NFRC Certification Program for Residential and Commercial Fenestration Energy-Related Performance Ratings

Ray McGowan March 22, 2012

Charleston, SC

LEARNING OBJECTIVES

1. Understand the 2009 IECC and ASHRAE 90.1-2007 fenestration energy requirements for commercial construction.

2. Understand the role of NFRC related to providing high-performance fenestration for energy-efficient commercial construction.

3. Understand the NFRC 100 and NFRC 200 documents, the NFRC commercial fenestration certification program (CMA), and how CMA enables energy codes compliance.

4. Understand how the NFRC Component Modeling Approach (CMA) Program and associated software (CMAST) are used as design and compliance tools for developing valid specifications for fenestration energy-related performance requirements.

AIA CES INFORMATION

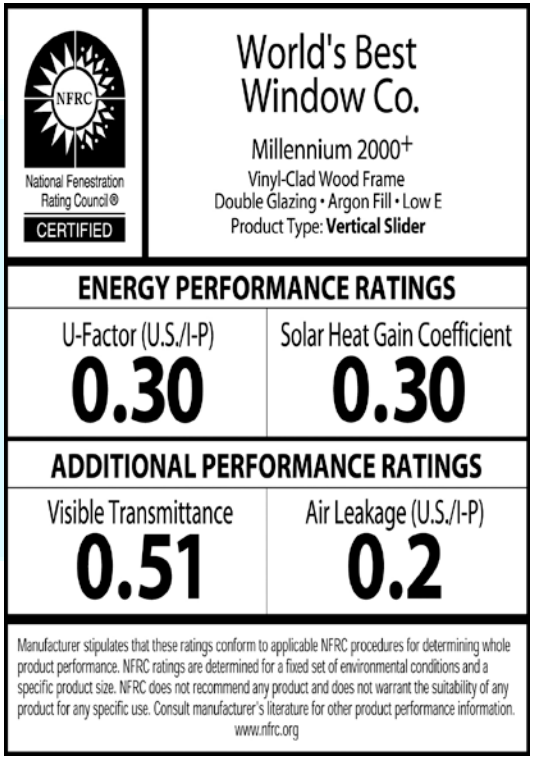
"The National Fenestration Rating Council" is a Registered Provider with The American Institute of Architects Continuing Education Systems. Credit earned on completion of this program will be reported to CES Records for AIA members. Certificates of Completion for non-AIA members are available on request.

This program is registered with the AIA/CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product. Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Copyright Materials

WHO IS NFRC ?

- An independent, non-profit, 501(c)3, organization; whose purpose is to serve the public good through education and research.
- We are a community of stakeholders with an interest in the energy performance of fenestration products.
- The indisputable authority for providing information people need to make the best decision about purchasing energy efficient windows, doors, and skylights.
- The NFRC label, indicating performance ratings, is found on all Energy Star® qualified windows, doors, and skylights.
- Consensus-driven organization – inclusive group decision-making process.



NFRC Membership

- Voice and Vote
  - *You* help decide how NFRC ratings are developed
  - Member ideas are voted into action and *you* vote on the ideas
- Industry News
  - Latest fenestration information on energy code references, technical interpretations, research and technology, regulatory and legislative news, and more
  - News to help you anticipate change and stay competitive
  - NFRC News Now (our blog), Facebook, LinkedIn, and Twitter
  - News You Can Use What's New for Windows, Doors, Skylights, latest Energy Code references, and more

Why Rate Fenestration Products?

- Provides means for a fair comparison
- Help consumer to make informed decisions
- Help meet the code requirements
- Provides a base line for developments and product improvement
- Promotes energy efficiency
- National / International harmonization

NFRC Background

- Created by industry/government assistance in 1989
- Created to provide standardized methods for rating *fenestration energy performance*
- Unique, 501 (c)(3) [educational non-profit public/private organization] representing:
  - Industry, codes officials, Design Professionals, Consumer Organizations

– 700 Manufacturers participating
– 250 Voting Members
– $4 million/yr operating budget
– 17 staff members, 3 supporting contractors, LBNL partnership
– Three International Licensees (India, South Africa, Australia)

National Fenestration Rating Council®

NFRC—Introduction & Overview

Mission:

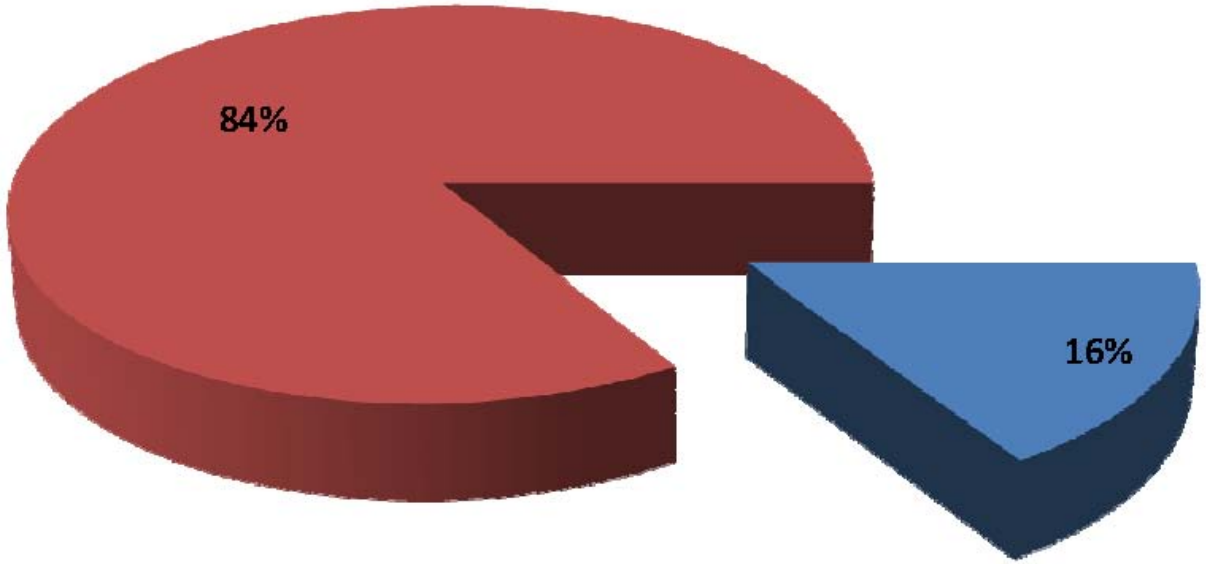
NFRC develops and administers comparative energy and related rating programs that serve the public and satisfy the needs of its private sector partners by providing fair, accurate and credible, user-friendly information on fenestration product performance.

NFRC Rating Determination

- **Computer simulation is the basis of all ratings**
  - *3 million records in CPD, 1% go to production*
- **Simulation performed at standardized sizes & environmental conditions**
- **Simulation generates a whole-product rating**
- **Simulated U-factors validated by physical testing**
  - **4000 tests/year**

Aggregate Building Loads

Non-residential buildings consume ~15.5 quadrillion BTU of primary energy - 16% of all energy used in U.S.



