Proposed Code Modifications

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WITH COMMENTS

TAC: Energy

Total Mods for **Energy** in **Approved as Submitted: 5**

Total Mods for report: 18

Sub Code: Energy Conservation

EN6782

1

Date Submitted	12/23/2015	**Section**	405.6.3	**Proponent**	Gary Beaumont
Chapter	4	**Affects HVHZ**	No	**Attachments**	No

TAC Recommendation Approved as Submitted
Commission Action Pending Review

Comments

General Comments **Yes**

Alternate Language **No**

Related Modifications

Summary of Modification

Change C405.6.3 to read the same as ASHRAE 90.1-2013 Addendum c 8.4.1 Voltage Drop. The conductors for feeders and branch circuits combined shall be sized for maximum of 5% voltage drop total.

Rationale

By not limiting the Feeder voltage drip to 2%, there is a major reduction in the first cost in certain projects (hi-rise, large commercial, etc.) and combining the voltage drop to a 5% total limit keeps the energy costs neutral. Lights, appliances, motors, etc. do not know whether the voltage drop occurred in the feeders or branch. This would save commercial projects in Florida millions of dollars a year with no additional energy costs.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

None

Impact to building and property owners relative to cost of compliance with code

The impact would be approximately .5% of the construction costs

Impact to industry relative to the cost of compliance with code

Commercial projects would save approximately .5 of the construction costs.

Impact to small business relative to the cost of compliance with code

If commercial building owners have lower construction costs they should lower rental costs.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Saves money with no negative energy effects.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Puts the energy code in compliance with NEC and ASHRAE addendum c

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

No effect.

Does not degrade the effectiveness of the code

Meets and exceeds NEC

Is the proposed code modification part of a prior code version? No

Alternate Language

1st Comment Period History

6782-A2

Proponent Bryan Holland **Submitted** 2/22/2016 **Attachments** Yes

Rationale

While I agree that a reasonable efficiency of operation will be provided by limiting the maximum total voltage drop of all conductors from the service to the farthest outlet to 5 percent, the permitted voltage drop on any one circuit or conductor should not exceed 3 percent. As proposed, a calculated voltage drop of less than 2 percent on a feeder would allow a 4 percent or more voltage drop on the branch circuits. Overheating of the branch circuit conductors and conductor terminations could be the result. By limiting the maximum voltage drop on any single conductor to 3 percent, the total 5 percent voltage drop permitted will be evenly distributed across the entire premise wiring system.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

None.

Impact to building and property owners relative to cost of compliance with code

None. This modified proposal will not have a significant impact on system design or cost of compliance.

Impact to industry relative to the cost of compliance with code

None. This modified proposal will not have a significant impact on system design or cost of compliance.

Impact to Small Business relative to the cost of compliance with code

If commercial building owners have lower construction costs they should lower rental costs.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

This has a minimal connection to health, safety, and welfare of the public.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

This modified proposal provides equivalent energy conservation to what is currently required by code.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

No.

Does not degrade the effectiveness of the code

No.

Is the proposed code modification part of a prior code version?

YES

The provisions contained in the proposed amendment are addressed in the applicable international code?

NO

The amendment demonstrates by evidence or data that the geographical jurisdiction of Florida exihibits a need to strengthen the foundation code beyond the needs or regional variation addressed by the foundation code and why the proposed amendment applies to the state?

YES

The proposed amendment was submitted or attempted to be included in the foundation codes to avoid resubmission to the Florida Building Code amendment process?

NO

2nd Comment Period

EN6782-G2

Proponent Bryan Holland **Submitted** 5/12/2016 **Attachments** No

Comment:

I support the TAC recommendation to Approve as Submitted. In addition to correlating voltage drop requirements in the FBC with the ASHRAE 90.1 Standard, a similar proposal to the 2018 IECC was recommended for approval at the ICC Group B Codes - Committee Action Hearings in April. Harmonization between all three codes will result in uniform and consistent enforcement.

1st Comment Period History

EN6782-G1

Proponent Thomas Lasprogato **Submitted** 2/3/2016 **Attachments** No

Comment:

I remain neutral

C405.6.3 Voltage drop.

~~**C405.6.3.1 Feeders and customer owned service conductors**. Feeder and customer owned service conductors shall be sized for a maximum voltage drop of 2 percent at design load.~~

~~**C405.6.3.2 Branch Circuits.** Branch circuit conductors shall be sized for a maximum voltage drop of 3 percent at design load.~~

The conductors for feeders and branch circuits combined shall be sized for a maximum of 5% voltage drop total.

Revise the proposed modification as follows:

C405.6.3 Voltage drop. The maximum combined voltage drop on customer owned service conductors, feeders and branch circuits shall not exceed 5 percent. The maximum voltage drop on any single conductor shall not exceed 3 percent.

Date Submitted	12/15/2015	**Section**	405.5.2	**Proponent**	Dwight Wilkes
Chapter	4	**Affects HVHZ**	Yes	**Attachments**	Yes

TAC Recommendation Approved as Submitted
Commission Action Pending Review

Comments

General Comments No **Alternate Language** Yes

Related Modifications

6562

Summary of Modification

Errata to reinsert and update text removed by mistake from the 2015 IECC

Rationale

ICC code change proposal RE173-13 partially changed “glazing area” to “vertical fenestration area” for the 2015 IECC.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code
No impact

Impact to building and property owners relative to cost of compliance with code
No impact

Impact to industry relative to the cost of compliance with code
No impact

Impact to small business relative to the cost of compliance with code
No impact

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public
Yes

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction
Yes

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities
Does not.

Does not degrade the effectiveness of the code
Does not.

Is the proposed code modification part of a prior code version?
YES

The provisions contained in the proposed amendment are addressed in the applicable international code?
OTHER

Explanation of Choice

Errata to reinsert and update text removed by mistake from the 2015 IECC.

This code change is also being proposed for the 2018 IECC.

Supporting RE173-13

The amendment demonstrates by evidence or data that the geographical jurisdiction of Florida exihibits a need to strengthen the foundation code beyond the needs or regional variation addressed by the foundation code and why the proposed amendment applies to the state?
YES

The proposed amendment was submitted or attempted to be included in the foundation codes to avoid resubmission to the Florida Building Code amendment process?
YES

Alternate Language

2nd Comment Period

6564-A2

Proponent Jeff Sonne / FSEC **Submitted** 6/21/2016 **Attachments** Yes

Rationale

The equation for "F" as provided in mod 6564 is the same as the equation for "F" in the current 2014 Florida Energy Code. FSEC has received numerous complaints from EnergyGauge software users that their "embedded" multifamily project (with significant common wall area) fails the code while the same multifamily project run as an end unit (with more exterior wall area) passes the code. The reason for this difference is how "F" is calculated. FSEC agrees with these users that embedded units are as a result unfairly penalized and recommends the mod A2 text change to address the issue.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

None.

Impact to building and property owners relative to cost of compliance with code

Will make code compliance less costly for a number of multifamily projects, especially for embedded units (with significant common wall area).

Impact to industry relative to the cost of compliance with code

Will make code compliance less costly for a number of multifamily projects, especially for embedded units (with significant common wall area).

Impact to Small Business relative to the cost of compliance with code

No impact

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Yes; removes an unfair penalty for projects with significant common wall area.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Yes; removes an unfair penalty for projects with significant common wall area.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate; removes an unfair penalty for projects with significant common wall area.

Does not degrade the effectiveness of the code

Does not degrade code effectiveness; removes unfair penalty.

Is the proposed code modification part of a prior code version? No

Revise Table R405.5.2 (1) as follows:

Step 1. Restore 2012 IECC footnote (b), in coordination with errata currently in process at ICC:

(Note: final footnote letter "#" is not yet available from ICC - must match

superscript reference in Table row dealing with Vertical Fenestration)

#. For residences with conditioned basements, R-2 and R-4 residences and townhouses,

the following formula shall be used to determine glazing area:

AF = A*s* × *FA* × *F*

where:

AF = Total glazing area.

As = Standard reference design total glazing area.

FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area

+ 0.5 × below-grade boundary wall area).

F = (Above-grade thermal boundary wall area)/(above-grade thermal boundary wall area

+ common wall area) or 0.56, whichever is greater.

and where:

Thermal boundary wall is any wall that separates conditioned space from

unconditioned space or ambient conditions.

Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.

Below-grade boundary wall is any thermal boundary wall in soil contact.

Common wall area is the area of walls shared with an adjoining dwelling unit.

Step 2. Modify the above restored footnote to coordinate with the rest of the code change that resulted in the removal of footnotes (a) and (b) for the 2015 IECC.

#. For residences with conditioned basements, R-2 and R-4 residences and townhouses,

the following formula shall be used to determine ~~glazing~~ fenestration area:

AF = A*s* × *FA* × *F*

where:

AF = Total ~~glazing~~ fenestration area.

As = Standard reference design total ~~glazing~~ fenestration area.

FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area

+ 0.5 × below-grade boundary wall area).

F = (Above-grade thermal boundary wall area)/(above-grade thermal boundary wall area

+ common wall area) or 0.56, whichever is greater.

and where:

Thermal boundary wall is any wall that separates conditioned space from

unconditioned space or ambient conditions.

Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.

Below-grade boundary wall is any thermal boundary wall in soil contact.

Common wall area is the area of walls shared with an adjoining dwelling unit.

[Starting with 6564 changes, only modify equation for "F" as follows:]

F = (Above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.80 ~~0.56~~, whichever is greater

RE173-13

Table R405.5.2(1) (IRC Table N1105.5.2(1))

Proponent: Dr. Thomas D. Culp, Birch Point Consulting LLC, representing the Glazing Industry Code Committee (culp@birchpointconsulting.com)

Revise as follows:

TABLE R405.5.2(1) (N1105.5.2(1))
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT
Opaque Doors
~~Glazing~~[a] Vertical Fenestration other than Opaque Doors
Skylights

(Portions of table not shown remain unchanged)

~~a. Glazing shall be defined as sunlight-transmitting fenestration, including the area of sash, curbing or other framing elements, that enclose conditioned space. Glazing includes the area of sunlight-transmitting fenestration assemblies in walls bounding conditioned basements. For doors where the sunlight-transmitting opening is less than 50 percent of the door area, the glazing area is the sunlight-transmitting opening area. For all other doors, the glazing area is the rough frame opening area for the door including the door and the frame.~~

Reason: This corrects the terminology in the performance path table to be consistent with the rest of the chapter. "Doors" can include both glazed and opaque doors, but the intent was clearly meant to be opaque doors, since it is referring to only the U-factor in Table R402.1.3. It is then unclear where to put glazed doors. This proposal clarifies the three fenestration rows as "opaque doors", "vertical fenestration other than opaque doors", and "skylights".

Cost Impact: This proposal will not increase the cost of construction.

Rationale:
ICC code change proposal **RE173-13** partially changed “glazing area” to “vertical fenestration area” for the 2015 IECC. The 2012 IECC definition of glazing only appeared in footnote (a) of the table, which was shown as deleted in the proposal. Footnote (b) was not marked for deletion, but it was discovered to be missing in the published code. The language in that footnote is still needed, and is restored in Step 1. (An errata to the 2015 IECC is currently in process.)

The changes in Step 2 are needed because in the 2015 IECC, a new definition of “fenestration” was approved under a different code change that separated the category into vertical fenestration and skylights. "Glazing" has therefore been purged as a defined synonym of fenestration in the 2015 IECC.

This code change is also being proposed for the 2018 IECC.

Supporting RE173-13

Date Submitted	12/21/2015	**Section**	406	**Proponent**	Jeff Sonne / FSEC
Chapter	4	**Affects HVHZ**	No	**Attachments**	No

TAC Recommendation Approved as Submitted
Commission Action Pending Review

Comments

General Comments **Yes** **Alternate Language** **No**

Related Modifications

6728

Summary of Modification

Energy Rating Index inconsistency correction and Standard

Rationale

There is an inconsistency in the base code. Section R406.3.1 of the base code requires that the proposed residential building be shown to have an annual total normalized modified load less than or equal to the annual total loads of the ERI reference design. This section in effect makes the ERI required to pass the code 100 or less, while Table R406.4 requires an ERI of 52 or less in Florida (Climate Zones 1 and 2). This proposed modification removes the confusing language such that the index level required is that given in Table R406.4.

Rationale for including the new ANSI/RESNET/ICC Standard is that it provides a consistent, uniform methodology for evaluating residential energy performance.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Helpful to local entity as it resolves a code inconsistency and provides a uniform energy rating methodology.

Impact to building and property owners relative to cost of compliance with code

No impact or lowers cost; resolves a code inconsistency and provides a uniform energy rating methodology.

Impact to industry relative to the cost of compliance with code

No impact or lowers cost; resolves a code inconsistency and provides a uniform energy rating methodology.

Impact to small business relative to the cost of compliance with code

No impact or lowers cost; resolves a code inconsistency and provides a uniform energy rating methodology.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Benefits the general public as it removes a code inconsistency and provides a uniform energy rating methodology.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Improves the code by removing a code inconsistency and providing a uniform energy rating methodology.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate; removes a code inconsistency and provides a uniform energy rating methodology.

Does not degrade the effectiveness of the code

Improves code effectiveness by removing a code inconsistency and providing a uniform energy rating methodology.

Is the proposed code modification part of a prior code version? No

2nd Comment Period

EN6727-G4

Proponent Diana Hanson **Submitted** 6/3/2016 **Attachments** No

Comment:

While AAMA supports integrated approaches to building design and performance, we have some concerns regarding renewable power generation replacing energy conservation measures as the ERI reference design values currently proposed; expressed as follows:

1. Baselines are not defined for the various building components which will degrade the overall performance of the envelope. No long-term studies have been developed which would confirm the impact that this might have on building structures.

2. Homeowner comfort can be compromised due to the potential degradation of individual building components, including but not limited to, fenestration, HVAC, and roofing systems. Considering the life cycle of residential buildings (50+ years), homeowners expect envelope efficiencies to be maintained long after site-generated energy systems are no longer in use.

3. AAMA is concerned about the indefinite time period proposed by Leading Builders of America (LBA) and Florida Home Builders Association (FHBA). Future code development is questionable due to a lack of defined time period.

4. AAMA requests that the TAC consider the Florida Solar Energy Center (FSEC) Option 7 proposal for R406.4 ERI-based compliance as an alternative to the proposal from LBA and FHBA. We believe that meets the intent of the ERI path of rating total building energy use of the referenced design while allowing some credits for on–site renewable power generation potential.

5. While we understand that the Commission is under mandate to update the 5th Edition, AAMA believes that the normal code update process for the 6th Edition should be followed to make sure all viewpoints are heard.

2nd Comment Period

EN6727-G5

Proponent Charles Cottrell **Submitted** 6/20/2016 **Attachments** Yes

Comment:

NAIMA's comment is attached in PDF format. It is the same general comment submitted to EN6933-G8.

2nd Comment Period

EN6727-G6

Proponent Eric Lacey **Submitted** 6/21/2016 **Attachments** No

Comment:

On June 7, 2016, the Energy TAC recommended that all proposals related to on-site renewable power generation trade-offs in the Energy Rating Index path be addressed in a Commission Work Group. We anticipate that proposals 6933 and 6727 will be addressed by this Work Group because both proposals will directly impact whether on-site renewable power generation will be permitted as a trade-off against energy conservation in the Energy Rating Index in the 6th Edition Code. RECA submits this public comment to keep these proposals alive until either the Work Group submits its recommendations to the TAC and Commission, or until the Commission addresses these issues in the normal course of its rulemaking.

1st Comment Period History

EN6727-G1

Proponent Jay Crandell **Submitted** 2/25/2016 **Attachments** No

Comment:

Proposal EN6727 should be disapproved because it references a standard (RESNET 301) which is conflicted in a significant way with the goals and intent of the existing ERI provisions, the performance path of the code, and also the equivalency mandate for alternative means and methods. For example, it will allow on-site electricity generation to be used to weaken long-term (permanent) energy conservation provided by the building envelope. On-site electricity generation should be (and is) used, but should not be promoted in the code at the expense of important and permanent energy conservation measures intended to work in concert with on-site electricity generation. And, it should be done in a way that does not create conflicts and inequities among the compliance paths within the code. For these reasons, EN6727 should be disapproved.

1st Comment Period History

EN6727-G2

Proponent Jeff Sonne / FSEC **Submitted** 2/25/2016 **Attachments** No

Comment:

In response to comment EN6727-G1, please see FSEC's alternate language comment 6933-A1 which limits on-site renewable power generation to meet the ERI (R406) code compliance option. We agree with the general goal of comment EN6727-G1. We don't want to reduce energy conservation measures; we believe FSEC's comment 6933-A1 will achieve the same level of conservation as the performance (R405) method while still allowing the option of on-site renewable power generation to go beyond the performance code compliance level to meet the stricter level of performance required for ERI.

1st Comment Period History

EN6727-G3

Proponent Eric Lacey **Submitted** 2/25/2016 **Attachments** Yes

Comment:

See attached comment.

R406.3 Energy Rating Index.

The Energy Rating Index (ERI) shall be a numerical integer value that is based on a linear scale constructed such that the *ERI reference design* has an Index value of 100 and a *residential building* that uses no net purchased energy has an Index value of 0. Each integer value on the scale shall represent a 1-percent change in the ~~total energy use~~ annual total normalized modified loads of the ~~rated design~~ *rated design* relative to the annual total ~~energy use~~ loads of the *ERI reference design.* The ERI shall consider all energy used in the *residential building.*

R406.3.1 ERI reference design.

The *ERI reference design* shall be configured such that it meets the minimum requirements of the 2006 *International Energy Conservation Code* prescriptive requirements.

~~The proposed *residential building* shall be shown to have an annual total normalized modified load less than or equal to the annual total loads of the *ERI reference design.*~~

R406.4 ERI-based compliance.

The ERI for the *rated design* shall be determined in accordance with ANSI/RESNET/ICC 301-2014, including Addendum A-2015, and ~~Compliance based on an ERI analysis requires that the *rated design* be~~ shown to have an ERI less than or equal to the appropriate value listed in Table R406.4 ~~when compared to the *ERI reference design*~~.

[No other changes to Section R406.]

Responsible Energy Codes Alliance Comment on Proposal EN6727

Proposal EN6727 should not be approved because it could fundamentally alter the nature of the 2015 IECC Energy Rating Index, and the potential impacts are not yet fully known. RESNET 301 is not referenced in the 2015 IECC, nor has it yet been fully vetted through the ICC process. Before adopting this code change and designating a single standard as the exclusive approach to calculate compliance under the ERI, a careful and detailed review and assessment of all of the provisions of the standard would need to be conducted. Without such a review by either the Commission or through the ICC process, it would be impossible to conclude that the standard is a reasonable substitute for the ERI. Our understanding is that RESNET 301 will be fully considered this year at ICC as part of the 2018 IECC/IRC update process, and we strongly recommend that the Commission not approve EN6727, but instead wait until the ICC process plays out before considering a proposal like this. This would avoid a premature adoption of the standard and an unnecessary waste of resources to evaluate it.

Further, by replacing the established ERI calculation process as reflected in the language of the code with a reference to an external standard (which is maintained and controlled by a body outside of the Florida Building Commission's control), this proposal would transfer an unnecessary and/or undesirable amount of authority over an entire code compliance path to a single outside non-governmental entity. As the RESNET standard is amended or updated in the future, there is a real risk that new issues outside the current scope of the IECC and/or the Florida Building Code could be incorporated into that standard.

In fact, there is already considerable concern that referencing RESNET 301 could incorporate provisions of the standard that are not allowed under the IECC's ERI. A good example is the fact that unlimited on-site electricity generation is permitted under RESNET 301, but such generation is not currently incorporated at all into the ERI rating. In order to address this concern, if RESNET 301 were adopted, we believe that this issue should be addressed explicitly by the Commission and that the Commission should specifically clarify that on-site generation is not allowed to be considered in the ERI.

Comments to Proposals for the 6th Edition (2017) Florida Building Code, energy Conservation
By the North American Insulation Manufacturers Association
June 17, 2016

The North American Insulation Manufacturers Association (NAIMA) is the trade association for North American manufacturers of fiber glass and mineral wool insulation. NAIMA member companies operate 38 manufacturing facilities in 18 states, collectively employing 225,000 people. Three NAIMA member companies – CertainTeed, Johns Manville and Owens Corning – operate facilities in Florida.

At its June 8th meeting, the Florida Building Commission deferred making a determination on whether to permit and/or limit the use of on-site generation for compliance using the Energy Rating Index (ERI) option in the 6th Edition of the Florida Building Code, and instead announced the formation of a working group to study this issue and make recommendations. NAIMA supports this procedural step as a precursor to final Commission action on the topic. While it is our expectation that proposals 6727 and 6933 will be considered by the Working Group, NAIMA submits the following comments to keep these proposals open.

Comments on Proposed Modifications

Mod# 6933 – Clarifying that No On-Site Power Production Should be Included in ERI Calculation / Mod #6727 – Energy Rating Index

NAIMA supports Mod #6933 clarifying that the Energy Rating index does not include on-site power production. NAIMA also opposes, in the absence of an explicit prohibition or limitation on the eligibility of on-site power generation, Mod #6727 adopting the RESNET 301 standard for the ERI compliance calculations.

The 2015 International Energy Conservation Code under consideration by the Florida Building Commission contains several options for compliance, including the new ERI option. While NAIMA does not oppose the adoption of the ERI option as published in the 2015 IECC, we are concerned that the methods and computer software used by RESNET 301 to calculate the ERI will be misapplied, creating substantial credit for the installation of on-site renewable energy generation, including rooftop solar systems. If applied this way, the software could enable homes using on-site renewable generation to be much less energy efficient and still comply with the energy conservation code.

Trading away efficiency improvements for on-site power generation raises the cost of home ownership by substantially increasing utility bills. It can also create home comfort and moisture problems and require larger HVAC systems. Using on-site energy production instead of first

building a home with up-to-date energy efficiency measures means a lifetime of home under-performance – 75 years or longer.

The energy conservation requirements of the Florida' Building Code are intended to promote energy conservation in buildings, and should not relax the efficiency requirements for buildings that simply produce more energy. Allowing on-site power production as a trade off against cost effective energy efficiency measures will have the practical effect of relaxing Florida's Building Energy Code. This should not be a policy outcome of the 6th Edition of the Florida Building Code.

Date Submitted	12/22/2015	**Section**	403.2.2	**Proponent**	Jeff Sonne / FSEC
Chapter	4	**Affects HVHZ**	No	**Attachments**	No

TAC Recommendation Approved as Submitted
Commission Action Pending Review

Comments

General Comments No **Alternate Language** Yes

Related Modifications

6765

Summary of Modification

New ANSI duct testing Standard.

