

Vermont  
**Energy Investment**  
Corporation

Taking it to the Streets...

HERS Ratings and  
Vermont's Energy Code

RESNET  
Building Performance Conference  
2015

Leslie Badger,  
Vermont  
Energy Investment  
Corporation

# About VEIC



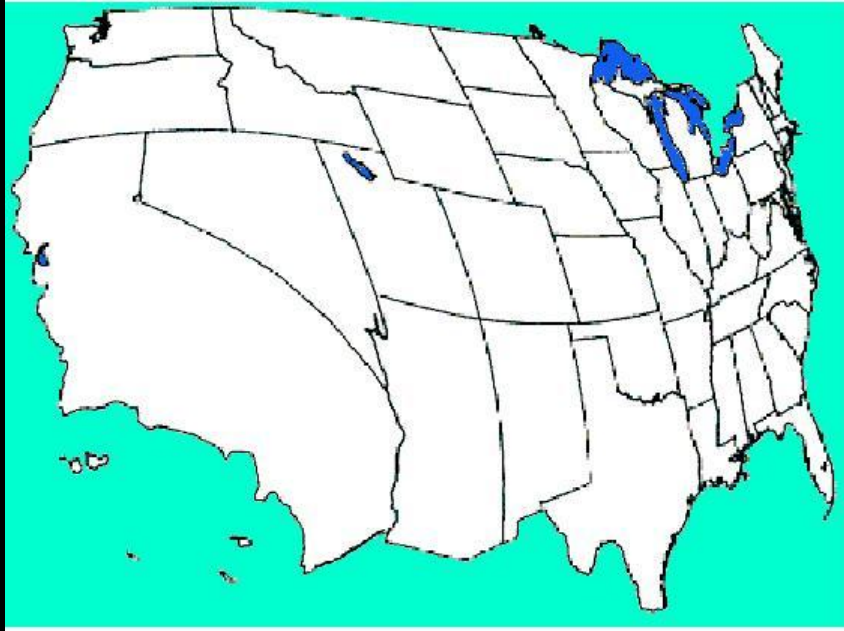
- Private, nonprofit corporation founded in 1986
- Designs, delivers, evaluates energy efficiency & renewable energy programs nationwide
- 300+ employees
- Locations: VT, DC, NJ, OH

# Efficiency Vermont

- Established in 2000 as nation's first statewide Energy Efficiency Utility
- Operated through non-profit Vermont Energy Investment Corporation under appointment from the State of Vermont
- Funded through an Energy Efficiency Charge on all electric bills (~\$0.01/kWh)
- 2011 efficiency led, in part, to a 2% decrease in the state's overall annual electrical demand



# Where is Vermont Anyway



\*The United States as seen from  
Santa Barbara, California

- Population ~625k
- Largest city - Burlington ~42k
- Small towns
- Small homebuilders
- ~1,000 (1-4 unit) building permits issued annually
- Most cities/towns without a Code Official
- Certificate of Occupancy not required in all towns
- “Owner/builder” special provision



And We're Prone to Building Things Like This...



# A Brief History of Vermont Programs & Codes

- 1987**  
Vermont issues first HERS Rating (Energy Rated Homes of VT)
- 1997**  
Consolidated statewide utility program created (Vermont Star Homes)
- 2005**  
RBES updated to include mechanical ventilation and combustion safety requirements
- 2015**  
Efficiency Vermont continues to deliver HERS based programs & code support services

- 1997**  
First statewide energy code (RBES) adopted  
\*Includes HERS compliance option
- 2000**  
Efficiency Vermont, nations first energy efficiency utility, begins delivering program services including Vermont ENERGY STAR Homes
- 2011**  
RBES updated to 2009 IECC with Vermont amendments
- 2015**  
RBES updated to 2015 IECC with Vermont amendments



# Efficiency Vermont - Key Program Statistics

	2008	2009	2010	2011	2012	2013	2014
Number of Builder Partners	277	319	355	371	385	396	410
% EVT RNC Program Market Share	32	36	29	31	29	34	36
Average EVT RNC program participant HERS Index	60	58	58	56	51	50	47

Builder Type	Percent of Total
Custom	46%
Developer	26%
Homeowner	16%
Modular	10%
Other	2%