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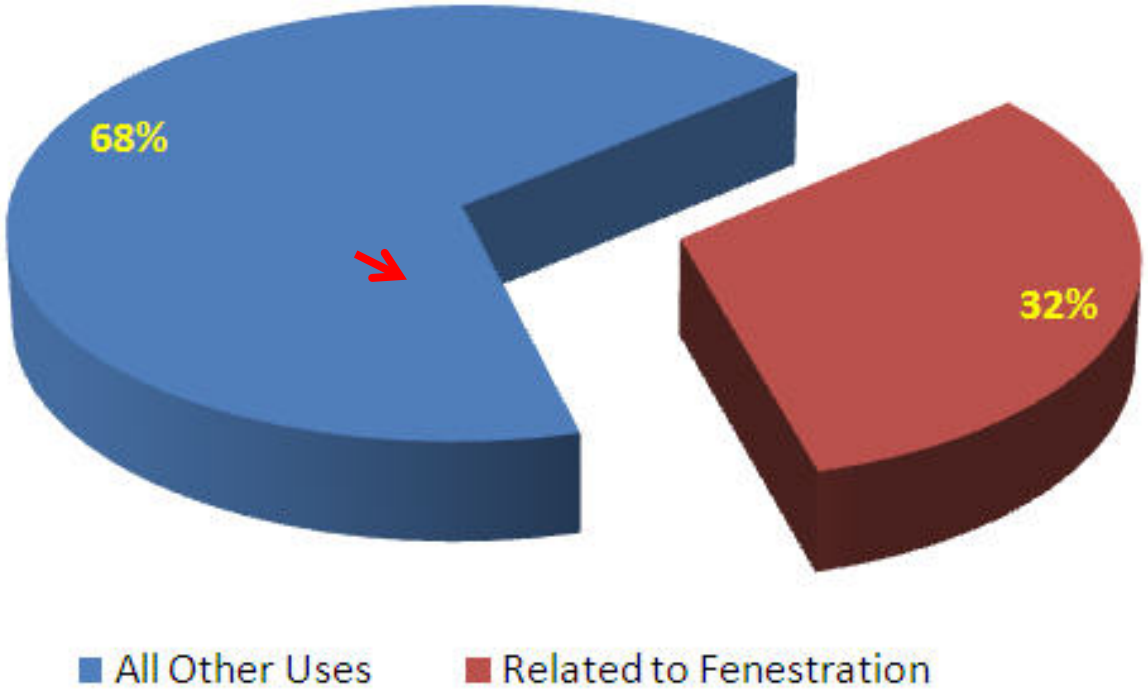
Aggregate Building Loads

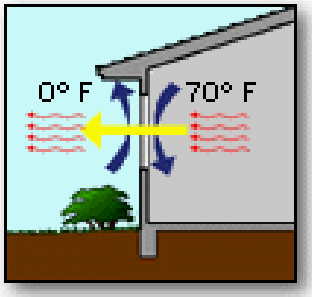
Fenestration consumes 32% of that primary energy *:*



WHAT DOES NFRC RATE ?

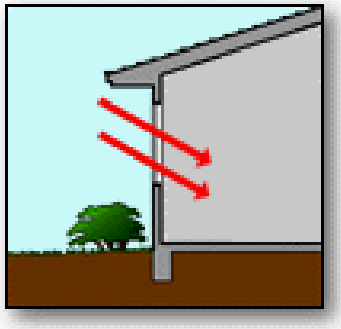
- Energy performance ratings:
  - Required Ratings
    - U Factor
    - Solar Heat Gain Coefficient
    - Visible Transmittance
  - Voluntary Ratings
    - Air Leakage
    - Condensation

NFRC Ratings

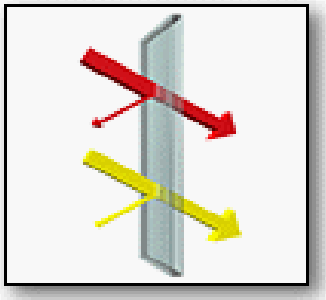


U-factor (thermal transmission)

NFRC 100



SHGC (Solar Heat Gain)
NFRC 200



VT (Visible Transmittance)

NFRC 200

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Mandatory Ratings

A. Basics of NFRC Ratings; **in southern areas,**
   - Heat loss rating ***(U-factor)*** **lower always better**
   - Solar Heat Gain rating ***(SHGC)*** **lower always better**
   - Visible Transmittance rating ***(VT)*** **higher generally better**

The NFRC "Rating Process"

Simulation Laboratory

Testing Laboratory

Inspection Agency (IA)

NFRC Label or Label Certificate

Market Place

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NFRC—Introduction & Overview

Our familiar residential temporary label

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NFRC Ratings

Future Ratings

- Attachment products ratings
- Ventilation ratings
- Daylighting ratings

Skylights

Courtesy of Ghar-Expert

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NFRC—References

NFRC *is* referenced by:

- **The International Model Building Codes**
- **ASHRAE**
- ***ENERGY STAR©***
- **USGBC (LEED), etc.**
- **Florida Building Code-Chapter 13**

Market Opportunity

Facts:

On average, Only ~30% of all nonresidential buildings *(somewhat higher % in residential)* use high performance windows;

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Energy Codes and Fenestration

South Carolina Energy Code

- **International Residential Code-IRC 09 effective January 1, 2011**
  - Similar to the IECC 09
- **IECC 09 shown for comparison**

IRC 09-N1101.5

N1101.5 Fenestration product rating. *U*-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and *labeled* and certified by the manufacturer. Products lacking such a *labeled* *U*-factor shall be assigned a default *U*-factor from Tables N1101.5(1) and N1101.5(2). The solar heat gain coefficient (SHGC) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and *labeled* and certified by the manufacturer. Products lacking such a *labeled* SHGC shall be assigned a default SHGC from Table N1101.5(3).

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Code Compliance

No label,
Use defaults!

TABLE N1101.5(3)
DEFAULT GLAZED FENESTRATION SHGC

SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
Clear	Tinted	Clear	Tinted	
0.8	0.7	0.7	0.6	0.6

TABLE N1101.5(1)
DEFAULT GLAZED FENESTRATION *U*-FACTORS

FRAME TYPE	SINGLE PANE	DOUBLE PANE	SKYLIGHT	
			Single	Double
Metal	1.2	0.8	2	1.3
Metal with thermal break	1.1	0.65	1.9	1.1
Nonmetal or metal clad	0.95	0.55	1.75	1.05
Glazed block	0.6			

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SC Building Code-Residential and Commercial Requirement

- **All Climate Zones:**
  - U-Factor < 0.50
  - SHGC < 0.35

Use NFRC Label to Confirm Compliance

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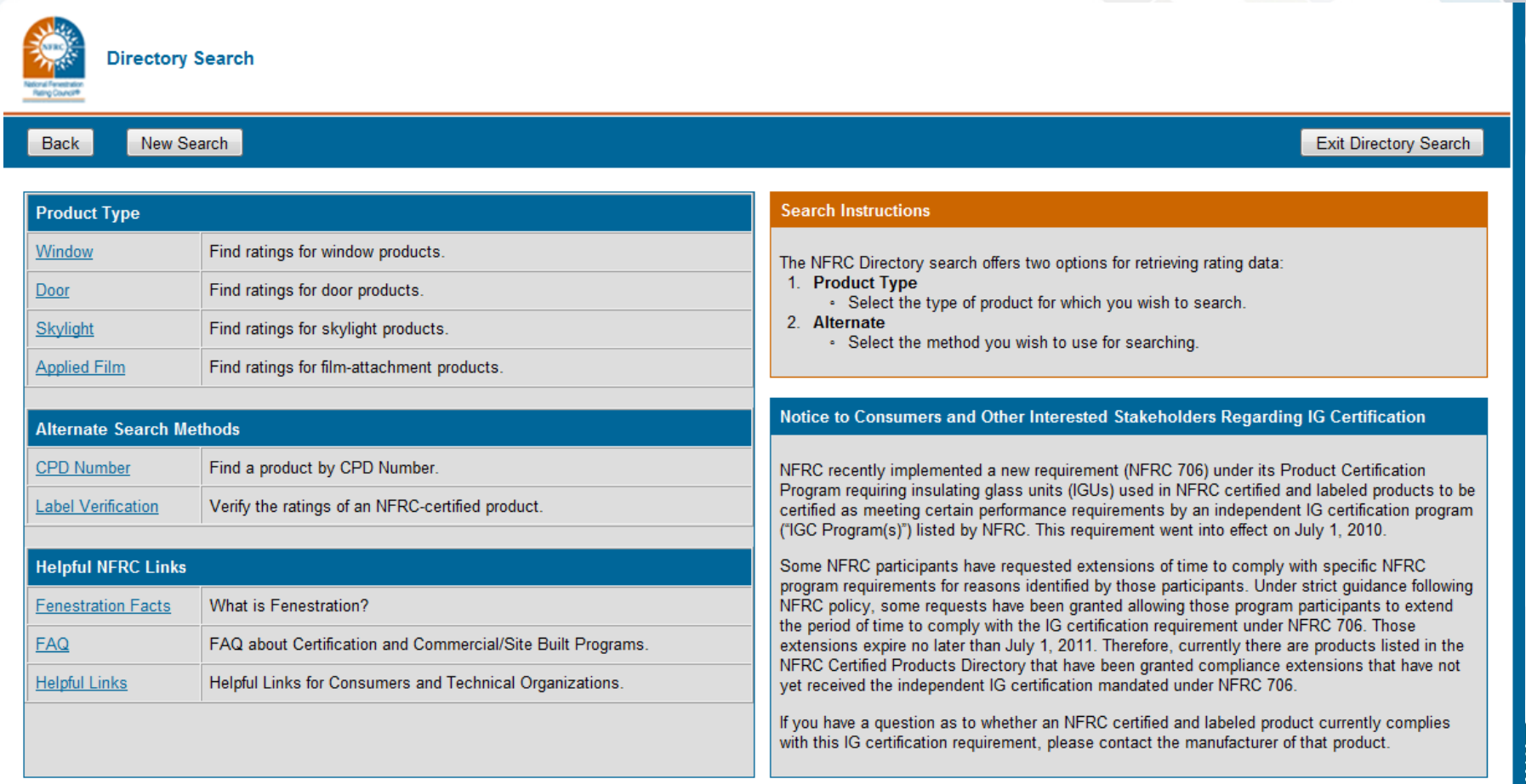
Use NFRC online database to confirm (www.nfrc.org)