Rationale

This change provides the new American National Standard that did not exist for reference during the last Florida Code cycle or for reference during the 2015 IECC cycle.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

None; this new American National Standard is appropriate for code use, but does not change duct testing requirements.

Impact to building and property owners relative to cost of compliance with code

None; this new American National Standard is appropriate for code use, but does not change duct testing requirements.

Impact to industry relative to the cost of compliance with code

None; this new American National Standard is appropriate for code use, but does not change duct testing requirements.

Impact to small business relative to the cost of compliance with code

None; this new American National Standard is appropriate for code use, but does not change duct testing requirements.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Yes; this new American National Standard is appropriate for code use, but does not change duct testing requirements.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Improves the code; this new American National Standard is appropriate for code use, but does not change duct testing requirements.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

No; replaces existing Standard with a new American National Standard, but does not change duct testing requirements.

Does not degrade the effectiveness of the code

Does not degrade the code; this new American National Standard is appropriate for code use, but does not change duct testing requirements.

Is the proposed code modification part of a prior code version? No

2nd Comment Period

6764-A1

Proponent Jeff Sonne / FSEC **Submitted** 6/20/2016 **Attachments** Yes

Rationale

Original mod had incorrect year for ANSI/RESNET/ICC 380 Standard-- this A-1 mod removes the incorrect year (2015) and replaces it with the correct year (2016). No other changes made to the mod.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

None; only corrects year of Standard.

Impact to building and property owners relative to cost of compliance with code

None; only corrects year of Standard.

Impact to industry relative to the cost of compliance with code

None; only corrects year of Standard.

Impact to Small Business relative to the cost of compliance with code

None; this new American National Standard is appropriate for code use, but does not change duct testing requirements.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Only corrects year of Standard.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Only corrects year of Standard.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

No; only corrects year of Standard.

Does not degrade the effectiveness of the code

No; only corrects year of Standard.

Is the proposed code modification part of a prior code version? No

R403.2.2 Sealing (Mandatory). All ducts, air handlers, and filter boxes and building cavities that form the primary air containment passageways for air distribution systems shall be considered ducts or plenum chambers, shall be constructed and sealed in accordance with Section C403.2.7.2 of the Commercial Provisions of this code and shall be shown to meet duct tightness criteria below.

Duct tightness shall be verified by testing ~~to Section 803 of the RESNET Standards~~ in accordance with ANSI/RESNET/ICC 380-2015by either an energy rater certified in accordance with Section 553.99, *Florida Statutes*,or as authorized by *Florida Statutes,* to be "substantially leak free" in accordance with Section R403.3.3.

[A-1 mod only corrects Standard year from 2015 to 2016; no other changes to original mod.]

R403.2.2 Sealing (Mandatory). All ducts, air handlers, and filter boxes and building cavities that form the primary air containment passageways for air distribution systems shall be considered ducts or plenum chambers, shall be constructed and sealed in accordance with Section C403.2.7.2 of the Commercial Provisions of this code and shall be shown to meet duct tightness criteria below.

Duct tightness shall be verified by testing ~~to Section 803 of the RESNET Standards~~ in accordance with ANSI/RESNET/ICC 380-2016~~5~~ by either an energy rater certified in accordance with Section 553.99, *Florida Statutes*, or as authorized by *Florida Statutes,* to be "substantially leak free" in accordance with Section R403.3.3.

Date Submitted	12/22/2015	**Section**	405.5	**Proponent**	Jeff Sonne / FSEC
Chapter	4	**Affects HVHZ**	No	**Attachments**	No

TAC Recommendation Approved as Submitted
Commission Action Pending Review

Comments

General Comments No **Alternate Language** Yes

Related Modifications

6764

Summary of Modification

New ANSI duct testing Standard.

Rationale

This change provides the new American National Standard that did not exist for reference during the last Florida Code cycle or for reference during the 2015 IECC cycle.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

None; this new American National Standard is appropriate for code use, but does not change duct testing requirements.

Impact to building and property owners relative to cost of compliance with code

None; this new American National Standard is appropriate for code use, but does not change duct testing requirements.

Impact to industry relative to the cost of compliance with code

None; this new American National Standard is appropriate for code use, but does not change duct testing requirements.

Impact to small business relative to the cost of compliance with code

None; this new American National Standard is appropriate for code use, but does not change duct testing requirements.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Yes; this new American National Standard is appropriate for code use, but does not change duct testing requirements.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Improves the code; this new American National Standard is appropriate for code use, but does not change duct testing requirements.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

No; replaces existing Standard with a new American National Standard, but does not change duct testing requirements.

Does not degrade the effectiveness of the code

Does not degrade the code; this new American National Standard is appropriate for code use, but does not change duct testing requirements.

Is the proposed code modification part of a prior code version? No

2nd Comment Period

6765-A1

Proponent Jeff Sonne / FSEC **Submitted** 6/20/2016 **Attachments** Yes

Rationale

Original mod had incorrect year for ANSI/RESNET/ICC 380 Standard-- this A-1 mod removes the incorrect year (2015) and replaces it with the correct year (2016). No other changes made to the mod.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

None-- only corrects Standard year.

Impact to building and property owners relative to cost of compliance with code

None-- only corrects Standard year.

Impact to industry relative to the cost of compliance with code

None-- only corrects Standard year.

Impact to Small Business relative to the cost of compliance with code

None; this new American National Standard is appropriate for code use, but does not change duct testing requirements.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Only corrects Standard year.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Only corrects Standard year.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

No; only corrects Standard year.

Does not degrade the effectiveness of the code

No; only corrects Standard year.

Is the proposed code modification part of a prior code version? No

TABLE R405.5.2(1)— SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS. [Starting from Florida Supplement document, modify as follows:]

TABLE R405.5.2(1)

SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermal distribution systems	Distribution System Efficiency: 0.88	Thermal distribution system efficiency shall be as tested in accordance with ~~Section 803 of RESNET Standards~~ ANSI/RESNET/ICC 380-2015 or as specified in Table R405.5.2(2) if not tested.
	Duct location: entirely within the building thermal envelope	As proposed ……. As proposed… …..
	Air Handler location: entirely within the building thermal envelope	As proposed
	Duct insulation: R-6	

[No other changes to table.]

[A-1 mod only changes Standard year from 2015 to 2016; no other changes to original mod.]

TABLE R405.5.2(1)

SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermal distribution systems	Distribution System Efficiency: 0.88	Thermal distribution system efficiency shall be as tested in accordance with ~~Section 803 of RESNET Standards~~ ANSI/RESNET/ICC 380-2016~~5~~ or as specified in Table R405.5.2(2) if not tested.
	Duct location: entirely within the building thermal envelope	As proposed ……. As proposed… …..
	Air Handler location: entirely within the building thermal envelope	As proposed
	Duct insulation: R-6	

TAC: Energy

Total Mods for **Energy** in **No Affirmative Recommendation with a Second: 13**

Total Mods for report: 18

Sub Code: Energy Conservation

EN6925 6

Date Submitted	12/30/2015	**Section**	402.4	**Proponent**	Eric Lacey
Chapter	4	**Affects HVHZ**	No	**Attachments**	Yes
TAC Recommendation	No Affirmative Recommendation with a Second				
Commission Action	Pending Review				

Comments

General Comments **No** **Alternate Language** **Yes**

Related Modifications

Summary of Modification

This proposal maintains the commercial fenestration SHGC requirement that currently applies under the 5th Edition Code.

Rationale

See attached Reason Statement.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

This proposal prevents an efficiency rollback and simplifies enforcement of the code.

Impact to building and property owners relative to cost of compliance with code

This proposal prevents an efficiency rollback and simplifies compliance with the code.

Impact to industry relative to the cost of compliance with code

This proposal prevents an efficiency rollback and simplifies compliance with the code.

Impact to small business relative to the cost of compliance with code

This proposal prevents an efficiency rollback and simplifies compliance with the code.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

This proposal supports the health, safety, and welfare of the general public by maintaining reasonable energy efficiency standards and simplifying the code.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

This proposal improves the code by simplifying compliance and enforcement and maintains the current fenestration SHGC requirement.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

This proposal does not discriminate against any product.

Does not degrade the effectiveness of the code

This proposal improves the effectiveness of the code.

Is the proposed code modification part of a prior code version? No

Alternate Language

2nd Comment Period

6925-A1

Proponent Eric Lacey **Submitted** 6/21/2016 **Attachments** Yes

Rationale

At the first Energy TAC meeting, some concern was expressed over the elimination of the SHGC-projection factor trade-off in the commercial chapter brought about by proposal 6925. The purpose of this public comment is to maintain the current stringency of the 5th Edition Florida Building Code, Energy Conservation, as it pertains to fenestration SHGC, but also to maintain the current trade-off option as published in the 5th Edition Code. The result of this public comment will be to maintain exactly the same fenestration SHGC and trade-off ability permitted in the 5th Edition Code, or “business as usual” on commercial fenestration SHGC. Without this proposal, the 6th Edition Energy Code would be less efficient than the 5th Edition, since it would allow higher SHGCs than what the current code allows, even where there is no overhang at all. There is no Florida-specific reason why fenestration SHGC should be less efficient going forward – in fact, SHGC has a substantial impact on overall energy efficiency in Florida, particularly in commercial buildings. This proposal will maintain the simplicity and efficiency of the 5th Edition Energy Code by carrying forward identical fenestration SHGC requirements into the 6th Edition.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

This proposal will facilitate enforcement because it carries forward identical SHGC requirements from the 5th Edition to the 6th Edition Code.

Impact to building and property owners relative to cost of compliance with code

Low SHGC fenestration will benefit building and property owners by keeping electricity costs low.

Impact to industry relative to the cost of compliance with code

There should be no impact on industry, since this proposal carries forward the current requirement for SHGC.

Impact to Small Business relative to the cost of compliance with code

This proposal prevents an efficiency rollback and simplifies compliance with the code.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Low-SHGC fenestration is critical to reducing electricity use and the need for electric peak generation. It will also keep occupants more comfortable.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

This proposal maintains the stringency of the code, whereas the 2015 IECC language would result in a less-efficient requirement.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

No.

Does not degrade the effectiveness of the code

No.

Is the proposed code modification part of a prior code version? No

1st Comment Period History

EN6925-G1

Proponent Roger LeBrun **Submitted** 1/12/2016 **Attachments** No

Comment:

Reassign this to the Energy TAC. Also, look for other mislocated energy code change proposals.

1st Comment Period History

EN6925-G2

Proponent Muthusamy Swami **Submitted** 2/25/2016 **Attachments** No

Comment:

Obviously, IECC and ASHRAE have seen reasons to slightly roll back these numbers.
The proposers have not presented any analytical justification challenging the reasons ASHRAE & IECC undertook these rollbacks.
TAC need to examine this closely to determine if deviation from the base code is warranted.

Revise Table C402.4 and section C402.4.3 as follows:

Table C402.4

BUILDING ENVELOPE FENESTRATION MAXIMUM U-FACTOR AND SHGC REQUIREMENTS

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration								
***U*-factor**								
Fixed fenestration	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29
Operable fenestration	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37
Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77
SHGC								
~~Orientation~~[a]	~~SEW~~	~~N~~	~~SEW~~	~~N~~	~~SEW~~	~~N~~	~~SEW~~	~~N~~	~~SEW~~	~~N~~	~~SEW~~	~~N~~	~~SEW~~	~~N~~	~~SEW~~	~~N~~
All Vertical Fenestration ~~PF~~	0.25	~~0.33~~	0.25	~~0.33~~	0.25	~~0.33~~	0.40	~~0.53~~	0.40	~~0.53~~	0.40	~~0.53~~	0.45	~~NR~~	0.45	~~NR~~
~~0.2 = PF~~	~~0.30~~	~~0.37~~	~~0.30~~	~~0.37~~	~~0.30~~	~~0.37~~	~~0.48~~	~~0.58~~	~~0.48~~	~~0.58~~	~~0.48~~	~~0.58~~	~~NR~~	~~NR~~	~~NR~~	~~NR~~
~~PF = 0.5~~	~~0.40~~	~~0.40~~	~~0.40~~	~~0.40~~	~~0.40~~	~~0.40~~	~~0.64~~	~~0.64~~	~~0.64~~	~~0.64~~	~~0.64~~	~~0.64~~	~~NR~~	~~NR~~	~~NR~~	~~NR~~
Skylights								
U-factor	0.75		0.65		0.55	0.50		0.50		0.50		0.50		0.50	
SHGC	0.35		0.35		0.35	0.40		0.40		0.40		NR		NR	

C402.4.3 Maximum U-factor and SHGC. The maximum *U*-factor and solar heat gain coefficient (SHGC) for fenestration shall be as specified in Table C402.4.

~~The window projection factor shall be determined in accordance with Equation 4-5.~~

~~*PF = A/B*~~	~~**(Equation 4-5)**~~

~~where:~~

~~*PF*~~	=	~~Projection factor (decimal).~~
~~*A*~~	=	~~Distance measured horizontally from the furthest continuous extremity of any overhang, eave or permanently attached shading device to the vertical surface of the glazing.~~
~~*B*~~	=	~~Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave or permanently attached shading device.~~

EN6925 - A1 - Eric Lacey

Text of Modification

Revise Table C402.4 and section C402.4.3 as follows:

Table C402.4
BUILDING ENVELOPE FENESTRATION MAXIMUM *U*-FACTOR AND SHGC REQUIREMENTS

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration *U*-factor								
Fixed fenestration	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29
Operable fenestration	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37
Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77
SHGC								
All Vertical Fenestration	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
Skylights								
U-factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

C402.4.3 Maximum U-factor and SHGC. The maximum *U*-factor and solar heat gain coefficient (SHGC) for fenestration shall be as specified in Table C402.4.

The window projection factor shall be determined in accordance with Equation 4-5.

$PF = A/B$		**(Equation 4-5)**

where:

PF	=	Projection factor (decimal).
A	=	Distance measured horizontally from the furthest continuous extremity of any overhang, eave or permanently attached shading device to the vertical surface of the glazing.
B	=	Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave or permanently attached shading device.

Where different windows or glass doors have different *PF* values, they shall each be evaluated separately.

C402.4.3.1 SHGC adjustment. Where the fenestration projection factor for a specific vertical fenestration product is greater than or equal to 0.2, the required maximum SHGC from Table C402.4 shall be adjusted by multiplying the required maximum SHGC by the multiplier specified in Table C402.4.3.1 corresponding with the orientation of the fenestration product and the projection factor.

TABLE C402.4.3.1
SHGC ADJUSTMENT MULTIPLIERS

PROJECTION FACTOR	ORIENTED WITHIN 45 DEGREES OF TRUE NORTH	ALL OTHER ORIENTATION
0.2 = PF < 0.5	1.1	1.2
PF = 0.5	1.2	1.6

~~Where different windows or glass doors have different *PF* values, they shall each be evaluated separately.~~

Reason Statement for Proposal to Maintain Current Fenestration SHGC Requirement and Avoid Rollbacks

The 2015 IECC requirements for SHGC are less stringent than those in the 2012 IECC or in ASHRAE 90.1-2013. The purpose of this proposal is to restore the simpler and more stringent SHGC values from the 2012 IECC (and ASHRAE 90.1-2013 – see Tables 5.5-1 through 5.5-8). Allowing higher fenestration SHGC for commercial buildings would decrease efficiency (and raise energy costs) for building owners and occupants, contribute to peak electric demand problems in Florida, and reduce comfort for building occupants. We see no value in permitting higher fenestration SHGC in Florida's climate zones in the 6th Edition code than would be allowed under the 5th edition code. To the extent that builders or design professionals incorporate permanent projections into building designs, proper credit for these projections can be taken via the performance path (Section C407) or in ASHRAE 90.1-2013, where the projections and the impact on energy use can be more accurately and consistently calculated.

This proposal will maintain the efficiency of the 5th Edition code and remove the potential for confusion in the application of this trade-off.

Date Submitted	12/31/2015	**Section**	403.2.3	**Proponent**	Jeff Sonne / FSEC
Chapter	4	**Affects HVHZ**	No	**Attachments**	No

TAC Recommendation No Affirmative Recommendation with a Second
Commission Action Pending Review

Comments

General Comments Yes **Alternate Language** No

Related Modifications

6983

Summary of Modification

Make sure code is consistent with federal heating and cooling equipment efficiency minimums.

Rationale

At times there is a conflict between the written code and the federal standards. This clarifies that the federal law/standards take precedence.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Consistent with federal law.

Impact to building and property owners relative to cost of compliance with code

None.

Impact to industry relative to the cost of compliance with code

None.

Impact to small business relative to the cost of compliance with code

None.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Yes, as the federal law limits have been vetted by government, manufacturers and energy advocates to be the best efficiency for any extra cost.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Yes; clarifies the code.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate.

Does not degrade the effectiveness of the code

Does not degrade the code; makes it clearer on what to do in case of conflict.

Is the proposed code modification part of a prior code version? No

2nd Comment Period

EN7021-G1

Proponent Jeff Sonne / FSEC **Submitted** 6/20/2016 **Attachments** No

Comment:

When the NAECA Standards for equipment change, lower efficiency equipment is no longer manufactured. Therefore federal law is effectively preemptive.

C403.2.3 HVAC equipment performance requirements

Equipment shall meet the minimum efficiency requirements ~~of~~ specified in federal law or in their absence those specified in Tables C403.2.3(1), C403.2.3(2), C493.2.3(3), C493.2.3(4), C403.2.3(5), C403.2.3(6), C403.2.3(7), C403.2.3(8) and C403.2.3(9) when tested and rated in accordance with the applicable test procedure. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of Table C403.2.3(10). The efficiency shall be verified through certification under an approved certification program or, where a certification program does not exist, the equipment efficiency ratings shall be supported by data furnished by manufacturer. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements. Where components, such as indoor or outdoor coils, from different manufacturers are used, calculations and supporting data shall be furnished by the designer that demonstrates that the combined efficiency of the specified components meets the requirements herein.

[No other changes to section.]

Date Submitted	12/27/2015	**Section**	402.4	**Proponent**	Joseph Belcher
Chapter	4	**Affects HVHZ**	Yes	**Attachments**	No

TAC Recommendation No Affirmative Recommendation with a Second

Commission Action Pending Review

Comments

General Comments Yes

Alternate Language No

Related Modifications

Summary of Modification

Permit air leakage testing of low-rise R-2 as permitted for commercial.

Rationale

Current provisions for multi-family dwelling classified as low-rise residential require the testing of each unit separately. This amendment adds an exception to allow compliance to the air barrier requirements and testing as for commercial residential buildings allowing builders to test the entire building as a whole, as is permitted for commercial buildings.

Air tightness testing for single-family detached homes is very straightforward; however, it is much more difficult to accurately test attached dwelling units, including multi-family buildings. Currently the FBC-EC treats low-rise multi-family buildings of three stories or less like single-family homes and multi-family buildings of four stories or more like commercial buildings. Regardless of height, all multi-family buildings have the same air-tightness testing complications, such as: Does the entire building need to be tested at one time? What about multi-family buildings with open corridors? Does every dwelling need to be tested? Can the leakages be averaged between units? Is the leakage tested only to the “outside” or should it include leakage to adjacent units?

By approving this change, low-rise multi-family buildings and attached single-family dwellings will avoid these complications, but still held to the same level of performance as high-rise (R-2) residential as well as all commercial buildings.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

No impact to local entity relative to code enforcement.

Impact to building and property owners relative to cost of compliance with code

No impact to building and property owners relative to code enforcement.

Impact to industry relative to the cost of compliance with code

The impact to industry relative to the cost of code compliance is most likely a reduction in costs as the builder could schedule testing of the entire building at once or test the units individually.

Impact to small business relative to the cost of compliance with code

No impact to small business.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Yes because it offers an option for the testing of buildings containing multiple dwellings as a single building and retains the ability to test units individually. This provides an option to the builder that could result in decreased costs while ensuring compliance with the code.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

The proposal strengthens and improves the code by providing a solution to a difficult problem.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

The proposal does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not degrade the effectiveness of the code

The proposal increases the effectiveness of the code.

Is the proposed code modification part of a prior code version? No

Alternate Language

1st Comment Period History

6806-A1

Proponent Mike Moore **Submitted** 2/22/2016 **Attachments** Yes

Rationale

The objective of EN6806 is to provide more options for air tightness testing of multiple attached dwelling units. If approved, however, EN6806 would inadvertently remove the requirement for mechanical ventilation of tight dwelling units, which is currently contingent on the results of a blower door test at or below 5 air changes per hour at 50 pascals. This comment would insure that if Florida approves EN6806, mechanical ventilation would still be required for all dwelling units in compliance with the air tightness requirements of Florida's IECC, regardless of the testing method that is used. Please refer to the rationale submitted for my proposed amendment to EN6573 for further information regarding combined ventilation/infiltration rates and health affects.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

As proposed, EN6806 may increase the local entity's burden by referencing a section of code that does not exist (i.e., C405.5.3.4 ??). Assuming this is corrected, increasing testing options can increase compliance, thereby reducing the local entity's costs of re-verification/inspection.

Impact to building and property owners relative to cost of compliance with code

By increasing compliance options, costs to industry may be reduced. These cost savings may be passed on to the building and property owners.

Impact to industry relative to the cost of compliance with code

Increases compliance options and likely promotes cost competitiveness.

Impact to Small Business relative to the cost of compliance with code

No impact to small business.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

The proposed changes to EN6806 are intended to safeguard public health, safety, and welfare by maintaining the requirement for mechanical ventilation currently in the model code.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

The proposed changes to EN6806 maintain the IAQ benefits of the model code while increasing options for compliance in verifying building air tightness.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

The proposed changes to EN6806 maintain current options for ventilation systems that can be used to provide minimum acceptable indoor air quality.

Does not degrade the effectiveness of the code

The proposed changes to EN6806 maintain the IAQ benefits of the model code while increasing options for compliance in verifying building air tightness.

Is the proposed code modification part of a prior code version? No

2nd Comment Period

EN6806-G2

Proponent Joseph Belcher **Submitted** 6/20/2016 **Attachments** No

Comment:

EN6806 FHBA requests the Energy TAC recommend approval of the modification as submitted.

RATIONALE: The reason given by the TAC as shown on the tracking chart for the Mod is that the provision is "not enforceable. ASHREA standards require tests for zones in AC units". The requested Mod simply applies provisions permitted for a four story or greater residential occupancy to three story or less multi-family occupancies. If the provision is in fact "unenforceable, how is Section C402.5 enforced for commercial buildings (which include R-2 more than three stories)? The statement that "ASHRAE standards require test for zones in AC units" as a reason to vote the request down is nonsensical. The Section of the base code referred to, Section 402.5, is a mandatory section on air leakage and makes no reference to ASHRAE standards. If the building was designed under ASHRAE standards, the provisions of ASHRAE would apply. If the building is designed using the FBC-EC, the provisions of the FBC-EC apply. It simply makes no sense to say a method suitable for a four story R-2 occupancy would not be acceptable for a three story R-2 occupancy, or a R-3 attached multi-family project such as townhouses.

