SUSTAINABLE
Water Management Conference

2018

THE Water Research FOUNDATION

brendle GROUP

WRF 4619: Developing Water Use Metrics and Class Characterization for Categories in the CII Sector

Amy Volckens

March 27, 2018

Why CII Water Use Metrics are Important

- Commercial, Industrial, and Institutional (CII)
- CII sales make up 30% of utility water sales in U.S.
- About 25% of utilities have CII efficiency programs

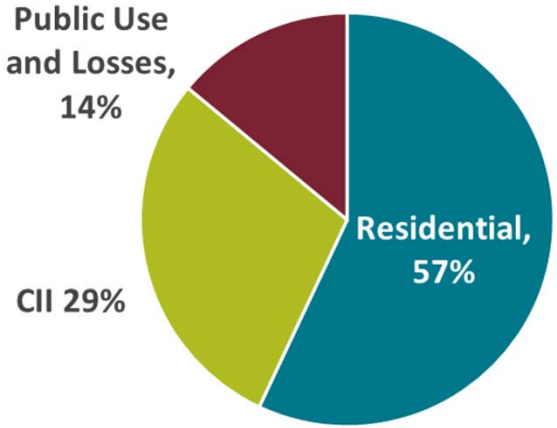


Figure 1: U.S. Water Public-Supply Withdrawals 2010 (Maupin et al., 2014)

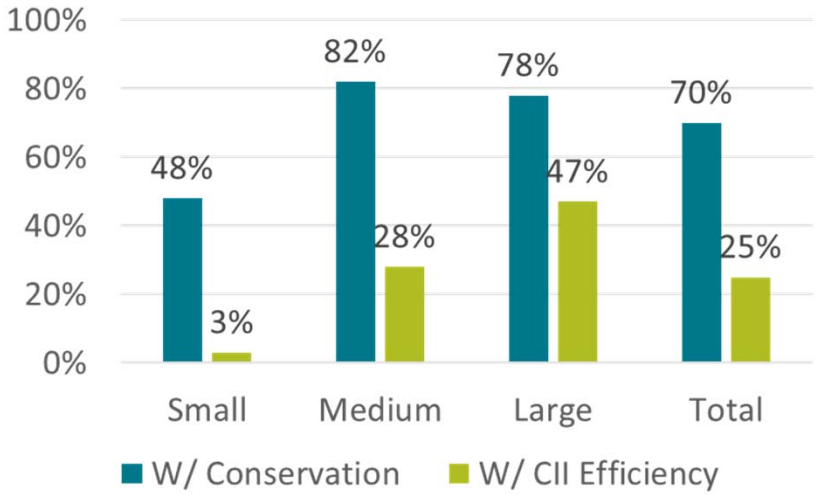


Figure 2. Prevalence of Utility Conservation Programs by System Size (Dziegielewski, 2016)

Working with the CII Sector

- Current challenges
  - Complex relationships between customer type and water use
  - Inconsistent customer categorization
  - Challenges with managing and collecting CII water use data
  - Inadequate staff availability and budgets

- Progress in the energy industry
  - Department of Energy's Building Performance Database (U.S. DOE, 2018)
  - U.S. Energy Information Administration's Commercial Buildings Energy Consumption Survey (U.S. EIA, 2018)