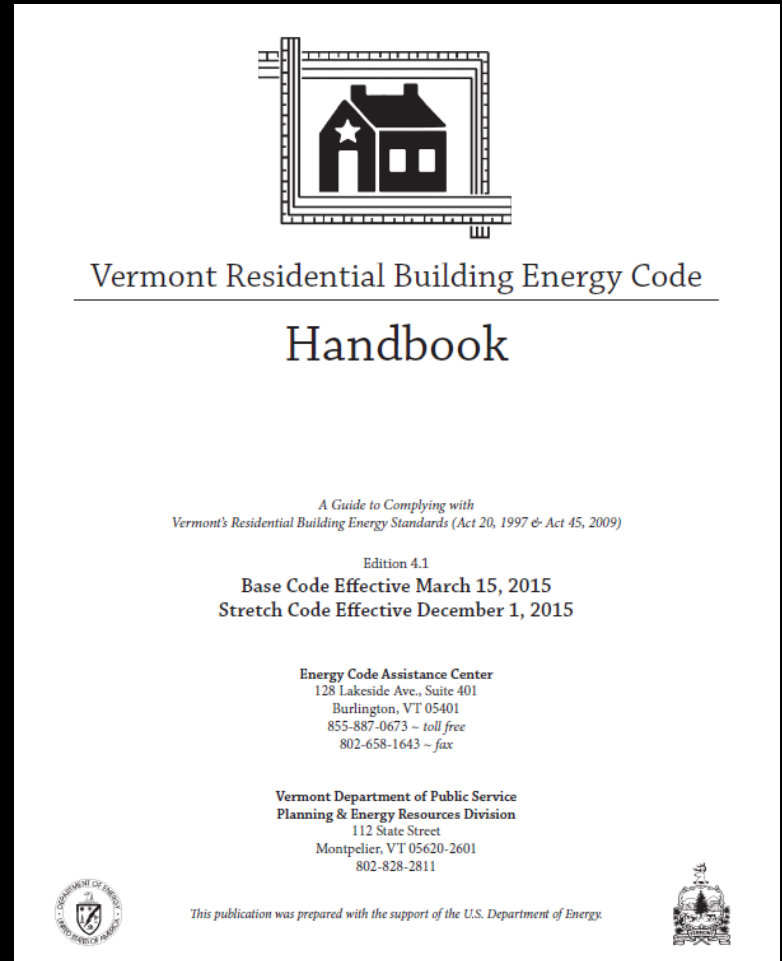
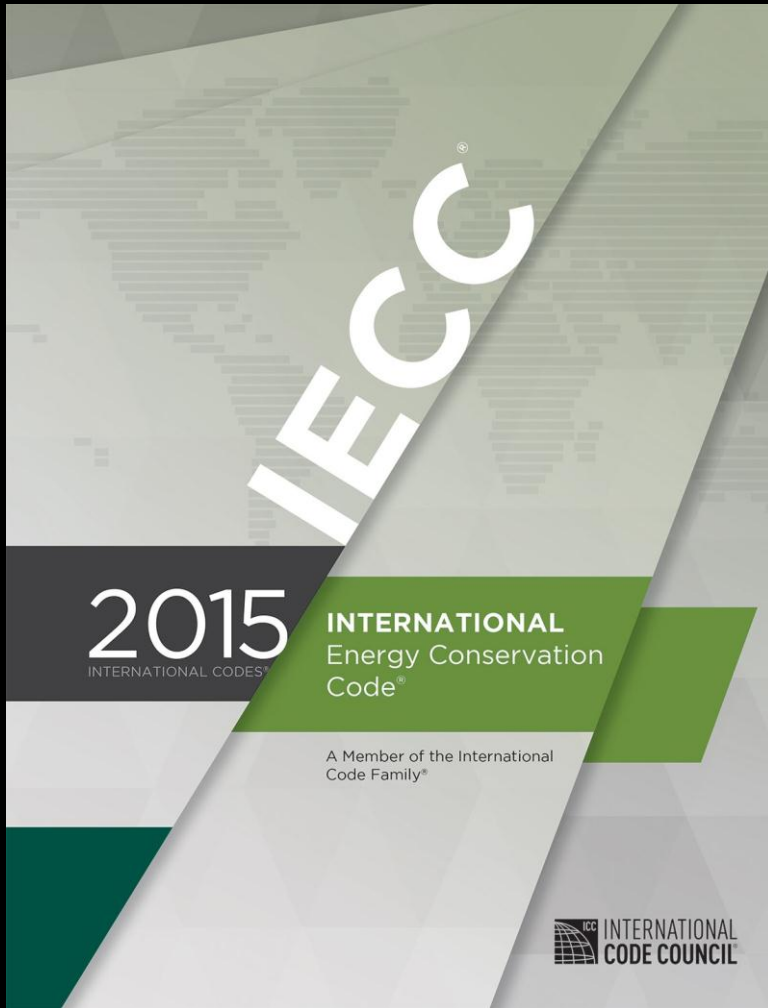


