial task of evaluating all 256 code change proposals. The ICC initiated formal committee balloting during the summer of 2022 and at the conclusion of balloting will combine the successful proposals into an integrated “public comment” draft of the entire proposed 2024 IECC, likely in early fall.

The workflow of the E4C and its subcommittees this code cycle was similar to that of the ASHRAE 90.1 Committee, with one significant difference: rather than processing a steady stream of changes, the E4C had 256 code change proposals land on its doorstep in a single tranche, and was given only six months to process them and create a complete draft of the proposed code for public comment. Maintaining a schedule to complete all this work within a six-month timeframe required the subcommittees and their *ad hoc* work groups to meet on a very demanding schedule. To their credit, each subcommittee’s participation and productivity remained strong throughout. Following publication of the 2024 IECC, the standard will revert to “continuous maintenance,” under which new proposals will be individually considered as they are received.

An important detail about voting for this process is that while simple majority votes were used to approve or disapprove individual code change proposals at the E4C meetings, a 2/3 majority is required to send the package of proposals out for public comment or final publication, and to approve changes generated during the public comment process.

The function of this initial committee balloting process is simply to approve a “public comment draft” for publication, and differs somewhat from processes used by other code organizations. The first ballot asks for a straight up-or-down approval or disapproval of the full package of proposals that were approved in the E4C by simple majority votes. It also provides an opportunity for committee members to submit comments supporting or opposing individual proposals, which will be collated and distributed to committee members. Informed by these comments, the E4C will vote a second ballot. If that ballot achieves a 2/3 majority vote in favor, the process ends and the Public Comment Draft will go out with its current full package of

proposals. If on the other hand the package is not approved by a 2/3 majority, then another process will begin.

The third ballot, if required, will individually consider each proposal that received negative comments, as well as any suggested revisions to those proposals. In this case, individual proposals would each need a 2/3 majority vote to be included in the public comment draft. (A fourth draft would be provided solely to any E4C members who were absent during committee voting.)

This process underscores why this body was named the Commercial Code *Consensus* Committee; consensus defined here as approval by at least 30 of the 45 committee members when all are present. Ensuring that we reach this ultimate consensus requires some finesse on the part of the subcommittee chairs and work group leaders, avoiding extreme positions and giving preference to proposals that will attract broad support. All but a handful of the proposals approved by the E4C had more than 2/3 support, which bodes well for continued cooperative work going forward.

Marching Orders

The ICC Board of Directors created a new “Intent” section for the 2024 code edition (ICC 2021a). This section includes more detail than the intent sections of earlier editions, but also created certain ambiguities:

- One phrase requires the code to be “...*life cycle cost effective, considering economic feasibility, including potential costs and savings for consumers and building owners, and return on investment.*” This creates a substantial ambiguity, because a feature that is “cost-effective” for tenants may not be considered cost-effective by investors, given the varying uses of that phrase.
- The Intent section suggests that the code should achieve “...*additional policy goals as identified by the Energy and Carbon Advisory Council...*” (ECAC), although as of July, 2022, the members of the ECAC had not yet been seated or held their first meeting. Since the ECAC is charged with recommending a policy for reduction of energy use and carbon emissions, its decisions could potentially require reworking of the draft code, or conflict with some interpretations of the Intent section requirement for a suitable return on investment.
- A zero-energy appendix is mandated, as well as a “glide path” appendix that reduces net energy use through the 2024 and 2027 codes to achieve zero net energy in the 2030 edition. In addition, the Intent section states that “...*non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources...*” may be included. Other contemporaneous ICC publications suggested that the ICC Board intended certain of these topics to be placed in appendix chapters rather than the body of the code, although staff later stated that such an interpretation was not correct.

Optional Appendices

As presented to the public in 2021, the new code format could provide regulatory flexibility by offering a range of optional appendix chapters that motivated jurisdictions could separately adopt, but that would not be mandatory for less progressive states and jurisdictions

(ICC 2021a). Suggested examples in ICC announcements included “...electric vehicle charging, electrification, and embodied carbon” (ICC 2021b). For this reason, this paper was entitled *Theme and Variations – The IECC as an Expandable Code*.

