

DEPARTMENT OF
**ENGINEERING
SCIENCE**



New approaches to understanding and changing energy use

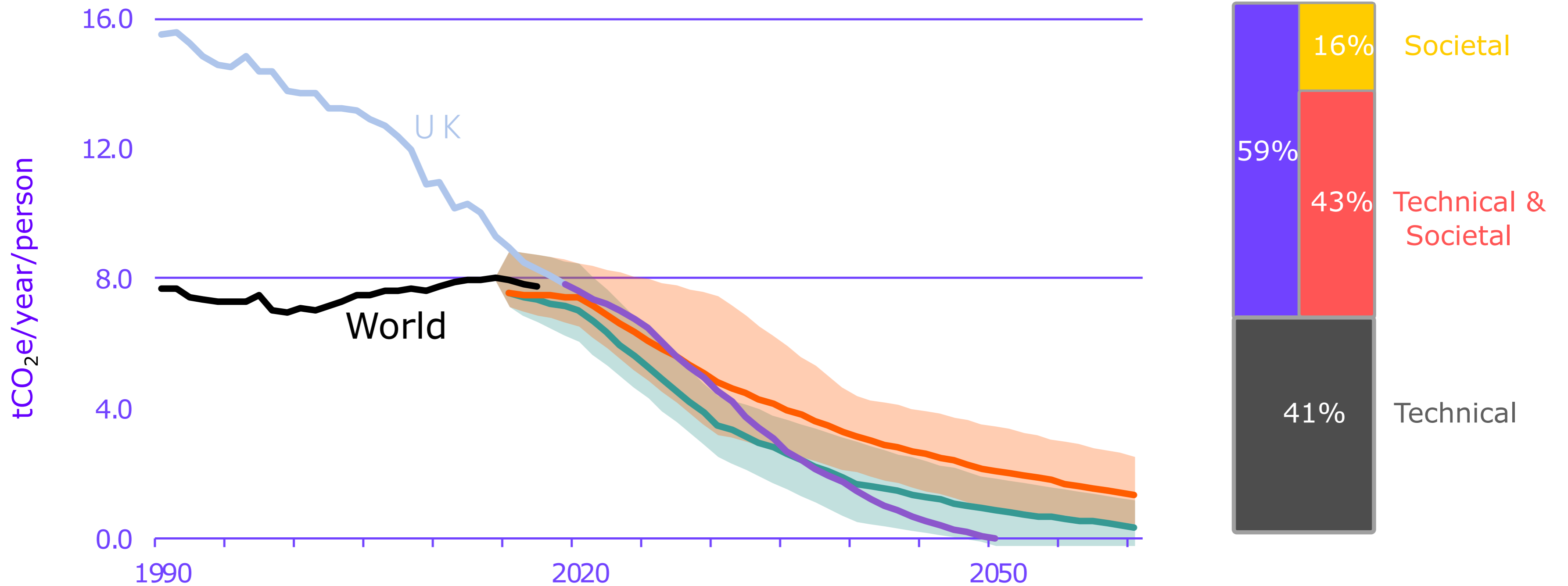
11th Oxford Energy Day

28 September 2023

Phil Grünewald

edol.uk/23oed

Context: it's the society, stupid



Source: Climate Change Committee. The UK's path to net zero. The sixth carbon budget, Climate Change Committee, December 2020

"Because the risk here,
for those of us who care
about reaching Net Zero
– as I do – is simple:

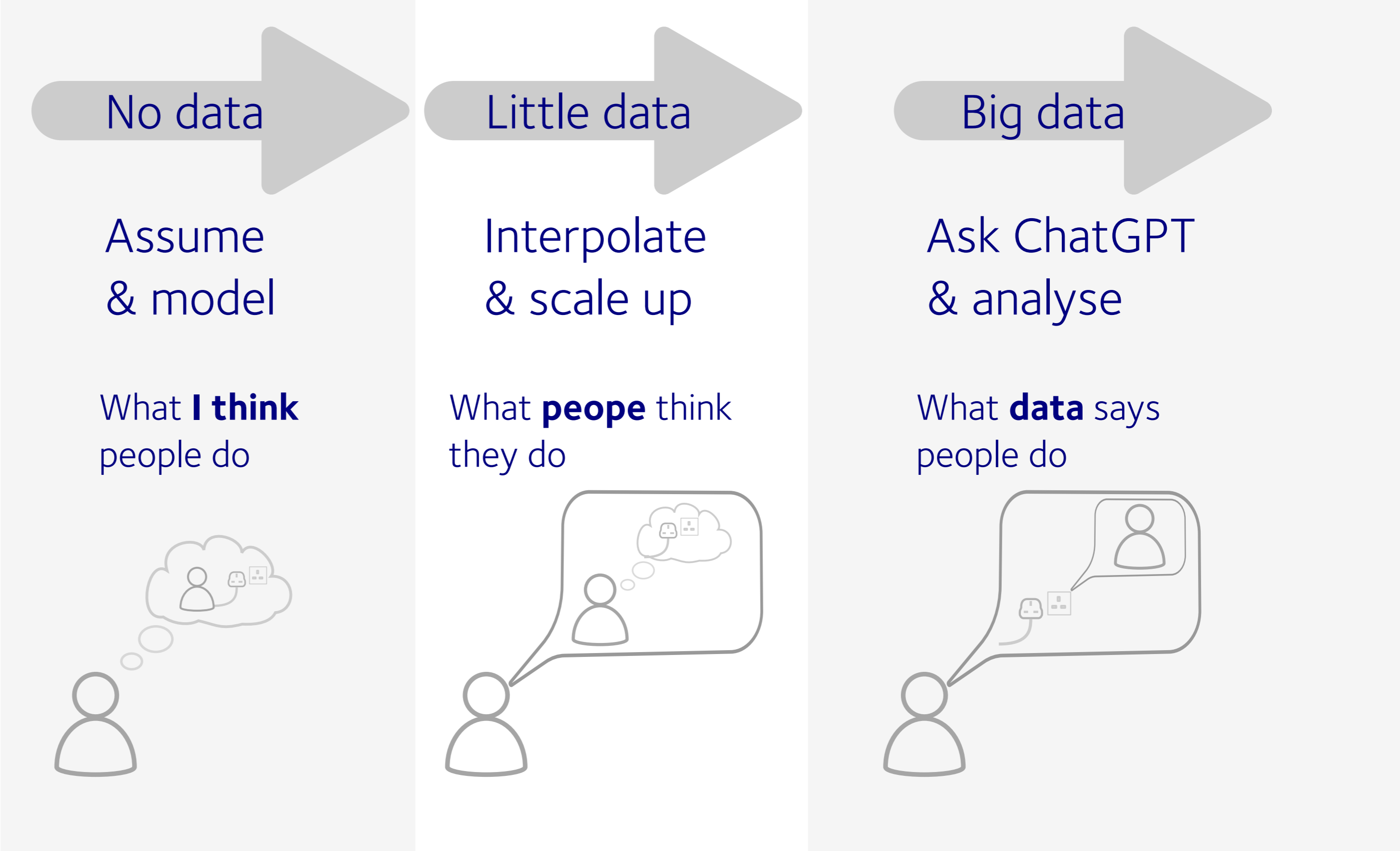
If we continue down this path,

we risk losing the consent of the British people."

