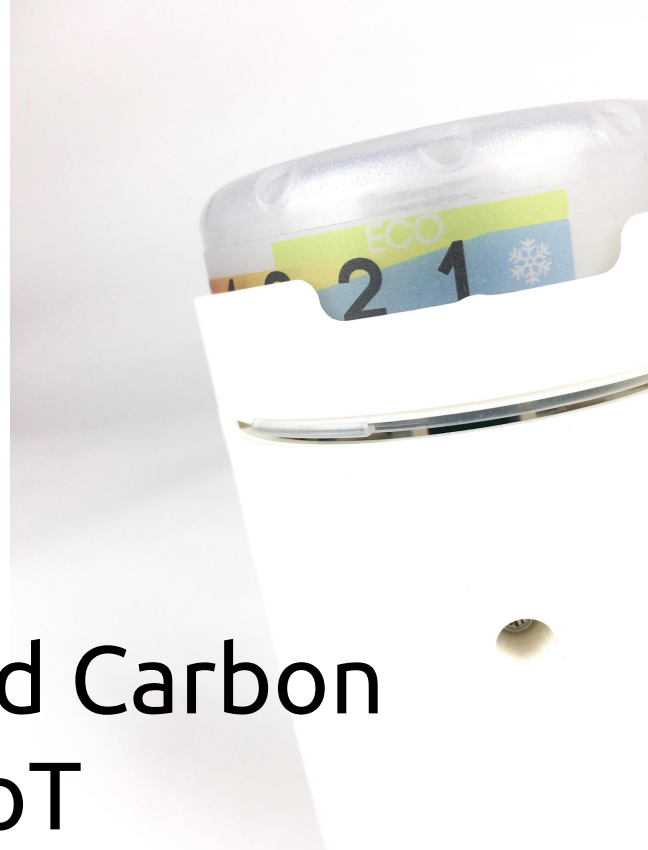


Cutting Energy Cost and Carbon Footprint with IoT

openTRV

Damon Hart-Davis
damon@opentrv.uk

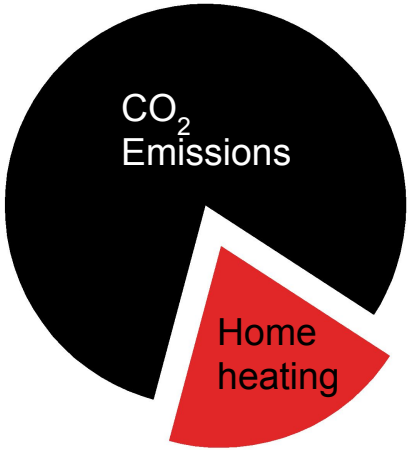
radbot

Mission

openTRV

Carbon

Fuel Poverty



Carbon

OpenTRV mission to cut EU28 CO_2 emissions by 8% through better home heating

Cutting carbon -> efficiency
Efficiency -> complexity
Humans don't do complexity well!

IoT!

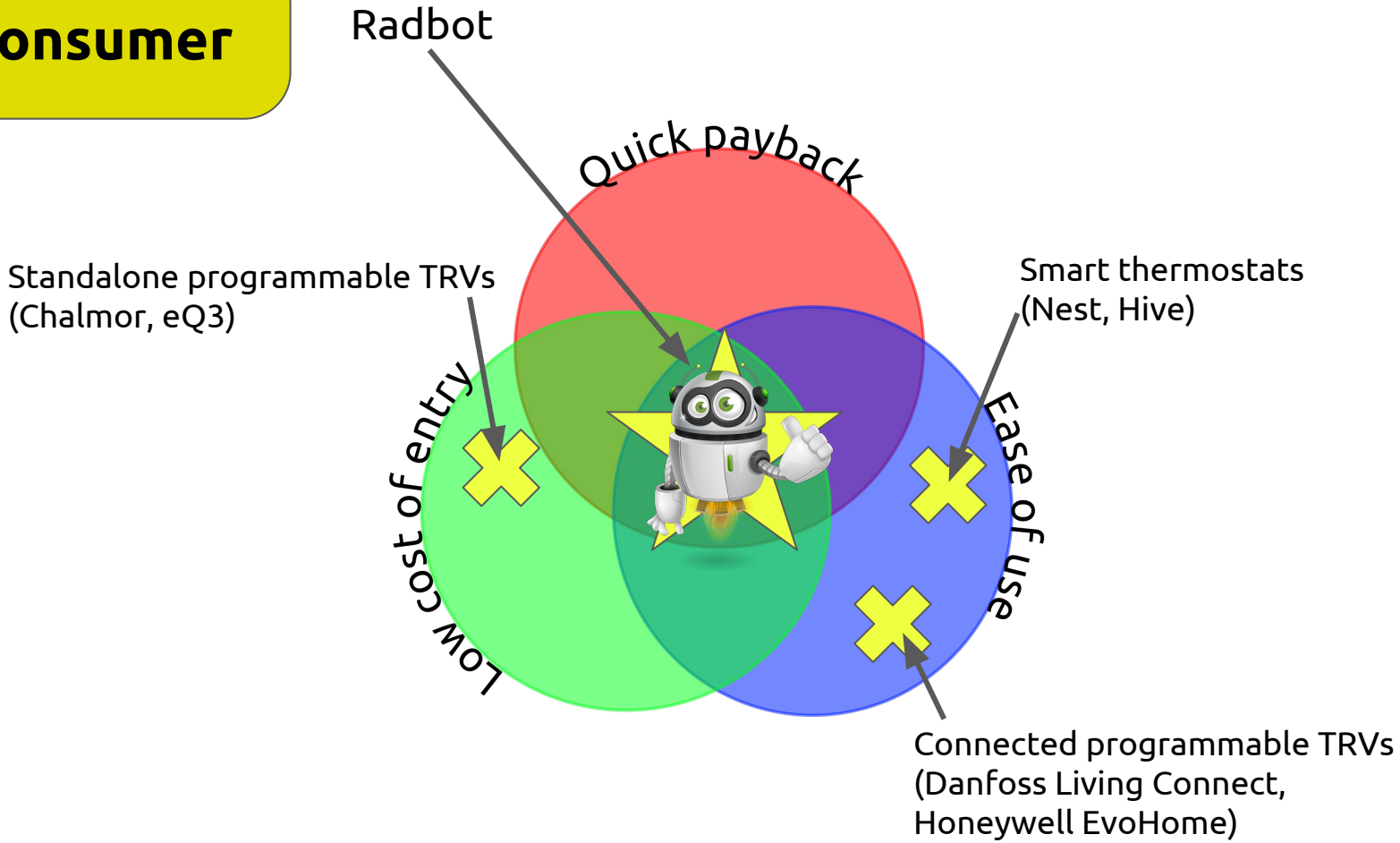
FAIL!
Energy History
DECEMBER
Heating control
Schedule
Manual
Off
Now
In Cosy
17°C
Below ideal, heating up
Next: Slumber at 22:35
Kitchen
Energy History
PROG
RESET
ENERGY
SCHEDULE
SETTINGS
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY
SUNDAY
COPY
PASTE
ADD
REMOVE
Network OWL
Online
Electricity Yesterday
CO2e
Solar Yesterday
Overview
AUTO
OFF
HEATING AUTO
SCHEDULE
BEDROOM 2
HOT WATER
DAY
COPY DAY
ROOM TEMP
CM927
DATE
PROG
AUTO
MAN
OFF

