Programme Area: Smart Systems and Heat

Project: Consumer Response and Behaviour

Title: Pilot Research Report Presentation

Abstract:

This report was prepared for the ETI by the consortium that delivered the project in 2013 and whose contents may be out of date and may not represent current thinking. This presentation sets out the results of the pilot study and makes recommendations for the qualitative element of consumer research to be carried out.

Context:

The delivery of consumer energy requirements is a key focus of the Smart Systems and Heat Programme. The Consumer Response and Behavior Project will identify consumer requirements and predict consumer response to Smart Energy System proposals, providing a consumer focus for the other Work Areas. This project involved thousands of respondents providing insight into consumer requirements for heat and energy services, both now and in the future. Particular focus was given to identifying the behaviour that leads people to consume energy - in particular heat and hot water. This £3m project was led by PRP Architects, experts in the built environment. It involved a consortium of academia and industry - UCL Energy Institute, Frontier Economics, The Technology Partnership, The Peabody Trust, National Centre for Social Research and Hitachi Europe.

ETI CRaB D5.4(i) Pilot presentation

Gareth Morrell & Lauren Kahn (NatCen)

Seb Junemann (PRP) & Tadj Oreszczyn (UCL)

29 January 2012

Overview

1. Qualitative Workshop pilot study
    - Design & aims
    - Recruitment & engagement
    - Topic guide & stimulus materials
    - Diary format & sequencing
    - Sequencing of qualitative study
    - Implications for main-stage study design
2. Residential Data Monitoring pilot study
3. Clarifications, Questions and Discussion
4. Afternoon workshop structure

WP5.4 Aims and objectives

RQ1 Consumer needs	- Mapping and measuring range of needs in relation to comfort, health, security, productivity, happiness. - Understanding priorities and dependent relationships - Identifying role of norms, preferences and standards	Quant Qual
RQ2 Consumer behaviour	- Mapping and measuring specific energy behaviours that are day-to-day, routine and one-off - Understanding generic and specific behaviours, their interaction with technology and how these vary over time	Quant Qual Monitoring
RQ3 Explaining behaviour	- Identifying why people adopt or change certain behaviour - Mapping and measuring factors influencing, enabling and constraining behaviour - Understanding awareness/knowledge and role of lifestyle	Qual (Quant)
RQ4 Variation across groups	- Demographics of individuals, h/holds and dwellings - Geographical location and physical infrastructure - Consumption patterns and broader attitudes	Quant Qual (Monitoring)

Role of qualitative work

- Mapping the range of needs and behaviours?
- Identifying factors that affect needs and behaviours?
- Understanding the difference between reported and actual behaviour?

Workshop pilot design

- 4 x 2h focus groups
- 8-10 participants per group
- 2 facilitators + 1 observer per group
- £45 incentive

	HH with children	Adult-only HH
Diary before FG	London N = 8-10 Needs-led discussion	Brighton N = 8-10 Behaviour-led discussion
Diary after FG + follow-up phone interview	Brighton N = 8-10 Behaviour-led discussion	London N = 8-10 Needs-led discussion

Workshop pilot aims

Desired insights

- Substantive
- Methodological

What we tested

- Recruitment & engagement
- Topic guide & stimulus materials
- Diary format & sequencing
- Overall sequencing of qualitative study

Sources of evidence

- Feedback from recruitment agency
- Feedback from participants
- Insights from facilitators & observers

Recruitment & engagement - Questions

What we aimed to test …

- Participants' **engagement** with materials
- Participants' **understanding** of information

- **Recruiters'** delivery of information – study & diary
- Ability to **achieve** sample targets

- **Reasons** for taking part / refusals
- Is research seen as too **burdensome**?
- Level of **incentive**

- **Appetite** for monitoring
- Potential **concerns** with monitoring

Recruitment & engagement - Findings

Recruitment materials / information

- ***Professional-looking*** information leaflet
- Recruiters gave ***accurate*** study explanation
- Some lack of ***clarity*** on overall aims / Misperceived as market research

Achieved sample

- High attendance rate (39/40)
- Good match with target primary sample criteria
- Diversity – gender housing type, tenure, heating systems

Reasons for taking part / refusal

- Suitable ***incentive*** = main reason for taking part
- Heat energy = ***relevant/timely*** topic
- ***Venue*** - local place of interest a draw-card
- No study-specific reasons for refusal

