

Seeing the light

The effects of LED light bulb installation on electricity demand in UK households: results of a large n randomised control trial

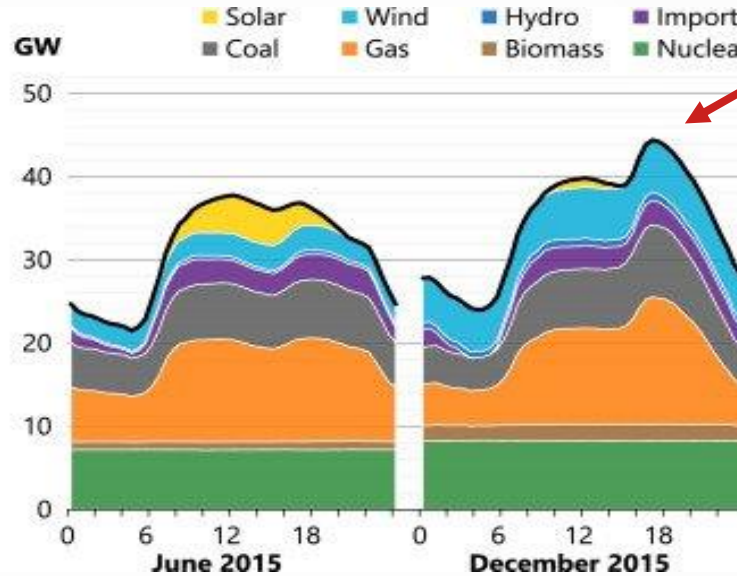
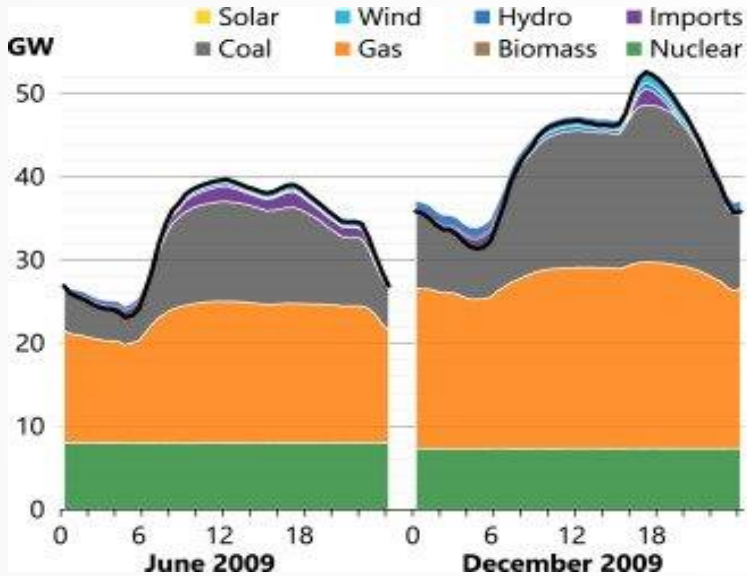
Tom Rushby, *Ben Anderson* (@dataknut), Patrick James, AbuBakr Bahaj

The menu

- The problem
 - Peak electricity demand
- The solution
 - Reducing & shifting demand
- Seeing the light
 - Large n LED light bulb trial
- Did it work?
- What do we need to do next?

Despite this...

UK electricity generation 2009 vs 2015



UK electricity decarbonisation 2009 - 2015

- The peak is still
 - Peaky
 - Expensive
 - Dirty
- Solutions
 - Reduce it
 - Shift it

Source: Staffell (2018)

<https://doi.org/10.1016/j.enpol.2016.12.037>

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Study Design

- South East England



- Stratified random sample
- N \approx 4000 households
- Randomly allocated to 4 trial groups
- <http://www.energy.soton.ac.uk/save-data-sources/>

