



Case study: Bicester Eco- town BPE

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Bicester Eco-town - a living lab for sustainable development

- Designed under Ecotown PPS -
i.e. **true zero carbon**
- Pushing the boundaries of
'mainstream' housing
- An exemplar to learn and inform
future legislation

Why would a developer sign up for that?

- Set as a planning condition
- Covers every building on site
- 5 years until the last dwelling is occupied
- Learning on all levels
 - Planning
 - Maintenance
 - Pipeline

Bicester Eco- town – the most comprehensively monitored development in the UK?

- Design stage - embodied carbon
- BPE testing & research – Innovate UK
- POE – inbuilt monitoring
- PhD research – Oxford Brookes
- Annual report- waste, transport, water

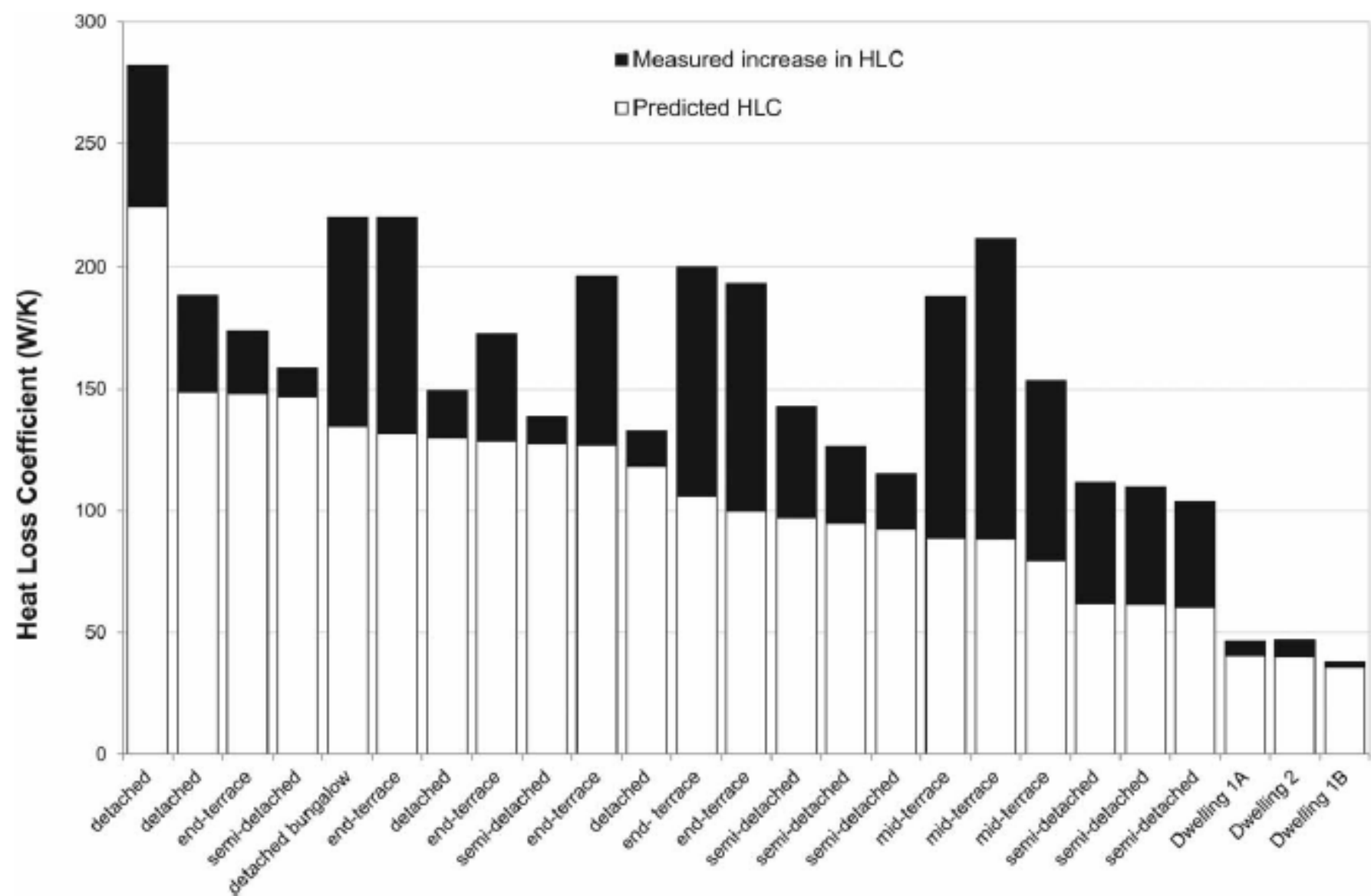


Figure 4 Measured versus the predicted heat loss coefficient (HLC) of the new-build co-heating database



