

Distributed data for distributed power

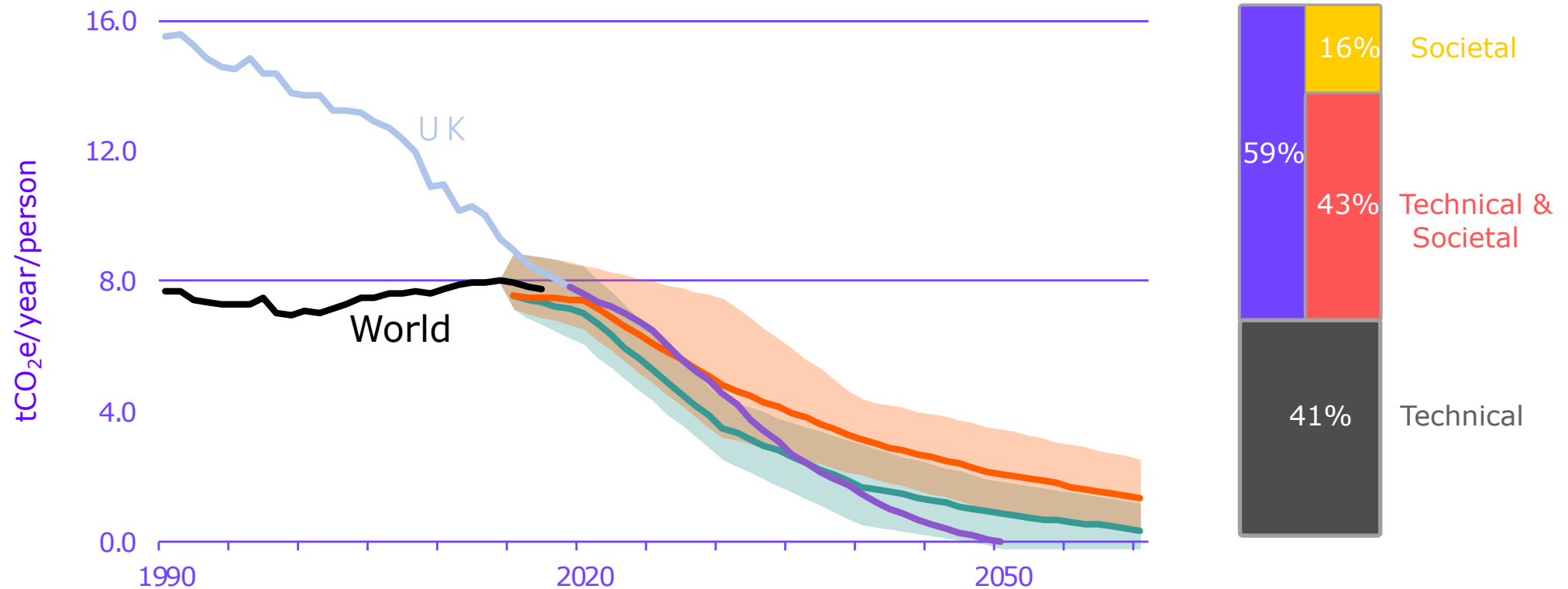
How data ownership and feedback can enable change

Phil Grünewald

ECEEE Summer Study 2022.

Paper s

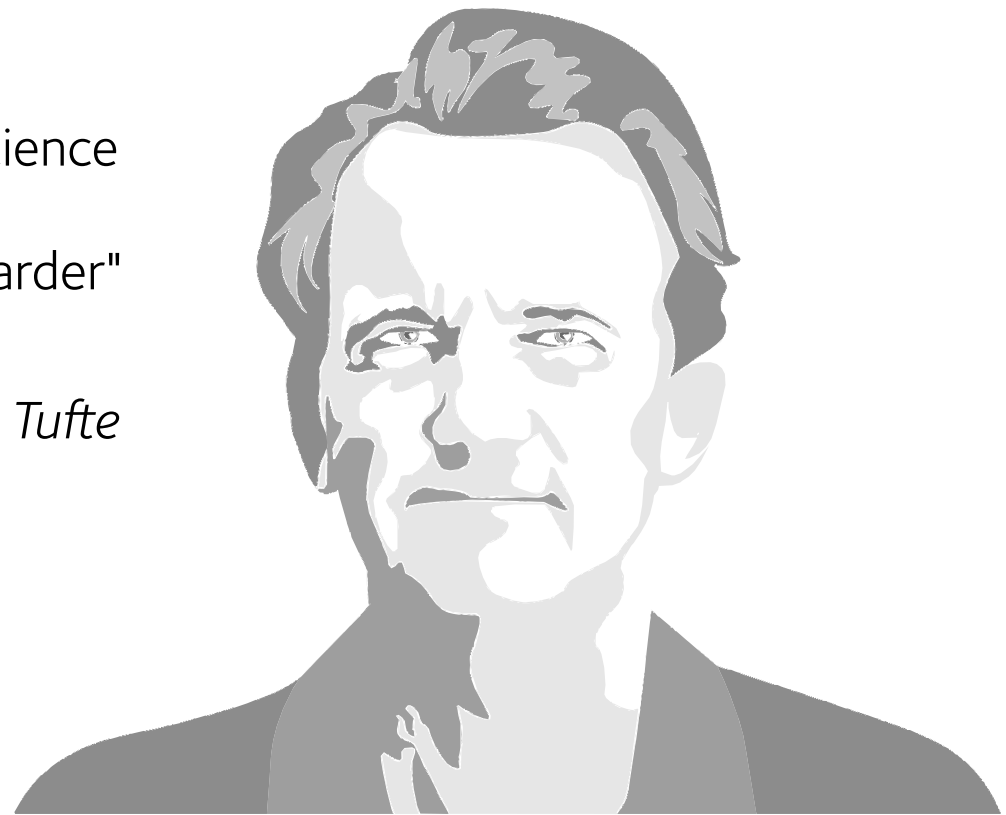
Half way there?



