Statistical analysis of water efficiency, metering, rainwater and greywater savings

(or how I learned to love looking at toilets)

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Acknowledgements

- Project completed on behalf of water industry collaborative fund

- Project team:
  - Rob Lawson
  - Victoria Ashton
  - Keith Ponsonby
  - Dene Marshallsay

A brief history of me

Age 11: Stood in river

Age 18: started BSc in Physical Geography

Age 21: 1st job: Graduate Hydrologist (did involve poo)

Age 24: MSc thesis in the effect of hydropower releases on salmon

Age 29: Asked to look into toilets…

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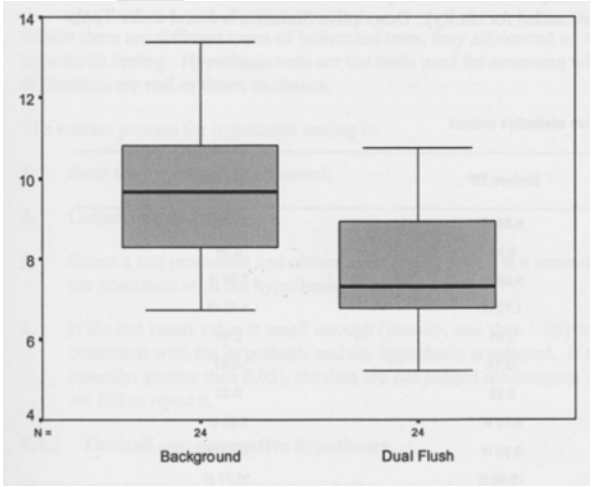
Water efficiency…the early years (late 90s)

- Dual flush toilet study
- Water butts
- Greywater recycling

Plate 3.3: The Peter Brann Device
The dial selector around the toilet handle determines the size of the flush, based upon the length of three tubes which extend below the device (not visible). The sipon is broken when water level in the cistern falls below the bottom of the tube selected.

Quantification of the savings, costs and benefits of water efficiency



- Principles of research
- Study design
- Introductory statistics

We determine a significance level of 5% for the test. Using the TTEST function in Excel (specifying two tailed test, assuming unequal variances) we obtain a t value of 6.11×10^{-5}. This is extremely small, and enables us to reject the null hypothesis. In retrospect we could have rejected the null hypothesis at the 1% significance level.

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Which brings us to the current project…