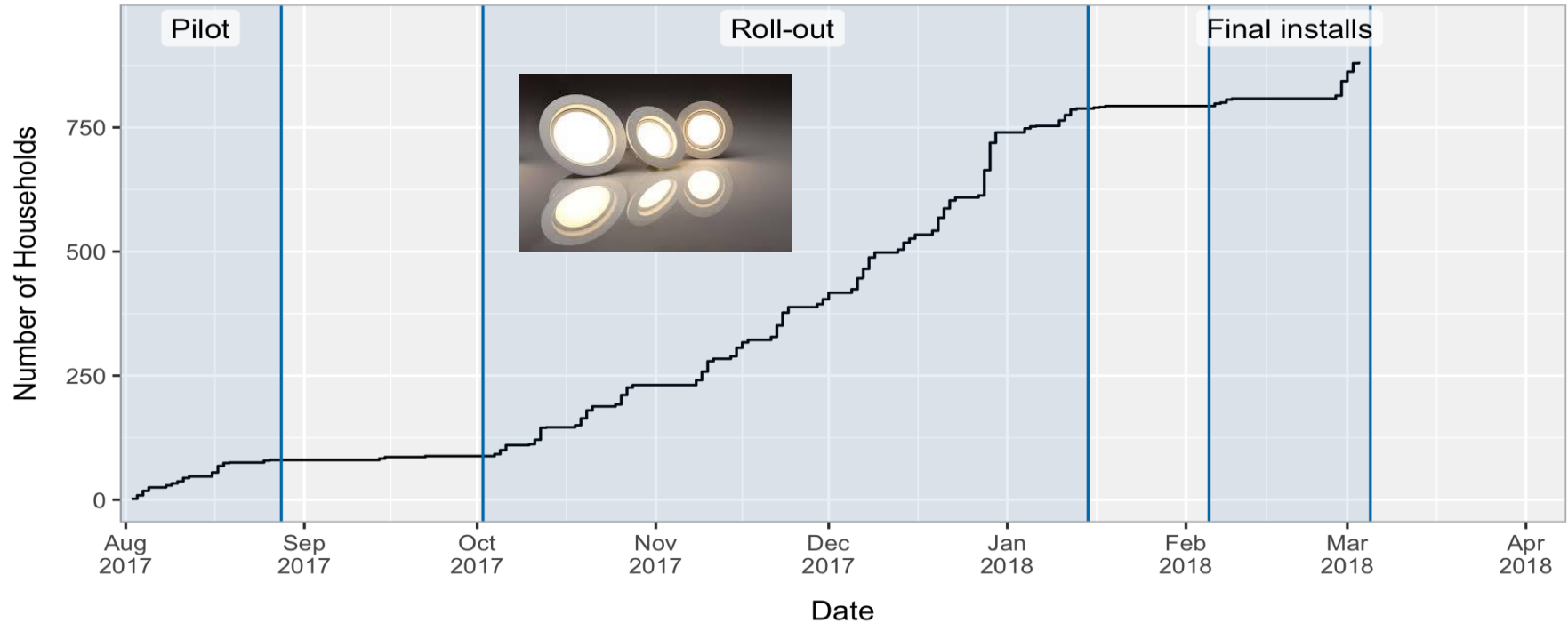
Statistical power analysis

LED trial is one of these

- W every 10s
- Wh every 15 min



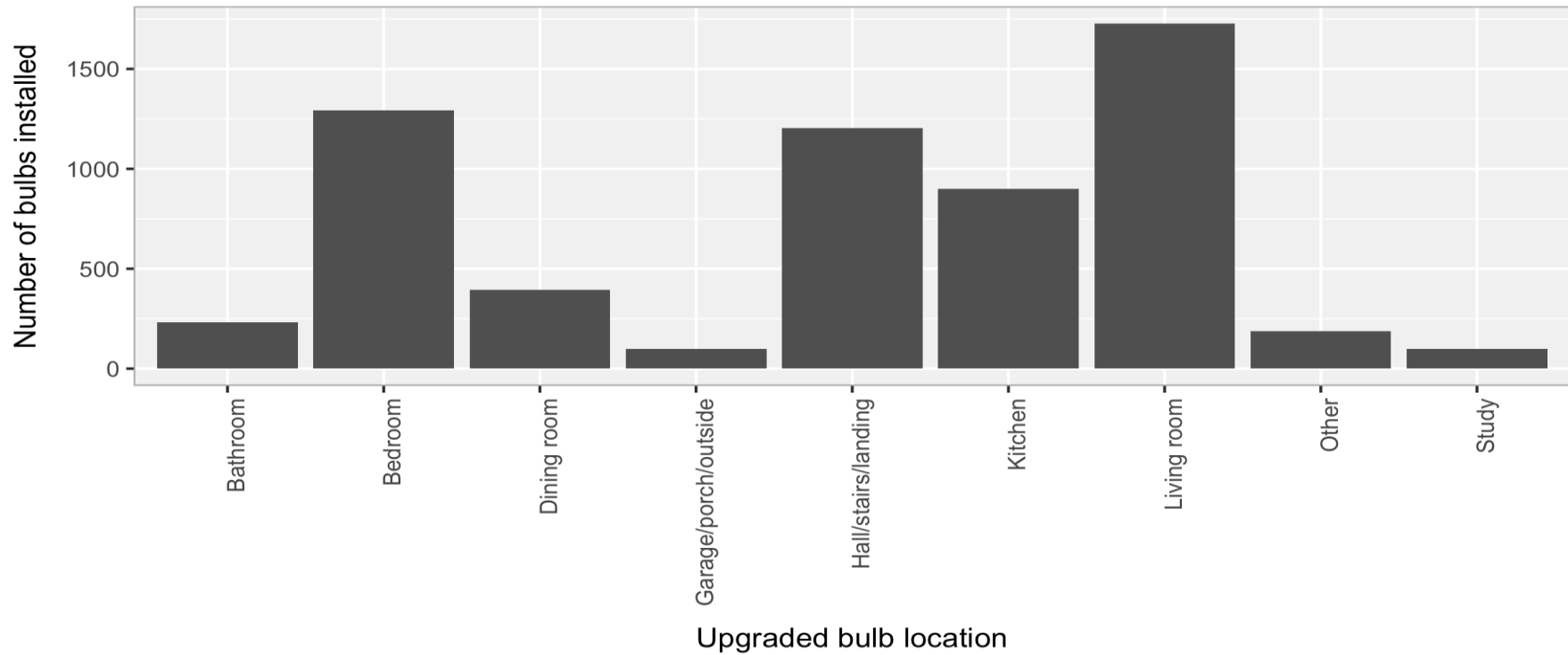