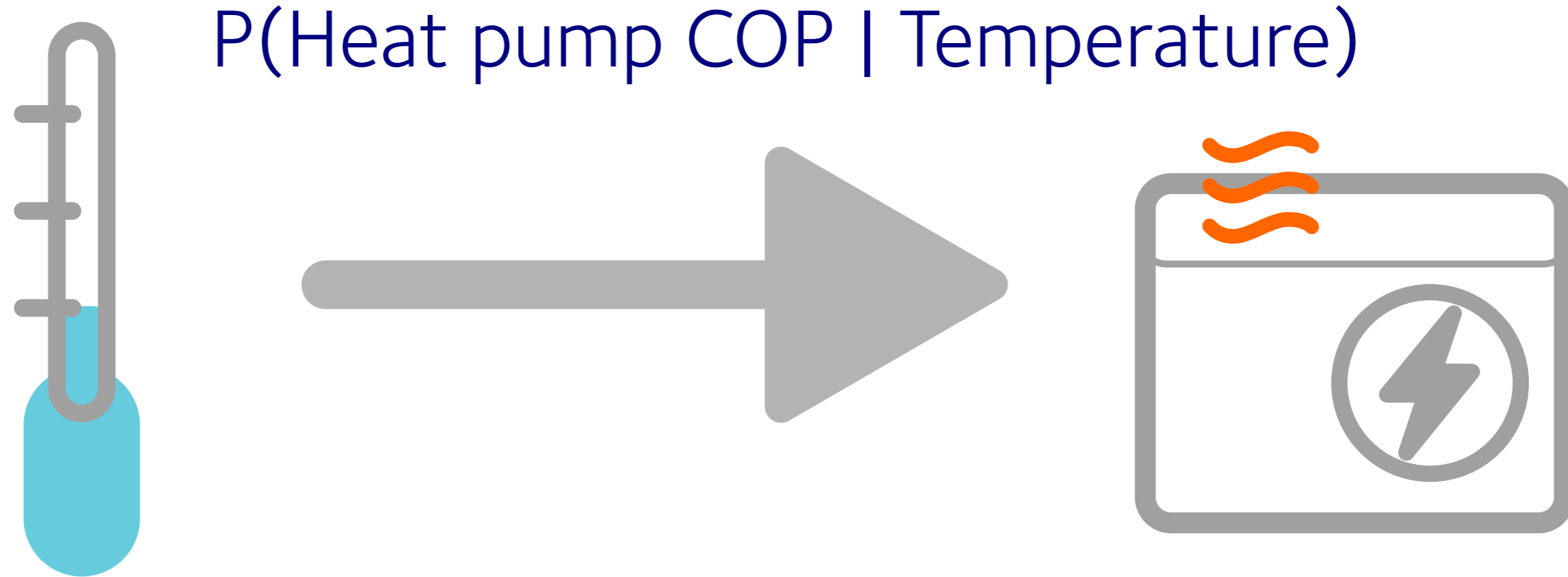


Energy demand research is evolving

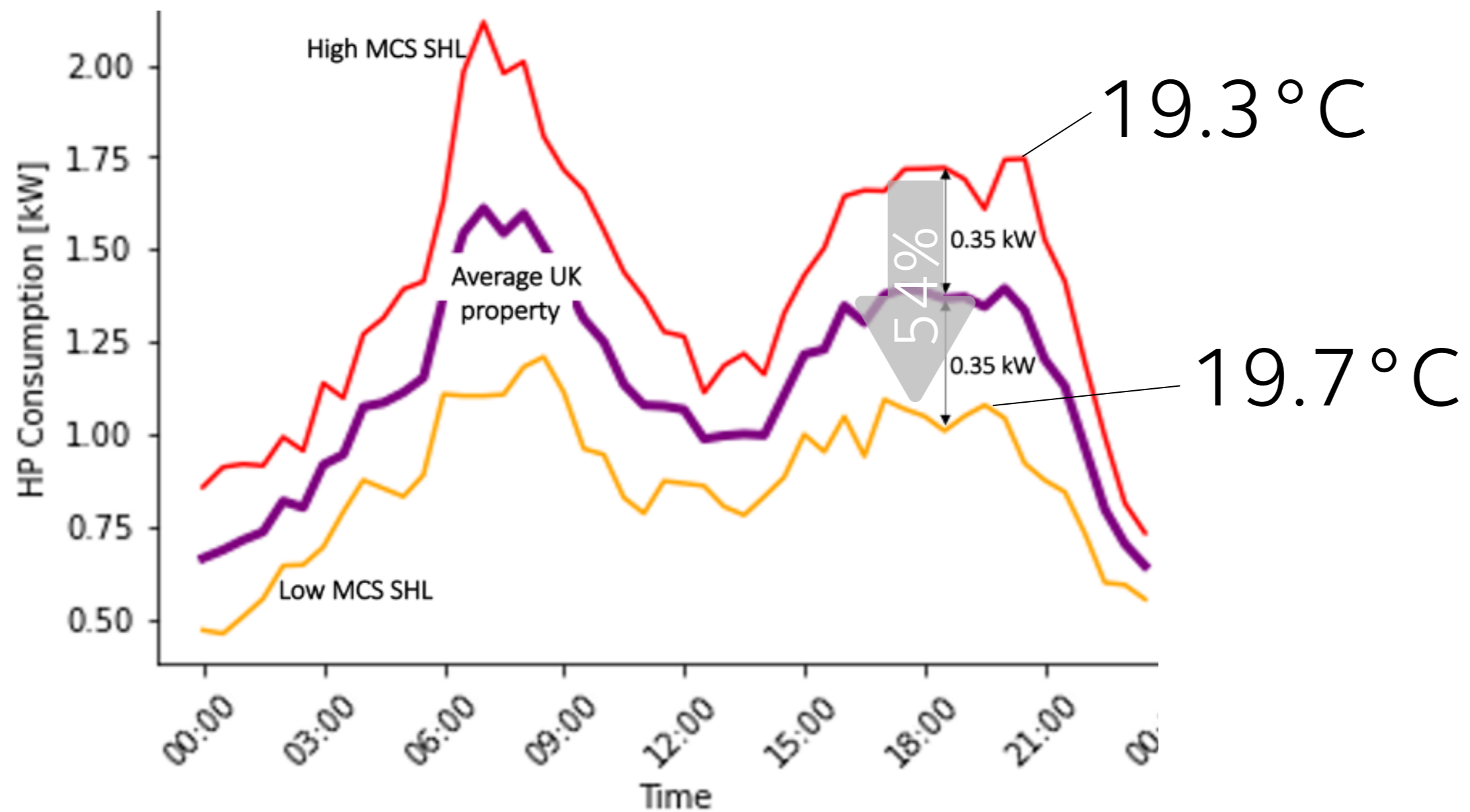
Understanding Demand



No data: I think... heat pumps don't work on the coldest day



Data says... heat pumps work on the coldest day and even better in efficient homes



Energy demand research is evolving

No data

Little data

Big data

Understanding
Demand

What do **I think**
people do

What do **people** think
they do

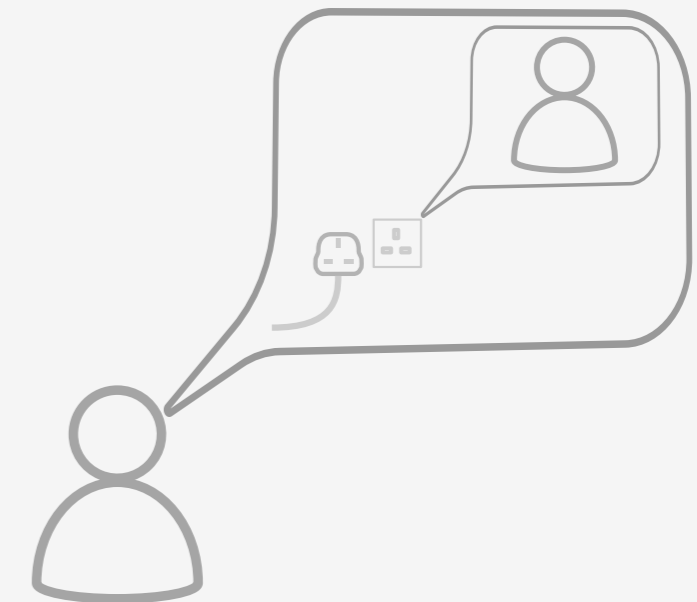
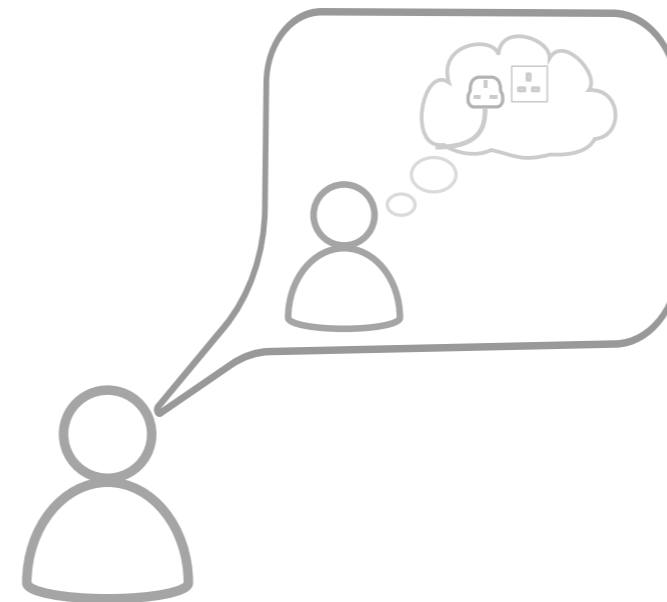
What does **data** say
people do

Changing
Demand

What **I think**
people **would do**, if...

