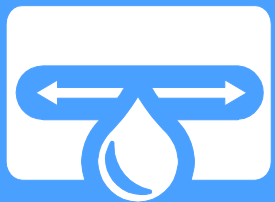


Water Efficiency Rating Update

Edward Osann
Natural Resources Defense Council

Olga Cano
US EPA WaterSense Program

EEBA High Performance Home Summit 2019
Denver, CO
October 2, 2019



RESNET
HERSH₂O

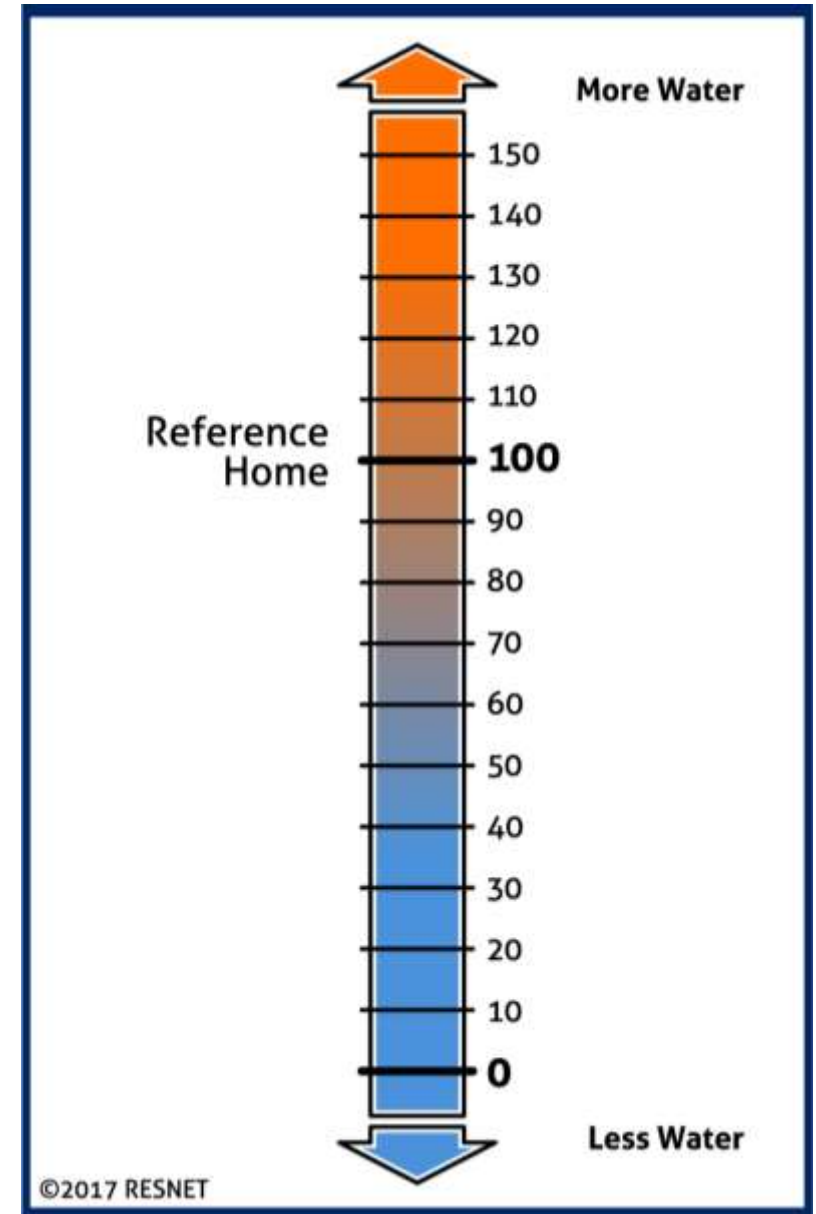
RESNET[®]
RESIDENTIAL ENERGY SERVICES NETWORK

HERS_{H2O} Under Development by RESNET

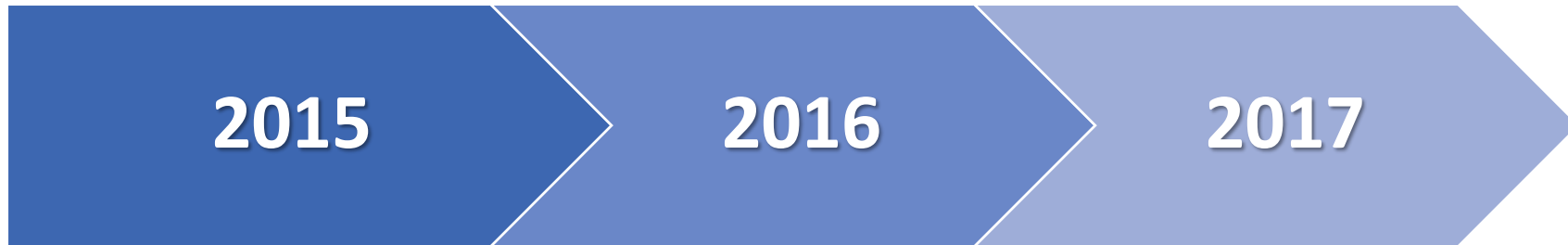
- RESNET is a non-profit organization founded in 1995
- A national standards development organization recognized by ANSI for building energy and water efficiency rating and certification systems in the USA
- Best known for the development and maintenance of the Home Energy Rating System (HERS), which is published as a US national standard
- Created and maintains the Mortgage Industry National Home Energy Rating System Standards
- Set the standards for certification of Home Energy Raters and Quality Assurance of HERS Ratings

Key Objectives for HERS_{H2O}

- Nationwide applicability (all climates)
- Suitable for both new and existing homes
- Encompasses both indoor and outdoor water efficiency
- Practical and affordable to administer
- Scores usable for quantitative comparison