This notion was quickly upended when an electric vehicle charging proposal was brought forward early in the work of the Commercial Energy Code Consensus Committee (E4C), not as an appendix, but as a mandatory provision for the body of the code. This paper’s author serves as chair of the E4C, and ruled that the proposal was out of scope for the body of the code, meaning that it could be considered only as an appendix. However, ICC leadership subsequently confirmed that measures such as mandatory EV charging infrastructure were indeed permissible for inclusion within the main body of the code under the new provisions of the new “Intent” section (ICC 2022a). Following considerable debate at its subsequent meeting, the E4C approved the EV charging proposal to be included in the body of the code.

Presuming that this provision remains in the code through the remaining steps of the process, any state or local jurisdiction that wants to adopt the 2024 IECC but chooses not to adopt the EV charging provisions will have to amend its code adoption to specifically excise this provision and related references.

Several renewable energy proposals were submitted, and these were combined by a working group comprised of the proponents and other experts into a single consensus proposal requiring 0.75 watts of installed solar generating capacity per square foot (8 W/m²) of the largest three floors of the building. This provides an example of the possibilities inherent in the new process, as the proposals ranged from requiring 0.25 W/sf to requiring 1.50 W/sf, and included varying treatments for off-site renewables. Rather having to debate and modify each proposal separately, the E4C was presented with a unified provision that represented a well-considered consensus of all the affected parties. This renewable energy consensus proposal was approved as an amendment to the main body of the code and not as a separate appendix, so once again, states or jurisdictions not wanting this provision in their codes will need to take action to delete it, whereas as an appendix chapter it could have been passively ignored.

For both the EV charging and the renewable energy proposals, proponents made the case that such provisions are too important and fundamental to the fight against climate change to be relegated to appendices, because adoption of such appendix chapters creates additional political hurdles not easily overcome by individual cities and counties. The counterargument frequently voiced is that if the code becomes too stringent, states might balk at adopting it at all.

Advantages of the “Standard” Development System

Although this author argued (unsuccessfully) against the move to this new code development format, a number of unexpected advantages have emerged. One major advantage is the opportunity for cooperative work. Several substantive topics each received multiple code change proposals, and the proponents of these related proposals have organized themselves into work groups to develop consensus proposals that combine the best aspects of each. The previous code adoption system had been very much “sink or swim,” with proponents given precisely 2 minutes at the microphone and a rigid procedure for considering any modifications. Even a minor error was often cause for rejection of an entire proposal, and a proposal disapproved at the first hearing required a 2/3 majority vote to survive the second round. Last-minute negotiations between impacted parties on a particular issue were sometimes attempted, but lacked any review process, and such code language often suffered from having been rushed into print.

Another benefit has been the amount of time and attention that each proposal received in its subcommittee before being considered by the main committee. The subcommittees are large organizations in themselves, each made up of more than twenty experts in their respective fields, with additional individuals participating as interested parties. Most proposals were modified by subcommittees as they were screened, because the varied expertise on hand helped to daylight conflicts and unintended consequences. As a result, almost all subcommittee recommendations for approval or disapproval were upheld by the E4C, while those few that were not upheld were typically remanded to the subcommittees for further resolution of issues.

The E4C is charged with producing a code that is clear, organized, and well-integrated. The majority of the code change proposals being processed are intended to accomplish just that, and have passed with near-unanimous votes. Almost none of the proposals had been intended to reduce building energy efficiency, and those few were disapproved by the subcommittees.

