



U.S. Department of Energy  
Energy Efficiency and Renewable Energy

# Building Energy Codes Program



## 2004 National Workshop on State Building Energy Codes

Recent Changes to the IECC and  
Energy Provisions of the IRC

Dave Conover  
July 19, 2004



# INTERNATIONAL CODE COUNCIL

**Not Just Codes but a  
Complete Building  
Regulatory System**



**Mission: to develop a  
comprehensive and compatible  
regulatory system for the built  
environment ...**



# Agenda

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- **Overview of the ICC**
- **ICC code development process**
- **Energy related changes in the IECC**
- **Changes in the IRC**



# Expected Outcome

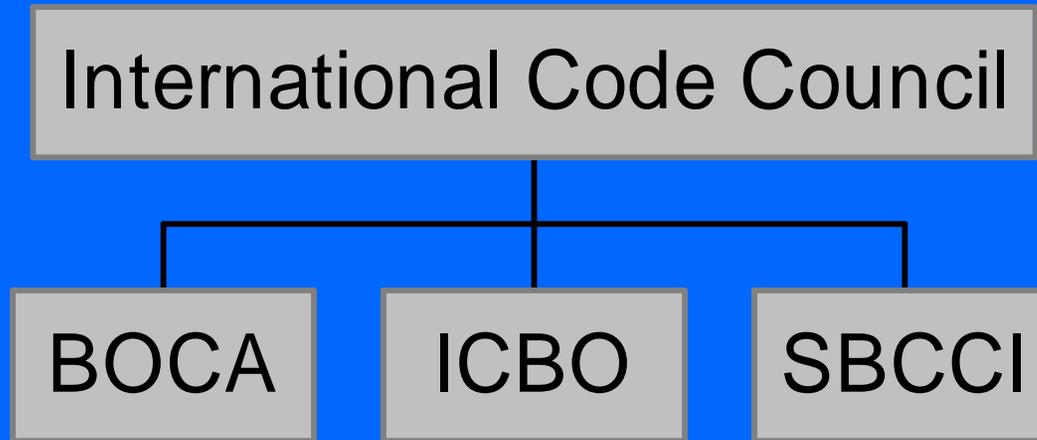
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- **A better understanding of the ICC and ICC code development process**
- **A better understanding of how the 2004 Supplement to the 2003 IECC and energy provisions of the 2003 IRC differ with the 2003 IECC and IRC**



# ICC Overview

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- **Over 300 highly trained staff in 15 U.S. and 2 international locations**
- **Widespread recognition throughout the U.S.**
- **A history of support for public health, safety and welfare**



# ICC Code Support Infrastructure

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*ICC's fulfills it's mission of ensuring public safety with a support infrastructure that no one else offers and which facilitates the ease of application and use of the codes*

- **Conformity Assessment**
  - Testing, Quality Assurance and Fabrication
  - Building Technology Evaluation
- **Codes and Standards Support Services**
- **Personnel Certification**
- **Professional Development Services**
- **Membership Services**



# ICC Code Development

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- **Any person, corporation or entity can participate**
- **Regulatory-based consensus**
- **Predictable agenda**
- **Two cycles every three years**
- **Two hearings per cycle**



**Code Changes  
Submitted by 8-20-04**

**Code Changes  
Submitted by 3/06**

**Code Changes  
Printed & Distributed 12/04**

**2004 Supplement  
Published ~ 7/21/04**

**2006 Editions  
Published 2/06**

**Open Public  
Hearing 2/05**

**2004/2005  
I-CODE DEVELOPMENT  
CYCLE**

**Final Action  
Hearing 9/05**

**Public Hearing Results  
Printed & Distributed by 5/05**

**Public Comments  
Printed & Distributed by 8/05**

**Public Comments  
Sought on Public  
Hearing Results until 5/05**



# 2003/2004 IECC Code Cycle

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- **54 proposed changes submitted by 26 proponents**
- **13 proposed changes approved as submitted**
- **7 proposed changes approved as modified**
- **24 proposed changes disapproved**
- **10 proposed changes withdrawn**



