

look for



Measuring Hot Water Use With **HERS_{H2O}**

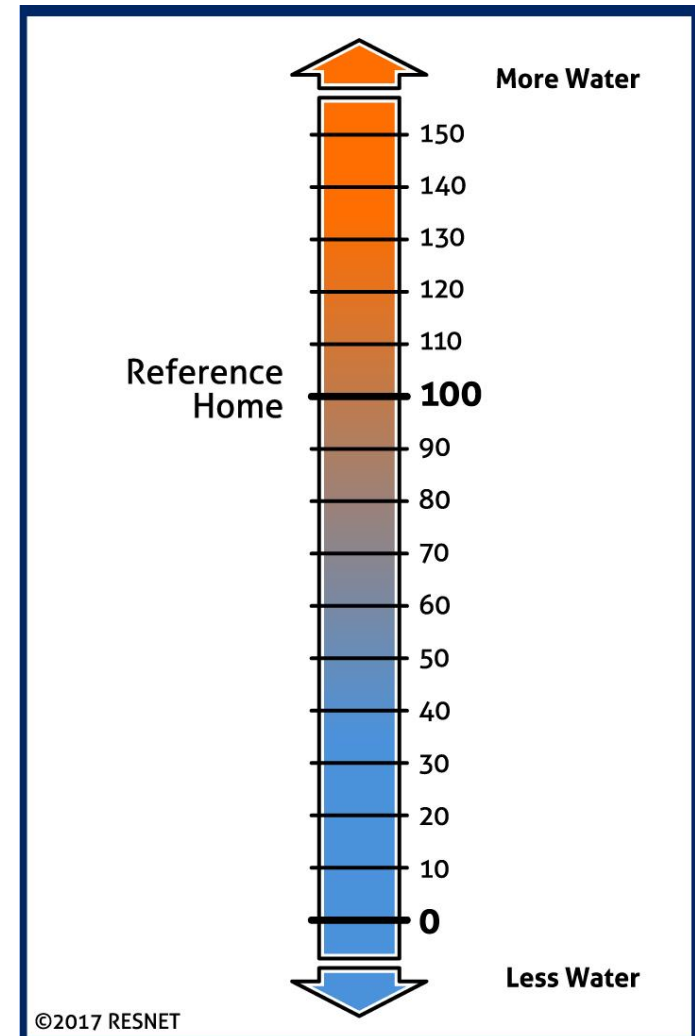


Hot Water Forum
March, 2018

Jonah Schein | EPA WaterSense

Key Objectives for HERS_{H2O}

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



Expanding From Addendum A

Domestic Hot Water
Systems Calculations

Add a Few More Indoor
and Outdoor Water
Usage Calculations

Factor in New
Technologies

Compare to a
Reference Home

Field
Verification

**RESNET's Whole House Water
Efficiency Rating System**

From Addendum A to HERS_{H2O}

- Split use of hot water using faucets into showerheads and faucets, and then again kitchen and faucet use
 - Removes showers from the total based on REUWS I & II data
 - 69% to the kitchen, 31% to lavatory based on analysis of REUWS I data
- Allows users to impact each end use separately
 - Addendum A treats efficiency as binary, you're "low-flow" or you're not, HERS_{H2O} maintains the binary method for lav faucets only
- Will ultimately allow the incorporation of technologies like grey water

Moving Toward Whole House Water Use

- Added toilet water use
 - Based on REUWS I and II data and EPACT federal standards
- Adjusts (“penalizes”) homes for excess pressure
 - Can be adjusted with the use pressure compensating fixtures
- Adds water softener use
 - Is added to both the reference and rated homes in locations that demonstrate hard water
- Outdoor water use

Outdoor Water Use Model

- We are rich in energy and building data
 - International Energy Conservation Code (IECC) provides a baseline for energy consumption in residential new construction
 - Residential Energy Consumption Survey (RECS) provide detailed end use information on a regular basis
 - American Housing Survey (AHS) provides additional data on the make up of the national building stock
- The best source of field data for outdoor water use is the Residential End Uses of Water Study (REUWS II)
 - Original REUWS study published in 1999
 - Revision published in 2016

Outdoor Water Use Model

- REUWS includes predictive methods for estimating outdoor water use that includes terms for:
 - Ln(irrigated area +1)
 - Ln(Net ET)
 - **Cost of water**
 - Indicator for in-ground sprinkler systems
 - Indicator for presence of swimming pools
- When we take cost of water out, the model starts to behave erratically

Ah ha moment #2!

