



HERS Ratings and Energy Code Compliance... What CEOs and Raters Need To Know... About Each Other

**Mike DeWein / Director of Strategic Programs
RESNET San Diego
February 17, 2015**

Where I Come From...



Where I Come From...



NEW
ENERGY
STORE



ALLIANCE TO
SAVE ENERGY

Creating an Energy-Efficient World



What We'll Cover Today...

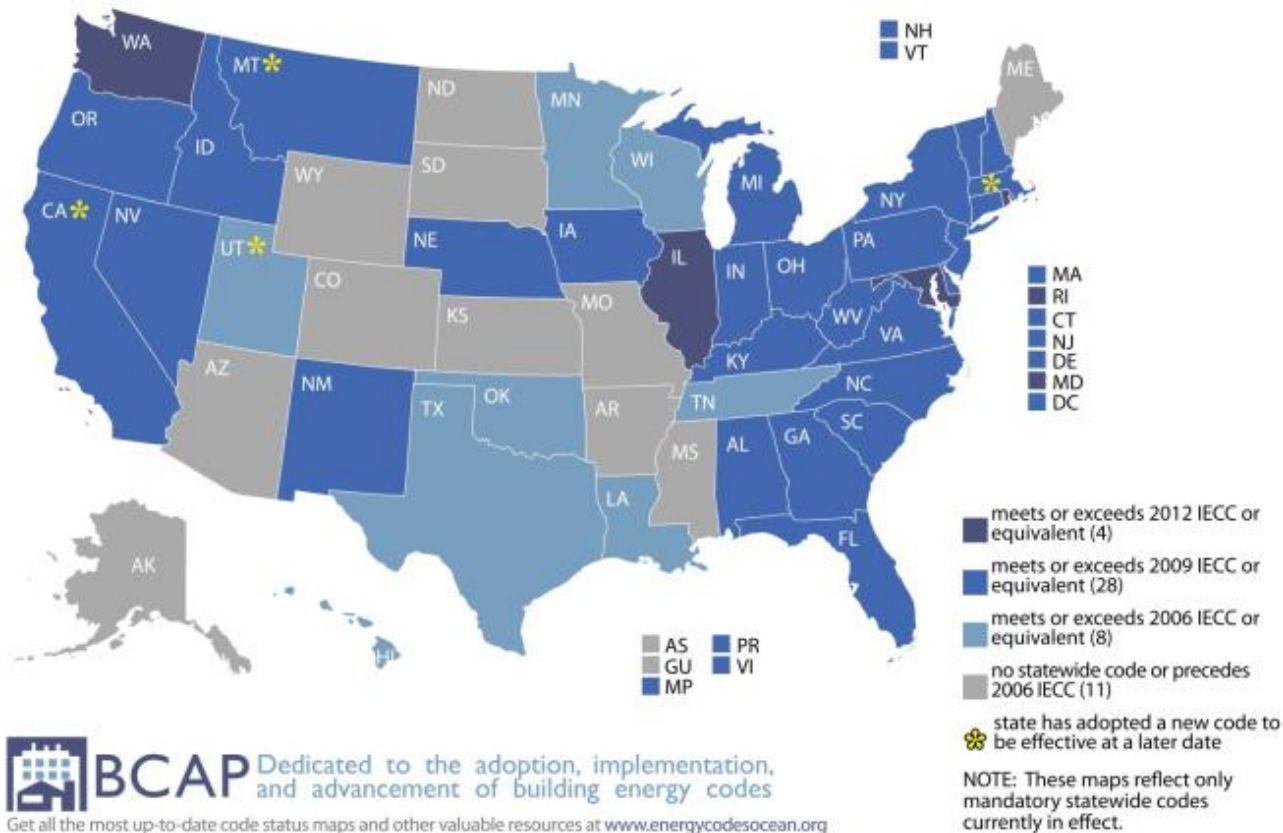
- > National Model Energy Codes – 2009 IECC and ON
- > Where the Action Is – National Adoption by States
- > Voluntary & Mandatory Whole-House Air Leakage Testing – 2009 through 2015
- > Air Leakage and Insulation Installation Criteria – Like TB Checklist
- > Duct Testing – All or Part system Outside the Envelope
- > Ventilation – Circuitous Path in the Codes!
- > 2015 IECC and ERI – RETURN to a True Performance Path Measurement, Use of HERS Index/ERI
- > **What CEOS and Raters Need to Know about Each Other AND Their Businesses!!**