# 2003/2004 IECC Code Cycle

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- **Many changes submitted to simplify provisions and ease their application**
- **Technically some changes are more stringent and others less but simplification supports increased compliance which in turn bolsters increased energy conservation**
- **Increased focus on solar heat gain and cooling dominated climates**



# EC 5-03/04 - item 1

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- **Revises definition of skylight**
- **2003 IECC refers to glazing that is less than 60 degrees from horizontal**
- **2004 Supplement refers to glass or transparent or translucent material at 15 degrees or more from vertical**
- **Code is now consistent with AAMA 101/1.S.2/NAFS-02 and IRC**



# EC 6-03/04

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- **Adds a definition for Solar Heat Gain Coefficient (SHGC) as the term is used in the IECC but is not defined in the 2003 IECC**
- **SHGC = the ratio of the solar heat gain through a fenestration or glazing assembly to the incident solar radiation**
- **Code change approved as modified based on EC 48-03/04**



# EC 7-03/04

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- Adds interior design temperatures for heating and cooling load calculations
- $\leq 72\text{F}$  for heating
- $\geq 78\text{F}$  for cooling
- IECC did and continues to refer to ASHRAE Handbook, Fundamentals as the basis for HVAC load calculations



# EC 30-03/04

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- **Places all requirements for commercial buildings in one Chapter**
- **Chapter 8 is used now to cover all commercial buildings to eliminate renumbering of sections and cross references**
- **References ANSI/ASHRAE/IES Standard 90.1-2001 as one path to compliance with the other path being the provisions in the IECC for commercial buildings**



# EC 31-03/04

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- **Eliminates 33 sets of envelope tables for various climate zones and replaces them with one table that provides envelope criteria for one of 8 zones**
- **Eliminates four prescriptive tables for commercial building envelope requirements based on glazing area and replaces them with one prescriptive table for opaque elements, one table for glazing and one describing metal building assemblies**



# EC 31-03/04

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- Envelope still requires use of 90.1 criteria for envelopes when window and glazed door area is >50% of above grade walls but envelope criteria only cover up to 40%

# EC 31-03/04

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- **Above grade walls used to be those completely above grade or the above grade portion of a basement or a first-story wall and are now those above grade or more than 15% above grade**
- **Nonglazed doors are now called opaque doors and are those with less than 50% glazing and are considered part of the above grade walls and must meet door U-factor requirements in the opaque envelope requirements table**



# EC 35-03/04

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- **Revises the criteria for air leakage associated with dampers that are part of the building envelope**
- **Applies air leakage criteria to outdoor air intakes and exhaust openings**
- **Motorized dampers must now be at least a Class 1, leakage-rated with maximum leakage rate of 4 cfm/sf (used to be 3 cfm/sf)**
- **Update reference to ACMA 500-D-98 for testing dampers**



# EC 36-03/04

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- **Revises provisions for hydronic system controls on simple systems to specify design capacity is output capacity**
- **Loweres the threshold of applicability for such controls on simple systems from 600,000 Btuh to 300,000 Btuh**



# EC 37-03/04

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## Adds new provisions requiring air to air energy recovery ventilation systems for simple HVAC systems

- applies to individual fan systems  $\geq 5,000$  cfm supply air capacity serving  $\geq 70\%$  of design supply air as outside air
- requires  $\geq 50\%$  change in enthalpy between outdoor air and return air at design conditions
- requires bypass or control of recovery system to allow cooling with outdoor air where required
- eight exceptions including IMC prohibition, some lab fume hoods, certain spaces based on climate or design conditions or where 60% of heating is by recovered or solar energy



# EC 38-03/04

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**Revises the provisions for cooling with outdoor air for simple HVAC systems (required supply air economizers)**

- **climate zones and thresholds changed**
- **requirement by cooling system capacity of  $\geq 65,000$  Btuh or  $\geq 135,000$  Btuh by climate zone**
- **deletes equipment efficiency exception by zone and cooling capacity and replaces it with % efficiency improvement over code minimum by zone**