Consumer

cost
comfort
control

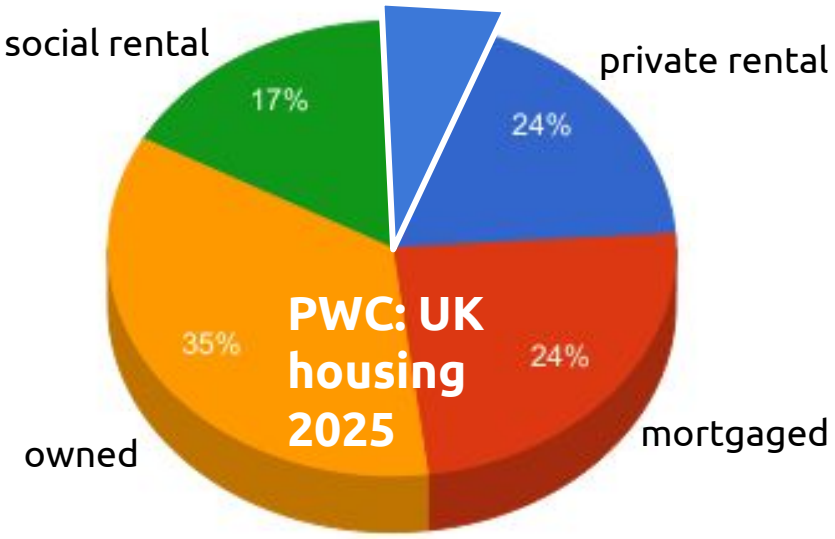
Simple and DIY
Affordable (1Y payback)
Learns so no programming

Consumer


Radbot
Quick payback
Standalone programmable TRVs
(Chalmor, eQ3)
Smart thermostats
(Nest, Hive)
Low cost of entry
Ease of use
Connected programmable TRVs
(Danfoss Living Connect,
Honeywell EvoHome)