Timeline of Initial Development



- RESNET Board Approves Water Efficiency Initiative
- Advisory Council Formed

- HERS_{H2O} Working Group Formed
- HERS_{H2O} Working Group Technical Subcommittees formed
- Initial work begins

- Technical Guidelines Drafted and Underwent Public Review and Comment Process
- Inspection Checklist completed
- Inspection guidance doc drafted
- Planning for Field Testing of Technical Guidelines
- RESNET/ICC ANSI Standard Development Committee Formed

2018 and 2019 Activities

2018

- **Guidelines approved by RESNET Board**
- **Development of ANSI Standard for a Water Rating Index (WRI)**
 - Final Guidelines serve as base text for draft standard
 - Review of draft Standard by SDC
 - First Public Comment Period
 - Review/respond to Public Comments
- **Development of HERS_{H2O} Implementation Standards**
 - Quality Assurance
 - Registry
 - Training
- **6 month pilot phase**

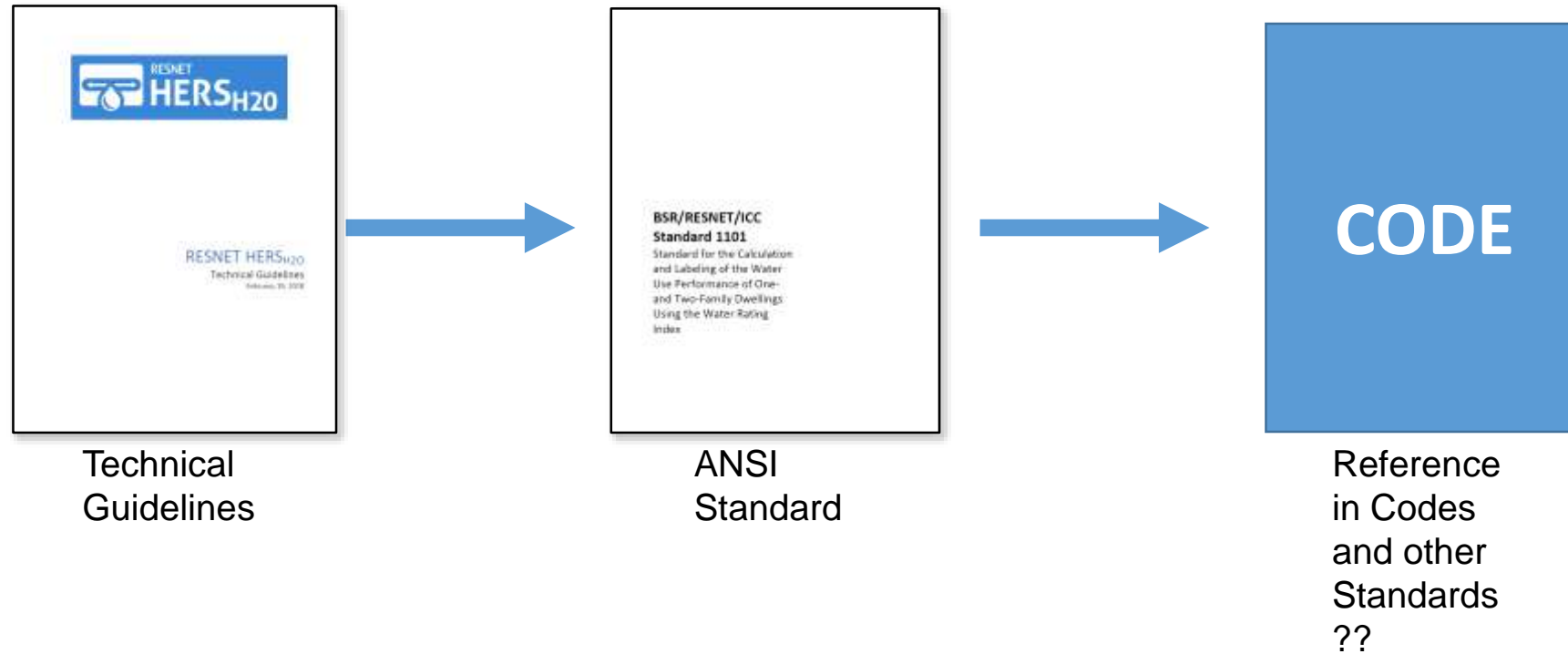
2019

- **Second round of public comments on Draft Standard**
- **Third round of public comments on Draft Standard**
- **Revisions to Inspection checklist and guidance document**
- **Development of HERS_{H2O} training**
- **Finalize HERS_{H2O} implementation standards**
- **Set up RESNET Registry to accept HERS_{H2O} data**
- **Forward Final Standard to ANSI for approval**

Update on Standard 850

- Numeric designation changed from Standard 1101 to Standard 850
- Appeals process pending
- Expect final standard to be forwarded to ANSI in late 2019 or early 2020

Development Process



Technical Guidelines serve as the basis for the Water Rating Index Standard (BSR/RESNET/ICC 850-201x).

How do Standard 850 and HERS_{H2O} Relate?

