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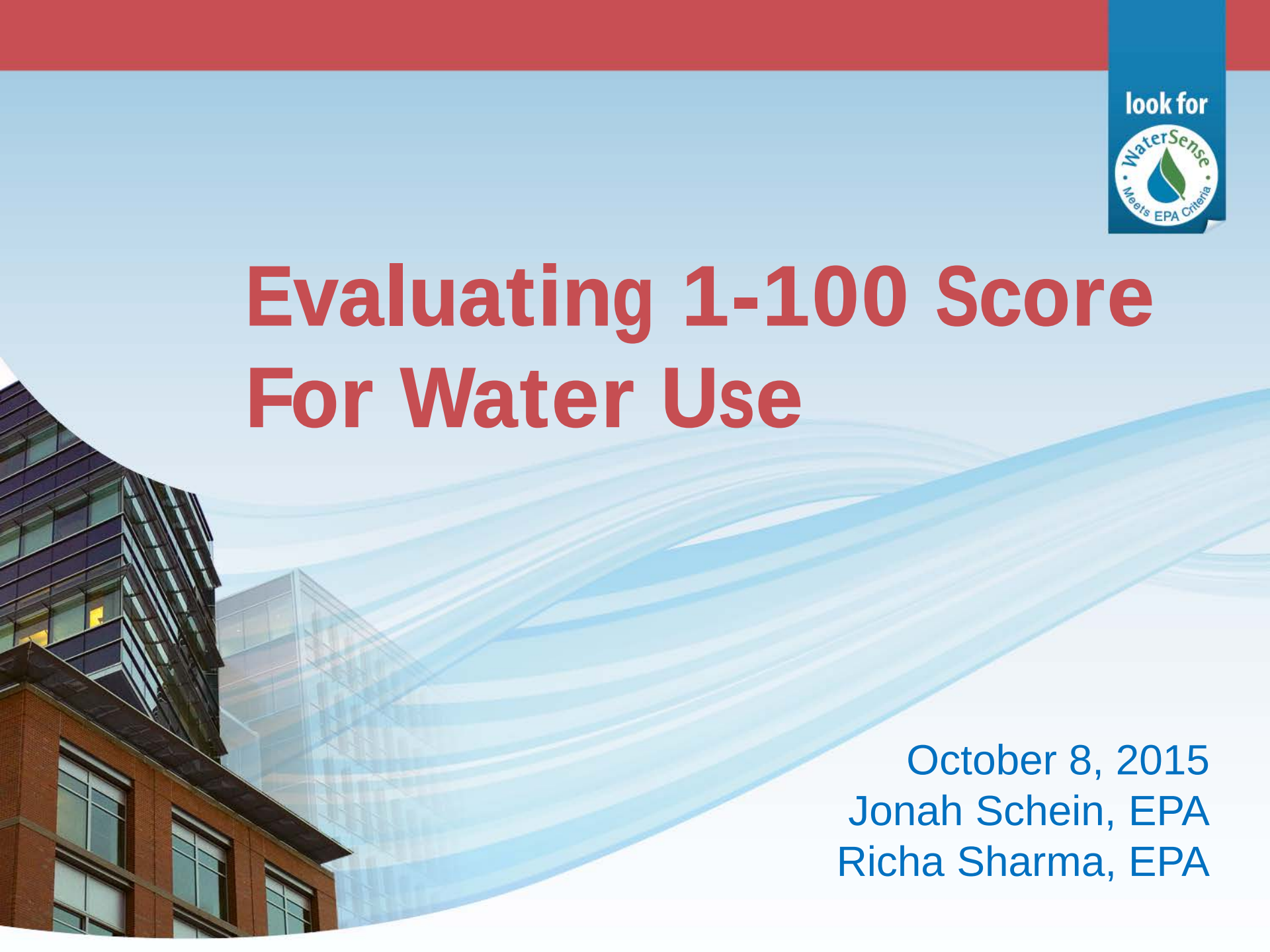