Implementation



Data: Winter 2017-2018

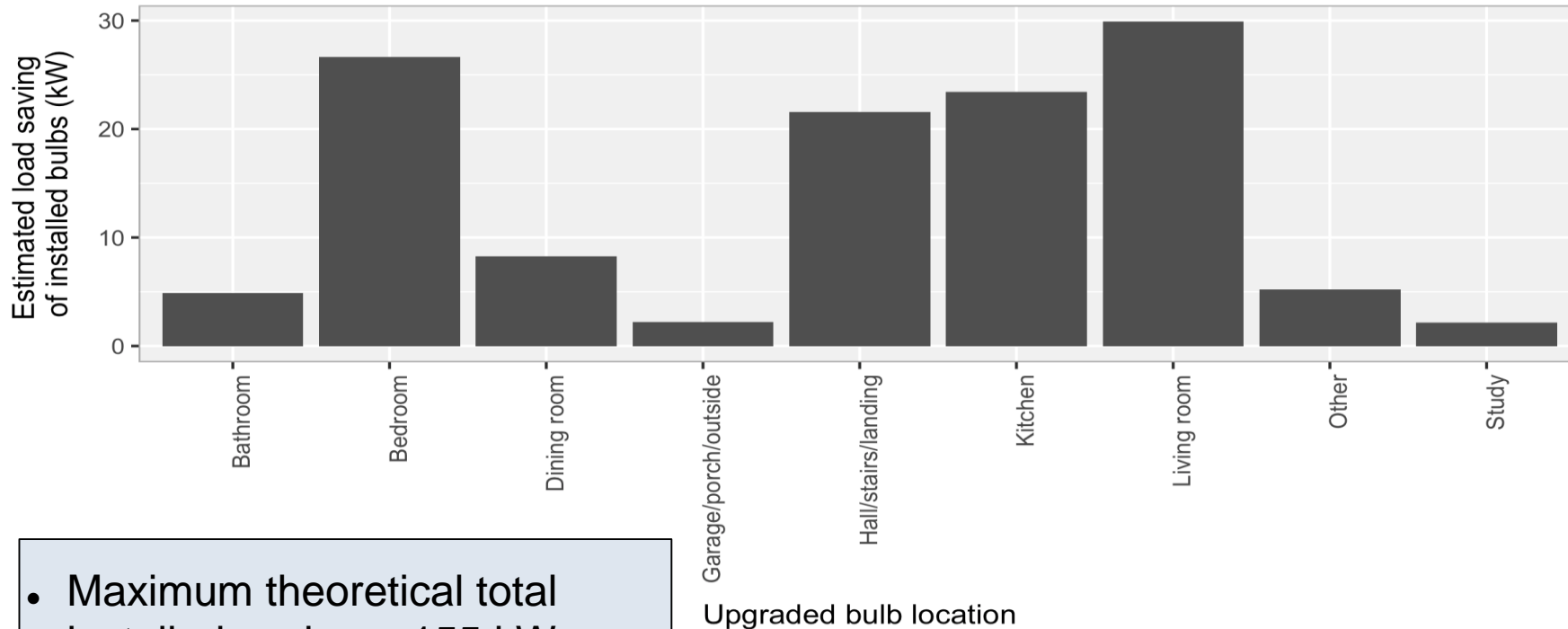
Cumulative total of LED lightbulb installations
Shaded area denotes Trial Period 2

