

Finally, Real Data from Bathrooms: Water Fixtures in Seattle Single-Family Homes

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Presentation outline

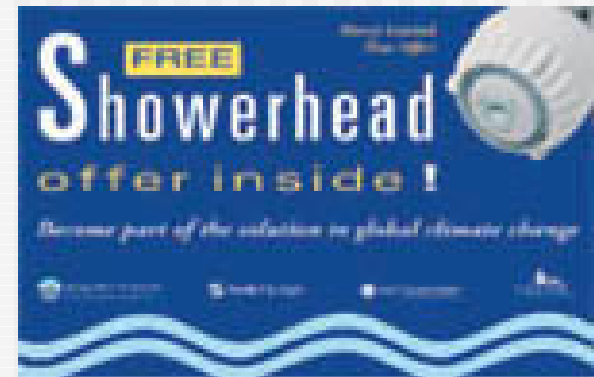
- Background – why are measurements important?
- How this study was done
- What we found out

Baseline data is essential

- Alliance for Water Efficiency testimony before Congress (Oct 2007):
 - Best baseline data 10 years old
 - New information critical for planning
 - What is conservation potential? Efficiency saturation?
 - Fundamental data should be collected regularly
 - \$3 million for residential sector a good start

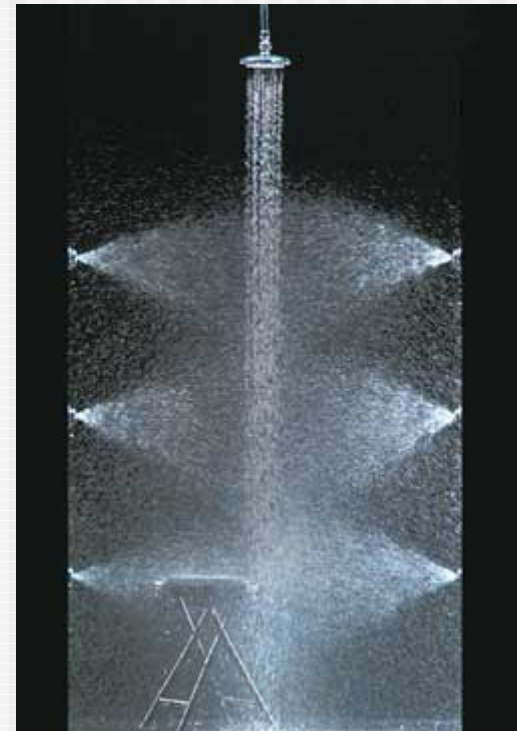
Baseline data underpins local programs

- Long-time utility collaborations
 - Seattle City Light (electric)
 - Puget Sound Energy (electric/gas)
 - Seattle Public Utilities/Saving Water Partnership (water/sewer)
- Need solid data to justify programs
- Showerhead program done many years ago—what's out there now?



Primary research objectives

- Help determine potential water/energy savings from replacing existing fixtures with high- efficiency ones in “average” homes.
- Identify the average replacement (retirement) rate of plumbing fixtures and water-using appliances.
- Examine multiple showerhead trends.



Other research considerations

- Obtain representative snapshot of water use, pressure, and hot water temperatures for existing home plumbing fixtures.
- Get diverse representative sample from single-family homes.
- Make actual in-home measurement of flow rates and flushing volumes.
- Overcome traditional barriers to in-home data collection and privacy by using a unique home access system.
- Create a service area baseline for the rate of plumbing fixture replacement over time.

Data collected

- Showerheads
 - Existing and efficient full flowrates
 - Presence of “luxury” showerheads
- Bathroom faucet aerators
 - Existing and efficient full flowrates
- Toilets
 - Measured flush volume
- Other water-related parameters
 - Static and flowing water pressure
 - Hot water temperature and time to reach it
 - Toilet flush volumes
- Water appliance characteristics
 - Age and manufacturer
 - Clothes washers, dishwashers
 - Water heater fuel
- Photo record of all fixtures and appliances

Selecting the sample

- Set sampling targets representative of Seattle Public Utilities service area
 - Geographical distribution
 - Age of home
- Recruit through...
 - Realtor open houses
 - Neighborhood Power Program
 - Senior Services Program
 - Study team acquaintances