Sense checking co- heating tests – 45% vs 29% over design

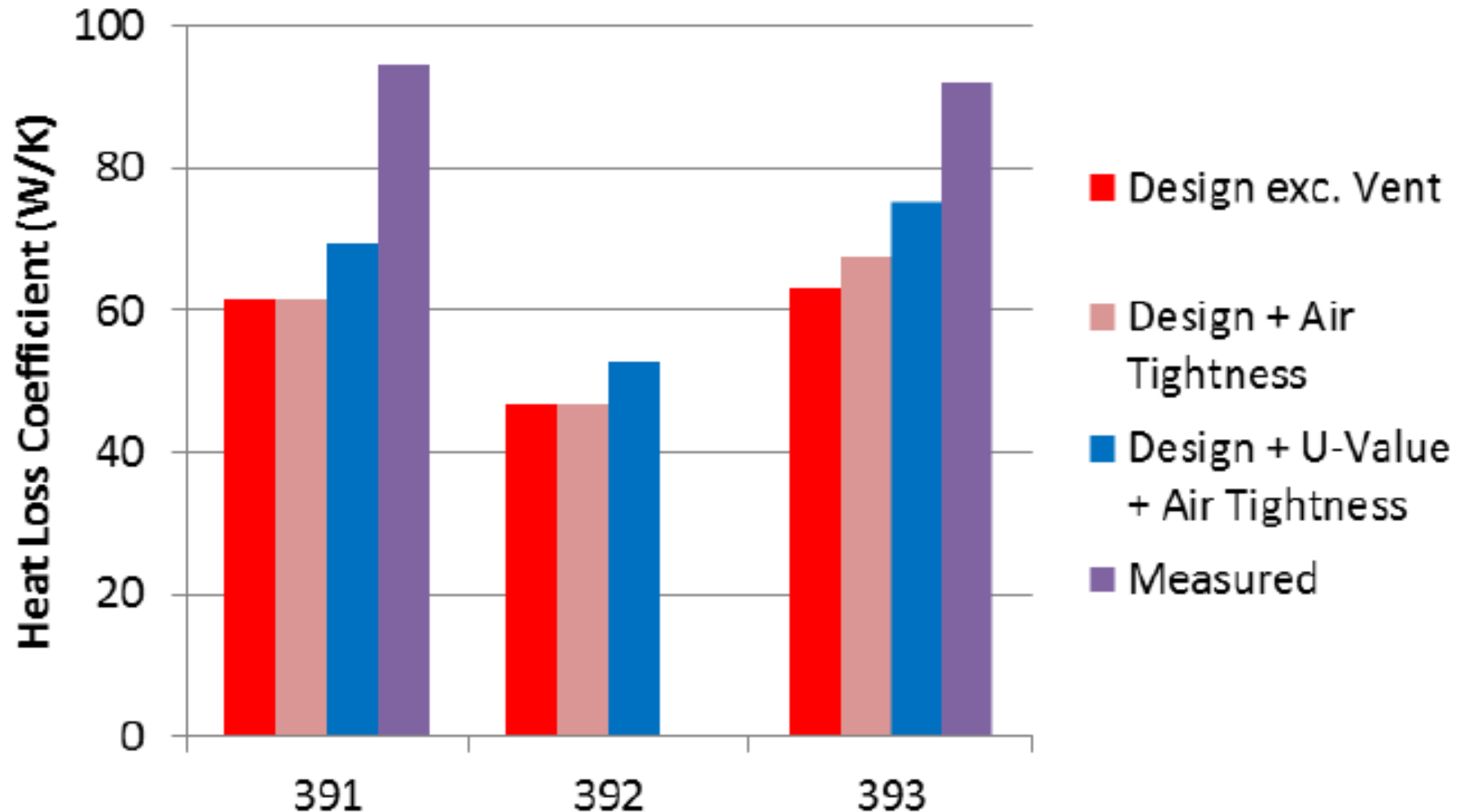


Figure 12: Design vs. Measured Heat Loss Coefficient

BEPIT

Toolkit Service





Critical process 2.03 – Sealing of DPM around services

Where the DPM forms part of the airtightness barrier, penetrations from rising services need to be sealed effectively. To ensure access for the application of tapes or grommets, services need to be positioned with sufficient space between themselves and the structure to allow for the correct amount of lap and adhesion.

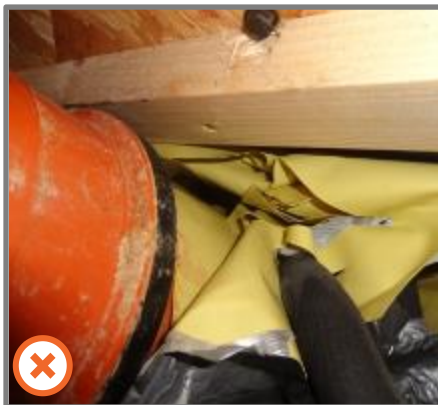


Figure A
Avoid using tape at inaccessible junctions



Figure B
Avoid sealing around multiple services



Figure C
Ensure all services are sealed individually



Figure D
Consider using a proprietary grommet system

BEPIT recommendations

Design	Design rising service positions with adequate clearance to suit the sealing method. Consider use of proprietary grommets
Procurement	Agree the method for sealing the DPM around rising services. Agree on the products to be used
Site start	Confirm the method for sealing the DPM around rising services. Confirm the availability of agreed products
Quality control	Check that services are sealed individually, with sufficient lap and that the taping is fully visible for inspection