Where were they put?



Source: BMG LED lightbulb installation data

Theoretical 'saving'

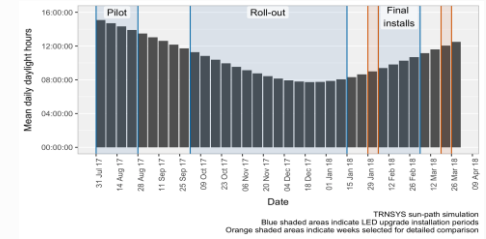
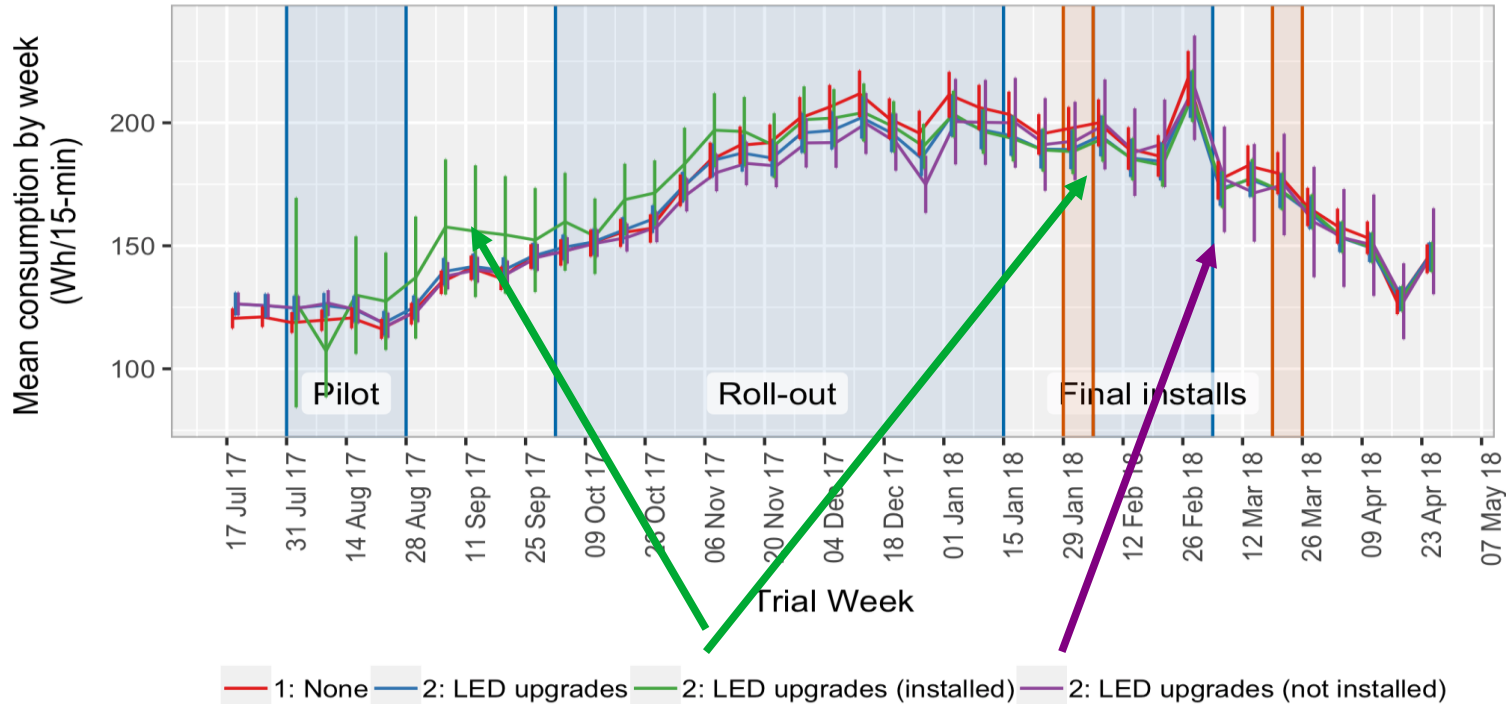