Outdoor residential water use is primarily a behavioral issue and we need to consider factors as to how they impact this behavior

- This seems obvious, but is actual counter to traditional methods of estimating outdoor water use
 - Typically based on the biological needs of plants
- Actual very similar to how addendum A works
 - the showerhead doesn't know what 105° F
 - Doesn't know when to turn off and on
- Makes homes with and without automatic irrigation fundamentally different
 - Models of use become stronger with more automation

Outdoor Water Use Model

Splitting the methodology for homes with and without an automatic irrigation systems, we get

$$\left[\frac{\exp(A)}{1 + \exp(A)} \right] * 1.18086$$
$$* [2.0341 * netET^{0.7154}$$
$$* Ref_Irr_Area^{0.6227} + 0.5756 * ind_Pool$$

$$\left[\frac{\exp(B)}{1 + \exp(B)} \right] * 1.22257$$
$$* [1.4233 + 0.6311 * netET + 0.9376$$

Outdoor Water Use Model

- What the equation is really saying is:

$$\left[\frac{\exp(A)}{1 + \exp(A)} \right] * 1.18086$$

$$* [2.0341 * \text{netET}^{0.7154}$$

$$* \text{Irr_Area}^{0.6227}$$

$$+ 0.5756 * \text{ind_Pool}$$

Water use in landscapes with automatic irrigation are a function of

- Size
- Climate(ET)
- Presence or absence of a pool.

$$\left[\frac{\exp(B)}{1 + \exp(B)} \right] * 1.22257$$

$$* [1.4233 + 0.6311$$

$$* \text{netET} + 0.9376$$

Water use in landscapes w/out automatic irrigation are a function of

- Size
- Climate (ET)
- Presence or absence of a pool



Indoor Rated Water Use

Will respond to:

- More efficient plumbing products
- Efficient Appliances
- More efficient plumbing distribution

Normalized for:

- Climate
- Size of house & predicted occupancy



Outdoor Rated Water Use

look for



Will respond to:

- Smaller landscapes (the reference landscape is fixed based on lot size)
- More efficient irrigation technology
 - Smart controllers
 - More efficient emitters (through a flow intensity calculation called RICl)
 - Proper commissioning by a trained professional

Normalized for:

- Climate

look for



Implementing HERS_{H2O}

Who's RESNET?

- An industry-based, not for profit organization
- A national standards making body for building energy efficiency rating and certification systems in the USA (ANSI Accredited Standards Development Organization)
 - Consensus based standard development and amendment process
 - Transparent review and adoption process – Formal public review and comment process

RESNET[®]
RESIDENTIAL ENERGY SERVICES NETWORK

Using RESNET's Infrastructure

- More than 2 million homes have received a HERS rating
- Multiple approved software vendors
 - Established process for approving and validating changes
- There are almost 2,000 certified HERS raters
 - Rigorous 40-hour course with national written and practical assessments
 - Apprentice-style probationary period for conducting a minimum of 5 ratings
 - Professional Development requirements to maintain certification
 - Contract with a RESNET Quality Assurance Provider

look for



What do raters do for energy? What can they do for water?