# Average HERS by Tier (2012 to present)

Efficiency Vermont Program Tier	Average HERS Index	Participants
Code Plus (IECC 2009)	53	49%
Vermont ENERGY STAR	49	49%
High Performance Homes	21	2%



# From There to Here

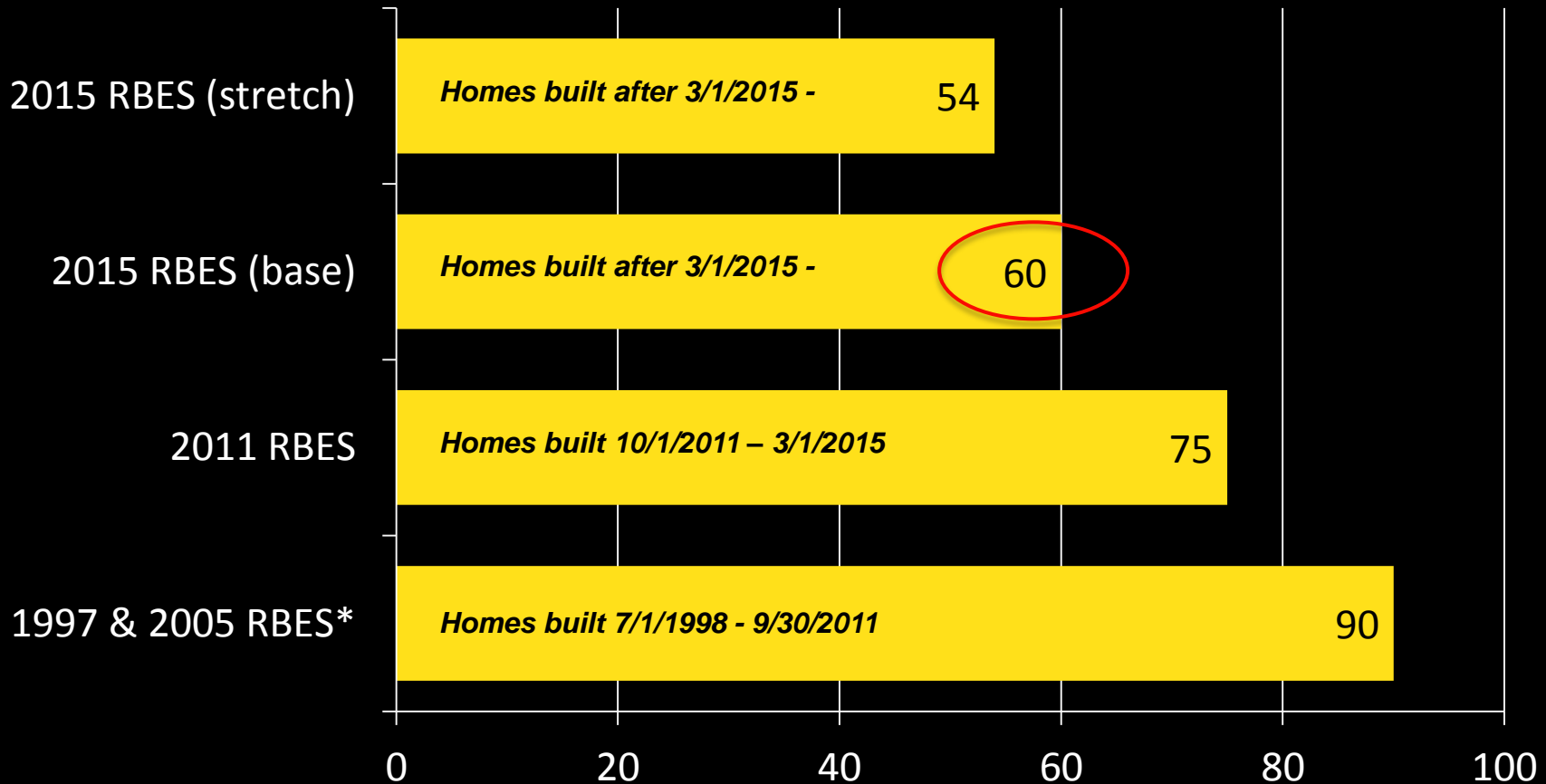


# Vermont's Code Cycle

- Energy code update required by Vermont Law
- Every 3 years (follows IECC updates)
- Adopted via state rulemaking process
- This year also adopting stretch code to apply to Act 250 projects (per Act 89)
- Process managed by Public Service Department



# HERS Code Compliance Thresholds



\*HERS Index 90 = HERS “Score” of 82

# IECC 2015 Table R406.5

## Maximum Energy Rating Index

Climate Zone	Energy Rating Index
1	52
2	52
3	51
4	54
5	55
6	54
7	53
8	53

# How Did We Get Here from There?

- Vermont Energy Code Compliance Options
  - Prescriptive Packages
  - RES*check* Software
  - Home Energy Rating (HERS)

