SEHPCAC

International Energy Conservation Code –
Chapter 6 International Green Construction Code

E1

IECC Sections C101.4.1 through C101.4.5; C401.2.1; R101.4.1 through R101.4.5

Establish a new Chapter 5 in both parts of the IECC entitled EXISTING BUILDINGS. Move 'existing', existing building provisions from various code locations into the new Chapters 5.

> **Reason**: People routinely try to address existing buildings with code changes in the body of the code. Only the frequent code user realizes that existing building issues are addressed in Chapter 1. Chapter 1 should be limited to addressing the scope of the code (or in this case the part of the code) and for code administration. Substantive requirements belong in a chapter. The format of the IBC is there is Chapter 34 where existing buildings are addressed. Once the chapter is created, future code changes addressing existing building will have a logical home.

E2

IECC Sections C101.5.2

Relocate the provisions to Section C402. Create an exception to C402.1

> **Reason:** This is a specific exception to the thermal envelop requirements for commercial buildings. This is an exception to a regulation that should be located with that regulation. Chapter 1 should be limited to the provision of scoping of the code and to provisions to administer the code. Regulation of this type should not be in Chapter 1.

E3 and GE1

IECC Section C202 – R202 – Climate Zone
IgCC Section 202; IBC Section 202, others as needed.

1 Define 'Climate zone'.

> **Reason:** There is a definition of 'zone' which is frequently confused in poorly constructed proposals. Climate zones are established in Chapter 3 – but the term is never defined. It would help administration of this code and other codes to define the term. There are more than one proposal being considered in the IBC during the 2012 cycle to specify limits based on Climate Zone.

E4

IECC Section C202 – Building Site

The same term is defined in the IgCC. The IgCC also uses 'site' but doesn't define it. IECC uses the term and defines the term 'building site'. It seems to be more akin to the term 'lot'. Consider coordination with IgCC definition of building site. Consider coordination with the term 'lot'.

> **Reason:** The family of codes should use strive to use a term the same way in all codes and coordinate revisions to obtain consistency and eliminate discrepancies.

E5

IECC Section C203, R203 – NEW

Add a section which is a list of abbreviations and what they mean.

> **Reason:** Except for the expert practitioners, many of the abbreviations are 'greek' to the users. For example if you read definition of dynamic glazing – it includes SHGC and VT…..what do those mean? In this case they are defined terms. In other places there are abbreviations in tables and the only place to figure out what they mean is in the index. For example Table C403.2.3(3) has the following abbreviations "EER" and "SEER". The text sending the code user to that table (Section C403.2.3) does not provide an explanation. Section C202 provides no definition. However in the Index you may find Energy Efficiency Ratio – (EER). The code user shouldn't have to find such explanations in the index.

E6

IECC Tables C301.3(2) and R301.3(2)

What is CDD, HDD? Add an explanation below each table for these 2 abbreviations.

> **Reason**: They should be explained beneath the table and listed on a table of abbreviations – see proposal for C203/R203.

E7

IECC Sections C402.1:

Clarify the envelope to clarify that the R-value and U-value paths are equal. Reword as follows:

The building thermal envelope assemblies shall comply with <u>either</u> Section C402.1.1 <u>or Section C402.1.2</u>. ~~Section C402.1.2 shall be permitted as an alternative to the R-values specified in Section C402.1.1.~~

> **Reason**: Recommended to match ASHRAE 90.1 tables, which include both the R-value and assembly U-value in the same mandatory table. The verbiage as written gives the appearance that

the insulation layers are mandatory. In reality, these “prescriptive” R-values are only one of many possible wall combinations. Creates confusion in building community: they feel that the R-values are required and there is not an option. Most seismically active locations (Oregon, WA, ID, MT) utilize 6” stud construction for low rise commercial construction. The walls under Table C402.1.2 are for 4” stud construction, which is uncommon in all but high-rise costruction in our region.

Making items even more confusing: the tables for C402.1.1 (the “prescriptive values”) are C402.2 and C402.3. These are located in the code AFTER the table for C402.1.2.
Additional note: in the past week, I have answered 10 phone inquiries from architects, engineers, and contractors who are confused by the order and feel that the only way to pass COMcheck/IECC is to have the continuous insulation, regardless of U-value of the assembly.

Requires also modifying the sub-sections of C402.2 to reference both R- and U-values as acceptable. As written, presents intention that all construction is acceptable if constructed only in one fashion.

1. Incorporate IgCC High efficiency and variable flow kitchen hoods (607.8.1?): copy IgCC language and table 607.8.1 (?) for low flow hoods and variable flow. Still allows small kitchen to be per IMC language, allowing for field constructed hoods. ADD language to cover that these hoods be UL 710 listed (avoid conflict with IMC minimum flow requirements). Secondary change: Reduce minimum from 5,000 CFM to 3,000 CFM to trigger the requirement. Many smaller restaurant chains with more than one hood are exempted.

2. **Lighting power density tables:** Re-visit with look at 90.1-2010 (and addenda), CA Title 24 and their research, IgCC, and Oregon Energy Efficiency Specialty Code/Oregon Reach Code. OEESC looked at all and took most restrictive for the Oregon Reach Code. Numbers vetted by leading lighting designers and can be designed. Note that State of California study of retail lighting levels shows that levels should not be reduced (however, Design firms in Oregon have been able to successfully modify prototype retail designs from national chains to work within Oregon, which is more restrictive than CA).

3. **Exterior Lighting Power Density**: New working group to revisit LPD levels. LED lighting progressing dramatically. Parking lots can be lit with much lower LPD (and Lumens/Sq. Ft. due to light quality: street lighting study in Seattle showing lower lumen level acceptable due to color quality).

4. **Exterior lighting control language:** Bring in IgCC language and compare with any 90.1 addenda proposals. MH

E8

IECC Tables C402.1.2 and C402.2

Clarify that the values in the tables are directly proportional to each other. The proper relationship is U = 1/R.

The U values in tables do not agree with tables regarding R values. The data is correct per code change approvals and they do not show how U values were computed, but upon investigation various climate zones are found the U values were inconsistent – not rounded off – they just do not agree with R values shown. The U values and R values need to be reviewed and agree. ED

E9

IECC Table C402.1.2 and Table C402.2

Establish a footnote which clarifies the application of 'Attic and Other' under the Roofs section of the table.