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NFRC and Compliance

IECC 09 requirement

303.1.3 Fenestration product rating. *U*-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled *U*-factor shall be assigned a default *U*-factor from Table 303.1.3(1) or 303.1.3(2). The solar heat gain coefficient (SHGC) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled SHGC shall be assigned a default SHGC from Table 303.1.3(3).

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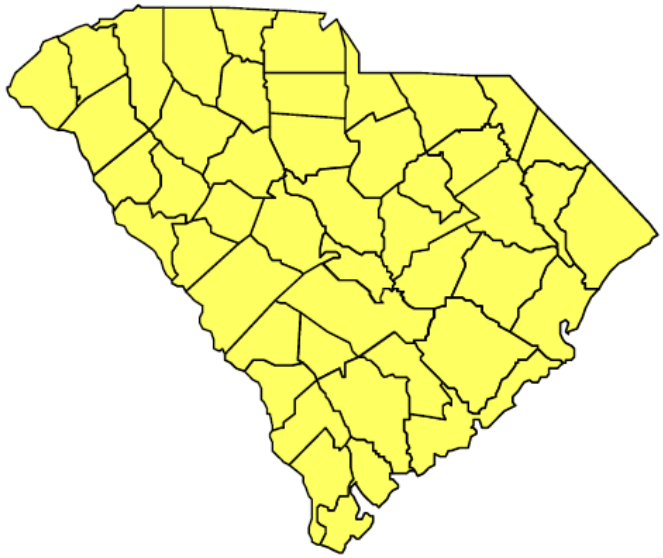
Residential Code Compliance

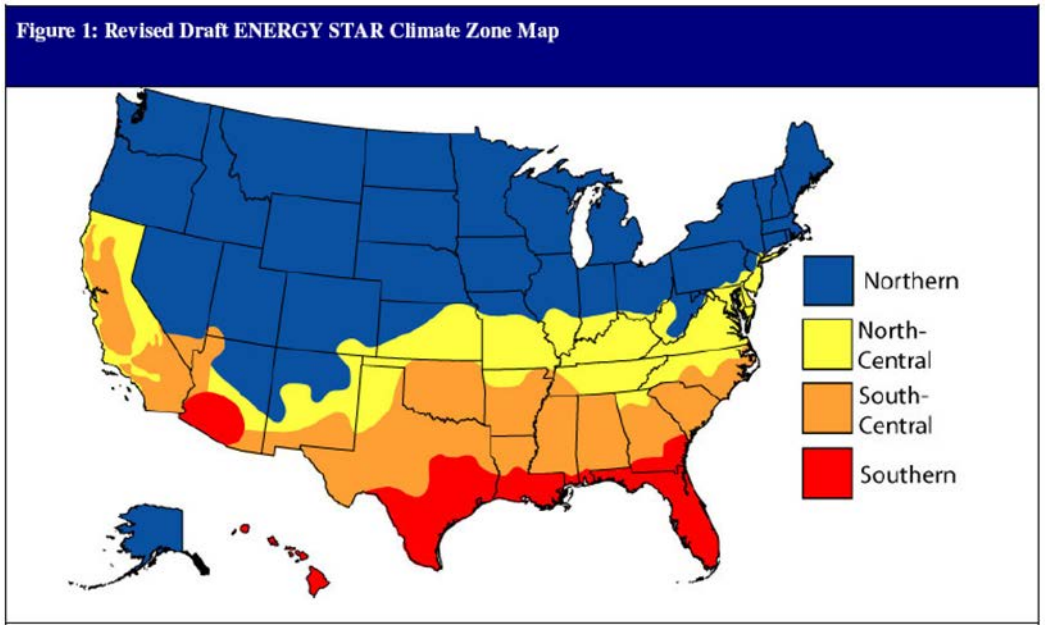
IECC 2009 Requirements



	Windows		
	Fenestration U-Factor	Skylight U-Factor	Glazed Fenestration SHGC
Zone 3	0.50	0.65	0.30

SHGC is lower

ENERGY STAR Criteria



Climate Zone	U-factor	SHGC
Northern	≤ 0.30 =0.31 = 0.32	NR ≥ 0.35 ≥ 0.40
North-Central	≤ 0.32	≤ 0.40
South Central	≤ 0.35	≤ 0.30
Southern	≤ 0.60	≤ 0.27

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2014 ENERGY STAR Criteria Being Developed

Preliminary Criteria Ranges

Windows

Air Leakage ≤ 0.3 cfm/ft²

Climate Zone	U-Factor Current	U-Factor Proposed	SHGC Current	SHGC Proposed
Northern	≤ 0.30	≤ 0.25-0.27	Any	Any
North-Central	≤ 0.32	≤ 0.28-0.30	≤ 0.40	≤ 0.35-0.40
South-Central	≤ 0.35	≤ 0.30-0.32	≤ 0.30	≤ 0.25
Southern	≤ 0.60	≤ 0.40	≤ 0.27	≤ 0.20-0.25

Doors

Glazing Level	U-Factor Current	U-Factor Proposed	SHGC Current	SHGC Proposed
Opaque	≤ 0.21	≤ 0.15-0.19	No Rating	No Rating
≤ ½-Lite	≤ 0.27	≤ 0.22-0.25	≤ 0.30	≤ 0.25
> ½-Lite	≤ 0.32	≤ 0.27-0.30	≤ 0.30	≤ 0.25

Air Leakage ≤ 0.3 cfm/ft² for sliding doors
Air Leakage ≤ 0.5 cfm/ft² for swinging doors

Skylights (including TDDs)

Air Leakage ≤ 0.3

Climate Zone	U-Factor Current	U-Factor Proposed	SHGC Current	SHGC Proposed
Northern	≤ 0.55	≤ 0.43-0.45	Any	≤ 0.25-0.35
North-Central	≤ 0.55	≤ 0.45-0.47	≤ 0.40	≤ 0.25-0.30
South-Central	≤ 0.57	≤ 0.48-0.50	≤ 0.30	≤ 0.25
Southern	≤ 0.70	≤ 0.55-0.60	≤ 0.30	≤ 0.25