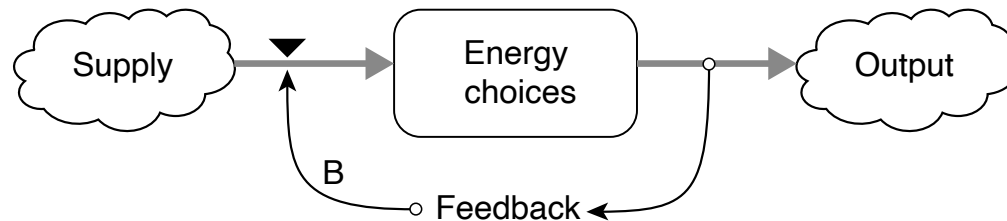
Source: Climate Change Committee. The UK's path to net zero.
The sixth carbon budget, Climate Change Committee, December 2020

"Understanding human behaviour isn't rocket science
– it's harder"

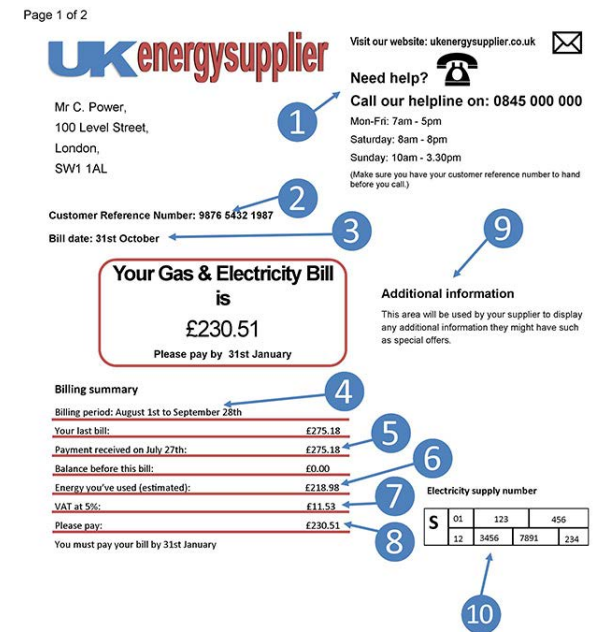
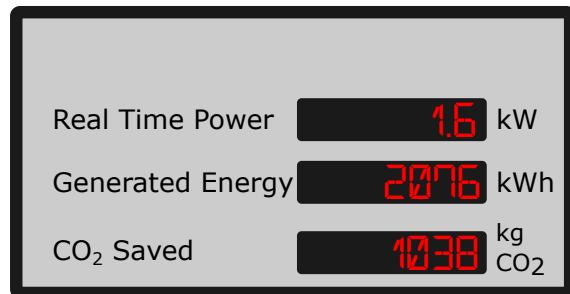
Edward Tufte