Status of State Energy Codes: 2003 IRC/2004 IECC

- > Code Gets VERY Prescriptive – “SIMPLE”
- > HVAC, Window Credits Lose Impact
- > Prescriptive Path Meant to Dominate
- > Performance Path Loses Impact
- > Some Adoption, Compliance Lags
- > RESCheck Helps

Status of State Energy Codes

Residential State Energy Code Status AS OF FEBRUARY 1, 2014



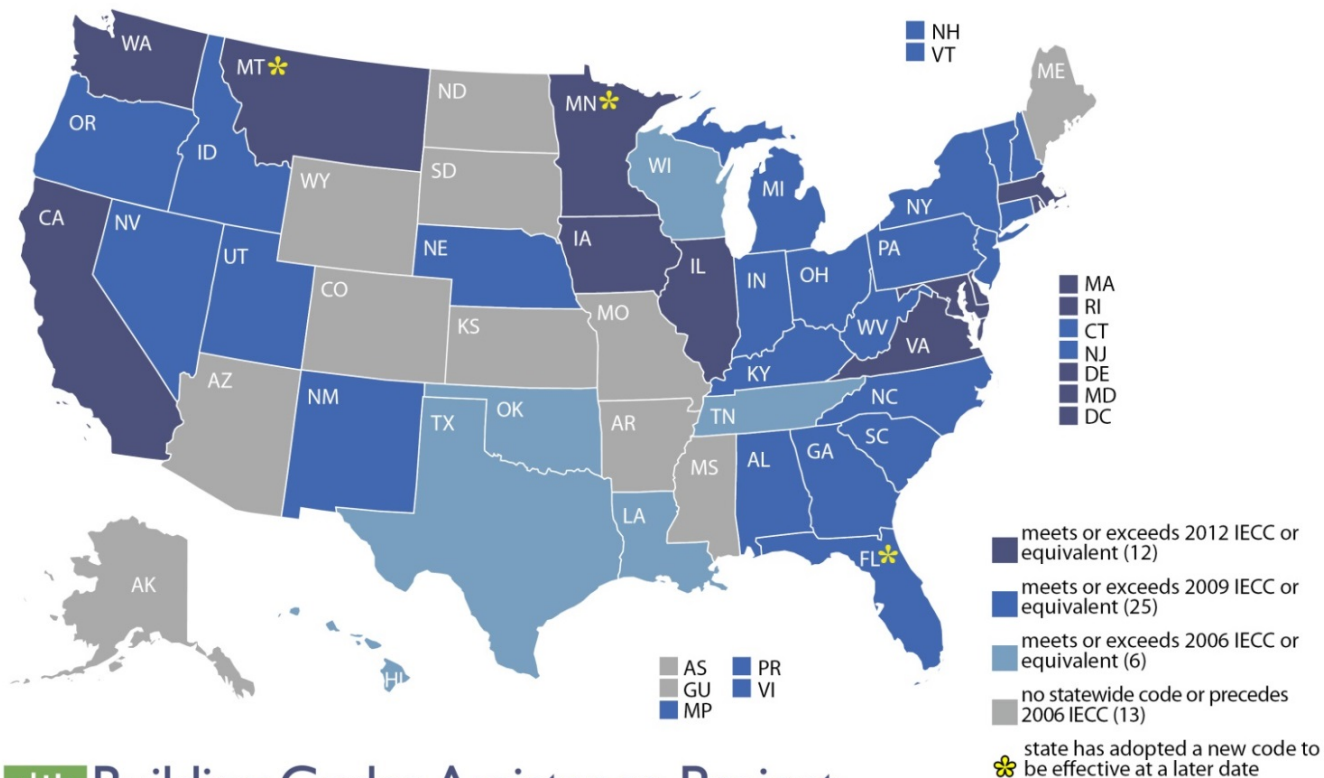
Status of State Energy Codes: 2009 IECC

- > ARRA Requirement
- > Significant Adoptions, However..
 - Low Implementation, Enforcement
- > Getting Serious about Testing
- > Whole-House Air leakage
- > Duct Leakage – if All or Some Outside Envelope
- > Air Leakage Checklist

Status of State Energy Codes: 2012 IECC

Residential State Energy Code Status

AS OF DECEMBER 1, 2014



Building Codes Assistance Project

Building Codes Building Communities

Get all the most up-to-date code status maps and other valuable resources at www.enrgeticscodesocean.org

NOTE: These maps reflect only mandatory statewide codes currently in effect.