WRF 4619 Research Objectives

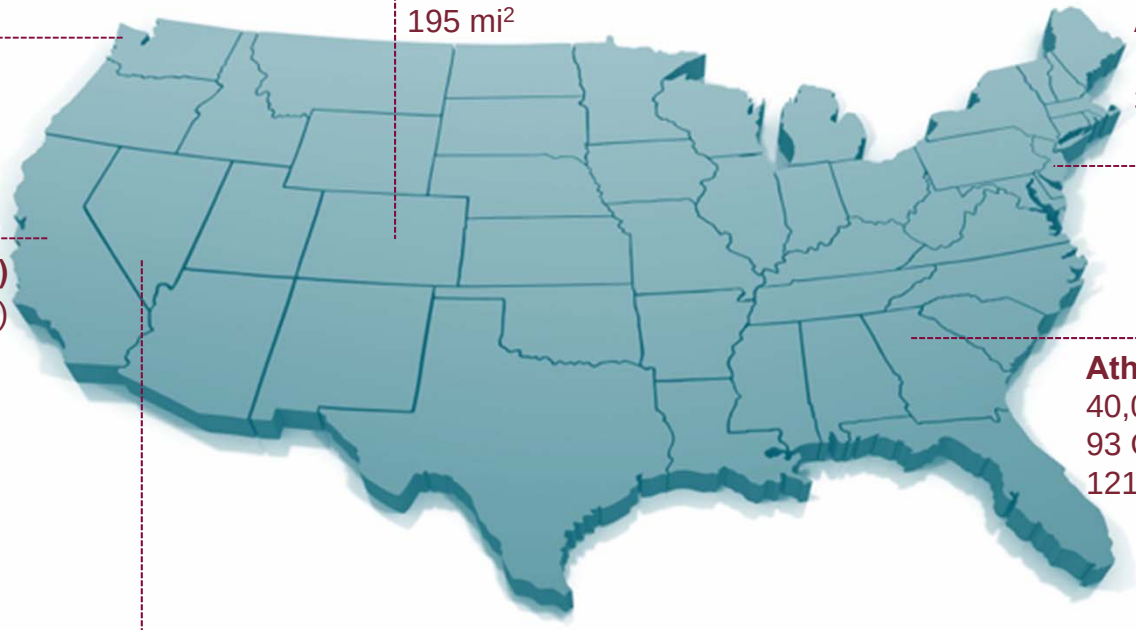
- To implement a **defined process** for evaluating CII customer water use and developing rate-of-use metrics (Keifer et al, 2015).
- To **estimate water use metrics** and set water use benchmarks for selected CII customer categories.
- To develop a CII water use metrics **database** that can be integrated with an existing resource (like the Environmental Protection Agency's Portfolio Manager).
- To provide **guidance for water utility staff** on how to use and implement CII water use benchmarks.

Participating Utilities

Aurora Water (AW)
79,000 accounts
115 GPCD (21% CII)
151 mi^2

Tacoma Water (Tac)
99,925 accounts (6% CII)
49 GPCD (46% CII)
117 mi^2

Colorado Springs Utilities (CSU)
140,000 accounts (10% CII)
145 GPCD (29% CII)
195 mi^2



American Water (AmW)
132,290 accounts (4% CII)
318 GPCD (23% CII)
170 mi^2

City of Sacramento (Sac)
135,830 accounts (7% CII)
208 GPCD (30% CII)
993 mi^2

Athens-Clarke County (ACC)
40,000 accounts (10% CII)
93 GPCD (45% CII)
121 mi^2

Southern Nevada Water Authority (SNWA)
562,698 accounts (5% CII)
205 GPCD (32% CII)
862 mi^2

Source: WRF project #4619, forthcoming

Data Collection and Processing

Dataset	Main Processing Objectives	Common Data Quality Issues
Consumption	• Separate indoor and outdoor use	• Partial records • Customer changes
Categorization	• Standardize customer categorization across utilities	• Mixed use (different customer categories associated with use)
Normalization	• Link to consumption and categorization data	• Shared use (more than one use record associated with building or parcel data)

Research Approach

1) Customer Classification

2) Preliminary Metric Development

- Indoor water use / building sq ft (default)
- Total water use / parcel sq ft (SNWA only)