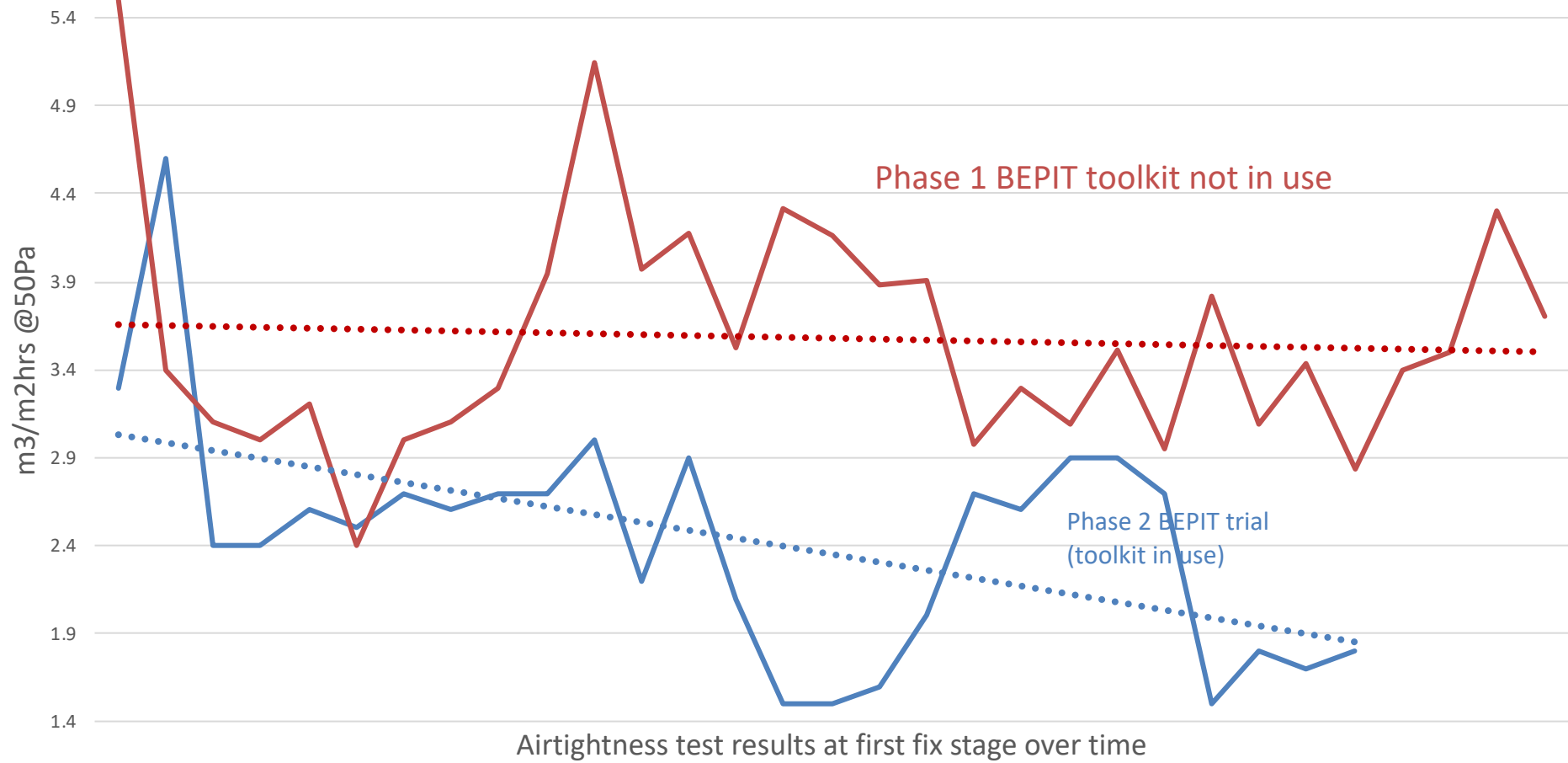
Performance improvement action

Ensure the services are sufficiently spaced to allow for access between them or around them during the sealing operation. Tapes are easiest applied to flat surfaces, so working with proprietary products such as pipe grommets is recommend. Take care to use the correct tapes suited to site conditions. Always seal services individually and with sufficient lap.

Potential effects if unaddressed

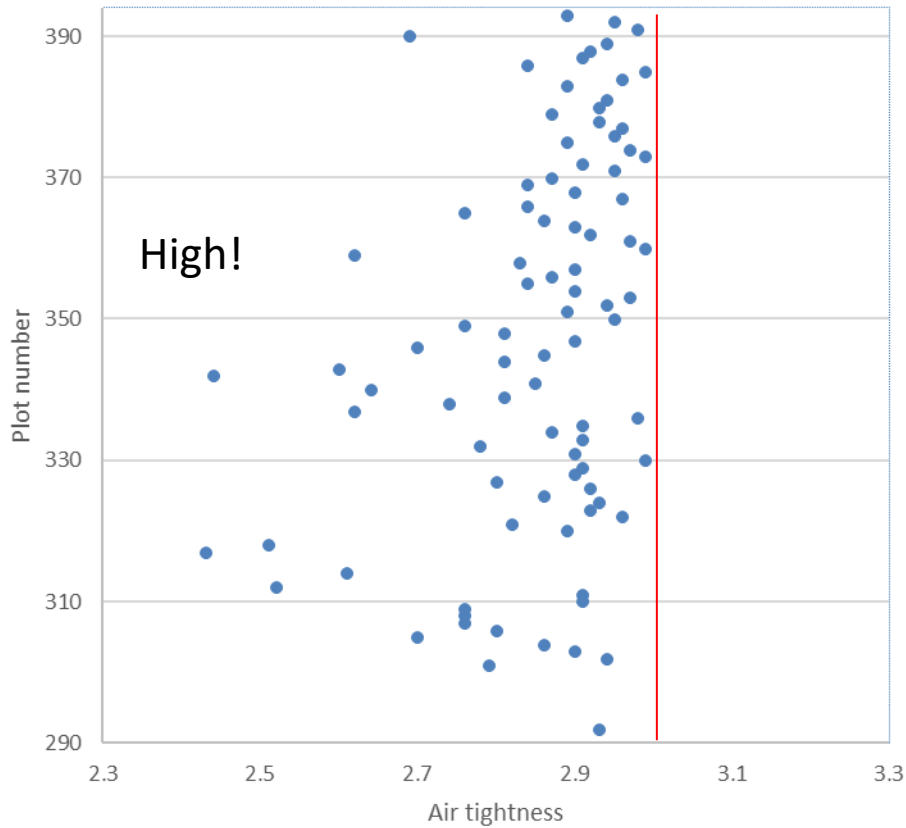
- Increased air permeability through the ground floor