Status of State Energy Codes: 2012 IECC

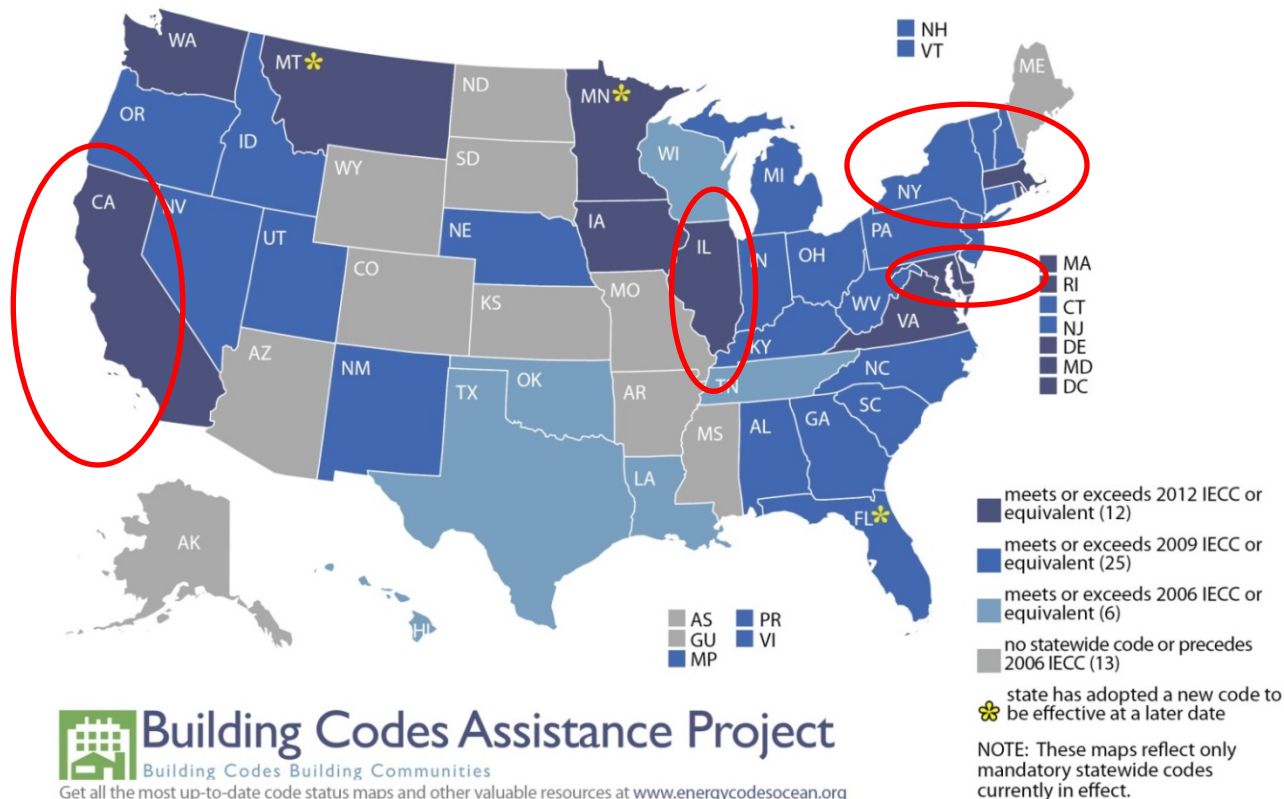
- > Mandatory Air Leakage Testing – ALL HOMES
- > *A Few Adoptions, However..*
 - *Low Implementation, Enforcement*
 - *Pushback, Many Levels*
- > 3ACH 50 Whole-House Air leakage
- > Duct Leakage – The Same, but Tighter
- > Air Leakage Checklist – Mandatory
- > **Prescriptive Path – Deemed Restrictive by Builders, Some Designers**

Status of State Energy Codes: 2015

- > Clean Up of Previous Versions
- > Requirements Much the Same, some Greater Prescriptive Requirements Added
- > RE-188 – Return to True Performance Compliance
- > **Utilizes ERI = HERS Rating**
- > Adopted by MD, VT,
- > Much Push Back