- Maximum theoretical total installed saving = 155 kW across group
- Actual total installed = 124 kW

Source: BMG LED lightbulb installation data
Households with LED upgrades and Loop data (as of 2018-01-29)

Mean: 176W per household

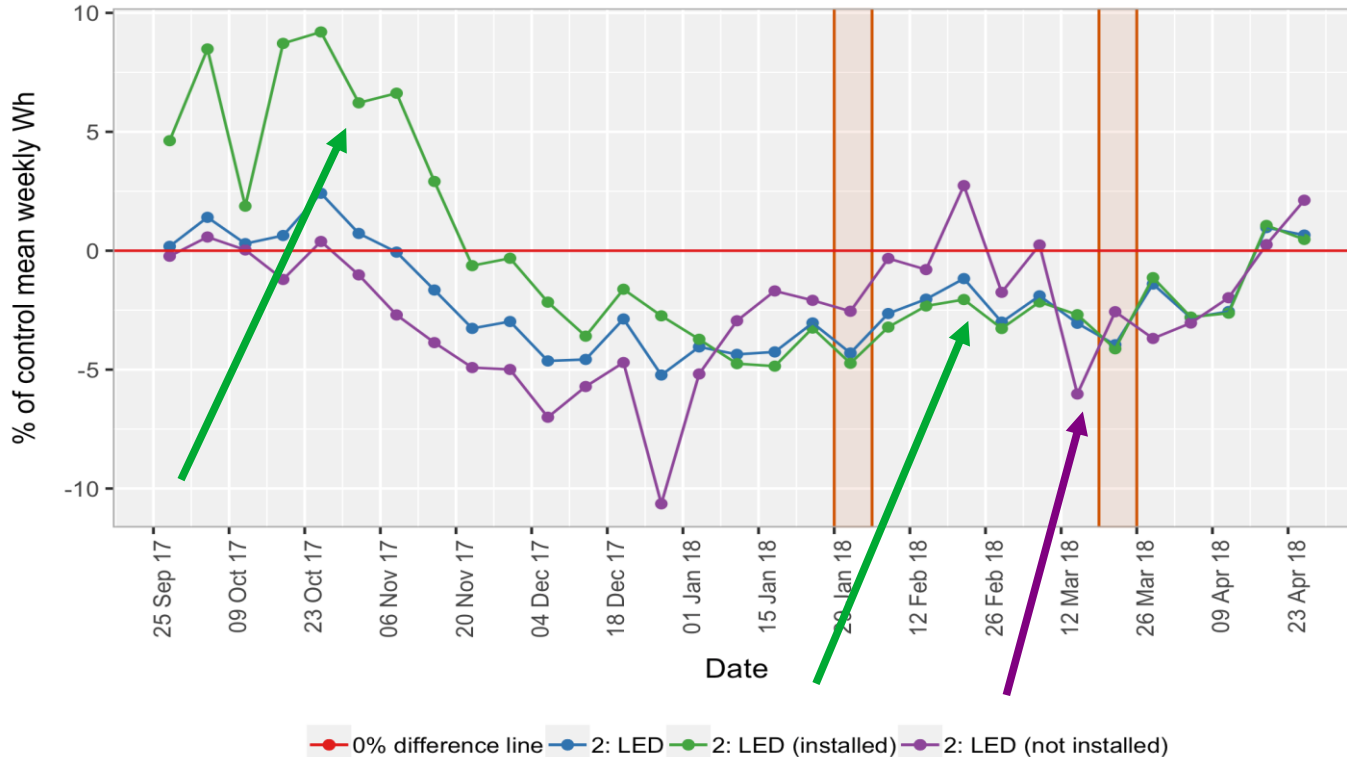
What happened?