Airtightness testing compiled

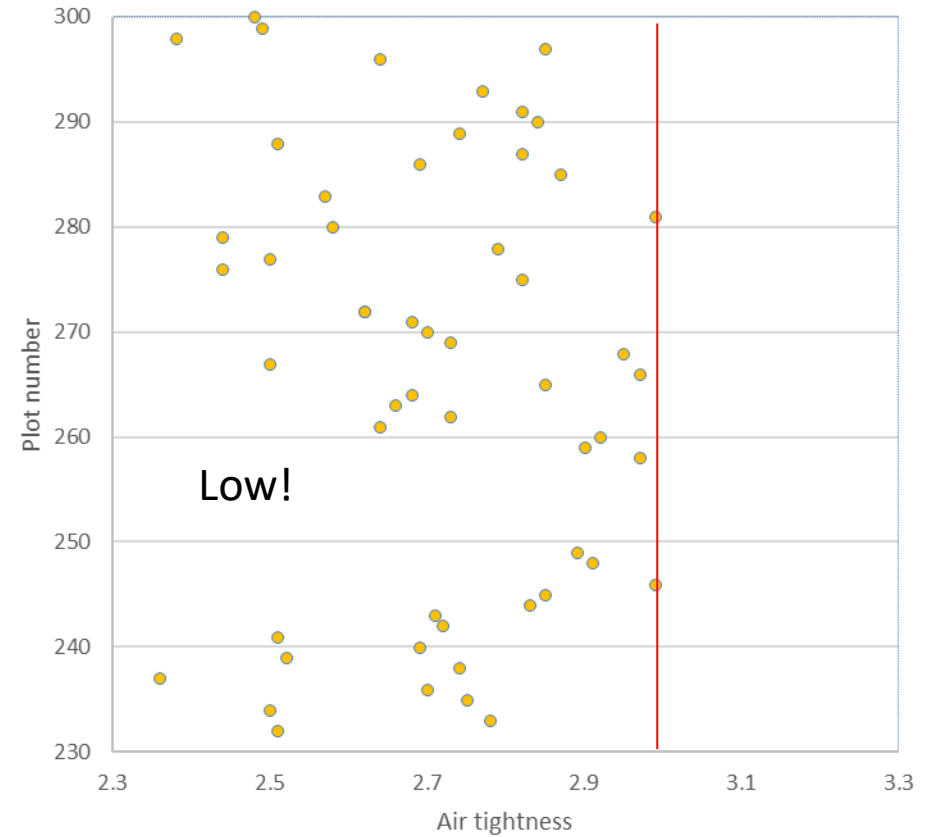


Distribution of results – the ‘first time pass’ graph

Result distribution completion test phase 1

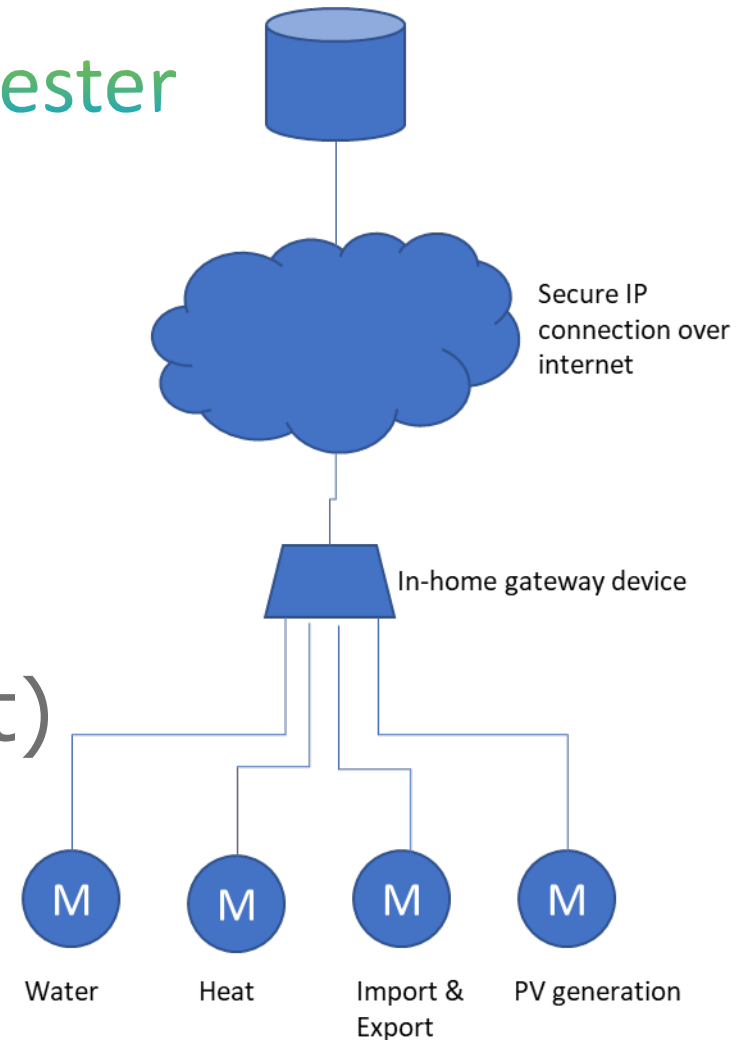


Result distribution completion test phase 2



The moniotring set up at Bicester

- Data architecture: Carnego Systems
- Real time data
- 1min granularity
- 1 kWh resolution (heat)
- 0.001 kWh (Elec, PV)
- Water 10 l resolution



POE monitoring takes time – as the data & collection process matures!