Reason: In the table under "Roofs", the term "attic and other" is not defined. I checked with S. Ferguson of ASHRAE and he defined it as "all other roofs with insulation entirely below (inside of) the roof structure (i.e. attics, cathedral ceilings, and single rafter ceilings), roofs with insulation both above and below the roof structure, and roofs without insulation but excluding metal building roofs." The bottom line is attic and other is any kind of roof that does not meet the definition of metal building roof, or insulation entirely above deck.

This is very confusing and people call regarding what "attic and other" is. In 2003 IECC it was detailed under roofs as all-wood joist/truss; metal joist/truss; concrete slab or deck; metal purlin with thermal blocks; metal purlin without thermal block. It should have remained this way. See 2003 IECC Tables 802.2(5 – 37).

E10

IECC Tables C402.1.2 and Table C402.2

Establish complete standards for Opaque doors in both tables.

Reason: The information for doors seems incomplete. Doors are only found in Table C402.2 which is supposed to be the table addressing R values. But R-values are only provided for roll-up and sliding doors, but not for swinging doors. For swinging doors it provides a U-factor. U-factors are commonly listed in Table C402.1.2, but this latter table has no provisions for doors. Similarly what is the U R factor for swinging doors.

E11

IECC Sections C402.2.1.1 –

Exception – Item 1.3 now says roof gardens or landscaped roofs – Add term 'vegetative roofs' and incorporate the IgCC definition of vegetative roofs into Chapter 2.

Reason – New terminology for a feature very similar to roof gardens and landscaped roofs. The same exception should apply to vegetative roofs. Coordination with new IgCC code.

E12

IECC Sections C402.2.1.1

Compare this section with Section 408.3.1 of the IgCC. Compare two provisions and see if changes should be made to IECC>

Reason - Both are speaking about the reflectance of materials on the roof of structures. IECC is addressing energy conservation. IgCC is trying to mitigate heat island impact. IgCC represents a more recent massaging of the requirements and related standards. The IECC may need some coordinative changes.

E13

IECC Table C401.2.3.3.1, possibly others

Make adjustments to allow application in Southern hemisphere.

> **Reason:** The code was written with a Northern hemisphere bias. This table needs to show information for both hemispheres. Other provisions of the code such as Table C301.3(1) do address application to the Southern hemisphere.

E14

IECC C402.3.2.2:

Need extra reference other than ASTM D1003; this is a test for plastics. Does not apply to aerogel or glass. Extra exception if the skylights are "shaded" by other buildings.

> **Reason:** As written, skylights per this section are required to be plastic. MH

E15

IECC Table C402.3.3.1 – Similar proposals came from 2 proponents – both reason statements are included.

North Glazing issue. Can this be worked in better fashion? Allowance for higher SHGC if shading devices used, but if within 45 degrees of true north, the glass should be allowed a higher SHGC. North glazing should be allowed additional SHGC regardless of overhang in climate zones 4 and higher. SHGC of 0.40 reduces daylighting too much.

> **Reason**: Multiple energy studies in our climate zone (4C and 5B) show that for majority of occupancies, the SHGC on north facing glazing should be as clear as possible. I have participated in energy modeling for many structures, and nearly every building returned lower energy use when the structure had the clearer/lower SHGC glazing on the north exposure, several without shading devices or additional daylighting controls. The perimeter zone in these heating dominated climates gets more benefit from the solar gain in winter and shoulder seasons than from the additional cooling load on peak days in summer. The effective heating and daylighting benefit (which is increasingly applied through code) more than offset increase in summer/cooling month solar heat gain. Buildings use less energy with clearest possible north facing glazing outside of zones 1A/B, 2A/B, and 3A (3B may need additional study: borderline climate for cooling vs. heating).
>
> Recommendation: Figure for "north glazing" higher than "Other" for climate zones 4 and higher. Would not be as applicable to zones 3 and lower (sun at very low angle at summer peak cooling time). Want a study to determine relative levels. With the US DOE/PNNL baseline model building shapes, this can be determined relatively quickly
>
> Additional investigation: Can we develop a "vertical shading factor" prescriptive factor? Much more effective for west and north exposures.
>
> **Reason:** Different orientations require different results as noted. The code change proponents decided, however, for simplicity, that only a single SHGC rating for all fenestration, regardless of the

orientation. Larger SHGC ratings are only possible where shading is provided, and the adjustment factors in Table C403.3.3.1 are applied. Shading has a greater impact on the SHGC ratings of windows when the orientation is south or west. Therefore, the adjustment factors are greater for these windows. Granted this results in an illogical situation in which SHGC ratings can be higher for south and west oriented windows, simply because the code prescribes a single maximum SHGC for an entire building, rather than adjust the original values based upon orientation.

E16

IECC C402.4.7, Vestibules:

Add requirement that all spaces (any size, any climate zone) if room connects to an elevator shaft and/or stairwell over 75-ft (height up for study by sub-committee) in height. Sole exception(s): Does not apply to a door out of an egress stair shaft (or lobby in a parking garage level).

Reason: Driving force of building stack effect is substantial. Following quick analysis for 0.5 Sq. Ft. opening (combined leakage opening at top of building), 70F indoor, 40F outdoor, difference in stack effect on leakage into building (assuming a 21 SF door opens, then 0.5 SF equivalent in combined opening in stair/elevator shaft/other openings through rest of building). http://chuck-wright.com/calculators/stack_effect.html (an on-line easy resource. Could provide more definitive calculations in the future)

a. 15 ft height: 147 CFM
b. 75 ft height: 321 CFM

Elevation change can increase leakage over 2 times in cold weather. Need to reduce driving force of stack effect.

Applies to Zones 1 & 2 as well (I worked for 3 years in a 10-story building in Tampa with small lobby and the winter infiltration was terrible on colder days; exfiltration due to inverse on hot days as well, but that “feels good”: there is a cool blast of air hitting your face as you walk into the building).