Regarding the Public Comment by FSEC on the original proposal, there is a misunderstanding; the Section cited in the original proposal was correct. The intention of the change is to allow R-2 occupancies of less than four stories in height to comply with the provisions applicable to R-2 occupancies of four stories in height or greater.

1st Comment Period History

EN6806-G1

Proponent Jeff Sonne / FSEC **Submitted** 2/25/2016 **Attachments** No

Comment:

[This comment assumes the proposer intended to reference IECC 2015 / FL base energy code section C402.5 instead of what was actually in the mod's text: "FBC-EC Section C405.5.3.4".] Testing an entire multifamily residential building as a whole would not be able to address between unit pollution. For this reason, we are against this mod.

Note ASHRAE Standard 62.2 addresses "compartmentalization" as follows:

8.4.1 Transfer Air. Measures shall be taken to minimize air movement across envelope components separating dwelling units, including sealing penetrations in the common walls, ceilings, and floors of each unit and by sealing vertical chases adjacent to the units. All doors between dwelling units and common hallways shall be gasketed or made substantially airtight.

8.4.1.1 Compliance. One method of demonstrating compliance with Section 8.4.1 shall be to verify a leakage rate below a maximum of 0.2 cfm per ft2 (100 L/s per 100 m2) of the dwelling unit envelope area (i.e., the sum of the area of walls between dwelling units, exterior walls, ceiling, and floor) at a test pressure of 50 Pa by a blower door test conducted in accordance with either ANSI/ASTM-E779, Standard Test Method for Determining Air Leakage Rate By Fan Pressurization,1 or ANSI/ASTM-E1827, Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door. The test shall be conducted with the dwelling unit as if it were exposed to outdoor air on all sides, top, and bottom by opening doors and windows of adjacent dwelling units.

R402.4 Air leakage (Mandatory). The building thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Section R402.4.1 through R402.4.4.

Exception: Dwelling units of R-2 Occupancies and multiple attached single family dwellings shall be permitted to comply with FBC-EC Section C405.5.3.4

Change the IECC as follows:

R402.4 Air Leakage (Mandatory). The building thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Section R402.4.1 through R402.4.4.

Exception: Dwelling units of R-2 occupancies and multiple attached single family dwellings shall be permitted to comply with FBC-EC Section C405.5.3.4.

R403.6 Mechanical ventilation (Mandatory). The building shall be provided with mechanical ventilation that meets the requirements of Section M1507 of the *International Residential Code* or Section 403 of the *International Mechanical Code*, as applicable, or with other approved means of mechanical ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

Change the IRC as follows:

R303.4 Mechanical ventilation. ~~Where the air infiltration rate of a *dwelling unit* is 5 seven air changes per hour or less where tested with a blower door at a pressure of 0.2 inch w.c (50 Pa) in accordance with Section N1102.4.1.2, the *d*~~*D*~~*welling units*~~ shall be provided with ~~whole-house~~ mechanical ventilation in accordance with Section M1507.3.

Change the IMC as follows:

401.2 Ventilation required. Every occupied space shall be ventilated by natural means in accordance with Section 402 or by mechanical means in accordance with Section 403. ~~Where the air infiltration rate in a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2 inch water column (50 Pa) in accordance with Section R402.4.1.2 of the *International Energy Conservation Code*, the d~~Dwelling units shall be ventilated by mechanical means in accordance with Section 403. Ambulatory care facilities and Group I-2 occupancies shall be ventilated by mechanical means in accordance with Section 407.

Date Submitted	12/30/2015	**Section**	405.5	**Proponent**	Jeff Sonne / FSEC
Chapter	4	**Affects HVHZ**	No	**Attachments**	Yes

TAC Recommendation No Affirmative Recommendation with a Second

Commission Action Pending Review

Comments

General Comments Yes

Alternate Language No

Related Modifications

Summary of Modification

Modify Table R405.5.2(1) proposed design, non-tested air exchange rate.

Rationale

This change is designed to cover the possibility that the legislature or FBC will allow homes to not be tested for air leakage. In that event a default air leakage needs to be applied. This mod suggests 7 ach50 to cover this hole in the performance code for untested residences.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

None; makes code clearer.

Impact to building and property owners relative to cost of compliance with code

None; makes code clearer.

Impact to industry relative to the cost of compliance with code

None; makes code clearer.

Impact to small business relative to the cost of compliance with code

None; makes code clearer.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Yes; by clarifying the code.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Improves the code by clarifying it.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate.

Does not degrade the effectiveness of the code

Does not degrade the code; makes code clearer.

Is the proposed code modification part of a prior code version?

YES

The provisions contained in the proposed amendment are addressed in the applicable international code?

OTHER

Explanation of Choice

[No] as the international code requires testing of all homes.

The amendment demonstrates by evidence or data that the geographical jurisdiction of Florida exihibits a need to strengthen the foundation code beyond the needs or regional variation addressed by the foundation code and why the proposed amendment applies to the state?

OTHER

Explanation of Choice

This is needed if the Florida legislature enacts bills that limit the ability of the FBC to call for testing. If no legislature or other code changes relative to testing residences is enacted, this proposed change will not affect anything.

The proposed amendment was submitted or attempted to be included in the foundation codes to avoid resubmission to the Florida Building Code amendment process?

NO

2nd Comment Period

EN6920-G1

Proponent Joseph Belcher **Submitted** 6/21/2016 **Attachments** No

Comment:

FHBA requests the Energy TAC recommend approval of the modification as submitted

RATIONALE: The reason shown for the negative vote on the Tracking Chart indicates there may have been confusion on the vote. The Mod referenced in the Tracking Chart reason “NAR- basis of previous vote and to correlate language with mod 6765.” does not make sense because Mod 6756 deals with an ANSI duct testing standard. There is no indication what “previous vote” is being referenced. Mod 6920 deals with changing the air leakage rate for residences that are not tested from 5 ACH50 to 7 ACH50 for the proposed design as approved elsewhere in the code and as specified by Florida Statute.

[See support file for mod text.]

Code Mod Proposal 6920 Text

TABLE R405.5.2(1)— SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS. [modify as follows:]

Air exchange rate	Air leakage rate of 5 air changes per hour in climate zones 1 and 2, and 3 air changes per hour in climate zones 3 through 8 at a pressure of 0.2 inches w.g. (50 Pa). The mechanical ventilation rate shall be in addition to the air leakage rate and the same as in the proposed design, but no greater than 0.01 x *CFA* + 7.5 x *(Nbr* + 1) where: *CFA* = conditioned floor area *Nbr* = number of bedrooms Energy recovery shall not be assumed for mechanical ventilation.	For residences that are not tested, ~~the same air leakage rate as the standard reference design~~ air leakage rate of 7 air changes per hour at a pressure of 0.2 inches w.g. (50 Pa). For tested residences, the measured air exchange rate[a]. The mechanical ventilation rate[b] shall be in addition to the air leakage rate and shall be as proposed.

[No other changes to table.]

Date Submitted	12/30/2015	**Section**	406.3	**Proponent**	Eric Lacey
Chapter	4	**Affects HVHZ**	No	**Attachments**	Yes

TAC Recommendation No Affirmative Recommendation with a Second

Commission Action Pending Review

Comments

General Comments Yes

Alternate Language No

Related Modifications

Summary of Modification

Clarifies that on-site power production does not factor into the calculation of the Energy Rating Index.

Rationale

See attached Reason Statement.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

This will improve enforcement by clarifying the scope of the Energy Rating Index.

Impact to building and property owners relative to cost of compliance with code

This proposal will not impact building and property owners relative to cost of compliance.

Impact to industry relative to the cost of compliance with code

This proposal will not impact industry relative to cost of compliance.

Impact to small business relative to the cost of compliance with code

This proposal will not impact small business relative to the cost of compliance.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

This proposal will add clarity to the energy code, which is part of a comprehensive set of building codes dedicated to the health, safety, and welfare of the general public.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

This proposal improves the energy code by clarifying the calculation of the Energy Rating Index.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

This proposal does not discriminate against any products.

Does not degrade the effectiveness of the code

This proposal improves the effectiveness of the code by adding clarity to the ERI calculation.

Is the proposed code modification part of a prior code version? No

Alternate Language

1st Comment Period History

6933-A1

Proponent Jeff Sonne / FSEC **Submitted** 2/25/2016 **Attachments** Yes

Rationale

Requires the ERI to be met primarily through energy efficiency and conservation measures, not through on-site power generation with renewables. This assures an efficient house. The mod only allows on site renewable power generation to meet a small portion of the target. Clarifies how to handle ERI method that includes on-site renewable power generation.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Would require the local official to verify that the code submittal shows the ERI achieved without on-site renewable generation for those homes that have on-site renewable power generation.

Impact to building and property owners relative to cost of compliance with code

Clarifies code and allows options for building owners to use some renewables.

Impact to industry relative to the cost of compliance with code

Optional, so no impact unless on-site renewables are used.

Impact to Small Business relative to the cost of compliance with code

This proposal will not impact small business relative to the cost of compliance.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Yes; encourages renewables in Florida and provides options while maintaining code effectiveness.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Improves the code by providing options while maintaining code effectiveness.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate; provides additional options.

Does not degrade the effectiveness of the code

Does not degrade the effectiveness of the code; encourages renewables in Florida and provides options while maintaining code effectiveness.

Is the proposed code modification part of a prior code version? No

2nd Comment Period

EN6933-G8

Proponent Charles Cottrell **Submitted** 6/20/2016 **Attachments** Yes

Comment:

See attached PDF for NAIMA comments on EN6933-G8

2nd Comment Period

EN6933-G9

Proponent Jeff Sonne / FSEC **Submitted** 6/20/2016 **Attachments** No

Comment:

We anticipate that since an ERI on-site renewables Working Group has been formed, all previously submitted related proposals will still be considered. This comment is to request that FSEC's 6933-A1 mod be considered by the ERI Working Group.

2nd Comment Period

EN6933-G10

Proponent Eric Lacey **Submitted** 6/21/2016 **Attachments** No

Comment:

On June 7, 2016, the Energy TAC recommended that all proposals related to on-site renewable power generation trade-offs in the Energy Rating Index path be addressed in a Commission Work Group. We anticipate that proposals 6933 and 6727 will be addressed by this Work Group because both proposals will directly impact whether on-site renewable power generation will be permitted as a trade-off against energy conservation in the Energy Rating Index in the 6th Edition Code. RECA submits this public comment to keep these proposals alive until either the Work Group submits its recommendations to the TAC and Commission, or until the Commission addresses these issues in the normal course of its rulemaking.

1st Comment Period History

EN6933-G1

Proponent Amanda Hickman **Submitted** 2/22/2016 **Attachments** Yes

Comment:
Please see attached file.

1st Comment Period History

EN6933-G2

Proponent Justin Baca **Submitted** 2/23/2016 **Attachments** Yes

Comment:
See uploaded comment file.

1st Comment Period History

EN6933-G3

Proponent Antheil Mike **Submitted** 2/24/2016 **Attachments** Yes

Comment:
FlaSEIA firmly believes that the Florida Building Commission should reaffirm its commitment to using on-site renewable energy as an energy efficiency and conservation tool for code compliance under the 2015 IECC. Solar energy integrated in to new construction is essential to the perpetuation of efficient building practices. FlaSEIA supports all efforts to keep solar affordable and a desirable option for every homeowner. Resale values of homes with solar have proven the cost-effectiveness of this option. On-site renewable generation is a cost-effective conservation tool under the IECC and is also embraced by the Florida Energy & Efficiency Conservation Act (FEECA) –a utility regulation administered at the Florida Public Service Commission. Continuing the use of renewable on-site generation under the 2015 IECC promotes consistent conservation principles that are deeply rooted in Florida law, and compliments both the legislature's intent and black letter law.
Pursuant to FEECA related statutes in 366.81 and 366.82(3), in addition to the fact that continuing the use of on-site renewable generation under the IECC 2015 is also consistent and complimentary of federal law, FlaSEIA respectfully requests that the Florida Building Commission should reaffirm its commitment to using on-site renewable energy as an energy efficiency and conservation for code compliance under the 2015 IECC. On-site renewable generation is a cost-effective conservation compliance tool since the 1980s under the Florida Energy & Efficiency Conservation Act (FEECA) –a utility regulation administered at the Florida Public Service Commission since the 1980s. Continuing the use of renewable on-site generation under the 2015 IECC promotes consistent conservation principles deeply rooted in Florida law, and compliments both Florida's legislature's intent and Federal Housing Authority's energy efficient loans.

Thank you,

Mike Antheil
Executive Director, FlaSEIA

1st Comment Period History

EN6933-G4

Proponent Charles Cottrell **Submitted** 2/24/2016 **Attachments** No

Comment:

Modification EN6933 – Clarifying that No On-Site Power Production Should be Included in ERI Calculation: NAIMA strongly supports the proposal and reason statement filed by the Responsible Energy Code Alliance (RECA) clarifying that the Energy Rating Index does not include on-site power production.

The 2015 International Energy Conservation Code (IECC) under consideration by the Florida Building Commission contains several options for compliance, including the new Energy Rating Index (ERI) option. While NAIMA does not oppose the adoption of the ERI compliance option as published in the 2015 IECC, we are concerned that the methods and computer software used to calculate the ERI will be misapplied, creating substantial credit for the installation of on-site renewable energy generation, including rooftop solar systems. If applied this way, the software could enable homes using on-site renewable generation to be much less energy efficient and still comply with the energy conservation code. The use of on-site generation for compliance is not considered in any way in the 2015 IECC residential requirements.

Trading away energy efficiency improvements for more on-site electricity production actually raises the cost of home ownership by substantially increasing utility bills. It can also create home comfort and moisture problems and require larger HVAC systems. Using on-site energy production instead of building a home with up-to-date energy efficiency measures could result in homes that under-perform for the life of the home – 75 years or longer.

The energy conservation requirements of the Florida' Building Code are intended to promote energy conservation in buildings, and should not relax the efficiency requirements for buildings with systems that simply produce more energy. Allowing on-site power production as a trade off against cost effective energy efficiency measures would have the practical effect of relaxing Florida's Building Energy Code.

1st Comment Period History

EN6933-G5

Proponent Jay Crandell **Submitted** 2/25/2016 **Attachments** No

Comment:

Proposal EN6933 should be approved as an appropriate means to allow use of on-site power generation and avoid the consequence of having it be used to reduce the fundamentally important role of energy efficiency of the building envelope which is the foundation of the energy code. Without efficient envelopes, the value and potential impact of on-site power generation is limited. Thus, maintaining adequate thermal envelopes will encourage the effective use of on-site power generation as is already being experienced in the market. The energy code should encourage the use of on-site renewable power, but not at the expense of long-term, reliable energy efficiency. This proposal will serve the purpose of ensuring an adequate energy code and will not erode or prohibit the use of on-site power generation. In fact, it will increase its value to the overall design of a building.

1st Comment Period History

EN6933-G6

Proponent Joseph Belcher **Submitted** 2/25/2016 **Attachments** Yes

Comment:

The Florida Home Builders Association supports the flexibility provided to builders and designers in the new Energy Rating Index Method of Section 406 of the base code unmodified. FHBA opposes the modifications suggested by Mod EN6933 for the reasons detailed in the uploaded comment file.

1st Comment Period History

EN6933-G7

Proponent Michael Fischer **Submitted** 2/25/2016 **Attachments** Yes

Comment:

In support of EN6933; see attached file.

It's a bad idea to waste energy simply because it happens to be generated onsite.

For additional information on the role of renewables, visit: http://www.ase.org/buildingenergycodes

Revise Sections R406.3 and R406.4 as follows:

R406.3 Energy Rating Index. The Energy Rating Index (ERI) shall be a numerical integer value that is based on a linear scale constructed such that the *ERI reference design* has an Index value of 100 and a *residential building* that uses no net purchased energy has an Index value of 0. Each integer value on the scale shall represent a 1-percent change in the total energy use of the rated design relative to the total energy use of the *ERI reference design*. The ERI shall consider all energy used in the *residential building*, and shall not include the effect of any on-site power production.

R406.4 ERI-based compliance. Compliance based on an ERI analysis requires that the *rated design* be shown to have an ERI less than or equal to the appropriate value listed in Table R406.4 when compared to the *ERI reference design*. No credit shall be allowed for on-site power production. The ERI report shall demonstrate that no on-site power production has been incorporated into the ERI calculation.

[No changes to section R406.3 of base code.]

R406.4 ERI-based compliance. Compliance based on an ERI analysis requires that the *rated design* be shown to have an ERI less than or equal to the appropriate value listed in Table R406.4 when compared to the *ERI reference design*. If on-site renewable electric generation is included on a design to meet the required ERI in Table R406.4, then the proposed design must also be simulated without any on-site renewable electric generation and achieve an ERI of 61 or less.

For your consideration, Amanda Hickman, InterCode Incorporated on behalf of The Leading Builders of America (LBA) respectfully submits the following Comment on RECA's Modification Proposal (EN6933).

RECA asserts that the purpose of their modification is to "clarify" that renewables are not permitted in determining the total energy use using Energy Rating Index (ERI) Compliance Alternative under section R406. However, characterizing a significant technical revision as a "clarification" is disingenuous.

RECA sites the 2015 International Energy Conservation Code (IECC) Section R405 (the IECC performance path) as basis for their argument to exclude renewables from the ERI in the 2015 IECC Section R406 (the ERI path). This is because the scoping language of R405 specifically states that the criteria for performance analysis shall include "heating, cooling, and service water heating energy **ONLY**". We agree that performance path (R405) clearly disallows the energy from renewables to be considered as it uses the word "only" after the above-mentioned list of allowed criteria. However, it is a far reach to then make the argument that the scoping section of one path (R405 the performance path) somehow applies to a totally separate compliance path, i.e., R406 (ERI path). This simply is not how the code works.

The International Code Council publishes a "Code Commentary" to provide code users and enforcers with direction and clarification on code language. The "2015 IECC Code Commentary" states what Section R406 Energy Rating Index Compliance Alternative does. It *"provides an ERI with established rating numbers to allow alternative programs using an ERI to be designed to meet these criteria. The section provides guidelines for the development of the index, requirements for documentation to be provided to ensure compliance and a requirement that an approved third party verify that the building complies with the applicable ERI."*
Section R405 and Section R406 have nothing to do with each other.

RECA states in its own rationale that *"popular home energy rating systems and software include the impact of on-site power production in the calculation of energy ratings, that the ERI can also include on-site power production."*

We agree. One such home energy rating systems is HERS, the widely accepted system developed by RESNET. It bases its program's software calculation on ANSI/ICC/RESNET 301-2014. Clearly, on-site power production is included in the calculation criteria of Standard 301. See item 24 from the table below.

ANSI/ICC/RESNET 301-2014, Table 4.4.2(1) Minimum Rated Features

Building element	Minimum Rated Feature
1. Floor/Foundation Assembly	Construction type (slab-on-grade, crawl space; basement), insulation value (edge, under slab, cavity, sheathing), framing material and on-center spacing, insulation installation (Grade I, II, or III), vented or unvented (crawl space), capacitance (if slab or basement receives appreciable solar gain).
2. Walls Assembly	Construction type, insulation value (cavity, sheathing), framing material and on-center spacing, insulation installation (Grade I, II, or III), capacitance, color (light, medium, or dark).
3. Roof/Ceiling Assembly	Construction type, insulation value (cavity, sheathing), framing material and on-center spacing, insulation installation (Grade I, II, or III), framing covered by insulation or exposed, roof color (light, medium, or dark).
4. Rim Joist	Insulation value (cavity, sheathing).
5. Doors	Construction type, insulation value.
6. Windows	Construction type, orientation, U-value (of complete assembly), solar heat gain coefficient (of complete assembly), shading.
7. Skylights	Construction type, orientation, tilt, U-value (of complete assembly), solar heat gain coefficient (of complete assembly), shading.
8. Passive Solar System (Direct Gain system)	Solar type, collector type and area, orientation, tilt efficiency, storage tank size, and pipe insulation value.
9. Solar Domestic Hot Water Equipment	System type, collector type and area, orientation, tilt, efficiency, storage tank size, pipe insulation value.
10. Air Leakage	Air leakage measurement type (default estimate, blower door test, tracer gas test), volume of conditioned space.
11. Distribution System	System type, location, insulation value (duct and pipe), air leakage measurement type (default estimate, duct

ANSI/ICC/RESNET 301-2014, Table 4.4.2(1) Minimum Rated Features

Building element	Minimum Rated Feature
	pressurization).
12. Heating Equipment	Equipment type, location, efficiency (AFUE, HSPF), Auxiliary Electric Energy (Eae); power rating of ground fluid circulating pump(s) for ground-loop and ground-water heat pumps.
13. Cooling Equipment	Equipment type, location, efficiency (SEER, COP).
14. Domestic Hot Water Equipment	Equipment type, location, energy factor or seasonal efficiency, extra tank insulation value, pipe insulation value.
15. Control Systems	Thermostat type.
16. Light Fixtures	Number of Qualifying and non-qualifying Light Fixtures in Qualifying Locations, including (i.e. kitchens, dining rooms, living rooms, family rooms/dens, bathrooms, hallways, stairways, entrances, bedrooms, garages, utility rooms, home offices, and all outdoor fixtures mounted on a building or pole, (excluding landscape lighting).
17. Refrigerator(s)	Total annual energy consumption (kWh) for all units as determined from either the refrigerator Energy Guide label or from age-based defaults as defined in Section 4.2.2.5.2.5.
18. Dishwasher(s)	Labeled energy factor (cycles/kWh) or labeled energy consumption (kWh/y) for all units as defined in Section 4.2.2.5.2.9.
19. Range/Oven	Burner Energy Factor (BEF) and Oven Energy Factor (OEF) as defined in Section 4.2.2.5.2.7.
20. Clothes Washer	Energy Rating (kWh/y), electric rate ($/kWh), annual gas cost (AGC), and gas rate ($/therm) from Energy Guide label; and washer capacity (cubic feet) from manufacturer's data or the CEC database or the EPA ENERGY STAR website as defined in Section 4.2.2.5.2.10.