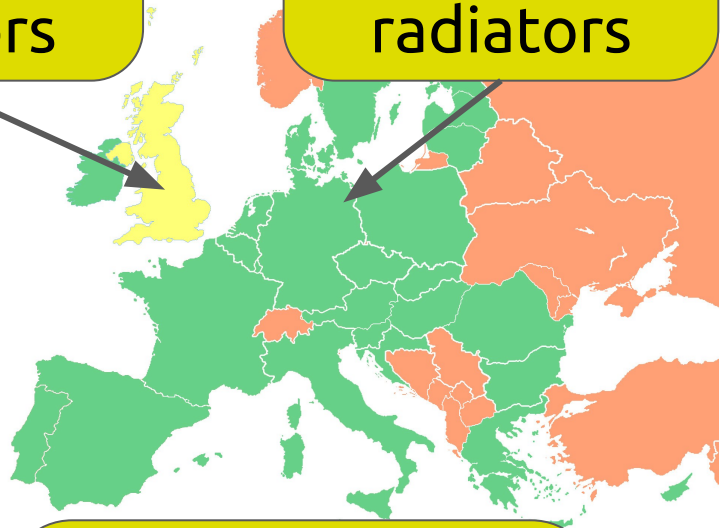
HaaS

⅓ increase 2015-25

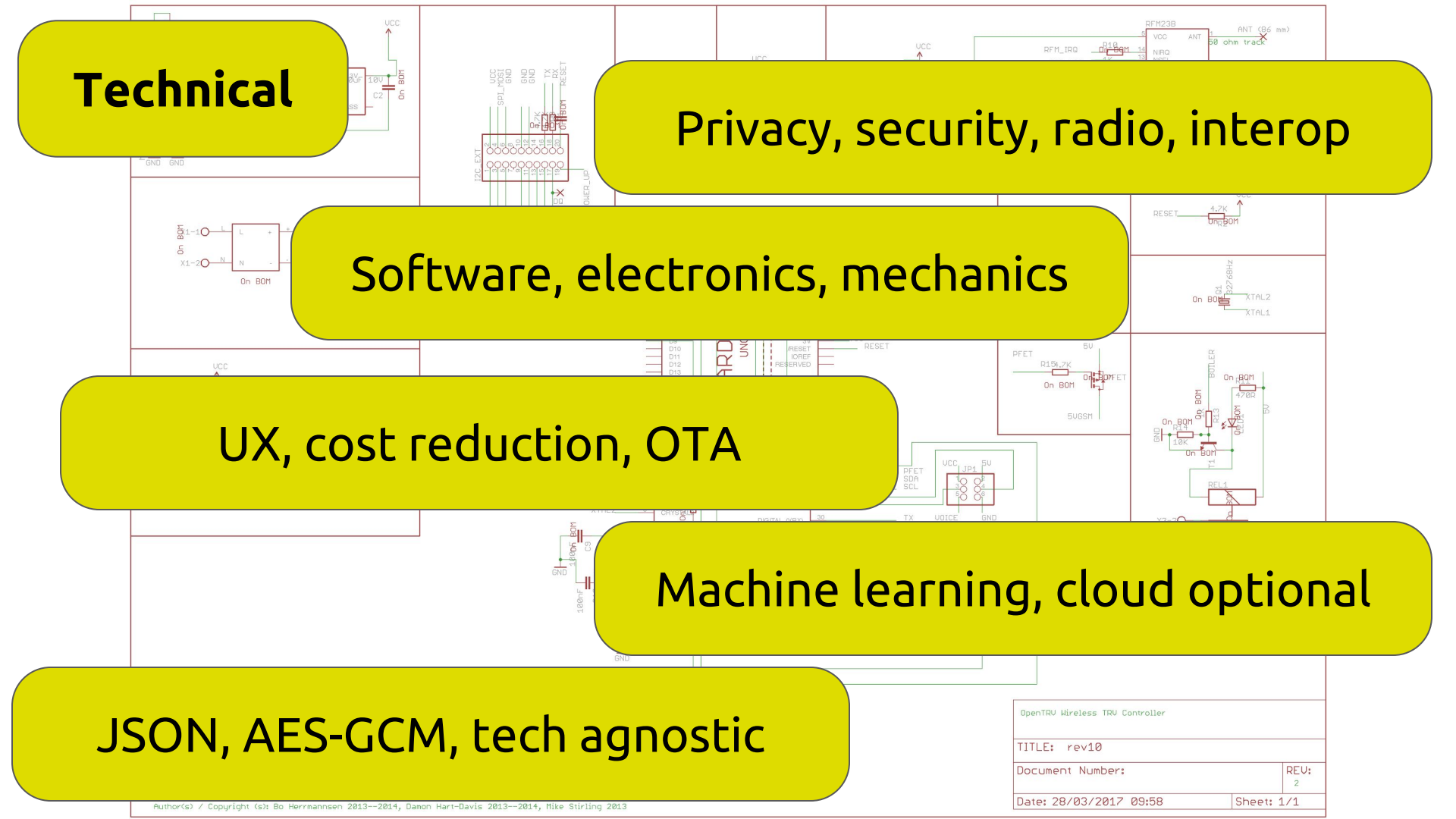


100m home radiators

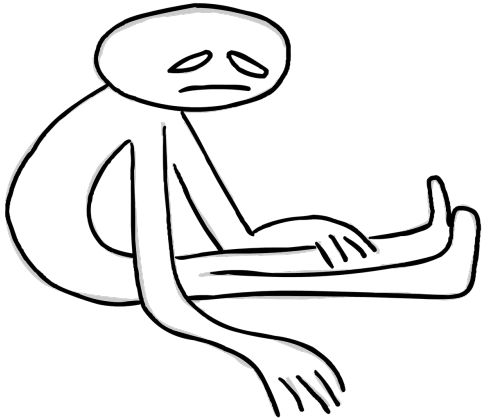
400m home radiators



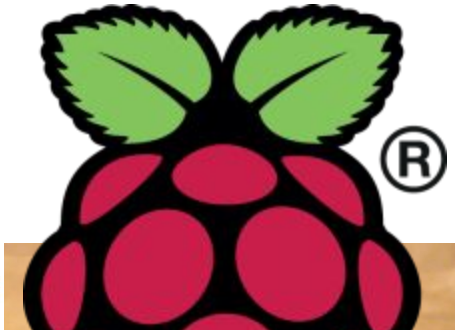
EU28 domestic heating controls: €1.2bn annually

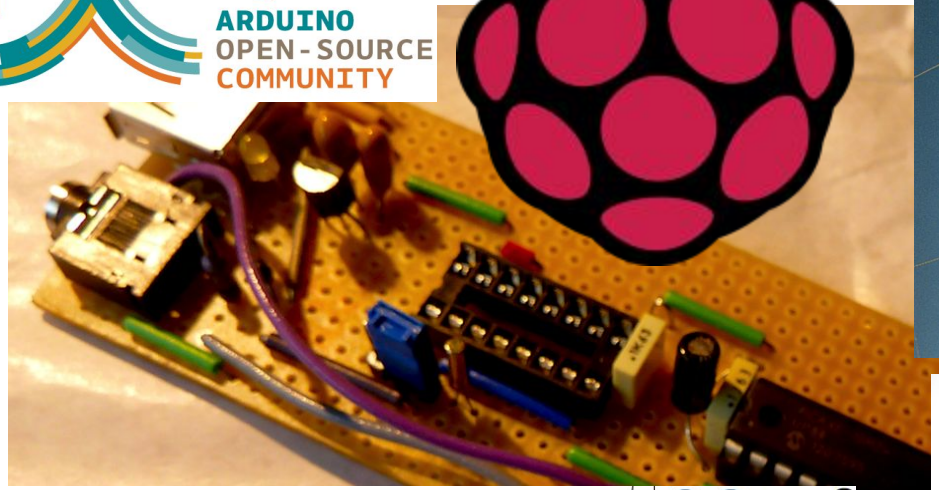

Technical
Privacy, security, radio, interop
Software, electronics, mechanics
UX, cost reduction, OTA
Machine learning, cloud optional
JSON, AES-GCM, tech agnostic
OpenTRV Wireless TRV Controller
TITLE: rev10
Document Number:
REV: 2
Date: 28/03/2017 09:58
Sheet: 1/1
Author(s) / Copyright (s): Bo Herrmannsen 2013--2014, Damon Hart-Davis 2013--2014, Mike Stirling 2013