- Mean Wh
- 16:00 – 20:00 only

15 minute Wh consumption - weekly mean 16:00 - 20:00
 Error bars: 90% CI. Data from 2,021 households
 Blue shaded areas indicate installation periods
 Orange shaded areas indicate weeks selected for detailed comparison

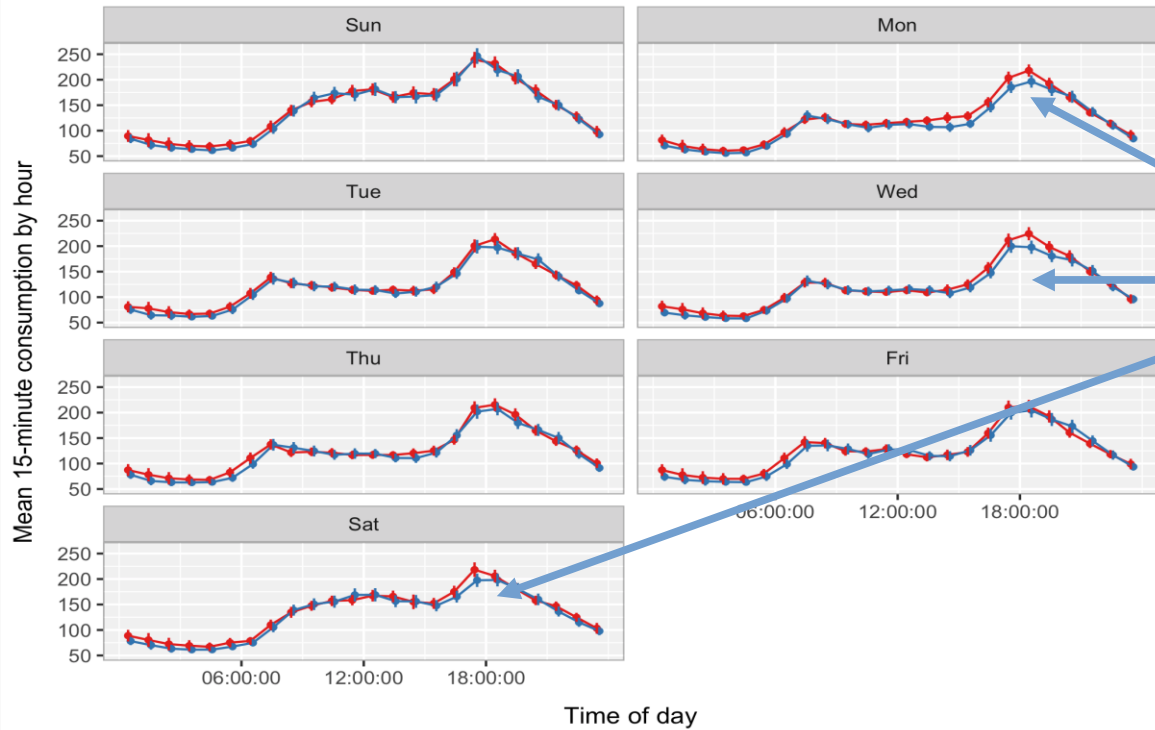
What happened?