Request to water companies for recent projects

Fifty projects proposed

Nine stand-alone water efficiency projects

Nine phases of ESW H2Eco

Seven projects from previous phase

Three metering projects

One RWH/GWR project

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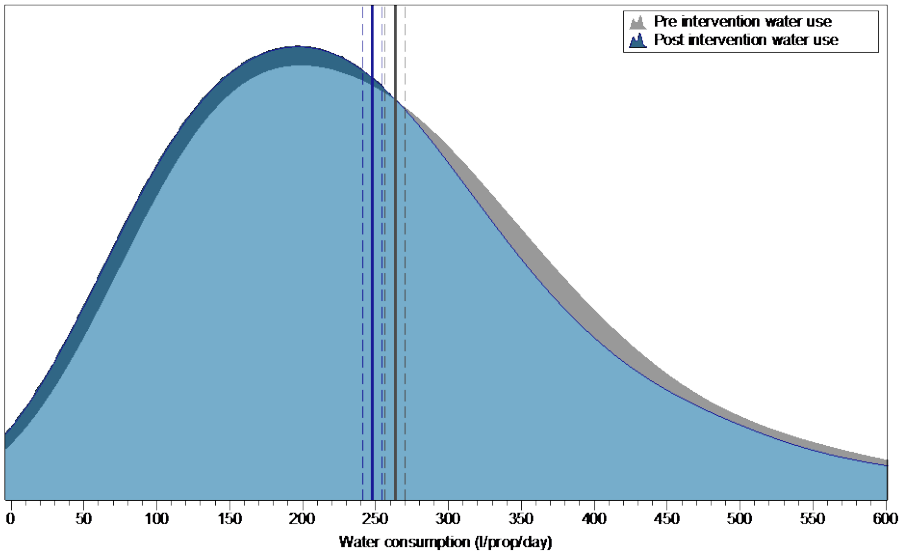
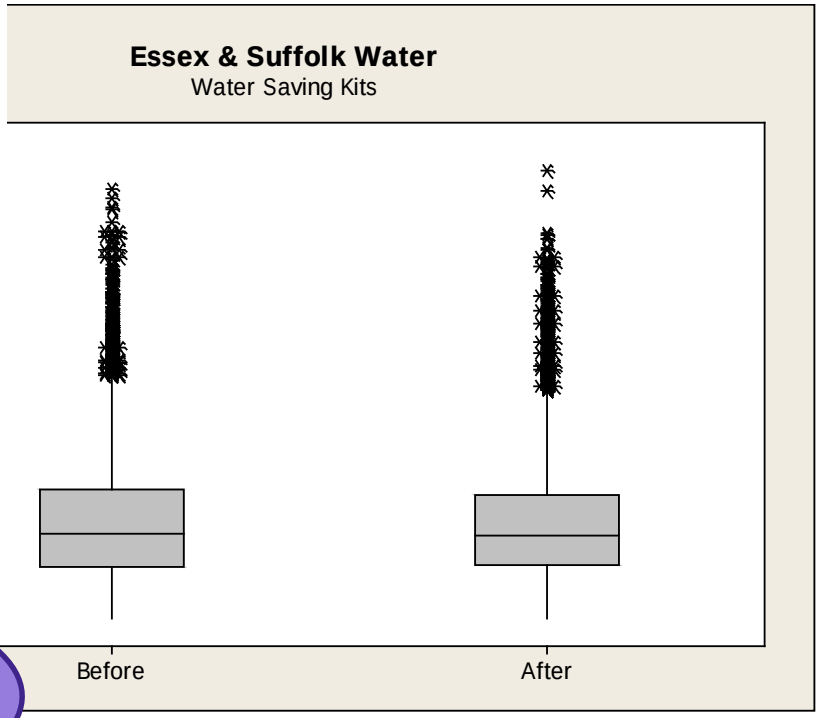
Challenge of detecting the signal in the noise





PH 400 200

Yay! Someone's using that stuff I wrote 12 years ago

Solutions:

- Test for significant differences between savings and zero
- P value of 0.1

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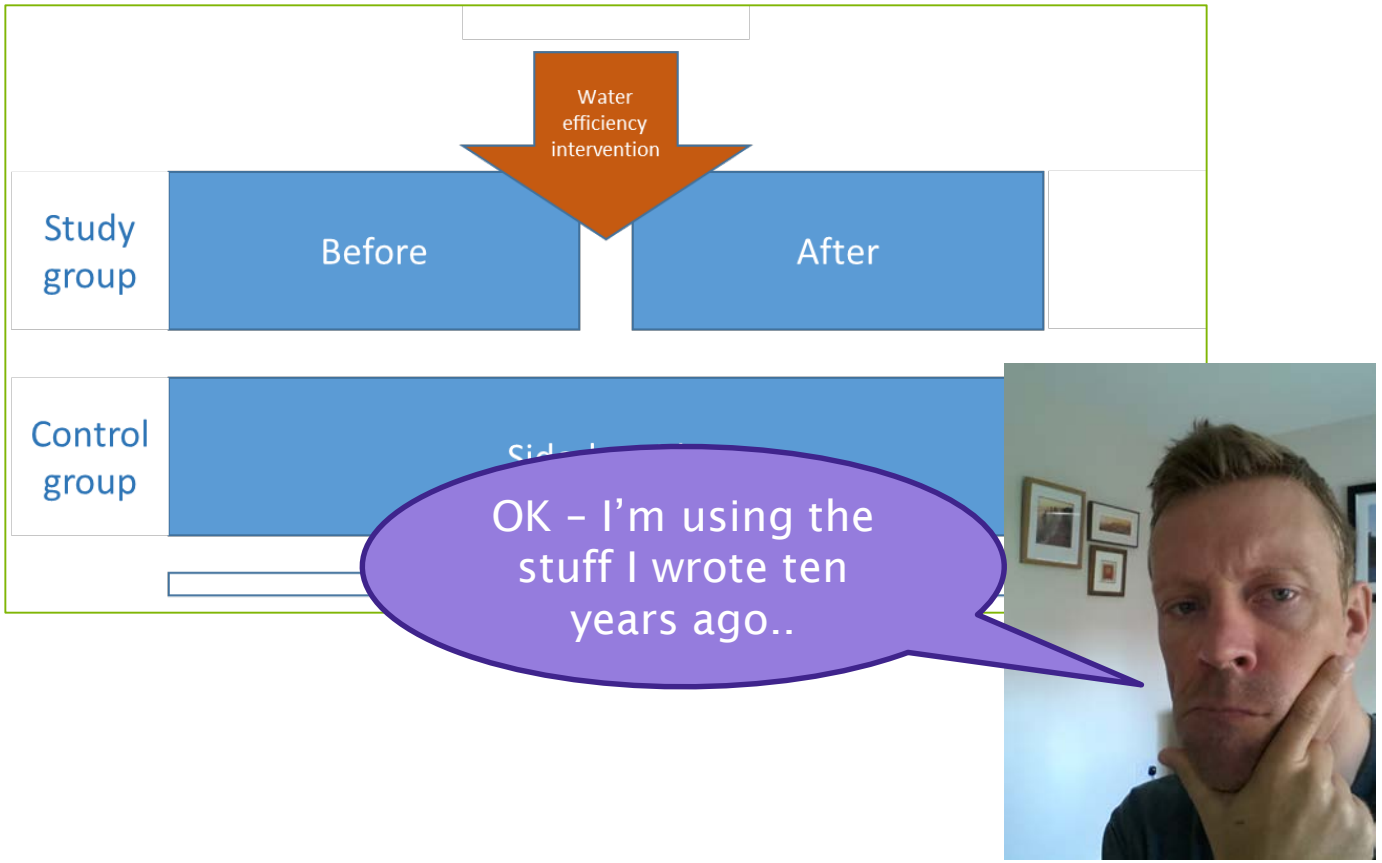
Study and control groups



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Results of Essex & Suffolk Water's water saving kit analysis using a side-by-side control

Statistic	Value	Units
Sample number used	11,349	
Measurements excluded	98	
Mean	2.8	l/prop/day
90% CI	1.9, 3.7	l/prop/day
Lower quartile	-18.9	l/prop/day
Upper quartile	27.1	l/prop/day
Median	2.9	l/prop/day
Skewness	-0.2	
Kurtosis	2.0	
Statistically Significant?	Yes	

- 11,447 properties were available with complete sets of pre and post meter reads.
- Data exclusion rules stated resulting in the exclusion of 98 records and therefore a final sample number of 11,349.
- Skewness acceptable and close to normal.
- Kurtosis acceptable with median result close to the mean, this finding is robust.
- There was a statistical significant mean saving of **2.8 litres per property per day**