Results for summer weather for the same 0.5 Sq.Ft. opening, 72F indoor, 90F outdoor: 75 Ft. height has 244 CFM leakage; 15 Ft. height has 109 CFM. So “hot climate” can experience a doubling of exfiltration out of a ground level lobby due to stack effect. And the effect will likely be even greater: the “exit path” for the leaving air is an open, 21 Sq. Ft. door, building “pressurization” is helping push the air, etc.

E17

IECC Tables C403.2.3(1), (3) and (7)

Table C403.2.3(1) –Remove the column titled “Before 6/1/2011’
Table C403.2.3(3) – Remove the column titled ‘Before 10/08/2012’
Table C403.2.3(7) – Remove the column titled ‘Before 1/1/2010’

Reason: The information will be out of date. In fact 2 of these columns are already out of date. For any building permitted under the 2015 IECC, requirements only valid through 2012 are irrelevant.

E18

IECC Sections C403.2.4.5 –

Delete phrase "so that the potential for snow or ice accumulation is negligible."

Reason: This language describes the intent of the section, but is unenforceable language. The section provides prescriptive requirements. If the requirement was a 'performance' requirement then intent language is important. There is nothing within the requirement which allows changes or adjustments to 'achieve' negligible accumulation. "Negligible' is undefined. It would also likely vary regionally. A snow fall which might be considered negligible in Aspen would be considered a blizzard in San Diego.

E19

IECC Table C403.2.8.

Reformat the footnote to be text preceding the table.

Reason: There is too much regulatory information buried in the footnotes. This was discovered in parallel provisions in the IgCC – Section 606.4 and were reformatted by the CCC. See below:

606.4 Heating, ventilation and air conditioning (HVAC) piping insulation. Piping with a nominal diameter greater than ¼ inch, including associated valves, fittings and piping system components, in heating, ventilation and air conditioning (HVAC) systems shall be thermally insulated in accordance with Table 606.4. For insulation outside of the conductivity ranges specified in Table 606.4, the minimum thickness of the insulation shall be determined in accordance with Equation 6-4.

$T = r\,[(1 + t/r)K/k^{1}]$ **(Equation 6-4)**

Where:

T = minimum insulation thickness (inches).
r = actual outsite radius of pipe (inches)
t = insulation thickness specified in Table 606.4 for applicable fluid temperature and pipe size.
K = Conductivity of alternate material at mean temperature indicated for the applicable fluid temperature (Btu x in/h x ft^2 x ^oF)
k = the upper value of the conductivity range specified in Table 606.4 for the applicable fluid temperature.

Building cavities and interstitial framing spaces shall be large enough to accommodate the combined diameter of the pipe plus the insulation, plus the full thickness of the insulation plus any other objects in the cavity that the piping must cross.

Exception: Piping insulation is not required for the following:

1. Factory-installed piping within HVAC equipment tested and rated in accordance with Section 606.2.
2. Piping conveying fluids having a design operating temperature range between 60°F and 105°F.
3. Piping conveying fluids not heated or cooled such as roof and condensate drains, cold water supply, and natural gas piping.
4. Where heat gain or heat loss will not increase energy usage such as liquid refrigerant piping.
5. Piping having an outside diameter or 1 inch or less, associated with strainers, control valves, and balancing valves.

TABLE 606.4
MINIMUM PIPE INSULATION THICKNESS[a, b]

Fluid	Conductivity Btu-in./(h-ft^2-F)	Ratio of Wall Thickness of Pipe Insulation to Nominal Pipe Diameter
Steam	0.27 – 0.34	≥ 2:1
Hot Water	0.22 – 0.29	≥ 1:1
Chilled Water	0.22 – 0.28	≥ 1:1

a. The proportions apply to all nominal pipe diameters greater than ¼ inch and less than or equal to inches. For nominal pipe diameters larger than 2 inches, outside diameter, the minimum wall thickness of the insulation shall be equal to the wall thickness required for 2 inch pipe.
b. These thicknesses are based on energy efficiency considerations only.

E20 and GE2

IECC Sections C403.3.1 and Table C403.3.1(1). Also IgCC 606.5.1, 606.5.1.1 –

The parallel provisions in the IECC and the IgCC need to be clarified and changed in the same format.

Reason: The first issue is raised by the Title to the tables 'Economizer Requirements.' However the code text never says that economizers are required based on the table. It does refer to the table in Exception Item #1 which says economizers are not required for systems less than in the Table. Further the table says for a couple of climate zones – no requirement . How do you go less than no requirement? And the footnote just adds to the weirdness. Is this a requirement or a limitation on the exception? A proposal to fix this issue was presented to the CCC, but was turned down because they were unclear if it was editorial. That proposal is as follows:

Proposal to the CCC

CODE SECTIONS 606.5 (formerly 607.6)

Format based on PV1.0 and 2.0

606.5 Economizers. Economizers shall meet the requirements of the *International Energy Conservation Code*, except as noted herein.

606.5.1 Air Economizer systems. Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Section 606.5.1.1 or 606.5.1.2, respectively.

Exception: Economizers are not required for the following.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table 606.5.1(1).
2. In Group I-2, Hospitals, and Group B, Ambulatory care facilities, where more than 75 percent of the air designed to be supplied by the system is to spaces that are required to be humidified above 35° F (__ ° C) dew-point temperature to comply with applicable codes or accreditation standards. In all other occupancies, where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F (°C) dew-point temperature to satisfy process needs.
3. Systems that include a condenser heat recovery system that is designed to utilize sixty percent of the peak heat rejection load at design conditions and there is a documented need for that rejected heat for either service hot water or space heating during peak heat rejection design conditions.
4. Systems that serve spaces estimated as having a sensible cooling load at design conditions, excluding transmission and infiltration loads, of less than or equal to transmission and infiltration losses at the temperature and relative humidity design conditions in accordance with Section 6.1 of ASHRAE 55.
5. Where the use of *outdoor air* for cooling will affect supermarket open refrigerated casework systems.
6. Where the cooling *efficiency* meets or exceeds the *efficiency* improvement requirements in Table 606.5.1(2).

TABLE 606.5.1(1) ECONOMIZER REQUIREMENTS

CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B	No requirement

2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	Economizers on all cooling systems having a capacity ≥ 33,000 Btu/h[a]

For SI: 1 British thermal unit per hour = 0.293 W.

a. The total capacity of all systems without economizers shall not exceed 480,000 Btu/h per *building* or 20 percent of the building's air economizer capacity, whichever is greater.