ANSI/ICC/RESNET 301-2014, Table 4.4.2(1) Minimum Rated Features

Building element	Minimum Rated Feature
21. Clothes Dryer	Clothes washer Modified Energy Factor (MEF) and clothes washer Labeled Energy Rating (kWh/y) from Energy Guide label; clothes washer capacity from manufacturer's data or CEC database or EPA ENERGY STAR website; and clothes dryer Efficiency Factor from CEC database as defined in Section 4.2.2.5.2.8.
22. Ceiling Fans	Labeled cfm, Watts and cfm/Watt at medium fan speed from EPA ENERGY STAR ceiling fan label.
23. Whole-House Mechanical Ventilation System(s)	Equipment type, daily run hours, and wattage (may be listed in a source is the Certified Home Ventilating Products Directory available from the Heating and Ventilation Institute (HVI)).
24. On-site Power Production	Total annual kWh generation and total site fuel used in the On-Site Power Production as derived from manufacturer's performance ratings.

Furthermore, the attempt to constrain the ERI compliance path in this manor violates the spirit of the code. Under the scope of the 2015 IECC there is a section (R102) that deals with Alternative Materials, Design, and Methods of Construction and Equipment. This section states, *"The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction* ***not specifically prescribed by this code****, provided that any such alternative has been approved. The code official shall be permitted to approve an alternative material, design or method of construction where the code official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code."*

The IECC Commentary on this section further clarifies the point by stating the following: *"This section reinforces Section R101.3, which states that the code is meant to be flexible, as long as the intent of the proposed alternative is to promote the effective use of energy.* ***The code is not intended to inhibit innovative ideas or technological advances****.* ***A comprehensive regulatory document such as an energy code cannot envision and then address all future innovations in the***

industry. As a result, a performance code must be applicable to and provide a basis for the approval of an increasing number of newly developed, innovative materials, systems and methods for which no code text or referenced standards yet exist. The fact that a material, product or method of construction is not addressed in the code is not an indication that the material, product or method is prohibited."

Moreover, Florida statute (553.73(9)(a)3,F.S.) requires that code modification proposals *"not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities."* We would argue that this modification aggressively violates the statute eliminating credit for renewables, particularly the use of photovoltaics in an approved code compliance path.

For all of these reasons we strongly recommend that the Florida Building Commission reject RECA's proposed modification.

For your consideration, Amanda Hickman, InterCode Incorporated on behalf of The Leading Builders of America (LBA) respectfully submits the following Comment on RECA's Modification Proposal (EN6933).

RECA asserts that the purpose of their modification is to "clarify" that renewables are not permitted in determining the total energy use using Energy Rating Index (ERI) Compliance Alternative under section R406. However, characterizing a significant technical revision as a "clarification" is disingenuous.

RECA sites the 2015 International Energy Conservation Code (IECC) Section R405 (the IECC performance path) as basis for their argument to exclude renewables from the ERI in the 2015 IECC Section R406 (the ERI path). This is because the scoping language of R405 specifically states that the criteria for performance analysis shall include "heating, cooling, and service water heating energy **ONLY**". We agree that performance path (R405) clearly disallows the energy from renewables to be considered as it uses the word "only" after the above-mentioned list of allowed criteria. However, it is a far reach to then make the argument that the scoping section of one path (R405 the performance path) somehow applies to a totally separate compliance path, i.e., R406 (ERI path). This simply is not how the code works.

The International Code Council publishes a "Code Commentary" to provide code users and enforcers with direction and clarification on code language. The "2015 IECC Code Commentary" states what Section R406 Energy Rating Index Compliance Alternative does. It *"provides an ERI with established rating numbers to allow alternative programs using an ERI to be designed to meet these criteria. The section provides guidelines for the development of the index, requirements for documentation to be provided to ensure compliance and a requirement that an approved third party verify that the building complies with the applicable ERI."*
Section R405 and Section R406 have nothing to do with each other.

RECA states in its own rationale that *"popular home energy rating systems and software include the impact of on-site power production in the calculation of energy ratings, that the ERI can also include on-site power production."*

We agree. One such home energy rating systems is HERS, the widely accepted system developed by RESNET. It bases its program's software calculation on ANSI/ICC/RESNET 301-2014. Clearly, on-site power production is included in the calculation criteria of Standard 301. See item 24 from the table below.

ANSI/ICC/RESNET 301-2014, Table 4.4.2(1) Minimum Rated Features

Building element	Minimum Rated Feature
1. Floor/Foundation Assembly	Construction type (slab-on-grade, crawl space; basement), insulation value (edge, under slab, cavity, sheathing), framing material and on-center spacing, insulation installation (Grade I, II, or III), vented or unvented (crawl space), capacitance (if slab or basement receives appreciable solar gain).
2. Walls Assembly	Construction type, insulation value (cavity, sheathing), framing material and on-center spacing, insulation installation (Grade I, II, or III), capacitance, color (light, medium, or dark).
3. Roof/Ceiling Assembly	Construction type, insulation value (cavity, sheathing), framing material and on-center spacing, insulation installation (Grade I, II, or III), framing covered by insulation or exposed, roof color (light, medium, or dark).
4. Rim Joist	Insulation value (cavity, sheathing).
5. Doors	Construction type, insulation value.
6. Windows	Construction type, orientation, U-value (of complete assembly), solar heat gain coefficient (of complete assembly), shading.
7. Skylights	Construction type, orientation, tilt, U-value (of complete assembly), solar heat gain coefficient (of complete assembly), shading.
8. Passive Solar System (Direct Gain system)	Solar type, collector type and area, orientation, tilt efficiency, storage tank size, and pipe insulation value.
9. Solar Domestic Hot Water Equipment	System type, collector type and area, orientation, tilt, efficiency, storage tank size, pipe insulation value.
10. Air Leakage	Air leakage measurement type (default estimate, blower door test, tracer gas test), volume of conditioned space.
11. Distribution System	System type, location, insulation value (duct and pipe), air leakage measurement type (default estimate, duct

ANSI/ICC/RESNET 301-2014, Table 4.4.2(1) Minimum Rated Features

Building element	Minimum Rated Feature
	pressurization).
12. Heating Equipment	Equipment type, location, efficiency (AFUE, HSPF), Auxiliary Electric Energy (Eae); power rating of ground fluid circulating pump(s) for ground-loop and ground-water heat pumps.
13. Cooling Equipment	Equipment type, location, efficiency (SEER, COP).
14. Domestic Hot Water Equipment	Equipment type, location, energy factor or seasonal efficiency, extra tank insulation value, pipe insulation value.
15. Control Systems	Thermostat type.
16. Light Fixtures	Number of Qualifying and non-qualifying Light Fixtures in Qualifying Locations, including (i.e. kitchens, dining rooms, living rooms, family rooms/dens, bathrooms, hallways, stairways, entrances, bedrooms, garages, utility rooms, home offices, and all outdoor fixtures mounted on a building or pole, (excluding landscape lighting).
17. Refrigerator(s)	Total annual energy consumption (kWh) for all units as determined from either the refrigerator Energy Guide label or from age-based defaults as defined in Section 4.2.2.5.2.5.
18. Dishwasher(s)	Labeled energy factor (cycles/kWh) or labeled energy consumption (kWh/y) for all units as defined in Section 4.2.2.5.2.9.
19. Range/Oven	Burner Energy Factor (BEF) and Oven Energy Factor (OEF) as defined in Section 4.2.2.5.2.7.
20. Clothes Washer	Energy Rating (kWh/y), electric rate ($/kWh), annual gas cost (AGC), and gas rate ($/therm) from Energy Guide label; and washer capacity (cubic feet) from manufacturer's data or the CEC database or the EPA ENERGY STAR website as defined in Section 4.2.2.5.2.10.

3

ANSI/ICC/RESNET 301-2014, Table 4.4.2(1) Minimum Rated Features

Building element	Minimum Rated Feature
21. Clothes Dryer	Clothes washer Modified Energy Factor (MEF) and clothes washer Labeled Energy Rating (kWh/y) from Energy Guide label; clothes washer capacity from manufacturer's data or CEC database or EPA ENERGY STAR website; and clothes dryer Efficiency Factor from CEC database as defined in Section 4.2.2.5.2.8.
22. Ceiling Fans	Labeled cfm, Watts and cfm/Watt at medium fan speed from EPA ENERGY STAR ceiling fan label.
23. Whole-House Mechanical Ventilation System(s)	Equipment type, daily run hours, and wattage (may be listed in a source is the Certified Home Ventilating Products Directory available from the Heating and Ventilation Institute (HVI)).
24. On-site Power Production	Total annual kWh generation and total site fuel used in the On-Site Power Production as derived from manufacturer's performance ratings.

Furthermore, the attempt to constrain the ERI compliance path in this manor violates the spirit of the code. Under the scope of the 2015 IECC there is a section (R102) that deals with Alternative Materials, Design, and Methods of Construction and Equipment. This section states, *"The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction* ***not specifically prescribed by this code****, provided that any such alternative has been approved. The code official shall be permitted to approve an alternative material, design or method of construction where the code official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code."*

The IECC Commentary on this section further clarifies the point by stating the following: *"This section reinforces Section R101.3, which states that the code is meant to be flexible, as long as the intent of the proposed alternative is to promote the effective use of energy.* ***The code is not intended to inhibit innovative ideas or technological advances****.* ***A comprehensive regulatory document such as an energy code cannot envision and then address all future innovations in the***

industry. As a result, a performance code must be applicable to and provide a basis for the approval of an increasing number of newly developed, innovative materials, systems and methods for which no code text or referenced standards yet exist. The fact that a material, product or method of construction is not addressed in the code is not an indication that the material, product or method is prohibited."

Moreover, Florida statute (553.73(9)(a)3,F.S.) requires that code modification proposals *"not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities."* We would argue that this modification aggressively violates the statute eliminating credit for renewables, particularly the use of photovoltaics in an approved code compliance path.

For all of these reasons we strongly recommend that the Florida Building Commission reject RECA's proposed modification.

FlaSEIA firmly believes that the Florida Building Commission should reaffirm its commitment to using on-site renewable energy as an energy efficiency and conservation tool for code compliance under the 2015 IECC. Solar energy integrated in to new construction is essential to the perpetuation of efficient building practices. FlaSEIA supports all efforts to keep solar affordable and a desirable option for every homeowner. Resale values of homes with solar have proven the cost-effectiveness of this option. On-site renewable generation is a cost-effective conservation tool under the IECC and is also embraced by the Florida Energy & Efficiency Conservation Act (FEECA) –a utility regulation administered at the Florida Public Service Commission. Continuing the use of renewable on-site generation under the 2015 IECC promotes consistent conservation principles that are deeply rooted in Florida law, and compliments both the legislature's intent and black letter law.

Under FEECA, and pursuant to Section 366.81, Florida Statutes,

> "The Legislature finds and declares that it is critical to utilize the most efficient and cost-effective energy conservation systems in order to protect the health, prosperity, and general welfare of the state and its citizens. Reduction in, and control of, the growth rates of electric consumption and of weather-sensitive peak demand are of particular importance. The Legislature further finds that the Florida Public Service Commission is the appropriate agency to adopt goals and approve plans related to the conservation of electric energy and natural gas usage. The Legislature directs the commission to develop and adopt overall goals and authorizes the commission to require each utility to develop plans and implement programs for increasing energy efficiency and conservation within its service area, subject to the approval of the commission. Since solutions to our energy problems are complex, the Legislature intends that the use of solar energy, renewable energy sources, highly efficient systems, cogeneration, and load-control systems be encouraged. [. . .]"

FEECA can be found in Sections 366.80-83, Florida Statutes.

http://www.leg.state.fl.us/statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=0300-0399/0366/Sections/0366.80.html

See also, Section 366.82(3), Florida Statutes where solar PV up to 2MWs is statutorily characterized and treated as a conservation measure: "(3) In developing the goals, the commission shall evaluate the full technical potential of all available demand-side and supply-side conservation and efficiency measures, including demand-side renewable energy systems [. . .]"

http://www.leg.state.fl.us/statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=0300-0399/0366/Sections/0366.82.html

FEDERAL ENERGY EFFICIENT LOANS

In addition, continuing the use of on-site renewable generation under the IECC 2015 is also consistent and complimentary of federal law. Under the Federal Housing Authority's energy efficient mortgages, on-site use of solar as an energy conservation measure is specifically enumerated as a qualifying measure to obtain the loan: http://programs.dsireusa.org/system/program/detail/742

These FHA loans allow lenders to add up to 100% of energy efficiency improvements to an existing mortgage loan with certain restrictions. FHA mortgage limits vary by county, state and the number of units in a dwelling.

See FHA link, http://portal.hud.gov/hudportal/HUD?src=/program_offices/housing/sfh/eem/energy-r

CONCLUSION

In conclusion, FlaSEIA respectfully requests that the Florida Building Commission should reaffirm its commitment to using on-site renewable energy as an energy efficiency and conservation for code compliance under the 2015 IECC. On-site renewable generation is a cost-effective conservation compliance tool since the 1980s under the Florida Energy & Efficiency Conservation Act (FEECA) –a utility regulation administered at the Florida Public Service Commission since the 1980s. Continuing the use of renewable on-site generation under the 2015 IECC promotes consistent conservation principles deeply rooted in Florida law, and compliments both Florida's legislature's intent and Federal Housing Authority's energy efficient loans.

Thank you,

Mike Antheil
Executive Director, FlaSEIA
2555 Porter Lake Dr. Suite 106
Sarasota FL 34240
321.220.0371

CC: FlaSEIA Board of Directors

The Florida Home Builders Association opposes Modification EN6933 and strongly supports the Public Comment submitted by the Leading Builders of America (LBA). The rationale for Mod 6933 begins by stating the modification is a clarification. The modification is not a clarification, but is most definitely an attempt to change the code. There is nothing in the IECC 2015 Section 406 or elsewhere that precludes including On-Site Power Production or Renewable Energy Systems in the energy efficient design of a home. The intent of the proponent is to change the code for the benefit of certain proprietary materials and manufacturers; not to clarify the code. **The Florida Home Builders Association supports the flexibility provided to builders and designers in the new Energy Rating Index Method of Section 406 of the base code unmodified.**

It is not possible for any code to address all the permutations and variations involved with buildings and building systems. An item, a system, or an aspect of a building that is not addressed by the code does not automatically become disallowed by omission. If such were the case the codes would be lengthy lists of items to make sure they were permitted. While the IECC does not specifically address On-Site Power Production or Renewable Energy Systems, such systems are recognized in nationally recognized standards in use today, one of which is proposed for adoption in the FBC-EC, 6th Edition (EN6728). The widely accepted rating system HERS developed by RESNET now uses ANSI/ICC/RESNET 301 for the base of its software calculation. These rating systems are often used to determine compliance with the code and to demonstrate above-code features of a structure. ANSI/ICC/RESNET 301 contains definitions for these systems:

> ***"On-Site Power Production (OPP)*** – Electric power produced at the site of a Rated Home. OPP shall be the net electrical power production, such that it equals the gross electrical power production minus any purchased fossil fuel energy used to produce the on-site power, converted to equivalent electric energy use at a 40% conversion efficiency in accordance with Equation 4.1-3."
>
> ***"Renewable Energy System*** – Means of producing thermal energy or producing electric power that rely on naturally-occurring, on-site resources that are not depleted as a result of their use. Renewable Energy Systems shall include, but are not limited to, solar energy systems, wind energy systems and biomass energy systems."[1]

In addition to the recognition of On-Site Power Production at Table 4.4.2(1) Item 24, as documented by the LBA Public Comment in opposition to Mod EN6933, various types of solar systems are also included in the calculation criteria of ANSI/ICC/RESNET 301 at Table 4.4.2(1) Minimum Rated Features. The proposed modification is a blatant attempt to preclude the use of On-Site Power Production and Renewable Energy Systems to the benefit of other proprietary systems and manufacturers; not to clarify the code. **The Florida Home Builders Association supports the flexibility provided to builders and designers in the new Energy Rating Index Method of Section 406 of the base code unmodified.**

ANSI/ICC/RESNET 301-2014 Table 4.4.2(1) Minimum Rated Features

Building element	Minimum Rated Feature
1.Floor/Foundation Assembly	Construction type (slab-on-grade, crawl space; basement), insulation value (edge, under slab, cavity, sheathing), framing material and on-center spacing, insulation installation (Grade I, II, or III), vented or unvented (crawl space), capacitance (if slab or basement receives appreciable solar gain).

[1] ANSI/ RESNET/ICC 301-2014; First Published March 7, 2014, Republished January 15, 2016; Residential Energy Services Network, Inc. P.O. Box 4561 Oceanside, CA 92052-4561 http://resnet.us/; International Code Council 500 New Jersey Avenue, NW, 6th Floor Washington, D.C. 20001 www.iccsafe.org

ANSI/ICC/RESNET 301-2014 Table 4.4.2(1) Minimum Rated Features

Building element	Minimum Rated Feature
2.Walls Assembly	Construction type, insulation value (cavity, sheathing), framing material and on-center spacing, insulation installation (Grade I, II, or III), capacitance, color (light, medium, or dark).
3.Roof/Ceiling Assembly	Construction type, insulation value (cavity, sheathing), framing material and on-center spacing, insulation installation (Grade I, II, or III), framing covered by insulation or exposed, roof color (light, medium, or dark).
4.Rim Joist	Insulation value (cavity, sheathing).
5.Doors	Construction type, insulation value.
6.Windows	Construction type, orientation, U-value (of complete assembly), solar heat gain coefficient (of complete assembly), shading.
7. Skylights	Construction type, orientation, tilt, U-value (of complete assembly), solar heat gain coefficient (of complete assembly), shading.
8. Passive Solar System (Direct Gain system)	Solar type, collector type and area, orientation, tilt efficiency, storage tank size, and pipe insulation value.
9. Solar Domestic Hot Water Equipment	System type, collector type and area, orientation, tilt, efficiency, storage tank size, pipe insulation value.
24.On-site Power Production	Total annual kWh generation and total site fuel used in the On-Site Power Production as derived from manufacturer's performance ratings.

The following brief responses are offered in response to the Reason Statement submitted by the proponent of Mod EN6933.

Proponent's Reason Statement	Response
The purpose of this proposal is to clarify that the Energy Rating Index calculation does not include on-site power production such as solar photovoltaics. It also provides more specific guidance to software providers in order to help maintain consistency between software and code compliance. Our understanding is that the current Florida Building Code, Energy Conservation does not award credit for on-site power production in Section R405 simulated performance alternative, and this proposal would maintain a consistent approach to on-site power production across all compliance paths (including the new ERI path, if adopted).	1. The change is not a clarification but a code change. 2. The adoption of ANSI/RESNET/ICC 301-2014 will specifically recognize On-Site Power Production and Renewal Energy Systems. (See Item above.) 3. It is true that R405 does not award credit; however, R406 is a new Section presenting another method which recognizes all systems. The two methods are independent and separate. There should not be

	consistency because the ERI includes all building energy uses and Section 405 includes only heating, cooling, hot water and lighting energy. Further, the overall efficiency for homes complying through Section R406 is approximately 20% greater than required by Section R405. These two paths are not equivalent, or intended to be so, in any way.
The plain language of Section R406 does not permit the inclusion of electricity production in ERI calculations. Consistent with the scope outlined in Section R101.3 of the 2014 Florida Building Code, Energy Conservation, to "regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building," the language establishing the ERI in Section R406 focuses on energy *use* and *loads*, not the *production* of energy. The methodology prescribed by the ERI provisions does not mention the use of renewable energy or other on-site energy production, and these issues were not adequately analyzed or addressed during the 2015 IECC code development process.	If the intent was to prohibit the inclusion of electricity production in ERI calculations, the code would so state. The fact that On-Site Power Production and Renewable Energy Systems are not specifically included in the code does not mean they are precluded or prohibited. The code is designed to allow innovation where performance can be demonstrated.
However, some have suggested that because popular home energy rating systems and software do include the impact of on-site power production in the calculation of energy ratings, that the ERI can also include on-site power production. We are concerned that allowing on-site energy production could open up Pandora's Box, broadening the scope of the 6th Edition Code well beyond the intended scope. This code change proposal will clarify that regardless of the energy rating software used, the ERI calculation shall not include renewable or other on-site energy production. It should be noted that current software can still be used to calculate the ERI under this proposal, so long as no on-site power production is input into the calculation.	Again, the proposal is not a clarification, but a code change vastly exceeding the intent of the base code. There is no intent or provision in the base code prohibiting or precluding the use of renewable energy systems or on-site power production. Nationally recognized rating systems give credit for such systems.
To allow unrestricted trade-offs for on-site power production would bring about several unintended consequences. The most significant problem would be a reduction in thermal	1. This report fairly clearly shows that if a home meets the prescriptive requirements of the

envelope efficiency in favor of more on-site power production. For example, a recent report analyzed the potential impact of solar photovoltaics on the HERS Index. *See* Residential Energy Services Network, Inc., *The Impact of Photovoltaic Arrays on the HERS Index* (2015), http://www.academia.edu/15036659/The_Impact_of_Photovoltaic_Arrays_on_the_HERS_Index. This report found that in most parts of the country, a 4 kW photovoltaic array could reduce a HERS Index Score by 20-40 points. In Miami, for example, the analysis found that a 4kW system could reduce a HERS score by 26-32 points. *Id*. at 3.	2015 IECC and is equipped with 4 kWp PV, then it will obtain HERS Index scores that will allow it to comply through Section R406 of the code. The home would not come anywhere close to complying with R406 by just meeting the prescriptive requirements of 2015 IECC. 2. Yes, from about 80 to about 50, which is the required ERI compliance score in these areas. And this is for a home that complies with the 2015 IECC prescriptive requirements. This appears to make the case that the Sunshine State should take advantage of the abundant sunshine.
If the 6th Edition Code were amended to allow direct, unlimited trade-offs between electricity generation and the efficiency of the thermal envelope, it would virtually eliminate the need to incorporate efficiency measures into the home to meet the code, wiping out many years of progress in improving the energy efficiency of homes. This is fundamentally inconsistent with the scope and intent of the Florida Building Code, Energy Conservation, and it should not be permitted.	The purpose of energy efficiency provisions in the code is not to sell or promote products, materials, or systems. The overall goal of energy efficiency should be to allow the use of energy without negative impact on the environment or the planet. Converting natural sources freely available into useable energy with no effect on the planet is possible and should be pursued.
To be clear, this proposal does not take any position on the value of solar photovoltaics or other types of generation in themselves. Nor does this proposal affect the use of these systems in Florida homes. We note that sustainability-oriented and green codes such as the IgCC and ICC- 700 have addressed on-site power production, along with other sustainability-oriented measures that are beyond the scope of an energy conservation code. However, to begin allowing electric generation to replace critical energy efficiency measures in the 6th Edition Code, such as a good thermal envelope, will result in higher peak demands, less occupant comfort and substantial additional energy use given the much longer typical life of envelope measures. And given the uncertain future of net-metering or incentive programs, or the possibility that panels could be removed, a homeowner could be stuck with huge energy bills and higher costs over the long run. For all these reasons, we recommend that the Florida Building Code, Energy Conservation be clarified to	There is no evidence to support this assertion. In fact, there is some new evidence from field studies of code compliance that new homes are actually exceeding code

specifically exclude on-site power production from the ERI calculation.	requirements for building efficiency.

