

AEP Subcommittee Meeting

NFRC Fall Meeting

Arlington, VA

November 7, 2006

Background Info

Scope and Board Guidelines

Scope

The Annual Energy Performance Subcommittee shall be responsible for developing the procedures to rate the annual energy performance of fenestration products and fenestration product attachments in homes taking into account the variability of housing characteristics and operation.

The Annual Energy Performance Subcommittee shall report to the Technical Committee.

Board Guidelines

In September, Board issued guidelines regarding AEP:

- Develop and approve NFRC 901 calculation guideline document first.
AEP Rating would be developed afterwards, if warranted.
- Provide for variability; final result must be a range.
- Two ratings with separate heating and cooling results.
May also reflect climate zones or other factors.
- Include user-specific variable behavioral inputs (e.g. thermostat set points, shading, and orientation).
- Any assumptions must be supported by research and technically sound.
- Intended audience is the consumer and/or builders in both new and existing markets. Not intended for code use.
- Any rating program that is developed must have revenue generation and IP protection consistent with supporting NFRC.

Proposed Calculation Approach

Fixed vs. Operational Variables

- Several assumptions fixed for the home.
- Certain operational variables identified as homeowner-dependent:
 - Temperature setpoints, use of blinds, use of dynamic windows, window ventilation
 - Ranges will be defined for higher and lower heating / cooling.

Default home

- Standardized other than input of window values and city.
- Four results will be calculated based on range of operational variables:
 - Highest Cooling, Lowest Cooling
 - Highest Heating, Lowest Heating

User-specific home

- User can make several choices about home size, type, foundation, orientation, shading, HVAC.
- User also puts in specific values for operational variables (e.g. setpoint) which best matches their behavior.

**New Business
at Arlington Meeting
(November 2006)**

NFRC 901

“Guidelines to Estimate Fenestration Annual Energy Performance in Single Family Residences”

- New draft of sent out for ballot
(subcommittee ballot only)
- 9 Approve
3 Approve with Comment
9 Do Not Approve
- Proposed approach for today:
 - Vote on key issues combined from ballot results and previous unresolved comments from Minneapolis.
 - Use results to generate next draft and new ballot.

General Comments

- 3 negatives (Andersen, IGMA, WESTLab) question whether need and/or validity of NFRC developing AEP guidelines at all.
 - Legitimate opinions, but Board has already given direction to go down this path.
- 2 negatives (Seattle, Simonton) saying correct underline / strikethrough format was not used.
 - This is a new document, so technically, everything should be underlined. Not done for clarity.
 - Strikethrough / underline version compared to prior non-ballot draft was provided on website.
- 1 negative (LBNL) questioned use of range concept, rather than one set of typical operating conditions with a % variability.
 - Issue already debated and voted in Minneapolis.

Issue 1 – Insulation Values

- Comment from G. Stone:
 - On specific house, have user input insulation values if known, or use default values.
- Comment from S. Selkowitz:
 - Why are operating conditions allowed to be varied but not construction characteristics?

Question 1

Allow user to input insulation values for specific house, or use default.

or

Only use fixed default values.

Vote:

Option A

22-4

Issue 2 – Window Area

- Comment from G. Stone, J. Larsen:
 - In default house, use 18% of floor area to be consistent with max area in IECC standard home.
- Comment from J. Batt:
 - Disagree, use 15%. National average is ~ 14-15%.

Question 2

Window area in default house:

15% of floor area

or

18% of floor area

Vote:

Option C

0-1-lots

Option C added at meeting:

or

15% of floor area for existing home,

18% of floor area for new home

Issue 3 – Window Orientation

- Comments from G. Stone:
 - Treat window distribution and orientation as operational parameter in default house with range of options for higher / lower heating and cooling.
For example, predominantly north/south vs. east/west.
 - Alternately, input specific area by orientation.
- Task group previously said to use equal distribution on all four sides.

Question 3

In default house:

Fix windows as equally distributed on all four sides

or

Treat window distribution as variable parameter with predominantly E/W and N/S distributions for highest / lowest heating and cooling range.

or

Require user to input area by orientation

Vote: Option C, 0-12-14

Issue 4 – Area Weighting

- Comment from C. Curcija:
 - Area weighting is not appropriate for annual energy simulation.
 - Software tool should be capable of specifying more than one window per orientation.

Question 4

Allow multiple windows per orientation as option

or

Have only 1 average window input per orientation

Vote:

Option B

0-14

Issue 5 – Heating Temperature Setpoint

For default house:

Lower heating – 68 F setpoint in current draft

- Comment from J. Larsen:
 - 68 F doesn't satisfy ASHRAE 55 comfort. Use higher setpoint?

Higher heating – 72 F setpoint in current draft

- Comment from G. Stone, J. Batt: use 75 F
- Comment from D. Smith: 75 F too high
- Comment from J. Larsen: okay with 72 F

- Comment from C. Curcija: don't have range, fix at 70 F with 65 F nighttime setback.