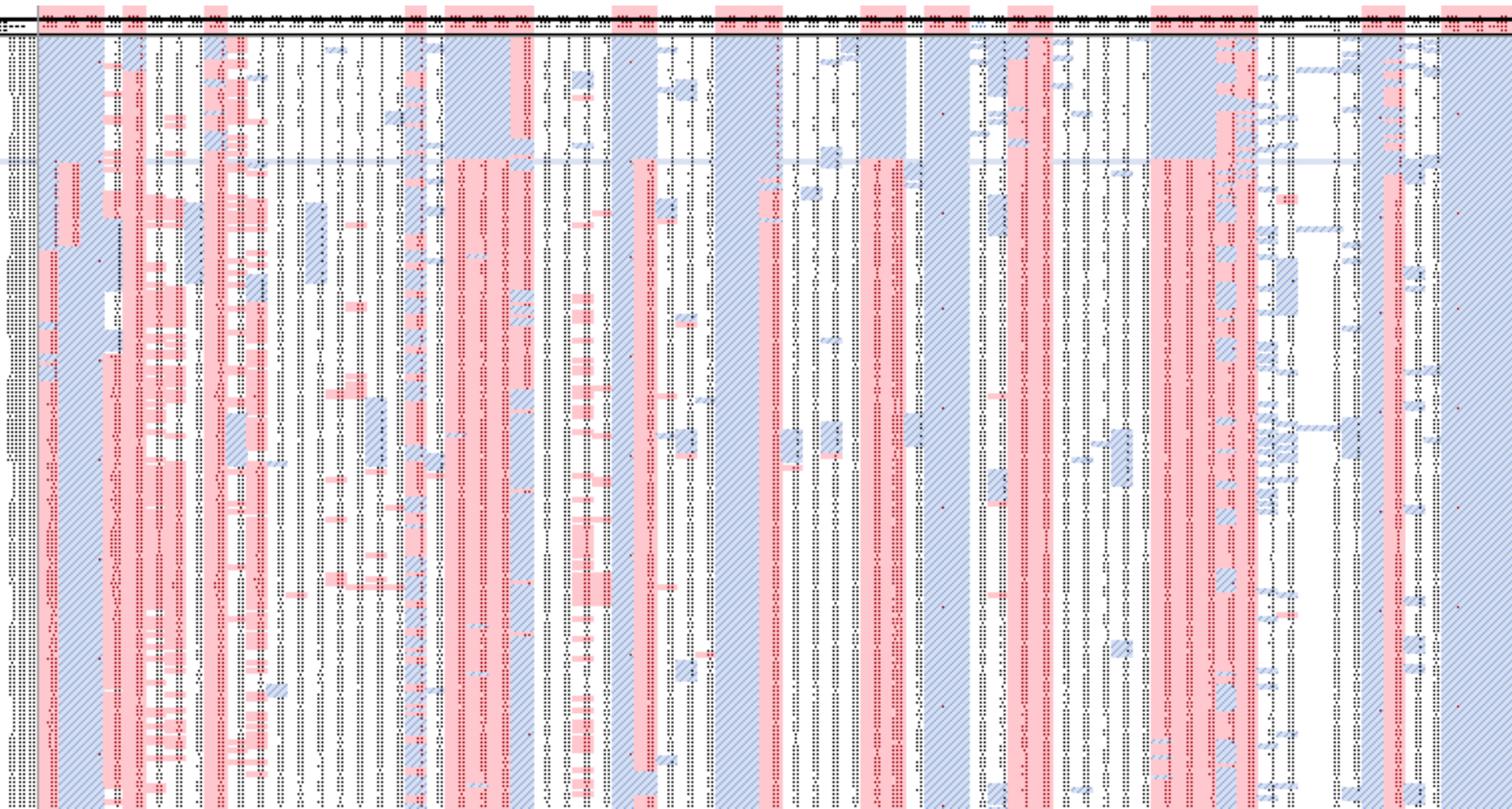


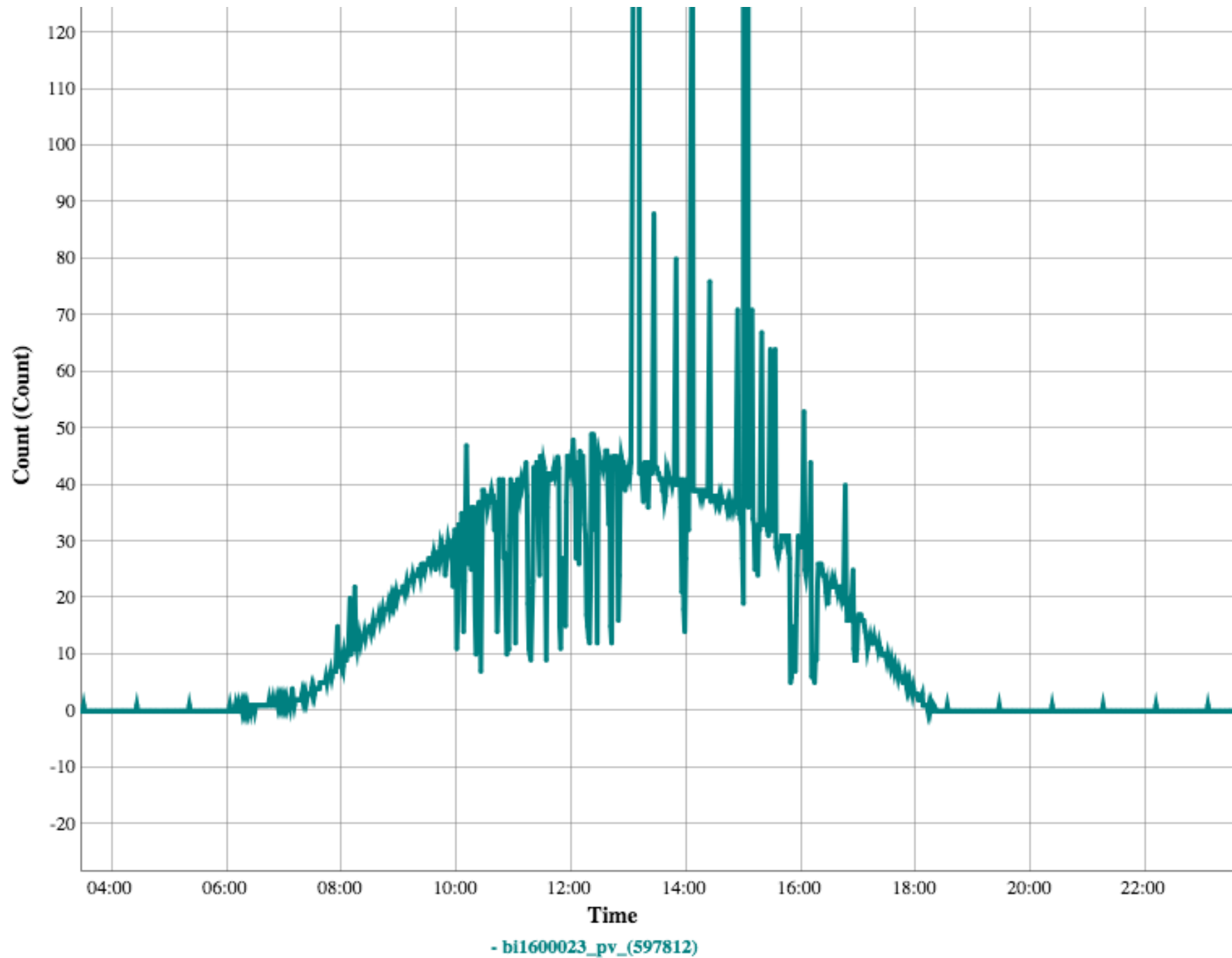
Bioregional

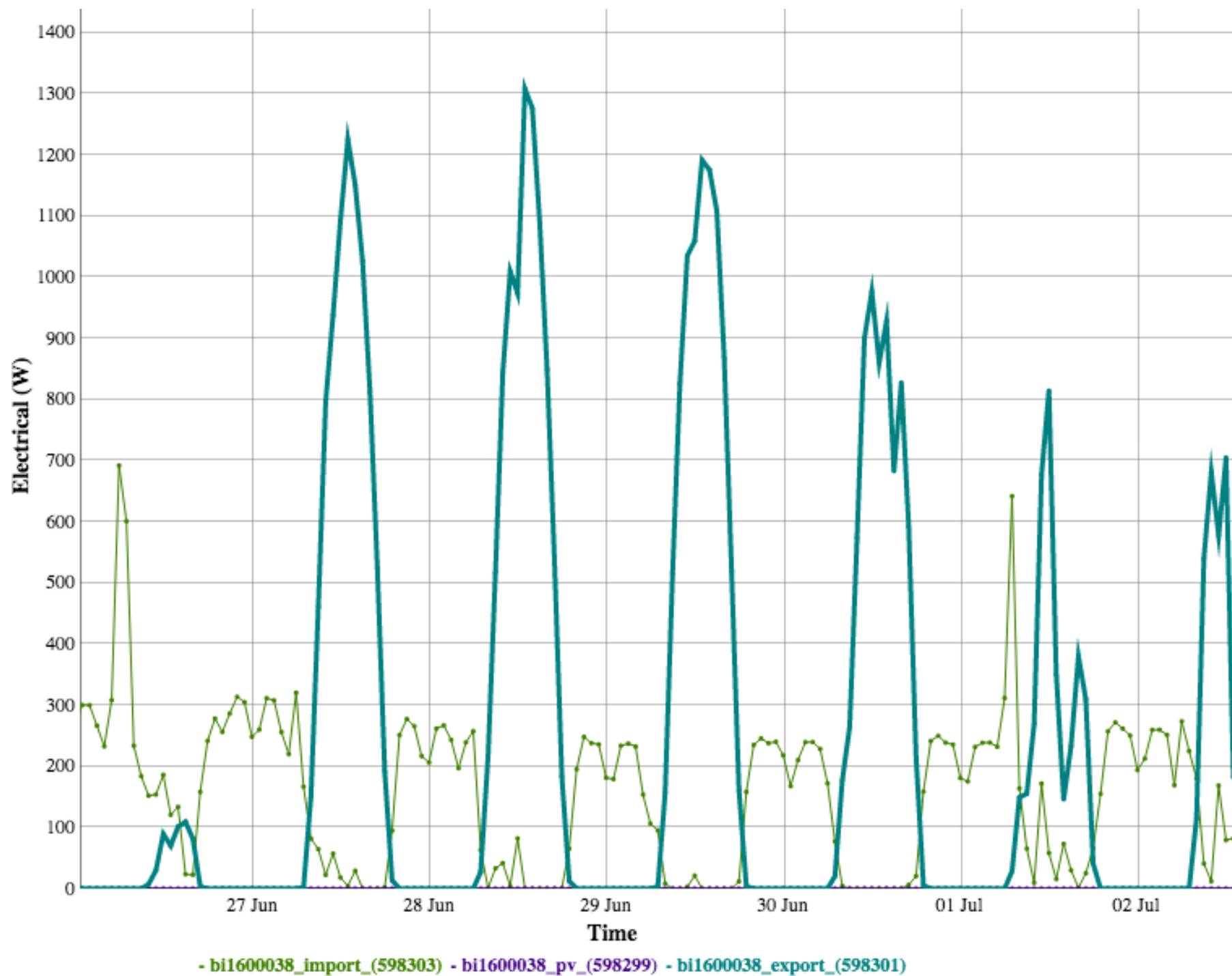
Data quality - some common issues..