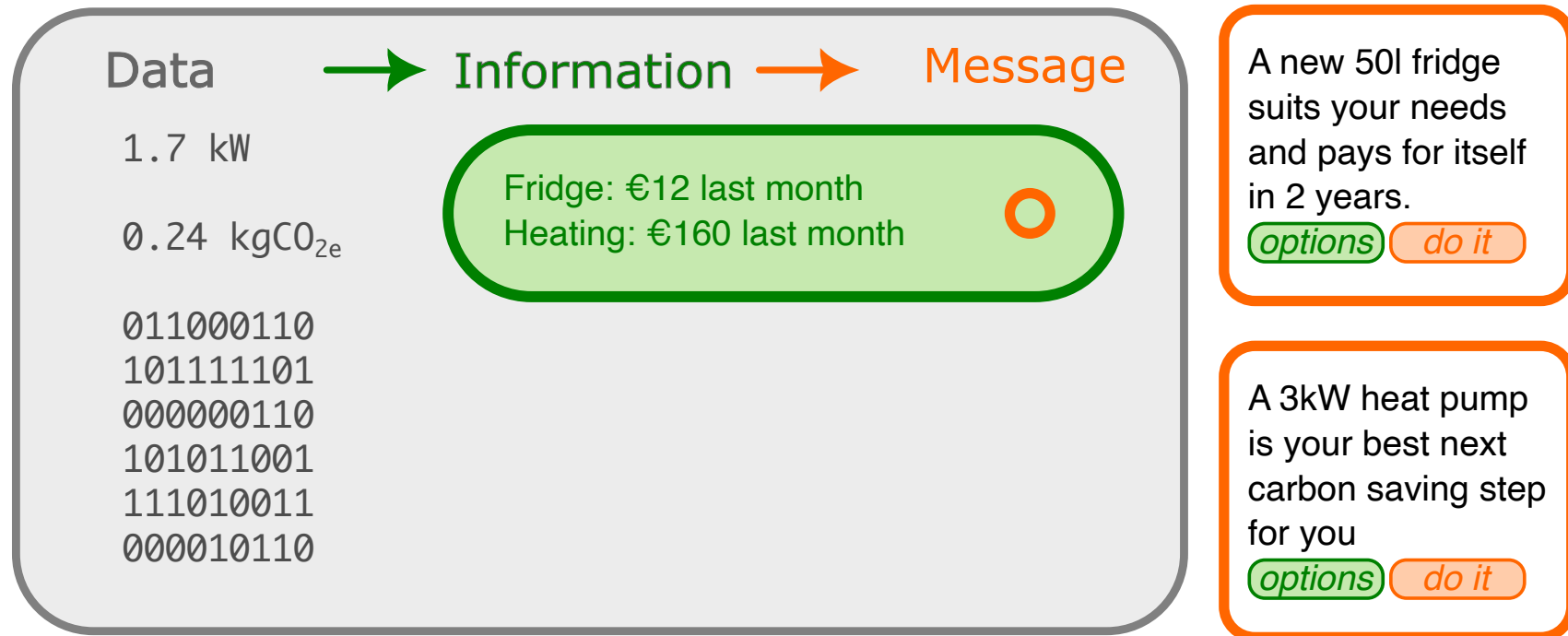
Feedback



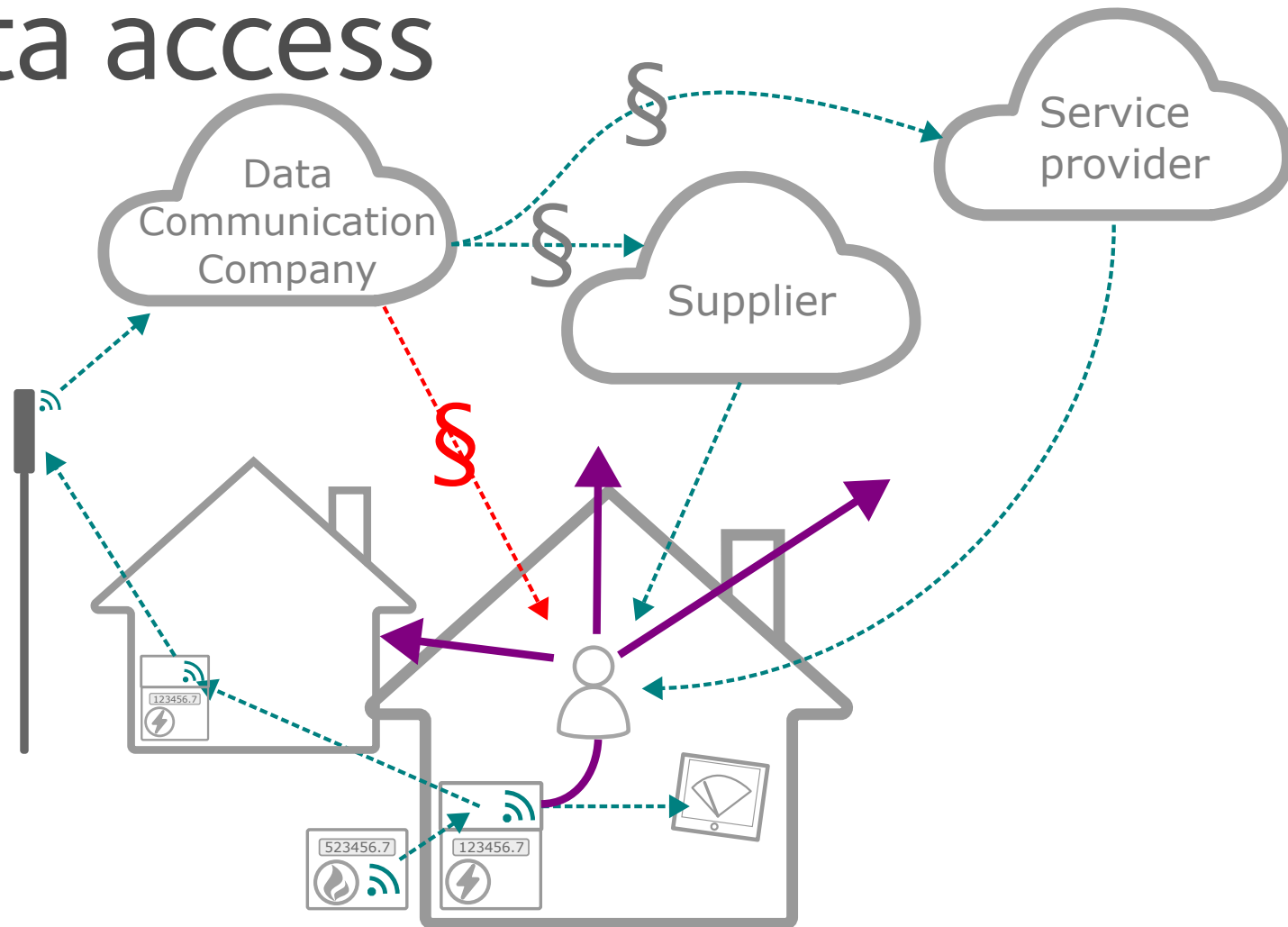
1) Timely 2) Accurate 3) Actionable



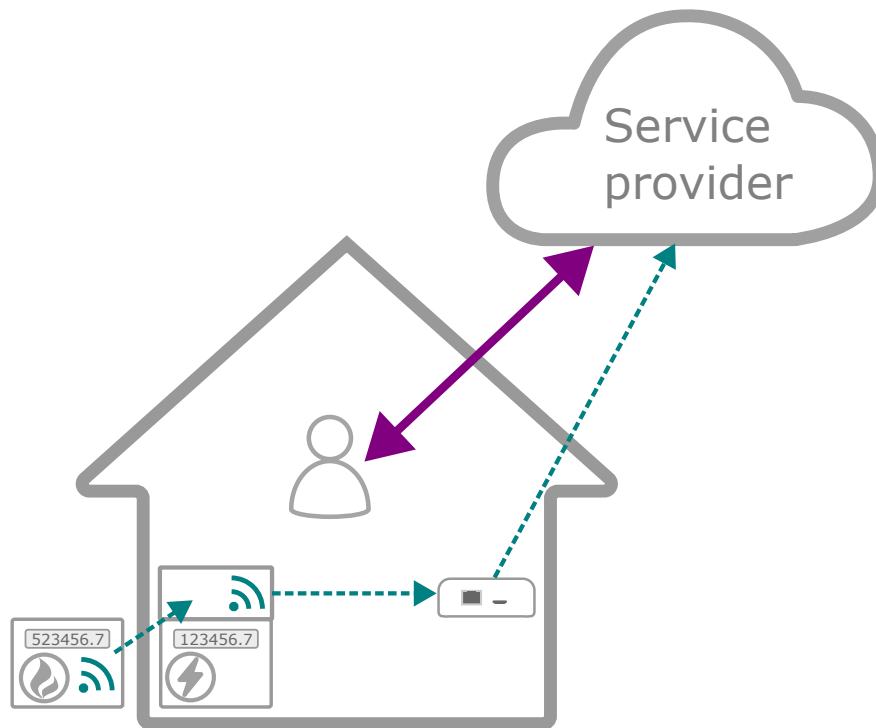
Data for feedback



Data access



Data access



Your Smart Meter Access Device

1

Connect the USB cable to power



2

Connect the Ethernet cable to your router
Done.

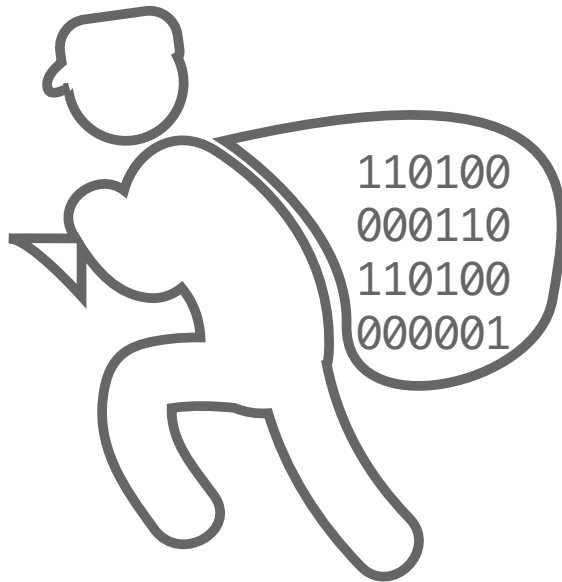


Green LEDs: the device is connected to your meter.
Red LEDs: move closer to your meter, if you can.
Any questions? Email philipp.grunewald@eng.ox.ac.uk

Informed consent?