EPA

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Commercail Rating-CMA Program and CMAST

B. Overview of the *Component Modeling Approach* ('CMA') Program

Overview, CMA Program, CMAST

The CMA process: A New Approach ~

New concept: “build” virtual products & projects using predefined and certified components from online CMA database to issue project-specific label certificates

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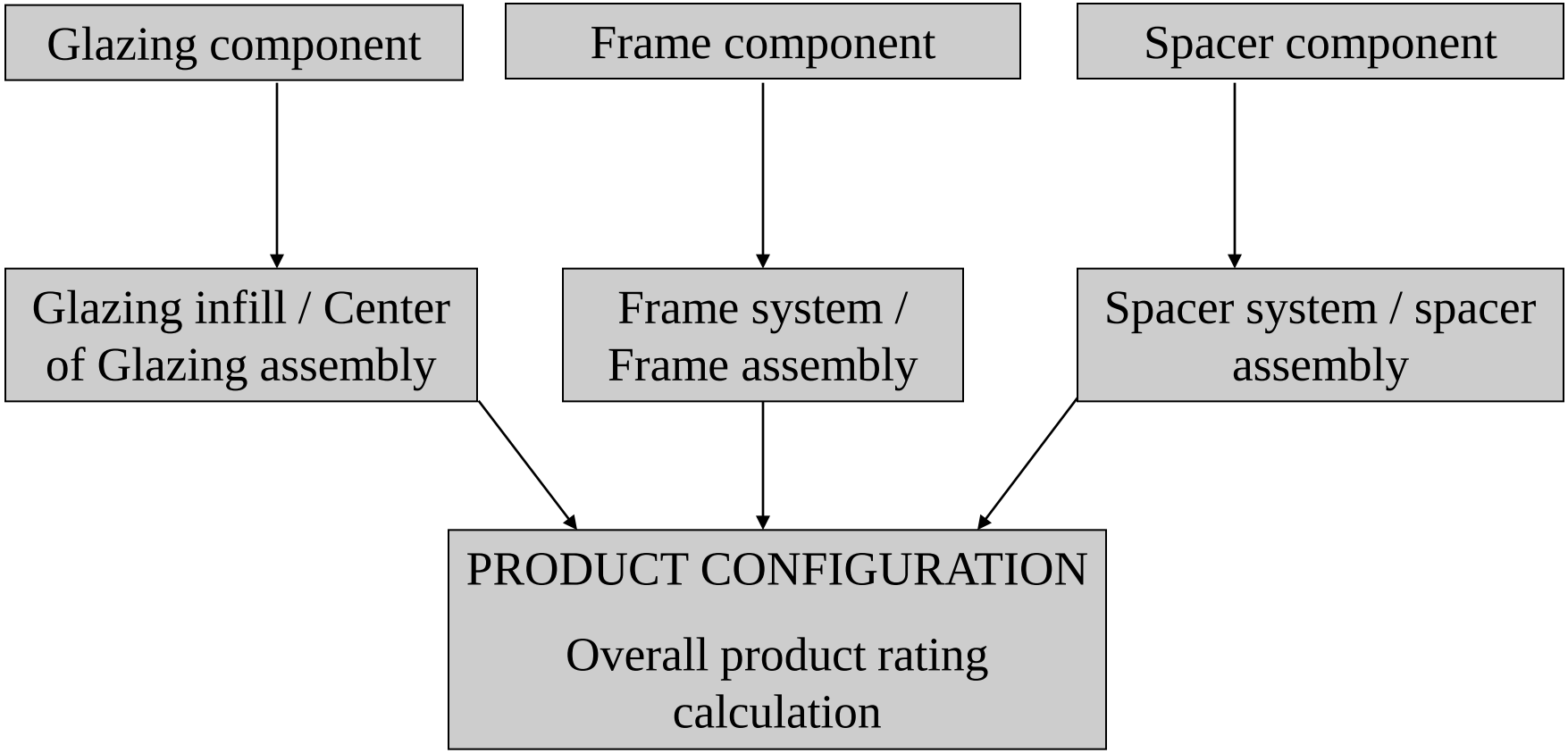
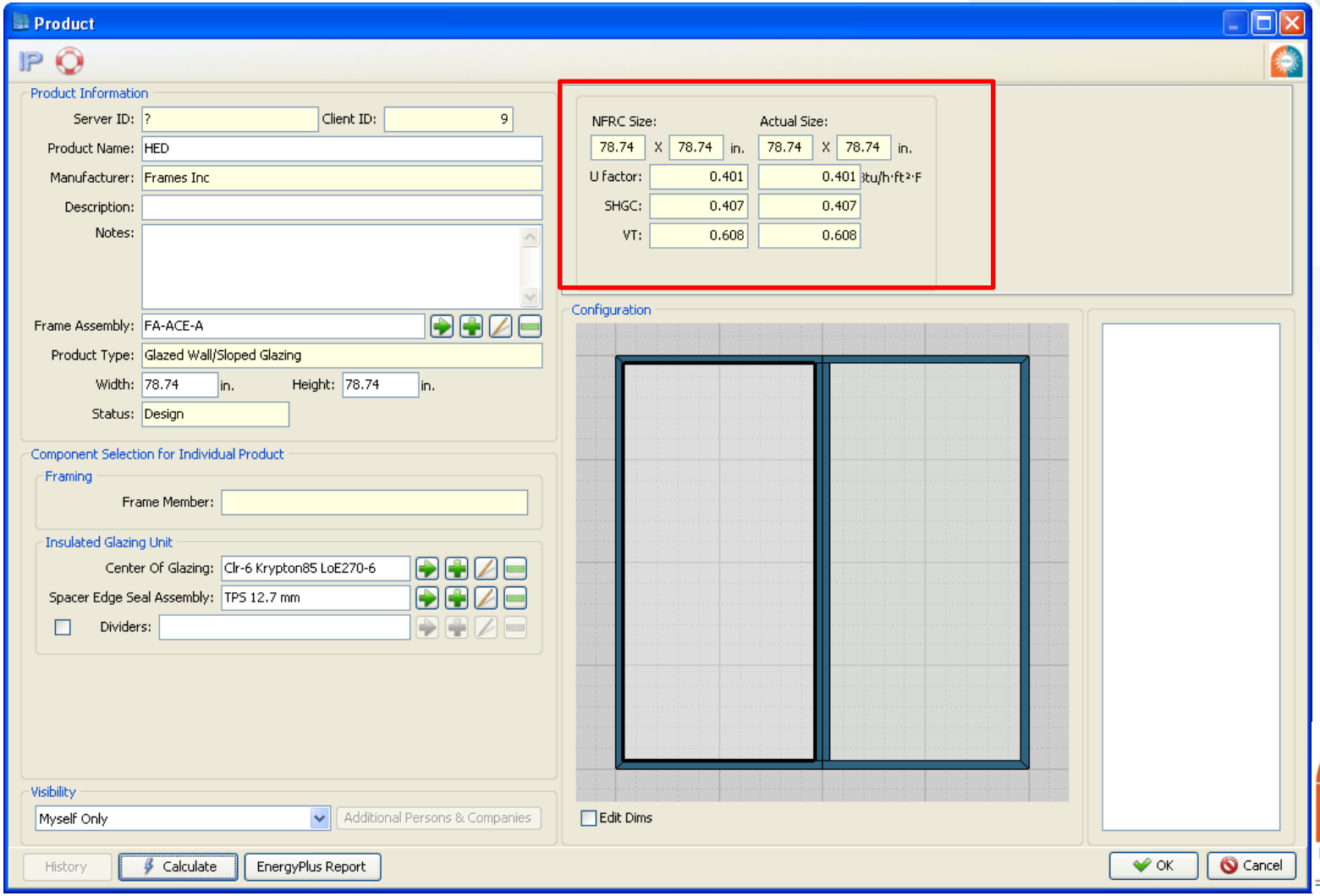
Overview, CMA Program, CMAST



