



R1702/R1710 Residential New Construction Codes and Standards Assessment



Technical Presentation of Final Results to Connecticut Energy Efficiency Board, Eversource, United Illuminating, and Stakeholders

NMR Research Team: Zack Tyler, Jerrad Pierce, Jared Powell

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NY, TX, VA, & VT



41 EMPLOYEE OWNERS



Agenda



- Background
- Study purpose
- Project tasks and methodology
- Compliance Study
 - Key findings
 - Recommendations
- Review of other programs
 - Key findings
 - Recommendations
- Questions

Background



- Historically, Connecticut has not measured RNC code compliance nor offered a dedicated code compliance enhancement program.
- An RNC baseline study (R1602) was completed in 2017.
- Connecticut adopted a 2012 IECC-based building code (2012 IECC-CT) in June of 2016.
 - Permissible air leakage reduced by 57% for detached homes
 - Efficient lighting requirement increased 50%
 - Reduced permissible duct leakage by 33%

Study Purpose – Compliance



- What is the compliance level of 2009 IECC built homes?
 - What is the minimum estimated compliance rate for early 2012 IECC-CT built homes?
- How does compliance vary:
 - between program and non-program homes?
 - between states?
- What are gross technical potential savings available from code compliance enhancement efforts under both 2009 IECC and 2012 IECC-CT? How do estimates vary:
 - between program and non-program homes?
 - between states?

Study Purpose – Enhancement



- What is the design of compliance enhancement programs in other jurisdictions?
- If the Companies implement a compliance enhancement program, how should it handle:
 - savings calculation approaches
 - attribution methodologies
 - *etc.*
- Which aspects may require further research to develop or support a code enhancement program?

Project Tasks and Methodology



Data collection: Fall 2016 – Winter 2017

- R1602 Baseline study
 - Onsite HERS ratings at nonprogram homes (n=70: 46 spec, 24 custom)
- Program data (n=180)

Analysis: Fall 2017

- Model four permutations of each home (2009 and 2012 codes, as-built and prescriptive code compliant)

Literature Review: Fall 2017 – Spring 2018

Key Findings – Compliance: P vs. NP

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Building System	2009 IECC			2012 IECC-CT (Minimum, Business-as-Usual)		
	Program	Non-Program	Statewide (Weighted)	Program	Non-Program	Statewide (Weighted)
n	180	70	2,880	180	70	2,880
Windows	99%*	94%	95%	99%*	85%	86%
Air Leakage	100%*	98%	98%	90%*	64%	65%
Above Grade Walls	96%*	88%	89%	98%*	89%	89%
Ducts	100%*	95%	96%	99%*	76%	77%
Ceilings	98%*	78%	80%	94%*	70%	72%
Lighting	100%*	90%	91%	100%*	79%	81%
Frame Floors	86%*	72%	73%	89%*	75%	76%
Foundation Walls	92%*	85%	85%	89%*	80%	80%
Slabs	99%*	94%	94%	99%*	92%	93%
OVERALL	97%*	90%	91%	96%*	78%	79%

* Significantly different from non-program homes at the 90% confidence level

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Key Findings – Compliance: P vs. NP