What **people** think
they **would** do, if...

What **data** says
people **did do**, when...



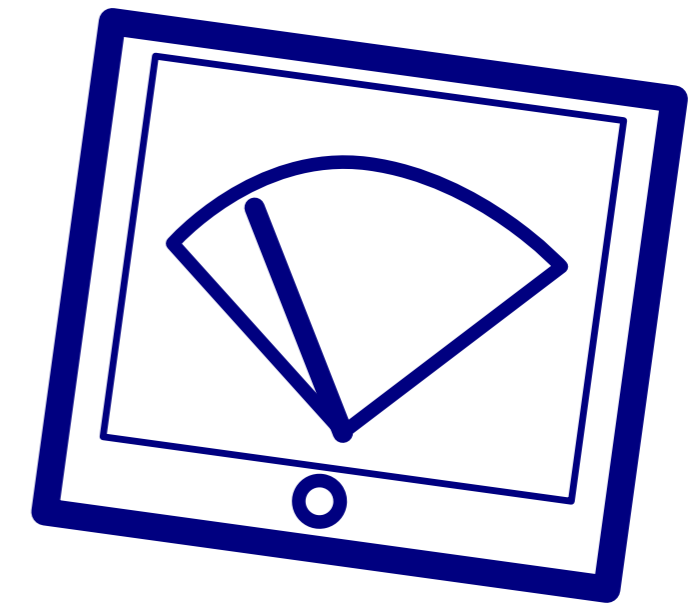
No data: I think... demand falls when prices rise