3) Additional Data Collection

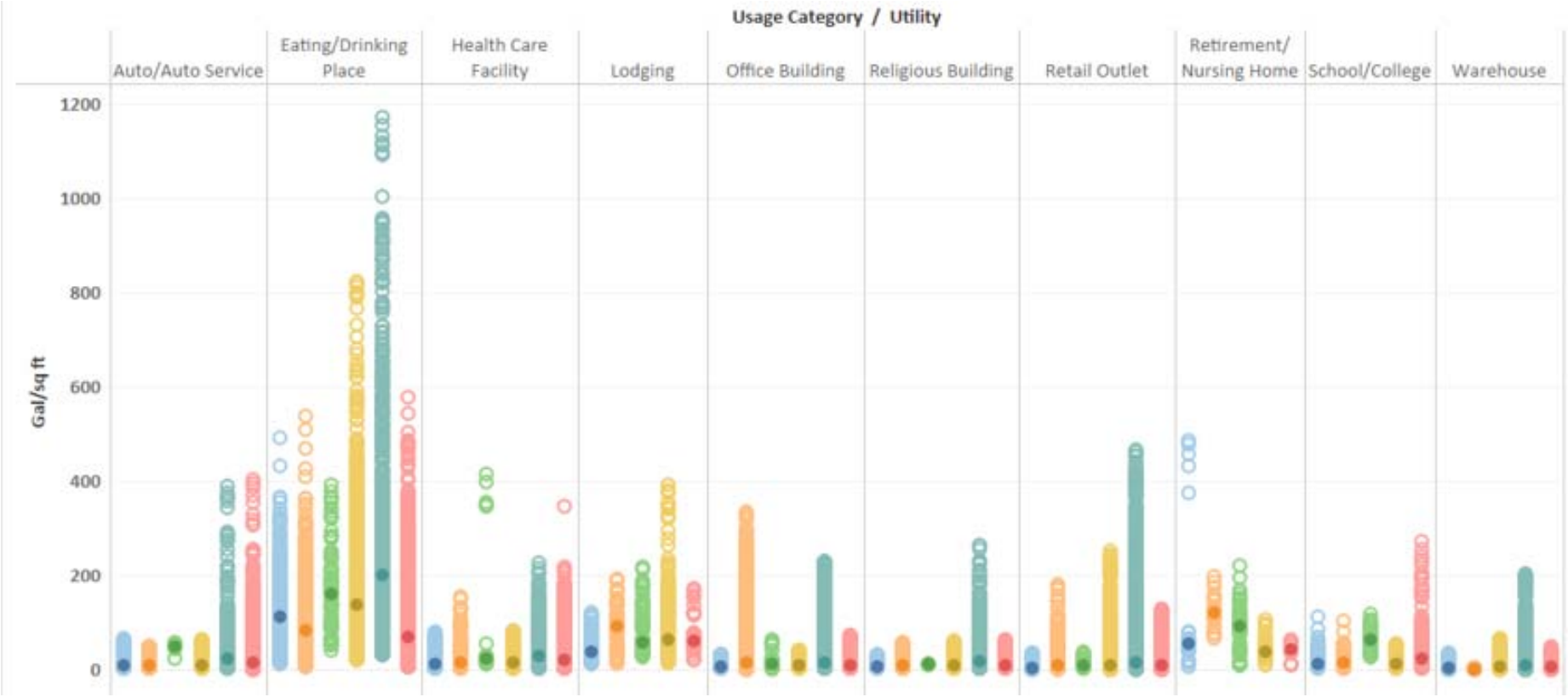
4) Metric Refinement and Benchmark Development

- Sub-categorization
- Other normalization factors

10 Customer Categories

1. Schools/College
2. Lodging
3. Office Building
4. Eating/Drinking Places
5. Retail Outlet
6. Health Care Facility
7. Warehouse
8. Auto/Auto Service
9. Religious Building
10. Retirement/Nursing Homes