# EC 38-03/04

## Revises the provisions for economizers for complex HVAC systems

- must be able to operate at 100% outdoor air even if additional cooling needed to meet building cooling load
- climate zone and thresholds changed
- requirement by cooling system capacity of  $\geq 65,000$  Btuh or  $\geq 135,000$  Btuh by climate zone
- deletes equipment efficiency exception by zone and cooling capacity and replaces it with % efficiency improvement over code minimum by zone
- adds exception for certain water chilling packages when IPLV is exceeded by a certain % for certain zones



# EC 39-03/04

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- **Previously required duct and plenum tapes and mastics to be listed and labeled as meeting UL 181A or 181B**
- **Requires markings of 181A-P for pressure-sensitive tape, 181 A-M for mastic or 181 A-H for heat-sensitive tape**
- **Requires tape and mastic for flexible ducts and connectors to meet UL 181B and be marked 181B-FX for pressure-sensitive tape and 181 B-M for mastic**



# EC 40-03/04

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## Adds new provisions requiring air to air energy recovery ventilation systems for complex HVAC systems

- applies to individual systems  $\geq 5,000$  cfm supply air capacity serving  $\geq 70\%$  of design supply air as outside air
- requires  $\geq 50\%$  change in enthalpy between outdoor air and return air at design conditions
- requires bypass or control of recovery system to allow cooling with outdoor air where required
- eight exceptions including IMC prohibition, some lab fume hoods, certain spaces based on climate or design conditions, series style energy recovery coils wrapped around the cooling coil or where 60% of heating is by recovered or solar energy



# EC 41-03/04

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**Changes exception for economizers on complex systems to allow elimination of water economizers when they can provide 100% (as opposed to up to 100%) of the expected cooling load at 50F db and 45F wb and below**

# EC 42-03/04

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**Revises provisions for hydronic system part load controls for complex systems to specify design capacity of  $\geq 300,000$  Btuh is output capacity**



# EC 44-03/04

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## Adds new provisions for pools from ASHRAE 90.1

- Pool heaters must have a readily accessible on-off switch separate from thermostat
- Continuously burning pilot lights are not allowed on natural gas pool heaters
- Automatic on-off time switches are required for pool heaters and pumps unless health standards require 24-hour operation or pumps are required to operate solar or waste heat recovery systems
- Heated pools must have a vapor retardant pool cover and if heated to over 90F the cover must be at least R-12, unless over 60% of energy is from solar or site-recovered sources



# EC 45-03/04

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**Revises the provisions for lighting system controls in hotel, motel, boarding house and similar occupancies to clarify that they must be considered separately (e.g. stand alone) as opposed to the current situation where they are considered a subset of additional control provisions applicable to all buildings**



# EC 46-03/04

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- **Revises the calculation of lighting power by either the entire building method or the tenant area/building portion method to refer to floor area as opposed to conditioned floor area**
- **Clarifies that lighting power for interior spaces is not limited to conditioned spaces but to all spaces other than those exempted by the code**



# EC 48-03/04

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- **Eliminates the current IECC provisions for other than commercial buildings and replaces them with more compact and usable set of energy provisions**
  - **Administrative Chapter**
  - **Definitions**
  - **Design Conditions**
  - **Residential**
- **Significant effort by proponent to work with interested and affected parties**



# EC 48-03/04

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## Administrative

- Adds specific provisions to exempt storm window, glass only replacements, and non-exposed envelope assemblies associated with alterations, renovations and repairs
- Adds a provision that envelope assemblies exposed during alterations, renovations and repairs must have cavities filled with insulation
- Eliminates the allowance for minor accessory uses ( $\leq 10\%$  of floor area) to be considered as part of the primary occupancy



# EC 48-03/04

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## Administrative (con't.)

- **Adds recognition for the use of approved software, worksheets, compliance manuals etc. in determining code compliance**
- **Eliminates the ability to calculate SHGC based on SC/0.87**
- **Simplifies default fenestration and door U-factor and fenestration SHGC tables**
- **Deletes duct insulation R-value marking**



# EC 48-03/04

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## Administrative (con't.)