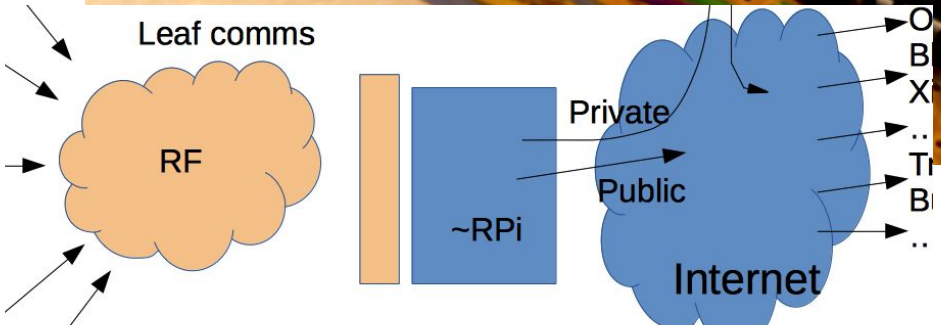
Friends



ARDUINO
OPEN-SOURCE
COMMUNITY

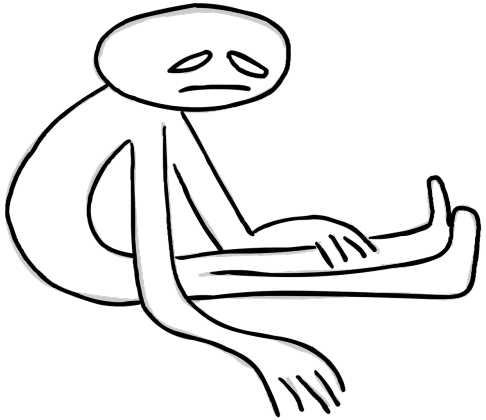


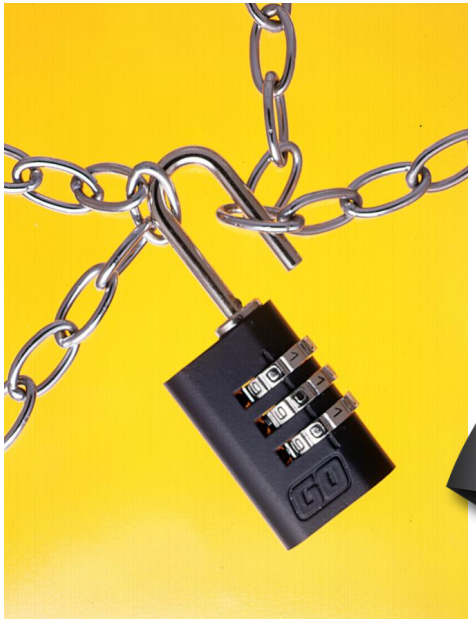


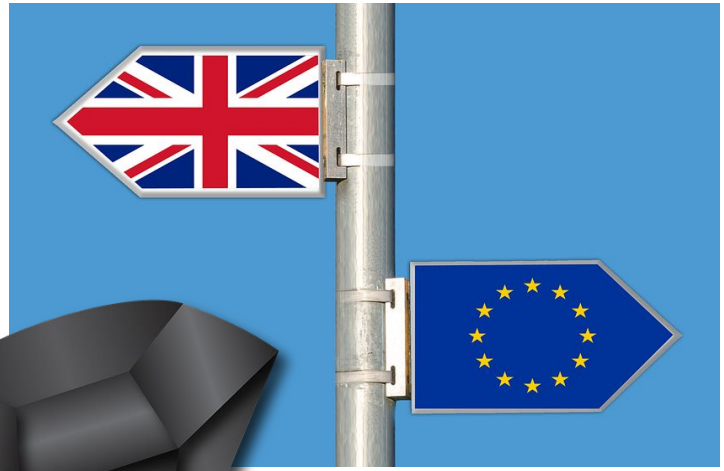

Leaf comms
RF
~RPi
Private
Public
Internet

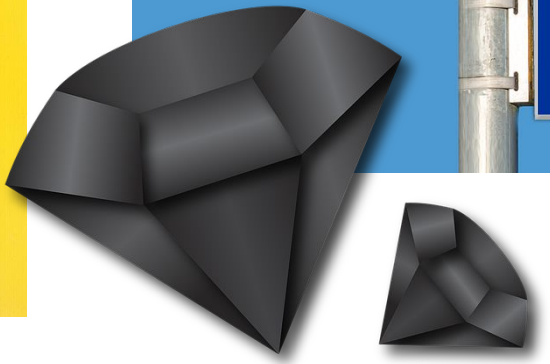
TENANCY
AGREEMENT

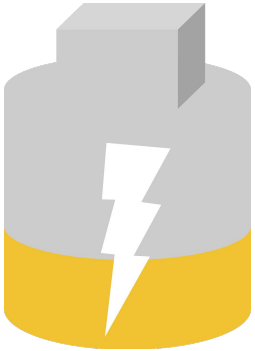
Foes











Neutral

CE

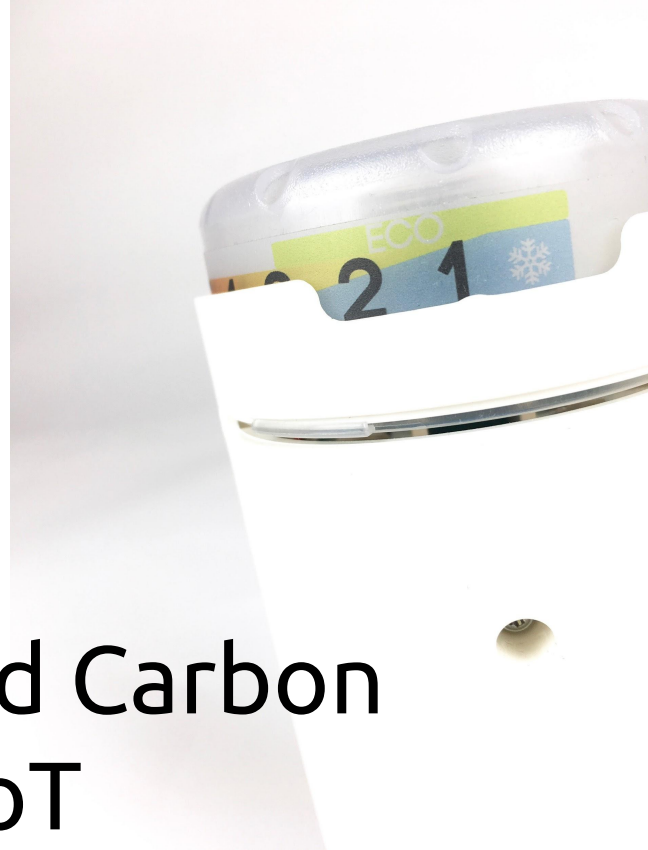
SGN
elster
BK-G4
D87
7 122 43
G4 K9027495 09 01
Qmax 6 m³/h
Qmin 0,04 m³/h
V 2,0 dm³
Pmax 75 mbar
G4
Elster Metering Ltd.
2009
0 0 0 0 2 7 3 8
m³
002526252556
1 imp ≙ 0,01m³
IF YOU THINK YOU CAN SMELL GAS
Turn off the supply at the control valve. Open doors and windows.
Do NOT use naked flames. Do NOT turn electrical switches on or off.
Do NOT smoke.
IMMEDIATELY CONTACT THE GAS EMERGENCY SERVICE.
THE TELEPHONE NUMBER IS
0800 111 999
Do NOT reopen the supply until remedial action has been taken by a competent person to prevent gas escaping again.
METER EXCHANGE / FIX DETAILS
OLD METER NO
OLD METER INDEX
NEW METER INDEX
DATE
IF METER BANK GIVE FLAT NO.