- Consumption as % of control
- 16:00 – 20:00 only

15 minute Wh consumption - weekly mean 16:00 - 20:00
Error bars omitted for clarity. Data from 2,021 households
Shaded areas indicate weeks selected for detailed comparison

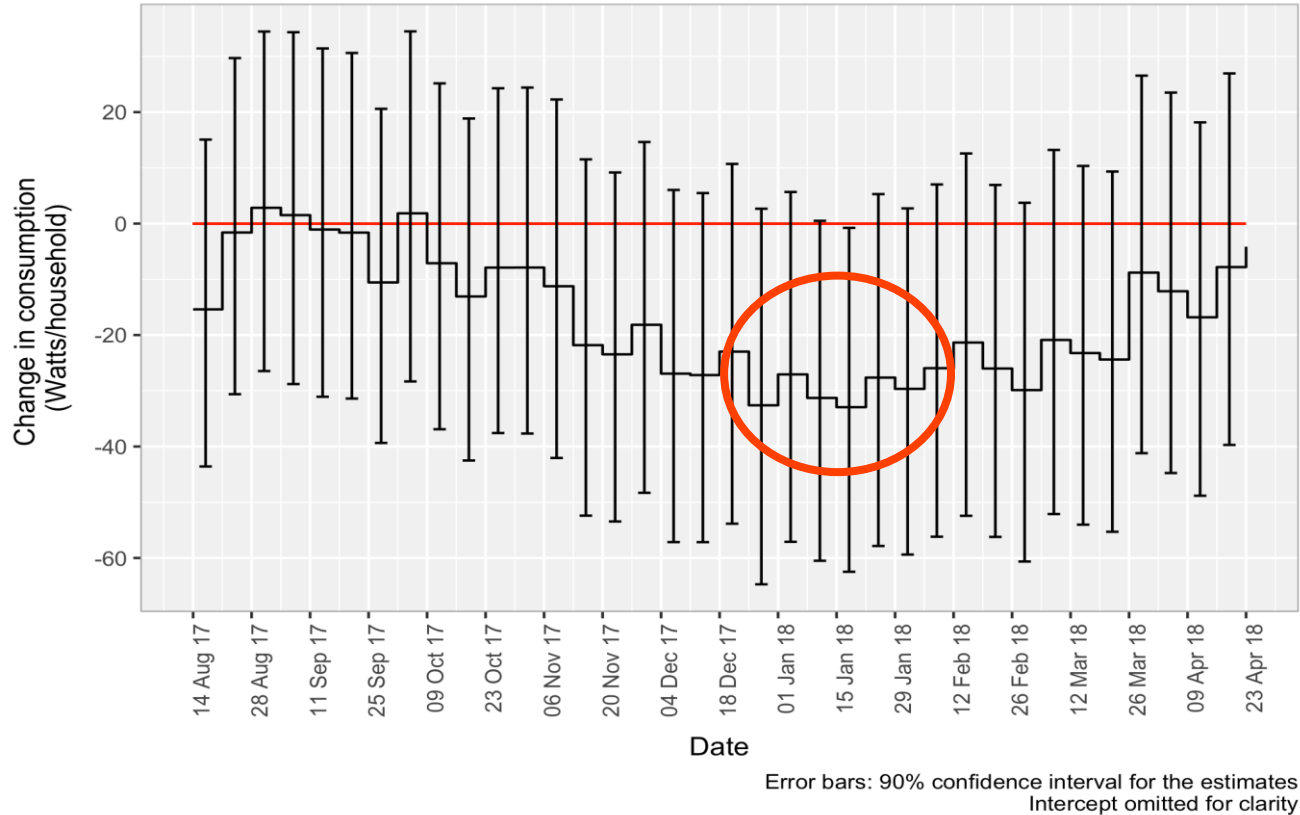
What happened?