BSR/RESNET/ICC Standard 850

- Developed through an ANSI consensus-based process
- RESNET's Standard Development Committee 850 is responsible for the development of this standard
- Technical subcommittee also provides recommendations
- Upon publication, available to be adopted by code development and adopting entities

HERS_{H2O}

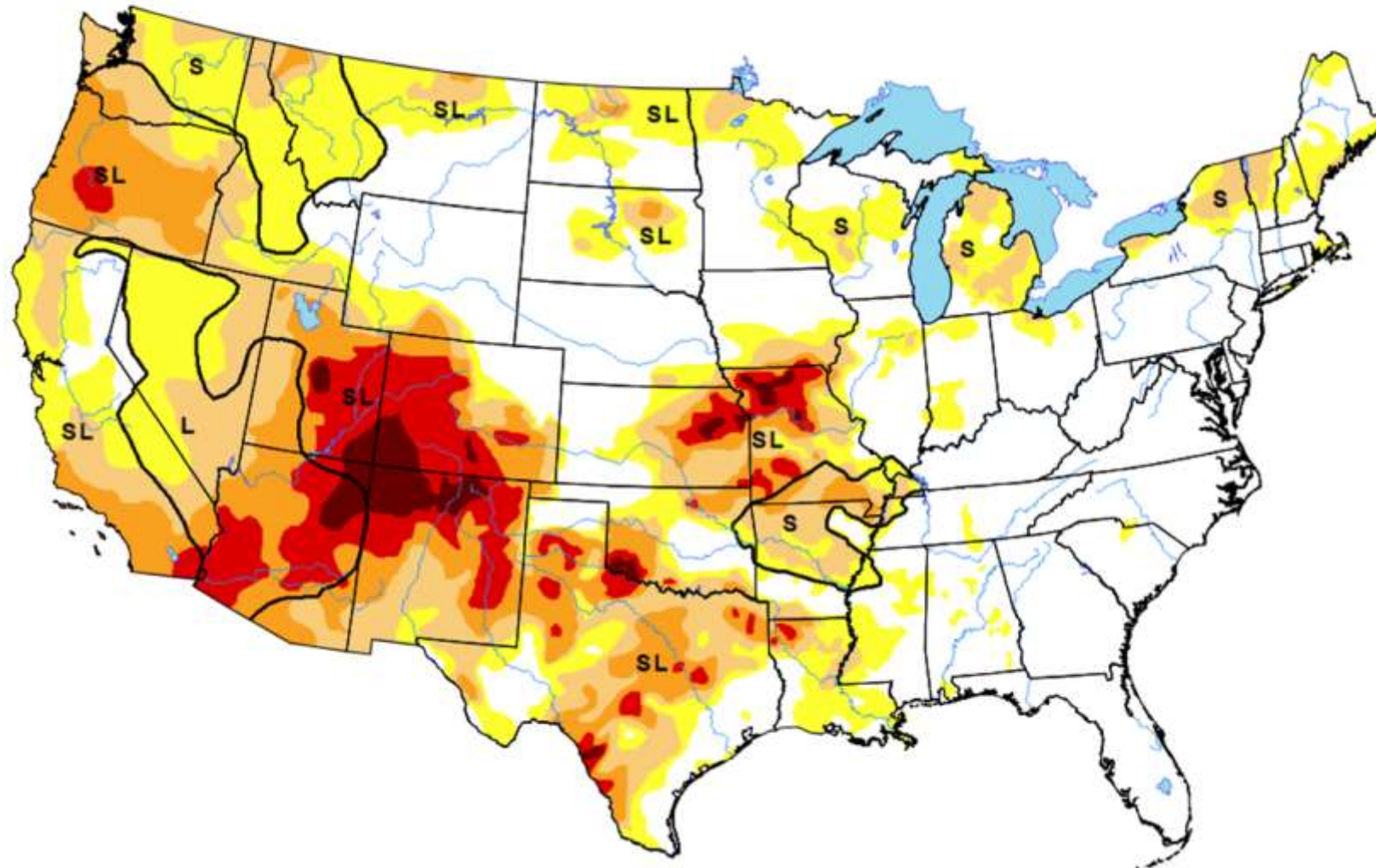
- RESNET program that will be based on Standard 850
- Additional program requirements to include:
 - Certification of raters
 - Accreditation of rating providers
 - Quality Assurance oversight
 - Approval of software

Introduction to HERS_{H2O}

Drought- Not the Only Driver for Water Efficiency Efforts

Map for August 16, 2018

Data valid: August 14, 2018 | Author: [Richard Heim](#), NOAA/NCEI



Increases in Water & Sewer Costs

Water cost increases from 2000-2012:

1. Atlanta: 233%
2. San Francisco: 211%
3. Wilmington: 200%
4. Philadelphia: 164%
5. Portland: 161%
6. Wichita: 153%
7. New York: 151%
8. Waterloo, IA: 145%
9. Binghamton, NY: 143%
10. San Diego and Augusta: 141%



Basic Concept of a Rating



Reference Home

- Automatically generated by software
- Establishes baseline for comparison with the rated home
- Minimum requirements ~2006 construction practices for plumbing
- Scores ~100 on HERS_{H2O} Index scale



Rated Home

- The “as-built” home
- Components entered by the Rater
- Each component that is more efficient than the reference home will reduce water use and Index score in the rated home.
- Less efficient components will do the opposite.

Scope of the Standard

This Standard will provide a uniform methodology for evaluating, rating and labeling the indoor and outdoor water use performance of new and existing one- and two-family dwellings.