A handful of the proposals considered by the E4C were taken from code requirements already in force in the author's home city of Seattle. Two examples include the HVAC Total System Performance Ratio (TSPR) that was approved by the E4C for use in the efficiency credits system (ICC 2022b – CEPI-76-21), but also the Dedicated Outdoor Air System (DOAS) proposal that was voted down at both the subcommittee and the E4C with virtually no support. American energy code development frequently follows a trajectory in which novel concepts arise in one of several progressive cities, serving as a kind of “code test drive,” and are then incorporated into state codes or proposed for inclusion in the national model codes. Those ideas that survive the model code development gauntlet subsequently spread throughout the country as the new code is adopted in one state after another, thus completing what can be a decade-long journey. For certain states, the journey takes as long as two decades as shown in Figure 1, leaving a substantial discrepancy between the leading and lagging states with regards to the energy use of their new buildings.

An informal glance at the code adoption map in Figure 1 suggests a potential correlation between more advanced energy codes and more vibrant state economies, which may indicate an emerging equity problem. States with significantly more efficient buildings will send less and less revenue out of state to buy fuel, leaving more money in-state circulating as wages and profits, and thus exacerbating the economic differences between leading and lagging regions.

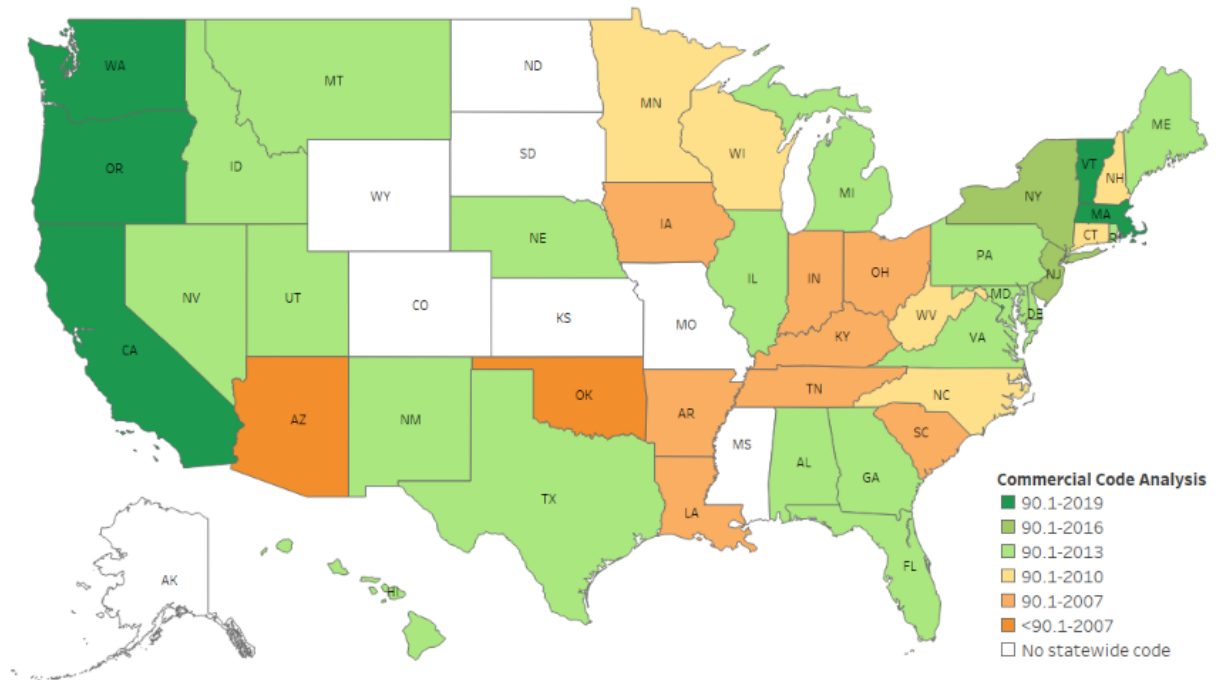


Figure 1. U.S. Status of State Energy Code Adoption – Commercial Source: [Status of State Energy Code Adoption Commercial | Building Energy Codes Program](#) 2022.