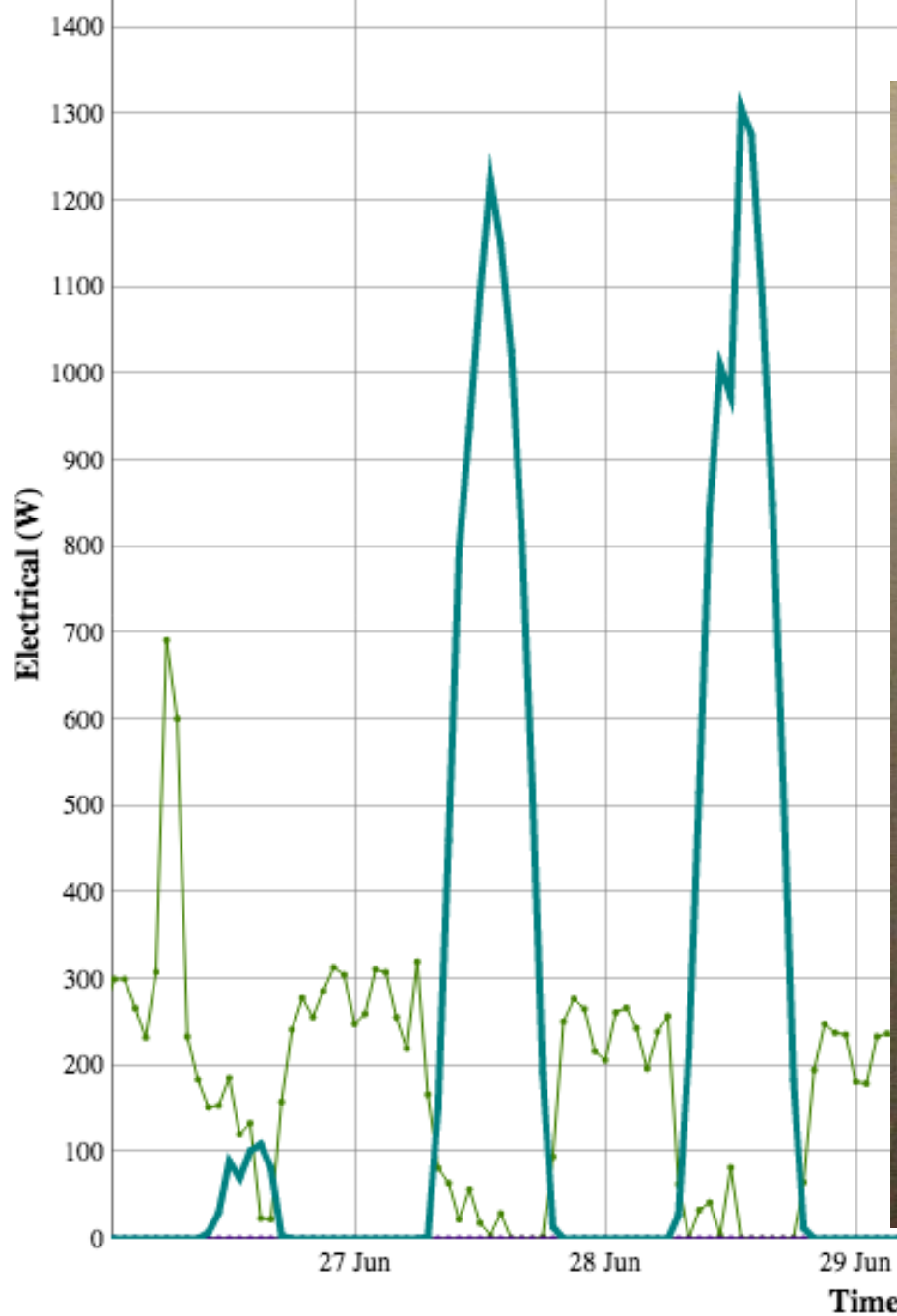
- Water leaks vs garden jacuzzi
- PV inverter outages
- Accidental shut off
- Geeks!
- Induced current
- Loose cables
- Server reboots

Assessing data quality...