The image shows a document titled "Informed consent?" which appears to be a form for a research study. The document is tilted and contains a grid of text and checkboxes. The text is too small to read, but the structure suggests it is a detailed consent form. The title "Informed consent?" is prominently displayed at the top of the document.

What are we trying to protect?



Energy use?

Occupancy?

Privacy?

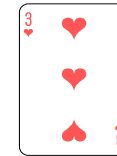
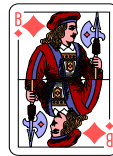
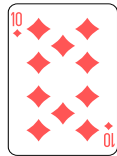
Identity?

Identity

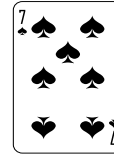
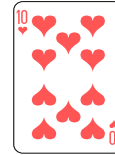
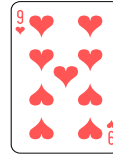
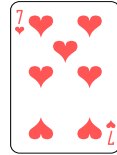


How much smart meter data does it take
to uniquely identify **you**?

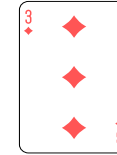
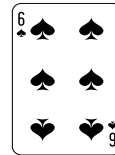
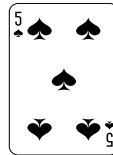
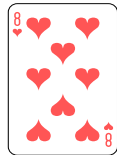
1. London



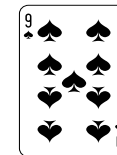
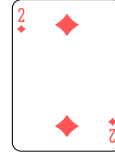
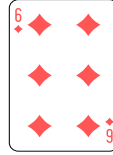
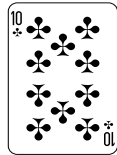
2. Paris



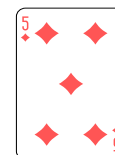
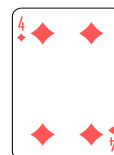
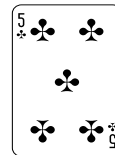
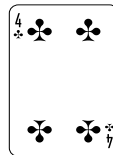
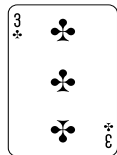
3. Rome



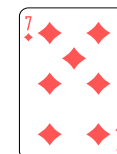
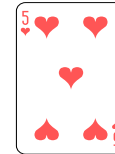
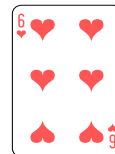
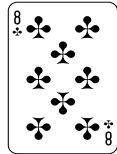
4. Stockholm



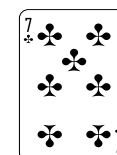
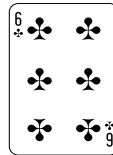
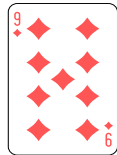
5. Kopenhagen