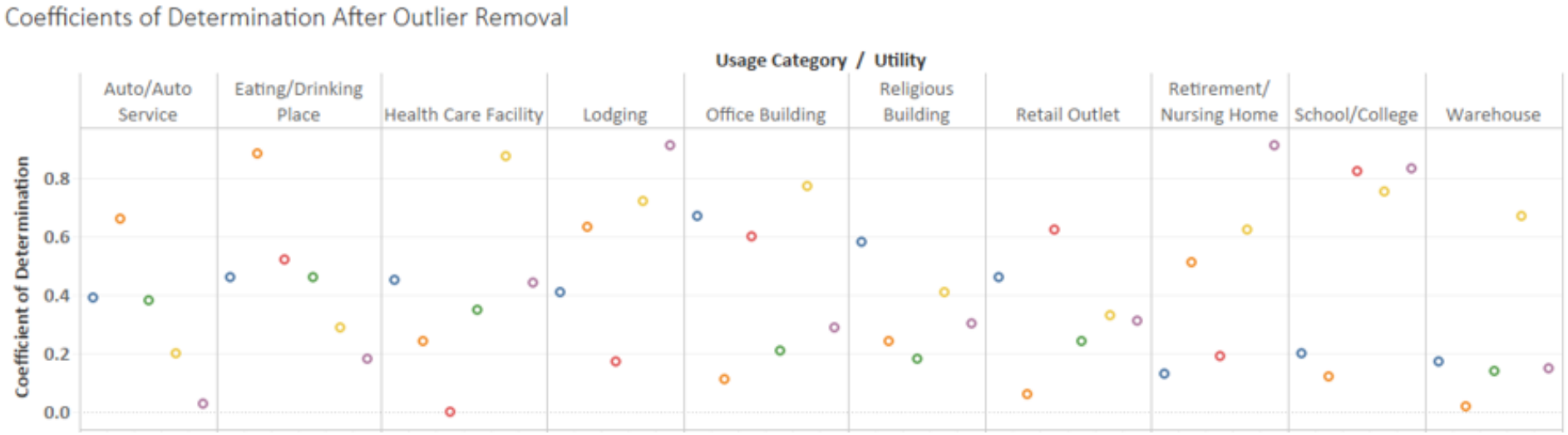
Rate-of-Use Metrics (gal/sq ft)



Source: WRF project #4619, forthcoming

- Highly skewed datasets
- Percentiles (25, 50, 75) used for efficient, typical, and high use

Rate-of-Use Metrics (R^2)