Reasons for taking part

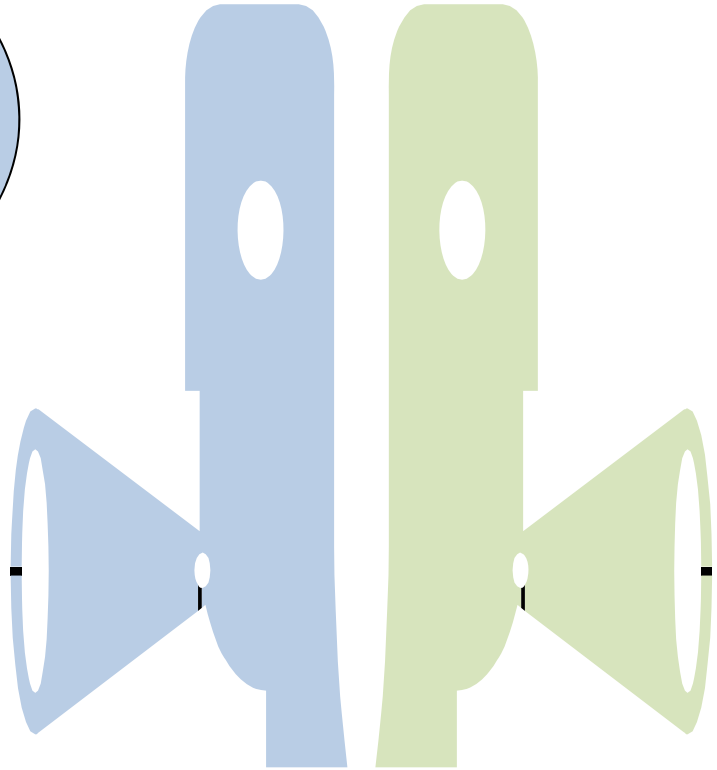
What worked

"I thought 'what the hell'…I stopped, and they [the recruiters] mentioned money and I was like YEAH!"

"You wouldn't do it for free!"

Challenges

"I thought it would be like an energy company [at discussion] and we were going to bloody complain!"



Recruitment & engagement – Findings (2)

Most people open to idea of monitoring … BUT…

- ***Reassurances needed:*** anonymity, data security, damage to walls; number of wires; running costs; data type (no images!)

Monitoring burden / incentive

- ***12 month***: viewed positively, cover all seasons
- ***Incentive***: amount & structure viewed positively
- ***Relevance***: How will data be useful to participant?

The monitoring 'pitch'

- ***When?*** Follow substantive discussion – 'warm up' to idea
- ***How?*** Images aid discussion (use images to-scale/actual devices). Avoid term 'monitoring'
- ***Who?*** Non-expert (accessibility) + 'Experts' (authority, technical detail)
- ***Caution:*** Managing negative responses in workshop

Views on monitoring

Willingness

"I don't have an issue with the it [devices] other than would it damage my walls"

"I think in a way it would be more beneficial than having the diary. It would be much more accurate."

"If I could save £200 over 12 months as a result of that [monitoring], I would be more than happy to have those things [devices]."

Concerns

"I want to know how these things [devices] are going to be fixed to the walls because I wouldn't want my wall damaged"