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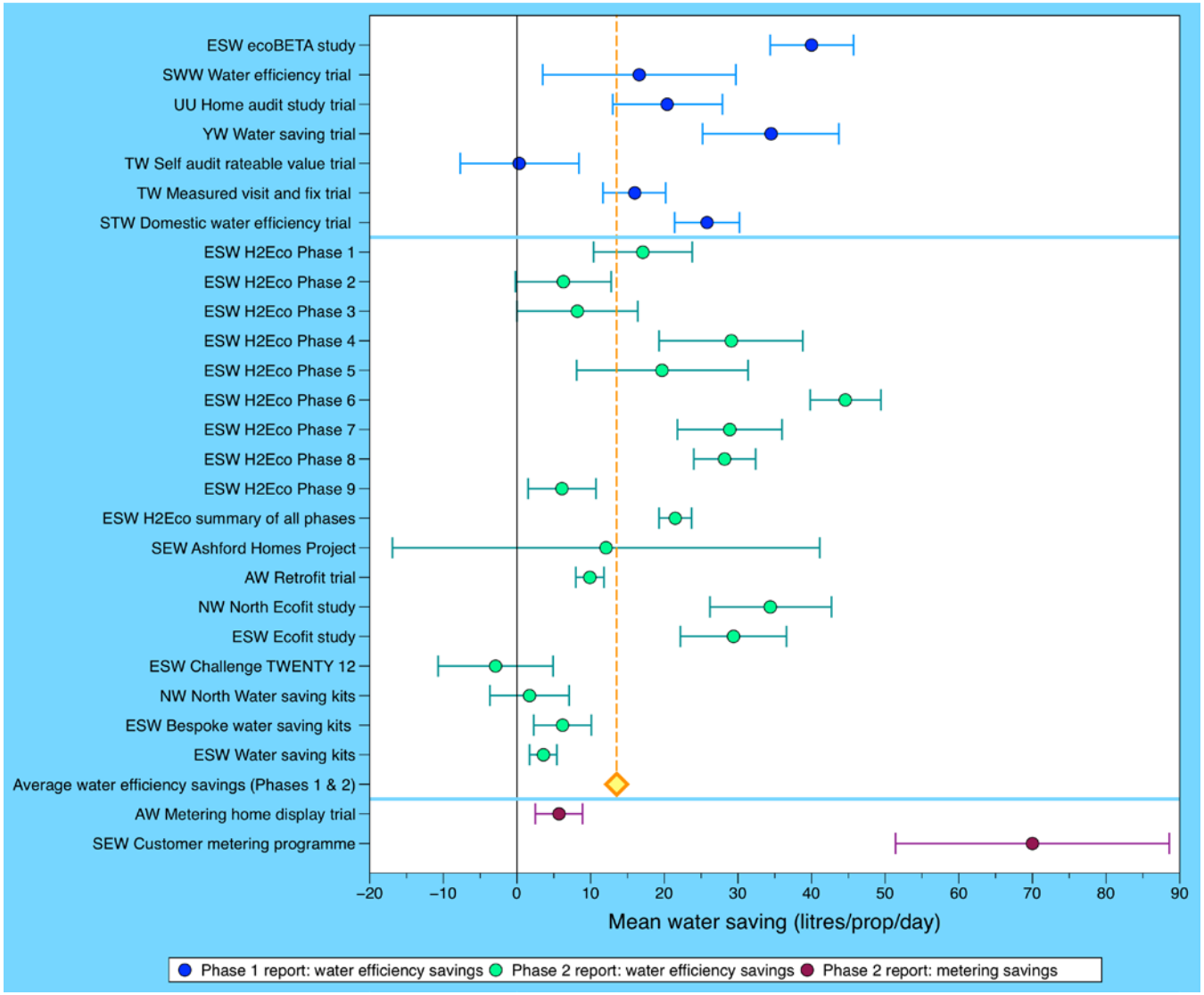
Meta-analysis of results



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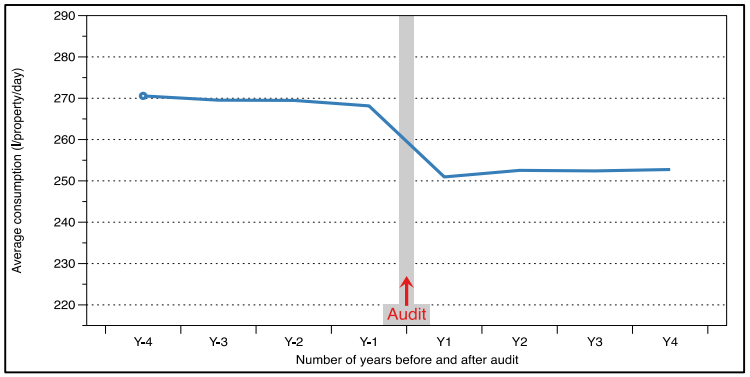
Summary (water efficiency and metering)