A Complication from Justice Dillon

John Dillon was an Iowa Supreme Court justice in the 1870s. The legal principle bearing his name stipulates that cities and counties have only those powers expressly granted them by the state. The US is split between states that have adopted some version of Dillon’s rule and others known as “home rule” states that grant local jurisdictions greater decision-making autonomy. This is not a clear-cut division; most states apply some combination of the two, with rules often varying based on the population of the jurisdiction.

Dillon’s rule is germane to the construction of this code in that a large proportion of American cities and counties in Dillon states are effectively prohibited from adopting any of the IECC appendices locally to provide greater efficiency, unless specifically granted that authority by state law. This generates tension particularly in those politically conservative Dillon states that encompass politically liberal urban areas. A decision by the E4C to place a code provision in an optional appendix puts it effectively out of reach of perhaps half of American jurisdictions. Therefore, the “theme and variations” intent of the code is not universally applicable.

Virtual Meetings and Team Cohesiveness

As a process born during the global COVID pandemic, the IECC is the first national energy standard to be developed entirely online, with no in-person meetings. This could potentially become a model for other large-scale technical meetings, avoiding the tremendous cost, time investment, and travel-related carbon emissions of national in-person meetings, as well as the practical difficulties of compressing a huge amount of work into a severely limited timeframe. It also allows full participation and influence by those with limited budgets or difficulty traveling, including local building officials, parents of young children, nonprofit

agency staff, foreign nationals, and others. The downside of course is that there is no opportunity for those chance connections that might otherwise occur while riding a shuttle bus, waiting in line for lunch, or gathering late in the evening at a hotel bar.

To partially compensate, the committee instituted “3 *Minutes of Fame*,” a brief break from the agenda scheduled twice each meeting, allowing committee members to introduce themselves. These have been popular with participants, serving to break up the intense work of 3-hour meetings, and have given the committee members a glimpse each other’s families, activities, and work projects, learning whatever that day’s 3 *Minutes of Famer* wants the others to know about who they are and what they stand for. Many participants have made these short presentations into creative projects, using image collages that express the individual personalities involved. While this may strike some as a frivolous use of a large committee’s time, it is sometimes just such personal insights and connections that facilitate mutual understanding and compromise; “Consensus” is literally the committee’s middle name.

Costs and Benefits

As mentioned above, one of the ICC Board of Directors’ mandates embedded in the “Intent” section is that the code must be “...*life cycle cost effective, considering economic feasibility, including potential costs and savings for consumers and building owners, and return on investment.*” (ICC 2021a) Over the course of several meetings, a volunteer advisory group of E4C members led by Michael Tillou of Pacific Northwest National Laboratory (PNNL) reached consensus on a standard set of economic assumptions along with a data presentation format for life cycle cost analyses (LCCA) (ICC 2022c). The LCCA for any project will be presented as both an ASHRAE-style Scalar Ratio threshold and a Net Present Value approach, and at both 3% and 7% real discount rates. In addition, the advisory group settled on a “social cost of carbon” factor that can be separately included at the proponent’s discretion. Thus, for each code change proposal analyzed, the E4C members will see the proposal’s life cycle cost from several viewpoints, rather than just a single number, and will see this information in a consistent format for each proposal, enabling a more fully informed decision.

Cost effectiveness of the great majority of proposals appears to be self-evident and therefore not requiring formal LCCA analyses. LCCA analyses have been conducted by PNNL for the energy credits and EV charging proposals, and more are likely to be conducted as the process continues (ICC 2022b – CEPI-193-21; ICC 2022b – CECPI-1-21).