Summary

IoT fits this space very well

Significant tech, regulatory issues

Must avoid lock-in when maturing



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radbot

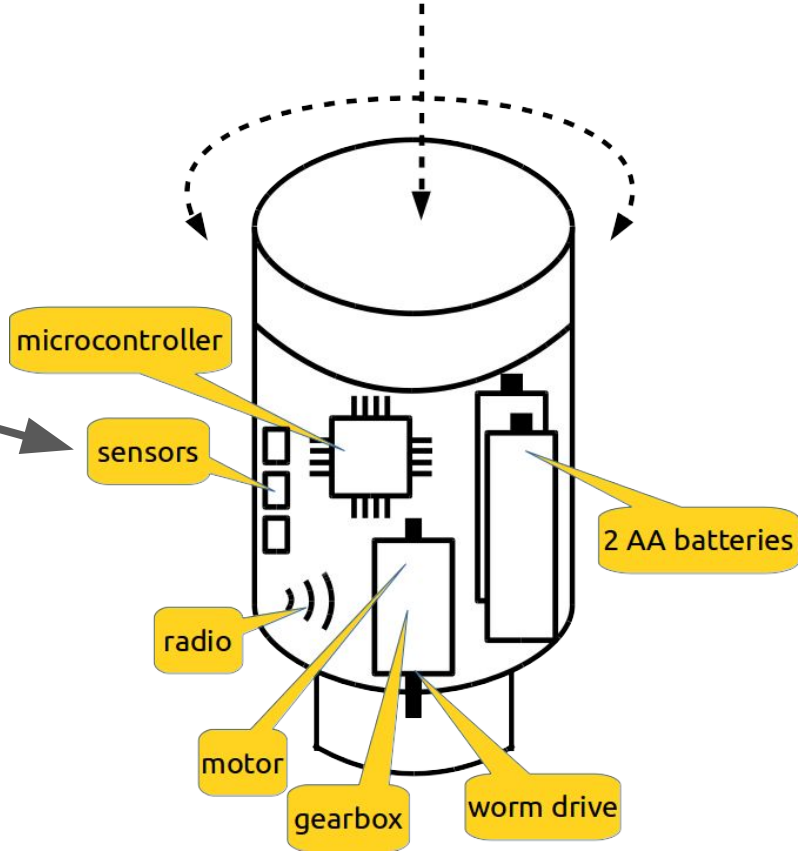
Appendices

Contains supporting information about OpenTRV and Radbot

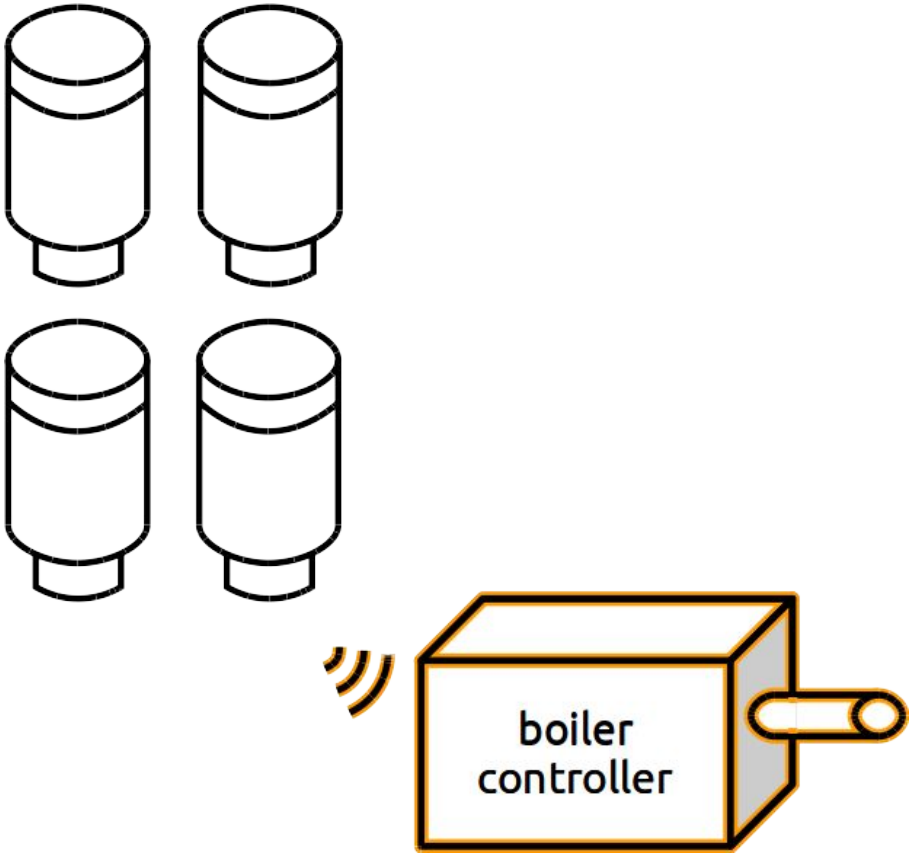
Not part of main presentation.

Technical details

- Temperature
- Light levels
- Button presses
- Optional
  - Humidity
  - Volatile organic gases
  - CO2 levels
  - Sound
  - Speech
  - etc.