- Winter: w/c 29 Jan 2018
- Differences visible

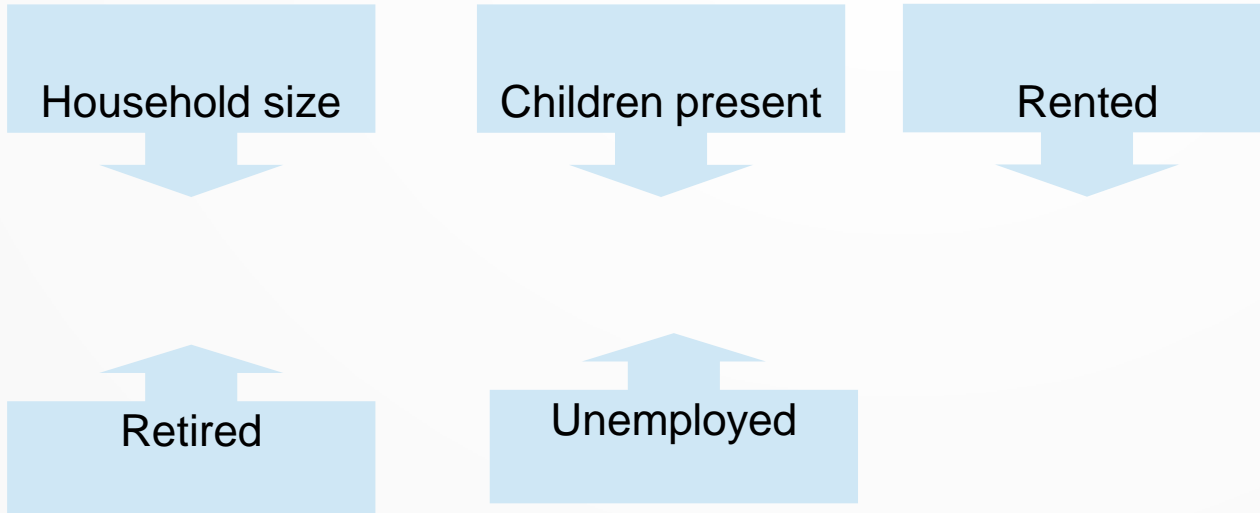
SAVE sample households: 2018-01-29 to 2018-02-04
Error bars: 90% confidence interval
Sample size: Control = 778, Treatment = 706

But...



- 16:00 – 20:00
- Difference in Difference Model
- Huge inter-household variation
- Lack of precision

Interactions...



Difference-in-difference regression interacting attributes with treatment

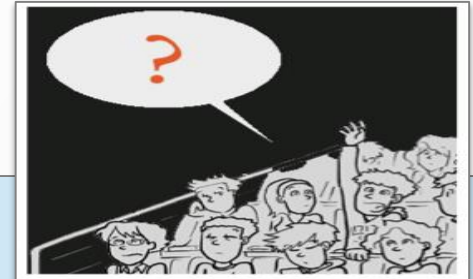
Was it worth it?

- 'Biggest' week (mid-winter):
 - Median -23W (-33W in peak) per household
 - Median -3.9 kWh per household per week
 - ~£0.70 p/w!

- Complex payback period calculations
 - Seasonal effect in load reduction
 - Install ££
 - Network load avoidance
 - Customer savings

Work in Progress :-)

176W installed



- Thank you!
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