FBC Mod EN6933.

In support of this mod.

Note that this Mod is intended to clarify the intent of the energy code to ensure that buildings are designed and constructed in accordance with the minimum provisions of the code. The inclusion of the ERI path is a positive step in code development, but as Florida determines whether or not to include this ERI option in the 2017 Florida Energy Code, it is critical to avoid any potential rollbacks of the current code.

The use of on-site renewables as a trade-off for other building features, including opaque walls and roofs, ceiling insulation, roof reflectance, HVAC equipment efficiency, and fenestration performance is not appropriate. Some commenters have pointed out that the ANSI/ICC/RESNET 301-2014 Standard includes the option to use onsite renewables to determine a HERS Score. That standard, however, is not referenced in the 2015 IECC. It will likely be the subject of discussion for the 2018 IECC but the standard has not been yet reviewed by the IECC code committee or the ICC governmental members. Those arguments are not valid.

The Florida Code development process requires that modifications to the base codes have a Florida-specific need. In the case of the ERI option, it is critical that the Florida Building Commission affirm the obvious need to maintain an energy efficient building design, so that the benefits of on-site renewables such as rooftop mounted photovoltaics are used to improve the energy footprint of the building and not to replace other efficiency measures.

Some may declare that using renewables to determine the ERI will simply increase options and flexibility of the code, but make no mistake; such an approach would be a step backwards. The current text of the section proposed for inclusion in the Florida Energy Code includes:

“The ERI shall consider all energy used in the residential building”.

Onsite power production is not “energy used”.

Renewable energy, including onsite power generation, is an important tool towards zero-net energy goals. It would be a shame to allow the technology to undo decades of progress to improve Florida’s buildings.

Respectfully submitted,

Mike Fischer
Director of Codes and Regulatory Compliance
Kellen

Comments to Proposals for the 6th Edition (2017) Florida Building Code, energy Conservation
By the North American Insulation Manufacturers Association
June 17, 2016

The North American Insulation Manufacturers Association (NAIMA) is the trade association for North American manufacturers of fiber glass and mineral wool insulation. NAIMA member companies operate 38 manufacturing facilities in 18 states, collectively employing 225,000 people. Three NAIMA member companies – CertainTeed, Johns Manville and Owens Corning – operate facilities in Florida.

At its June 8th meeting, the Florida Building Commission deferred making a determination on whether to permit and/or limit the use of on-site generation for compliance using the Energy Rating Index (ERI) option in the 6th Edition of the Florida Building Code, and instead announced the formation of a working group to study this issue and make recommendations. NAIMA supports this procedural step as a precursor to final Commission action on the topic. While it is our expectation that proposals 6727 and 6933 will be considered by the Working Group, NAIMA submits the following comments to keep these proposals open.

Comments on Proposed Modifications

Mod# 6933 – Clarifying that No On-Site Power Production Should be Included in ERI Calculation / Mod #6727 – Energy Rating Index

NAIMA supports Mod #6933 clarifying that the Energy Rating index does not include on-site power production. NAIMA also opposes, in the absence of an explicit prohibition or limitation on the eligibility of on-site power generation, Mod #6727 adopting the RESNET 301 standard for the ERI compliance calculations.

The 2015 International Energy Conservation Code under consideration by the Florida Building Commission contains several options for compliance, including the new ERI option. While NAIMA does not oppose the adoption of the ERI option as published in the 2015 IECC, we are concerned that the methods and computer software used by RESNET 301 to calculate the ERI will be misapplied, creating substantial credit for the installation of on-site renewable energy generation, including rooftop solar systems. If applied this way, the software could enable homes using on-site renewable generation to be much less energy efficient and still comply with the energy conservation code.

Trading away efficiency improvements for on-site power generation raises the cost of home ownership by substantially increasing utility bills. It can also create home comfort and moisture problems and require larger HVAC systems. Using on-site energy production instead of first

building a home with up-to-date energy efficiency measures means a lifetime of home under-performance – 75 years or longer.

The energy conservation requirements of the Florida' Building Code are intended to promote energy conservation in buildings, and should not relax the efficiency requirements for buildings that simply produce more energy. Allowing on-site power production as a trade off against cost effective energy efficiency measures will have the practical effect of relaxing Florida's Building Energy Code. This should not be a policy outcome of the 6th Edition of the Florida Building Code.

Reason Statement for Proposal to Clarify that No On-Site Power Production Should Be Included in ERI Calculation

The purpose of this proposal is to clarify that the Energy Rating Index calculation does not include on-site power production such as solar photovoltaics. It also provides more specific guidance to software providers in order to help maintain consistency between software and code compliance. Our understanding is that the current Florida Building Code, Energy Conservation does not award credit for on-site power production in Section R405 simulated performance alternative, and this proposal would maintain a consistent approach to on-site power production across all compliance paths (including the new ERI path, if adopted).

The plain language of Section R406 does not permit the inclusion of electricity production in ERI calculations. Consistent with the scope outlined in Section R101.3 of the 2014 Florida Building Code, Energy Conservation, to "regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building," the language establishing the ERI in Section R406 focuses on energy *use* and *loads*, not the *production* of energy. The methodology prescribed by the ERI provisions does not mention the use of renewable energy or other on-site energy production, and these issues were not adequately analyzed or addressed during the 2015 IECC code development process.

However, some have suggested that because popular home energy rating systems and software do include the impact of on-site power production in the calculation of energy ratings, that the ERI can also include on-site power production. We are concerned that allowing on-site energy production could open up Pandora's Box, broadening the scope of the 6th Edition Code well beyond the intended scope. This code change proposal will clarify that regardless of the energy rating software used, the ERI calculation shall not include renewable or other on-site energy production. It should be noted that current software can still be used to calculate the ERI under this proposal, so long as no on-site power production is input into the calculation.

To allow unrestricted trade-offs for on-site power production would bring about several unintended consequences. The most significant problem would be a reduction in thermal envelope efficiency in favor of more on-site power production. For example, a recent report analyzed the potential impact of solar photovoltaics on the HERS Index. *See* Residential Energy Services Network, Inc., *The Impact of Photovoltaic Arrays on the HERS Index* (2015), http://www.academia.edu/15036659/The_Impact_of_Photovoltaic_Arrays_on_the_HERS_Index . This report found that in most parts of the country, a 4 kW photovoltaic array could reduce a HERS Index Score by 20-40 points. In Miami, for example, the analysis found that a 4kW system could reduce a HERS score by 26-32 points. *Id*. at 3.

If the 6th Edition Code were amended to allow direct, unlimited trade-offs between electricity generation and the efficiency of the thermal envelope, it would virtually eliminate the need to incorporate efficiency measures into the home to meet the code, wiping out many years of progress in improving the energy efficiency of homes. This is fundamentally inconsistent with the scope and intent of the Florida Building Code, Energy Conservation, and it should not be permitted.

To be clear, this proposal does not take any position on the value of solar photovoltaics or other types of generation in themselves. Nor does this proposal affect the use of these systems in

Florida homes. We note that sustainability-oriented and green codes such as the IgCC and ICC-700 have addressed on-site power production, along with other sustainability-oriented measures that are beyond the scope of an energy conservation code. However, to begin allowing electric generation to replace critical energy efficiency measures in the 6th Edition Code, such as a good thermal envelope, will result in higher peak demands, less occupant comfort and substantial additional energy use given the much longer typical life of envelope measures. And given the uncertain future of net-metering or incentive programs, or the possibility that panels could be removed, a homeowner could be stuck with huge energy bills and higher costs over the long run. For all these reasons, we recommend that the Florida Building Code, Energy Conservation be clarified to specifically exclude on-site power production from the ERI calculation.

Date Submitted	12/30/2015	**Section**	405.2	**Proponent**	Eric Lacey
Chapter	4	**Affects HVHZ**	No	**Attachments**	No

TAC Recommendation No Affirmative Recommendation with a Second
Commission Action Pending Review

Comments

General Comments No **Alternate Language** Yes

Related Modifications

Summary of Modification

This proposal adds an important thermal envelope backstop to the simulated performance alternative.

Rationale

This proposal establishes a crucial trade-off "efficiency safety net" for Florida homeowners. It would require that the thermal envelope components at least meet the 2009 IECC prescriptive values as a backstop, just like Section R406 does for the new ERI compliance option. We recommend adopting this proposal in any event, but especially if the Commission decides to continue to permit equipment trade-offs in Section R405.

As we explain in a separate proposal to eliminate the equipment trade-offs from Section R405, trade-offs between equipment and envelope components allow an unnecessary weakening of the overall efficiency of the home, and can leave homeowners saddled with higher energy bills over the lifetime of the home. We believe that the most sensible solution is to follow the model of the IECC and eliminate these trade-offs, but if the Commission decides to allow equipment trade-offs in the 6th Edition code, we offer the above proposal in order to ensure at least a minimal efficiency level in the thermal envelope. This proposal would apply the same mandatory requirements, including envelope requirements at least as efficient as those specified in the 2009 IECC, in section R405 that are required in the Energy Rating Index compliance option (Section R406). We believe it is reasonable to require a sensible minimum efficiency level for the thermal envelope components, irrespective of other trade-offs.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

This proposal should not have a significant impact on local enforcement of the code.

Impact to building and property owners relative to cost of compliance with code

This proposal should not negatively impact building and property owners.

Impact to industry relative to the cost of compliance with code

This proposal should not negatively impact building industry relative to compliance.

Impact to small business relative to the cost of compliance with code

This proposal should not negatively impact small business.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

This proposal will help maintain building quality and efficiency by setting reasonable trade-off backstops on the thermal envelope efficiency.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

This proposal improves the code by ensuring at least a minimum level of efficiency in the thermal envelope, regardless of the compliance path selected by the code user.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

This proposal does not discriminate against any materials or products.

Does not degrade the effectiveness of the code

This proposal improves the effectiveness of the code by helping ensure that even in the performance path, each building has a reasonably efficient thermal envelope.

Is the proposed code modification part of a prior code version? No

2nd Comment Period

6934-A1

Proponent Eric Lacey **Submitted** 6/21/2016 **Attachments** Yes

Rationale

This revised proposal recommends changes suggested by the National Association of Home Builders at the ICC Committee Action Hearings in April 2016. To be clear, RECA continues to believe that Florida homeowners would benefit significantly from the elimination of equipment trade-offs (per EN6935); however, if the Commission continues to allow such trade-offs, we strongly recommend the adoption of a thermal envelope backstop to help ensure at least a minimal level of thermal envelope efficiency. RECA initially proposed that the same backstop that applies to the ERI be applied to the simulated performance alternative (EN6934), and that is still our preference. This modification further relaxes that backstop by allowing additional flexibility in both the U-factors and SHGCs. Specifically, it permits buildings to have a thermal envelope UA that is up to 15% higher (or less efficient) than what would be permitted under the prescriptive or UA paths, and permits fenestration to have a 60% higher SHGC than allowed under the prescriptive or UA paths.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

None.

Impact to building and property owners relative to cost of compliance with code

None.

Impact to industry relative to the cost of compliance with code

None.

Impact to Small Business relative to the cost of compliance with code

This proposal should not negatively impact small business.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

This proposal would help ensure that every home achieves at least a minimal level of energy efficiency and comfort by requiring a reasonable thermal envelope.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Improves the code by creating a homeowner "safety net" for efficiency.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

No.

Does not degrade the effectiveness of the code

No.

Is the proposed code modification part of a prior code version? No

1st Comment Period History

EN6934-G1

Proponent Charles Cottrell **Submitted** 2/24/2016 **Attachments** No

Comment:

Modification EN6934 – Applying the 2009 IECC Envelope Backstop of the ERI to the Performance Path: NAIMA strongly supports the proposal and reason statement filed by the Responsible Energy Code Alliance (RECA) adding a thermal envelope backstop from the ERI to the performance path.

While the 2015 IECC introduced the ERI performance path to give builders additional flexibility, it also recognized the importance of retaining minimum standards for the thermal envelope. As a consequence, the IECC requires that homes complying with the ERI path meet, at a minimum, the 2009 IECC prescriptive standards for thermal envelope components. We believe this is a reasonable requirement to place on all new home construction, irrespective of any trade-off that might be allowed within the Florida Building Code.

1st Comment Period History

EN6934-G2

Proponent Jeff Sonne / FSEC **Submitted** 2/25/2016 **Attachments** No

Comment:

We feel that the additional performance compliance method stringency that this mod proposes is overly restrictive; the performance method is intended to allow "trade-offs" which account for less efficient components. It appears this mod would not allow any compliance method option for which glazed fenestration with an SHGC over 0.30 could be used.

1st Comment Period History

EN6934-G3

Proponent Jay Crandell **Submitted** 2/25/2016 **Attachments** No

Comment:

Proposal EN6934 should be approved only as a reasonable and secondary alternative to the preferred solution in proposal EN6935 by the same proponent to eliminate the equipment efficiency trade-off loophole. The reason for supporting this proposal are consistent with the reasons given by comment to proposal EN6935. Maintaining an adequate level of building envelope thermal efficiency is fundamentally important to long-term energy savings and performance because the envelope is present and must function for the life of the building. It is the foundation for energy efficiency and cannot easily be improved later in the life of a building.

1st Comment Period History

EN6934-G4

Proponent Michael Fischer **Submitted** 2/25/2016 **Attachments** No

Comment:

Kellen supports this common sense backstop and urges adoption. If equipment tradeoffs are to be permitted, it is important that basic minimum requirements be met.

Revise Section R405.2 as follows:

R405.2 Mandatory requirements. Compliance with this section requires that: (i) the mandatory provisions identified in Section R401.2 shall be met; (ii) all building thermal envelope components (insulation and fenestration) shall comply with the building thermal envelope requirements specified under Section R406.2; and (iii) all. ~~All~~ supply and return ducts not completely inside the *building thermal envelope* shall be insulated to a minimum of R-6.

Revise Section R405.2 as follows:

R405.2 Mandatory requirements. Compliance with this section requires that~~: (i)~~ the mandatory provisions identified in Section R401.2 shall be met.~~; (ii)~~ The proposed total building thermal envelope UA, which is the sum of U-factor times the assembly area, shall be less than or equal to the UA of the building thermal envelope using the prescriptive U-factors from Table R402.1.4 multiplied by 1.15 in accordance with Equation 4-1. The area-weighted average maximum fenestration SHGC permitted shall be 0.40. ~~all building thermal envelope components (insulation and fenestration) shall comply with the building thermal envelope requirements specified under Section R406.2; and (iii)~~ ~~a~~All supply and return ducts not completely inside the *building thermal envelope* shall be insulated to a minimum of R-6.

$UA_{proposed\ design} = 1.15 * UA_{prescriptive\ reference\ design}$ Equation 4-1

Date Submitted	12/30/2015	**Section**	403.7.1.1	**Proponent**	Jeff Sonne / FSEC
Chapter	4	**Affects HVHZ**	No	**Attachments**	No

TAC Recommendation No Affirmative Recommendation with a Second

Commission Action Pending Review

Comments

General Comments **No**

Alternate Language **Yes**

Related Modifications

Summary of Modification

Variable capacity equipment sizing exception.

Rationale

Allows for the opportunity of variable capacity equipment to operate at more efficient lower capacity stages more often, thereby consuming less energy while meeting load. Reference: http://fsec.ucf.edu/en/publications/pdf/FSEC-PF-459-14.pdf.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Code officials will need to be aware of this code exception; otherwise none.

Impact to building and property owners relative to cost of compliance with code

This is a voluntary option that enables owners and occupants to reap greater space conditioning energy savings than existing code.

Impact to industry relative to the cost of compliance with code

None; optional.

Impact to small business relative to the cost of compliance with code

None; optional.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

There is no negative impact. Oversized variable capacity systems will operate at the lower stages more often at which they are quieter.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Improves the code by allowing owners and occupants to reap greater space conditioning energy savings than existing code

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate; provides another option.

Does not degrade the effectiveness of the code

Does not degrade effectiveness of the code; only provides an option.

Is the proposed code modification part of a prior code version? No

2nd Comment Period

6938-A1

Proponent Jeff Sonne / FSEC **Submitted** 6/20/2016 **Attachments** Yes

Rationale

Mod A-1 is similar to the original mod (allows for the opportunity of variable capacity equipment to operate at more efficient lower capacity stages more often, thereby consuming less energy while meeting load), except A-1 adds two-capacity and three-capacity systems and sizing limits are now based on ACCA Manual S Tables N2-1 and N2-2.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Same as original mod-- code officials will need to be aware of this code exception; otherwise none.

Impact to building and property owners relative to cost of compliance with code

Same as original mod-- this is a voluntary option that enables owners and occupants to reap greater space conditioning energy savings than existing code.

Impact to industry relative to the cost of compliance with code

None; optional.

Impact to Small Business relative to the cost of compliance with code

None; optional.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

There is no negative impact. Oversized variable capacity systems will operate at the lower stages more often at which they are quieter and more efficient.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Improves the code by allowing owners and occupants to reap greater space conditioning energy savings than existing code.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate; provides another option.

Does not degrade the effectiveness of the code

Does not degrade effectiveness of the code; only provides an option.

Is the proposed code modification part of a prior code version? No

R403.7.1.1 Cooling equipment capacity. Cooling only equipment shall be selected so that its total capacity is not less than the calculated total load but not more than 1.15 times greater than the total load calculated according to the procedure selected in Section 403.7, or the closest available size provided by the manufacturer's product lines. The corresponding latent capacity of the equipment shall not be less than the calculated latent load.

The published value for AHRI total capacity is a nominal, rating-test value and shall not be used for equipment sizing. Manufacturer's expanded performance data shall be used to select cooling-only equipment. This selection shall be based on the outdoor design dry bulb temperature for the load calculation (or entering water temperature for water-source equipment), the blower CFM provided by the expanded performance data, the design value for entering wet bulb temperature and the design value for entering dry bulb temperature.

Design values for entering wet bulb and dry bulb temperature shall be for the indoor dry bulb and relative humidity used for the load calculation and shall be adjusted for return side gains if the return duct(s) is installed in an unconditioned space.

Exceptions:

1. Attached single- and multiple-family residential equipment sizing may be selected so that its cooling capacity is less than the calculated total sensible load but not less than 80 percent of that load.

2. When signed and sealed by a Florida-registered engineer, in attached single- and multiple-family units, the capacity of equipment may be sized in accordance with good design practice.

3. Variable capacity systems capable of delivering at least four different capacities may have a nominal rated size up to 1.5 times greater than the calculated total load.

R403.7.1.1 Cooling equipment capacity. Cooling only equipment shall be selected so that its total capacity is not less than the calculated total load but not more than 1.15 times greater than the total load calculated according to the procedure selected in Section 403.7, or the closest available size provided by the manufacturer's product lines. The corresponding latent capacity of the equipment shall not be less than the calculated latent load.

The published value for AHRI total capacity is a nominal, rating-test value and shall not be used for equipment sizing. Manufacturer's expanded performance data shall be used to select cooling-only equipment. This selection shall be based on the outdoor design dry bulb temperature for the load calculation (or entering water temperature for water-source equipment), the blower CFM provided by the expanded performance data, the design value for entering wet bulb temperature and the design value for entering dry bulb temperature.

Design values for entering wet bulb and dry bulb temperature shall be for the indoor dry bulb and relative humidity used for the load calculation and shall be adjusted for return side gains if the return duct(s) is installed in an unconditioned space.

Exceptions:

1. Attached single- and multiple-family residential equipment sizing may be selected so that its cooling capacity is less than the calculated total sensible load but not less than 80 percent of that load.

2. When signed and sealed by a Florida-registered engineer, in attached single- and multiple-family units, the capacity of equipment may be sized in accordance with good design practice.

3. Two-capacity or three-capacity systems may have a nominal rated size up to 1.2 times greater than the calculated total load and variable-capacity systems capable of delivering at least four different capacities may have a nominal rated size up to 1.3 times greater than the calculated total load.

Date Submitted	12/31/2015	**Section**	402.1.2	**Proponent**	Jeff Sonne / FSEC
Chapter	4	**Affects HVHZ**	No	**Attachments**	No

TAC Recommendation No Affirmative Recommendation with a Second

Commission Action Pending Review

Comments

General Comments No

Alternate Language Yes

Related Modifications

Summary of Modification

Limit prescriptive compliance glazed fenestration area as a fraction of total house conditioned area.

Rationale

Houses that have large glazed areas will have increased energy use relative to those with less glazed area. Historically most builders comply using the performance method where the actual home is compared against a home that has a limited amount of glazed area. This modification allows homes to continue to comply using the performance method and avoids having new homes that will have excessive air conditioning use due to large glazed areas relative to floor area. Some homes with very high glazed areas may also cause extra load at peak times on utilities. Florida homes main energy use is through air conditioning and windows allow our sun to pass through it and are one of the main loads for a house. Thus this change is more applicable to Florida than other locations. Furthermore, very high glazed fenestration area homes (upscale custom homes) have been built in Florida.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Very little as this only applies to a small portion of homes.

Impact to building and property owners relative to cost of compliance with code

Will force those homes with high glazing areas relative to floor area to maintain the same level of energy performance as homes with standard amounts of glazing to floor areas.

Impact to industry relative to the cost of compliance with code

For most homes this change would not have any impact. For those homes where it might cause a change a builder can comply in any number of ways, from better windows to better HVAC equipment using the performance method.

Impact to small business relative to the cost of compliance with code

None.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

The purpose of the energy code is to avoid high energy use new homes. Without this requirement there is no assurance that a new home might not use as much energy as many 20-year old homes of the same size.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Yes, this strengthens the code by limiting energy use in some cases.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate.

Does not degrade the effectiveness of the code

Increases code effectiveness by limiting energy use in some cases.

Is the proposed code modification part of a prior code version?

YES

The provisions contained in the proposed amendment are addressed in the applicable international code?

NO

The amendment demonstrates by evidence or data that the geographical jurisdiction of Florida exihibits a need to strengthen the foundation code beyond the needs or regional variation addressed by the foundation code and why the proposed amendment applies to the state?

OTHER

Explanation of Choice

This has more bearing on Florida due to the homes we build and our high air conditioning load.

The proposed amendment was submitted or attempted to be included in the foundation codes to avoid resubmission to the Florida Building Code amendment process?