Question 5

For Lower Heating:

Use 68 F

or

Use 70 F

**Vote:
Option A
14-11**

Question 5b

For Higher Heating:

Use 72 F

or

Use 75 F

**Vote:
Option B
14-16**

Issue 6 – Cooling Temperature Setpoint

For default house:

Lower cooling – 78 F setpoint in current draft

- Comment from C. Hayes:
 - Use 80 F

Higher cooling – 75 F setpoint in current draft

- Comment from G. Stone: use 70 F
- Comment from J. Batt: use 70-72 F
- Comment from D. Smith: 70 F is too low
- Comment from J. Larsen: use 74 F

- Comment from C. Curcija: don't have range, fix at 76 F with 80 F daytime setup.

Question 6

For Lower Cooling:

Use 78 F

or

Use 80 F

Vote:
Option A
25-0

Question 6b

For Higher Cooling:

Use 75 F

or

Use 76 F **or** 74 F **or** 72 F **or** 70 F

Vote:
72 F
2-1-2-22-7

Issue 7 – Basement

- Comment from J. Larsen:
 - Assume basements are conditioned space.
 - Use same heating and cooling setpoints as house.
- Current draft has basement as partially conditioned.
 - 62 F heating setpoint, 85 F cooling setpoint

Question 7

Partially conditioned basement

or

Fully conditioned basement

Vote:
Option A
16-7

Issue 8 – Dynamic Windows

In default house:

- Lower cooling / lower heating uses:
 - High SHGC setting in winter
 - Low SHGC setting in summer
- For higher cooling / higher heating, need to decide upon one of following:
 - SHGC fixed at intermediate position and does not vary with season (constant, intermediate SHGC setting).
J. Hayden, T. Culp, J. Batt
 - SHGC used in non-ideal manner for each season (low SHGC setting in winter, high SHGC setting in summer)
C. Hayes, M. Thoman

Question 8

For higher cooling / higher heating, use:

SHGC fixed at intermediate position
and does not vary with season
(constant, intermediate SHGC setting).

or

SHGC used in non-ideal manner for each season
(low SHGC setting in winter, high SHGC setting in
summer)

Vote:
Option B
0 - majority

Issue 9 – External Shading

- Current draft:
 - Average shading with 1 ft overhang, adjacent building
 - SHGC multiplier reduced by 0.1 for dirt, insect screens, trees, self-shading.
- Comment from G. Stone, J. Larsen:
 - Do not use external shading for default house
 - Do not use 0.1 SHGC reduction for default or specific house.
 - Minimizes fenestration performance, and more consistent with IECC performance path
- Comment from J. Batt:
 - External shading more common in existing homes, so at least use it there.
- Comment from D. Smith:
 - Exterior shading is a fact of architectural design and actual use. Include it.

Question 9

For default house:

Average external shading

or

No external shading

Vote:

Option B

7-14

Question 9b

For specific house:

Use 0.1 SHGC multiplier reduction

or

Don't use 0.1 SHGC multiplier reduction

Vote:

Option B

6-11

Issue 10 – Internal Shading

In default house:

- Lower cooling / lower heating uses:
 - Internal blinds used seasonally
 - More closed in summer, more open in winter (SHGC multiplier 0.7 in summer, 0.85 in winter)
- For higher cooling / higher heating, need to decide upon one of following:
 - Internal blinds fixed at intermediate position and does not vary with season (constant, intermediate SHGC multiplier).

J. Hayden, T. Culp, J. Batt

- Internal blinds used in non-ideal manner for each season (0.7 multiplier in winter, 0.85 multiplier in summer).

G. Stone, M. Thoman

Question 10

For higher cooling / higher heating, use:

Internal blinds fixed at intermediate position
and does not vary with season
(constant, intermediate SHGC multiplier).

or

Internal blinds used in non-ideal manner
for each season
(low SHGC setting in winter, high SHGC setting in
summer)

Vote:
Option B
2-16

Note: suggestion to re-check what SHGC multiplier should be based on average blind, rather than just accept current values.

Issue 11 – Internal Shading

In specific house:

- Current draft has options for seasonal use (closed more in summer), fixed mainly open, fixed mainly closed.
- Comment from G. Stone:
 - include 2nd seasonal option, but opposite: internal blinds open more in summer and less in winter (SHGC multiplier 0.85 in summer, 0.75 in winter).

Question 11

Vote:

Yes

Voice vote

Yes

or

No

Issue 12 – Gas Furnace Efficiency

- Comment from G. Stone:
 - Use higher AFUE for new construction than federal minimum (0.78)
 - 0.80 in zones 1-3, 0.90 in zones 4-8
- Comment from J. Larsen:
 - 34% of furnaces sold are condensing (AFUE \geq 0.90), probably most in north.

Question 12

Use 0.78 AFUE in all zones

or

Use 0.82 AFUE in all zones (34% 0.90, 66% 0.78)

or

Use 0.80 AFUE in zones 1-3, 0.90 in zones 4-8

Vote:

Option C

0-3-13

Issue 13 – Natural Ventilation

- In current draft, opening windows is operational variable.
 - Higher cooling, lower heating: windows never opened.
 - Lower cooling, higher heating: windows opened when outside temperature / humidity allows.
- Comment from C. Curcija:
 - Do not have ventilation as a variable. Fix with windows closed at all times.
- Comment from G. Stone:
 - How model when only portion of window is opened (e.g. 10% in California) because of design or security concerns?