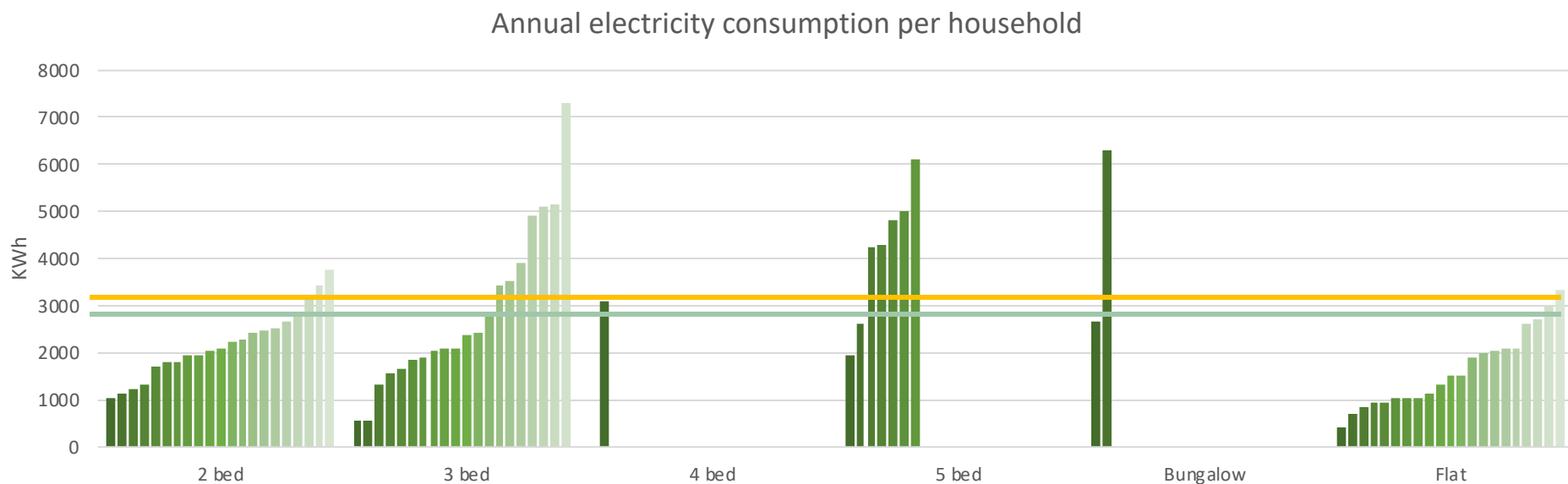




- bi1600038_import_(598303) - bi1600038_pv_(598299) - bi1600038_export_(598301)

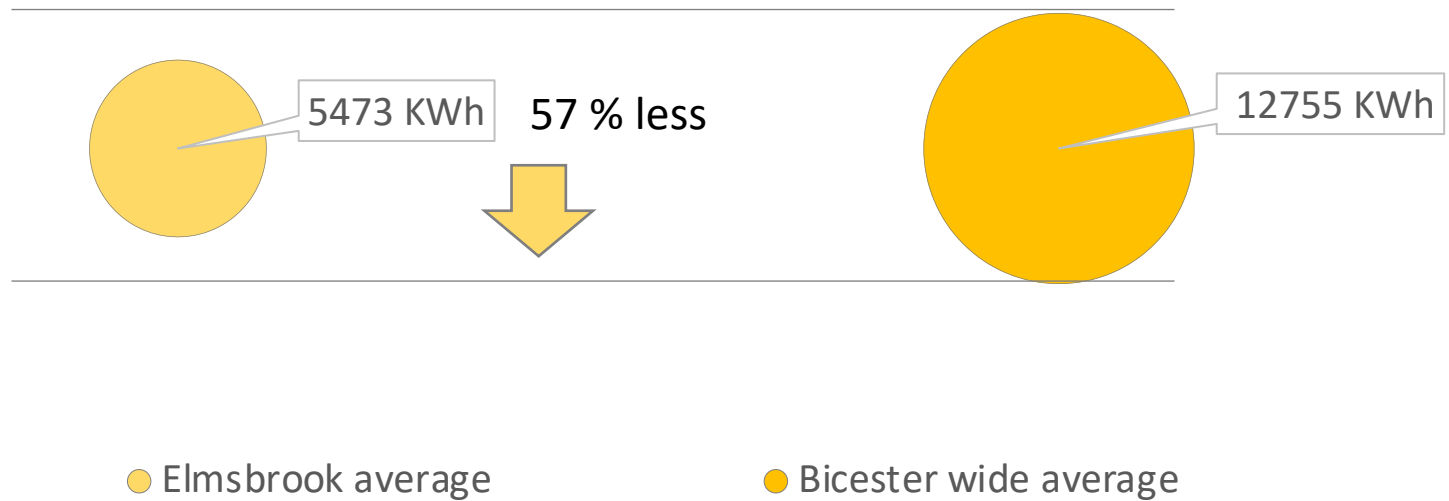


Scores on the doors – electricity point of use data year two



(NB: Green horizontal line = target, orange = average)

Scores on the doors – heat point of use data year two



Source: In house monitoring April 2017 to March 2018 – 118 households

National statistics gas usage by postcode 2015

Fabric performance: design vs 'at the meter' vs co- heating (space heating)

- 28.85 kWh/ m² / a (design)
- Sample 1: 36.37 kWh/m²/a
(measured at the meter)
= Performance gap of 26%
- Sample 2: 34.60 kWh/m²/a
= Performance gap of 20%
- Co- heating performance gap =
29% (Phase 1)