Collecting data

- Hot water system
 - Fuel and system type
 - Areas served
- Showerheads
 - Time for hot water to reach far point
 - Install gauge - pressures with no flow and full flow
 - Bucket test – existing and efficient flowrates, plus leakage
 - Manufacturer, date, presence of multiple heads
- Faucet aerators
 - Bag test – existing and efficient mixed water flowrates

Collecting data

- Toilets
 - Flush volume: mark fill line, flush with disabled inflow, refill with graduated bucket
 - Manufacture date
 - Leakage
- Other water appliances
 - Clothes washer: type, manufacturer, nameplate
 - Dishwasher: type, manufacturer, nameplate

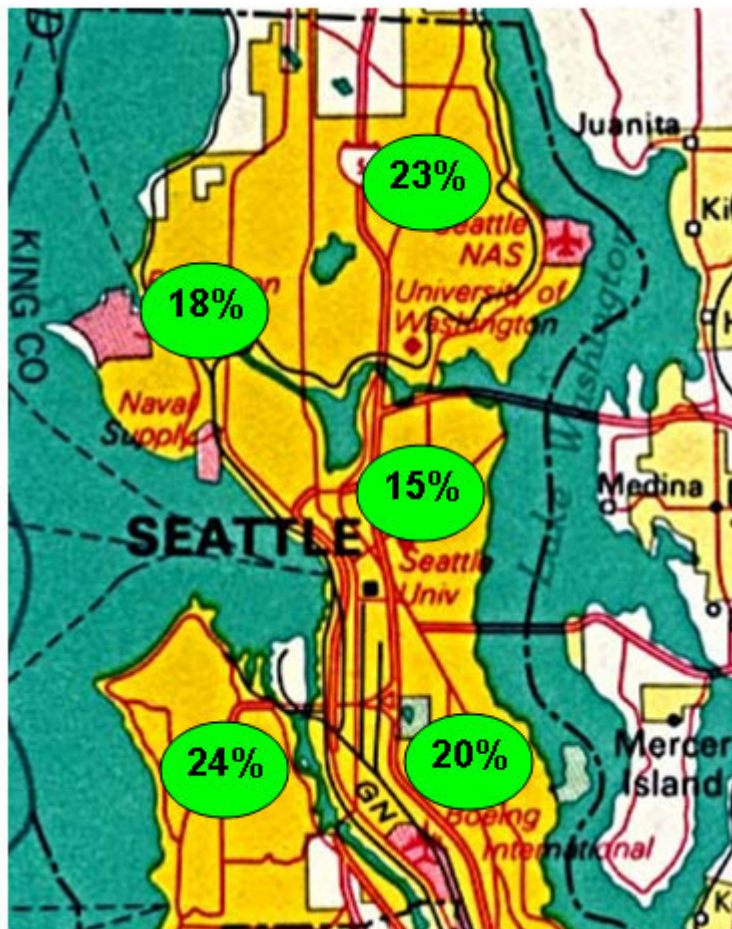


Analyzing the data

- Quality control
- Summary statistics
- Final report
- Photographic records



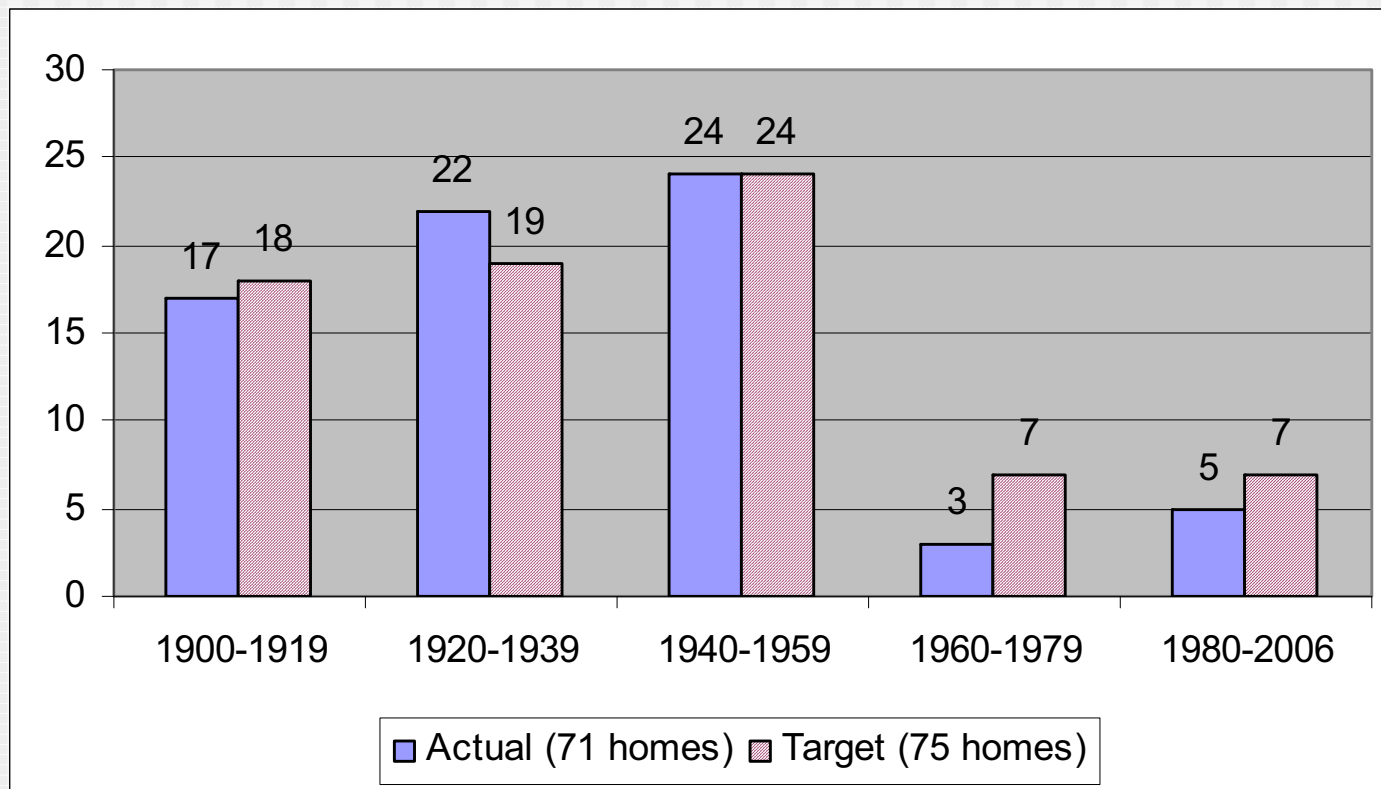
Homes sampled by location



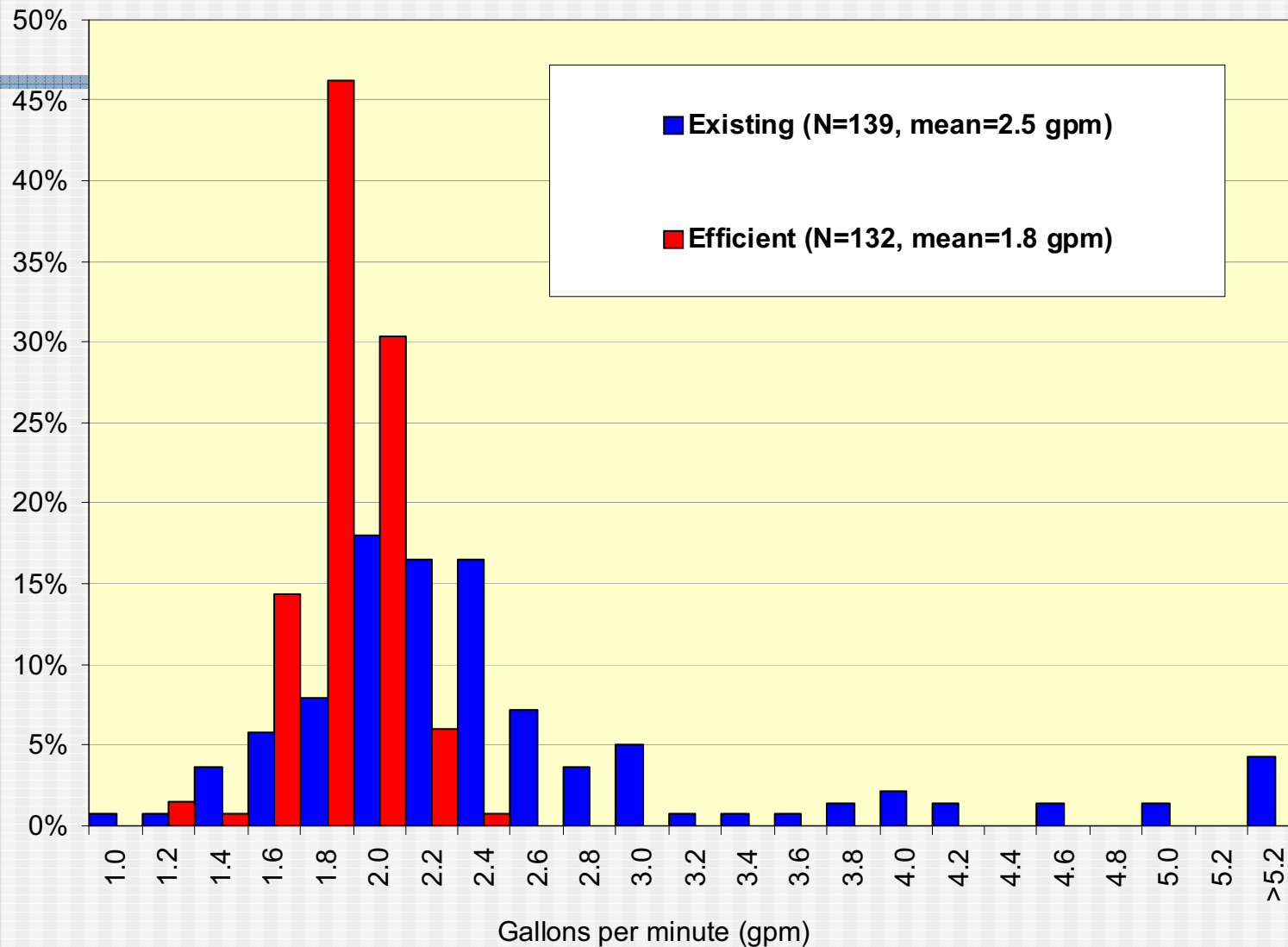
- 71 single-family detached homes
- 151 bathrooms
- 2.1 baths/home