And the winner is.... Prescriptive Packages



# What are the Prescriptive Packages?

Prescriptive Requirements Single-Family and Multi-Family Homes ~ <i>Fast-Track Method</i>					
Component	Package 1	Package 2	Package 3	Package 4	Package 5
1. Ceiling R-Value	R-49	R-49	R-28 cont.	R-60 attic / R-49 slope	R-49
2. Above-Grade Wall R-value	R-13+10	R-25	R-21 cont.	R-20 cav.	R-13+10
3. Floor R-value	R-30	R-30	R-30	R-30	R-30
4. Basement/Crawl Space Wall R-value	R-15/20	R-15/20	R-15/20	R-15/20	R-15/20
5. Slab Edge R-value	R-15, 4ft.	R-15, 4ft.	R-15, 4ft.	R-15, 4 ft	R-10, 4 ft
6. Heated Slab R-value (Edge and Under)	R-15	R-15	R-15	R-15	R-15
7. Window and Door U-value	0.32	0.28	0.32	0.28	0.28
8. Skylight U-value	0.55	0.55	0.55	0.55	0.55
9. Maximum Air Leakage	3 ACH50	3 ACH50	3 ACH50	3 ACH50	3 ACH50
10. Maximum Duct Leakage	4 CFM25/ 100 CFA	4 CFM25/ 100 CFA	4 CFM25/ 100 CFA	4 CFM25/ 100 CFA	4 CFM25/ 100 CFA

**DRAFT**



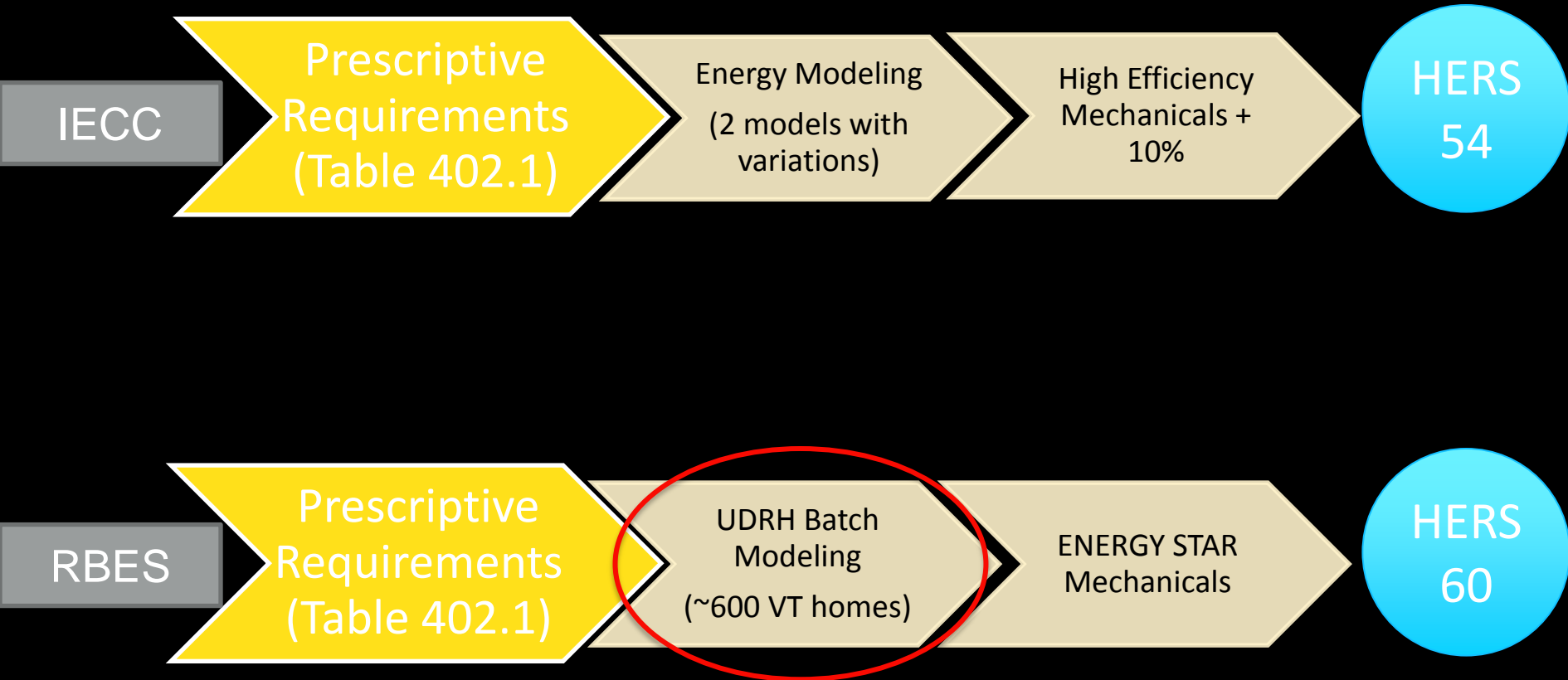
# How do the Prescriptive Packages Relate to HERS