Evaluating 1-100 Score For Water Use

October 8, 2015
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The ENERGY STAR Program

- An EPA voluntary program
- >85% consumer brand recognition
- Promotes and recognizes superior energy efficiency in products, homes, and buildings
- >40% of U.S. commercial building space (400,000+ buildings) is benchmarked using ENERGY STAR's Portfolio Manager

What Do We Mean by “Benchmark”

This effort is about a consumption based comparison tool for water use in multifamily buildings

It is not:

- A predicted or asset based rating
- Point based rating system
- A comparison of consumption rates

ENERGY STAR® Portfolio Manager™

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- Free online tool for existing buildings:
  - Assess the energy use of existing buildings
  - Compare your energy use against peers
  - Track changes in energy use over time in single buildings, groups of buildings, or entire portfolios
  - Receive an energy performance score (1-100 scale)
  - Apply for ENERGY STAR certification
  - Track cost savings and CO_2 reductions
  - Track water usage (about 25% of Portfolio Manager users track water use)
- http://www.energystar.gov/benchmark

Eligible to Receive an ENERGY STAR Score and Certification

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Bank/Financial Institutions

Courthouses

Data Centers

Dormitories

Hospitals

Hotels

Houses of Worship

K-12 Schools

Medical Offices

Office Buildings

Retail Stores

Senior Care Communities

Supermarkets

Warehouses

Wastewater Treatment Plants

ENERGY STAR Score Statistical Methodology

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The Score Does
✓ Evaluate as-billed energy/water use relative to building operations
✓ Normalize for operational characteristics (e.g., size, number of employees, cash registers, computers, climate)
✓ Depend on a statistically representative sample of the commercial building population
The Score Does Not
× Sum the energy/water use of each piece of equipment
× Normalize for technology choices or market conditions (e.g., type of lighting, energy price)
× Explain why a building operates as it does

Can This Approach Work for Water?

- Does the data exist?
  - Most ENERGY STAR models are based on the Commercial Building Energy Consumption Survey (CBECS)
- Can water use be normalized the same that energy use can?
- ENERGY STAR and WaterSense began evaluating the technical feasibility of benchmarking water use in 2014

Why Multifamily?

Multifamily buildings were chosen based on a variety of factors:

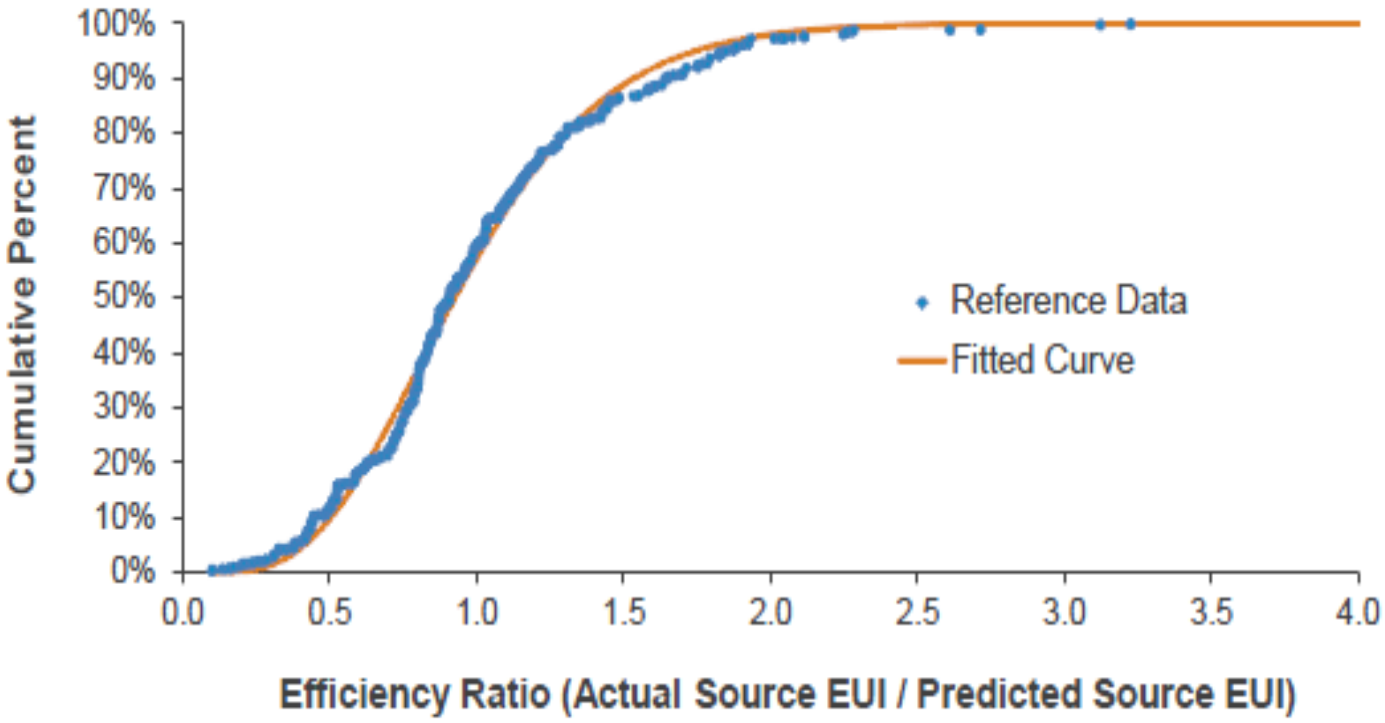
- Availability of data
- Prevalence of building type in the national stock
- Interest from stakeholder groups
- Intensity of water use

How is a Score Created?

- A national, statistically representative survey is used to create a model to predict mean water use intensity (WUI) in the specific building type
  - WUI is expressed as gallons/ft^2
- The water use models are built using the Fannie Mae Green Initiative's Energy and Water Market Survey (https://www.fanniemae.com/multifamily/green-initiative)
  - 2012 survey of over 1,000 multifamily property owners and managers across the US
  - Used to develop the 1-100 ENERGY STAR for multifamily properties (launched in September 2014)