Ratable Features of a Rated Home



Shower Heads



Kitchen Faucet



Lavatory
Faucets



Clothes Washer



Toilet Flush
Volume



Water Softener



Leaks/Other
Water Use



Excess Pressure



Irrigation



Pool or Spa

Other Attributes Included in the Rating



House Size



Geographic Location



Number of Bedrooms



Lot & Landscape Size



Hot Water Distribution Layout



Hot Water Pipe Insulation

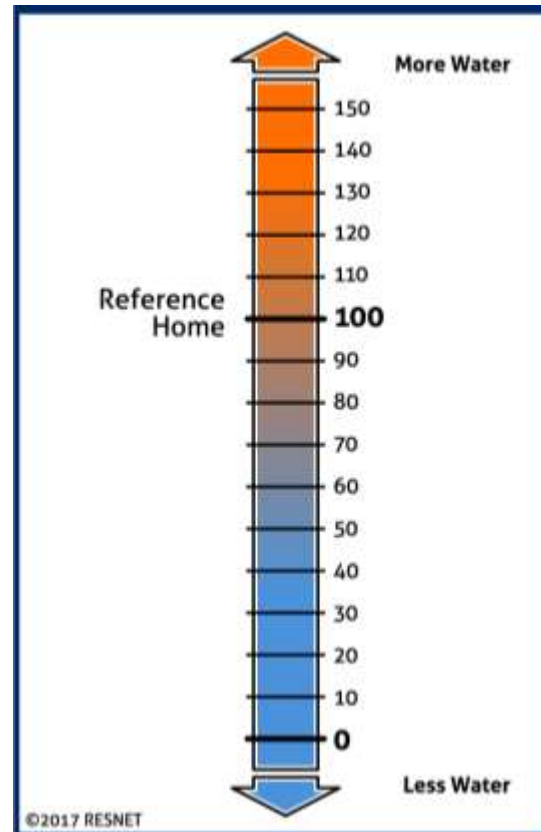
Not Addressed (Yet) -- Rainwater and Gray Water

- Not addressed in the Standard
- Explanation included in the Forward
- Standards Committee decision:
 - Insufficient reliable data to quantify the impact of alternative water sources on a home's potable water use
- Goal is to include in future revisions



Calculating the Index Score

$$\text{HERS}_{\text{H}_2\text{O}} \text{ Index} = \frac{\text{indoor and outdoor gpd for the rated home}}{\text{indoor and outdoor gpd for the reference home}} * 100$$



Rating Calculation Methodology

- Grounded in water use data as much as possible
- Indoor reference home based primarily on HERS
- Outdoor reference home based on Residential End Uses of Water Study
- Number of bedrooms used as predictor of occupancy
- Built upon ANSI/RESNET/ICC Standard 301-2014 and Addendum A

What Moves the Needle?

Indoor model will respond to:

- More efficient plumbing products
- Efficient Appliances
- More efficient pipe layout



Outdoor model will respond to:

- Smaller irrigated landscapes (the reference landscape is fixed based on lot size)
- More efficient irrigation technology
 - Smart controllers
 - More efficient emitters, as expressed by the Residential Irrigation Capacity Index (RICI)

Outdoor Water Use

Outdoor Use calculation takes into account:

- Lot size
- Irrigated Area of rated home
- Location of the home (climate)
- Whether or not there is an automatic irrigation system
- Features of the irrigation system (weather-based controller, flow rates)
- Presence or absence of a swimming pool or spa



What is RIC?

Residential Irrigation Capacity Index

- Optional method to quantify efficient outdoor water use
- An index within an index
- Estimates irrigation use without knowledge of plantings
- Baseline RIC is set to 5 based on data
- Each 1-point reduction from baseline = 10% reduction in outdoor water use

$$RIC_{rat} = \frac{\text{sum of flow (gpm) of all irrigation valves}}{\text{square feet irrigated area}} * 1,000$$

Testing for RIC1

Determine the irrigated area.

- Start with lot area
- Subtract the footprint of the home and any hardscaping
- Subtract any other areas that will not receive irrigation (artificial turf)

Determine Irrigation Flow Rates

- Turn off all fixtures and appliances
- Set irrigation controller to run each zone for a few minutes (equalize system)
- After the valve for a zone is fully opened and water emission devices are operating nominally, measure the flow rate for the zone by noting start reading of the meter, watch for 30 seconds, and multiply water used by 2
- Sum together flow rates for all zones, in gpm.
- Enter this number into the $HERS_{H2O}$ calculation spreadsheet



Calculation Spreadsheet

Outdoor Water Use Calculation Fields

Example Water Use Calculations										
User input fields are yellow		Water Use	Cold Wtr	Hot Wtr	Total Wtr	Home characteristics:		Drain Water Heat Recovery:		
Location (pull down)	Castle Rock, CO	Shower_gpd	7.0	17.1	24.1	CFA	2400	Showers connected	all	
Distribution system	std	KitchF_gpd	4.1	10.1	14.2	Nbr	3	Equal flow?	yes	
HW pipe Insulation	none	LavF_gpd	1.8	4.5	6.4	Nfl	2	CSA 55.1 DWHR _{eff}	54.0%	
Shower (gpm)	2.5	Waste_gpd	4.5	11.2	15.7	Bsmt	0	Tmains =	55.9	
Kitch Faucet (gpm)	2.2	CW_gpd	20.6	3.9	24.5	Appliances:		WHinTadj =	0.00	
Lav Faucet efficiency	std	DW_gpd		4.3	4.3	Dishwasher	std	WHinT =	55.9	
Std sys pipe length	89	Toilets_gpd	21.9		21.9	Clothes washer	std			
Recirc sys loop length	159	Soft_gpd	0.0		0.0	WF	9.5			
Recirc sys branch length	10	Other_gpd	15.7	2.1	17.8	Toilets:				
Recirc pumpWatts	50	EP_gpd	0.0	0.0	0.0	gpf	1.6			
DW heat recovery?	no	Indoor_gpd	75.7	53.2	128.9	Water Softener:				
		Outdoor_gpd	67.8	0.0	67.8	Softener	no			
Lot Area (ft2)	5,000	Total_gpd	143.5	53.2	196.6	gal/removed	5.0	gallons/1,000 grains removed		
Landscaped Area (ft2)	2,348	Ref_In =	75.7	53.2	128.9	Outdoors:				
% Outdoor H2O =	34%	Ref_Out =	67.8	0.0	67.8	Inground Pool?	no			
Ref_Irr_Area =	2,348	Ref_Tot =	143.5	53.2	196.6	Irrigation?	no			
Tot_Ref_Irr_ratio =	47.0%	Save_Tot =	0.0	0.0	0.0	Smart controller?	no			
Net_Lscape_ratio =	61.8%	H2O_in =	100	100	100	Use RIC?	no			
Lot size (acres) =	0.115	H2O_Out =	100	100	100	Zone flow rates	25.2	Sum of irrigation zone flow rates		
		H2O_Tot =	100	100	100	Prof Audit?	no			
		HERS _{H2O} =	100	H2Osave* =	0	Static Pressure	90			
Ref std sys pipe length =	89.3	* Gallons per year		\$save** =	\$0	H2O Price	\$3.90	\$/CCF (1 CCF = 748.05 gallons)		
Ref recirc sys loop length =	158.6	** \$ per year								