Next Steps

The IECC public comment draft will be posted in early fall, 2022, with comments due later in the year, after which the E4C will reconvene and begin the process of responding to each comment. Any further changes to the draft code will require a 2/3 majority approval. While some comments are likely to be negative – “Disapprove this code change, for the following reasons...” others will provide useful insights or constructive edits to the proposed language and formatting. Note that supportive comments are less often submitted – stakeholders appear to be more motivated to go to the time and effort of drafting comments when they have strong objections. For this reason, affected parties who *favor* a substantive and potentially controversial code proposal may find it worth their while to support it with their own well-reasoned comments, so that the relevant subcommittee will be exposed to multiple viewpoints. After the changes instigated by public comments have been resolved, a second draft will be posted in the winter of

2023 for a “cleanup comment” round, and the accepted refinements will be integrated into a final draft to be ratified by the E4C. Figure 2 illustrates this timeline.

The public comments will likely result in modifications to the draft code language, and some comments may persuade subcommittee members to reverse earlier decisions or create new solutions to vexing code problems. The final content of the 2024 IECC is certain to be improved through this process, with the resolution of the inevitable conflicts and unintended consequences that are brought to light by the commenters.

Once the 2024 edition has been finalized, the IECC will move into “continuous maintenance” mode. Code change proposals will be accepted at any time, and will be considered periodically by the subcommittees and the E4C, on a schedule yet to be determined. Interested states and jurisdictions would have the opportunity to adopt any of the proposals accepted mid-cycle, although the experience of other national standards has been that this does not often occur.