- On average, water efficiency programmes save water!
- Mean saving of 13.5 litres per property per day for water efficiency projects
- South East Water and Southern Water metering savings large and consistent
- Not enough RWH or GWR evidence to make firm conclusions

Conclusions (water efficiency and metering)

- Water efficiency programmes should:
  - Identify the most effective water saving device
  - Target households that will use it most
  - Install it as cost-effectively as possible
- H2Eco has provided valuable insights:
  - Savings appear to stabilize
  - 'Urban Adversity' households save most water
  - Properties with an occupancy of three save the most water
- Consumption at unmeasured households needs to be measured before customers transfer from rateable value to a metered tariff

Device	Water saving (l/device/day)	# properties
ecoBETA	22.6	7,296
Save-a-flush	6.4	7,296
Showerhead	10.5	7,296
Tap insert	6.7	7,296



Acorn Category	Counts	Actual Savings l/prop/day
Affluent Achievers	2,120	16.5
Rising Prosperity	259	18.7
Comfortable Communities	2,578	19.6
Financially Stretched	789	23.9
Urban Adversity	1,310	37.4

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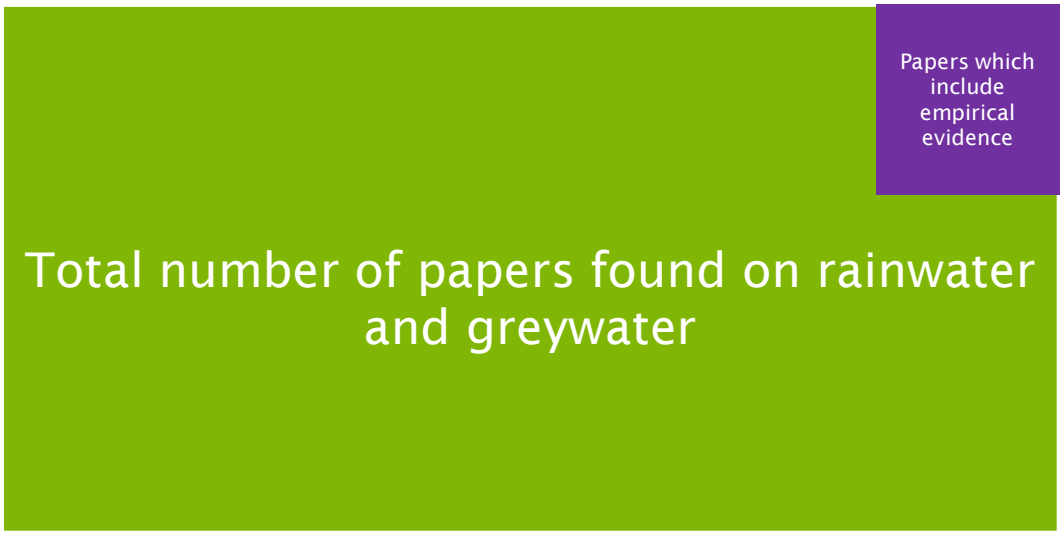
Rainwater and greywater findings and conclusions

- We only identified one valid, household-scale study, with water company involvement, with limited data available (at the time of writing).
- This study indicated that grey water recycling could save 11% of potable water supplied to households.
- We know lots has been done in this area, but published empirical evidence is very limited…