- Based on shell efficiency
  - Minimum equipment efficiencies not required
  - NAECA minimums assumed
  - Maximum fenestration area not required
- What is the average HERS Index for “this shell” applied to Vermont homes

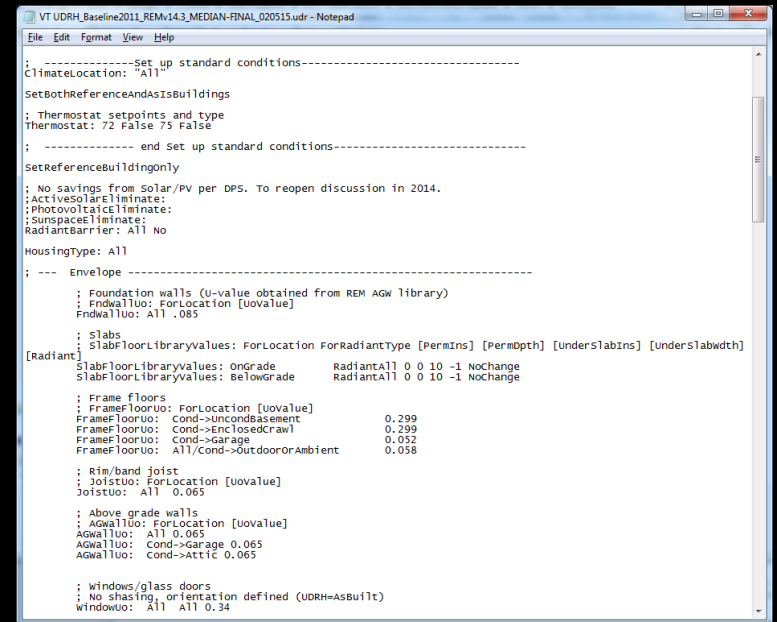
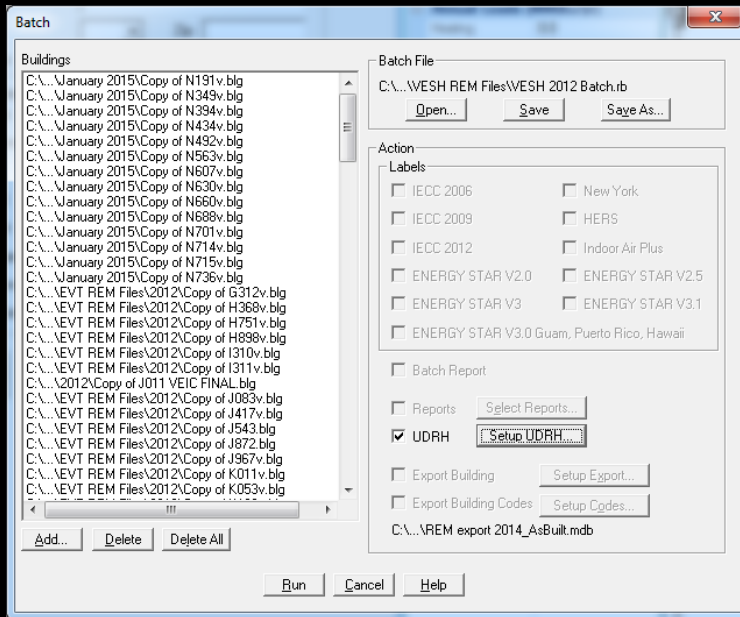