Status of State Energy Codes

Residential State Energy Code Status AS OF DECEMBER 1, 2014



Bottom Line – LOW Compliance

- > Compliance LOW, Adoption Stalled Post-ARRA
- > CEOs Poorly Supported, Resourced by Communities, States
- > CEOs Have MANY Codes to Enforce
- > Energy Code NOT Seen As Life/Health/Safety
- > Energy Codes Complicated – Even After Simplification
- > Unfunded Mandate – State to Local

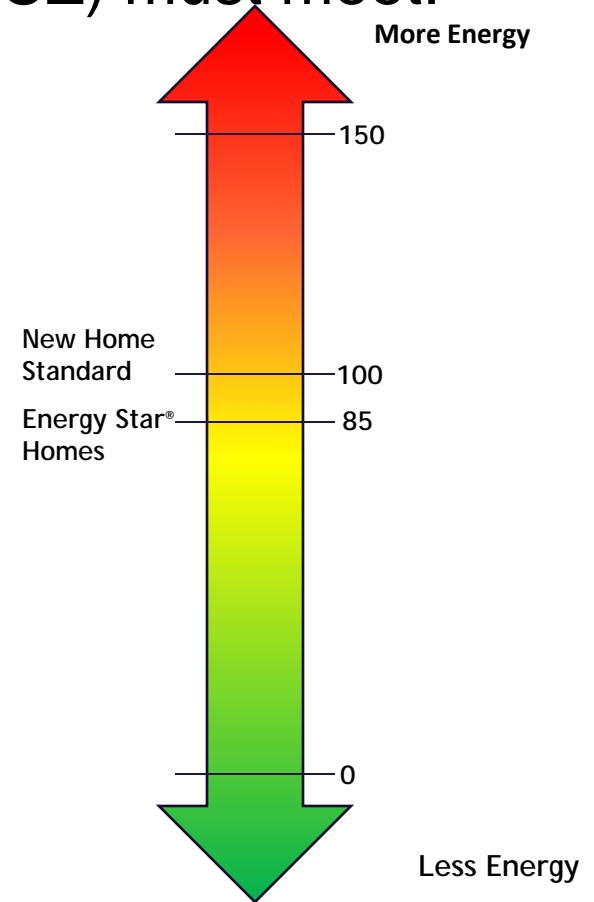
Opportunity - How the Door Opens with 2015 IECC and ERI

- > Offers Greater Flexibility to Designers, Builders
- > Requires Energy Professional for Compliance
- > ERI = HERS Rating
- > HOWEVER...
- > Need to Create Relationships
- > Learn Each Others Businesses
- > Reduce the “Black Box” Fear
- > *Use of Energy Professionals For Compliance Role – 3rd Party*

Climate Zone

HERS Index each climate zone (CZ) must meet:

CZ 1 & 2	52
CZ 3	51
CZ 4	54
CZ 5	55
CZ 6	54
CZ 7 & 8	53



Why Builders and Designers Like It...

- > It Provides Cost Effective Options - Flexibility
 - LBA and HRC Determined 2015 IECC ERI vs. Prescriptive = \$1300/\$3000
- > Designers Like Options
- > Greater Marketability
 - ERI/HERS Ratings Aids Marketing
- > **With ALL Stakeholders Bought In – Greater Chance of Higher Compliance?**
- > **Opportunity to Impact ALL Homes**

However - What the Raters Need to Learn...

- > This Can Be a Great Business Opportunity
- > Impact ALL Buildings, NOT Just Voluntary Programs
- > Developing Relationships and Understanding Positions
- > Documentation – What to Provide the CEO – ALL HE/SHE Wants!
- > ***We Don't Know It All...***
- > CEOs Approached FIRST with Community Building Performance Issues!

However - What the Raters Need to Learn... About CEO's Business

- > Charged With Life/Health/Safety
- > Is Energy Code = L/H/S?
- > Just Another Code?



- > Community Support?
- > *Community PRESSURE??*
- > **OVERWORKED and UNDERSTAFFED**

However - What We Need to Learn about CEOs...

- > Don't Know from RESNET/HERS/ERI
 - Supportive Collateral from Industry
- > Fear of Black Box
 - Software Exposure
- > Pressed to Do It, BUT Don't Take It Away!
 - THEY Give Cert. of Occupancy
- > Still Responsible for Final Inspection QA?QC - How Can CEO Be Sure?
- > What Happens if NOT 3ACH @ 50Pa??
- > ***BUILD RELATIONSHIPS***

And - What We Need to Deliver...