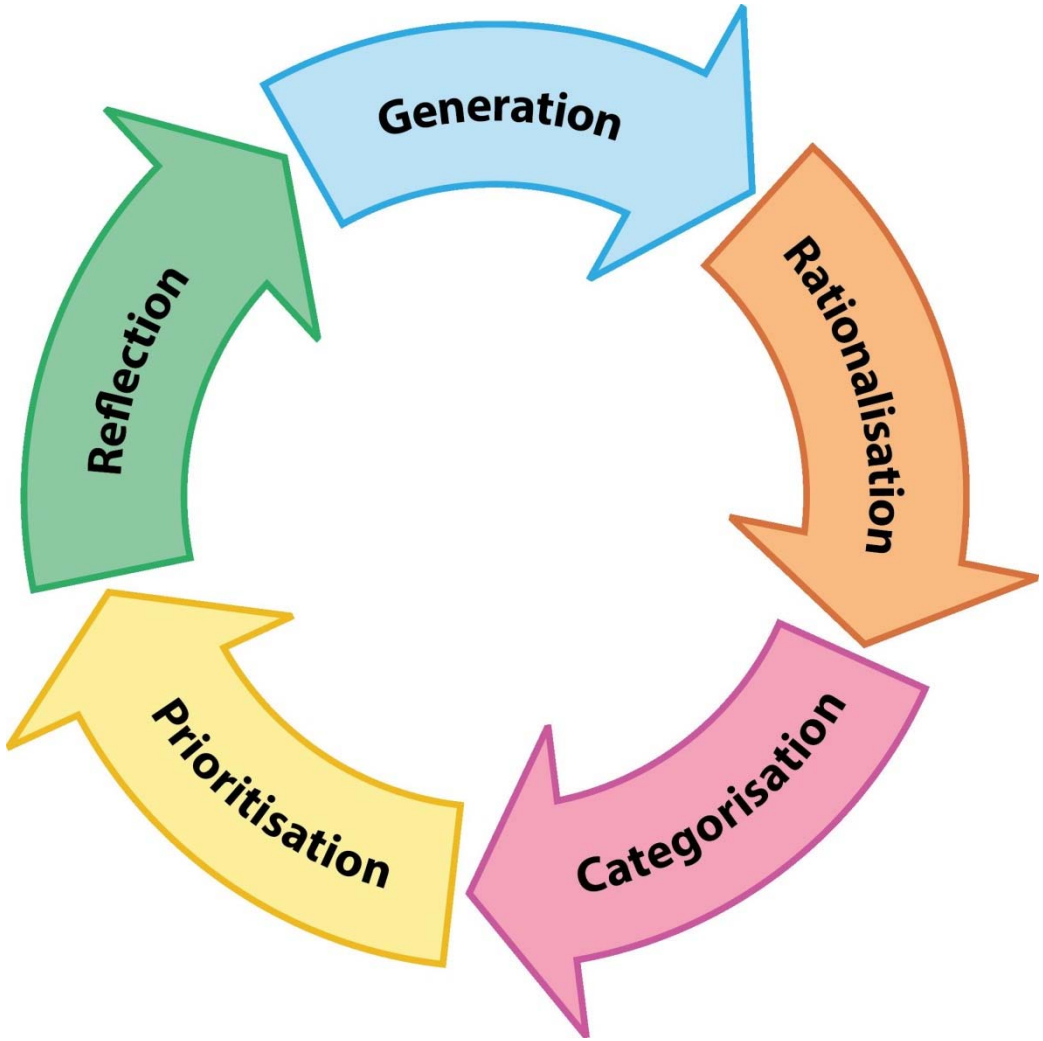
"I think people will be willing to have these [devices] put in their homes. But when it comes to the quarterly visits, then its about the financial incentives."

"If they [researchers] start telling you what you can and can't do in your own home, then that would put me off"

Topic guide and stimulus tools - Questions

What we aimed to test

- Overall **format** of topic guide
- Needs-led **versus** behaviour-led
- **Vignettes** – relevance; ability to prompt critical reflection



Topic guide & stimulus tools – Findings

Overall format is effective

- Staged journey to deeper critical reflection,
- e.g. from 'to get warm' to 'comfort', 'mood', 'unconscious habits'