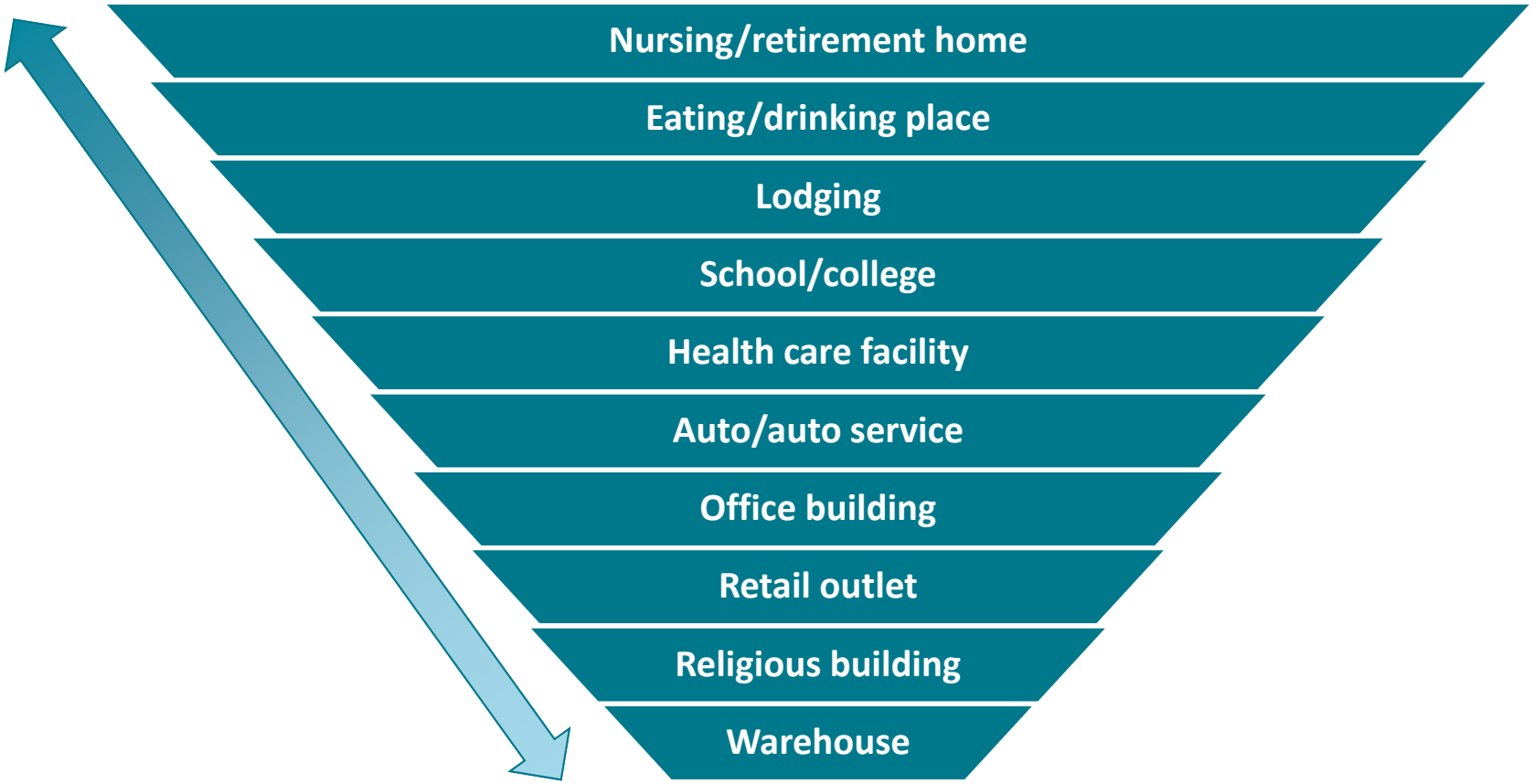


Source: WRF project #4619, forthcoming

- How much variation in indoor water use does building area explain?
- Highly variable, few discernible trends

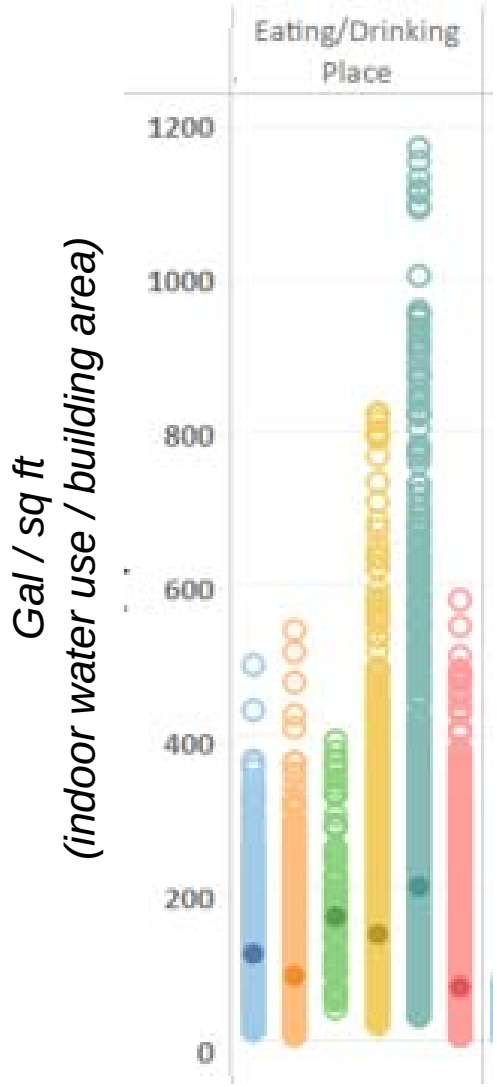
Typical Category Rankings

Higher use / sq ft



Lower use / sq ft

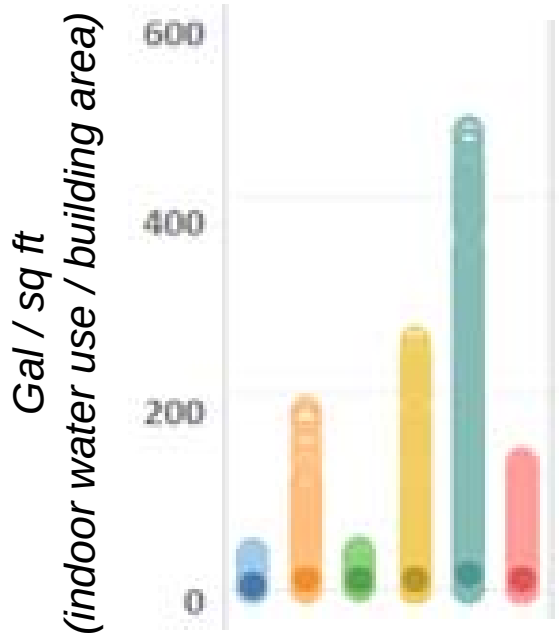
Eating/Drinking Places



- Sub-categories
  - Full service | Fast food | Bakery/cafeteria | Bar/club
- Other normalizing factors
  - Number of seats | Hours open per week | Customers per day
- Key findings
  - In addition to building area, number of seats and hours open per week are promising normalizing factors.
  - Bakeries and full-service restaurants tend to show higher rates of water use.