- Estimating Irrigation Impact. Only need: Lot area, landscaped area and “yes” for irrigation
- Smart controller and Professional Audit are optional
- Only enter zone flow rates when “yes” is selected for RIC (documentation provided)

WaterSense Labeled Homes

WaterSense Labeled Homes



Voluntary partnership and labeling program
launched by EPA in 2006.

Simple way for consumers to identify products
that use less water and perform well.

WaterSense Labeled Homes

WaterSense Labeled Products



Tank-Type Toilets
3,800 labeled models

Flushometer-Valve
Toilets
1,400 labeled models



Showerheads
8,900 labeled models



Spray Sprinkler Bodies
190 labeled models



Irrigation Controllers
800 labeled models



Lavatory Faucets
17,900 labeled models



Flushing Urinals
700 labeled models



Labeled products are listed at:

www.epa.gov/watersense/products/index.html



WaterSense Labeled Homes

The WaterSense label is available to

- **Single-family homes and townhomes**
- **Residential units in multi-family buildings three stories or less in size**
- **Residential units in multi-family buildings of any size, that have independent heating, cooling, and hot water systems**
 - Includes mixed-use buildings
 - Units in buildings with central hot water can qualify if at least 50% of the energy consumed for domestic hot water comes from an alternative source



WaterSense Labeled Homes

Important Terminology

- **Home Certification Organization (HCO)**
 - Organizations responsible for establishing the specific requirements and overseeing the certification and labeling of homes for WaterSense
 - Similar to a Program Administrator or Verification Oversight Organization (VOO)
- **WaterSense Approved Certification Method (WACM)**
 - Methodology and verification protocol that homes can comply with to demonstrate adherence to WaterSense's technical requirements
 - Administered (and possibly developed by) an HCO
- **Designee**
 - An organization such as a provider or other organization to whom the HCO has designated specific certification responsibilities and is capable of adhering to WaterSense's certification requirements
 - An HCO may choose to designate many of the responsibilities associated with certification
- **Verifier**
 - Individual responsible for inspecting or rating a home to a specific WACM
 - Analogous to a Water Efficiency Home Inspector, "WaterSense rater", or an energy rater

WaterSense Labeled Homes

WACM

(WaterSense Approved Certification Method)

HERS_{H2O} would become a WACM when approved by WaterSense.

The purpose of WACMs is to:

1. Provide a method of calculating water efficiency in a home.
 - There may be more than WACM available in the future
2. Ensure that the methods used to achieve 30% efficiency are regionally appropriate.
 - Each WACM will have different characteristics that achieve the 30% efficiency.

Technical Requirements

Homes must meet two main requirements to be eligible to earn the WaterSense label:

1. Comply with all items on a mandatory checklist
2. Be at least 30% more water efficient than typical new construction
 - The 30% efficiency would be determined by the WACM.

WaterSense Labeled Homes

MANDATORY CHECKLIST FOR WATERSENSE LABELED HOMES

Item	Requirements	Confirmed	
Leaks	Pressure-loss test on all water supplies detected no leaks	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	Free of visible leaks from hot water delivery system	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	Free of visible leaks from toilet(s), as determined through visual assessment and by conducting a dye tablet test in each toilet to ensure the flapper is not leaking	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	Free of visible leaks from bathroom faucet(s)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	Free of visible leaks from showerhead(s)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	Free of visible leaks from bathroom tub faucet(s), i.e., tub spout(s), when showerhead(s) is activated, as determine through visual assessment after showerhead has been activated for one minute	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	Free of visible leaks from kitchen and other sink faucet(s)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	Free of visible leaks from other fixtures or appliances (e.g., clothes washers, dishwashers, hose bibs, irrigation systems) at point of use or point of connection to water distribution system	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Toilets	WaterSense labeled	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Bathroom sink faucets	WaterSense labeled	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Showerheads	WaterSense labeled	<input type="checkbox"/> Yes	<input type="checkbox"/> No

What About Outdoors?



- Outdoor requirements don't appear on the checklist, but *this doesn't mean they aren't included in the program*
 - It will be virtually impossible for many homes to meet the requirements without substantial outdoor efficiency measures
- It is difficult to identify outdoor measure that meet the checklist's goals for
 - Universal applicability
 - Minimal incremental cost
 - Focus on quality-performance

WaterSense Labeled Homes

Efficiency Requirements

- Homes must be at least 30% more efficient than typical new construction
 - Presumably, this would mean a $HERS_{H_2O}$ rating of 70 or less
 - WaterSense based this number on analysis of typical features, common efficiencies measures, and potential impacts across different climates

Example of Climate Differences

Lot: 5,000 ft²

House: 2,400 ft², 3 bedroom, 2 floors

Landscape: 2,348 ft² with automatic irrigation

	Duluth, MN	Phoenix, AZ
Annual water use	~60,000 gallons	~140,000 gallons
Indoor water use	~80%	~33%
Water savings from installing WaterSense labeled plumbing products	~10%	~4%
Approaches to achieve 30 percent reduction	Both indoor and outdoor improvements	MUST make substantial outdoor improvements