YES

2nd Comment Period

6980-A1

Proponent Jeff Sonne / FSEC **Submitted** 6/20/2016 **Attachments** Yes

Rationale

Please also see rationale for original mod. This A1 mod is the same as the original mod, except an exception has been added which removes the glazing area limit for additions and replacements. As noted in the original mod's rationale, houses that have large glazed areas will have increased energy use relative to those with less glazed area. EnergyGauge USA performance compliance runs have been made for three actual southwest Florida houses with high glass to floor areas (GFAs). The only changes made to these houses were to substitute prescriptive minimum efficiencies where applicable and since they are not required for prescriptive compliance, remove window overhangs. A house from this group with a 0.333 GFA and another with a 0.498 GFA failed the performance method with an e-Ratio of 1.16 each and another house with a 0.610 GFA failed the performance method with an e-Ratio of 1.17. So while these high GFA projects all pass prescriptive compliance, they do not pass performance compliance by a significant amount. There is also long-term Florida Code precedent for prescriptive GFA limits; the residential Florida Energy Conservation Codes through the 2010 edition all included these limits. The 20% limit is chosen as a value consistent with the value approved by the FBC for the 2010 Florida code. The 20% limit allows most tract housing to comply using the prescriptive method, but would require housing with higher glass to floor area ratios to comply using the performance method where, if they have overhangs or high efficiency equipment they may comply without any changes, but if not, they would need to incorporate efficiency measures of some type. For the above reasons, FSEC highly recommends that the 20% prescriptive glazing limit provided in this proposal be approved.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Very little as especially with the A-1 mod changes, this only applies to a small portion of homes.

Impact to building and property owners relative to cost of compliance with code

Will force those homes with high glazing areas relative to floor area to maintain the same level of energy performance as homes with standard amounts of glazing to floor areas. A-1 mod removes this requirement for additions and replacements.

Impact to industry relative to the cost of compliance with code

For most homes this change would not have any impact. For those homes where it might cause a change a builder can comply in any number of ways, from better windows to better HVAC equipment using the performance method.

Impact to Small Business relative to the cost of compliance with code

None.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

The purpose of the energy code is to avoid high energy use new homes. Without this requirement there is no assurance that a new home might not use as much energy as many 20-year old homes of the same size.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Yes, this strengthens the code by limiting energy use in some cases.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate.

Does not degrade the effectiveness of the code

Increases code effectiveness by limiting energy use in some cases.

Is the proposed code modification part of a prior code version?

YES

The provisions contained in the proposed amendment are addressed in the applicable international code?

NO

The amendment demonstrates by evidence or data that the geographical jurisdiction of Florida exihibits a need to strengthen the foundation code beyond the needs or regional variation addressed by the foundation code and why the proposed amendment applies to the state?

OTHER

Explanation of Choice

This has more bearing on Florida due to the homes we build and our high air conditioning load.

The proposed amendment was submitted or attempted to be included in the foundation codes to avoid resubmission to the Florida Building Code amendment process?

OTHER

Explanation of Choice

Original mod, yes; A-1 mod, no.

1st Comment Period History

EN6980-G1

Proponent Eric Lacey **Submitted** 2/25/2016 **Attachments** Yes

Comment:

See attached comment.

1st Comment Period History

EN6980-G2

Proponent Jeff Sonne / FSEC **Submitted** 2/25/2016 **Attachments** No

Comment:

We disagree with the logic presented in general comment EN6980-G1 for rejecting this mod. The lack of window limits on the prescriptive path allow homes that would fail compliance under any performance path where the reference home has upper limits of glass. These houses could consume considerably more energy than homes built to earlier Florida codes (2010 and earlier) that included such limits. Many very large homes (some with more than 10,000 square feet) exceed the 20% threshold proposed and could end up costing Floridians considerable cost by increasing peak power demand. Our long summer weather and contemporary housing styles make Florida particularly sensitive to this loophole in IECC that the Commission had, up until 2014, correctly avoided. Homes with more glass will be able to comply by incorporating other efficiency measures using the performance method.

1st Comment Period History

EN6980-G3

Proponent Jeff Inks **Submitted** 2/25/2016 **Attachments** No

Comment:

The Window & Door Manufacturers Association believes this proposed amendment should be rejected for several reasons. In particular the proposed 20% maximum glazed area is an arbitrary value and has not been substantiated by any sound data regarding energy efficiency gains that will result -- nor is there substation that this amendment is needed in the jurisdiction of Florida or elsewhere. Furthermore, while we don't dispute that houses with large glazed areas may have greater energy use than a similar home with less glazing, that can be for many reasons and is not true in all cases. Asserting otherwise ignores all of the other aspects of the building design, construction and operation that impact the efficiency of the building, as well as the other beneficial attributes provided by the glazed areas. A home with a large glazed area can also have lessened energy use relative to those with a less glazed area.

1st Comment Period History

EN6980-G4

Proponent Jeff Sonne / FSEC **Submitted** 2/25/2016 **Attachments** No

Comment:

Concerning general comment 6980-G3, the commenter states the following:

"Furthermore, while we don't dispute that houses with large glazed areas may have greater energy use than a similar home with less glazing, that can be for many reasons and is not true in all cases. Asserting otherwise ignores all of the other aspects of the building design, construction and operation that impact the efficiency of the building, as well as the other beneficial attributes provided by the glazed areas. A home with a large glazed area can also have lessened energy use relative to those with a less glazed area."

FSEC agrees with this statement and believes that the performance method would indeed determine if the house uses too much energy or has incorporated the design parameters that would indeed allow it to use less energy. We believe this comment makes an argument for accepting FSEC's 6980 mod as originally submitted.

TABLE R402.1.1

INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTORbj	SKYLIGHTb *U*-FACTOR	GLAZED FENESTRATION SHGCb, e	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUEi	FLOOR *R*-VALUE	BASEMEN WALL *R*-VALUE
1	.65	0.75	0.25	30	13	3/4	13	0
2	0.40	0.65	0.25	38	13	4/6	13	0
3	0.35	0.55	0.25	38	20 or 13+5h	8/13	19	5/13f
4 except Marine	0.35	0.55	0.40	49	20 or 13+5h	8/13	19	10 /13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5h	13/17	30g	15/19
6	0.32	0.55	NR	49	20+5 or 13+10h	15/20	30g	15/19
7 and 8	0.32	0.55	NR	49	20+5 or 13+10h	19/21	38g	15/19

[No change to table or footnotes a, and c – j]

b. The sum of all glazed fenestration areas must be <= 0.20 * conditioned floor area. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in climate zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.

TABLE R402.1.1

INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE
1	.65	0.75	0.25	30	13	3/4	13	0
2	0.40	0.65	0.25	38	13	4/6	13	0
3	0.35	0.55	0.25	38	20 or 13+5h	8/13	19	5/13f
4 except Marine	0.35	0.55	0.40	49	20 or 13+5h	8/13	19	10 /13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5h	13/17	30g	15/19
6	0.32	0.55	NR	49	20+5 or 13+10h	15/20	30g	15/19
7 and 8	0.32	0.55	NR	49	20+5 or 13+10h	19/21	38g	15/19

[No change to table or footnotes a and c – j]

b. Except for additions and replacements, the sum of all glazed fenestration areas must be <= 0.20 * conditioned floor area. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in climate zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.

Responsible Energy Codes Alliance Comment on Proposal EN6980

Proposals EN6980, 6981, and 6982 all attempt to apply a 20% glazing area limitation to the prescriptive-based compliance options in the IECC. This proposal is inconsistent with the IECC, and is an unnecessary complication of the prescriptive compliance options. The component-based prescriptive path, the assembly based U-factor alternative, and the Total UA approach are all designed to be simple, straightforward, efficient means of complying with the IECC. These simple options have served builders and code officials well, because the "rules of the game" are clearly spelled out for all parties. Applying glazing area limitations on these paths will not only complicate these straightforward options, but could also drive more builders toward the performance path, where compliance and enforcement are significantly more complicated. We recommend that the Commission reject these three proposals and maintain consistency with the IECC on this issue.

Date Submitted	12/31/2015	**Section**	402.1.4	**Proponent**	Jeff Sonne / FSEC
Chapter	4	**Affects HVHZ**	No	**Attachments**	No

TAC Recommendation No Affirmative Recommendation with a Second

Commission Action Pending Review

Comments

General Comments No

Alternate Language Yes

Related Modifications

6980

Summary of Modification

Limit prescriptive U-factor Alternative compliance glazed fenestration area as a fraction of total house conditioned area.

Rationale

Houses that have large glazed areas will have increased energy use relative to those with less glazed area. Historically most builders comply using the performance method where the actual home is compared against a home that has a limited amount of glazed area. This modification allows homes to continue to comply using the performance method and avoids having new homes that will have excessive air conditioning use due to large glazed areas relative to floor area. Some homes with very high glazed areas may also cause extra load at peak times on utilities. Florida homes main energy use is through air conditioning and windows allow our sun to pass through it and are one of the main loads for a house. Thus this change is more applicable to Florida than other locations. Furthermore, very high glazed fenestration area homes (upscale custom homes) have been built in Florida.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Very little as this only applies to a small portion of homes.

Impact to building and property owners relative to cost of compliance with code

Will force those homes with high glazing areas relative to floor area to maintain the same level of energy performance as homes with standard amounts of glazing to floor areas.

Impact to industry relative to the cost of compliance with code

For most homes this change would not have any impact. For those homes where it might cause a change a builder can comply in any number of ways, from better windows to better HVAC equipment using the performance method.

Impact to small business relative to the cost of compliance with code

None.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

The purpose of the energy code is to avoid high energy use new homes. Without this requirement there is no assurance that a new home might not use as much energy as many 20-year old homes of the same size.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Yes, this strengthens the code by limiting energy use in some cases.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate.

Does not degrade the effectiveness of the code

Increases code effectiveness by limiting energy use in some cases.

Is the proposed code modification part of a prior code version?

YES

The provisions contained in the proposed amendment are addressed in the applicable international code?

NO

The amendment demonstrates by evidence or data that the geographical jurisdiction of Florida exihibits a need to strengthen the foundation code beyond the needs or regional variation addressed by the foundation code and why the proposed amendment applies to the state?

OTHER

Explanation of Choice

This has more bearing on Florida due to the homes we build and our high air conditioning load.

The proposed amendment was submitted or attempted to be included in the foundation codes to avoid resubmission to the Florida Building Code amendment process?

YES

Alternate Language

2nd Comment Period

6981-A1

Proponent Jeff Sonne / FSEC **Submitted** 6/20/2016 **Attachments** Yes

Rationale

Please also see rationale for original mod. In this A1 mod, an exception has been added which removes the glazing area limit for additions and replacements. As noted in the original mod's rationale, houses that have large glazed areas will have increased energy use relative to those with less glazed area. EnergyGauge USA performance compliance runs have been made for three actual southwest Florida houses with high glass to floor areas (GFAs). The only changes made to these houses were to substitute prescriptive minimum efficiencies where applicable and since they are not required for prescriptive compliance, remove window overhangs. A house from this group with a 0.333 GFA and another with a 0.498 GFA failed the performance method with an e-Ratio of 1.16 each and another house with a 0.610 GFA failed the performance method with an e-Ratio of 1.17. So while these high GFA projects all pass prescriptive compliance, they do not pass performance compliance by a significant amount. There is also long-term Florida Code precedent for prescriptive GFA limits; the residential Florida Energy Conservation Codes through the 2010 edition all included these limits. The 20% limit is chosen as a value consistent with the value approved by the FBC for the 2010 Florida code. The 20% limit allows most tract housing to comply using the prescriptive method, but would require housing with higher glass to floor area ratios to comply using the performance method where, if they have overhangs or high efficiency equipment they may comply without any changes, but if not, they would need to incorporate efficiency measures of some type. For the above reasons, FSEC highly recommends that the 20% prescriptive glazing limit provided in this proposal be approved.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Very little as especially with the A1 mod changes, this only applies to a small portion of homes.

Impact to building and property owners relative to cost of compliance with code

Will force those homes with high glazing areas relative to floor area to maintain the same level of energy performance as homes with standard amounts of glazing to floor areas. A1 mod removes this requirement for additions and replacements.

Impact to industry relative to the cost of compliance with code

For most homes this change would not have any impact. For those homes where it might cause a change a builder can comply in any number of ways, from better windows to better HVAC equipment using the performance method.

Impact to Small Business relative to the cost of compliance with code

None.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

The purpose of the energy code is to avoid high energy use new homes. Without this requirement there is no assurance that a new home might not use as much energy as many 20-year old homes of the same size.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Yes, this strengthens the code by limiting energy use in some cases.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate.

Does not degrade the effectiveness of the code

Increases code effectiveness by limiting energy use in some cases.

Is the proposed code modification part of a prior code version?

YES

The provisions contained in the proposed amendment are addressed in the applicable international code?

NO

The amendment demonstrates by evidence or data that the geographical jurisdiction of Florida exihibits a need to strengthen the foundation code beyond the needs or regional variation addressed by the foundation code and why the proposed amendment applies to the state?

OTHER

Explanation of Choice

This has more bearing on Florida due to the homes we build and our high air conditioning load.

The proposed amendment was submitted or attempted to be included in the foundation codes to avoid resubmission to the Florida Building Code amendment process?

OTHER

Explanation of Choice

Original mod, yes; A1 mod, no.

1st Comment Period History

EN6981-G1

Proponent Eric Lacey **Submitted** 2/25/2016 **Attachments** Yes

Comment:

See attached comment.

1st Comment Period History

EN6981-G2

Proponent Jeff Sonne / FSEC **Submitted** 2/25/2016 **Attachments** No

Comment:

We disagree with the logic presented in general comment EN6981-G1 for rejecting this mod. The lack of window limits on the prescriptive path allow homes that would fail compliance under any performance path where the reference home has upper limits of glass. These houses could consume considerably more energy than homes built to earlier Florida codes (2010 and earlier) that included such limits. Many very large homes (some with more than 10,000 square feet) exceed the 20% threshold proposed and could end up costing Floridians considerable cost by increasing peak power demand. Our long summer weather and contemporary housing styles make Florida particularly sensitive to this loophole in IECC that the Commission had, up until 2014, correctly avoided. Homes with more glass will be able to comply by incorporating other efficiency measures using the performance method.

1st Comment Period History

EN6981-G3

Proponent Jeff Inks **Submitted** 2/25/2016 **Attachments** No

Comment:

The Window & Door Manufacturers Association believes this proposed amendment should be rejected for several reasons. In particular the proposed 20% maximum glazed area is an arbitrary value and has not been substantiated by any sound data regarding energy efficiency gains that will result -- nor is there substation that this amendment is needed in the jurisdiction of Florida or elsewhere. There is also no substantiation for why this should be a condition for the use of the U-factor alternative provision or of the improvement in energy efficiency that results, and it undermines the intent of the provision to provide reasonable flexibility.

Furthermore, while we don't dispute that houses with large glazed areas may have greater energy use than a similar home with less glazing, that can be for many reasons and is not true in all cases. Asserting otherwise ignores all of the other aspects of the building design, construction and operation that impact the efficiency of the building, as well as the other beneficial attributes provided by the glazed areas. A home with a large glazed area can also have lessened energy use relative to those with a less glazed area.

1st Comment Period History

EN6981-G4

Proponent Jeff Sonne / FSEC **Submitted** 2/25/2016 **Attachments** No

Comment:

Concerning general comment 6981-G3, the commenter states the following:

"Furthermore, while we don't dispute that houses with large glazed areas may have greater energy use than a similar home with less glazing, that can be for many reasons and is not true in all cases. Asserting otherwise ignores all of the other aspects of the building design, construction and operation that impact the efficiency of the building, as well as the other beneficial attributes provided by the glazed areas. A home with a large glazed area can also have lessened energy use relative to those with a less glazed area."

FSEC agrees with this statement and believes that the performance method would indeed determine if the house uses too much energy or has incorporated the design parameters that would indeed allow it to use less energy. We believe this comment makes an argument for accepting FSEC's 6981 mod as originally submitted.

R402.1.4 U-factor Alternative. An assembly with a U-factor equal to or less than that specified in Table R402.1.3 shall be permitted as an alternative to the R-value in Table R402.1.1. The U-factor Alternative method shall only apply to residences where the sum of all glazed fenestration areas is <= 20% of the conditioned floor area of the residence.

[A1 text includes original mod and adds an exception:]

R402.1.4 U-factor alternative. An assembly with a U-factor equal to or less than that specified in Table R402.1.3 shall be permitted as an alternative to the R-value in Table R402.1.1. The U-factor alternative method shall only apply to residences where the sum of all glazed fenestration areas is <= 20% of the conditioned floor area of the residence.

Exception: the glazed fenestration area limit does not apply to additions or replacements.

Responsible Energy Codes Alliance Comment on Proposal EN6981

Proposals EN6980, 6981, and 6982 all attempt to apply a 20% glazing area limitation to the prescriptive-based compliance options in the IECC. This proposal is inconsistent with the IECC, and is an unnecessary complication of the prescriptive compliance options. The component-based prescriptive path, the assembly based U-factor alternative, and the Total UA approach are all designed to be simple, straightforward, efficient means of complying with the IECC. These simple options have served builders and code officials well, because the "rules of the game" are clearly spelled out for all parties. Applying glazing area limitations on these paths will not only complicate these straightforward options, but could also drive more builders toward the performance path, where compliance and enforcement are significantly more complicated. We recommend that the Commission reject these three proposals and maintain consistency with the IECC on this issue.

Date Submitted	12/31/2015	**Section**	402.1.5	**Proponent**	Jeff Sonne / FSEC
Chapter	4	**Affects HVHZ**	No	**Attachments**	No

TAC Recommendation No Affirmative Recommendation with a Second

Commission Action Pending Review

Comments

General Comments No

Alternate Language Yes

Related Modifications

6980 and 6981

Summary of Modification

Limit prescriptive Total UA Alternative compliance glazed fenestration area as a fraction of total house conditioned area.

Rationale

Houses that have large glazed areas will have increased energy use relative to those with less glazed area. Historically most builders comply using the performance method where the actual home is compared against a home that has a limited amount of glazed area. This modification allows homes to continue to comply using the performance method and avoids having new homes that will have excessive air conditioning use due to large glazed areas relative to floor area. Some homes with very high glazed areas may also cause extra load at peak times on utilities. Florida homes main energy use is through air conditioning and windows allow our sun to pass through it and are one of the main loads for a house. Thus this change is more applicable to Florida than other locations. Furthermore, very high glazed fenestration area homes (upscale custom homes) have been built in Florida.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Very little as this only applies to a small portion of homes.

Impact to building and property owners relative to cost of compliance with code

Will force those homes with high glazing areas relative to floor area to maintain the same level of energy performance as homes with standard amounts of glazing to floor areas.

Impact to industry relative to the cost of compliance with code

For most homes this change would not have any impact. For those homes where it might cause a change a builder can comply in any number of ways, from better windows to better HVAC equipment using the performance method.

Impact to small business relative to the cost of compliance with code

None.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

The purpose of the energy code is to avoid high energy use new homes. Without this requirement there is no assurance that a new home might not use as much energy as many 20-year old homes of the same size.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Yes, this strengthens the code by limiting energy use in some cases.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate.

Does not degrade the effectiveness of the code

Increases code effectiveness by limiting energy use in some cases.

Is the proposed code modification part of a prior code version?

YES

The provisions contained in the proposed amendment are addressed in the applicable international code?

NO

The amendment demonstrates by evidence or data that the geographical jurisdiction of Florida exihibits a need to strengthen the foundation code beyond the needs or regional variation addressed by the foundation code and why the proposed amendment applies to the state?

OTHER

Explanation of Choice

This has more bearing on Florida due to the homes we build and our high air conditioning load.

The proposed amendment was submitted or attempted to be included in the foundation codes to avoid resubmission to the Florida Building Code amendment process?

YES

2nd Comment Period

6982-A1

Proponent Jeff Sonne / FSEC **Submitted** 6/20/2016 **Attachments** Yes

Rationale

Please also see rationale for original mod. In this A1 mod, an exception has been added which removes the glazing area limit for additions and replacements. As noted in the original mod's rationale, houses that have large glazed areas will have increased energy use relative to those with less glazed area. EnergyGauge USA performance compliance runs have been made for three actual southwest Florida houses with high glass to floor areas (GFAs). The only changes made to these houses were to substitute prescriptive minimum efficiencies where applicable and since they are not required for prescriptive compliance, remove window overhangs. A house from this group with a 0.333 GFA and another with a 0.498 GFA failed the performance method with an e-Ratio of 1.16 each and another house with a 0.610 GFA failed the performance method with an e-Ratio of 1.17. So while these high GFA projects all pass prescriptive compliance, they do not pass performance compliance by a significant amount. There is also long-term Florida Code precedent for prescriptive GFA limits; the residential Florida Energy Conservation Codes through the 2010 edition all included these limits. The 20% limit is chosen as a value consistent with the value approved by the FBC for the 2010 Florida code. The 20% limit allows most tract housing to comply using the prescriptive method, but would require housing with higher glass to floor area ratios to comply using the performance method where, if they have overhangs or high efficiency equipment they may comply without any changes, but if not, they would need to incorporate efficiency measures of some type. For the above reasons, FSEC highly recommends that the 20% prescriptive glazing limit provided in this proposal be approved.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Very little as especially with the A1 mod changes, this only applies to a small portion of homes.

Impact to building and property owners relative to cost of compliance with code

Will force those homes with high glazing areas relative to floor area to maintain the same level of energy performance as homes with standard amounts of glazing to floor areas. A1 mod removes this requirement for additions and replacements.

Impact to industry relative to the cost of compliance with code

For most homes this change would not have any impact. For those homes where it might cause a change a builder can comply in any number of ways, from better windows to better HVAC equipment using the performance method.

Impact to Small Business relative to the cost of compliance with code

None.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

The purpose of the energy code is to avoid high energy use new homes. Without this requirement there is no assurance that a new home might not use as much energy as many 20-year old homes of the same size.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Yes, this strengthens the code by limiting energy use in some cases.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate.

Does not degrade the effectiveness of the code

Increases code effectiveness by limiting energy use in some cases.

Is the proposed code modification part of a prior code version?

YES

The provisions contained in the proposed amendment are addressed in the applicable international code?

NO

The amendment demonstrates by evidence or data that the geographical jurisdiction of Florida exihibits a need to strengthen the foundation code beyond the needs or regional variation addressed by the foundation code and why the proposed amendment applies to the state?

OTHER

Explanation of Choice

This has more bearing on Florida due to the homes we build and our high air conditioning load.

The proposed amendment was submitted or attempted to be included in the foundation codes to avoid resubmission to the Florida Building Code amendment process?