CMAST Screenshot



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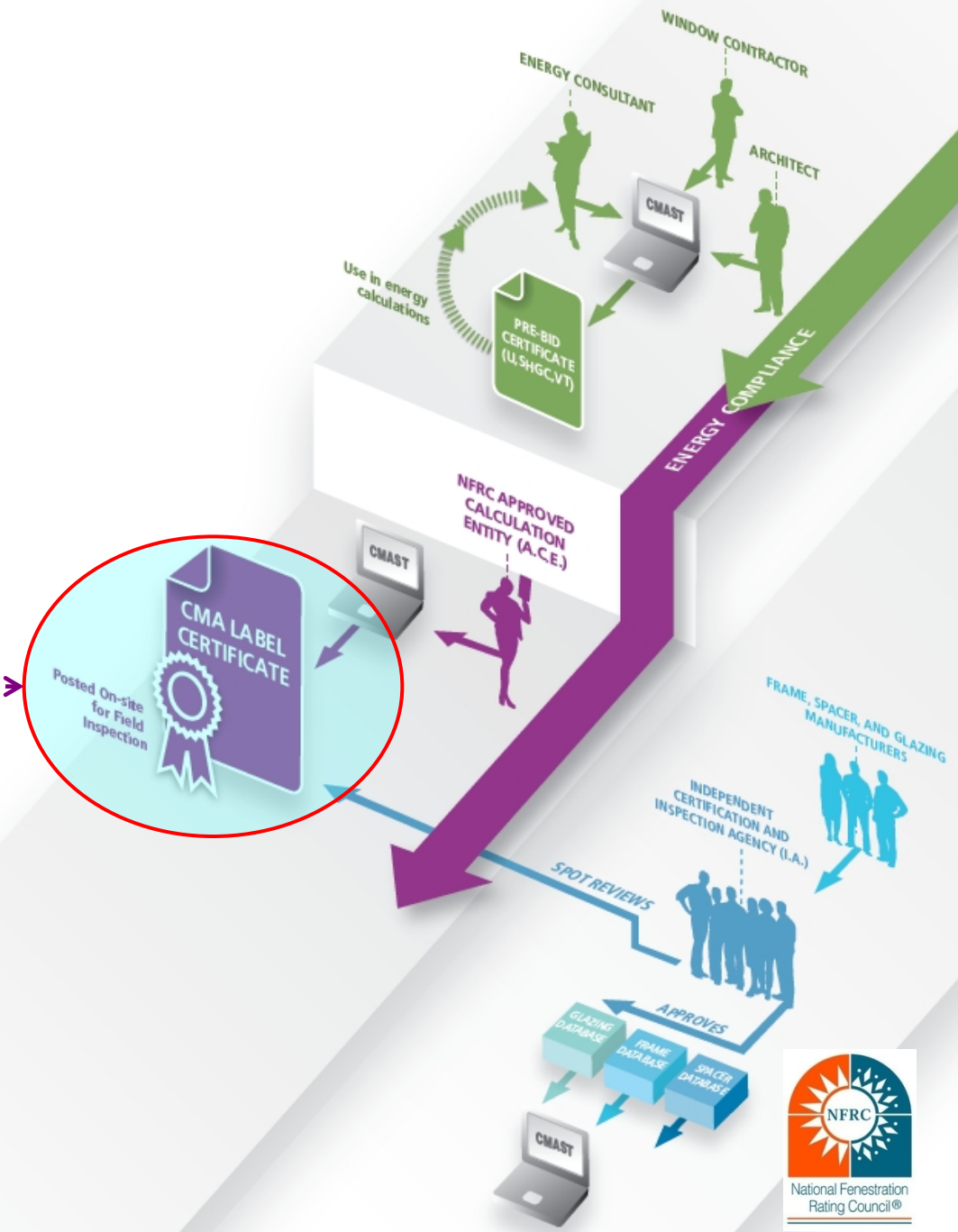
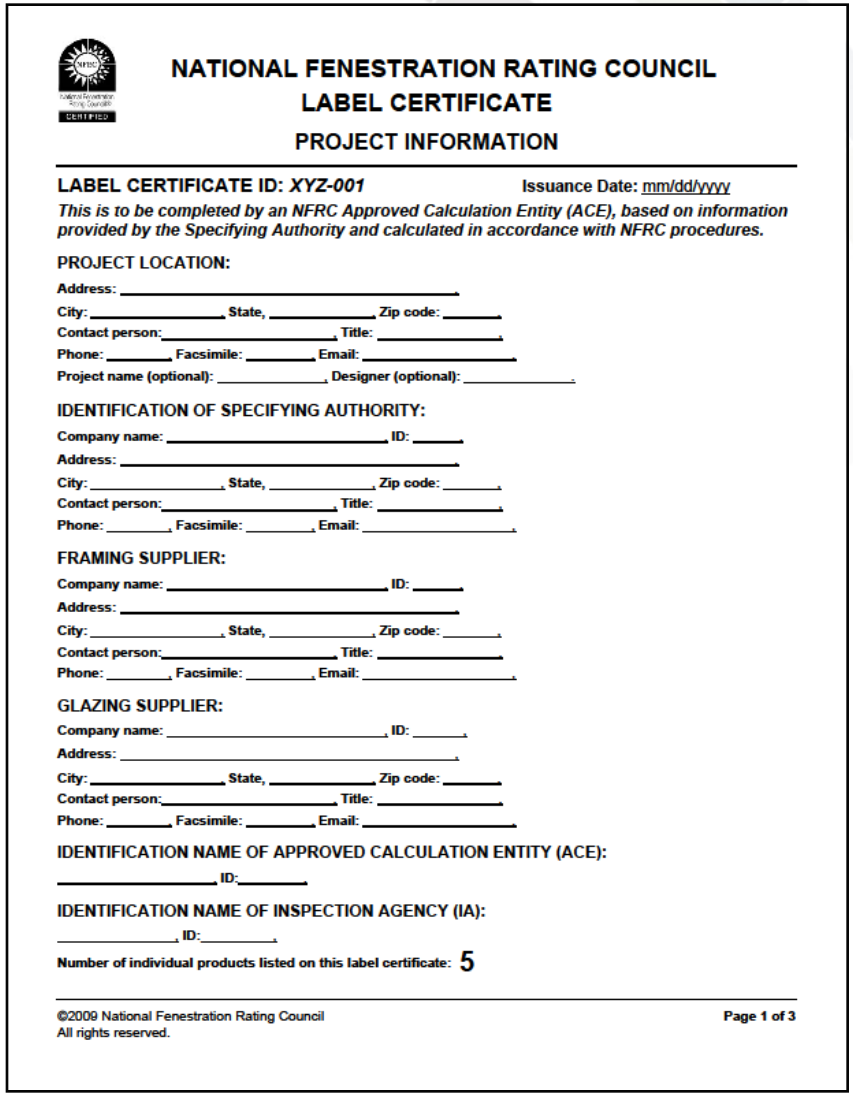
CMA Process

- FIELD INSPECTION PHASE
  - Finally, the CMA Label Certificate is posted on-site for field inspection



HESCHONG MAHONE GROUP

NFRC CMA Label Certificate *(cover page):*



NATIONAL FENESTRATION RATING COUNCIL
LABEL CERTIFICATE

PROJECT INFORMATION

LABEL CERTIFICATE ID: ***XYZ-001*** **Issuance Date:** mm/dd/yyyy

This is to be completed by an NFRC Approved Calculation Entity (ACE), based on information provided by the Specifying Authority and calculated in accordance with NFRC procedures.

PROJECT LOCATION:

Address: _____,
City: _____, **State,** _____, **Zip code:** _____,
Contact person: _____, **Title:** _____,
Phone: _____, **Facsimile:** _____, **Email:** _____,
Project name (optional): _____, **Designer (optional):** _____.