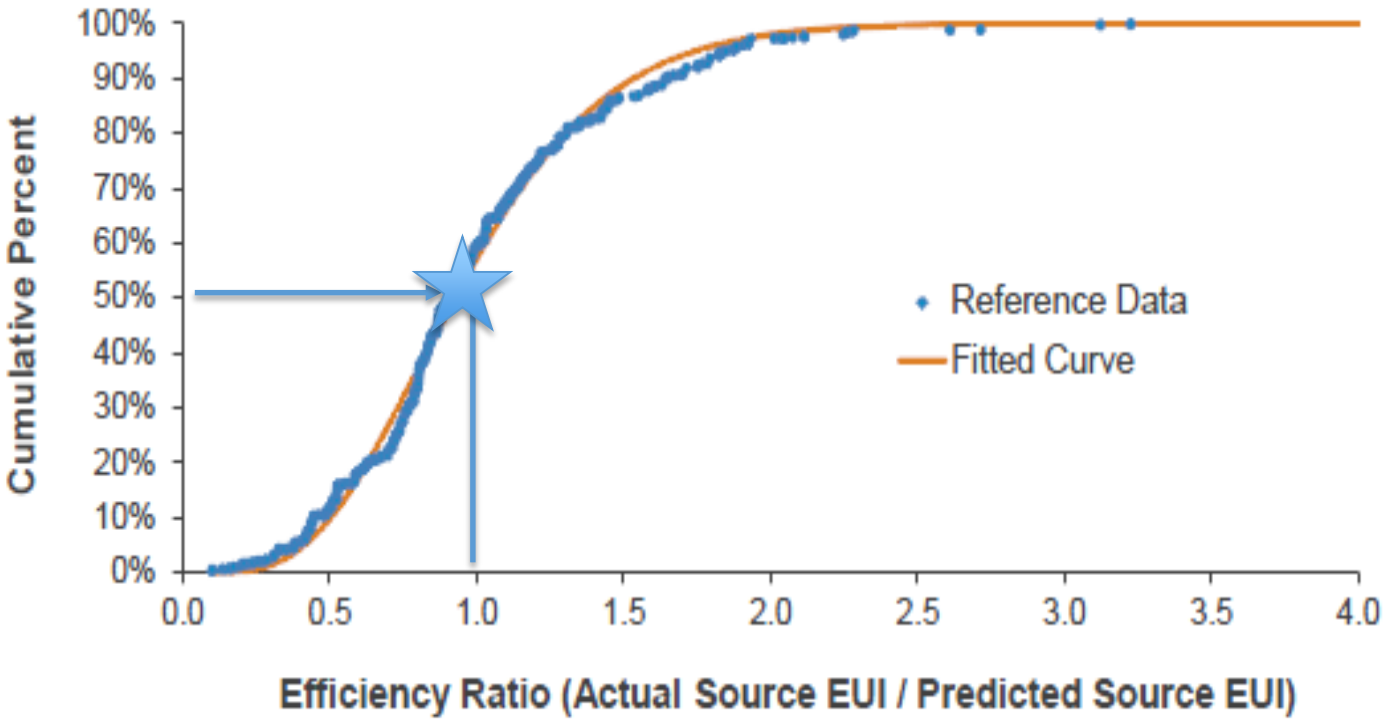
How is a Score Created?

$$\frac{Actual\ WUI\ (over\ 12\ months)}{Predicted\ WUI} = ratio$$



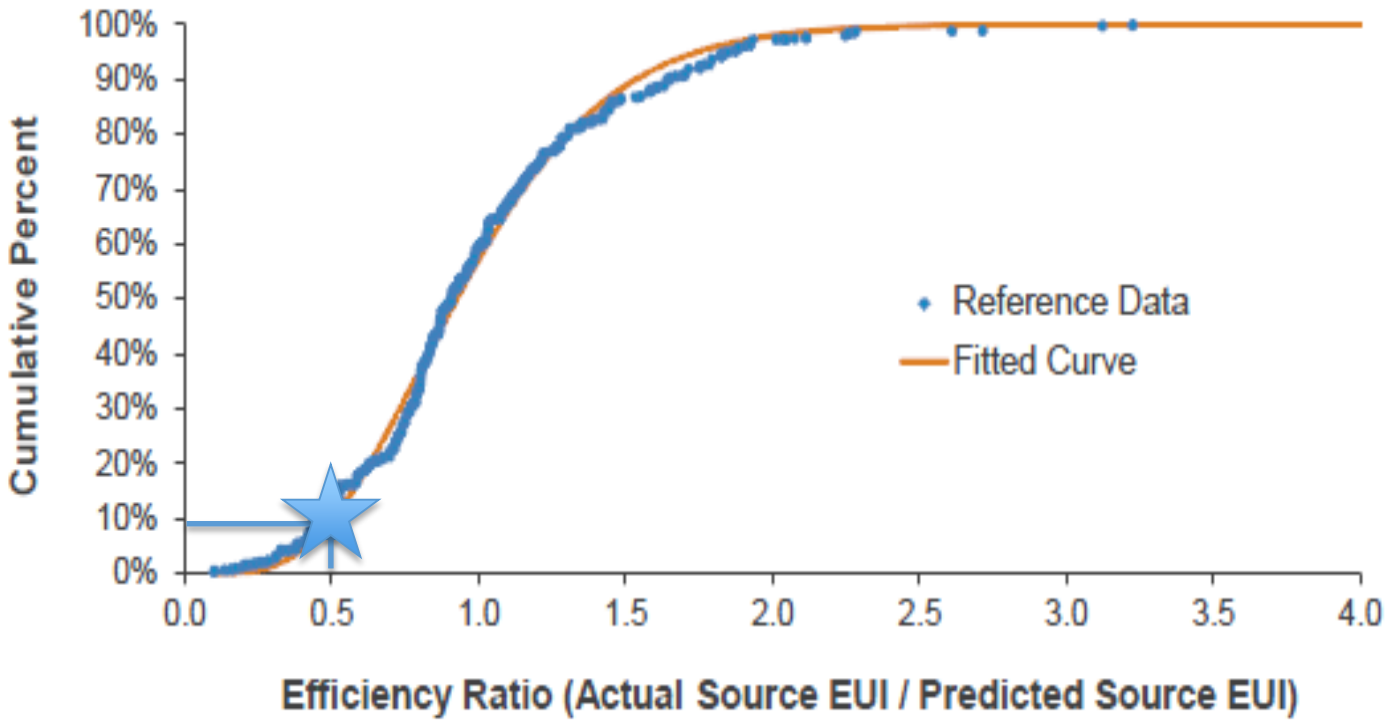
How is a Score Created?