£

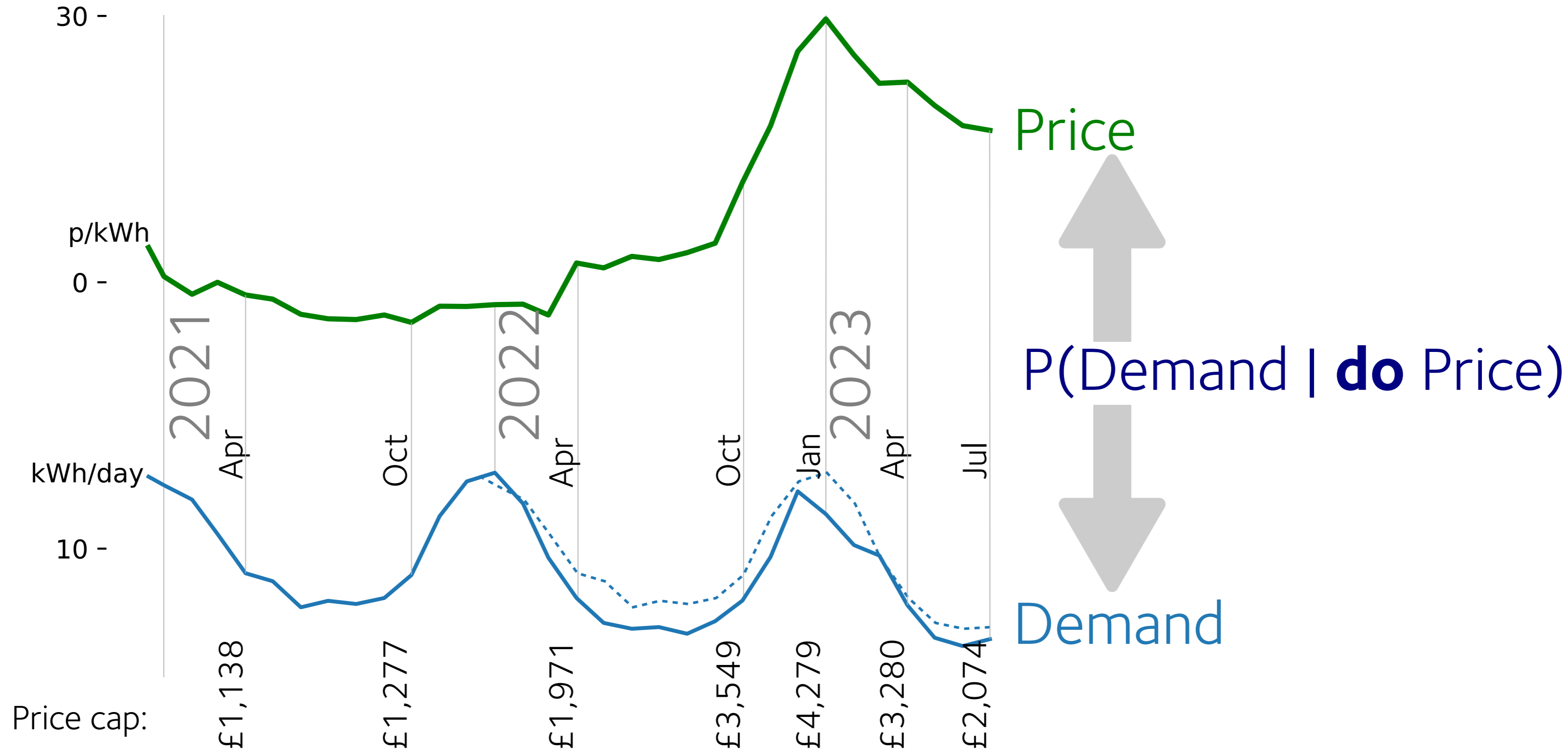


$P(\text{Demand} \mid \text{Price})$

$P(\text{Demand} \mid \mathbf{do}(\text{Price}))$

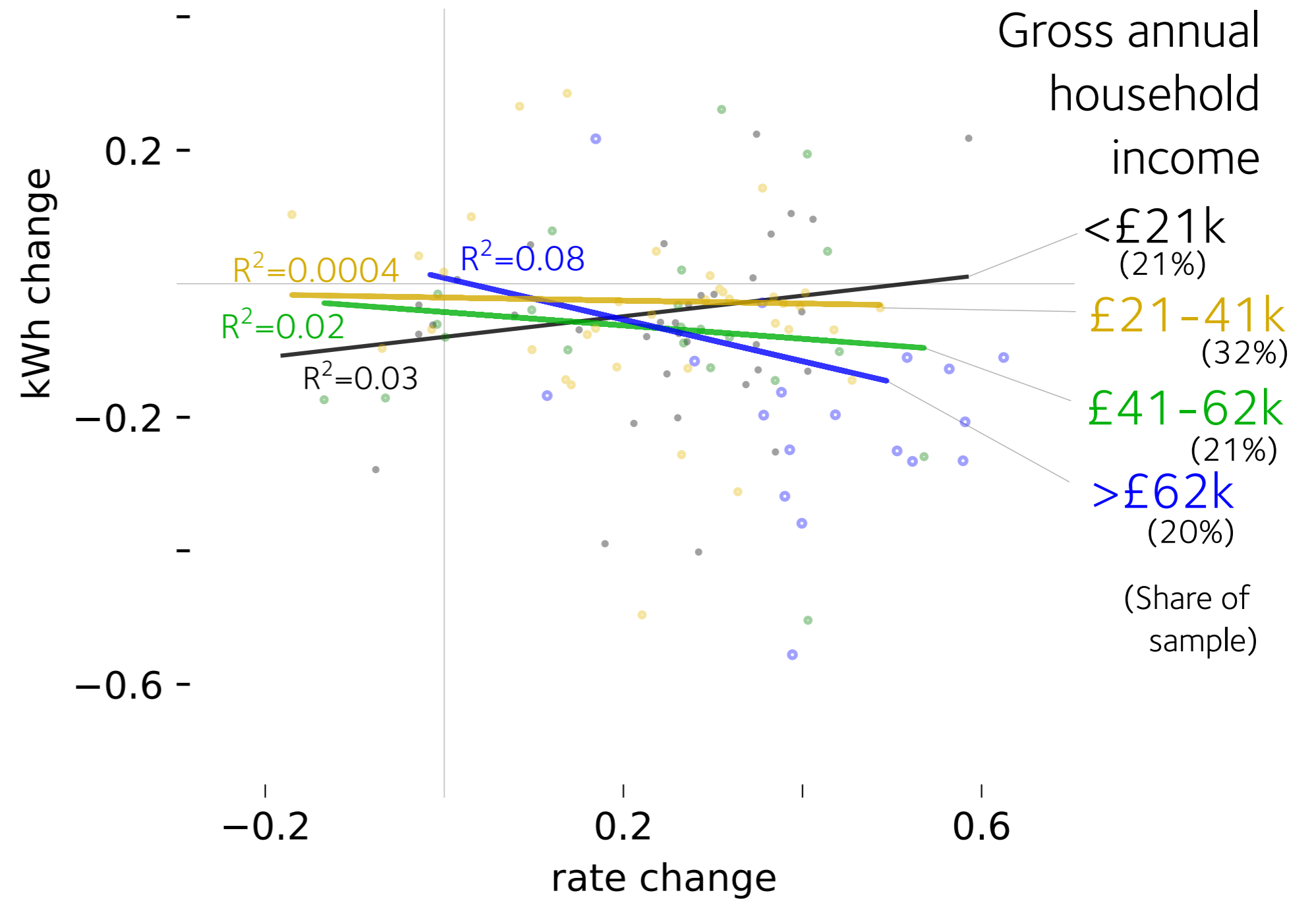
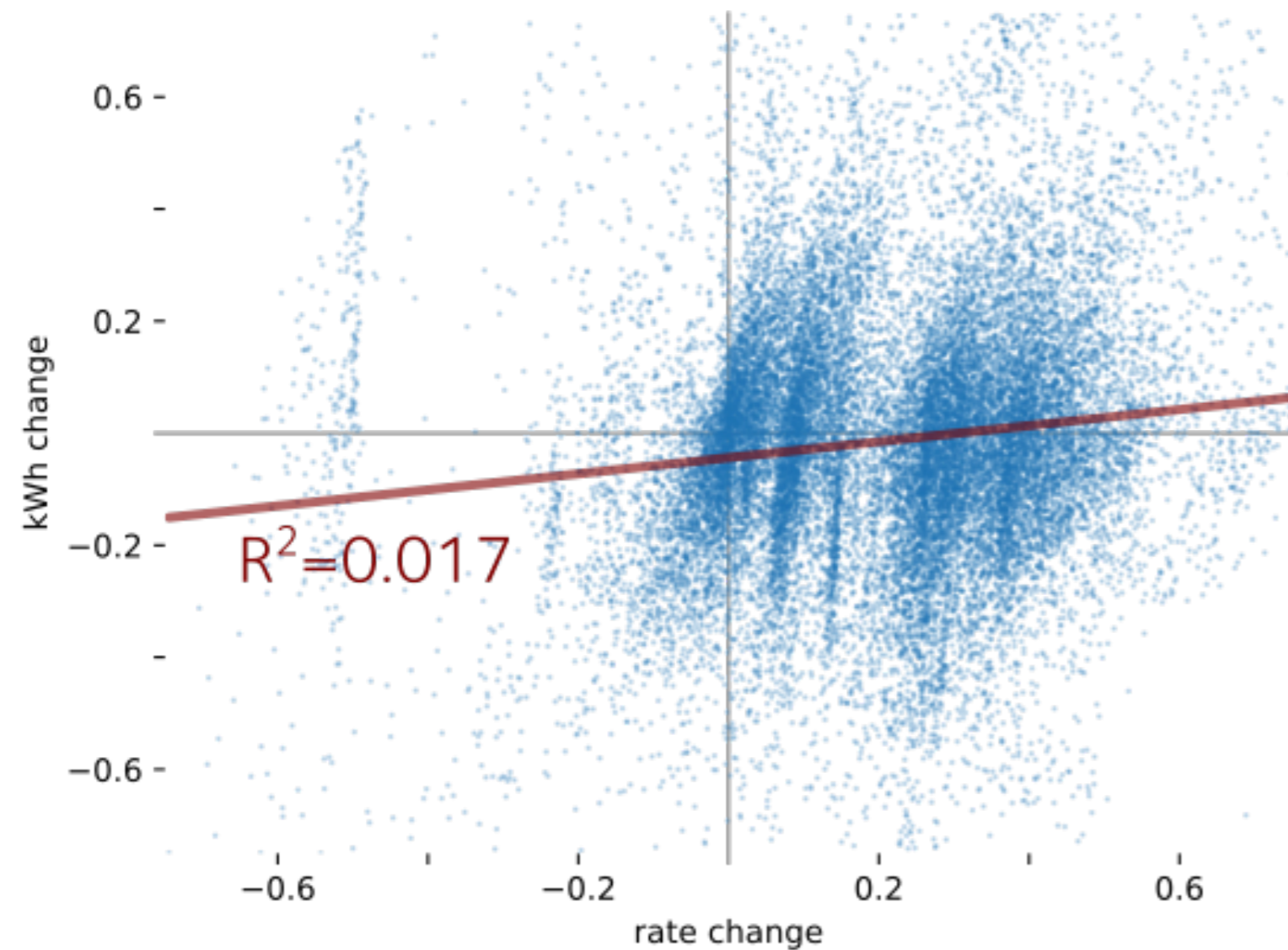


Little data: demand falls when prices rise



Big data: ... it depends

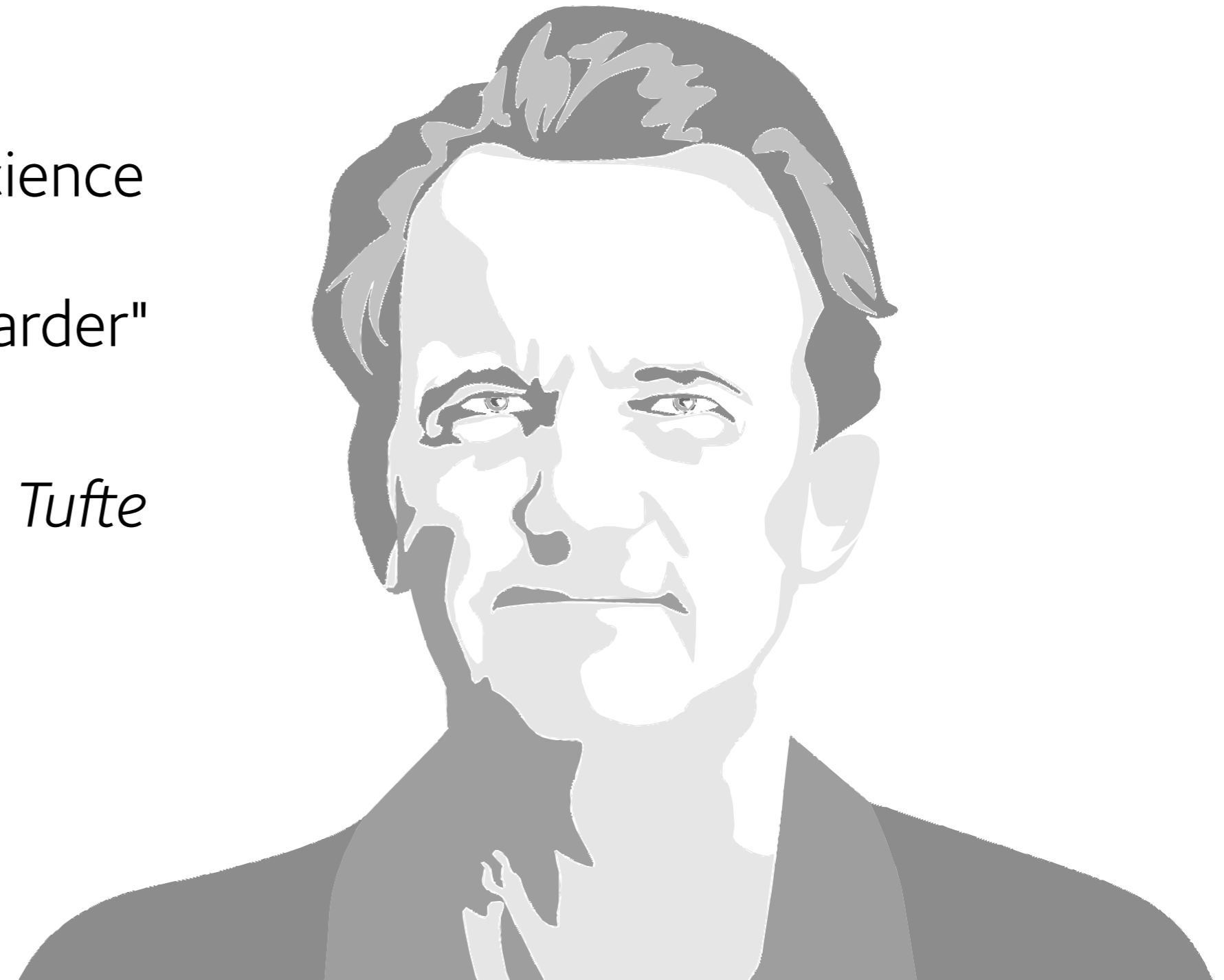
Price elasticity is weak and depends on circumstances