- ✓ Energy efficiency plan reviews
- ✓ Building envelope leakage testing
- ✓ Duct leakage testing
- ✓ Pre-drywall inspections for insulation, envelope air sealing, duct insulation and sealing and verification of window U-values and SHGC
- ✓ Verification of compliance with the IECC Energy Rating Index Compliance Path

65
HERS Index Score

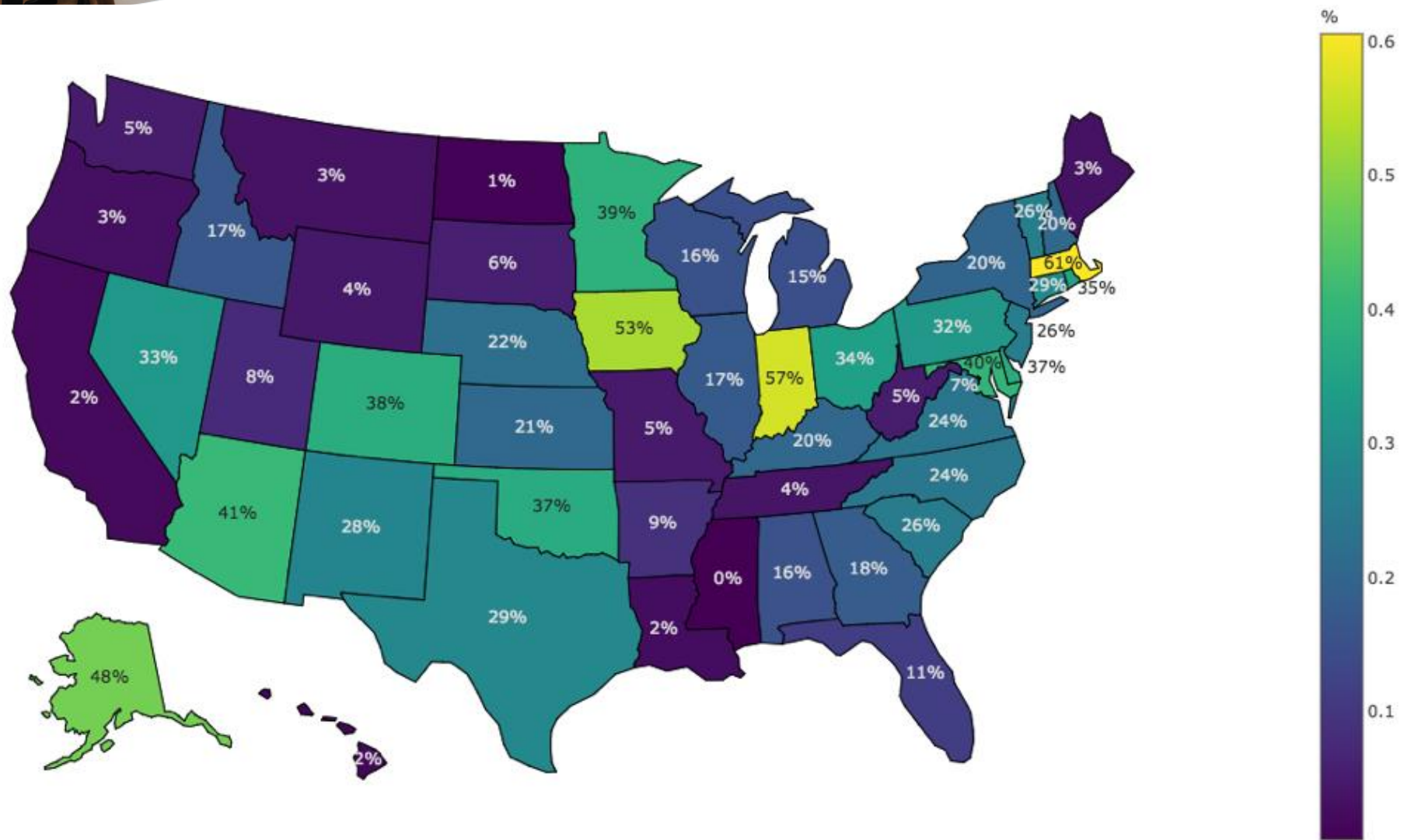
The HERS Index

✓ Energy modeling to determine HERS Index Score and estimated energy usage

Water Efficiency Ratings...coming soon!