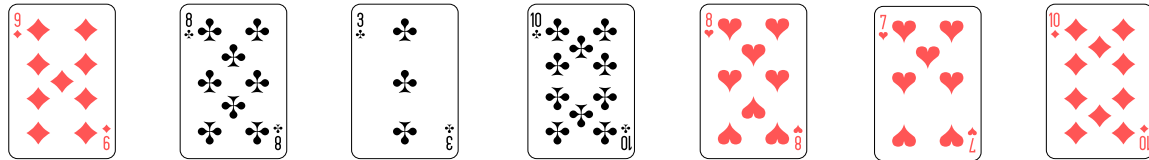
6. Berlin



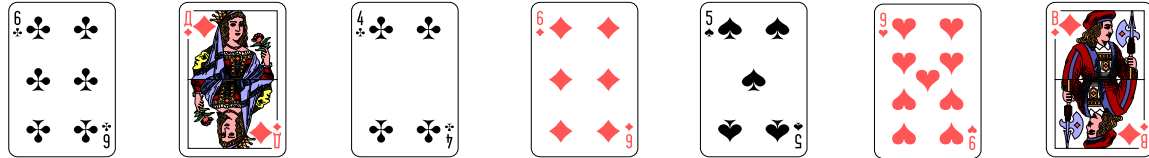
7. Prefer no to say



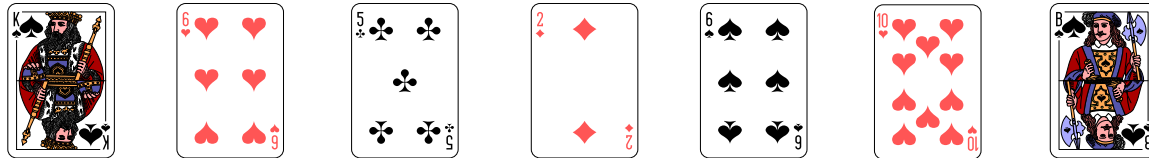
1. Bike



2. Car



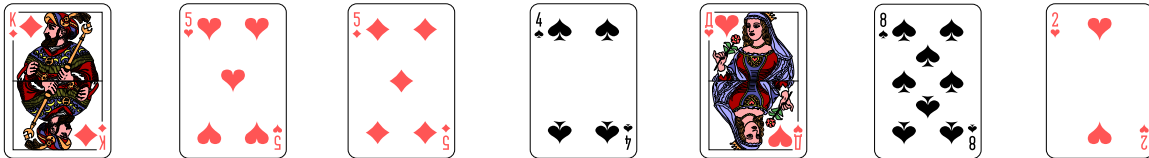
3. Bus



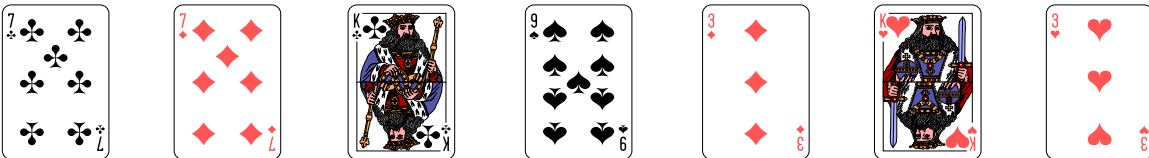
4. Walk



5. Scooter



6. Prefer no to say



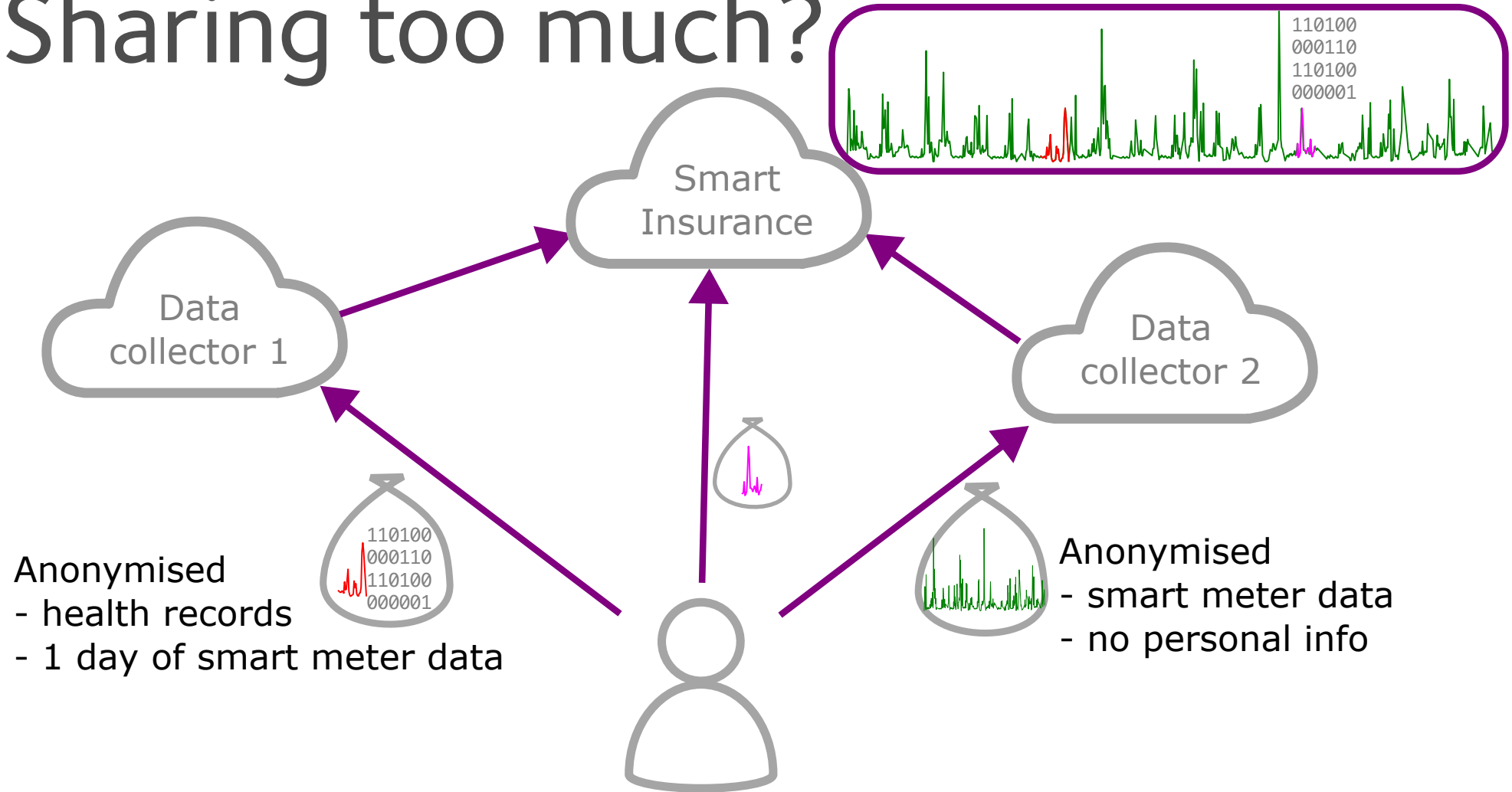
Identity



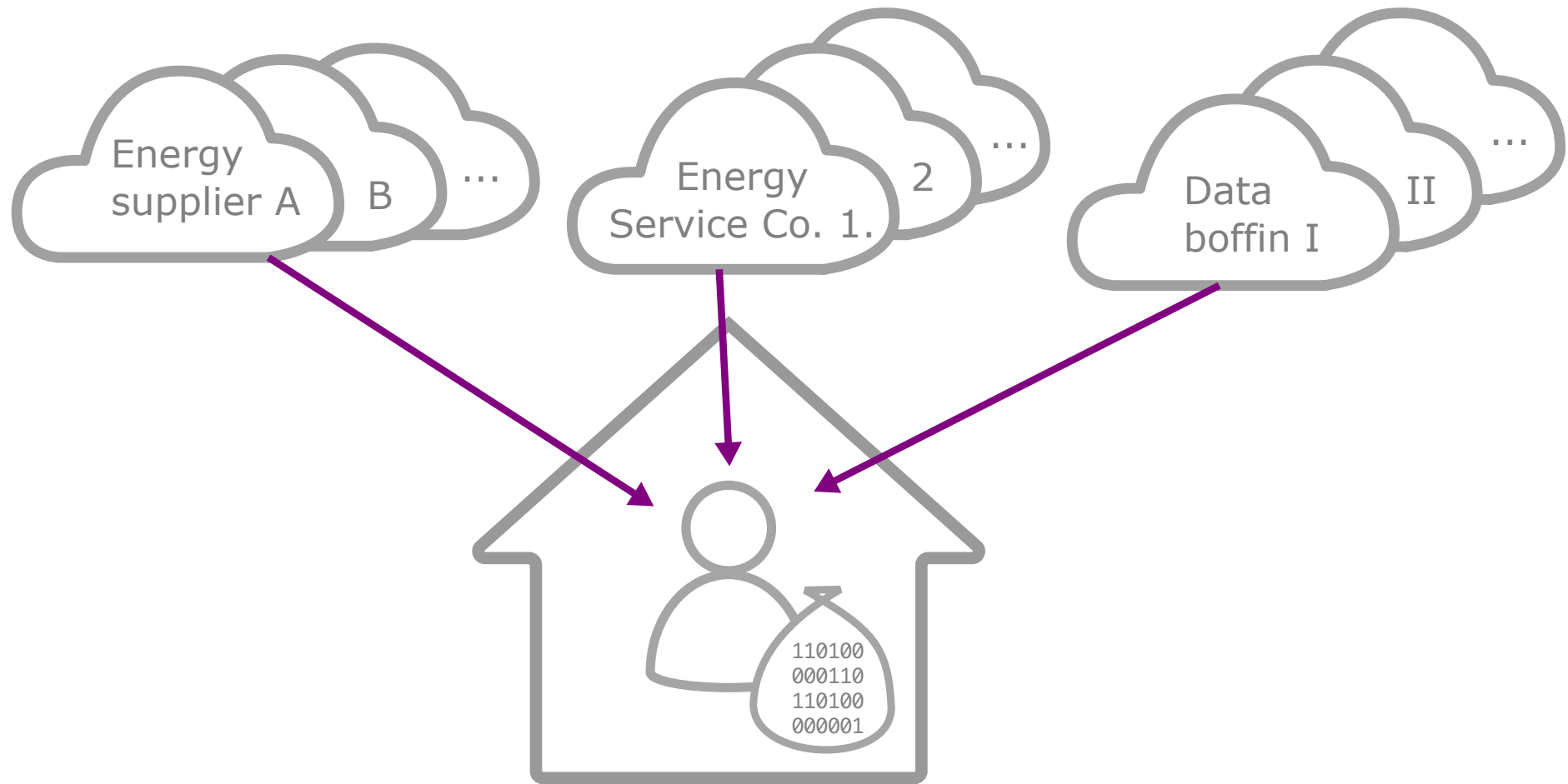
How much smart meter data does it take to uniquely identify **you**?