IDENTIFICATION OF SPECIFYING AUTHORITY:

Company name: _____, **ID:** _____,
Address: _____,
City: _____, **State,** _____, **Zip code:** _____,
Contact person: _____, **Title:** _____,
Phone: _____, **Facsimile:** _____, **Email:** _____,

FRAMING SUPPLIER:

Company name: _____, **ID:** _____,
Address: _____,
City: _____, **State,** _____, **Zip code:** _____,
Contact person: _____, **Title:** _____,
Phone: _____, **Facsimile:** _____, **Email:** _____,

GLAZING SUPPLIER:

Company name: _____, **ID:** _____,
Address: _____,
City: _____, **State,** _____, **Zip code:** _____,
Contact person: _____, **Title:** _____,
Phone: _____, **Facsimile:** _____, **Email:** _____,

IDENTIFICATION NAME OF APPROVED CALCULATION ENTITY (ACE):

_____, **ID:** _____,

IDENTIFICATION NAME OF INSPECTION AGENCY (IA):

_____, **ID:** _____,

Number of individual products listed on this label certificate: **5**

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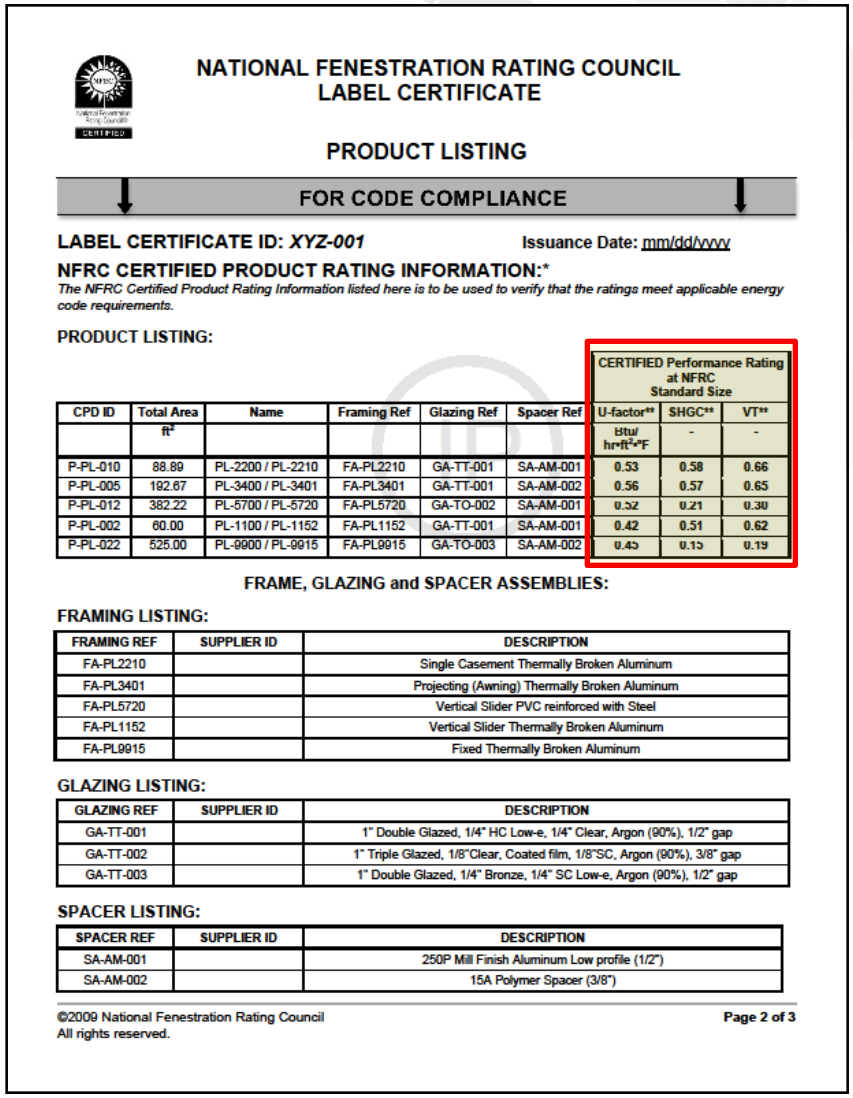
NFRC CMA Label Certificate *(page 2):*



NATIONAL FENESTRATION RATING COUNCIL
LABEL CERTIFICATE

PRODUCT LISTING

FOR CODE COMPLIANCE

LABEL CERTIFICATE ID: ***XYZ-001*** **Issuance Date:** mm/dd/yyyy

NFRC CERTIFIED PRODUCT RATING INFORMATION:*

The NFRC Certified Product Rating Information listed here is to be used to verify that the ratings meet applicable energy code requirements.

PRODUCT LISTING:

CPD ID	Total Area ft²	Name	Framing Ref	Glazing Ref	Spacer Ref	CERTIFIED Performance Rating at NFRC Standard Size U-factor** Btu/hr·ft²·°F	SHGC** -	VT** -
P-PL-010	88.89	PL-2200 / PL-2210	FA-PL2210	GA-TT-001	SA-AM-001	0.53	0.58	0.66
P-PL-005	192.67	PL-3400 / PL-3401	FA-PL3401	GA-TT-001	SA-AM-002	0.56	0.57	0.65
P-PL-012	382.22	PL-5700 / PL-5720	FA-PL5720	GA-TO-002	SA-AM-001	0.52	0.21	0.30
P-PL-002	60.00	PL-1100 / PL-1152	FA-PL1152	GA-TT-001	SA-AM-001	0.42	0.51	0.62
P-PL-022	525.00	PL-9900 / PL-9915	FA-PL9915	GA-TO-003	SA-AM-002	0.45	0.15	0.19

FRAME, GLAZING and SPACER ASSEMBLIES:

FRAMING LISTING:

FRAMING REF	SUPPLIER ID	DESCRIPTION
FA-PL2210		Single Casement Thermally Broken Aluminum
FA-PL3401		Projecting (Awning) Thermally Broken Aluminum
FA-PL5720		Vertical Slider PVC reinforced with Steel
FA-PL1152		Vertical Slider Thermally Broken Aluminum
FA-PL9915		Fixed Thermally Broken Aluminum

GLAZING LISTING:

GLAZING REF	SUPPLIER ID	DESCRIPTION
GA-TT-001		1" Double Glazed, 1/4" HC Low-e, 1/4" Clear, Argon (90%), 1/2" gap
GA-TT-002		1" Triple Glazed, 1/8"Clear, Coated film, 1/8"SC, Argon (90%), 3/8" gap
GA-TT-003		1" Double Glazed, 1/4" Bronze, 1/4" SC Low-e, Argon (90%), 1/2" gap

SPACER LISTING:

SPACER REF	SUPPLIER ID	DESCRIPTION
SA-AM-001		250P Mill Finish Aluminum Low profile (1/2")
SA-AM-002		15A Polymer Spacer (3/8")

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Overview, CMA Program, CMAST

Fenestration Manufacturer to-date:

- Benson Industries, LLC
- EFCO, A Pella Company
- FM Graham
- Kawneer Company Inc.
- Peerless
- TRACO
- Wausau Window & Wall Systems

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Access CMA on NFRC site

- http://cmast.nfrc.org/
- Register, download, begin to design!
- Free for six months
- Fees thereafter:

CMA Software Usage Fees [1]	≤25 Users	>25 Users
Initial Software License Fee	$500	$500
Initial Additional License Fee (per user) [2]	$125	$100
Annual Maintenance Software License Fee	$250	$250
Annual Maintenance Additional License Fee (per user) [2]	$25	$15