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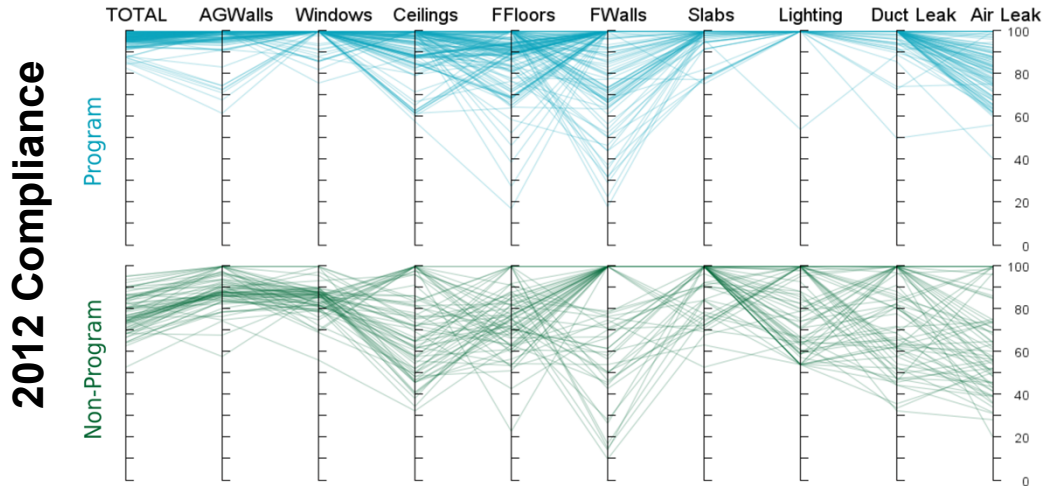
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Above Grade Walls	96%*	88%	89%	98%*	89%	89%
Ducts	100%*	95%	96%	99%*	76%	77%
Ceilings	98%*	78%	80%	94%*	70%	72%
Lighting	100%*	90%	91%	100%*	79%	81%
Frame Floors	86%*	72%	73%	89%*	75%	76%
Foundation Walls	92%*	85%	85%	89%*	80%	80%
Slabs	99%*	94%	94%	99%*	92%	93%
OVERALL	97%*	90%	91%	96%*	78%	79%

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Key Findings – Compliance: P vs. NP



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Key Findings – Compliance Comparison



Building System	Late 2009 IECC			Early 2012			
	CT (2017)	MA (2016)	ID (2013)	CT: BAU	CT: MA-IR	MA (2016)	RI (2017)
Windows	95%*	98%	100%	86%	94%	97%	
Air Leakage	98%	99%		65%	81%	85%	
Above Grade Walls	89%	91%	91%	89%	88%	90%	
Ducts	96%	91%		77%	78%	75%	
Ceilings	80%	83%	76%	72%	87%	89%	
Lighting	91%*	82%	74%	81%	76%	72%	
Frame Floors	73%*	81%	100%	76%	73%	83%	
Foundation Walls	85%*	91%		80%	80%	86%	
Slabs	94%	94%	86%	93%	92%	92%	
OVERALL	91%	91%		79%	86%	86%	83%

* Significantly different from Massachusetts at the 90% confidence level
 BAU: Business-as-usual
 MA-IR: Massachusetts Improvement Ratio

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Key Findings – Gross Technical Potential Savings: P vs. NP



Building System	Required?	2009 IECC			2012 IECC-CT (Maximum)		
		Program	Non-Program	Statewide	Program	Non-Program	Statewide
		TOTAL	6%*	17%	17%	7%*	34%

* Significantly different from non-program homes at the 90% confidence level

- The average Program home is built with a sufficient performance buffer that potential savings are largely unaffected by changes to code.