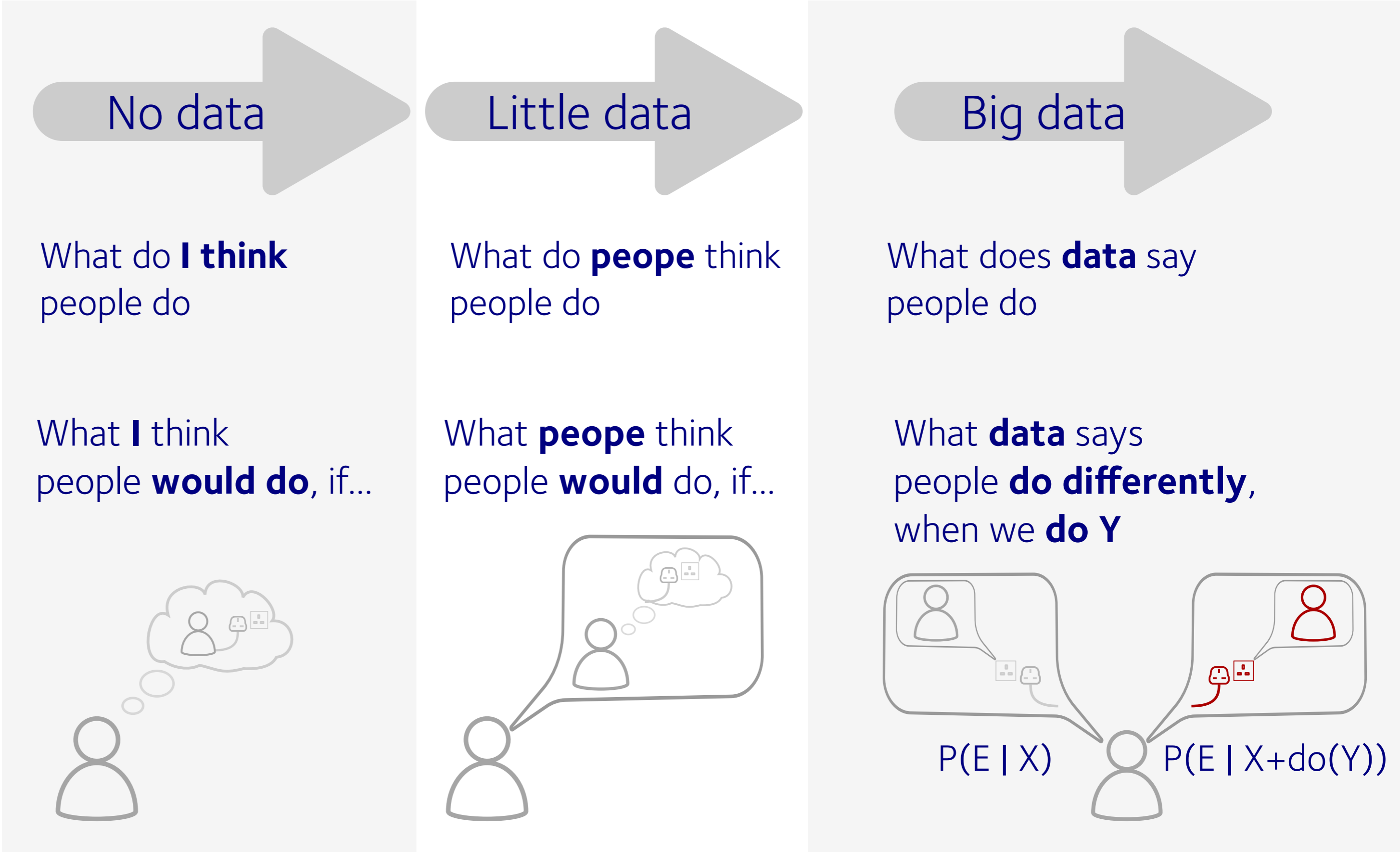
"Understanding human behaviour isn't rocket science

– it's harder"

Edward Tufte



Energy demand research is evolving



Understanding Demand

Changing Demand

What do **I think** people do

What **I** think people **would do**, if...

What do **people** think people do

What **people** think people **would** do, if...

What does **data** say people do

What **data** says people **do differently**, when we **do Y**

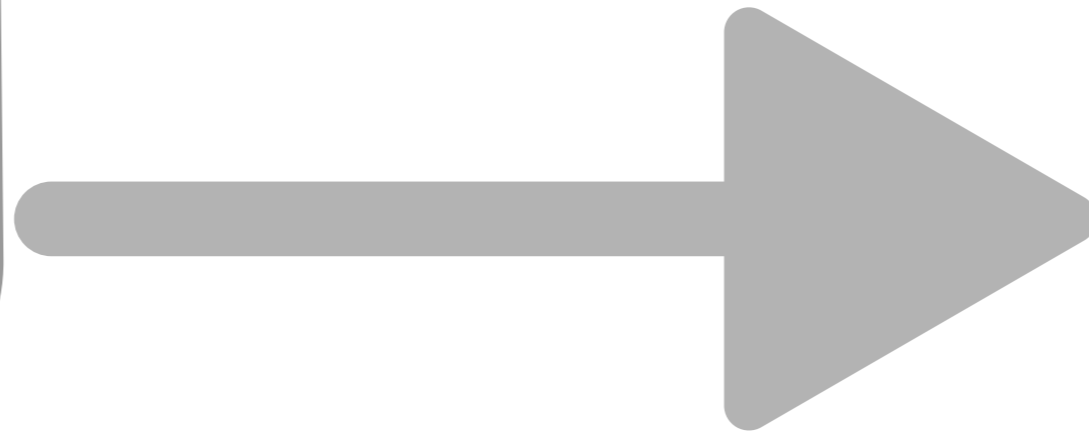
$$P(E | X)$$

$$P(E | X + do(Y))$$

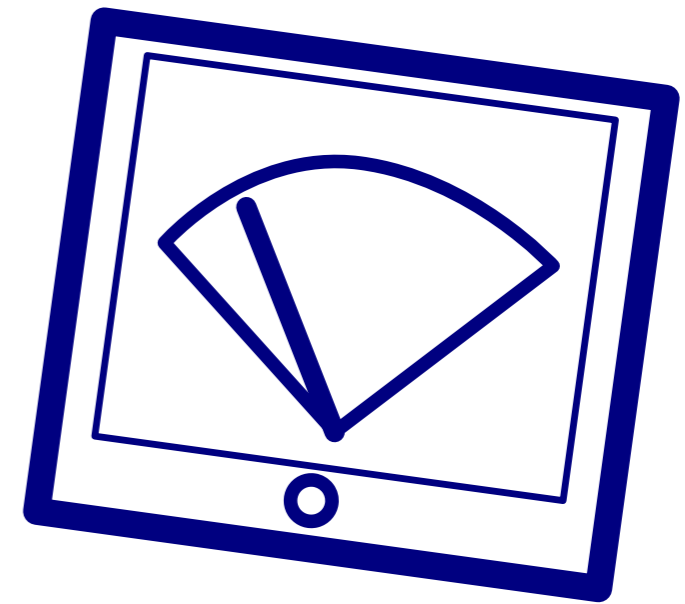
No data: I think... no way will people give up dinner for DSR