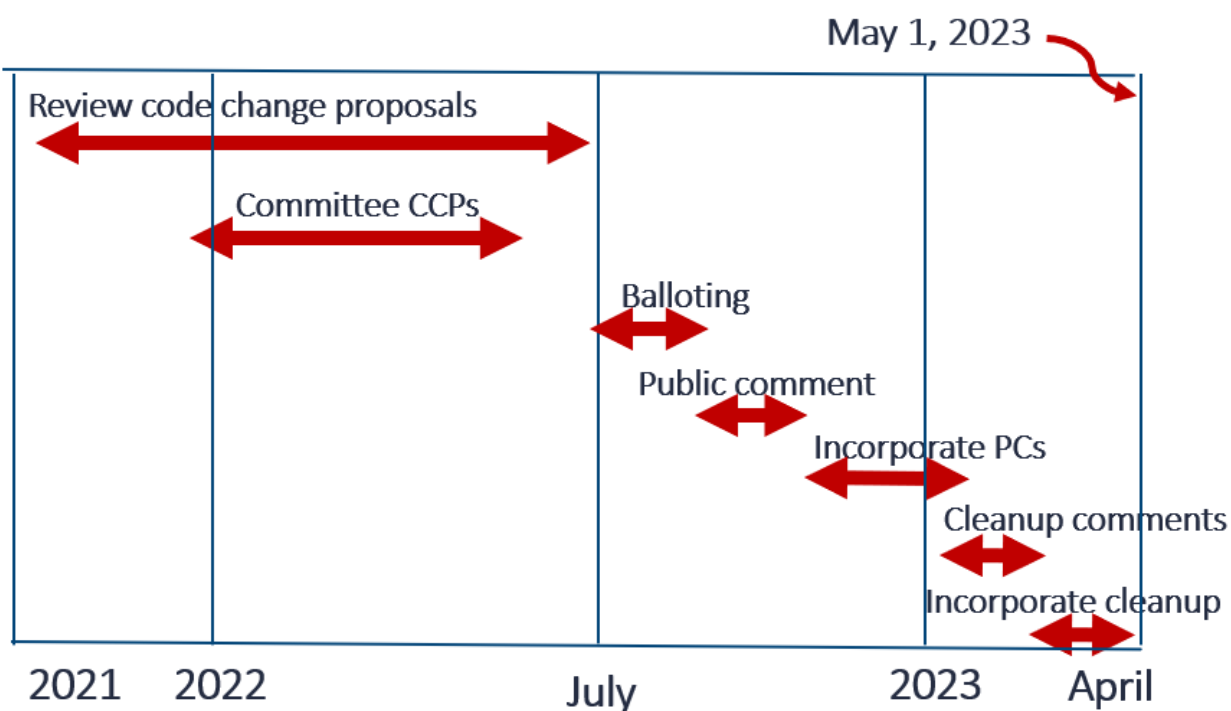


Figure 2. E4C work timeline

Appendices

Two appendix chapters are mandated in the IECC “Intent” section: One for a zero net energy code and another known as the “Glide Path” that progresses incrementally towards a zero-energy code for the 2030 code edition (ICC 2021a). The existing “zero code” originally promulgated by Architecture 2030 and published as Appendix CC of the 2018 IECC will remain in the 2024 edition, modified by a number of changes that were consolidated through a working group into a consensus proposal (ICC 2022b – CECPI-5-21). That appendix requires renewable energy resources that are sufficient to equal the project’s predicted energy use, leaving the design team to select the most economical balance between energy efficiency of the building and procurement of renewable energy.

The "Glide Path" appendix has been developed for the convenience of the many jurisdictions that have announced intentions for their new buildings to operate at zero net energy beginning with the 2030 code edition. To provide a starting point, this author submitted a glide path proposal that requires incremental energy use reductions for the 2024, 2027, and 2030 codes, along with a renewable energy requirement that incrementally increases through those same three code cycles until the annual energy produced approximates the annual energy consumed under the 2030 code (ICC 2022b – CEPI-257-21). An "efficiency first" approach is taken for the Glide Path, while recognizing the practical limits to the efficiency improvements that are feasible for regulated systems such as HVAC, lighting, and water heating, and very limited code influence over unregulated systems such as appliances and miscellaneous electrical loads. Rather than customizing the renewable energy requirement to each occupancy type's predicted energy use, it uses a straight watts-per-square-foot requirement for all buildings. For the 2024 code, the first of the three incremental steps, the renewable energy requirement approximates 1/3 of the expected average energy use of all new buildings under the 2030 code. In this manner, community resource buildings with large process loads such as grocery stores, data centers, restaurants, and hospitals will not be saddled with the prohibitive expense of generating all their own energy. This proposal was also extensively modified by E4C experts.

An "all-electric" appendix was approved as part of an "electric ready" proposal (ICC 2022b – CEPI-22-21). This appendix will be useful for those communities that are following the lead of many California cities to require that new construction use no fossil fuels at all.

Approved Base Code Proposals

Of the original 256 proposals, 125 were approved by the E4C, the great majority of them modified during the committee process from their original language, often substantially. Only three of these were focused on alterations, while all the rest were focused on new construction. In addition, seven "committee generated proposals" (those with CECPI designations) were approved, each consolidating the best features of several individual proposals. These seven were:

- CECPI-1 EV Ready
- CECPI-2 Renewable Energy
- CECPI-3 Air Leakage
- CECPI-4 Thermal Bridging
- CECPI-5 Appendix CC "Zero Code"
- CECPI-6 Parking Garage Ventilation
- CECPI-7 Indoor lighting efficiency

"Electrification" of buildings was directly addressed by only one of the successful proposals (ICC 2022b – CEPI-22-21), even though electrification would be a prerequisite to achieving zero emissions buildings. One defeated proposal would have required heat pump water heating for hotel and multifamily occupancies, similar to an existing rule in the Seattle Energy Code, but not yet adopted in other US codes (ICC 2022b – CEPI-129-21).

Almost none of the submitted proposals were intended to weaken or roll back code stringency, whereas the majority provided clarification, corrections, and coordination. Several dozen make incremental improvements to individual systems, while by one count, fewer than 20 of the proposals appear likely to move the needle enough to measurably reduce new building

energy use. The fate of those “Top 20” code changes as they move through the remaining steps of the IECC development process will determine this code edition’s overall progress.