Berlin field trip

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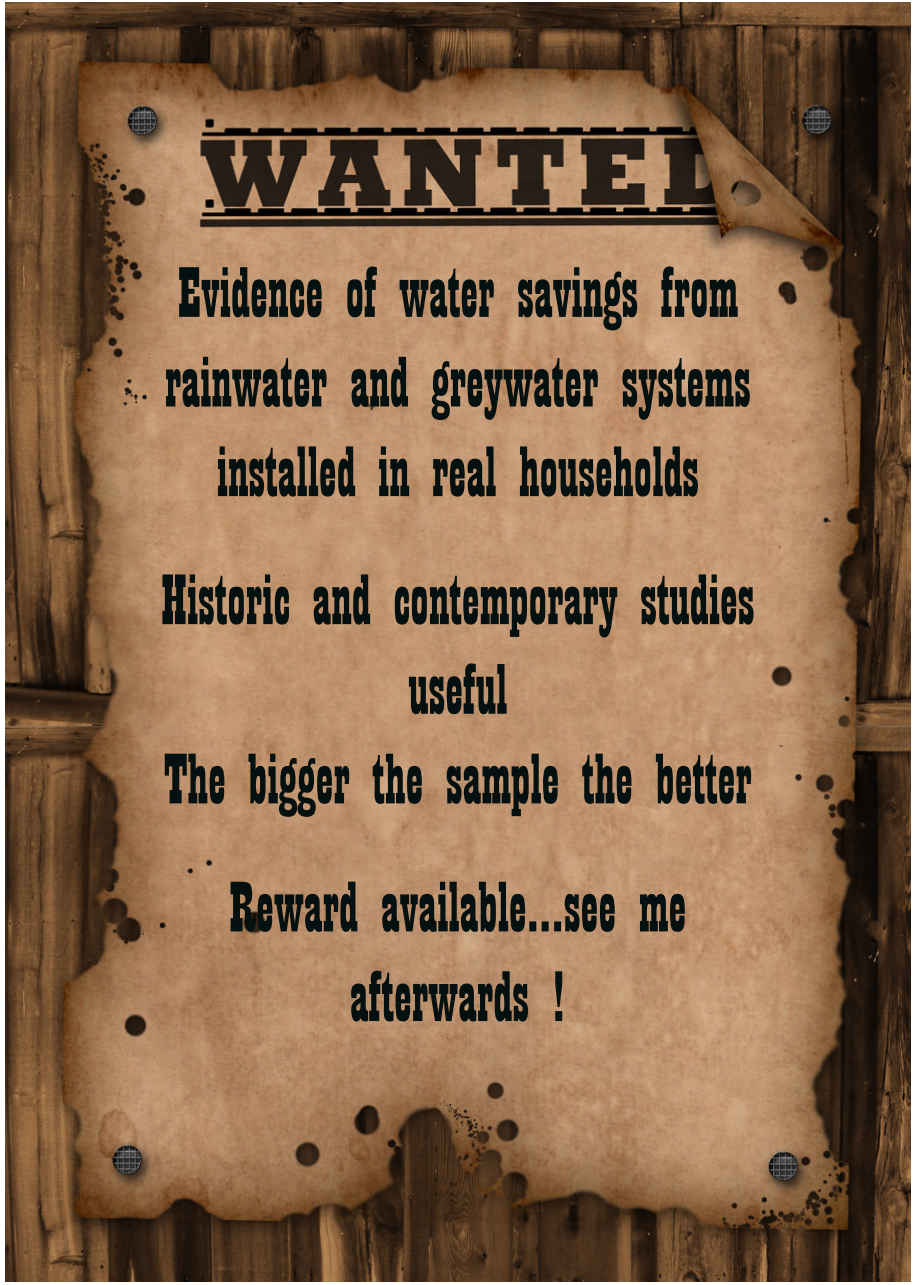

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Anyway, back to me…

Age 30-45:

Water efficiency on military sites

Disaggregation of savings due to metering

Savings from water efficiency across SE England

Cost effectiveness of demand management

Thames Gateway water neutrality study

Eco-towns and water neutrality

Design standards for water efficiency in London

Government procurement and water efficiency

Update to MTP briefing notes for water

Water and energy efficiency

Now let's sort out metering, rainwater and greywater!