On average less than
5 readings with
50W precision

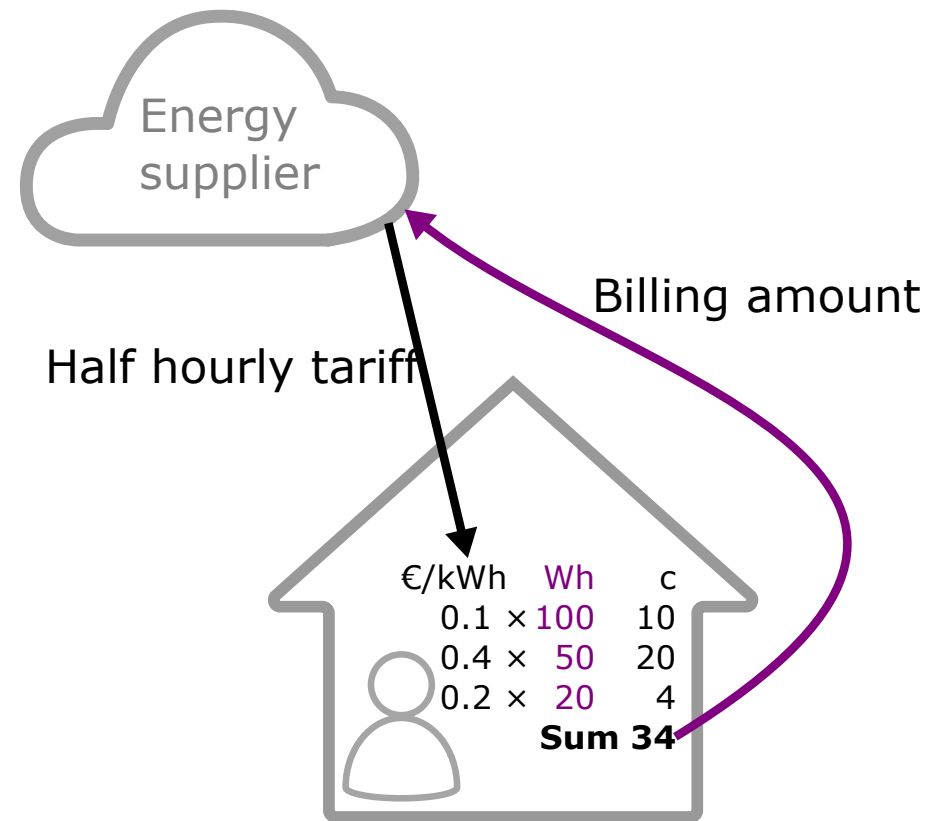
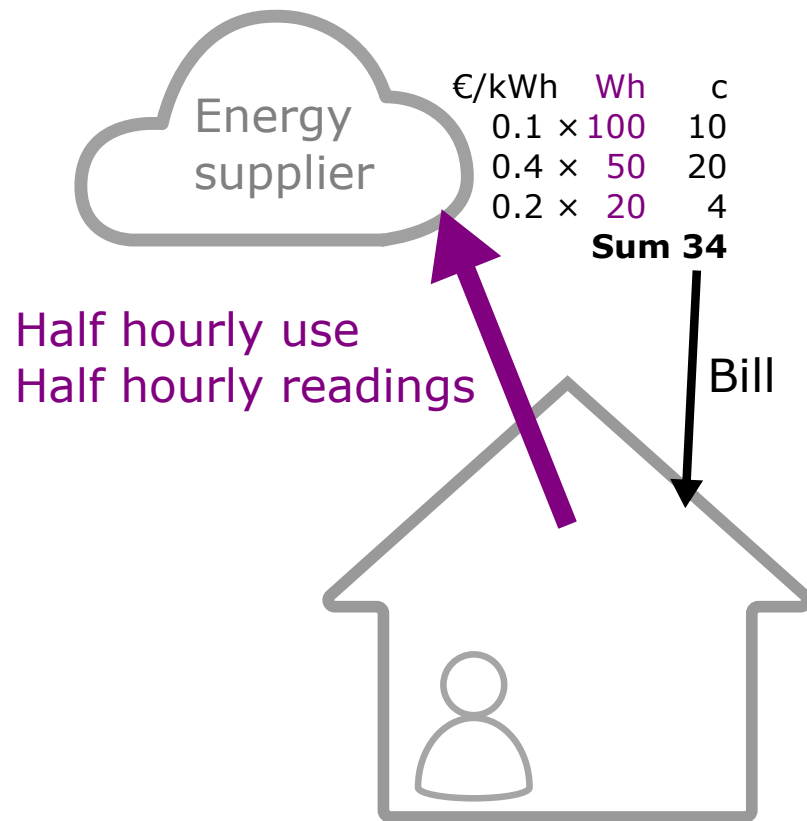
Sharing too much?