Please,
1) Keep a diary
2) Reduce demand
5pm to 7pm

$P(E \mid \text{Life})$

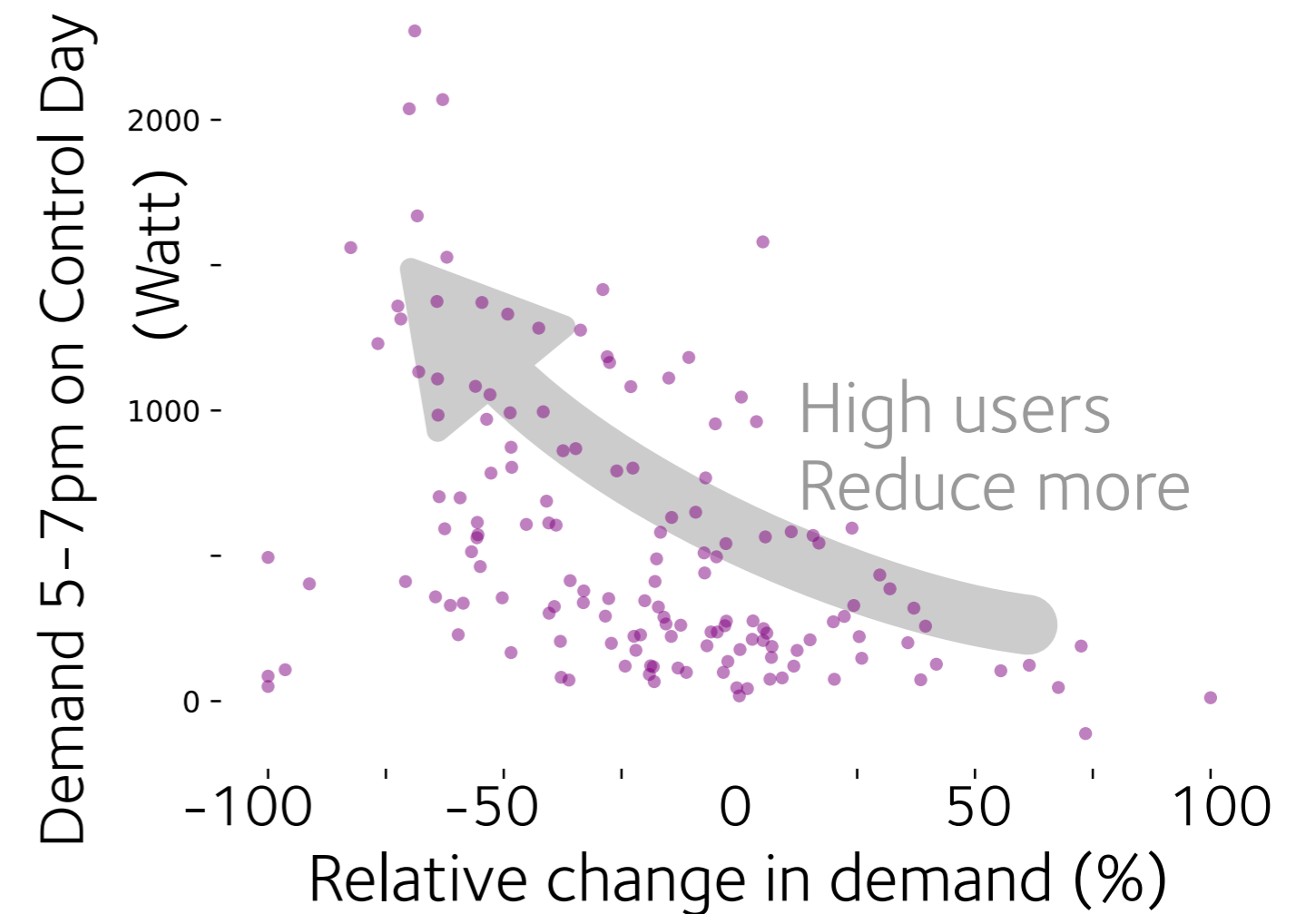
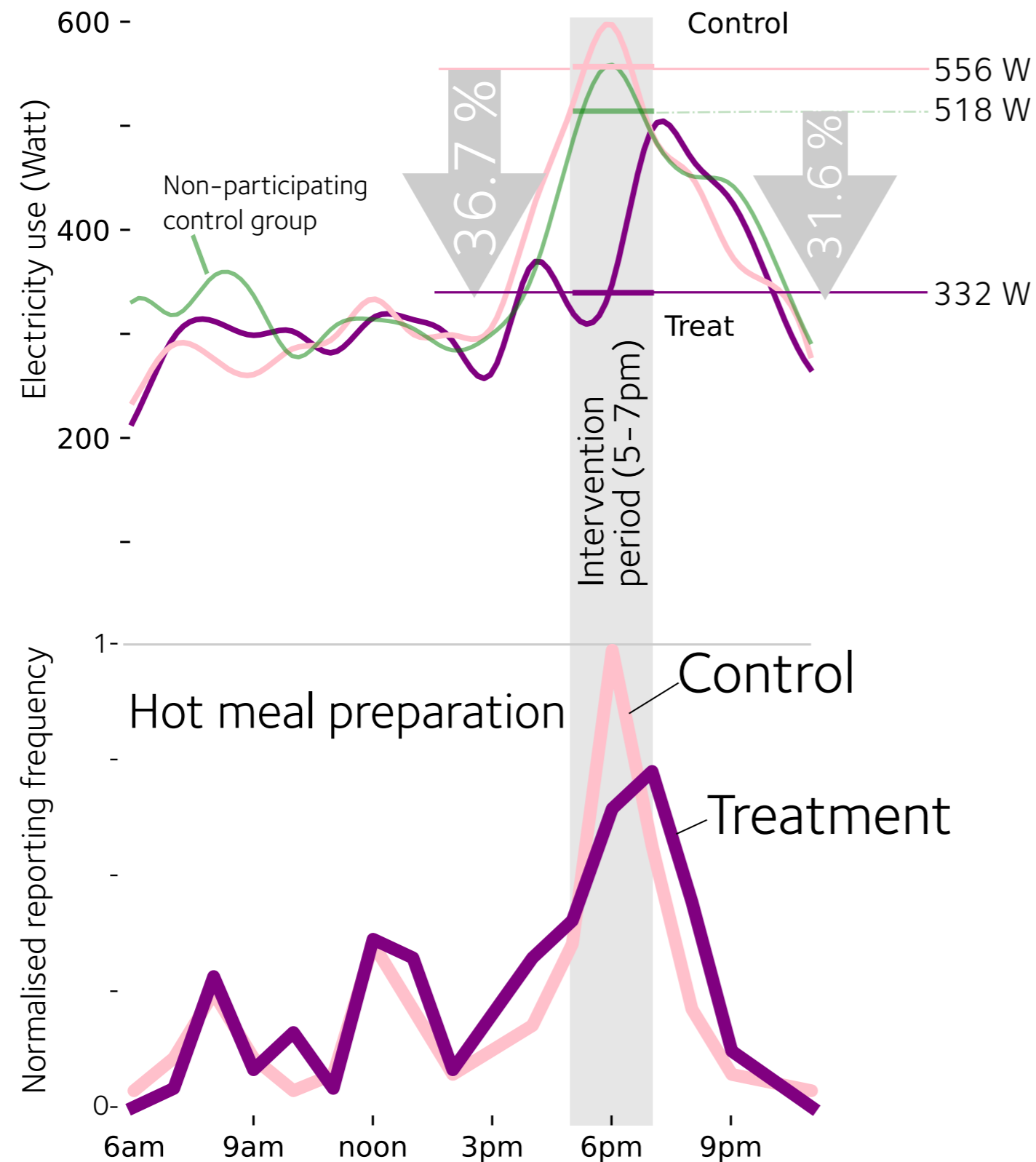


$P(E \mid \text{Life} + \mathbf{do}(\text{Ask}))$




Control and intervention data:

Responses are significant, repeatable and effective



The data: linking smart meters with smart phones

Register your smart meter

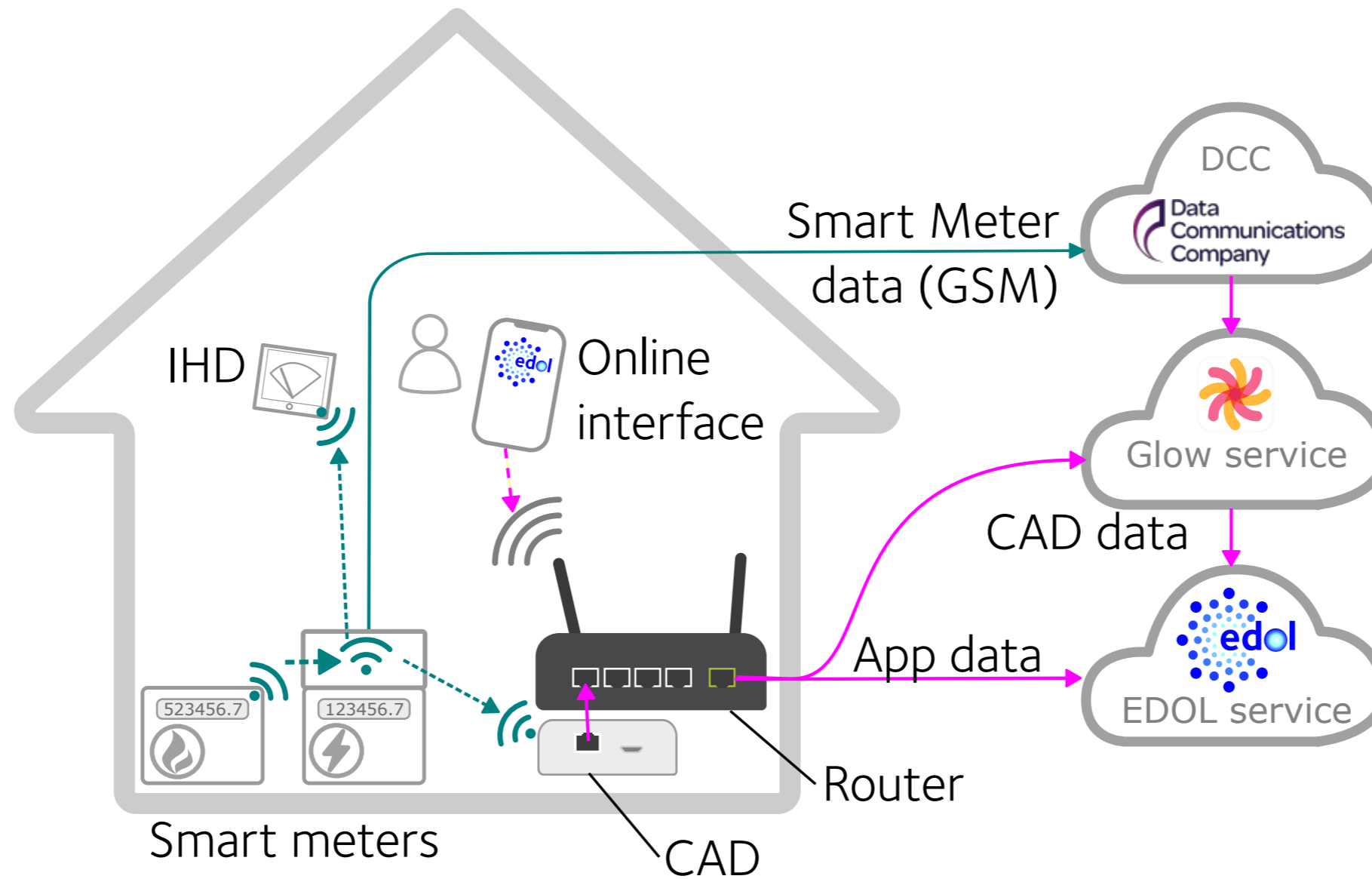


GUID: 1A-2B-3C-4D-5E-6F-7G-8H

Please enter the 16 digit code under your smart meter display and confirm your postcode

xx xx xx xx xx xx xx xx

postcode



GLOW

ReNEW

UNIVERSITY OF OXFORD

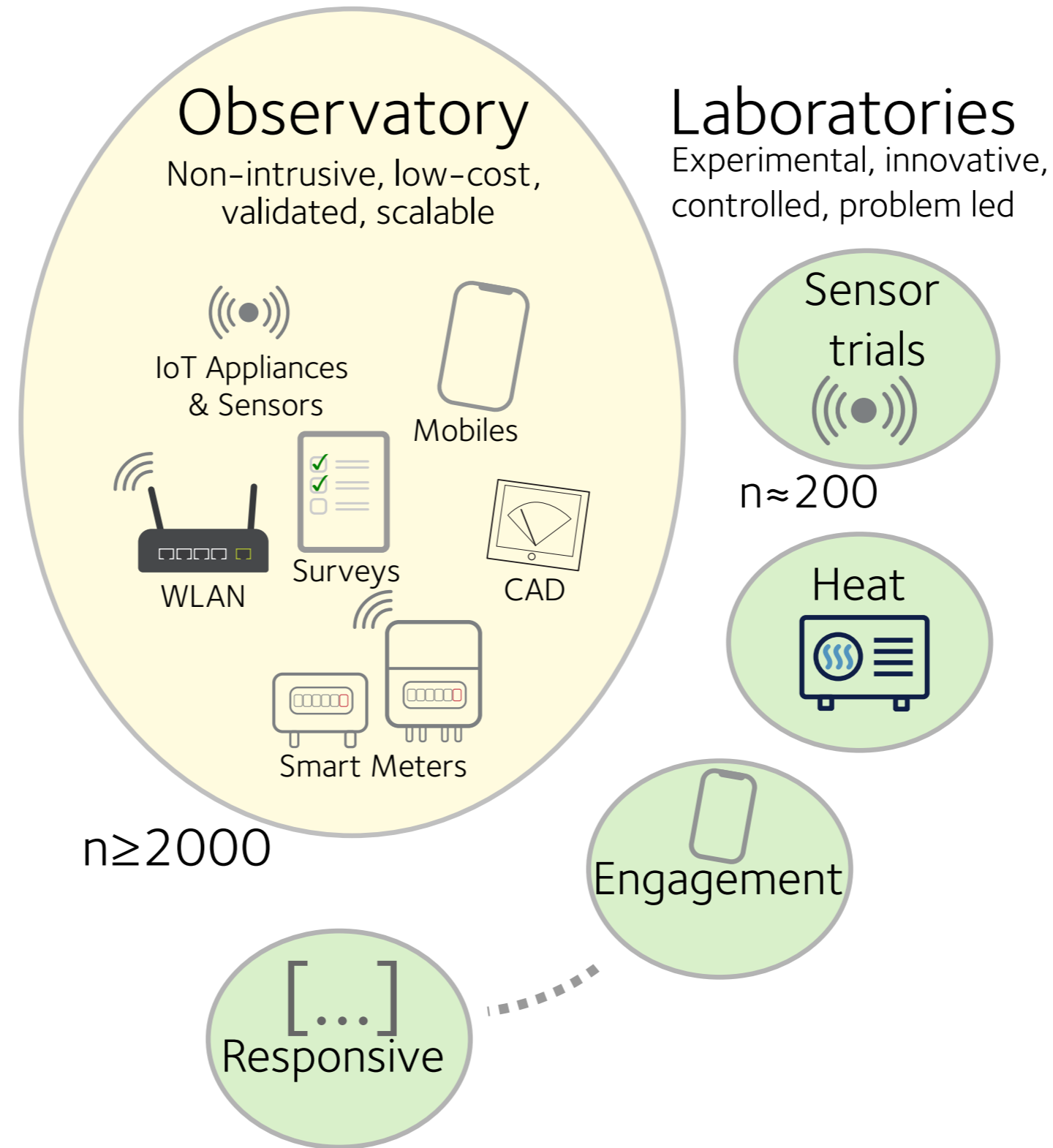
Your Smart Meter Access Device

- 1 Connect the USB cable to power
- 2 Connect the Ethernet cable to your router
Done.