Rating WaterSense Requirements in HERS_{H2O}

Indoor Water Use Target Score=70

Location	WaterSense 2.0 Requirements (Homes Checklist)	Energy Star Clothes Washer and Dishwasher	1.5 gpm Shower and Kitchen	Toilet @ 0.8 gpf	Eff. Hot Water Distribution	Best Available Clothes Washer & Dishwasher
Park City, UT	93	88	81	77	73	69
Phoenix, AZ	96	92	92	86	83	81
Tampa, FL	93	87	79	76	71	67
Denver, CO	94	89	83	80	76	73
Riverside, CA	95	90	84	84	78	75

Outdoor Water Use in HERS_{H2O}

Location	Irrigation = "YES"	Prof. Audit & Weather-based controller	20% Reduction in Irrigated Area	Use RICl (6 gpm all zone flow rates)
Park City, UT	77	68	62	56
Phoenix, AZ	86	73	63	55
Tampa, FL	75	67	61	56
Denver, CO	80	70	62	56
Riverside, CA	82	71	63	56

Impact of Irrigation Choices on HERS H2O

- Total Lot Size: 5,000 sq. ft.
- Reference Irrigated Area: 2,348 sq. ft.
- Indoor set to WaterSense 2.0 Requirements.

Location	WaterSense 2.0 Requirements (Homes Checklist)	Ref. Irr Area & 25% Flow Reduction (8.8 gpm all zones as per RIC1)	Ref. Irr Area & 50% Flow Reduction (5.9 gpm all zones as per RIC1)	Reduce Irrigated Area by 20% and Add Weather-based Controller
Park City, UT	93	89	84	75
Phoenix, AZ	96	89	80	68
Tampa, FL	93	90	85	77
Denver, CO	94	89	83	73
Riverside, CA	95	89	82	71

HERS_{H2O} Inspection Process

Two Inspection Resources

- Inspection Checklist
- Inspection Guidance Document

Item	Section	Home Criteria	Yes	No	NI	Doc
Indoor Water Efficiency Criteria						
Leaks	1	Pressure-loss test on all water supplies detected no leaks				
		No visible leaks from hot water delivery system				
		No visible leaks from tank type toilets from dye test				
		No visible leaks from bathroom faucets				
		No visible leaks from kitchen faucets				
		No visible leaks from showerheads				
		No visible leaks from other fixtures or appliances				
		Check meter with all systems off for system leak				
Service Pressure	2	Pressure tank installed and set \leq 60 psi OR				
		Pressure Regulating Valve installed upstream of fixtures and pressure test \leq 60 psi OR				
		Written documentation from water supplier that pressure \leq 60 psi OR				
		On-site static pressure test: _____ psi				
Hot Water	3	Is there a hot water recirculation system present? If so, what type:				
Toilet	4.1	Flush volume Marker*				Req.
	4.1.1	Single Flush <u>Flush Rate**</u> <u>gpf</u>				Req.
	4.1.2	Dual Flush <u>Flush Rate**</u> <u>gpf</u>				Req.
		Non-water consuming toilet				
Bathroom sink faucet	4.2	Flow Rate Marker* <u>gpm</u>				Req.
Kitchen sink faucet	4.3	Flow Rate Marker* <u>gpm</u>				Req.
Showerhead***	4.4	Flow Rate Marker* <u>gpm</u>				Req.
Dishwasher	4.5	Check for documentation of Water Factor				Req.
Clothes washer	4.6	Check for documentation of Water Factor				Req.
Water softener	4.7	Certified to NSF/ANSI Standard 44, including if available voluntary efficiency rated claim (stamped on data plate or indicated in the product manual)				Req.
	4.7.1	Verify water hardness of area or conduct test				Req.

Inspection Tools

- Stop watch/ cell phone timer
- Digital thermometer such as a digital food thermometer
- Pressure gauge
- Bucket or flow bag with volume measures marked
- Dye tablets for toilets
- Tape measure
- Water Hardness Tester



Typical Inspection Process- Indoor

It's anticipated this will be done during a typical HERS rating final inspection

Inspection Process:

1. Put dye tablets in toilets
2. Verify flow rates of fixtures
3. Record make/model of dishwasher (if installed)
4. Record make/model of clothes washer (if installed)
5. Record make/model of water softener system (if installed)
6. Go back and check toilets for leaks (flush toilets to clear dye)
7. Verify flush rates stamped on toilets
8. Check house water pressure (or obtain documentation from builder)



Things to Note

- There is a mandatory training for raters
- It will be available in RESNET's training portal
- The rating can usually be done in 45 minutes
- They are working on opening the program to non-HERS raters