Proposed format

606.5 Economizers. Economizers shall comply with the requirements of the *International Energy Conservation Code*, except as noted herein.

606.5.1 Air Economizer systems. Each cooling system that has a fan shall include either an air economizer complying with Section 606.5.1.1 or a water economizer complying with Section 606.5.1.2.

Exception: Economizers are not required for the following.

1. In climate zones other than 1A and 1B, individual fan-cooling units with a supply capacity less than 33,000 Btu/h, provided the total capacity of all systems without economizers within a building shall not exceed 480,000 Btu/h, nor 20 percent of the building's air economizer capacity, whichever is greater.

No change to exceptions 2 through 6

Delete Table 606.5.1(1).

E21 and GE3

IECC Table C403.3.1.1.3(1), IgCC Table 606.5.1.1.3(1).

Turn the footnote into a chapter 2 definition.

Reason: It is a definition. Beyond defining 'Electronic enthalpy controllers', the footnotes provide no regulatory information, nor change the application of the table.

E22

IECC Section C403.3.1 Economizers: Add exception #7:

"For single stage cooling units < 92,000 Btu/h cooling capacity, if the heating load at design conditions is equal to 50% or more of the design sensible cooling load."

OR:

"For single stage cooling units < 92,000 Btu/h cooling capacity, if the heating load at design conditions is equal to 50% or more of the design sensible cooling load AND the system operating hours are 84 hours or less per week."

Reason: Economizers do not recover their added cost during the life of the unitary equipment for most small buildings. Under 7.5 tons, it requires high internal heat gains and operation over 84 hours per week (more than ½-time) to get to a payback period of under 20 years.

- Most smaller buildings have low cooling loads when the outdoor conditions are acceptable for economizer use: large proportion of envelope to interior space, lower interior lighting heat generation due to code mandated reductions in LPD.
- Most buildings are not operating at night when most economizer conditions are available, etc. During cooler weather, the need for cooling drops enough that the average

- **Sections C403.3.1.1.1 and C403.3.1.1.4 have increased the cost of adding an economizer to over $1200.** These sections changed the cost-benefit ratio for economizers on small equipment. Most all packaged rooftop equipment under 7.5 tons now requires a powered exhaust in order to satisfy the 100% outdoor air and full relief of excess capacity required by these sections (can provide links to the relief and fan static capabilities for typical RTUs from Trane, Carrier, York/Johnson Controls). A basic economizer for 3-5 ton equipment is $499; the powered exhaust requires and additional $800. . Is a cost premium for a building with a 3-ton unit of nearly $1.00/Sq. Ft.
- Addition of economizer at 100% capacity also increase fan energy over that of typical unit. When adding additional energy during normal operation (avg. 0.05-0.08" S.P.) plus the additional fan energy needed to move 100% outside air and the fan to relieve this air, the energy savings decrease even more, increasing payback well beyond the life expectancy of the equipment. This fails any cost-benefit analysis.
- Utilizing the PNNL/DOE "small office" and "small retail strip mall" configurations (for zones 4C and 5B), we found that 3 and 4 ton packaged equipment had an average energy savings of about $40 per year. That results in a 30-year payback for an economizer to be used on a rooftop unit that operates during normal business hours (without adding relief fan energy consumption).

So we are recommending that there be an exemption for conditions when a smaller unit has low internal heat gain relative to the envelope and ventilation losses. A unit serving high internal heat generation and little or no envelope exposure will have adequate payback to justify its inclusion for units as small as 3-ton nominal cooling (such as a unit serving a conference room or equipment room interior to a large building).

The language proposed with the 50% level (open for modification/further discussion, but our models show this is a good level). If not completely acceptable to the group, have added "hours of operation" to the proposal. If the space operates more than ½-time, then it will see more "evening/night" conditions where free cooling will be more accessible. Will be running the models at 18-hour/day operation to see difference and will report results.

E23

IECC Section C405.2

The following proposal is intended as a complete replacement for Section C405.2.

SEE Attached

Reason: There are several goals for this proposed re-write:

Reorganization. It is hoped that readers will find this proposal easier to interpret than the current code. Technical requirements for timeswitch controls and occupant sensors, in particular, are organized into discrete sections.
Clarity of Intent. It is clear that this proposal requires the use of automatic controls for almost all lighting, and that connecting a higher percentage of lighting to occupant sensors is better.
Greater Energy Savings. We believe that occupant sensors will achieve more energy savings than bi-level switching. We also believe that restrictions on 24-hour night lighting will reduce lighting system energy use by 5%-10% compared to current code, and that controls requirements for signage and visual displays will make these systems more efficient. This proposal also includes a mandatory requirement for daylight responsive lighting controls, which would be a first for the IECC.
Easy Integration with IGCC. We believe that IECC should offer "levers" for IGCC to require enhanced energy performance for lighting systems prescriptively.

Flexibility. By requiring a percentage of lights to be connected to occupant sensors designers are empowered to find the best solutions for their projects. This will yield better results than one-size-fits-all approaches.

But perhaps most important, this proposal would allow the structure of the code to remain fixed over time as enhanced efficiency is required. Rather than adding new sections to the code for specific space types the code can be improved by adjusting numbers in a table. In this way, users of the code will not have to learn new methodologies every three years. JB

E24

IECC Table C405.5.2(2)

Fix or delete footnote a to Table C405.5.2(2).

Reason: It seems like this footnote may be extensive commentary – and should be in the commentary. It appears to be an 'example' calculation – with an exception which has nothing clearly to do with the regulation.

E25

IECC Section C406.1 –

In the last paragraph, revise to eliminate phrasing 'unless documentation can be provided that demonstrates".

Reason: This is phrasing typical to a standard which needs internal enforcement guidance. It is not typical of the International Codes. Administration and enforcement is addressed in Chapter 1. This section should be reformatted to provide clarity as to the options. The last paragraph perhaps needs to be in a new Section C406.1.1.

E26

IECC Table C406.2(6) and C406.2(7);

Resolved overlap in the two tables both regulating 'absorption chillers".