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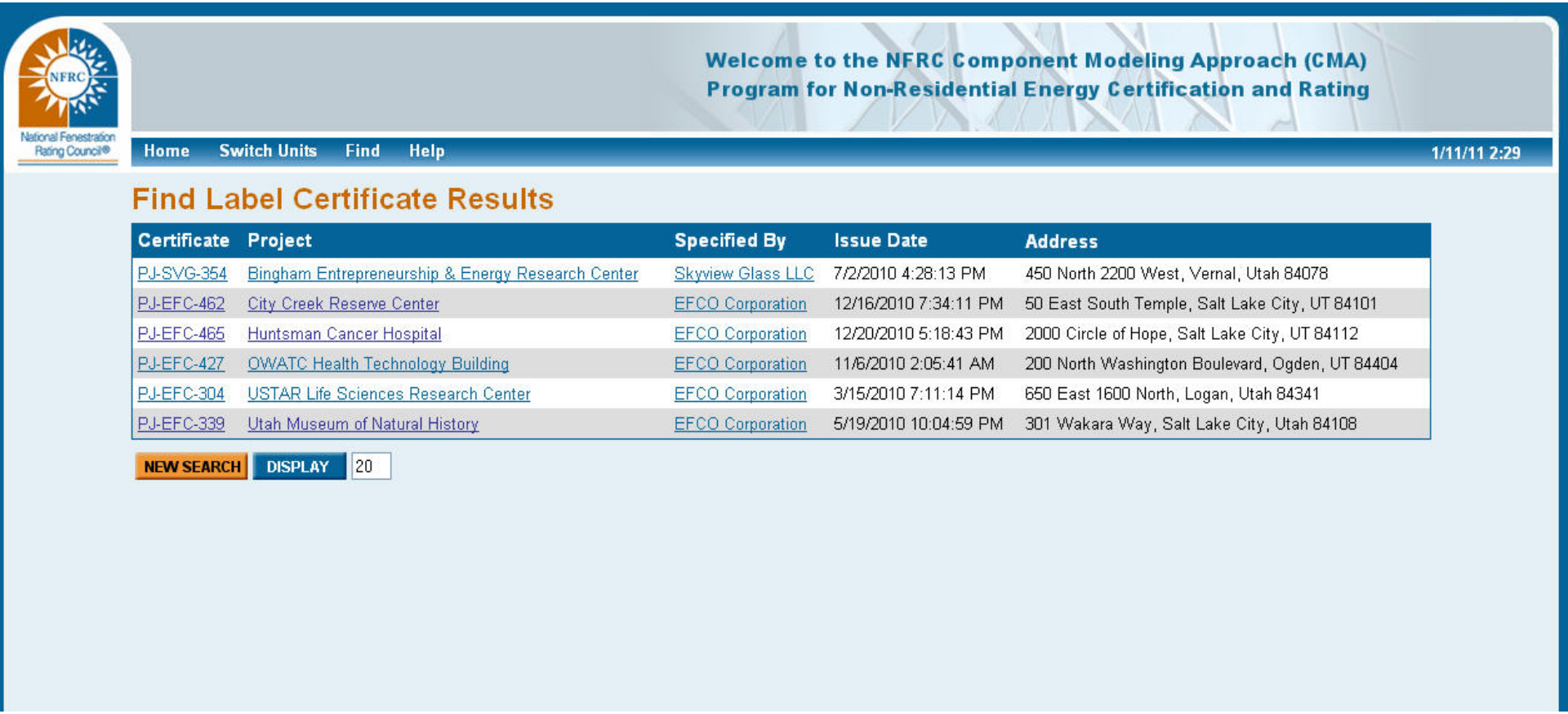
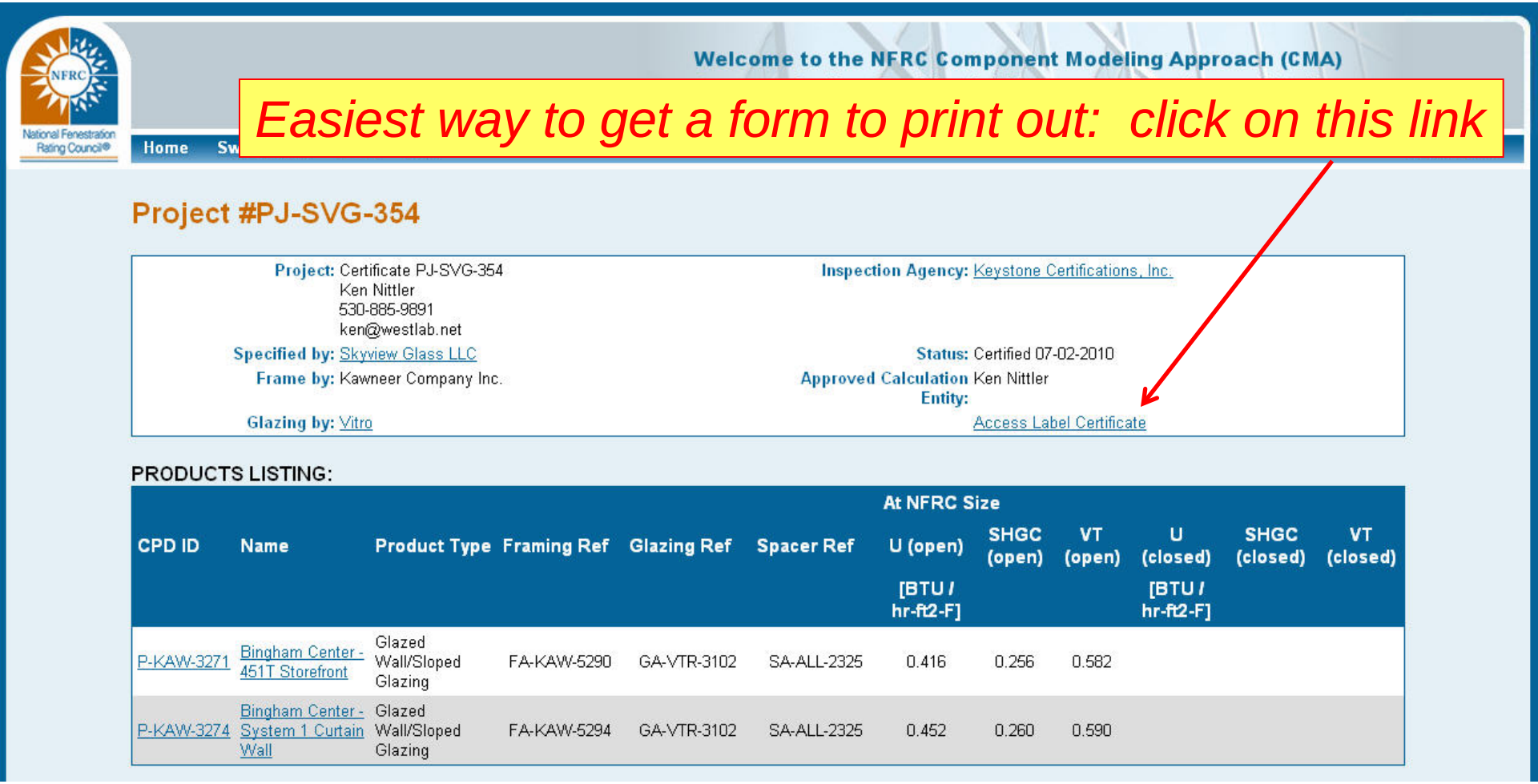
CMAST ~ Using the Certified Products Directory (CPD)



CMAST ~ Using the Certified Products Directory (CPD)



NATIONAL FENESTRATION RATING COUNCIL
LABEL CERTIFICATE

PRODUCT LISTING

FOR CODE COMPLIANCE

LABEL CERTIFICATE ID: ***PJ-SVG-354*** **Issuance Date:** 7/2/2010

NFRC CERTIFIED PRODUCT RATING INFORMATION: *

The NFRC Certified Product Rating Information listed here is to be used to verify that the ratings meet applicable energy code requirements.