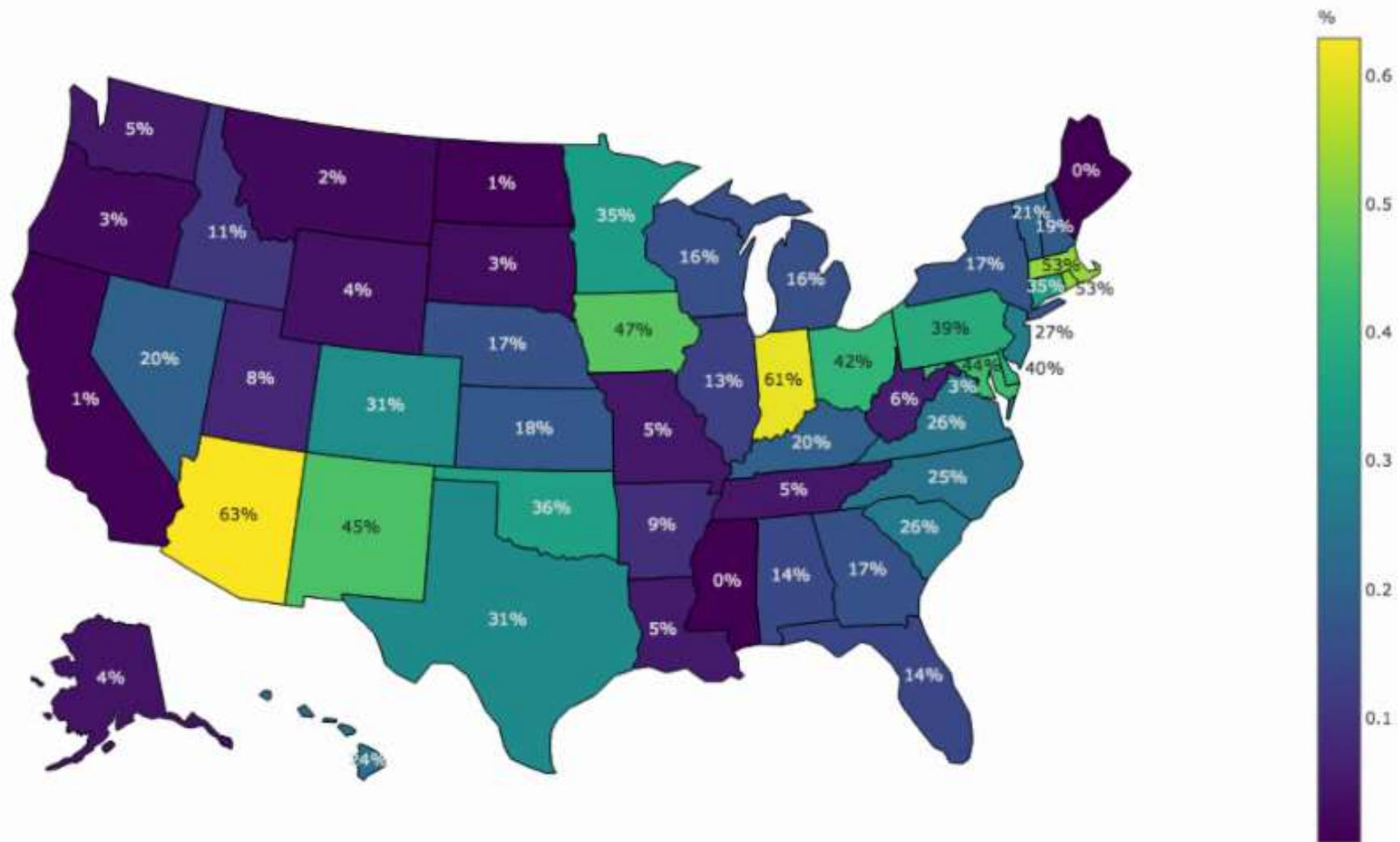
Potential Impact

Popularity of HERS



Percentage of New Homes HERS Rated

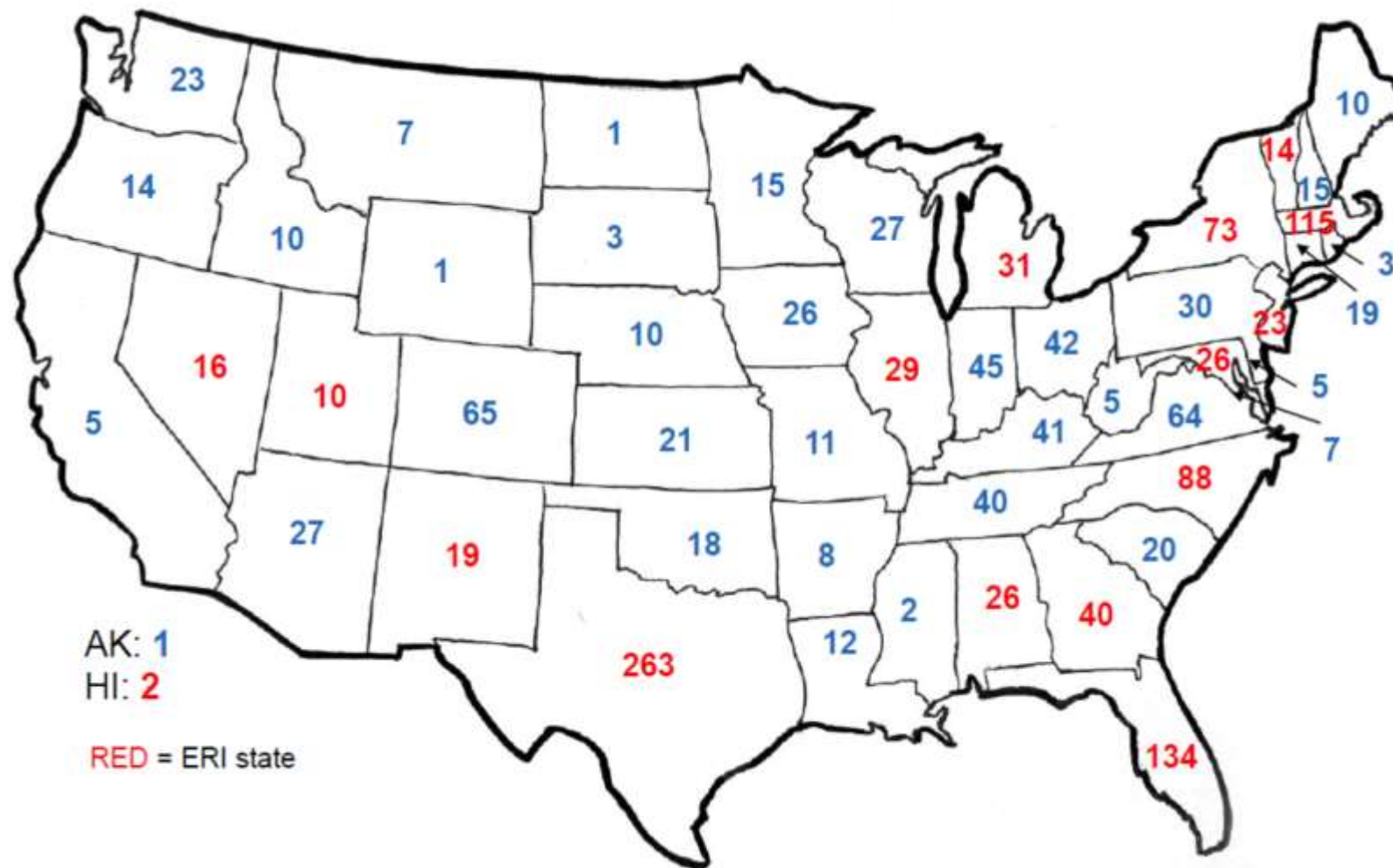
23% of all new homes in 2017 were HERS Rated!