Table 1. High-Impact Proposals Approved by E4C for Public Comment Draft (ICC 2022b)

Proposal	Title	Brief Description	Impact*
Envelope			
CEPI-29	U-value of thru-wall mech (PTAC)	0.50 default U-value for wall occupied by PTACs and similar thru-wall equipment	0.1
CECPI-4	Thermal bridging	Accounts for heat loss through parapets, window frames, cantilevered decks, etc.	0.3
CEPI-58	Air leakage	Test air barriers to maximum 0.25 cfm/ft2 air leakage	0.4
Lighting & Electrical			
CECPI-1	EV charging	A percentage of new parking spaces must have EV charging infrastructure	0.0
CECPI-2	On-site renewables	0.75 watts of installed solar capacity per ft2 of conditioned floor area of largest three floors	5.0
CECPI-7	Interior LPA	Reduces interior lighting power allowances	0.5
CEPI-156	Dimming	Dimming required in many space types	0.5
CEPI-183	Exterior LPA	Reduces allowances for exterior lighting	0.1
CEPI-148	Egress lighting	Most egress lighting must shut off when no occupants are present	0.5
CEPI-169	Hotel lighting controls	Occupancy sensor controls required for hotel guestrooms	0.2
Mechanical			
CEPI-119	Fan energy	Reduce fan energy by 10% on average.	0.5
CEPI-108	Occupied standby	Occupied standby controls reduce ventilation based on number of occupants in space	2.0
CEPI-107	VAV turndown	Updates to minimum VAV turndown requirements	0.7
CECPI-6	Garage vent	Parking garage ventilation	0.2
Modeling/Whole Building			
CEPI-193	Add'l Energy Credits	Expands energy credit table & differentiates for various occupancy types	4.0
CEPI-22	Electric-ready	Requires buildings to be set up to convert to all-electric in future, plus an all-electric appendix	0.0
CEPI-203	Metering	Metering and sub-metering of power loads	0.1
CEPI-257	Glide path	Optional appendix providing stepped pathway to ZNE for 2030 code edition	0.0
	All other	Several dozen minor measures	1.0

* Impact means estimated average percentage reduction in energy use across all new buildings. These are rough preliminary guesses – formal analysis will take place during fall of 2022.

Next Steps

While the 2022 ACEEE Summer Study is under way in California, the committee balloting process will be underway, and the public comment period will likely begin a few weeks later. When the E4C reconvenes later in the year, it will consider every submitted comment and produce a “nearly final draft” that will go out for a final “cleanup” review. The committee’s final editing and voting must be completed by late spring, 2023.

During future code cycles, progress on energy efficiency and carbon reduction will depend on the creation and submittal of viable, defensible, and well-crafted proposals, each capable of garnering support across a broad spectrum of stakeholders, and covering the range of likely avenues for substantive progress. In the interim, individual states, cities and institutions that independently establish their own advanced efficiency standards can support IECC progress by demonstrating the viability of such advanced provisions in their own codes. It is much harder for opponents to make a case that “this can’t be done” when the proponents can point to cities and states that are already successfully implementing a new code provision.

Conclusion

Although the time commitment from participants has been substantial, the advantages of this code development system have become clear. Proposals have been reviewed, debated, and coordinated on several levels, resulting in a more fully resolved and integrated draft.

Mandatory construction codes and their related standards appear to be the only realistic means to dramatically improve the performance of our built environment. Any place in the world where high-performance buildings are being constructed at significant scale – California, Toronto, Denmark – you’ll find that the jurisdiction will only issue building permits for high performance buildings. Incentive programs and voluntary “above-code” standards do serve to light the way for others to follow, but by themselves they’re barely moving the needle. The energy code is society’s means of getting the whole community to do this *together*.

The “2024” title of this code edition is deceptive, due to the length of the code adoption and building construction timelines. As the states move through their code adoption procedures, the 2024 code will generally start taking effect for new permit applications sometime in 2026. By the time that the very first “2024” permits have been issued, foundations poured, buildings constructed, and businesses open, it will already be 2026. New buildings constructed under this code being written in 2022 will be opening their doors in 2030 and beyond. For anyone considering how our new buildings must perform in 2030, we’re essentially arriving there with our actions today. If we are going to make serious changes in design and construction to confront the climate emergency, it is not something to be resolved by some future committee. The time is now.

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