- Adds a provision to allow for use of national, state or local energy efficiency programs that exceed the code to be used as a basis for code compliance
- Eliminates provisions related to the systems analysis approach
- Allows the code official to require document preparation by a registered design professional



# EC 48-03/04

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## Definitions added

above grade wall, energy recovery ventilation system, energy simulation tool, factory assembled glazed fenestration product, and site built glazing product



# EC 48-03/04

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## Definitions deleted

air transport factor, AFUE, Btu, COP, comfort envelope, condenser, condensing unit, cooled space, deadband, HDD, CDD, energy, EER, evaporator, duct and warm air furnaces, glazing area, gross area of exterior walls, gross floor area, heat, heat capacity, heat pump, heat rejection equipment, heated space, HSPF, HVAC, HVAC system components and equipment, IPLV, luminaire, multifamily dwelling, multiple single family dwelling, occupancy, opaque areas, outdoor air, ODF, PTAC, PTHP, positive cooling and heat supply, refrigerant, renewable energy sources, RAC, sash crack, SEER, service systems, simulation tool, slab on grade floor insulation, solar energy source, standard truss, thermal conductance, thermal resistance overall, thermal transmittance overall, townhouse, unitary heating and cooling equipment, unitary heat pump, water heater instantaneous, water heater storage, and window projection factor



# EC 48-03/04

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## Definitions modified

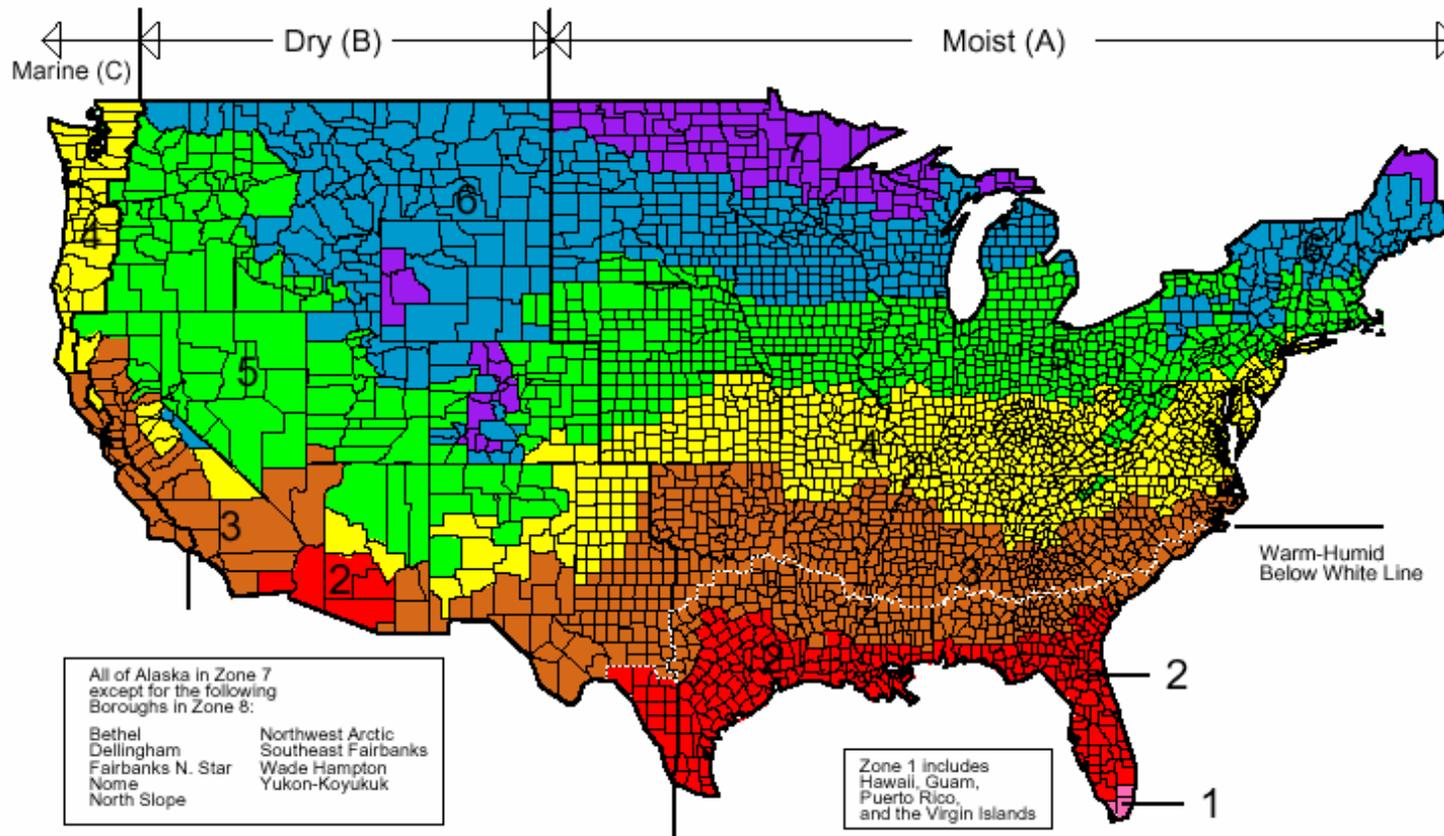
basement wall, building envelope, conditioned floor area, conditioned space, economizer (air and water), energy analysis, energy cost, exterior wall, fenestration, heated slab, infiltration, repair, residential building, roof assembly, skylight, sunroom (addition), and thermal isolation