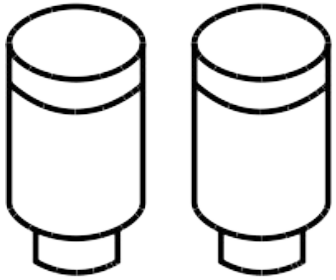
Smart TRVs + boiler controller



add a boiler controller

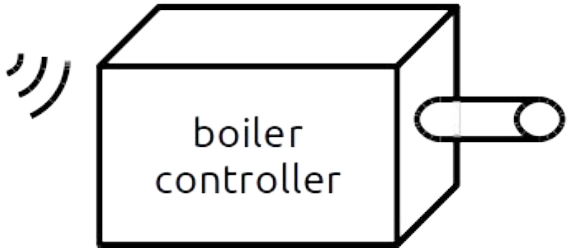
energy savings 10-50%
across the home

Smart TRVs + internet gateway



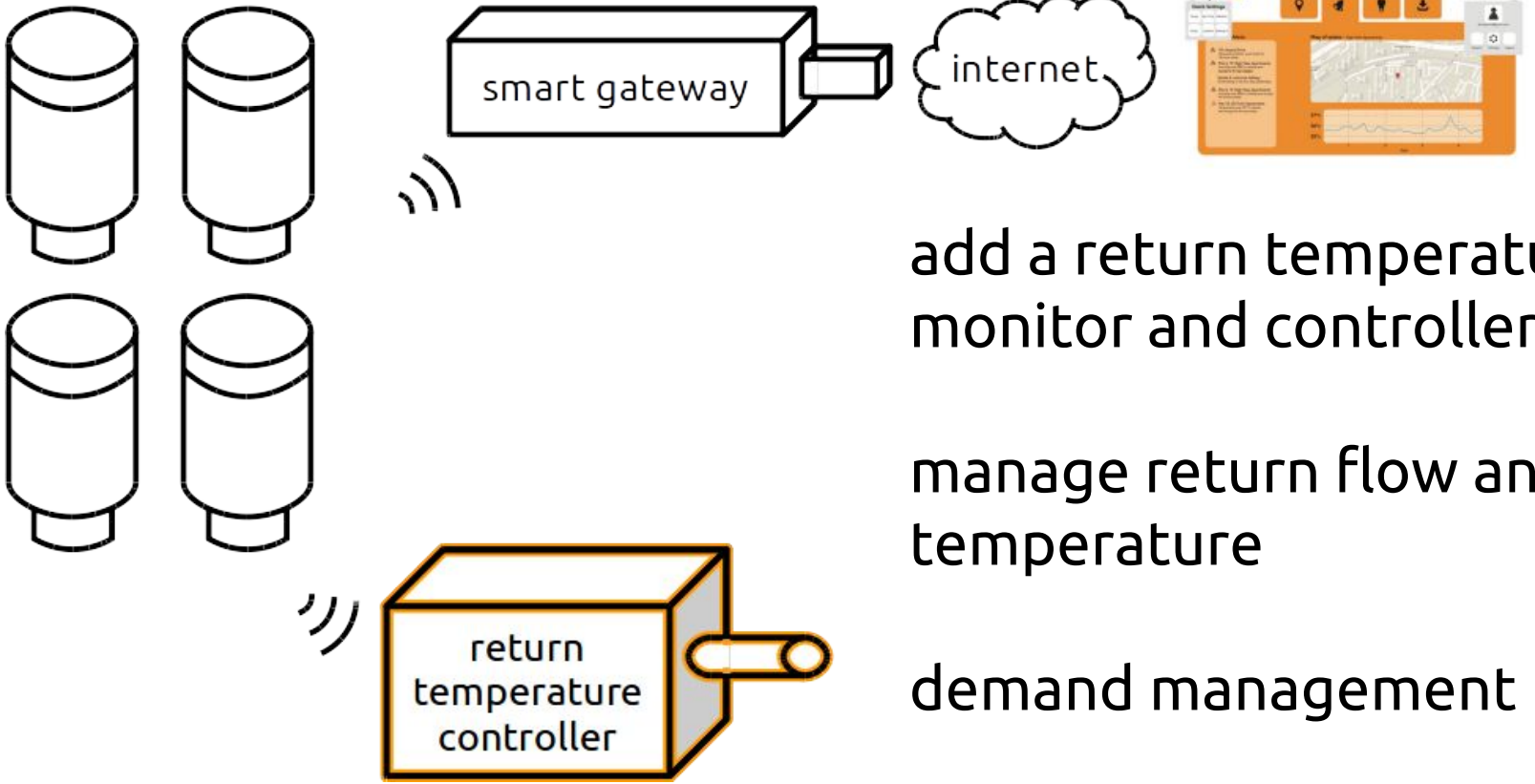