Sense checking co- heating tests – 45% vs 29% over design

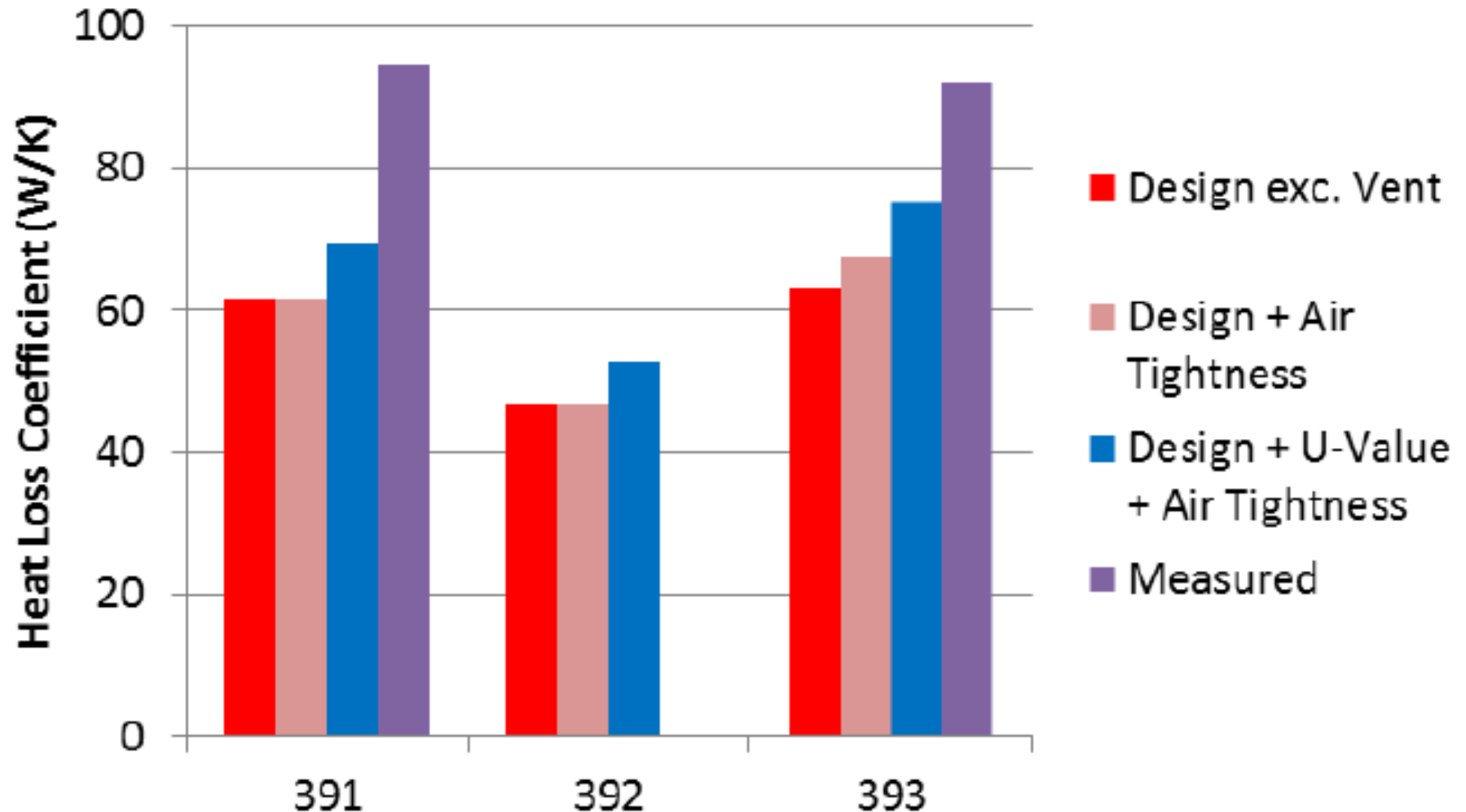


Figure 12: Design vs. Measured Heat Loss Coefficient

The energy balance at Bicester



Bicester

211,862 kWh PV export

304,600 kWh CHP export



UK

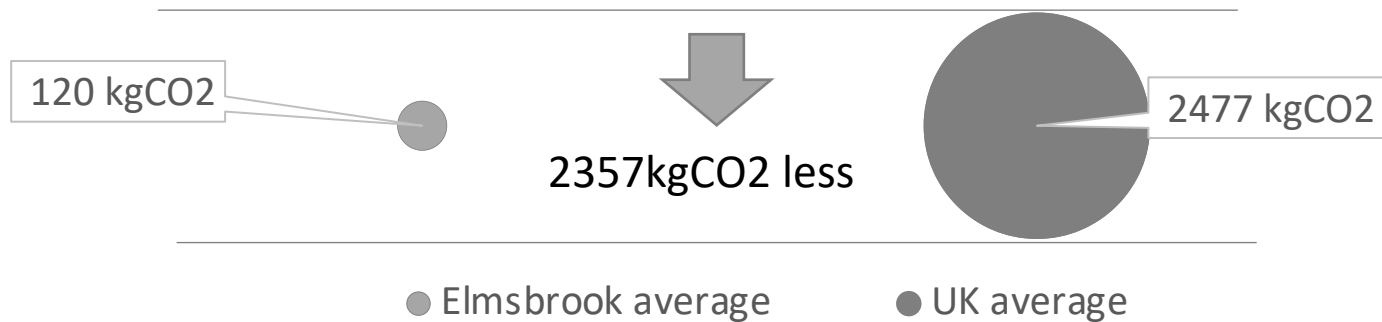
240,171 kWh Elec. Imp.



Net export = 276,291 kWh

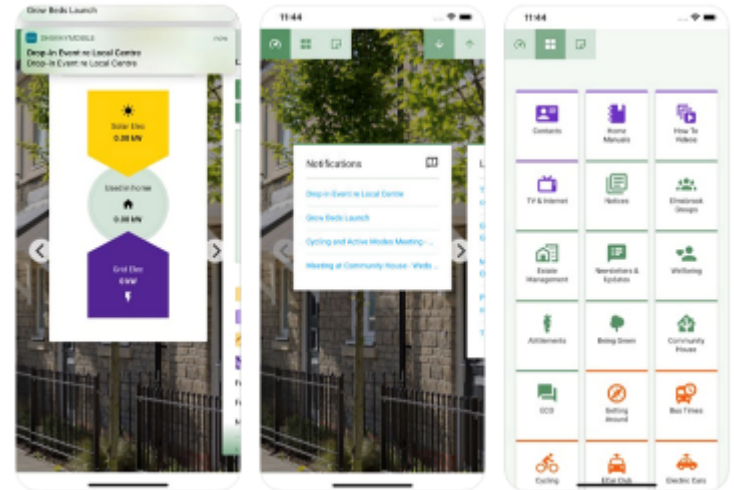
[this export displaces more carbon intensive grid electricity = saving, offsets our gas use]

Scores on the doors – point of use data year two



Key outcome of Bicester POE

- Feedback - on all levels!
- Focuses the builder
- Better meters
- Warning algorithms
- Development of APP



What do we need to do to increase the uptake of BPE in the UK housing sector?

- Demonstrate value!
- Target Housing Associations
 - Asset management
 - Grid management
 - Behavior change initiatives

Thank you!

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