# EC 48-03/04

## New climate zones created and includes international criteria

Map of DOE's Proposed Climate Zones



# EC 48-03/04

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## Residential criteria

- One prescriptive path to compliance
- Simplified systems tradeoffs
- Window area removed
- Criteria independent of component area
  - calculations not needed
  - enforcement with or without plans
- Singular table of building envelope criteria
- No distinction between single and multi-family housing



# EC 48-03/04

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## Residential criteria (con't.)

- **Cooling better integrated than in the past**
  - **new climate zones in the south pay more attention to cooling**
  - **higher levels of ceiling insulation in the south**
  - **cutoff for vapor retarder criteria moved further north**



# EC 48-03/04

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## Residential criteria (con't.)

- **Better alignment between the IECC and IRC**
  - same climate zones where IECC was HDD based and IRC had county based zones
- **More simplified compliance alternative based on building performance**
- **Code official is allowed to waive slab insulation in areas of heavy termite infestation**



# EC 48-03/04

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## Residential criteria (con't.)

- **New format facilitates direct supply of code-compliance products as requirements do not vary from home design to home design**
- **Windows at Energy Star levels in more than half of the U.S.**
- **Overall new code is slightly more stringent than the previous code**



# EC 48-03/04

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## Residential criteria (con't.)

- **Some inconsistency in IECC between insulation requirements and equivalent U-factors**
- **U-factors based on climate zone instead of sliding scale based on HDD**
- **Maximum cathedral ceiling R-value set at 30 for first 500 sq. ft.**



# EC 48-03/04

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## Residential criteria (con't.)

- **Wall insulation that might require 2x6 construction now allows 2x4 with insulated sheathing**
- **Floor cavity insulation required to be in contact with the underside of the floor**
- **Mass wall and steel framing applications greatly simplified**



# EC 48-03/04

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## Residential criteria (con't.)

- Piping in circulating systems to be insulated to at least R-2 instead of insulation thickness of 1/2 to 2 in. based on pipe diameter and water temperature
- Swimming pool criteria removed
- Eliminated HVAC equipment efficiencies (covered by Federal law)



# EC 48-03/04

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## Commercial criteria

- **Most commercial requirements in Chapter 8 unchanged**
- **Changes climate criteria so commercial and residential use the same zones**
- **Combine Chapter 7 (90.1) reference and Chapter 8 (simplified commercial provisions) into one chapter on commercial buildings**



# EC 50-03/04

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- **Eliminates a provision from EC48-03/04 that would have exempted residential fenestration in jurisdictions in certain climate zones that require impact resistant fenestration from the fenestration U-factor requirement in the code**
- **Residential buildings in areas where impact resistant fenestration is required will continue to have to satisfy the thermal requirements in the code**



# EC 53-03/04

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- **Revises EC 48-03/04 with respect to the standard reference design associated with the systems analysis approach for residential buildings**
- **EC 48-03/04 had proposed that the default SHGC for fenestration be 0.55 for some climate areas and 0.4 for others**
- **EC 53-03/04 as modified results in a SHGC default of 0.4 being used in all climates**



# EC 55-03/04

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## Updated reference standards