- > Quality, Understandable Documentation
- > Air Leakage Inspection AND Testing
- > Rating Report, OR Code Compliance Report
- > Materials/Equipment Details
- > Testing Checklists
- > Observe Air/Duct Leakage Testing?
- > R103 – Construction Documents
- > R104 - Inspections
- > ALL HE/SHE Wants!
- > Offer Training to Jurisdictions - ACCREDITED

Documentation...

NEW YORK STATE ANDREW M. CUOMO, GOVERNOR		DEPARTMENT OF STATE CESAR A. PERALES, SECRETARY OF STATE
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New York Residential Duct and Envelope Tightness (DET) Compliance Certificate**

House Address: _____	Permit #: _____
Builder/Design Prof.: _____	Phone: _____

I. Building Envelope Tightness (BET) test results (mandatory):

BET test conducted by: _____ Phone: _____
Fan Flow at 50 Pascals = _____ CFM50 Total Conditioned Volume = _____ ft³
ACH50 = CFM50 x 60 / Volume = _____ ACH50 (must be ≤ 5 ACH50 beginning 1/1/2014)

Visual Inspection (Mandatory)

Visual inspection conducted by: _____
Address: _____ Phone: _____

II. Duct Air Leakage (DAL) test results

Total Air Handler CFM (based on design calculations): _____ CFM
Duct Tightness Test Conducted by: _____ Phone: _____
System Method (DB, MBDS, AMBD) Test (PCO, PCT, RIT) CFM25 Area served (ft²) Result (%)*

1. PCO (≤ 8%)
2. PCT (≤ 12%)
3. RIT (≤ 6%)

*Note: CFM25 per 100 ft² of conditioned floor area = CFM25 x 100 / Conditioned floor area served
If all ducts are not located within conditioned space, builder must verify that either the post construction duct leakage to outdoors (PCO) is ≤ 8%, the post construction total duct leakage (PCT) is ≤ 12%, or the rough-in total duct leakage (RIT) with air handler installed is ≤ 6%.

**Note: This permanent certificate shall be posted on or in the electrical distribution panel or air handler. Certificate shall be completed by the builder or registered design professional. Where there is more than one value for each component, certificate shall list the value covering the largest area.

III. Where to find Certified DET providers

Documentation...

Residential Air Leakage and Insulation Installation Checklist

ECCCNYS-2014

Table 402.4.1.1

Date: _____ Name of Evaluator(s): _____

Building Name & Address: _____ Conditioned Floor Area: _____ ft²

Building Contact: Name: _____ Phone: _____ Email: _____

Compliance Approach: ☐ Prescriptive (402.1.2 or 402.1.3) ☐ UA Trade-off (402.1.4) ☐ Building Performance (405) ☐ REScheck

State: _____ Jurisdiction: _____

Building Type: 1- and 2-Family, Detached: ☐ Single Family ☐ Modular ☐ Townhouse

Multifamily: ☐ Apartment ☐ Condominium

Project Type: ☐ New Construction ☐ Addition to existing building ☐ Existing building renovation

COMPONENT	CRITERIA ^a	PLAN REVIEW			SITE INSPECTION		
		Y	N	N/A	Y	N	N/A
Air barrier and thermal barrier	A continuous air barrier shall be installed in the building envelope.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Exterior thermal envelope contains a continuous air barrier.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Breaks or joints in the air barrier shall be sealed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Air-permeable insulation shall not be used as a sealing material.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ceiling/attic	The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier sealed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Access openings, drop down stair or knee wall doors to unconditioned attic spaces shall be sealed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

REM/Rate Sample Report

- > Total annual energy costs
- > Duct insulation
- > Window U-factor and SHGC
- > Envelope and duct testing
Compared between
Energy Code and actual
home