Age 46: Feel like we've come a long way…

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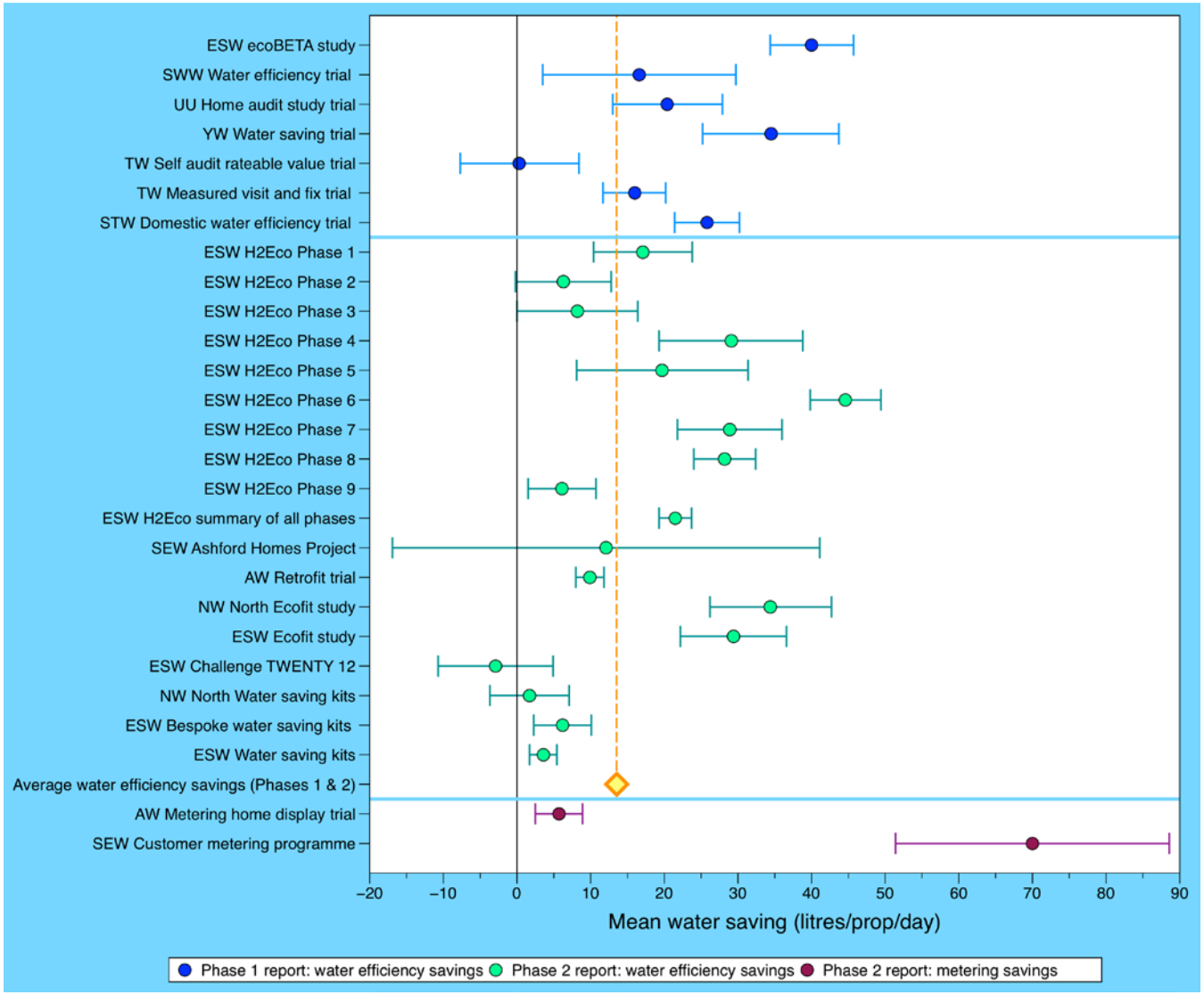
Thank you



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