Question 13

Include window ventilation
as operational variable.

or

Assume windows never opened.

Vote:
Option B
7-16

Issue 14 – NFRC Procedures

- Comment from G. Stone:
 - Include language that product ratings must come from NFRC procedures, in order to obtain accurate results. (no other procedures, no defaults for U and SHGC)
- Comment from J. Hayden:
 - Include air leakage ratings from *AAMA/WDMA/CSA 101/I.S.2/A440* as well as NFRC 400.
- Comment from C. Curcija:
 - NFRC U-factor and SHGC values from label are not appropriate for annual energy analysis, unless include effects of solar incident angle on glazing SHGC and local climatic data on U-factor.

Question 14a

Only allow NFRC 100, 200, 400

or

Also allow AAMA/WDMA/CSA
101/I.S.2/A440 for air leakage

or

“... in accordance with NFRC 100, 200, and 400, or other procedures which provide equivalent values.”

Vote:

Option B

0-21-2

Question 14b

Specify that software account for
solar incident angle for SHGC,
and local climatic data for U-factor?

Vote:
Yes
3-1

Yes
or
No

Note: already included if import Window file for specific glazing, but
need to include method to adjust U, SHGC input for generic glazing.

Issue 15 – Source Energy Reporting

- Comment from C. Curcija:
 - Include source energy in reporting

Question 15

Vote:
Yes
11-5

Yes

or

No

Issue 16 – Wording

- Comment from G. Stone:
 - Instead of “Annual Energy Performance”, change wording to “Heating and Cooling Consumption”.

Vote:

Option B

5-15-2

Question 16

“Annual Energy Performance”

or

“Heating and Cooling Consumption”

or

“Annual Heating and Cooling Consumption”

Issue 17 – Wording

- Comment from J. Larsen:
 - Call it “Reference House” instead of “Default House”
 - More consistent with IECC standard reference design.

Question 17

“Reference House”

or

“Default House”

Vote:
Option A
Voice vote

Issue 18 – Wording

- Comment from G. Stone:
 - In Forward and Disclaimers, include:

“Users should be cautioned that estimated energy consumption is only one of many parameters that should be considered in selecting a fenestration product. For example, this estimated energy consumption analysis does not factor in issues such as comfort, durability, visible light transmission and condensation.”

Question 18

Yes

Vote:

Yes

majority

or

No

Other comments / issues

- Home air infiltration – use SLA instead of airchanges
- Internal load model
- Internal shading multiplier as function of window SHGC

Next Steps

- Generate new draft based on comments and today's votes.
- Simulations to examine methodology and assumptions?

Other New Business:

New task group formed to start examining methods for calculating fenestration annual energy performance in commercial buildings.

Let us know if you want to participate.

Current members: Mahabir Bhandari (chair), C. Mathis, S. Selkowitz, T. Culp

Extra Info
Previous Minneapolis Votes
(July 2006)

Issue 1 – Range Concept

- Comment from D. Arasteh (LBL):
 - Concerned about range concept for default house.
 - Too wide range of input parameters to cover all possible lifestyle conditions will result in a such a large spread of outcomes as to be meaningless.
 - Restrict default assumptions to cover average operation. Calculate one result.
 - To illustrate variability in results due to different operating characteristics, provide additional information such as “results will vary by up to x%” depending on house specifics.

Question 1

Straw Poll: Continue with range concept
Option A *lowest heating* \leftrightarrow *highest heating*
25-17 *lowest cooling* \leftrightarrow *highest cooling*

or

Only calculate single result with error bar

heating \pm $x\%$

cooling \pm $x\%$

Issue 2 – Energy Costs

- Comment from G. Stone and J. Larsen:
 - Remove energy cost, only calculate and report energy consumption (MBtu, kWh).
 - Energy costs fluctuate and look backward, not forward.
- Comment from J. Batt:
 - How do you account for users who have two-tier pricing?

Question 2

Calculate and report only energy consumption
(MBtu, kWh)

or

Calculate and report both energy consumption
(MBtu, kWh) and energy cost (\$)

Option C added at meeting: **or**

Only energy consumption for default house;
allow user to input cost rates in user-specific
house (provide guidance on cost data sources, but
no assumed default values)

Initial Straw Poll: 19 – 7– 18

2nd poll without option B: nearly unanimous for option C

Issue 3 – Existing Buildings

- Comment from G. Stone:
 - Do not include Existing Building option for default home
 - Too much variability in existing construction to capture by average assumptions.
- Comments from J. Batt, D. Smith
 - Need to include Existing Building option
 - One main use will be when upgrading an existing home to improve energy performance.

Question 3

Straw Poll:

Option A

30-10

Include Existing Building option

or

Do not include Existing Building option for default house; allow for user-specific house