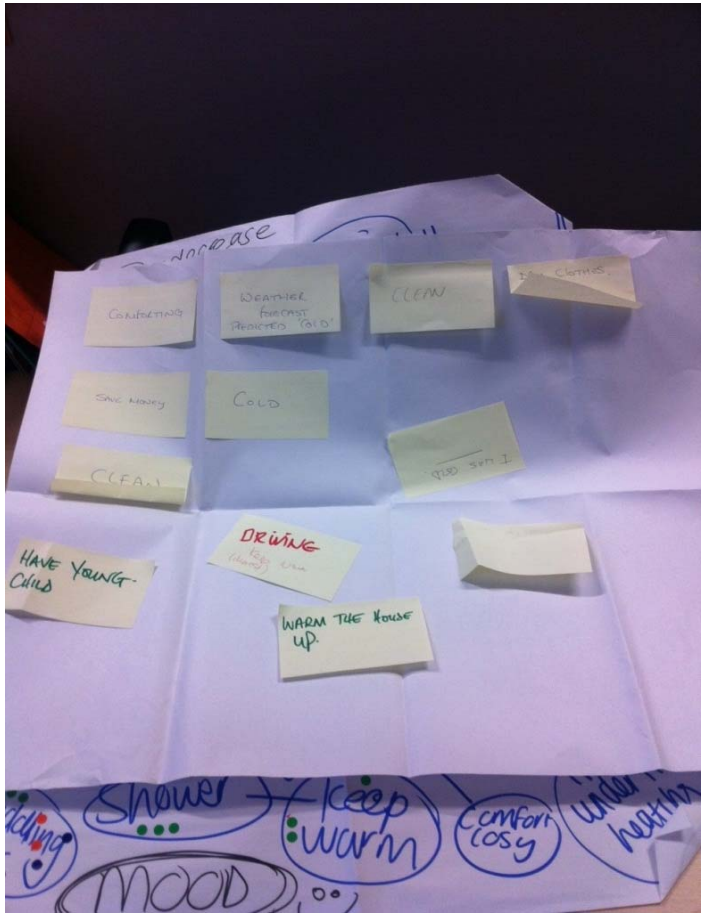
Behaviour-led approach is optimal

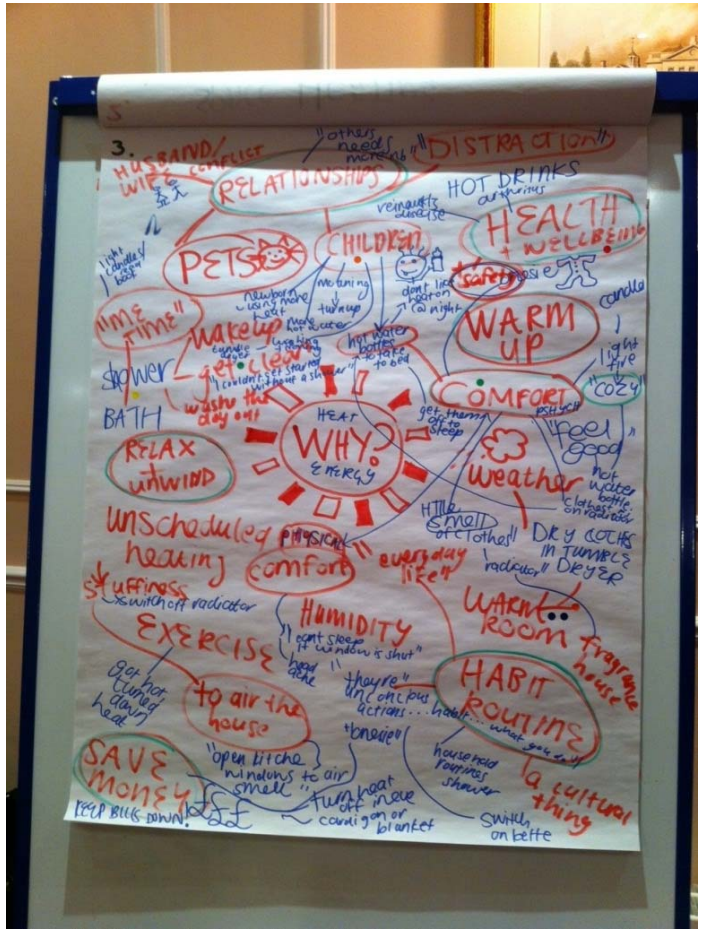
- Behaviour = easier concept to grasp
- Better flow & grounds discussion in needs
- Quicker to get beyond 'obvious' needs

Vignettes = effective/relevant stimulus tool

- Aid deeper exploration of issues through comparison
- Prompt discussion on issues that do not emerge spontaneously
- Could use more flexibly through-out discussion
- Sign-posting/prompts for facilitators

Mapping heat energy needs & behaviours





Generating

Categorising

Storyboard 1: Introduction

START
DM1 – Turning heating on
"I am in charge of bills"

1

[1]
B1 – Heating (Temp)
Husband puts heating on too high

2

[2]
N1 – Health (Spouse)
Heating on all time as husband is ill

3

[3]
B2 – Heating (Freq)
Heating on all the time

4

[4]
N1 – Health (Child)
Heating on all the time because of baby

5

[5]
I1 – Expense
Expensive to have heating on all time

6

[6]
B2 – Heating (Freq.)
Heating on all the time b/c weather

7

[7]
N1 – Health (Child)
Heating on all the time because of teenager

8

[8]
I1 – Expense
Dreading bills

9

[9]
E – Energy prices
Energy prices rising

Transition
"Go to work early. come back latish at night. So therefore nothing [changes]. The heating is on a timer & rooms have thermostats so you don't touch anything"