Reason: Absorption chillers are listed in BOTH table C406.2(6) and C406.2(7). In both tables single and double effect chillers are listed and the double effect chillers have different numbers between the two tables.

E27

IECC Table C406.2(5):

Fix boiler table efficiencies for Hot water, Natural Gas fired boilers. Values were revised from AEDG/Massachusetts Stretch Code figures at final action hearings. Published figures of 97% AFUE (<300 MBH), 97% E_t and 94% E_c are onerous and result in near sole-sourcing (cost prohibitive) of boilers.

Reason: Boilers at these efficiencies are nearly non-existent. The I-B-R listed table can be found at the following link and the table can be list all units by efficiency. Will include boiler list Excel file: From old I=B=R and Energy Star web sites.

NOTATION TO INCLUDED DOCUMENTS: I=B=R listing & Massachusetts Stretch code supplement.

- For the 97% AFUE, there are only 7 boilers manufactured listed at this efficiency, by only 5 manufacturers that can prove efficiency (Energy Star). Need to list standard for testing/proof of ratings: big issue with "claims" of efficiency. http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=BO
- For 97% E_t , there are only the following (I=B=R certified product directory; nothing new from AHRI/GAMA):
  - 1 buderus unit (not series)
  - 1 RayPak series
  - RBI: One unit (not series)
  - Viessman: 5 of 6 units
- For 94% E_c, Large units >2.5 Million: Only two manufacturers (Bryan triple flex not qualifying under I=B=R)
  - 1 Buderus model (3 sizes)
  - 1 Viessmann model (many sizes)

State of Massachusetts, for their Stretch Code, modified their boiler figures below even the AEDG levels due to push-back and local study. MA. went with ASHRAE 189.1 levels. Including background document as PDF from MA.
State of Oregon revised figures as amendment to Oregon Reach Code: Figures revised lower; still above EC-147, but lower than final approved 2012 IECC. Oregon used 95.5 AFUE for smaller boilers. Min. 12 manufacturers with multiple small boilers. Many new products coming on market, so small boilers do not to reduce to level done in MA. Larger boilers present bigger issue. Very limited number of high efficiency over 2.5 Million btu input.
Boiler efficiencies raise nearly 20% above federal minimums. Intent of Section C406 was for an average 10% efficiency increase. Gas-fired hot water boilers singled out for much higher efficiency improvement than oil-fired or steam boilers.

Recommendation: Go with new consensus figures for gas boilers; review Oregon Reach Code, ASHRAE, figures.

E28

IECC Section C407.3

1. The sentence starting Energy prices shall…. The text 'source approved by the code official' is redundant because 'approved' is defined as by the code official. Secondly, the example 'such as' is commentary and should be removed from the code.

2. The sentence starting 'Code officials shall" should be changed to 'The code official shall"

Reason: Proper code format and content.

E29

IECC Table C407.5.1(1)

Revise either Footnote d or Section C403.4.1.

> **Reason.** In the 2009 code this footnote refers to a section of the code that addressed supply air economizers in Complex HVAC systems. Now it refers to a section that regulates water economizers in complex HVAC systems. Unless water economizers are 'supply air economizers – the footnote is referring to a section that doesn't address the same topic.

E30 and GE4

IECC Section C408 and IgCC Section 611 –

System Commissioning. These need to be edited to improve the language to be more 'code like'. They need to be done simultaneously to maintain consistency.

> **Reason**: Clarity of code language – enforceability.

E31

IECC Table R402.4.1.1 and R402.3.2 Fireplaces

Fireplaces are required to have gasketed doors. The code is silent regarding 'wood burning fireplaces.

> **Reason**: In 2012 Table R402.4.1.1 Fireplace criteria states an air barrier shall be installed on fireplace walls. Fireplaces shall have gasketed doors. In Section R402.4.2 it states new wood-burning fireplaces shall have tight-fitting flue dampers and outdoor combustion air. No reference to gasketed doors. What is a new wood-burning fireplace? Does it include masonry fireplaces? Lots of inquiries and people concerned. In 2009 IECC Section 402.4.3 Fireplaces. New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.

E32

IECC Table R405.5.2(1)

Establish a standard reference design for residential design.

> **Reason:** The building component "thermal distribution systems" does not have any information regarding standard reference design. There have been many inquiries. Please consider a reference, note – no data, as many think it is errata.

E33

IECC RESIDENTIAL:

"Additional measure" menu list. Add section similar to C406 for commercial.

Requires sub-committee to develop. ASHRAE 90.2 has announced moving to this method. Oregon energy code has had an additional measures list for a couple of code cycles (first in nation to go with "pick list" that allows selection of high efficiency equipment in code without violating federal preemption rules). Working group to consider possible list. NOTE: State of Oregon contracted independent energy modeling (Ecotope, using SEEM modeling) of all Oregon Code measures and has data for relative effectiveness of each measure. Would not apply outside of climate zones 4C and 5B, but would provide a good starting point for consideration by the committee (an assigned sub-committee). ASHRAE 90.2 may be able to share some of their findings as well.

Benefit of this method: allows for selecting the additional conservation measure appropriate for the residence. The next levels of efficiency are going to be much harder to achieve from a "one-size-fits-all" prescriptive, mandatory list. Having a flexible list to choose from will be easier to get passed by the committee and the ICC membership.

E34

IECC Residential and Commercial Chapter 5 New

Establish a new chapter in the IECC to address solar installations (PV and solar thermal).

Reason: The PMG Group has had more requests for this than almost anything else. The IAPMO Solar Code is gaining momentum by virtue of the fact that we lack this. Perhaps an ad-hoc group should be formed to generate a first draft as it is urgently needed for the 2015 code.

E35

IECC Sections C402.2.1.1; C202, C101.4.3

1. Add the following new language **after section C402.2.1.1**:

C402.2.1.2 Insulation Requirements for Roof Replacements. For roof replacement on an existing building with insulation entirely above the deck and where the roof slope is less than two units vertical in 12 units horizontal, the insulation shall conform to the energy conservation requirements as specified in Table C402.2.