- Selected in five areas to match actual single-family distribution

Homes sampled by age



Measured showerhead flows



Showerhead comparison

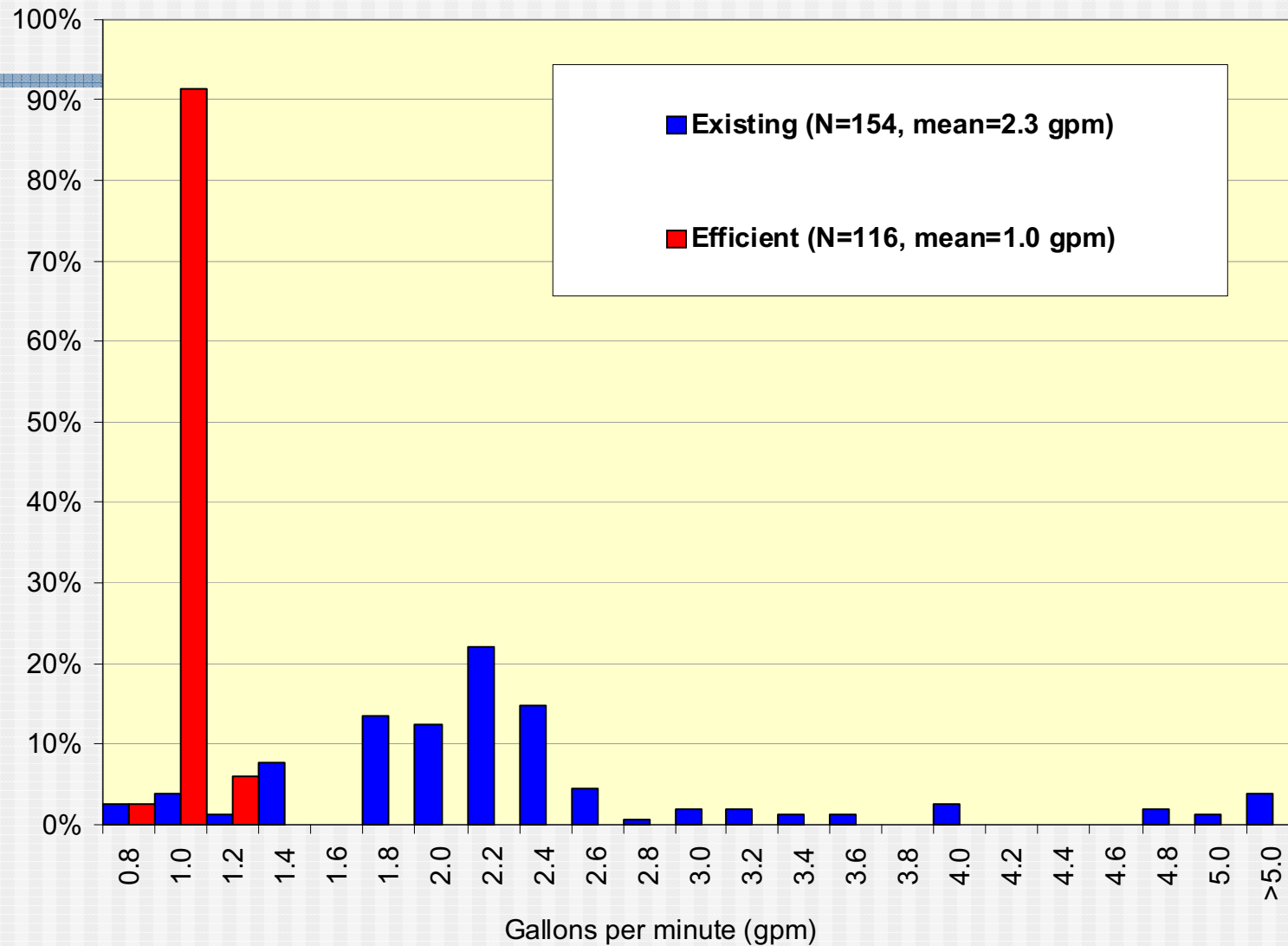
- Seattle baseline
 - 2.5 gpm measured
 - Full flow, 52-61 psi
 - Savings with 2.0-nominal-gpm head = 0.7 gpm

- National baseline*
 - 2.2 – 7.0 gpm, depending on year manufactured/installed
 - Full flow, 60 psi
 - Savings = ???

*per Vickers/AWWARF REUS



Measured aerator flows



Aerator comparison

- Seattle baseline
 - 2.3 gpm measured
 - Full flow, 52-61 psi
 - Savings with 1.0-nominal-gpm aerator = 1.3 gpm

- National baseline*
 - 1.3 – 6.2 gpm, depending on year manufactured/installed
 - Full flow, 60 psi
 - Savings = ???

*per Vickers/AWWARF REUS

Toilet comparison

- Seattle baseline:
 - 2.3 gpf measured
 - Savings with 1.28-nominal-gpf HET = 1.0 gpf
 - 49% efficient toilets (1.6 gpf) ← good opportunity, even 14 years after EPAct.
- National baseline*
 - 1.6 – 7.0 gpm, depending on year manufactured/installed
 - Savings = ???



*per Vickers/AWWARF REUS

Water temperatures

- Maximum hot water temperature
 - 105 - 159F
 - 125F average
- Time to reach the maximum temperature
 - 0.4 - 7.0 minutes
 - 1.9 minutes average
- Time to reach comfortable shower temperature (105°F)
 - 0.1 to 4.5 minutes
 - 0.7 minutes average
- Amount of water to reach comfortable temperature
 - 0.2 to 8.5 gallons
 - 1.6 gallons average

Other sample characteristics

- Home age 70 years
- Floor area 1,857 sq. ft.
- Hot water fuel type 58% electric
- Showerhead type 78% standard,
22% hand-held
0% luxury
- Toilet turnover 67% replaced
within last 16 years

Conclusions

- Sample was small, but fairly representative.
- High cost of in-home measurements generally limits sample size and extensive research. Creative alternatives can mitigate this.
- Collecting robust baseline data is not simple – must be done carefully.
- Baseline data is critical for projecting savings for future programs, especially when past programs and code changes have altered the mix.

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