- A building that has actual WUI very close to its predicted WUI has a ratio of 1, and scores very close to 50 (i.e. average)



How is a Score Created?

- A building that has actual WUI half its predicted WUI has a ratio of 0.5, and scores close to 90 in this example



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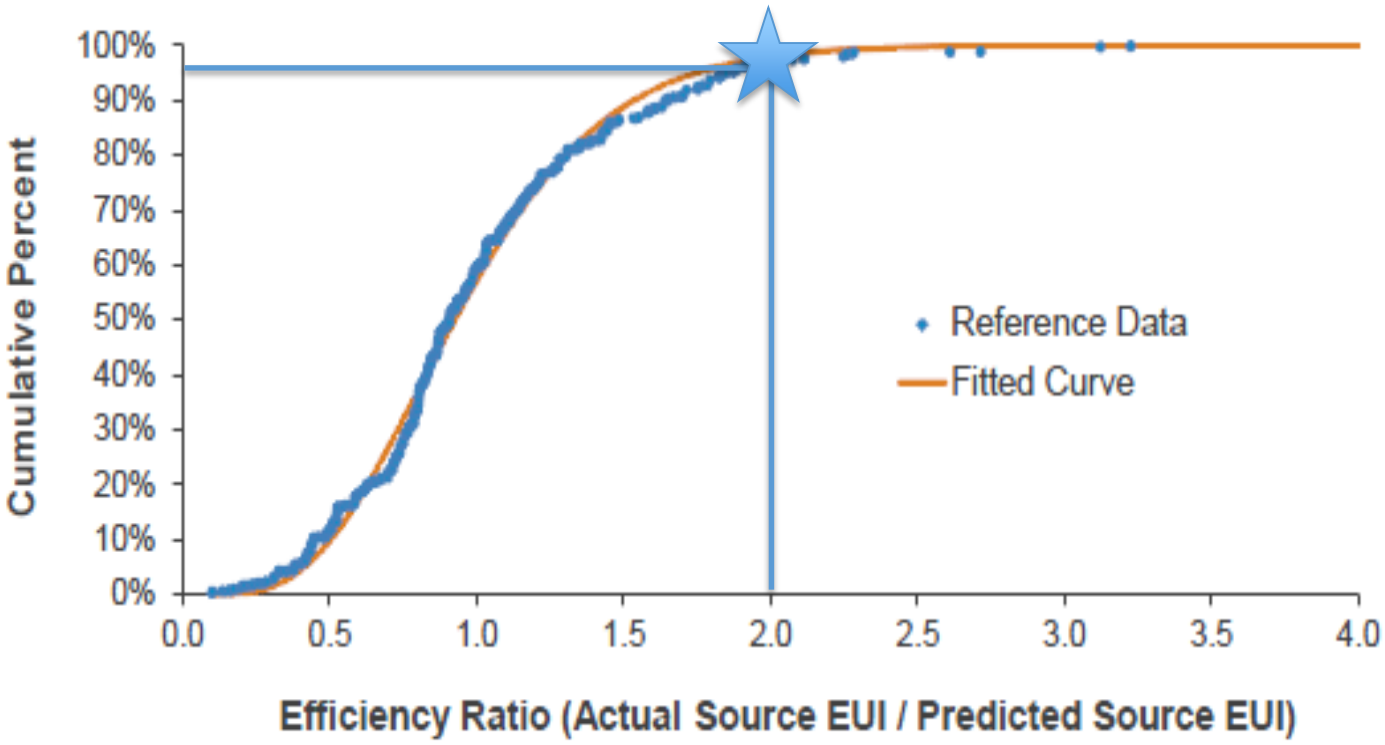