add an internet gateway

energy savings 10-60% across the home



gather data, analyse and offer metrics and dashboard

District heating variant



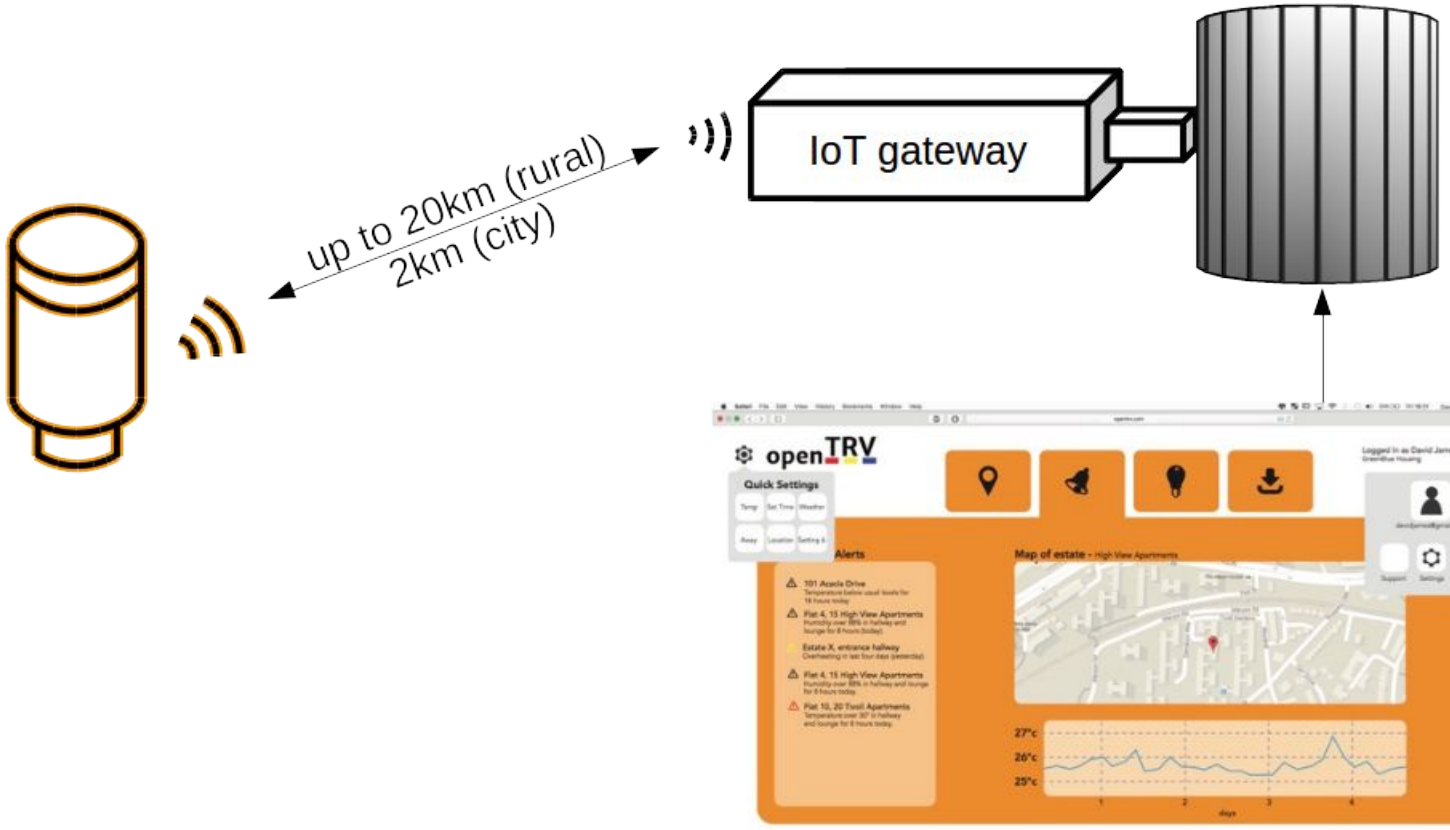
add a return temperature monitor and controller