Exception: Where the required R-value cannot be provided due to thickness limitations presented by existing rooftop conditions, including heating, ventilation and air-conditioning equipment, low door or glazing heights, parapet heights, proper roof flashing heights, the maximum thickness of insulation compatible with the available space and existing uses shall be installed.

2. Add the following new definition under **section C202:**

Roof replacement. An alteration consisting of the removal of the existing roof covering, repairing any damaged substrate and installing a new roof covering.

3. Add the following language under **section C101.4.3 (Exception #5):**

C101.4.3 Additions, alterations, renovations or repairs

Exceptions:

5. Reroofing of roofs not covered by section C402.2.1.2 and where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.

Reason Statement

The prescriptive envelope requirement for re-roofing of low-slope roofs under the 2012 IECC is confusing and does not appropriately addresses the technical concerns that often arise during these projects. This proposed change would clarify existing requirements under the IECC, but would not add any new requirements. Also, this proposal is very similar to language adopted on October 31, 2011 by the International Code Council (ICC) as part of the International Green Construction Code (IgCC), section 1003.3.11 (Code Change #GG722-11).

Application of the 2012 IECC to roof alterations is partly determined by interpretation of section C101.4.3 (Additions, alterations, renovations or repairs) and exception #5 of that section. The ambiguities in this section and exception, as applied to low-slope roofs with insulation entirely above deck, have created an opportunity for intentional and unintentional misinterpretation. For instance, it is common practice to use a cover board or slip sheet between the primary insulation layer and the roof membrane. If these materials are left in place during the roof replacement process, then the insulation would not be "exposed" and compliance with the IECC as it applies to roof alterations could be avoided.

Another problem with the current language is that it seems to ignore the possibility that existing structural constraints on the roof may prevent the required thickness of insulation. Not addressing this issue in a clear fashion may result in high compliance costs, but more likely it encourages non-compliance all together.

This proposed code change would improve clarity by adding a new section to chapter 4 addressing the insulation requirements for "roof replacements" on low-slope roofs were insulation is above deck. This would remove the confusion caused by the current provision. Along with this new section, an exception would be added that recognizes the issue of existing roof structural constraints, but would still require installation of the maximum thickness of insulation that would be compatible with those constraints.

This proposal would further clarify the re-roofing issue in general by adding a definition in the IECC for the term, "roof replacement" that would help the reader distinguish between a "roof replacement" and a "roof recover." This new definition is similar to, but also a slight improvement of, the "roof replacement" definition under the International Building Code (IBC).

This proposal would improve building energy efficiency as a result of improved code compliance. Also, the improved clarity would make enforcement by state and local code officials easier and would therefor lower administrative costs.

E36

IECC Section R401.3 and IRC Section N1101.16

R401.3 (IRC - N1101.16) Certificate (Mandatory). A permanent certificate shall be completed and posted on ~~or in the electrical distribution panel~~ the inside of the cabinet door that is located under the kitchen sink by the builder or registered design professional. The certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall list the predominant *R* values of insulation installed in or on ceiling/roof, walls, foundation (slab, *basement wall,* crawlspace wall and/or floor) and ducts outside conditioned spaces; *U*-factors for fenestration and the solar heat gain coefficient (SHGC) of fenestration, and the results from any required duct system and building envelope air leakage testing done on the building. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the types and efficiencies of heating, cooling and service water heating equipment. Where a gasfired unvented room heater, electric furnace, or baseboard electric heater is installed in the residence, the certificate shall list "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be *listed* for gas-fired unvented room heaters, electric furnaces or electric baseboard heaters**.**

Reason:
1. Certificates placed on or in the electrical distribution panel may become destroyed because of the location of the panel. Panels for many buildings in the Southwest portion of the United States are located outside of the building; thereby, causing certificates on or in these panels to become destroyed due to weather.
2. Safety. Additional printed material (such as the energy certificate) on electrical distribution panel makes it difficult to see the warning labels that or located on or in the panel.
3. Certificates located on or in the electrical panel are not very visible due to the location of the panels; thereby, rendering the certificate useless. A certificate located on the cabinet door under on the kitchen sink will be seen much more often by the building occupant.

E37

New IECC Sections

Insert sections that require metering and reporting. An example (primarily from the IgCC) is shown below.

Reason:
Energy usage can be reduced by requiring the use of meters because they provide information that can empower building owners and operators to make sound decisions about how their buildings use energy. Additionally, the 2013 version of ASHRAE 90.1 will require metering.

C407.7 Intent. The intent of these requirements is to provide for the ongoing metering, measuring, reporting and display of the energy use of the whole building and its systems.

C407.7.1 Energy distribution design requirements and load type isolation. Energy distribution systems within, on or adjacent to and serving a building shall be designed such that each primary circuit, panel, or feeder supplies only one energy use type as defined in Sections C407.7.1.1 through C407.7.1.6. The energy use type served by each distribution system shall be clearly designated on the energy distribution system with the use served, and adequate space shall be provided for installation of metering equipment or other data collection devices to measure their energy use. The energy distribution system shall be designed to facilitate the collection of data for each of the building energy use categories in Sections C407.7.1.1 through C407.7.1.6. Where there are multiple buildings on a building site, each building shall comply separately with the provisions of Section C407.7.

Exception: Buildings designed and constructed such that the total usage of each of the load types described in Sections C407.7.1.1 through C407.7.1.6 shall be permitted to be measured through the use of installed sub-meters or other equivalent methods as approved.

C407.7.1.1 HVAC system total energy use. This category shall include all energy used to heat, cool, and provide ventilation to the building including, but not limited to, fans, pumps, boiler energy, chiller energy and hot water.

C407.7.1.2 Lighting system total energy use. This category shall include all interior and exterior lighting used in occupant spaces and common areas.

C407.7.1.3 Energy used for building operations. This category shall include all energy use by vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains and fireplaces, swimming pools, snow-melt systems, and all other building operations.

C407.7.1.4 Plug loads. This category shall include all energy use by devices, appliances and equipment connected to convenience receptacle outlets.

C407.7.1.5 Process loads. This category shall include the energy used by any single load associated with activities within the building—such as, but not limited to, data centers, manufacturing equipment and commercial kitchens—that exceeds 5% of the total energy use of the whole building.

C407.7.1.6 Miscellaneous loads. Energy use for building operations and other operational loads.