Source: WRF project #4619, forthcoming

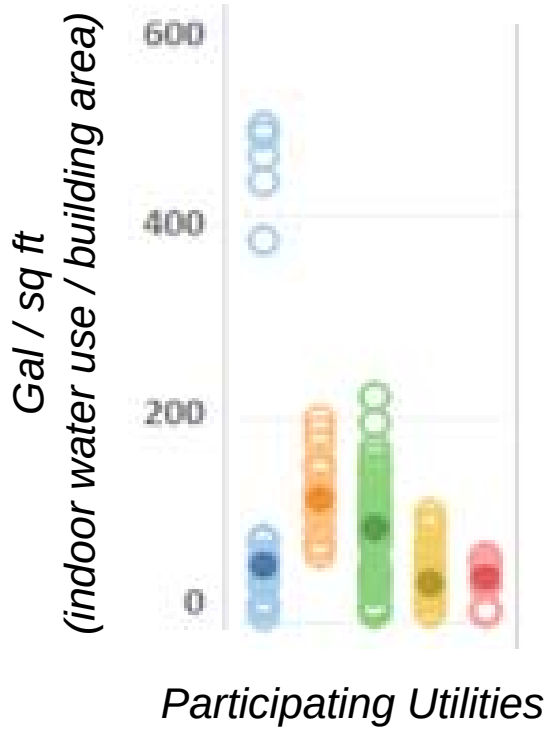
Retail Outlets



- Sub-categories
  - Shopping centers and malls | Grocery stores and supermarkets | Convenience stores | Pharmacy
- Other normalizing factors
  - None
- Key findings
  - Wide-ranging category
  - Grocery stores tend to have the highest rate-of-use metrics.

Source: WRF project #4619, forthcoming

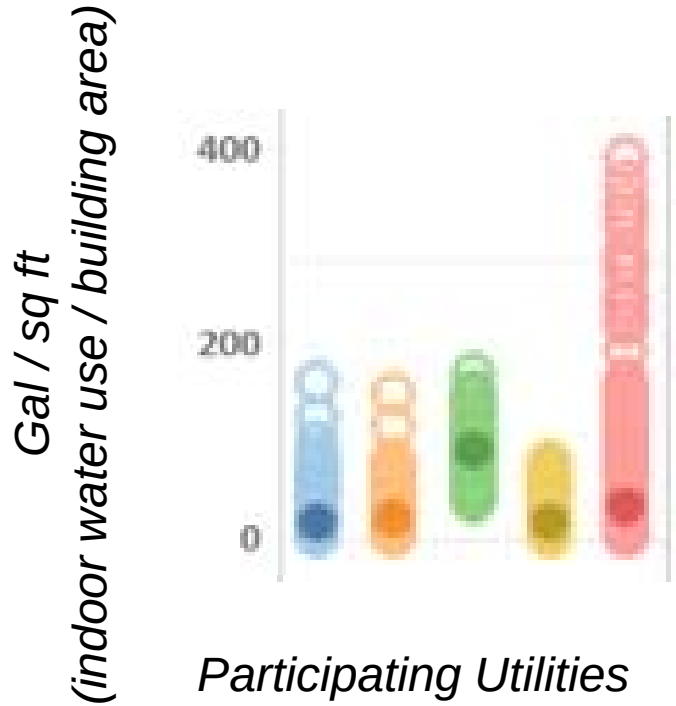
Retirement/Nursing Homes



- Sub-categories
  - Long-term nursing homes | Retirement homes
- Other normalizing factors
  - Number of residents (or beds) | Meals per day
- Key findings
  - Small sample sizes
  - Long-term nursing homes show higher use than retirement homes
  - Number of beds showed promise as a normalizing factor

Source: WRF project #4619, forthcoming

Schools



Source: WRF project #4619, forthcoming

- Sub-categories
  - Pre-schools and daycare | Primary and secondary schools | Universities/college campuses
- Other normalizing factors
  - Number of students
- Key findings
  - Decreasing trend in normalized water usage as the age of the students increased.
  - Student counts were easy to obtain for primary and secondary schools and showed promise.