Key Findings – Gross Technical Potential Savings: P vs. NP

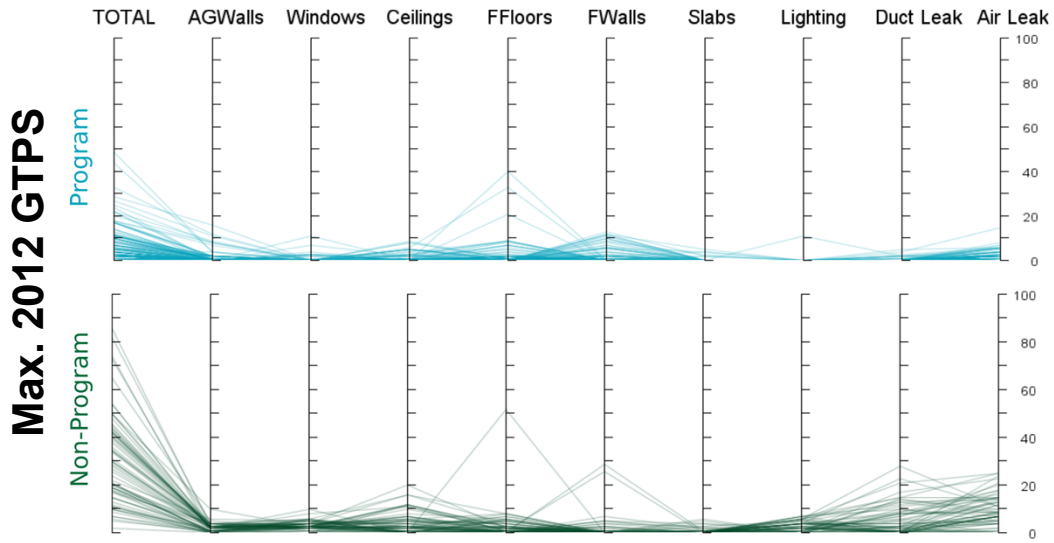


Building System	Required?	2009 IECC			2012 IECC-CT (Maximum)		
		Program	Non-Program	Statewide	Program	Non-Program	Statewide
		TOTAL	6%*	17%	17%	7%*	34%

* Significantly different from non-program homes at the 90% confidence level

- The average Non-Program home is only minimally compliant, whereas the average Program home is built with a sufficient performance buffer that potential savings are largely unaffected by changes to code.

Key Findings – Gross Technical Potential Savings: P vs. NP



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Key Findings – GTPS: Early 2012 CT (MA-IR) vs. MA



Building System	Required?	Connecticut			MA
		Program	Non-Program	Statewide	
Air Leakage	Mandatory	<1%	4%	4%	3%
Duct Leakage	Mandatory	2%	4%	4%	4%
Ceilings	Path dep.	1%	2%	1%	1%
Windows	Path dep.	<1%	1%	1%	1%
Frame Floors	Path dep.	1%	2%	2%	2%
Above Grade Walls	Path dep.	1%	2%	2%	2%
Lighting	Mandatory	0%	3%	3%	3%
Foundation Walls	Path dep.	1%	3%	2%	1%
Slabs	Path dep.	<1%	<1%	<1%	<1%
TOTAL		6%	21%	20%	18%

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Recommendations – Compliance & GTPS



- Target non-program homes with future efforts.
- Emphasize air leakage and duct leakage code requirements, representing the largest gross technical potential savings from compliance enhancement.

Key Findings – Code Enhancement Program Features



	CA	FL	IA	MA	NY	RI	TX	VT	WA
Training	X			X	X	X			
Circuit riders		X		X	X	X			
Field guide	X				X	X			
Hotlines	X					X		X	
Marketing									X
Inspection fee support							X		X
Contingent program access			X						
Checklists/paperwork assistance	X								

Key Findings – Other Program Features

- There are other ways to influence the RNC market
 - Traditional RNC incentive programs
 - Code development programs
 - Big component of CA programs (Title 24)
 - Market transformation initiatives to accelerate the adoption of zero energy buildings
 - Pieces of this are already included in CT RNC program through DOE Zero Energy Ready offering

Key Findings – Program Design

Indicative comments concerning code enhancement content

“It’s important to make the sections of the code as simple as possible. Make it more user friendly. There should be commentary on the IECC code books to help code officials and builders interpret it. Break down the intent of the sections. They need to come out with something that shows this more clearly.”

— MA CCSI attendee

Recommendations – Program Design



- Monitor compliance enhancement programs elsewhere. Potential savings are non-trivial, but others have struggled.
- Continue incorporating code trainings in RNC programs. Code enhancement savings can be claimed through net-to-gross (NTG) assessments (R1707).
 - R1707 study has been hindered by limited data. More detailed records of training efforts would facilitate future evaluations.
- Consider strategies to claim the savings from any continuing commercial training efforts.

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Questions?

A photograph of a brick wall with a sign for NMR Group, Inc. The sign is made of a reddish-brown material and features the letters "NMR" in large, green, 3D block letters. Below "NMR", the words "Group, Inc." are written in a smaller, black, sans-serif font. The sign is mounted on a red brick wall. In the background, a window with a grid pattern is visible.

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Thank you

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