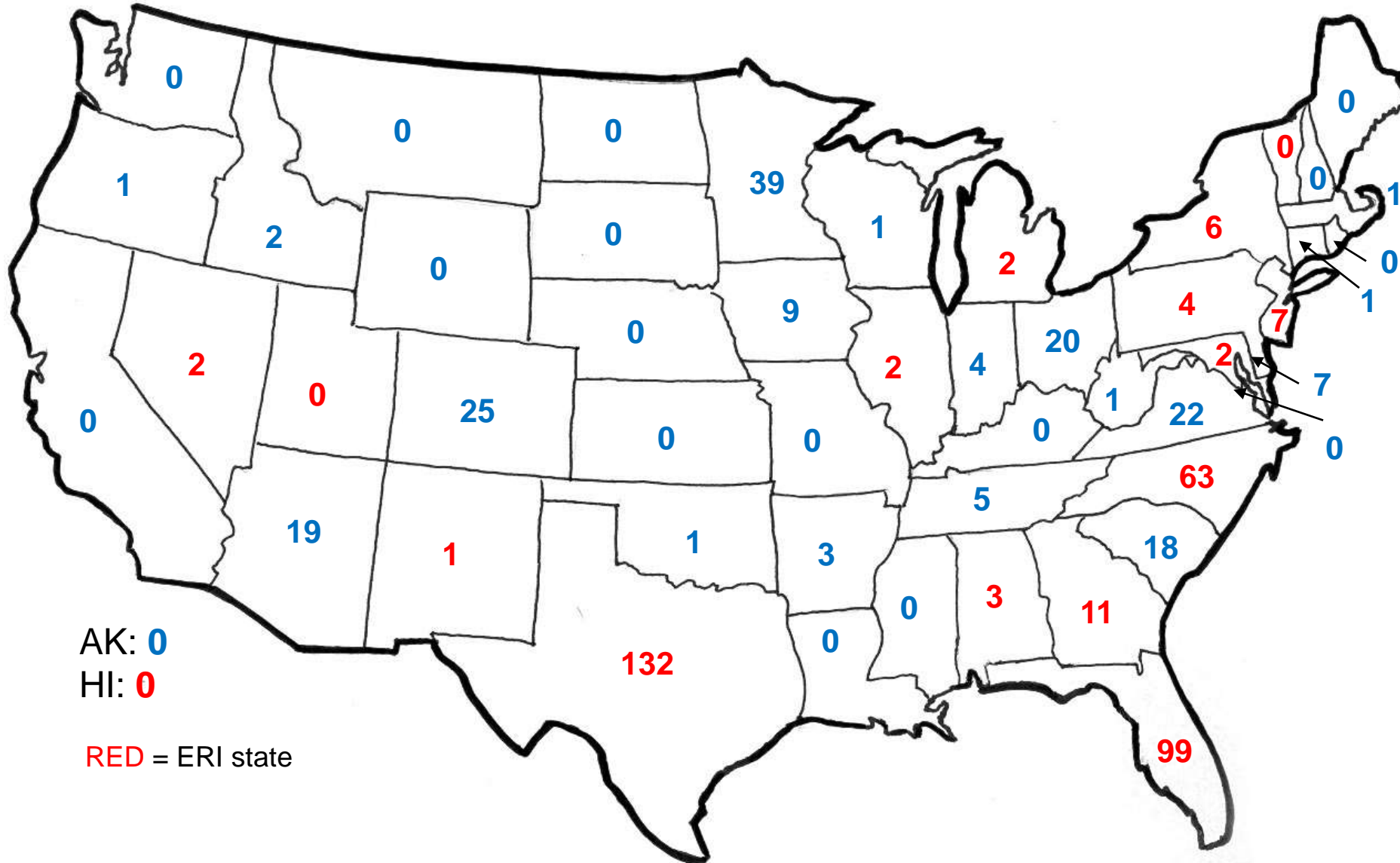
Credit: Dave Roberts, NREL

Can Scale Quickly

Over 1,900 Active RESNET Certified HERS Raters



Rating Field Inspectors By State



AK: 0

HI: 0

RED = ERI state

~800 RFIs



Interested Parties

Know someone interested in staying up to date on the water efficiency work of RESNET?

- Have them email Ryan Meres at ryan@resnet.us.
- Will receive periodic updates
- Notices of public comment periods and webinars
- Monthly “Water Update Newsletter”.

Thank you!

Edward R. Osann, Senior Policy Analyst
Natural Resources Defense Council
eosann@nrdc.org
310-403-5676

Olga Cano, LEED AP
WaterSense Homes
Environmental Protection Agency
cano.olga@epa.gov
202-564-6306

Ryan Meres, Program Director
RESNET
ryan@resnet.us
760-681-2391