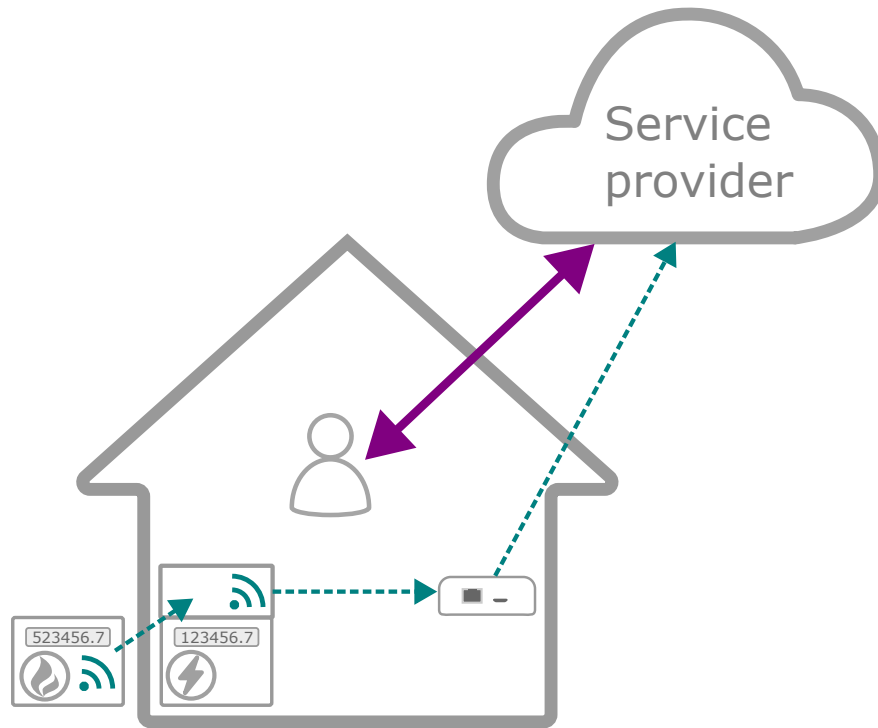
Model meets data (at home)




Model meets data (at home)



Model meets data (training camp)



Register your smart meter



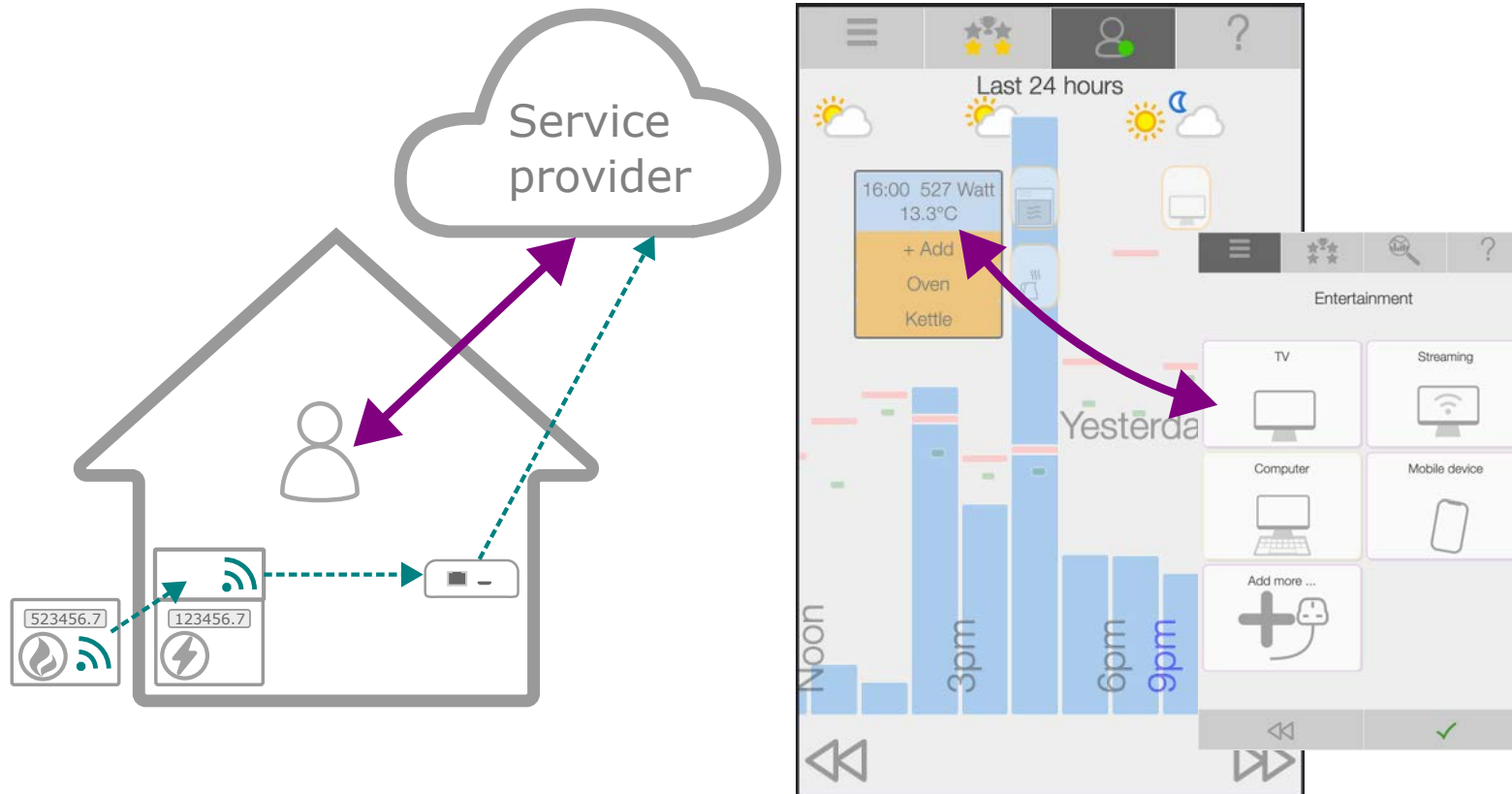
GUID: 1A-2B-3C-4D-5E-6F-7G-8H

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

xx xx xx xx xx xx xx xx

postcode

Model meets data (training camp)