manage return flow and temperature

demand management

Dashboard and metrics

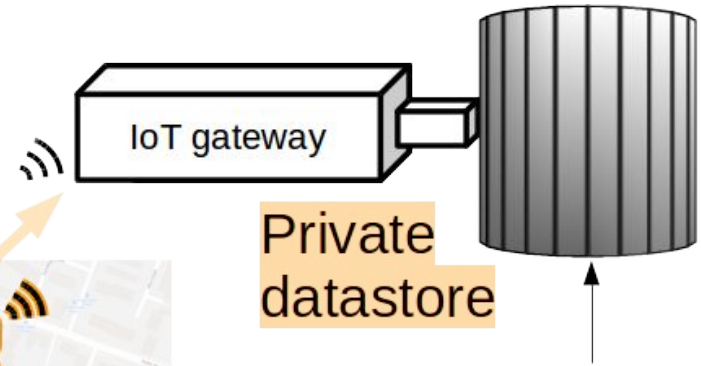
Long range smart TRV



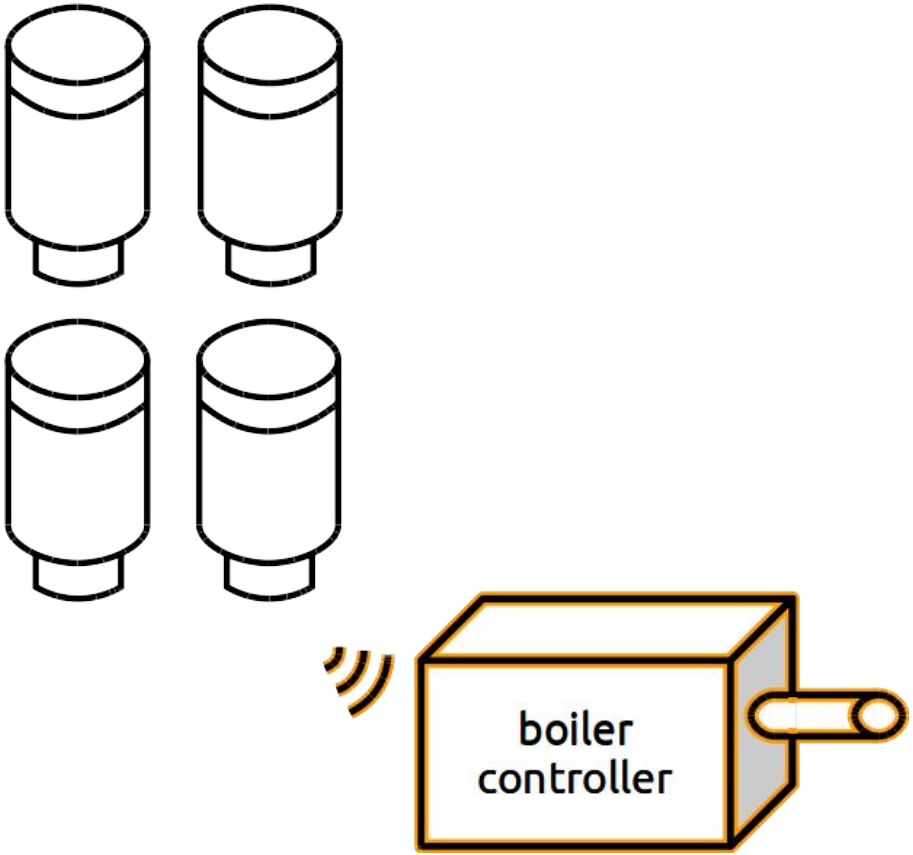
Estate rollout of long range TRVs

hundreds of homes
in 1.5km radius

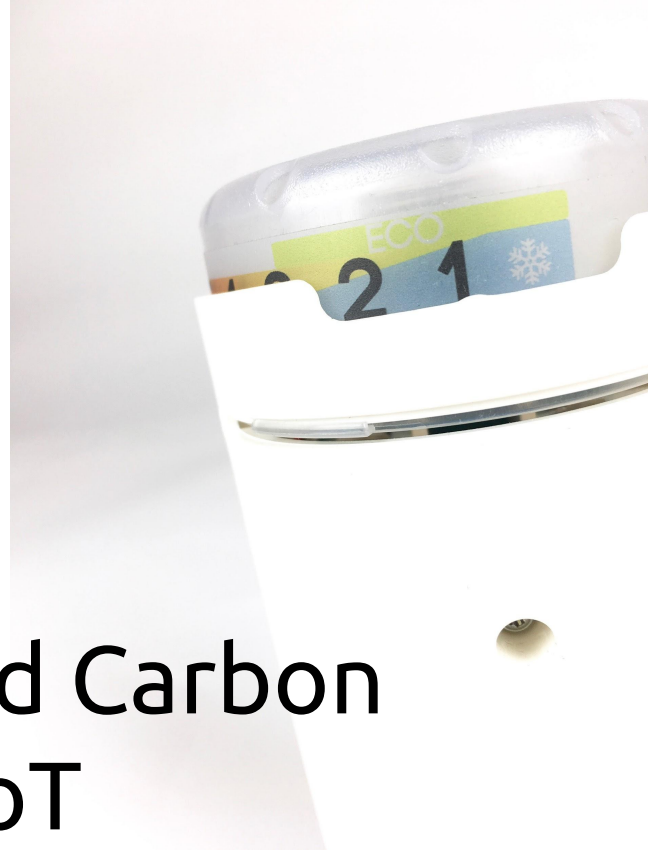
optional
boiler
controller



Electricity demand response



UK boilers contain 1GW potential demand response from water pumps



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