# How Did We Get Here from There?



# UDRH Batch Modeling



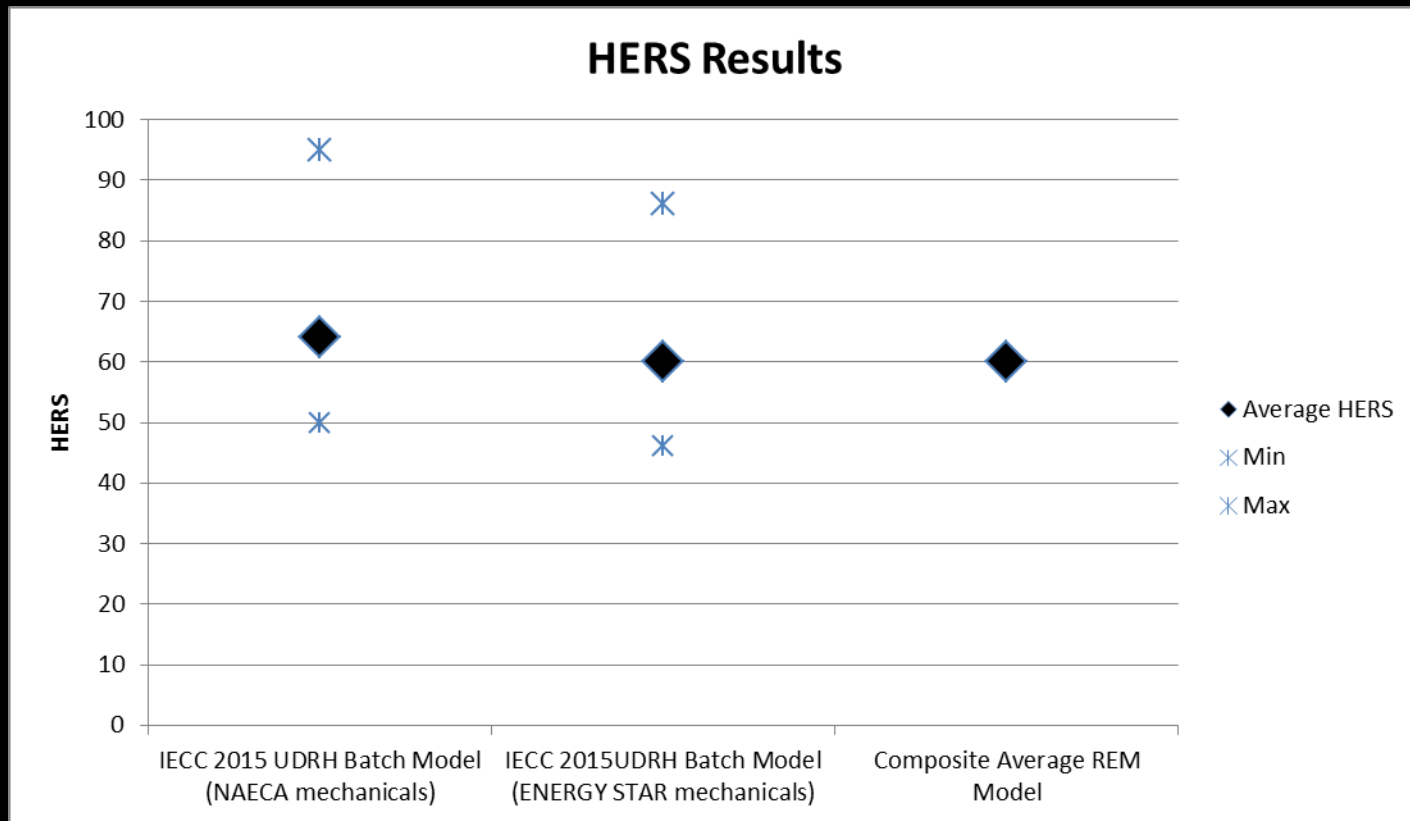
Queries	LBDLGRUNN	FBIACOND	FHERSSCOR	FBIVOLUME	NBISTORIES	NBIBEDS	NBIHTYPE	NBIFTYPE
qryCooling	0	2936	58	38584	3	3	1	4
qryHtgLoadSrv_All	1	3056	60	27424	3	2	1	4
qryHtgLoadSrv_ASHP	2	3732	50	26896	2	4	1	4
qryHtgLoadSrv_HTDH	3	4265	51	39366	3	3	1	4
qryHtgLoadSrv_Htg	4	1870	54	17200	1	2	4	4
qryMMBtu	5	1120	56	9680	2	2	4	7
qrySummary	6	2256	60	19308	2	3	1	4
	7	6061	49	42021	3	5	1	4
	8	2788	52	28581	2	2	1	4