2009 IECC ANNUAL ENERGY COST COMPLIANCE		
Date:	August 04, 2010	Rating No.:
Building Name:	ACME House	Rating Org.:
Owner's Name:	Mike Barcik	Phone No.:
Property:	Willie E. Coyote Road	Rater's Name:
Address:	Atlanta, GA 30308	Rater's No.:
Builder's Name:		
Weather Site:	Atlanta, GA	Rating Type:
File Name:	Burk_Plan2_CM_DB_CM_QAD.big	Rating Date:
		7/18/10
Annual Energy Cost		
	2009 IECC	As Designed
Heating:	530	514
Cooling:	214	220
Water Heating:	271	256
Lights & Appliances:	555	555
Photovoltaics:	-0	-0
Service Charge:	120	120
Total:	1689	1666 *
Duct Insulation R-Value Check (per Section 405.2)		
Minimum Duct Insulation (Design must be higher):	6.0	8.0
Window SHGC Check (per Section 402.5)		
Window SHGC Value (Design must be lower):	0.500	0.310
Home Infiltration per Section 402.4.2:		PASSES
Duct Leakage per Section 403.2.2:		PASSES
This home MEETS the annual energy cost requirements in accordance with Section 405 of the 2009 International Energy Conservation Code based on a climate zone of 3A.		
Name:	Diana Burk	Signature:
Organization:	Southface Energy Rated Homes	Date:
		August 04, 2010
* Design energy cost is based on the following systems: ASHP: Htg: 70.1 kBtu/h, 7.7 HSPF; Clg: 36.0 kBtu/h, 13.0 SEER. Water Heating: Conventional, Elec, 0.95 EF. ASHP: Htg: 64.1 kBtu/h, 8.0 HSPF; Clg: 30.0 kBtu/h, 13.0 SEER. Window-to-Floor Area Ratio: 0.15 Code default: Htg: 0.35 Clg: 0.35 ACHnat		
In accordance with IECC, building inputs, such as setpoints, infiltration rates, and window shading may have been		
REM/Rate - Residential Energy Analysis and Rating Software v12.83		
This information does not constitute any warranty of energy cost or savings. © 1985-2010 Architectural Energy Corporation, Boulder, Colorado.		

What About Manual J, D, S?

Cold Climate Manual J Calculations

Rhvac - Residential & Light Commercial HVAC Loads
Building Science Corporation
Westford, MA 01886



Elite Software Development, Inc.
Venture Cape
Page 3

System 1 Room Load Summary

Room No	Room Name	Area SF	Htg Sens Btuh	Htg Nom CFM	Run Duct Size	Run Duct Vel	Clg Sens Btuh	Clg Lat Btuh	Clg Nom CFM	Air Sys CFM
---Zone 1---										
1	Basement	816	7,597	102	1-7	383	1,961	63	92	92
2	Living	197	2,231	30	1-4	452	838	76	39	39
3	Dining	126	1,632	22	1-5	342	991	462	47	47
4	Kitchen	97	644	9	1-5	472	1,365	28	64	64
5	Back Hall	35	513	7	1-4	94	175	11	8	8
6	Mstr Bath	60	865	12	1-4	242	449	41	21	21
7	Master Bedroom	198	1,875	25	1-6	360	1,500	476	71	71
8	Downstair Hall	103	497	7	1-4	121	225	19	11	11
9	Bedroom 2	324	2,032	27	1-6	373	1,555	34	73	73
10	Bedroom 3	323	2,029	27	1-4	391	724	34	34	34
11	Bath 2	70	822	11	1-4	268	496	33	23	23
12	Stair	100	917	12	1-4	427	791	14	37	37
Ventilation			3,342				590	948		
System 1 total			2,449	24,996	291		11,660	2,239	521	521

System 1 Main Trunk Size: 9x12 in.
Velocity: 745 ft./min
Loss per 100 ft.: 0.103 in.wg

Cooling System Summary

	Cooling Tons	Sensible/Latent Split	Sensible Btuh	Latent Btuh	Total Btuh
Net Required:	4.16	0.40 / 0.60	11,660	2,239	13,899

8.5 x 11 in

3 of 3

What About Manual J, D, S?