Share of New Homes Receiving HERS Ratings

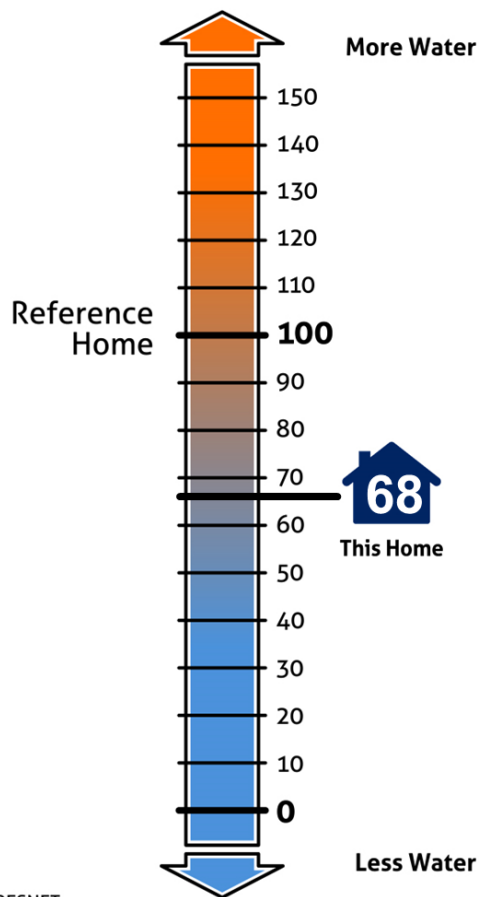


look for



Measures Water Efficiency Improvements

RESNET HERS_{H2O} Index



©2017 RESNET

Water efficiency rating certificate for:

100 Sunshine Dr.
Irvine, CA 90000

Size of home: 1980 sq. ft.
Number of bedrooms: 3
Size of lot: 5000 sq. ft.
Size of irrigated area: 2000 sq. ft.

This Home, Compared to the Reference Home

(Reference home is similarly sized, at same location, with attributes typical of a 2006 home)

32%
more water
efficient

34,080
gallons of water
annual savings

\$175

annual saving on water utility bills

Rated by:

Justin Miller
Efficiency Unlimited
Santa Ana, CA 90000

Date: January 19, 2018



look for



What This Means to Builders

KB HOME ENERGY PERFORMANCE GUIDE

Copperleaf The Maston Plan



ESTIMATED MONTHLY ENERGY COST OF A TYPICAL, SIMILARLY SIZED, RESALE HOME

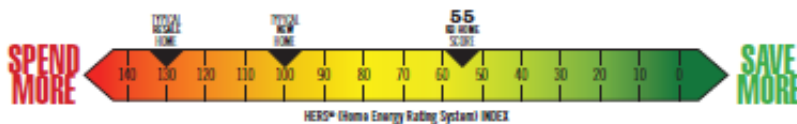
\$234

Actual energy consumption and costs will vary.

ESTIMATED MONTHLY ENERGY COST OF THIS ENERGY STAR® CERTIFIED KB HOME

\$107

Actual energy consumption and costs will vary.



ESTIMATED ANNUAL SAVINGS = \$1,524*

- Adding water savings to this
- Lets an efficient builder further differentiate themselves on cost savings
 - Quantifies the homes impact on water resources
 - Clearly communicates that this home is differed
 - Better is better



Nest Steps

- Finalize ANSI standard (RESNET/ICC 1100)
- Pilot HERSH2O Guidelines
- Develop training and quality assurance process for raters
 - Add procedures for non-raters



Thank You!

Jonah Schein | Schein.Jonah@epa.gov

RESNET Contact:

Ryan Meres, Program Director

ryan@resnet.us

760-681-2391