Taking it to the Streets... HERS Ratings and Vermont's Energy Code

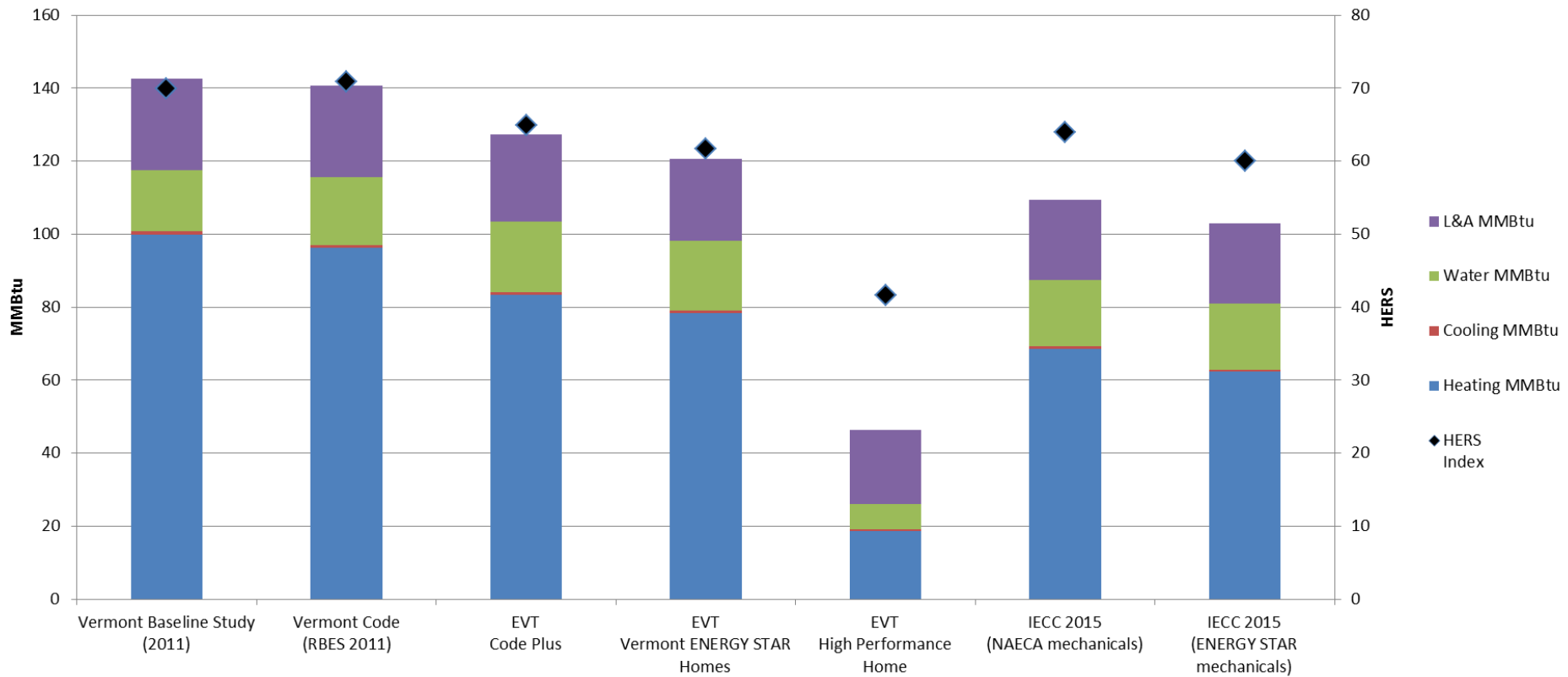
# UDRH Batch Modeling – Results Summary

- Sample Homes: 2012-2013 EVT RNC Program
- Total Building Count: 584



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# UDRH Batch Modeling – Sample Summary

Total Building Count: 584

Sample Homes: VESH 2012-2013

	Min	Max	Average	Median
Conditioned Floor Area	413	9,980	2,072	1,865
Volume	4,551	121,800	21,785	20,346
Stories	1	3	2	2
Bedrooms	1	6	3	3