Findings that you might have guessed

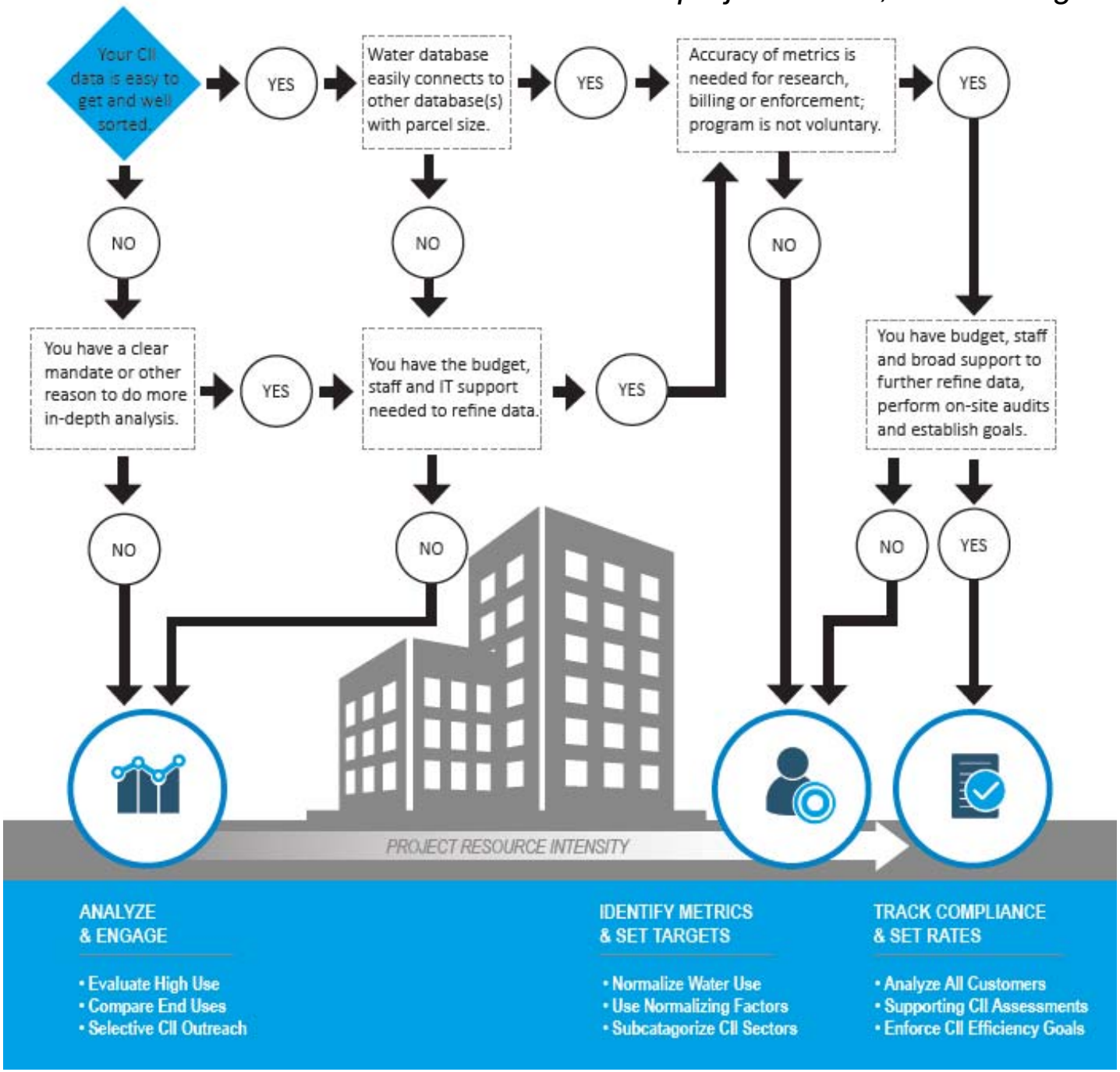
- The presence of a car wash significantly impacts normalized rate-of-use metrics for the **auto/auto service** category.
- In the **health care facilities** category, hospitals tend to show much higher rates of water use than medical offices.
- Water use in the **warehouses** category is low regardless of building size.