OTHER

Explanation of Choice

Original mod, yes; A1 mod, no.

1st Comment Period History

EN6982-G1

Proponent Eric Lacey **Submitted** 2/25/2016 **Attachments** Yes

Comment:

See attached comment.

1st Comment Period History

EN6982-G2

Proponent Jeff Sonne / FSEC **Submitted** 2/25/2016 **Attachments** No

Comment:

We disagree with the logic presented in general comment EN6982-G1 for rejecting this mod. The lack of window limits on the prescriptive path allow homes that would fail compliance under any performance path where the reference home has upper limits of glass. These houses could consume considerably more energy than homes built to earlier Florida codes (2010 and earlier) that included such limits. Many very large homes (some with more than 10,000 square feet) exceed the 20% threshold proposed and could end up costing Floridians considerable cost by increasing peak power demand. Our long summer weather and contemporary housing styles make Florida particularly sensitive to this loophole in IECC that the Commission had, up until 2014, correctly avoided. Homes with more glass will be able to comply by incorporating other efficiency measures using the performance method.

1st Comment Period History

EN6982-G3

Proponent Jeff Inks **Submitted** 2/25/2016 **Attachments** No

Comment:

The Window & Door Manufacturers Association believes this proposed amendment should be rejected for several reasons. In particular the proposed 20% maximum glazed area is an arbitrary value and has not been substantiated by any sound data regarding energy efficiency gains that will result -- nor is there substation that this amendment is needed in the jurisdiction of Florida or elsewhere. There is also no substantiation for why this should be a condition for the use of the Total UA Alternative provision or of the improvement in energy efficiency that results, and it undermines the intent of the provision to provide reasonable flexibility.

Furthermore, while we don't dispute that houses with large glazed areas may have greater energy use than a similar home with less glazing, that can be for many reasons and is not true in all cases. Asserting otherwise ignores all of the other aspects of the building design, construction and operation that impact the efficiency of the building, as well as the other beneficial attributes provided by the glazed areas. A home with a large glazed area can also have lessened energy use relative to those with a less glazed area.

1st Comment Period History

EN6982-G4

Proponent Jeff Sonne / FSEC **Submitted** 2/25/2016 **Attachments** No

Comment:

Concerning general comment 6982-G3, the commenter states the following:

"Furthermore, while we don't dispute that houses with large glazed areas may have greater energy use than a similar home with less glazing, that can be for many reasons and is not true in all cases. Asserting otherwise ignores all of the other aspects of the building design, construction and operation that impact the efficiency of the building, as well as the other beneficial attributes provided by the glazed areas. A home with a large glazed area can also have lessened energy use relative to those with a less glazed area."

FSEC agrees with this statement and believes that the performance method would indeed determine if the house uses too much energy or has incorporated the design parameters that would indeed allow it to use less energy. We believe this comment makes an argument for accepting FSEC's 6982 mod as originally submitted.

R402.1.5 Total UA Alternative. If the total building thermal envelope UA (sum of U-factor times assembly area) is less than or equal to the total UA resulting from using the U-factors in Table R402.1.4 (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with Table R402.1.~~2~~1. The UA calculation shall be done using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials. The SHGC requirements shall be met in addition to UA compliance. The Total UA Alternative method shall only apply to residences where the sum of all glazed fenestration areas is <= 20% of the conditioned floor area of the residence.

[A1 text includes original mod and adds an exception:]

R402.1.5 Total UA alternative. If the total building thermal envelope UA (sum of U-factor times assembly area) is less than or equal to the total UA resulting from using the U-factors in Table R402.1.4 (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with Table R402.1.~~2~~1. The UA calculation shall be done using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials. The SHGC requirements shall be met in addition to UA compliance. The Total UA alternative method shall only apply to residences where the sum of all glazed fenestration areas is <= 20% of the conditioned floor area of the residence.

Exception: The glazed fenestration area limit does not apply to additions or replacements.

Responsible Energy Codes Alliance Comment on Proposal EN6982

Proposals EN6980, 6981, and 6982 all attempt to apply a 20% glazing area limitation to the prescriptive-based compliance options in the IECC. This proposal is inconsistent with the IECC, and is an unnecessary complication of the prescriptive compliance options. The component-based prescriptive path, the assembly based U-factor alternative, and the Total UA approach are all designed to be simple, straightforward, efficient means of complying with the IECC. These simple options have served builders and code officials well, because the "rules of the game" are clearly spelled out for all parties. Applying glazing area limitations on these paths will not only complicate these straightforward options, but could also drive more builders toward the performance path, where compliance and enforcement are significantly more complicated. We recommend that the Commission reject these three proposals and maintain consistency with the IECC on this issue.

Date Submitted	12/31/2015	**Section**	403.7	**Proponent**	Jeff Sonne / FSEC
Chapter	4	**Affects HVHZ**	No	**Attachments**	No

TAC Recommendation No Affirmative Recommendation with a Second
Commission Action Pending Review

Comments

General Comments Yes **Alternate Language** No

Related Modifications

Summary of Modification

Keep 2015 IECC heating and cooling equipment efficiency requirements.

Rationale

We recommend the 2015 IECC efficiency text be retained / included in the 2017 Florida Energy Conservation Code to provide clear efficiency rating requirements that do not need to be updated to keep up with changes to the federal law. While Section R303.1.2 addresses cooling and heating equipment efficiency, it does not stipulate "the minimum required by federal law…."

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Consistent with federal law.

Impact to building and property owners relative to cost of compliance with code

None.

Impact to industry relative to the cost of compliance with code

None.

Impact to small business relative to the cost of compliance with code

None.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Yes, as the federal law limits have been vetted by government, manufacturers and energy advocates to be the best efficiency for any extra cost.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Yes; consistent with federal law.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate; consistent with federal law.

Does not degrade the effectiveness of the code

Increases the effectiveness of the code by making it clearer.

Is the proposed code modification part of a prior code version?

YES

The provisions contained in the proposed amendment are addressed in the applicable international code?

YES

The amendment demonstrates by evidence or data that the geographical jurisdiction of Florida exihibits a need to strengthen the foundation code beyond the needs or regional variation addressed by the foundation code and why the proposed amendment applies to the state?

OTHER

Explanation of Choice

Needs to be in the Florida code as it is federal law; not including it will cause confusion.

The proposed amendment was submitted or attempted to be included in the foundation codes to avoid resubmission to the Florida Building Code amendment process?

OTHER

Explanation of Choice

See above.

2nd Comment Period

EN6983-G2

Proponent Jeff Sonne / FSEC **Submitted** 6/20/2016 **Attachments** No

Comment:

When the NAECA Standards for equipment change, lower efficiency equipment is no longer manufactured. Therefore federal law is effectively preemptive.

1st Comment Period History

EN6983-G1

Proponent Eric Lacey **Submitted** 2/25/2016 **Attachments** Yes

Comment:

See attached comment.

[Starting from the Florida Supplement to 2015 IECC]

R403.7 Heating and Cooling Equipment (Mandatory).

R403.7.1 Equipment efficiency rating. New or replacement heating and cooling equipment shall have an efficiency rating equal to or greater than the minimum required by federal law for the geographic location where the equipment is installed.

R403.7.~~1~~2 Equipment sizing. [Renumber only; no text changes.]

R403.7.~~1~~2.1 Cooling equipment capacity. [Renumber only; no text changes.]

R403.7.~~1~~2.2 Heating equipment capacity. [Renumber only; no text changes.]

R403.7.~~1~~2.2.1 Heat Pumps. [Renumber only; no text changes.]

R403.7.~~1~~2.2.2 Electric resistance furnaces. [Renumber only; no text changes.]

R403.7.~~1~~2.2.3 Fossil fuel heating equipment. [Renumber only; no text changes.

R403.7.~~1~~2.3 Extra capacity required for special occasions. [Renumber only; no text changes.]

[No other changes to section.]

Responsible Energy Codes Alliance Comment on EN6983

RECA supports proposal EN6983 because it would adopt language contained in Section R403.7 of the 2015 IECC. The proposal does not actually establish any new requirements, but rather requires that equipment meet the federal efficiency standard that applies to Florida. The proposal improves the effectiveness of the code by reinforcing a practice that should already be taking place in plan review and inspection – verification of the efficiency rating of heating and cooling equipment. Although federal rules set the minimum efficiency levels for manufacturers, only code officials can determine whether equipment actually installed in buildings meets or exceeds the federal minimums. This will strengthen the role of the code official who must enforce these requirements.

This proposal is more important now than in the past because federal minimum efficiencies are shifting away from single nationwide efficiency levels to regionally-based efficiency levels that can vary from state to state. Air conditioners in Florida and several other southern states, for example, must meet a higher efficiency rating than air conditioners installed in the northern part of the country. It is possible, whether by accident or bad intent, to see equipment that would meet federal requirements in one jurisdiction used in other states or regions in which it does not meet the regional requirement. Although this verification may already be taking place during inspection or plan review, this proposal would make it a specific requirement in all buildings. We recommend approval of proposal EN6983.

Date Submitted	12/31/2015	**Section**	403.5.6.2	**Proponent**	Jeff Sonne / FSEC
Chapter	4	**Affects HVHZ**	No	**Attachments**	No

TAC Recommendation No Affirmative Recommendation with a Second

Commission Action Pending Review

Comments

General Comments Yes

Alternate Language No

Related Modifications

6983 and 7021

Summary of Modification

Make sure code is consistent with federal water heating equipment efficiency minimums.

Rationale

At times there is a conflict with the written code and the federal standards code and federal standards. This clarifies that the federal law/standards take precedence.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Consistent with federal law.

Impact to building and property owners relative to cost of compliance with code

None.

Impact to industry relative to the cost of compliance with code

None.

Impact to small business relative to the cost of compliance with code

None.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Yes, as the federal law limits have been vetted by government, manufacturers and energy advocates to be the best efficiency for any extra cost.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Yes; clarifies the code.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate; consistent with federal law.

Does not degrade the effectiveness of the code

Increases the effectiveness of the code by making it clearer.

Is the proposed code modification part of a prior code version? No

2nd Comment Period

EN6985-G1

Proponent Jeff Sonne / FSEC **Submitted** 6/20/2016 **Attachments** No

Comment:

When the NAECA Standards for equipment change, lower efficiency equipment is no longer manufactured. Therefore federal law is effectively preemptive.

R403.5.6.2 Water heating equipment. Water heating equipment installed in residential units shall meet the minimum efficienc~~iesy of~~ requirements specified in federal law or in their absence those specified in Table C404.2 in Chapter 4 of the *Florida Building Code, Energy Conservation,* Commercial Provisions, for the type of equipment installed. Equipment used to provide heating functions as part of a combination system shall satisfy all stated requirements for the appropriate water heating category. Solar water heaters shall meet the criteria of Section R403.5.6.2.1.

Date Submitted	12/31/2015	**Section**	405	**Proponent**	David Yarbrough
Chapter	4	**Affects HVHZ**	No	**Attachments**	Yes

TAC Recommendation No Affirmative Recommendation with a Second

Commission Action Pending Review

Comments

General Comments Yes

Alternate Language No

Related Modifications

Summary of Modification

Modification to require use of area averaged emittance when evaluating the performance of approved attic radiant barrier systems or assemblies. The area averaged emittance is used in the calculation of radiant heat transfer.

Rationale

The proposed addition to R405.7.1 represents an important clarification concerning performance calculations for attic radiant barrier configurations that have been approved. A detailed discussion of the radiation calculations and the correct use of emittance values is contained in the attached file MOD 7004 Text 141 Stovall.pdf. The attached document contains a detailed discussion of the appropriate emittance to use for radiant barrier performance calculations. The paper shows that the simple area weighed average for emittance is a good approximation for the installation methods that have been approved with installation diagrams provided. The proposed addition to the code will improve performance evaluations and result is distinguishing differences in the performance of the approved methods of installation. The area average emittance is easily calculated and input to manual or computer based performance evaluations.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

No known impact

Impact to building and property owners relative to cost of compliance with code

None

Impact to industry relative to the cost of compliance with code

None

Impact to small business relative to the cost of compliance with code

None

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Not related

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Provides a way to use an important input property for performance evaluations.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate

Does not degrade the effectiveness of the code

Does not degrade effectiveness

Is the proposed code modification part of a prior code version? No

2nd Comment Period

EN7004-G2

Proponent David Yarbrough **Submitted** 5/17/2016 **Attachments** No

Comment:

The proposed modification will not require a "radiant variable inspection". The proposed modification requires use of the product emittance data for evaluation of the energy savings. The product's "emittance" (or emissivity) is a property that appears on the product label and in the technical data sheets prepared by the manufacturer.

The proposal requires that the actual product emittance be used in evaluations.

1st Comment Period History

EN7004-G1

Proponent David Yarbrough **Submitted** 2/25/2016 **Attachments** No

Comment:

Add sentence to EN7004
Existing sentence. Table R405.7.1(1) contains e ave for selected attic radiant barrier systems with 16 in. or 24 in. OC framing.

Add the following: When a coating is applied to the roof deck and attached rafters or truss elements, then e ave shall be the emittance of the coating.

R405.7.1 Installation criteria for homes claiming the radiant barrier option.
The sheet radiant barrier or interior radiation control coating (IRCC) options may be claimed where the radiant barrier system is to be installed in one of the configurations depicted in Figure R405.7.1, and the following conditions are met:

1. It shall be fabricated over a ceiling insulated to a minimum of R-19 with conventional insulation and shall not be used as a means to achieve partial or whole compliance with a minimum attic insulation level of R-19. Either a sheet type or spray applied IRCC may be used.

2. If the radiant barrier material has only one surface with high reflectivity or low emissivity it shall be facing downward toward the ceiling insulation.

3. The attic airspace shall be vented in accordance with Section R806 of the *Florida Building Code, Residential.*

4. The radiant barrier system shall conform to ASTM C 1313, *Standard Specification for Sheet Radiant Barriers for Building Construction Applications,* or ASTM C 1321, *Standard Practice for Installation and Use of Interior Radiation Control Coating Systems (IRCCS) in Building Construction* as appropriate for the type of radiant barrier to be installed. The operative surface shall have an emissivity not greater than 0.06 for sheet radiant barriers or 0.25 for interior radiation control coatings, as demonstrated by independent laboratory testing according to ASTM C 1371.

5. The radiant barrier system (RBS) shall conform with ASTM C 1158, *Use and Installation of Radiant Barrier Systems (RBS) in Building Constructions for Sheet Radiant Barriers,* or ASTM C 1321, *Standard Practice for Installation and Use of Interior Radiation Control Coating Systems (IRCCS) in Building Construction* for IRCC systems.

6. The radiant barrier shall be installed so as to cover gable ends without closing off any soffit, gable or roof ventilation.

7. When installed in accordance with this section, the area average emittance, e_{ave}, obtained with emittance for wood surfaces of 0.9 shall be used in performance evaluations. Table R405.7.1(1) contains e_{ave} for selected attic radiant barrier systems with 16 in. or 24 in. OC framing.

Table R405.7.1(1) Area Averaged Emittances for Methods 1, 2, and 3

Installation	Method	Operative Surface Emittance	Area Averaged Emittance	
			16 in.	24 in.
1		0.03	0.03	0.03
		0.06	0.06	0.06
2 and 3		0.03	0.11	0.08
		0.06	0.14	0.11
		0.15	0.22	0.20

	0.25	0.31	0.29

Analysis in Support of the Radiant Barrier Fact Sheet 2010 Update

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ABSTRACT

Quantifying the benefits of radiant barriers is complex because the benefits depend upon the climate, attic geometry, duct arrangements, and other building parameters. Homeowners, however, require simplified guidance regarding building envelope options, even those options that seem to have no simple answers. An extensive parametric evaluation of radiant barrier installation alternatives was made using a newly expanded and benchmarked version of an attic simulation program. To complement this analysis, a detailed numerical analysis of radiation heat transfer within the attic and within the small space bounded by the rafters and the sheathing was completed. The results provide guidance for homeowners and builders.

INTRODUCTION

Extensive experimental work has identified the energy savings and peak-load reduction benefits of radiant barriers in attics in the southern climates of the U.S. Eight homes, all with air-handling equipment located in the attic, were retrofit with radiant barrier systems in 2000 in central Florida. Subsequent monitoring and data analysis showed cooling energy savings of 9%, peak load reduction of 16%, and an improvement in indoor comfort (Parker et al. 2001). Previous experimental work in Tennessee on uninhabited homes with no ductwork in the attic also showed significant cooling energy savings (Levins and Karnitz 1986a). Significant savings due to radiant barriers were also measured in controlled laboratory experiments, with and without duct systems in the attic (Petrie et al. 1998). Numerous other studies have established the energy conservation characteristics of a radiant barrier system, with and without the impact of ducts (Parker and Sherwin 1998; Levins and Karnitz 1986b; Parker et al. 1993; Wilkes 1991a). As expected, these studies point out the importance of multiple factors in determining the potential energy savings, most importantly: the climate, the amount of insulation on the floor of the attic, and the presence or absence of ductwork in the attic.

Builders are more likely to place ductwork in the attic in southern climates than in other parts of the country. In addition to providing a satisfactory cool-air distribution to ceiling registers, this location is often selected because it is economically expedient for the builder. About 80% of single family housing units (not including mobile homes) located in cooling climates (2,000 cooling degree days or more and less than 4,000 heating degree days) are built on a slab, ruling out the possibility of using basements or crawlspaces for the ductwork (Energy Information Administration 2005).

Energy-conscious consumers are faced with the decision of whether or not to include a radiant barrier in their home, and if so, what type of radiant barrier to install. A number of products are marketed as attic radiant barriers for use in residential applications. These include aluminum foil or metalized film-faced materials stapled to the bottom surface of rafters, placed on top of the attic floor insulation, roof sheathing materials with a foil-covered interior surface, and liquid-applied low-emittance coatings. The Department of Energy has long provided information fact sheets to inform consumers and to help them determine their likely energy savings. The current fact sheet, posted in the mid-1990s, provides a series of IRS-type forms for the calculation of savings.

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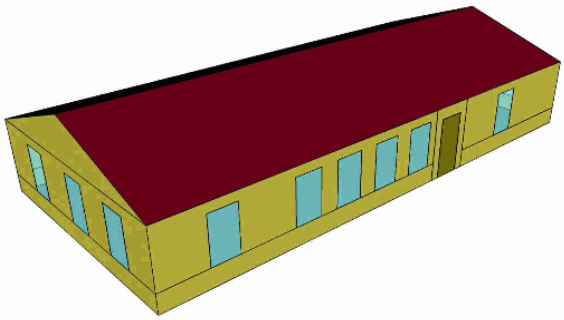

Figure 1 *Schematic of house used in EnergyPlus and AtticSim.*

The form was based on a large number of heat transfer calculations.

ANALYSIS APPROACH

The attic simulator, AtticSim, was developed to calculate the radiative, convective, and conductive energy exchanges in a specific attic geometry, with or without ducts (Wilkes 1991b; ASTM C1340 2009). This model has been benchmarked against experimental data from the controlled laboratory experiments, showing excellent accuracy for attics without ducts and moderate accuracy for attics with ducts. The attic model requires that the air temperature below the attic floor and the temperature and timing of air entering the ductwork be specified. To provide these values, a whole-building energy model, EnergyPlus, was used. This whole-building model includes leaking attic ducts and radiant energy exchange within the attic, but does not yet include radiant exchange between the attic surfaces and the duct surface (EnergyPlus 2009). These programs were coupled by using the same physical geometry and materials, the same weather data, and the same rate of duct leakage.

Both the attic and whole building calculations use a single emittance to represent the roof surface facing downward into the attic in order to maintain reasonable computation times, even though that surface can be a mixture of materials, such as reflective sheathing mounted upon a wooden rafter or truss system. This simplification was investigated during the course of this project by using different emittance values and realistic geometry in a multiple domain numerical analysis of the attic region.

COUPLED ENERGYPLUS-ATTICSIM ANALYSIS

The energy savings attributable to radiant barriers was calculated using a coupled AtticSim-EnergyPlus model. The current version of EnergyPlus (Version 4.0) ignores duct radiation heat exchange as well as duct heat transfer during conditioning equipment off-time. AtticSim is limited to simulating only the attic environment. Hence, input parameters for AtticSim, such as the temperature of the air provided by the conditioning equipment, the mean air temperature in the conditioned zone, supply air mass flow rate, duct air leakage rate, and conditioning equipment on-time were calculated using the building energy simulation program EnergyPlus. AtticSim results were used to estimate ceiling and duct heat transfers.

The Home Energy Rating System Building Energy Simulation Test (HERS BESTEST) Case L100A building model, shown in Figure 1, was used as a base building for this study (NREL/TP-472-7332a 1995). The building is a 57 ft × 27 ft single-story house with one conditioned zone, an unconditioned attic, and a vented crawl space. Although many of the homes in the southern climates are built on slabs, the crawl space foundation was retained in all zones for consistency. Because the temperature within the conditioned zone is considered to be well-mixed (i.e., no stratification), and is controlled to a setpoint, the air temperature below the attic floor (produced by EnergyPlus and used by AtticSim) should be unaffected by the foundation type. The foundation type would have a slight impact on the total house load, which would in turn impact the timing of the air entering the ductwork (the other EnergyPlus output used by the AtticSim model), but this should be a secondary effect, at worst. For example, if the total house load is changed by 10%, the total duct energy involved in the worst assumed leakage rate will change by 1.4%.

An hourly internal load schedule for the conditioned zone was also used as per the HERS BESTEST Case L100A building. The analysis was performed for eight cities, representing the eight ASHRAE climate zones, shown in Figure 2. For all climate zones, an interior 21.1°C (70°F) heating set point temperature and 23.9°C (75°F) cooling set point temperature were used.