FORM J-1
 Heating Calculation Procedures A, B, C, D
 Copyright by the
 Air Conditioning
 Contractors of America
 28 17th Street N.W.
 Washington, D.C. 20036
 Printed in U.S.A.
 986

LOT MA

Plan No. 7 Trolley Brook
 Date 5-9-03
 Calculated by M. Lennick

WORKSHEET FOR MANUAL J

LOAD CALCULATIONS FOR RESIDENTIAL AIR CONDITIONING

For: Name DiRasio Builders
 Address _____
 City and State or Province _____
 By: Contractor Boccardo Heating
 Address _____
 City _____

Design Conditions

Winter		Summer	
Outside db	<u>0</u> °F	Outside db	<u>90</u> °F
Inside db	<u>70</u> °F	Inside db	<u>75</u> °F
Winter Design Temperature Difference	<u>70</u> °F	Summer Design Temperature Difference	<u>15</u> °F
		Room RH	<u>55</u>
		Daily Range	<u>MA</u>

Heating Summary

Total Heat Loss for Entire House (Line 15) = 53925 Btuh
 Ventilation CFM = 50 Winter Design Temperature Difference = 70 °F
 Heat Required for Ventilation Air = 1.1 X 50 CFM X 70 °F = 3850 Btuh
 Design Heating Load Requirement = 53925 (house) 3850 (Vent) = 57775 Btuh

Cooling Summary

What About Manual J, D, S?

#7	M.Bath/Clos	#8	Loft	#9	BR#3	#10	Bath 2/Hall	#11	BR#2	#12	Basement	#13	#14
29		37		29		14		43					
9	x	20	14	x	13	13	x	11	x	16	x	x	x
	x		3	x	5	7	x	2					
9	x	20	14	x	13	13	x	11	x	16	x	x	x
	x		3	x	5	7	x	2					
9	x	20	3	x	5		x		x		x	x	x
	x			x			x		x		x	x	x
9	0.1	620	8	0.15	1576	8	0.15	1256	8	0.15	704		

Area or Length	Btuh	Area or Length	Btuh	Area or Length	Btuh	Area or Length	Btuh
Htg	Clg	Htg	Clg	Htg	Clg	Htg	Clg
261		296		232		112	
16	533	18	599	30	999	0	
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
16		0	10	140		0	
	704	8		352	30	1320	0
0		0		0		0	
0	0	0	0	0	0	0	0
245	1029	294	278	1168	334	202	848
0		0		0		0	
0		0		0		0	
0		0		0		0	
180	324	180	197	355	197	157	283
0		0		0		0	
180	306	0	15	26	0	0	0
0		0		0		0	

CALCULATION PROCEDURES A,B,C,D

Procedure A - Winter Infiltration HTM Calculation

1. Winter Infiltration CFM
 $0.5 \text{ AC/HR} \times 19950 \text{ Cu. FT.} \times 0.0167 = 167 \text{ CFM}$
 Volume

2. Winter Infiltration Btuh
 $1.1 \times 167 \text{ CFM} \times 70 \text{ Winter TD} = 12827 \text{ Btuh}$

3. Winter Infiltration HTM
 $12827 \text{ Btuh} / 328 \text{ Total Window \& Door Area} = 39 \text{ HTM}$

Procedure B - Summer Infiltration HTM Calculation

1. Summer Infiltration CFM
 $0.2 \text{ AC/HR} \times 19950 \text{ Cu. FT.} \times 0.0167 = 67 \text{ CFM}$
 Volume

2. Summer Infiltration Btuh
 $1.1 \times 67 \text{ CFM} \times 15 \text{ Winter TD} = 1099 \text{ Btuh}$

3. Summer Infiltration HTM
 $1099 \text{ Btuh} / 328 \text{ Total Window \& Door Area} = 3 \text{ HTM}$

Procedure D - Latent Infiltration Gain

Summer
 $0.68 \times 16 \text{ gr. diff.} \times 67 \text{ CFM} = 725 \text{ Btuh}$

Procedure D - Equipment Sizing Loads

1. Sensible Sizing Load

Sensible Ventilation Load	Btuh
$1.1 \times 50 \text{ Vent. CFM} \times 15 \text{ Summer TD}$	= 825
Sensible Load for Structure (Line 19)	= 23409
Sum of Ventilation and Structure Loads	= 24234
Rating of Temperature Swing Multiplier *	x 1
Equipment Sizing Load - Sensible	= 24234

2. Latent Sizing Load

Latent Ventilation Load	
$0.68 \times 50 \text{ Vent. CFM} \times 16 \text{ gr. diff.}$	= 544
Internal Loads = 230 x 6 people	+ 1380
Infiltration Load From Procedure C	+ 725
Equipment Sizing Load - Latent	= 2649

* Refer to Table 6

Information... How About Spreading The Word?