C407.7.2 Energy load type sub-metering. For buildings that are 5,000 square feet in total building floor area and larger, all of the Energy Load Types as defined in Section C407.7.1 shall be metered through the use of sub-meters.

C407.7.3 Minimum energy measurement and verification. Meters, sub-meters, and other approved devices installed in compliance with Section C407.7.2 shall be connected to a data acquisition and management system capable of storing not less than 36 months worth of data collected by all meters and other approved devices and transferring the data in real time to a display as required in Section C407.7.4.

C407.7.4 Energy display. A permanent, readily accessible and visible display shall be provided adjacent to the main building entrance or on a publicly available internet website. The display shall be capable of providing all of the following:

1. The current energy demand for the whole building level measurements, updated for each fuel type at the intervals specified in C407.7.1
2. The average and peak demands for the previous day and the same day the previous year,
3. The total energy usage for the previous eighteen (18) months.

E38

Ventilation and the 2012 IECC – Relevant code sections

Reason: There is a “break” in the current requirements for mechanical ventilation/combustion air that needs further discussion and fixing, from IECC to IRC, several chapters

The Residential Code IRC 2012 essentially states that a house complying with the 2012 IECC MUST have mechanical ventilation that complies with the 2012 IRC section following, since the new whole house leakage requirement of the 2012 IECC is 3 ACH50, and balanced ventilation must be supplied if the house is tighter than 5ACH50, per the IRC.

Where things get fuzzy is how we make sure that there is sufficient makeup air for combustion. BCAP believes there is a bit of a broken link between the codes, since the requirement that then requires MAKEUP AIR FOR COMBUSTION states that it must be provided when a house is tested to .40 ACH; then, it doesn’t tell us what standard .40 ACH IS (NACH, 50 pascal, etc.) therefore, we are left guessing.

Another potential – if a state adopts the IECC alone, it may balk at the reference to the IRC. Or, a state may adopt a different version IRC.

The 2012 IECC simple mechanical ventilation section, requiring specific fan efficacy, before referencing the IRC;

E39

Add language for better treating multifamily common walls

Attached for consideration from the NYS version 2009 IECC, enhanced as part of their current NYSECCC-2010.

402.2.12 Tenant separation walls. (Mandatory). Fire separations between dwelling units in two-family dwellings and multiple single-family dwellings (townhouses) shall be insulated to no less than R-10 and the walls shall be air sealed in accordance with Section 402.4.1 of this chapter.

International Green Construction Code

GE5

IgCC Tables 602.1.2.1, 602.1.2.2 and 602.2.1 -

Delete the footnotes.

Reason: The footnotes are commentary regarding the source of the information in the table. They are not regulatory. They do not add anything that can be used in design or enforcement. At best this information should be moved to the Commentary.

GE6

IgCC Section 603.2

Reformat the section to place the subsections in a table; reword the text accordingly.

Reason: The sections are not regulatory but are definitional. Proposed to CCC. The CCC committee was concerned that it wasn't completely editorial.

Description:

Format of Section 603.2 based on PV1.0 and 2.0

603.2 Energy distribution design requirements and load type isolation in buildings. Energy distribution systems within, on or adjacent to and serving a *building* shall be designed such that each primary circuit, panel, feeder, piping system or supply mechanism supplies only one energy use type as defined in Sections 603.3.1 through 603.3.5. The energy use type served by each distribution system shall be clearly designated on the energy distribution system with the use served, and adequate space shall be provided for installation of *metering* equipment or other data collection devices, temporary or permanent, to measure their energy use. The energy distribution system shall be designed to facilitate the collection of data for each of the *building* energy use categories in Section 603.4 and for each of the end use categories listed in Sections 603.3.1 through 603.3.5. Where there are multiple *buildings* on a *building site,* each *building* shall comply separately with the provisions of Section 603.

Exception: *Buildings* designed and constructed such that the total usage of each of the load types described in Sections 603.3.1 through 603.3.5 shall be permitted to be measured through the use of installed sub-*meters* or other equivalent methods as *approved*. *ventilation* to the *building* including, but not limited to, fans, pumps, boiler energy, chiller energy and hot water.

603.3.1 HVAC system total energy use. This category shall include all energy used to heat, cool, and provide *ventilation* to the *building* including, but not limited to, fans, pumps, boiler energy, chiller energy and hot water.

603.3.2 Lighting system total energy use. This category shall include all interior and exterior lighting used in occupant spaces and common areas.

~~**604.3.4**~~ **603.3.3 Plug loads.** This category shall include all energy use by devices, appliances and equipment connected to convenience receptacle outlets.

~~**604.3.5**~~ **603.3.4 Process loads.** This category shall include the energy used by any single load associated with activities within the building such as, but not limited to, data centers, manufacturing equipment and commercial kitchens that exceeds 5 percent ~~of the total energy use~~ of the peak connected load of the whole building.

~~**604.3.3**~~ **603.3.5 Energy used for building operations loads and other miscellaneous loads.** This category shall include all ~~energy use by~~ vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains and *fireplaces*, swimming pools inground spas, snow-melt systems, exterior lighting that is mounted on the *building* or used to illuminate *building* facades ~~and all other *building* operations~~ and the use of any miscellaneous loads in the building not specified in Sections 603.3.1 through 603.3.4.

Proposed reformat

603.2 Energy distribution design requirements and load type isolation in buildings. Energy distribution systems within, on or adjacent to and serving a *building* shall be designed so that each primary circuit, panel, feeder, piping system or supply mechanism supplies only one of the energy use categories specified in Table 603.2. The energy use category served by each distribution system shall be clearly designated on the energy distribution system with the use category served, and adequate space shall be provided for installation of *metering* equipment or other data collection devices, temporary or permanent, to measure the energy used. The energy distribution system shall be designed to facilitate the collection of data for each of the building energy use categories in Section 603.3 and for each of the energy use categories specified in Table 603.2. Where there are multiple *buildings* on a *building site,* each *building* shall comply separately with the provisions of Section 603.

Exception: *Buildings* designed and constructed so that the total usage of each of the load types specified in Table 603.2 is permitted to be measured through the use of installed sub-*meters* or other equivalent methods as *approved*.