PRODUCT LISTING:

						CERTIFIED Performance Rating at NFRC Standard Size		
CPD ID	Total Area	Name	Framing Ref	Glazing Ref	Spacer Ref	U-factor**	SHGC**	VT**
	ft²					Btu/ hr•ft²•°F	-	-
P-KAW-3271	3,070.69	Bingham Center - 451T Storefront	FA-KAW-5290	GA-VTR-3102	SA-ALL-2325	0.42	0.26	0.58
P-KAW-3274	6,689.72	Bingham Center - System 1 Curtain Wall	FA-KAW-5294	GA-VTR-3102	SA-ALL-2325	0.45	0.26	0.59

FRAME, GLAZING and SPACER ASSEMBLIES

FRAMING LISTING:

FRAMING REF	SUPPLIER ID	DESCRIPTION
FA-KAW-5294	KAW	1600 Curtain Wall, System 1
FA-KAW-5290	KAW	451T Storefront

GLAZING LISTING:

GLAZING REF	SUPPLIER ID	DESCRIPTION
GA-VTR-3102	VTR	1" Overall 0.25" SB70XL 0.5" Air 0.25" Clear

SPACER LISTING:

SPACER REF	SUPPLIER ID	DESCRIPTION
SA-ALL-2325	ALL	1/2" Aluminum Spacer

Note: For NFRC-approved frame, glazing and spacer component performance information see the NFRC Approved Component Library Database: www.nfrc.org/CMAST

**Certification information provided is for those fenestration systems listed and may not encompass all systems for the project.*

*** Each individual product certified performance rating is based on NFRC standard size in accordance with NFRC procedures.*

FOR CODE COMPLIANCE

SC Commercial Energy Code Requirement-IRC 09

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC
3	0.50[i]	0.65	0.35[e,j]

j. For impact-resistant fenestration complying with Section R301.2.1.2 of the *International Residential Code*, the maximum SHGC shall be 0.40.

Commercial Code Compliance

Compare Project Ratings to SC Energy Code Requirements

PRODUCT LISTING:

ID	Name	U	SHGC	VT
		Btu/h-ft^2-F	-	-
P-POL-1234	2011 Polaris Curtain Wall	0.40	0.29	0.40
P-POL-1234	2011 Polaris Store Front	0.45	0.30	0.39
P-POL-1234	2011 Polaris Casement	0.44	0.30	0.38

U-factor < 0.50?

SHGC < 0.35?

If yes, in compliance !!

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Energy Code Requirements from ASHRAE 90.1-2007/2010 referenced NFRC 100 and 200 only

5.8.2.4 U-factor. U-factors shall be determined in accordance with NFRC 100. U-factors for skylights shall be determined for a slope of 20 degrees above the horizontal.

5.8.2.5 Solar Heat Gain Coefficient. *SHGC* for the overall *fenestration area* shall be determined in accordance with NFRC 200.

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NFRC & Code Compliance

No NFRC ratings, use defaults:

TABLE A8.2 Assembly U-Factors, Assembly SHGCs, and Assembly Visible Light Transmittances (VLTs) for Unlabeled Vertical Fenestration

Frame Type	Glazing Type	Unlabeled Vertical Fenestration					
		Clear Glass			Tinted Glass		
		U-Factor	SHGC	VLT	U-Factor	SHGC	VLT
All frame types							
	Single glazing	1.25	0.82	0.76	1.25	0.70	0.58
	Glass block	0.60	0.56	0.56	n.a.	n.a.	n.a.
Wood, vinyl, or fiberglass frames							
	Double glazing	0.60	0.59	0.64	0.60	0.42	0.39
	Triple glazing	0.45	0.52	0.57	0.45	0.34	0.21
Metal and other frame types							
	Double glazing	0.90	0.68	0.66	0.90	0.50	0.40
	Triple glazing	0.70	0.60	0.59	0.70	0.42	0.22

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NFRC & Code Compliance

Energy Code Requirements for ASHRAE 90.1-07/10

TABLE 5.5-3 Building Envelope Requirements for Climate Zone 3 (A, B, C)*

	Nonresidential		Residential	S
Fenestration	**Assembly Max. U**	**Assembly Max. SHGC**		
Vertical Glazing, 0%–40% of Wall				
Nonmetal framing (all)[c]	U-0.65			
Metal framing (curtainwall/storefront)[d]	U-0.60	SHGC-0.25 all		
Metal framing (entrance door)[d]	U-0.90			
Metal framing (all other)[d]	U-0.65			
Skylight with Curb, Glass, % of Roof				
0%–2.0%	U_{all}–1.17	$SHGC_{all}$–0.39		
2.1%–5.0%	U_{all}–1.17	$SHGC_{all}$–0.19		
Skylight with Curb, Plastic, % of Roof				
0%–2.0%	U_{all}–1.30	$SHGC_{all}$–0.65		
2.1%–5.0%	U_{all}–1.30	$SHGC_{all}$–0.34		
Skylight without Curb, All, % of Roof				
0%–2.0%	U_{all}–0.69	$SHGC_{all}$–0.39		
2.1%–5.0%	U_{all}–0.69	$SHGC_{all}$–0.19		

*The following definitions apply: c.i. = continuous insulation (see Section 3.2); NR = no (insula

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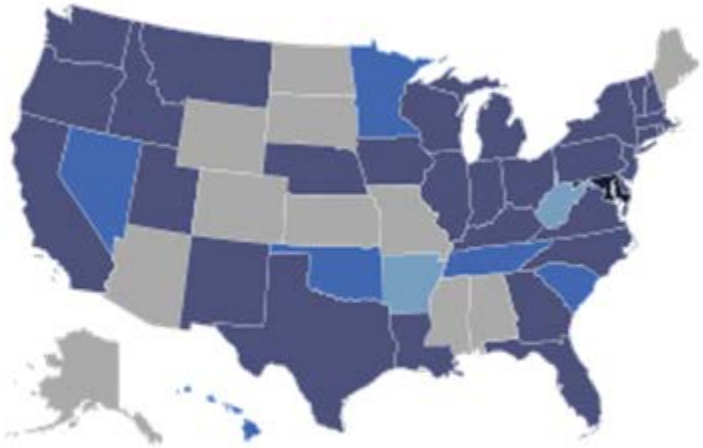
Energy Codes in US

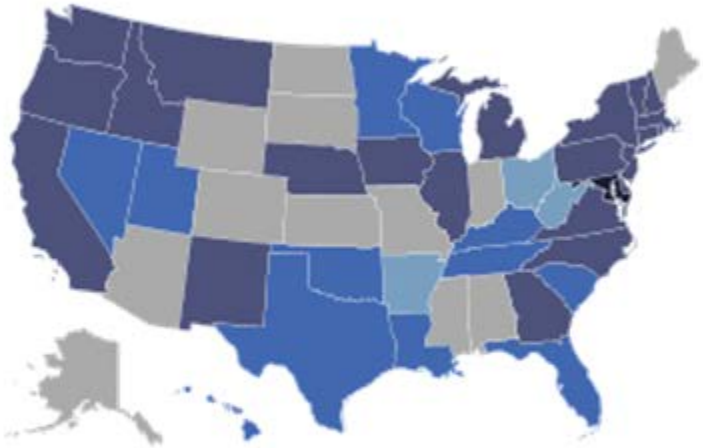
- Use Online Code Environment and Advocacy Network (OCEAN)
- http://www.bcap-ocean.org/code-status

Click on State

Code Status



Commercial Adoption
States that have Adopted ASHRAE Standard 90.1



Residential Adoption
States that have Adopted the IECC

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Summary & Conclusions

- NFRC's *Residential Fenestration Rating & Certification Program* is:
  - Well established, and in use for many years
  - Easy to understand
  - A great tool for proving code compliance; the temporary label makes for easy verification
  - Required for *ENERGY STAR®* rating of products

Additional Resources

- **NFRC Webpage:** www.nfrc.org
- **CMA Webpage:** http://nfrc.org/sb_aboutprogram.aspx
- **Labs and Agencies:** http://nfrc.org/labsagencies.aspx
- **CMAST Support**

  http://support.nfrc.org

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