How Can a Utility Use the Results?

- Analyze and engage
  - Better understand CII customer water usage
  - Assess potential for water savings
  - Reach out and educate large users
- Identify metrics and set targets
  - Establish comparative metrics
- Track compliance and set rates
  - Establish benchmarks to meet restrictive water reduction goals
  - Set and enforce benchmark-based rates

Determining Outcomes for Water Use Analysis

Source: WRF project #4619, forthcoming



In Closing

- Research report
  - Rate of use metrics
  - Research findings
  - Best practices for data collection and processing
- Utility user guide
  - Practical guide for developing and using CII rate-of-use metrics
  - Insight from participating utilities to balance outcomes and available resources
- Draft research report and utility guide being reviewed by project advisory committee and utilities right now
- Anticipate publication later in 2018

Note: Research results are not considered final until publication and are subject to change. Please do not reproduce photos, graphics, charts, and figures without permission from original source. Thank you!

Acknowledgements

Project Advisory Committee

Charlotte Ely
CA Water Resources Control Board:
Sacramento, CA

Heather Zarski
EPCOR Utilities:
Edmonton, AB (Canada)

Jack Kiefer
Hazen and Sawyer:
Marion, IL

Kristan VandenHeuvel
Water Environment & Reuse Foundation:
Alexandria, VA

Chris Meenan
Las Vegas Valley Water
Las Vegas, NV

Darren Sversvold
City of Phoenix Water:
Phoenix, AZ

Phil Segura
Denver Water:
Denver, CO

Bill Hoffman
Hoffman & Associates:
Austin, TX

Research Manager: Maureen Hodgins, Water Research Foundation: Denver, CO

Questions

Continue the Conversation!

Amy Volckens

AVolckens@BrendleGroup.com

(970) 207-0058

References

- Dziegielewski, B. 2016. *National Survey of Commercial, Industrial, and Institutional Water Efficiency Programs*: American Water Works Association, https://www.awwa.org/portals/0/files/resources/water%20knowledge/rc%20water%20conservation/awwasutilitysurveyofciiwaterefficiencyprogramsreport.pdf.
- Fedak, R., D. Hannon, R. Sands, Z. Taylor, A. Volckens. 2018. *Developing Water Use Metrics and Class Characterization for Categories in the Commercial, Industrial, and Institutional Sectors.* Water Research Foundation: Denver, CO. WRF Project #4619, *publication pending.*
- Fedak, R., D. Hannon, R. Sands, Z. Taylor, A. Volckens. 2018. *Water Use Analysis Guide: A How-To For Setting Commercial, Industrial and Institutional Efficiency Metrics.* Water Research Foundation: Denver, CO. WRF Project #4619, *publication pending.*
- Kiefer, J., L. Krentz, B. Dziegielewski. 2015. *Methodology for Evaluating Water Use in the Commercial, Institutional, and Industrial Sectors.* Water Research Foundation: Denver, CO. WRF Project #4375. http://www.waterrf.org/PublicReportLibrary/4375.pdf.
- Maupin, M.A., Kenny, J.F., Hutson, S.S., Lovelace, J.K., Barber, N.L., and Linsey, K.S. 2014. *Estimated use of water in the United States in 2010*: U.S. Geological Survey Circular 1405, 56 p., http://dx.doi.org/10.3133/cir1405.
- U.S. Department of Energy (U.S. DOE). 2018. *About the Building Performance Database*. https://www.energy.gov/eere/buildings/about-building-performance-database.
- U.S. Energy Information Administration (U.S. EIA). 2018. *About the Commercial Buildings Energy Consumption Survey*. https://www.eia.gov/consumption/commercial/about.php.