Air Leakage Requirements of the ECCCNY-2014 (R402.4)

The ECCCNY-2014 (Energy Code) contains very critical requirements for the air sealing in low-rise (3 stories or less) Residential Construction. These requirements are covered and are replicated for easy reference below.

Requirements begin here:

Thermal envelope shall be constructed to limit air leakage in R402.4.1 through R402.4.4.

Building thermal envelope shall comply with Sections R402.4.1.1 through R402.4.1.4. Similar materials shall allow for differential expansion and contraction.

For air sealing and thermal envelope construction, red, and you will find inspection in



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Duct Leakage Requirements of the ECCCNY-2014 (R403.2)

The ECCCNY-2014 (Energy Code) contains very critical requirements for the air sealing of HVAC distribution ducts in low-rise (3 stories or less) Residential Construction. These requirements are covered in Section R403.2 of the Energy Code, and are replicated for easy reference below.

R403.2 Ducts. Ducts and air handlers shall be in accordance with Sections R403.2.1 through R403.2.3.

First, all ducts located outside the building envelope must be insulated to the following R-values:

- **R403.2.1 Insulation (Prescriptive).** Supply ducts in attics shall be insulated to a minimum of R-8. All other ducts shall be insulated to a minimum of R-6.

Exception: Ducts or portions thereof located completely inside the *building thermal envelope*.

Perhaps MORE importantly, all ducts, whether inside or outside the building envelope, must be sealed to prevent conditioned air from leaking from them. This duct leakage can cause many problems in homes, including losses in energy efficiency, movement of air through spaces not intended for that air movement, and adverse impacts on building pressurization, potentially leading to gas appliance back drafting, struc-

Information... How About Spreading The Word?

- > Offer Training, Lunch and Learn
- > Software Demos
- > DET Demos
- > RESNET/ICC Collaboration & Guidance?
- > Support from Providers?

NEW YORK STATE
ANDREW M. CUOMO, GOVERNOR

DEPARTMENT OF STATE
CESARA PERALES, SECRETARY OF STATE

Duct Leakage Requirements of the ECCCNYS-NYS-2014 (R403.2)

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NEW YORK STATE
ANDREW M. CUOMO, GOVERNOR

DEPARTMENT OF STATE
CESARA PERALES, SECRETARY OF STATE


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The General ground rules for the air leakage requirements begin here:

- **R402.4 Air leakage (Mandatory).** The building thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.4.
- **R402.4.1 Building thermal envelope.** The building thermal envelope shall comply with Sections R402.4.1.1 and R402.4.1.2. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

The Table referenced below details the requirements for air sealing and insulation installation, to provide a proper air and thermal boundary in the home. It also provides guidance for the construction and inspection of homes; a visual inspection is required, and you will find a useful checklist for use in both construction and inspection in this manual.



What CEOs Need to Learn

- > Developing Relationships and Understanding
 - Learn HERS Business & History
 - Learn RESNET and Provider QA/QC
- > Systems approach
- > Documentation – Ask for What They Want
 - Punchlist of documentation?
 - Designers Need to Help Here
- > Understand Performance Approach
- > NOT A BLACK BOX - Understand TOOLS
- > **Opportunity for CEO and Jurisdiction – DECREASE Enforcement Workload!**

How PBFs and Utilities Support this HERS Marketing Opportunity

What If We Had...

- > A RATER in every New Home/Major Remodel?
- > RATERs Assist in the Program Marketing?

Questions:

- > Impacts on Marketing
- > Who Gets the Marketing \$\$
- > Who Pays for the Increased Compliance
- > How Many Homes Could We IMPACT

So....What's Next?

- > Stay tuned to RESNET and SUPPORT
- > Get to know the Code and Process in YOUR market
- > Meet Your CEO and establish relationship
 - Start with Marketing Testing – Ducts, Whole House
 - Expand to Performance Calculations, submitting your Client Code Documentation for Code Compliance, etc.
 - ***Full Tilt Cx!***
 - ***Commercial Building testing?***
 - ***Air Barriers, Air Leakage Testing, Water???***

Q & A



So...What Do We Do Next?

- > Buy The Code
- > Learn The Code
- > KNOW Your CEO
- > Understand HIS/HER World!
- > Help Teach Your Common World?
- > Let's Get 100% Compliance!
- > MORE IMPORTANT – High Performance Homes

Thank You!

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SUPPORT RESNET!

SUPPORT YOUR LOCAL CEOS!