- **New editions of ANSI gas-fired equipment standards and deletion of duct furnace standard**
- **New editions of ARI, DTI, NCMA, and UL standards**
- **New editions of ASTM standards and deletion of C236 on thermal performance via guarded hot box**



# 2003/2004 IRC (energy) Code Cycle

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- 3 proposed changes submitted by 3 proponents
- 1 proposed change approved as submitted
- 0 proposed changes approved as modified
- 1 proposed change disapproved
- 1 proposed change withdrawn
- 7 changes delegated to IRC from IECC Committee



# EC5-03/04 - item 2

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- **Editorial to refer to skylights as being 15 degrees or more from vertical instead of the current more than 15 degrees from vertical**
- **Code is now consistent with AAMA 101/1.S.2/NAFS-02**



# EC27-03/04 - item 2

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- **Changes a reference to ASTM C236 to ASTM C 1363 for hot box testing for assemblies not covered elsewhere in the code**
- **Appears to have been preempted by EC 48-03/04 such that the section that was the subject of the proposed change no longer exists**
- **The IRC now simply describes mass walls and lists insulation requirements**



# EC 48-03/04

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- **Eliminates the current IRC energy provisions and replaces them with more compact and usable set of energy provisions**
- **Intent to have the IRC look like the IECC**
- **Modified exception but essentially still exempts portions of the building envelope not enclosing conditioned space**



# EC 48-03/04

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- **Buildings can now meet IECC or IRC regardless of window area (used to limit IRC use 15% WWR for single family and 25% WWR for townhouses)**
- **When an R-value is marked on the insulation it must be applied by the manufacturer to each piece of insulation 12 in. wide (used to simply say on each piece of insulation)**



# EC 48-03/04

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- **Default U-factor and SHGC factors provided in the IRC instead of referencing the IECC and are the same more simplified default values included in revisions to the IECC**
- **Changes climatic zones consistent with changes made to the IECC**



# EC 48-03/04

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- **National, state or local programs that exceed the code requirements are allowed to be considered as a basis for code compliance**
- **Provisions added to require a permanent certificate on or near the electrical distribution panel that lists various energy-related specifications of the building**



# EC 48-03/04

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- Provides simplified insulation R-value and fenestration requirements by component for one of 8 climate zones (instead of 17) regardless of window area (used to be 15%WWR for SFD and 25% for townhouses)
- Adds a compliance path that provides equivalent U-factors for envelope assemblies
- Adds a compliance path that is based on a total building UA equivalent



# EC 48-03/04

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- **Modifies mass wall and steel framing criteria to fit with the new 8 zone envelope criteria format**
- **Floor insulation is now to be installed to contact the underside of the subfloor decking**
- **Heated slabs on grade require an additional R-5 insulation (used to be R-2)**



# EC 48-03/04

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- **Adds provisions for insulation and glazing in thermally isolated sunrooms**
- **Allows an area-weighted average fenestration product U-factor as well as area-weighted SHGC for products over 50% glazed**
- **Changes fenestration exemption from 1% of total glazing area to 15 sq. ft.**
- **Replacement fenestration must meet the requirements for new construction**



# EC 48-03/04

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- **Supply and return ducts must be insulated to R-8 except R-6 in floor trusses and no insulation when inside the building envelope (used to be R-5 when inside building but outside envelope and R-8 when outside the building)**
- **Deleted HVAC and SWH equipment efficiencies (covered by Federal law)**



# EC 48-03/04

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- **Mechanical piping insulation R-2 minimum as opposed to 3/4 to 1.5 in. depending on fluid temperature**
- **Heating system piping insulation threshold reduced from 120 F to 105 F**

# EC 48-03/04

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## Inconsistencies between IECC and IRC

- Some differences in the table values for frame wall R-values in the two codes and although the R-values are different the U-factor criteria are the same
- The IECC has a specific total building performance method and the IRC does not



# RB264-03/04

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- **Clarifies that required insulation on basement walls applies to exterior basement walls**
- **Consistency with IECC**
- **There may now be an inconsistency between IRC (exterior walls associated with conditioned basements) and IECC (walls associated with conditioned basements)**



# Questions ?

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