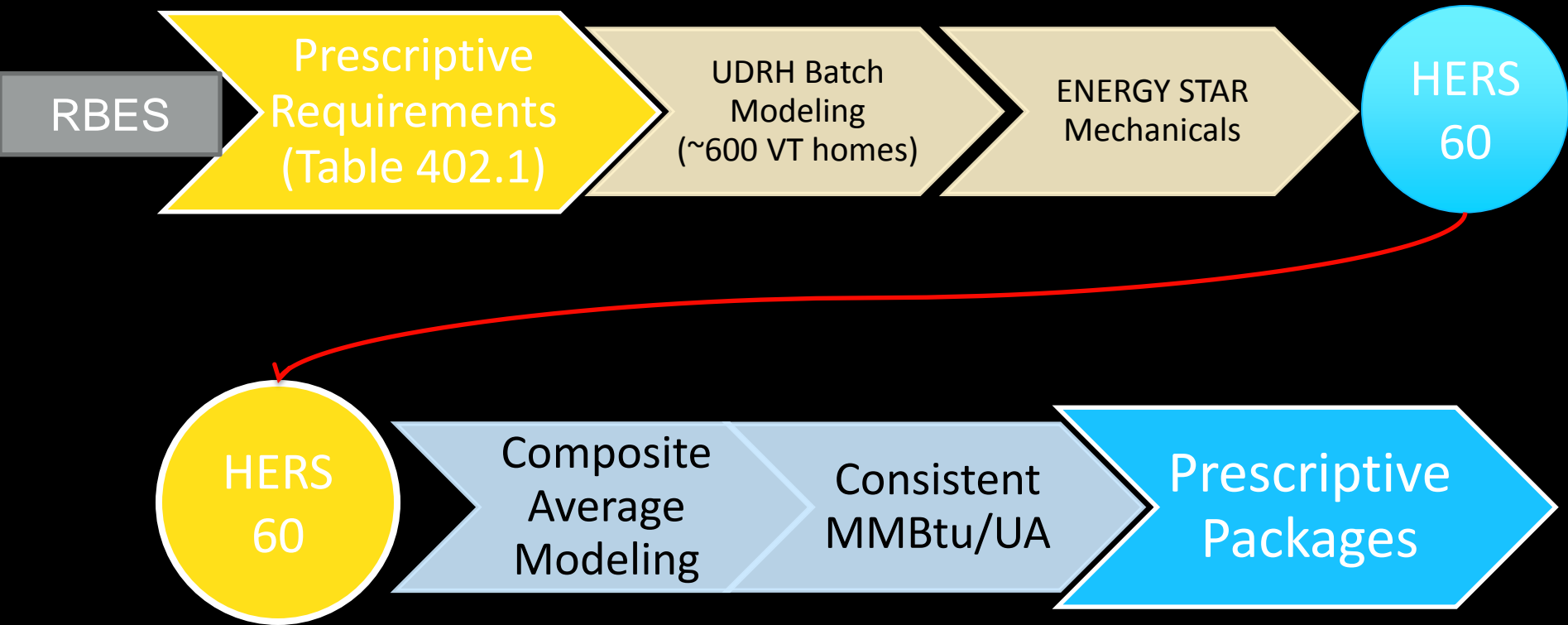
House Type	%
Single-Family Detached	62%
Townhouse, end unit	17%
Townhouse, inside unit	9%
Apartment, end unit	3%
Duplex, single unit	8%
Duplex, whole building	0%

Foundation Type	%
Slab	12%
Open Crawl	0%
Enclosed Crawl	0%
Conditioned Basement	83%
Unconditioned Basement	1%
Mixed	2%
Apt above cond space	2%

Primary Heating System/Fuel Type	%
Boiler - oil	1%
Boiler - gas/propane	35%
Boiler - wood	0%
Furnace - gas/propane	28%
Combined appliance - gas/propane	28%
ASHP	4%
Electric resistance	0%
Unit heater - propane	1%
Unit heater - wood	1%



# How Did We Get Here from There?



# How Did We Get Here from There?

	IF...	THEN...
IECC	Homes meet HERS 54 requirement	They will <i>at least</i> be as efficient as the minimum prescriptive requirements
RBES	Homes meets Prescriptive Package requirements	They will meet HERS 60 threshold on average



# Where Did We Land

	Base Code	Stretch Code	
Code Target	60	54	Max HERS Index to demonstrate code compliance
Sub-Target	65	65	Max HERS Index without renewables
Renewables Adder	5	11	Max allowable HERS points that can be counted toward Code target





# Obvious Questions

- Why not assume high efficiency mechanicals?
  - NAECA... Equipment manufactured in US must meet minimum efficiency standards
  - Building codes cannot require higher efficiency equipment than the NAECA minimum
  - Alternative compliance options are allowed, but at least one NAECA compliant package is required
- What about blower door testing?
  - Uncertainty around existing infrastructure
  - Start with Stretch Code and Act 250 projects



# Stretch Code

- Effective Dec 1, 2015
- Maintained the HERS 54 target
- Blower door testing required
- Started with Base Code composite average models
- Generated Prescriptive Packages to meet HERS 54
- Maintain comparable Total MMBtu, Overall UA, HERS
- Prescriptive Packages include a NAECA compliant package



# At the end of the day

- Vermont has set a reasonable, achievable HERS target
  - Historically consistent
  - Reflects IECC 2015 minimum shell requirements
  - Updated Prescriptive Packages accordingly
  - Adheres to NAECA requirements
- Vermont hopes to see more HERS ratings in the market
- Encourage non-participating builders to participate
- Improve the overall efficiency of the state's building stock



# Contributors

- Vermont Public Service Department
- Energy Futures Group
- Navigant Consulting
- Vermont Energy Investment Corporation
- Britt Makela Group
- New Buildings Institute
- Efficiency Vermont
- NEEP
- Mike DeWein
- Public Stakeholders



# Thank You!

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