TABLE 603.2
ENERGY USE CATEGORIES

Load Category	Description of energy use
Total HVAC system	Heating, cooling and ventilation including, but not limited to fans, pumps, boilers, chillers and water heating.
Total lighting system	Interior and exterior lighting used in occupant spaces and common areas
Plug loads	Devices, appliances and equipment connected to convenience receptacle outlets
Process loads	Any single load of an activity within the building that exceeds 5 percent of the peak connected load of the whole building including, but not limited to data centers, manufacturing equipment and commercial kitchens
Building operations and other miscellaneous loads	Loads not includes elsewhere in this table including, but not limited to, vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains, ornamental fireplaces, swimming pools, in-ground spas, snow-melt systems and exterior lighting that is mounted on the building or used to illuminate building facades

Reason: The recent code changes, even the changes reflected in PV2.0 are irrelevant to this proposal. The original format of the section was inconsistent with typical I-Code format. The subsections 603.3.1 through 603.3.5 do not contain any regulations but are merely descriptors (definitions) of 5 energy use (load) categories. The regulation contained in Section 603.2 is require each type of load /energy use to be separately metered. This proposal turns Sections 603.3.1 through 603.3.5 into a table of energy use types. It then revises the paragraph to refer to the table. It also provides consistency in the language used regarding 'load types' and 'categories'.

GE7

IgCC. **Section 604.4 – Item 1 of the Exception**.

Define the term 'lifeline services'.

Reason: This is an unusual term for the I-codes and needs to be clarified for application.

GE8

IgCC. **Section 605.1.1.1**

Fix so that you don't have to shade fenestration that is facing NE or NW.

Also – fix it further so that it works in the Southern hemisphere.

Reason: As written it says to apply the shading of fenestration to windows within 45 degrees of East, South and West. That means windows that are basically facing Northeast and Northwest. I am guessing that has little value in saving energy.

GE9

IgCC Table 606.5.1.2.

Move the footnote content into the section which refers to the table.

> **Reason:** The footnote is the regulation. It shouldn't be buried in the footnote. This is the style found in many ASHRAE type standards – and is not the ICC style.

GE10

IgCC Table 606.5.1.3.(2)

Delete or significantly revise the footnotes.

> **Reason**: Footnote a is an example (or part of it); Footnote b is commentary.

GE11

IgCC . Sections 606.9 and 608.2

These sections address controls in dwelling units and sleeping units – One regulates just R-1; the other regulates both R-1 and R-2.

> **Reason:** Should they be consistent?

GE12

IgCC Section 607.5 –

Change 'Group R-2 Buildings' to 'Group R-2 Occupancies'

> **Reason:** All the other things on the list are occupancies. Does a group R-2 Building include other occupancies in the building?

GE13

IgCC Sections 608.5 and 608.6.4.

Delete the occupancies B and E associated with the regulation of classrooms. Consider deleting the 'Group B' associated with 'offices'.

> **Reason:** Classrooms in other than E occupancies with an occupant load in excess of 100 will be Group A-3. Classrooms associated with an A-3 Place of religious worship will be Group A-3 regardless of size. Offices 99 times out of 100 will be Group B occupancy. An office in someone's home is probably not covered by this code.

GE14

IgCC Tables 608.8.1.1(1), (2) and (3).

Delete the footnotes for all 3.

> **Reason:** This appears to be source information – and therefore commentary. If the intent is that people are supposed to reduce the numbers in the table by those factors – we should just reduce the factors in the table and not bury it in the footnote.

GE15

IgCC Sections 608.10 and 608.11 –

Delete both.

> **Reason:** These are telling people how to conduct inspections and how to address things which are found to not comply at inspection. This is a subject for Chapter 1 – if needed at all. I attribute this type of language to proponents who are not familiar with the permit enforcement process.

GE16

IgCC. **Table 609.1**

Delete items from table that don't have federal standards.

> **Reason:** The table says its equipment covered by federal standards. Then the footnote says there aren't standards for some of these. Then they don't belong in the table.

GE17

International Fire Code
International Green Construction Code.

IFC Sections 317.2, 317.3, 605.11.3.3.1, 605.11.3.3.2, 605.11.3.3.3
IgCC – Section 408.3

Do the restrictions for access and separation of landscaped roofs and for solar installations contained in the IFC conflict with the requirement of the IgCC that 75% of the roof be covered with solar collectors, vegetative roofs and roof coverings with minimum solar reflectance? Establish appropriate separations and access pathways and adjust the 75% requirement as needed.

> **Reason:** Sections 317.2 and 317.3 require 6 feet of separation between landscaped roofs and rooftop gardens and rooftop structures including penthouses, skylights, roof vents, solar panels, antenna supports and building service equipment. That separation must have a class A rating even where a Class A rating isn't otherwise required for the roof. It also sets a maximum size of landscaped area to be 15,625 square feet without a separation. It is unclear whether this applies to vegetative roofs. That should be clarified.

Section 605.11.3.2 requires a 3 foot access pathway from eave to roof on 1 and 2 family structures where solar panels/modules are installed. The section then uses the term residential structures which isn't defined in the IFC. The definition in the IECC would apply this to Group R-2 –three stories or less in height.

Section 605.11.3.3 applies to other than residential structures (see definitional issue). It requires a 4 foot or 8 foot wide access pathway around the entire perimeter of the roof. Additional 4 foot pathways are required to other rooftop features including skylights, roof hatches, standpipes as well as centerline pathways across both axes of the roof.

If 3 feet is adequate on a 'residential building', why is 4 or 8 feet needed on a non-residential building?

GE18

IGCC Chapter 6

Address the energy used and heat generated by Data Centers

Reason: These are the data handling facilities that power cloud services, search engines and the Internet as a whole. These centers are sprouting all over the world and use substantial amounts of power. Dissipation of waste heat is a central concern, and options include air cooling and water cooling. Regardless, criteria are needed to minimize energy and water usage, and to recapture waste heat for use elsewhere. Resources:

LBNL Environmental Performance Criteria Guide for New Data Centers. DRAFT based on LEEDTM NC 2.2: http://hightech.lbl.gov/dc-epc.html

Three Steps to Greener Data Centers