The device automatically connects your smart meter. Please leave it plugged in during the study. If you have any questions, email support@joymeter.uk

EDOL - Energy Demand Observatory and Laboratory

Understand

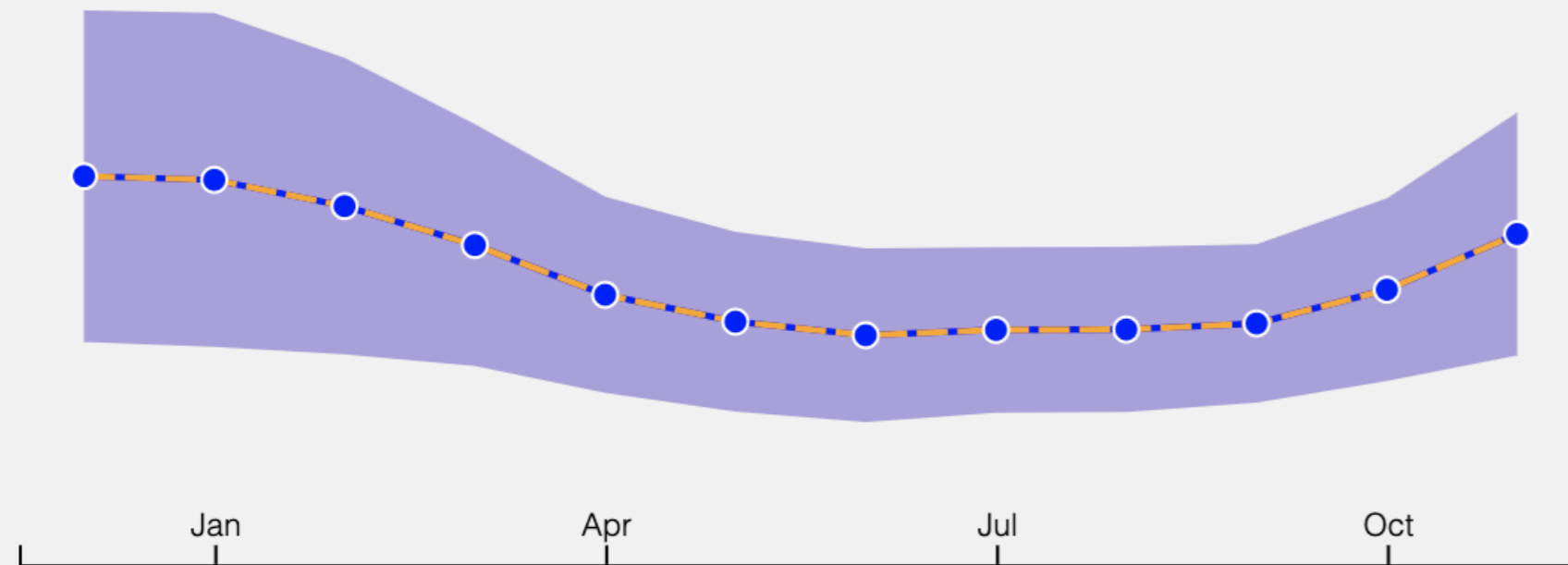


Change



Power Explorer

100% 160 days 139 homes



Months

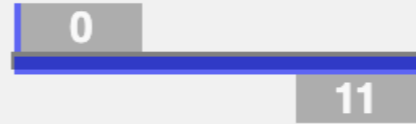
Days

Hours

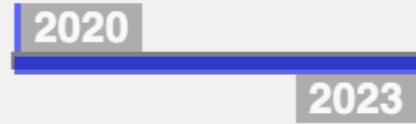
Download

Time

Month (0-11)



Year (2020-2023)



Season

Winter

Spring

Summer

Autumn

Pets

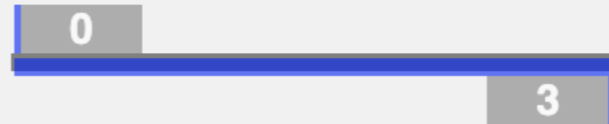
Dog

Cat

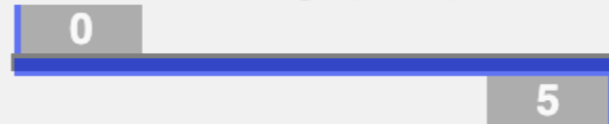
Fish

Household

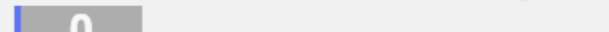
Children (0-3)



Affordability (0-5)



Financial situation (0-5)



Electrical Appliances

EV

Heat pump

PV

Electric hob

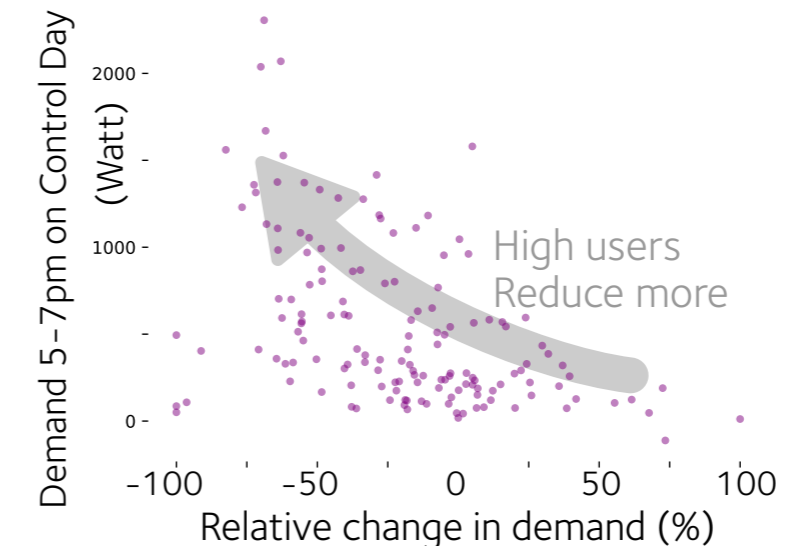
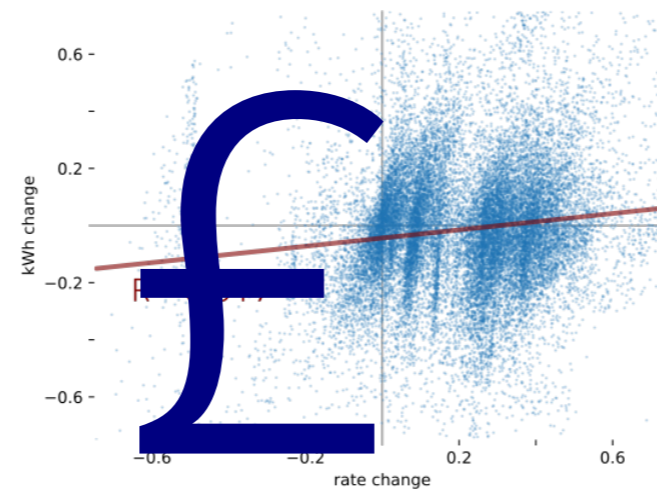
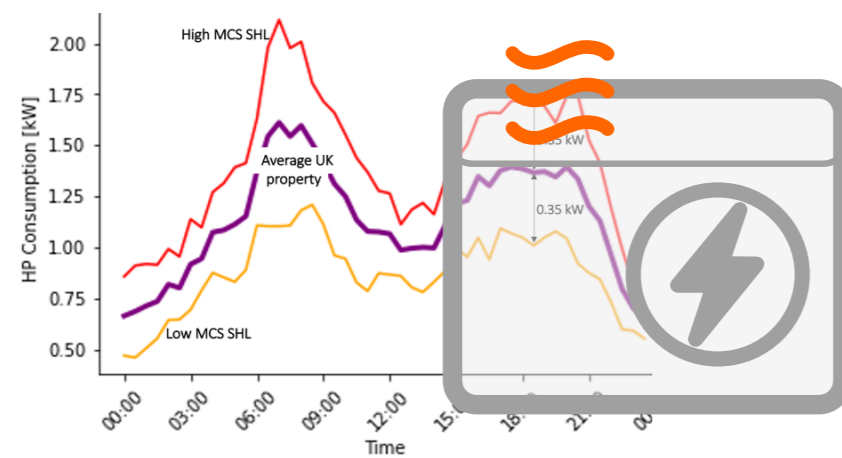
Summary: EDOL will

- Advance our **understanding** of energy demand
- Investigate the **causes** of why and how demand changes
- Equip us with **tools to explore**

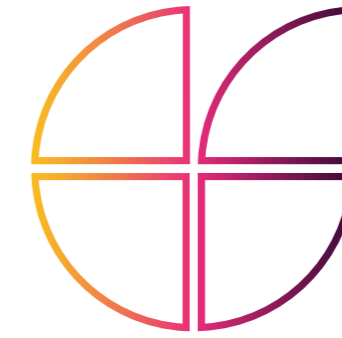
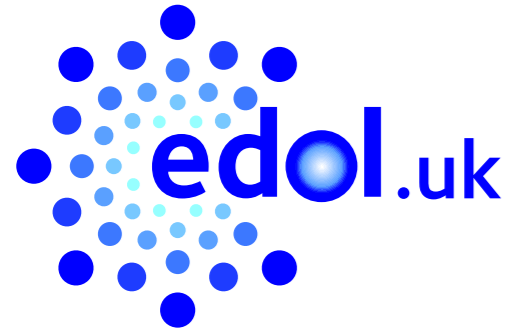
new technologies

new policies

new behaviours



Please **engage** in Lab development and **be rewarded** with data



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SCIENCE**



Thank you

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