Factors Considered for WUI Model in Multifamily Buildings

Variable	Units
Unit Density	Units/ft^2
Bedroom Density	Bedrooms/ 1,000 ft^2
Avg Bedroom per Unit	Bedroom/unit
Total bedrooms	# of bedrooms
Ratio of Irrigated Area to Floor Area	N/A
Irrigated Area	ft^2
Floor Area	ft^2

Variable	Units
Number of units	Units
Dishwasher	Indicator
Pools	Indicator
Low Rise	Indicator
Mid Rise	Indicator
High Rise	Indicator
Laundry	Indicator
Cooling Tower	Indicator

Factors Considered for WUI Model in Multifamily Buildings

Variable	Units
Observed Cooling Degree Days	# of CDD
Observed Heating Degree Days	# of HDD
Observed Annual Rainfall*	Inches
Observed Peak Rainfall*	Inches

Variable	Units
Historic Annual Rainfall*	Inches
Historic Peak Rainfall*	Inches
Historic Annual ET*	Inches
Historic Peak ET*	Inches

* Also used as a term multiplied by the ratio of irrigated area to floor area (rif)

Leading Terms Used in Models

Used in all models	**Unit density** **Bedrooms per unit** **Historic peak ET** **RIF**
Used in some models	**RIF* X historic peak ET**** **RIF* X historic peak rainfall**** **Number of units**** **Low-rise indicator**

*RIF = the ratio of irrigated area to floor area

**Terms are truncated in the final models

Why Historic Climate Data?

- Historic data was readily available, observed weather data for the survey year was obtained at substantial effort
  - It's unclear if reliable weather data could be obtained on a continual basis and connected to Portfolio Manager
- In our analysis, observed weather data was on par or slightly less significant than historic climate data
- Sites that experienced exceptionally wet or dry weather during the survey showed no clear pattern as a result
  - Sites experiencing dry conditions did not skew toward using more water than predicted, sites experiencing wet conditions did not use skew toward using less water than predicted

What Data Does A User Need?

- Required inputs for a building are:
  - 12 months of water use
  - Building location
  - Building size
    - floor area
    - number of units
    - total number of bedrooms
  - Irrigated area

What Data Does A User Need?

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  - Irrigated area

- Over 14,000 multifamily buildings are already using Portfolio Manager would be able to use the water use score by adding one piece of information: irrigated area

Next Steps

- Additional analysis and verification
  - Data call for additional information*
  - Call is targeted at existing ENERGY STAR Portfolio Manager as well as other interested parties
- Input and stakeholder engagement
- Model selection and programming (pending analysis)
- Decisions on certification
- Hope to have the score available in Fall 2016

*If you're interested in supporting our call for data please come talk to us!

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Questions?

WaterSense Information

Visit us online!

www.epa.gov/watersense

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