Two levels of building quality were evaluated, one with adequate ceiling insulation (new), and one with minimal insulation (old). The new homes were taken to have code-level insulation, corresponding to R-30 for climate zones 1–3, R-38 for climate zones 4 and 5, and R-50 for climate zones 6–8. An

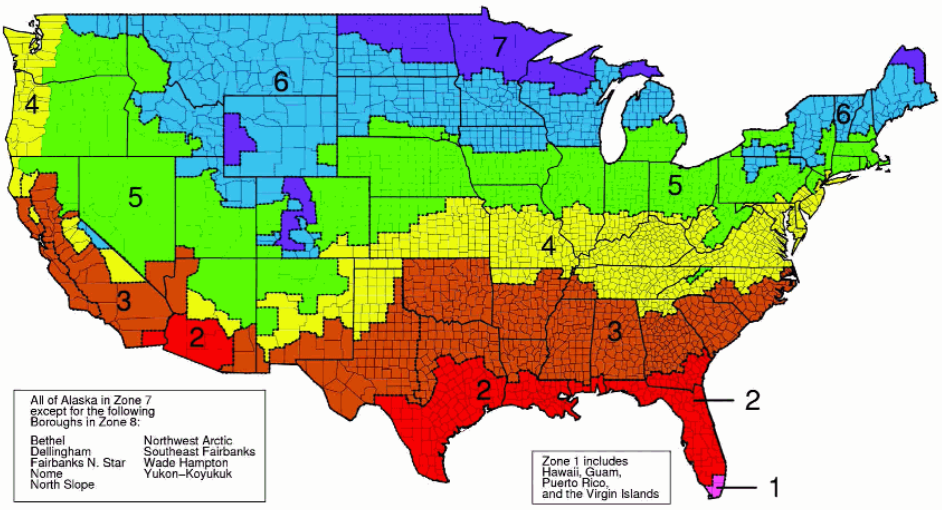

Figure 2 *Climatic zones used by ASHRAE and the IECC.*

attic insulation level of R-19 was used for the older home in all zones. Building air infiltration rates of one and two air changes per hour were used for the new and old homes, respectively. These leakage rates are consistent with those measured in a survey of 34 homes of various ages between 2004 and 2006, after adjusting the reported air change values at 50 Pa to 4 Pa, closer to the pressure difference that actually induces air exchange in homes (Antretter et al. 2007).

The study considered three cases for attic ducts, representing situations with no ducts (and therefore no duct losses), insulated and relatively tight ducts, and uninsulated leaky ducts. The leaky ducts were modeled with no insulation and 14±2% duct air leak. The better ducts were modeled with R-6 insulation and 4±1% duct air leakage. The EnergyPlus Airflow Network module was used to model the supply and return duct systems in an attic. In the Airflow Network module, the duct air leak for each moment in time is a function of four characteristic parameters ("Effective Leakage Ratio", "Maximum Flow Rate", "Reference Pressure Difference", and "Air Mass Flow Exponent") and two weather parameters (wind velocity and direction). The "Effective Leakage Ratio" was adjusted to get approximately the same duct air leakage rate, as a fraction of the total duct flow rate, for all climate zones.

To estimate the energy savings attributable to radiant barriers, four values of emittance (ε) for the downward-facing side of the interior attic space and the gable ends were considered; 0.05, 0.1, 0.2, and 0.9. The attic (that is, the top surface of the attic floor insulation) was given an emittance of 0.9. The building thermal load with no radiant barrier (ε = 0.9) was compared with the thermal loads with ε = 0.05, 0.1, and 0.2 to calculate the radiant barrier energy savings.

A DETAILED RADIATION MODEL OF THE RAFTER CAVITY SPACE WITHIN THE ATTIC ENVIRONMENT

The coupled AtticSim-EnergyPlus model requires the effective emittance of the downward-facing surfaces. In the simplest case, that of a radiant barrier stapled to the ends of the rafters, that value is well defined. However, if the radiant barrier is an integral part of the roof sheathing, supported over uncoated wood rafters, the radiation "view" facing down is a combination of both the barrier material and the wood. Previously, a projected area-weighted average was used. For example, if foil-faced sheathing was supported on 4 cm (1.5 in.) wide rafters spaced on 41 cm (16 in.) centers, the effective emittance was set equal to $(4\varepsilon_{rafter} + 37\varepsilon_{foil})/41$.

An analysis was performed to examine this simplification. The analysis divided the attic region into two sub-enclosures and a full three-dimensional surface-to-surface radiant interaction model was developed for each domain. The first region spans between the underside of the roof deck and the edges of the rafters. This region is further divided into a number of identical rafter enclosure models between two adjacent rafters, with a cross-section shown in Figure 3. The length of the unit cell in the direction perpendicular to this cross section is the length of the rafters. The temperatures of surfaces 7 to 13 were specified and a condition of symmetry with no heat flow was assumed on a plane through the center of each rafter. The second sub-enclosure, with a triangular cross-section shown in Figure 4, represents a simple attic region bounded by the top of the attic floor insulation, the two gable ends of the attic, and the plane stretched across the ends of the rafters.

For the two three-dimensional enclosures, the configurations were calculated based on three-dimensional expressions available in the literature and radiation is the only mode of heat

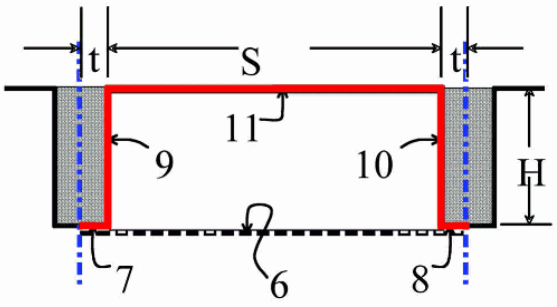

Figure 3 *Rafter Enclosure Model configuration. Surfaces 12 and 13 are at the ends of the channel.*

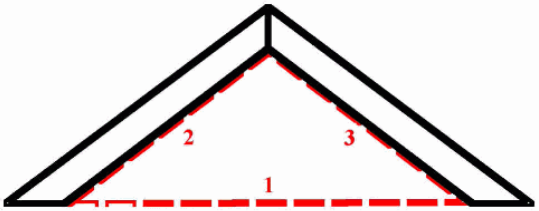

Figure 4 *Sketch of five-surface enclosure model of attic. Surfaces 4 and 5 are at the gable ends of the attic.*

transfer considered (Incropera and DeWitt 2002; Feingold 1966). Each of the surfaces in the enclosures is assumed to be diffuse gray with uniform radiosity and temperature. The temperature and emittance of surfaces 1, 4, and 5 in Figure 4 were specified for each case. These two solutions are coupled by the heat transfer, temperature, and effective emittance at the imaginary plane, identified as surface 6 in Figure 3 and surface 2 in Figure 4. The value for the effective emittance of that plane was varied parametrically to calculate the corresponding temperature and heat flux at the plane.

An integrated model combines the rafter enclosure and five-sided enclosure models into one and determines the temperature of the common plane, T_c, as a function of the emittance of the common surface, ε_c. Both enclosure models require that the emittances and temperatures of each surface be specified to calculate the radiant heat transfer for each of the surfaces. For a given emittance for surface 6 in Figure 3 (surface 2 in Figure 4), ε_c, its temperature, T_c, and heat flux can be determined by finding the temperature at which the heat transfer at that common surface is balanced between the two models. That is, for any emittance for the common surface, the surface temperature that satisfies both models corresponds to the condition where:

$$\left.\frac{q_6}{A_6}\right|_{\text{rafter enclosure model}} + \left.\frac{q_2}{A_2}\right|_{\text{five-sided enclosure model}} = 0 \qquad (1)$$

where

q_6/A_6 = heat flux across surface 6 in the rafter enclosure model (Figure 3)

q_2/A_2 = heat flux across surface 2 in the five-sided enclosure model (Figure 4)

These parametric results for q_c and T_c as a function of ε_c from the numerical analysis were then combined with an analytical model of the radiation heat transfer within the rafter domain. Looking at the general case for the rectangular region, shown in Figure 5, the heat flux across the common plane (note that in this convention, q_c will be negative when $T_h > T_c$) can be expressed as

$$q_c = \frac{\sigma(T_c^4 - T_h^4)}{\frac{1}{A_c}\left[\frac{1}{\varepsilon_c} + \frac{A_c}{A_h}\left(\frac{1-\varepsilon_h}{\varepsilon_h}\right)\right]} \qquad (2)$$

where

c and h surfaces are defined in Figure 5

q = heat flux, W/m^2

σ = Stefan-Boltzmann constant W/(m^2·K^4),

T = temperature (K),

A = area (m^2), and

ε = emittance.

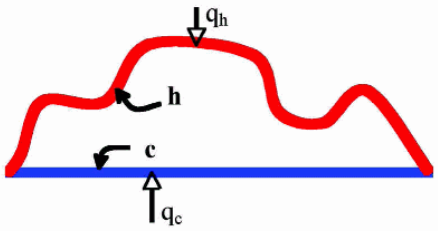

Figure 5 *General case for the rafter enclosure model.*

Table 1. Calculated Effective Emittance for Use with Whole House-Attic Model

Case Name	Roof Pitch	Rafter Spacing [cm (in.)]	Rafter Width[A] [cm(in.)]	Season[B]	Effective Values for Surface 6 in Figure 3 (which is also Surface 2 in Figure 3)			Simple Area, Averaged ε
					T (C)	Q (kW/m^2)	ε	
Foil radiant barrier stapled to the bottom of rafters[C]	Any	Any	Any	Any	–	–	0.05	0.05
All wood (Rafter and sheathing surface emittance of 0.9)	3	41 (16)	14 (5.5)	Summer	52	3.6	0.73	0.90
	3	41 (16)	14 (5.5)	Winter	–5.2	1.7	0.73	0.90
Foil-faced oriented strand board sheathing (Rafter emittance of 0.9 sheathing emittance of 0.1)	3	41 (16)	14 (5.5)	Summer	50	1.0	0.25	0.18
	3	41 (16)	14 (5.5)	Winter	–3.2	–0.50	0.26	0.18
	6	61 (24)	14 (5.5)	Summer	50	0.82	0.19	0.15
	6	61 (24)	28 (11.5)	Summer	50	0.51	0.21	0.15
	3	41 (16)	14 (5.5)[D]	Summer	50	0.77	0.19	0.18
	3	41 (16)	14 (5.5)[D]	Winter	–3.0	–0.36	0.19	0.18
Liquid-applied radiation coating (Rafter and sheathing surface emittance of 0.2)	3	41 (16)	14 (5.5)	Summer	50	0.85	0.21	0.20
	3	41 (16)	14 (5.5)	Winter	–3.1	–0.40	0.21	0.20
	6	61 (24)	14 (5.5)	Summer	50	0.86	0.20	0.20
	6	61 (24)	28 (11.5)	Summer	50	0.86	0.20	0.20
	3	41 (16)	14 (5.5)[D]	Summer	50	0.80	0.19	0.20
	3	41 (16)	14 (5.5)[D]	Winter	–3.0	–0.37	0.20	0.20

[A] All rafters 4 cm (1.5 in.) thick
[B] The temperatures used for the summer condition were 38°C (100°F), 66°C (150°F), and 66°C (150°F) at the top of the attic floor insulation, at the bottom of the attic sheathing, and at the gable ends of the attic, respectively. The temperatures used for the winter condition were 4.4, –18, and –18°C (40, 0, and 0°F) at the top of the attic floor insulation, at the bottom of the attic sheathing, and at the gable ends of the attic, respectively. During the summer the rafter temperature was 5.6°C (10°F) less than the sheathing temperature and during the winter the rafter temperature was 5.6°C (10°F) greater than the sheathing temperature.
[C] Not modeled because the emittance of the plane across the bottom of the rafters is known
[D] Temperature profile applied along width of rafter (fin effect)

Solving for the emittance of the hot surface for the case where the hot and cold areas are equal, that is, as the hot surface approaches the imaginary flat cold surface, the effective emittance of that surface can be expressed as

$$\varepsilon_{\text{effective, analytical}} = \left[\left(\frac{\sigma\left(T_c^4 - T_h^4\right)}{\left(q_c / A_c\right)} - \frac{1}{\varepsilon_c} \right) + 1 \right]^{-1} \quad (3)$$

The opposing surface temperature, T_h, was taken to be the area-weighted average of the surface temperatures 7 to 11 in the rafter enclosure model (Figure 3). The temperatures and heat fluxes from the full three-dimensional radiation models were used to calculate this effective emittance and compared to the assumed ε_c to find that point where the two values were equal.

$$\varepsilon_{\text{effective}} = \varepsilon_c \text{ that corresponds to}$$
$$\varepsilon_{\text{effective, analytical}}(\varepsilon_c, T_c, q_c) = \varepsilon_{c,\text{ numerical}}(T_c, q_c) \quad (4)$$

Table 1 summarizes the effective emittance for 14 combinations of materials and surface temperatures. For the summer conditions, the sheathing, gable ends, attic floor insulation, and rafter temperatures, respectively, were set equal to 339, 339, 311, and 333 K (150, 150, 100, and 140°F). For the winter conditions, the sheathing, attic floor insulation, and rafter temperatures, respectively, were 255, 255, 261, and 277 K (0, 0, 10, and 40°F). These temperatures are consistent with those measured at an experimental attic facility (Miller et al. 2007). The attic modeled here was 8.5 m × 12.8 m (28 ft × 42 ft) with a roof pitch (rise units for every 12 units of run) of either 3 or 6 (corresponding to roof angles of 14° and 27°).

In the equation for effective emittance of the imaginary slant surfaces of attic, the T_c and q_c are a part of the solution obtained in the numerical analysis. In other words, effective emittance is just what the name implies, but is not a property of any real surface unless one actually places a surface in there. Effective emittance depends on all input parameters. Other than the geometry, the significant parameters are the temperatures and the emittance of all other surfaces. So the values for the summer and winter seasons need not be the same.

For the cases where the foil-faced sheathing is placed upon wooden rafters, the overall effective emittance is greater than that of the foil because the foil is recessed within the rafter space and surrounded by materials with a greater emittance. The impact of this recessed effect is most marked in the case where the larger rafters, 4 cm × 28 cm (nominal 2 in. × 12 in.), are used.

RESULTS

To evaluate the potential economic savings due to radiant barriers, state average fuel prices and representative HVAC system efficiencies were applied to the calculated energy savings. For heat pumps and air conditioners, the seasonal efficiencies required in the 2006 Department of Energy standards were used, a Seasonal Energy Efficiency Ratio of 13 and a Heating Season Performance Factor of 7.7, to translate energy savings to electricity savings. For gas furnaces, an efficiency of 0.85 was assumed. Table 2 shows the energy prices used for each analysis location. For all locations, the lesser of the gas heat cost or the electric heat cost was used along with the electric air conditioning.

The results of the parametric evaluation showed that the savings estimates are most sensitive to the climate, then the presence and condition of the ductwork, and finally the effective emittance of the downward facing surface of the roof sheathing (in the range evaluated, from 0.05 to 0.20). Figure 6 shows the annual savings for a 143 m^3 (1540 ft^2) house for cases with no ducts, insulated ducts with a low leakage rate, and uninsulated ducts with a high leakage rate. Values are shown for attics with code-level insulation and houses with only R-19 attic floor insulation.

The influence of climate is immediately obvious, with the savings in zones 4 and 5 about half those in zones 1 and 2. The savings for houses with well-insulated low-leakage attic ducts (labeled "good" in Figure 6) versus houses with no ducts is

Table 2. Energy Prices Taken from EIA 2008 State Average Residential Retail Prices

Zone	City	Electricity (¢ per kWh)	Natural gas ($/1000 ft^3)
1	Miami, FL	11.17	21.29
2	Austin, TX	10.32	13.79
3	Atlanta, GA	9.12	18.5
4	Baltimore, MD	12.36	16.05
5	Chicago, IL	8.52	12.09
6	Minneapolis, MN	7.57	11.3
7	Fargo, ND	6.35	10.34
8	Fairbanks, AK	14.16	8.72

about a factor of two, although the savings for both are small. The savings for houses with poorly-insulated leaking ducts (labeled "poor" in Figure 6) are much greater in Zones 1 and 2, but the impact of duct condition is much less in colder climates, as shown in both Figure 6 and Figure 7. The influence of attic surface emittance on annual savings is relatively small in the range from 0.05 to 0.3, as shown in Figure 8 and by the closeness of the two points shown for each zone/duct condition in Figure 6. The two values shown for each case in this figure correspond to radiant barrier effective emittance of 0.05 (typical for a foil-faced barrier stapled to the bottom of the rafters) and 0.2 (representing a liquid-applied radiation coating covering both the sheathing underside and all exposed rafters). The savings for these two cases are very similar.

DISCUSSION

Our more recent whole-house models are able to provide detailed duct leakage and system run time information

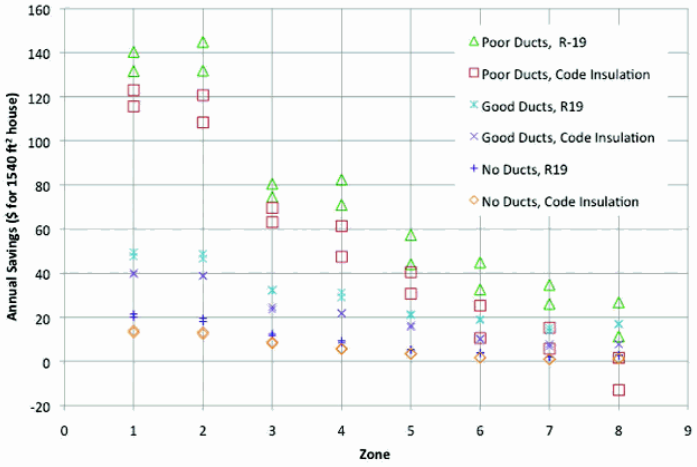

Figure 6 *Individual values shown for radiant barrier emittances of 0.05 and 0.20.*

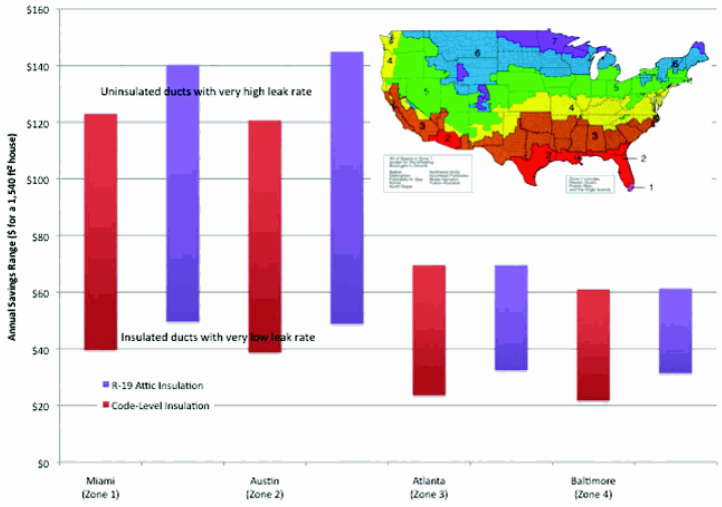

Figure 7 *Range of savings for attics with ducts in poor to good conditions for radiant barrier emittances up to 0.2.*

unavailable with previous hourly models. This more detailed information from the whole house model has in turn enabled us to better apply the attic model to examine the impact of duct leakage. These analyses revealed that the spread in radiant barrier savings estimates is extremely sensitive to this value, especially in the southern climates where radiant barrier savings are positive (see Figure 6 and Figure 7). Moreover, the results were less sensitive to the attic surface emittance for values between 0.05 and 0.3, as shown in Figure 8 for Zone 1.

Previous tools provided to consumers accommodated a large number of inputs, for heating and cooling system efficiency, local utility costs, local installed insulation costs, four levels of attic floor insulation, three different radiant barrier locations, and afforded a selection from 27 locations to match their climate. Fuel cost escalation factors were provided to help the consumer make a life-cycle cost calculation. Savings values were provided for two conditions, with or without ducts in the attic.

However, duct conditions can vary widely and are seldom well-characterized. Most customers will have no idea whether their ducts are leaking 5 or 20% of their conditioned air, or how much insulation is on the ductwork. Moreover, the savings calculations, both for the existing guidance and this new version, are based on a single attic geometry with a single whole-house model. Given these two factors, a detailed consumer tool asking for a host of specific values is likely to create an artificial perception of accuracy. At this point, it is likely that a range of values will be used to provide the information to the consumer, perhaps a graphic similar to Figure 7.

The detailed radiation analysis of the rafter cavity space within the attic environment was initiated because both the AtticSim and EnergyPlus models use a single surface to represent the downward facing side of the attic sheathing. The geometry in most real attics is much more complex; and the radiation heat transfer between this complex surface and the rest of the attic environment is of great interest when comparing the different types of radiant barrier products. Specifically, what is the performance difference between one product that covers every surface with a moderately low emittance coating versus another product that places a very-low emittance on a portion of the downward-facing surface?

The results for this numerical model showed a greater difference from the simple area-average model than was initially expected for the case of the foil-faced sheathing placed upon wood rafters. This difference was less when a temperature gradient was placed on the rafters to better reflect their thermal performance as fins. There were also small differences between the summer and winter effective emittance for the same geometry. This seasonal difference exemplifies one of the model limitations. The use of an artificial surface concept carries the drawback that the 'properties' of this artificial surface depend on the boundary temperatures as well as the geometry and radiation properties of the surrounding real surfaces. This numerical analysis is currently being extended to the point of a complete coupling of the two radiation domains without the use of the artificial surface concept. The expanded analysis will help us to make a more informed choice of an "effective" emittance for use in the simpler attic models.

CONCLUSIONS

Detailed consumer savings calculations are likely to provide a false sense of accuracy considering that the results are extremely sensitive to a factor, duct leakage, that most consumers will be unable to quantify. The update to the Radiant Barrier Factsheet will therefore likely delete the existing

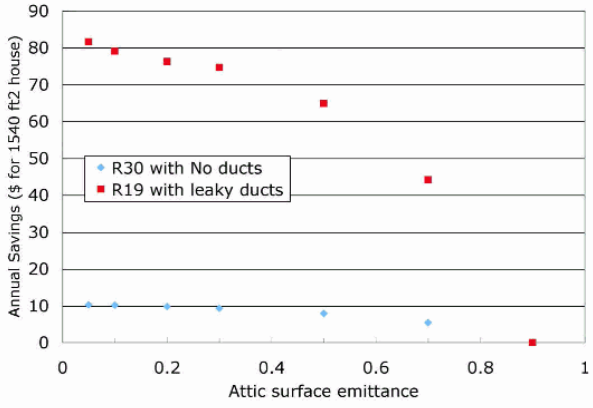

Figure 8 *Annual savings for a house in Zone 1 for various values of radiant barrier surface emittance applied to the underside of the roof only (not on the gable ends).*

calculator model and provide a more generalized guidance with regard to savings magnitudes.

The Fact Sheet guidance will likely include a statement to the effect that: "If you have poorly insulated and leaking ducts in the attic in climate zones 1 and 2 (e.g., Florida, southern parts of Texas), radiant barriers will save $50 to $150 per year. For other conditions and locations, savings will be much smaller or negative."

The numerical analysis shows that the effective emittance of the downward-facing roof surface is very similar for roof sheathing materials with a foil-covered interior surface, and liquid-applied low-emittance coatings. Furthermore, the savings for an emittance ranging from 0.05 to 0.2 were very similar, so consumers will be advised that these two approaches, as well as the use of aluminum foil or metalized film-faced materials stapled to the bottom surface of rafters, should provide similar savings.

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