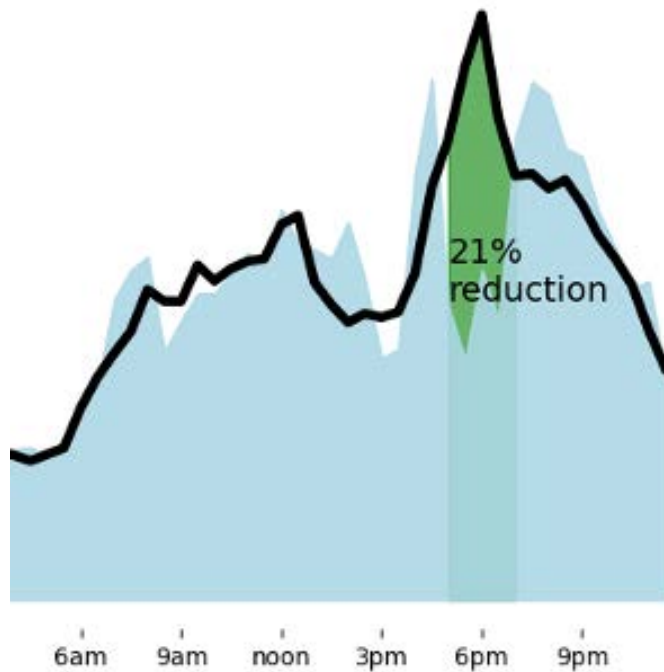


Phases

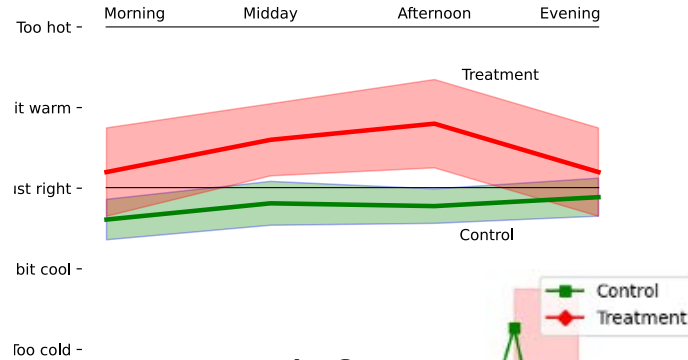
- 1) You tell us
 - training
 - 2) Verify suggestions
 - reinforcement learning
 - 3) Feedback
 - Timely
 - Accurate
 - Actionable
- Personal Messages

Learning from load shifting

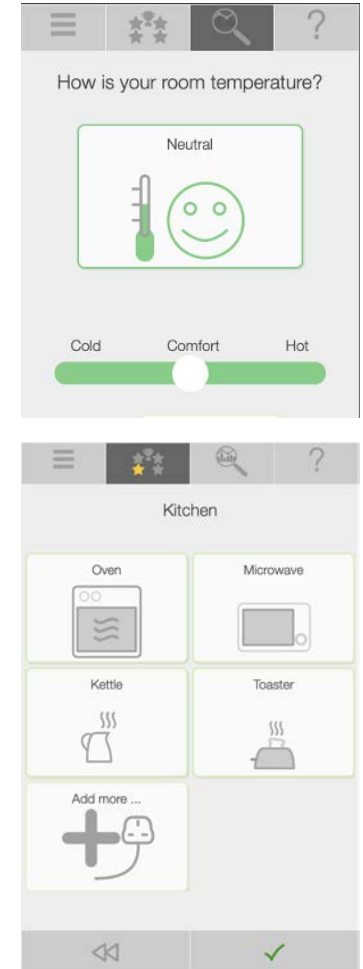
Load reduction



Thermal comfort



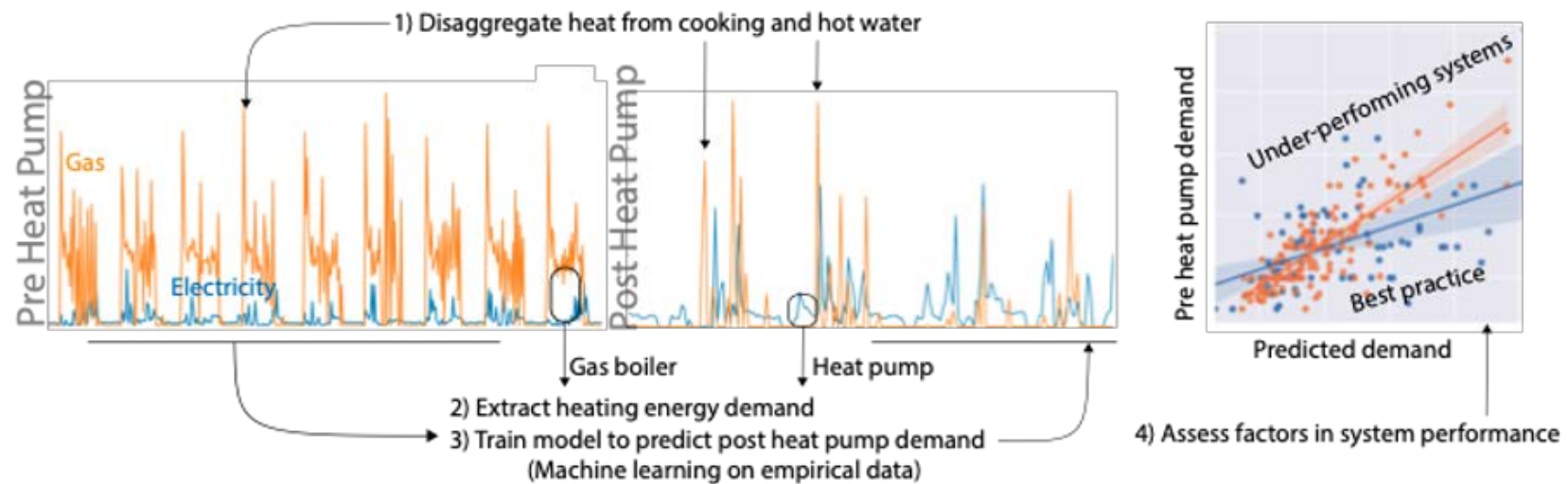
Activity shifting
(hot meals)



Learning from heat pumps



@mikefsway pumpchic.com



Summary

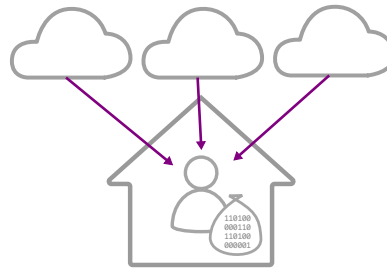


Powerful data

Energy data is personal

Potential for

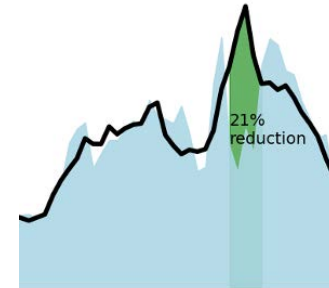
- inadvertent consent and
- powerful insights is high



Ownership empowers

Control over one's data

- can add security
- enables monetary and service value extraction



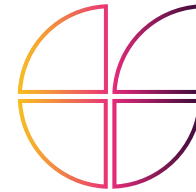
Trust enables insights

Data misuse will undermine large scale access and important insights

Inform or regulate?



Meet needs - not demand
energy-use.org



DEPARTMENT OF
**ENGINEERING
SCIENCE**



Thank you

for your feedback

and to the



philipp.grunewald@eng.ox.ac.uk