10

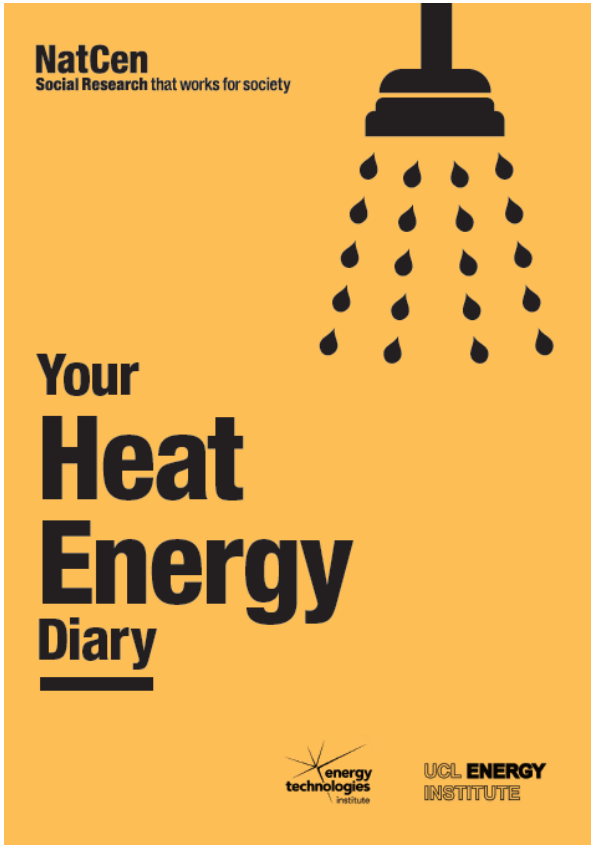
[10]
B3 – Heating (Freq.)
Heating behaviour not change weekly b/c of work and use of timer. Don't have to do think.

New segment

Influences on behaviour
- Routine/habit
- Weather
- Dependents/spouse
- Size of property

Key
- DM = Decision making
- B = Behaviour
- N = Needs
- I = Implication
- E = External factors/constraints

Format & sequencing of diary - Questions



Diary task – format & content

- Clarity of instructions
- Length and nature of task
- Paper vs online

Diary as stimulus tool

- Does diary work encourage deeper reflection?
- Impact on awareness / behaviour?

Sequencing of diary & group discussions

- Understanding diary task?
- Does diary work (DB) put people off taking part?
- Level of engagement/completion rates?
- Depth of critical reflection?

Diary example – John's day

What did you do and what did you use?	Why did you do this?	Did you decide on this on your own or with someone else?	When did you do this?	
Turned up the room thermostat	*Feeling very cold this morning – it was below freezing last night*	*Children agreed*	Morning	✓
			Afternoon	
			Evening	
			At night	
Turned on the shower	*To have a shower before work this morning*	*On my own*	Morning	✓
			Afternoon	
			Evening	
			At night	
Lit a fire	*Wasn't that cold but it just felt nice to have the glow of the fire.*	*The whole family was home for a change, and we were chatting together in the lounge. I thought it would be a good way to keep us all in one place!*	Morning	
			Afternoon	✓
			Evening	
			At night	
Dried clothes on the radiator	*It was raining outside*	*Out of my control – the weather decided for me!*	Morning	
			Afternoon	
			Evening	✓
Opened the kitchen window	*To let out the cooking smells*	*My wife was complaining about the smell*	Morning	
			Afternoon	
			Evening	✓
			At night	
Switched off the radiator	*Don't like sleeping with the radiator on. It gets stuffy.*	*On my own*	Morning	
			Afternoon	
			Evening	
			At night	✓
Filled a hot water bottle	*It was a really cold night, but didn't want to waste gas / electricity. Our bills have been way to high!*	*My wife and I have been discussing ways to save money – we thought we could cut back by saving money on gas*	Morning	
			Afternoon	
			Evening	
			At night	✓

Format & sequencing of diary - Findings

Diary format & content

- Instructions carried out well – clarify 'record what you do'
- Length & nature of task = good starting point for group work
- Paper = effective medium for group work

Diary = effective stimulus tool (DB &DA)

- Good understanding of task
- Good engagement / prompted deeper reflection
- Grounded & structured 'generation' task
- Reported > awareness, no behaviour change

Diary-before approach is optimal

- Diary as 'homework' task not a reason for refusal
- 100% completion rates (DB group)
- Appetite for pre-FG diary work (DA group)
- DB group = helped think about issues beforehand, better starting point/deeper reflection in group discussions

Reflections on the diary task

Positive reflections

"It didn't take me long to complete at all"

"Towards the end of the week, I was becoming more conscious about the things I do…you know habitually."

"I think it [diary] made me realise I have the heating on more than I thought."

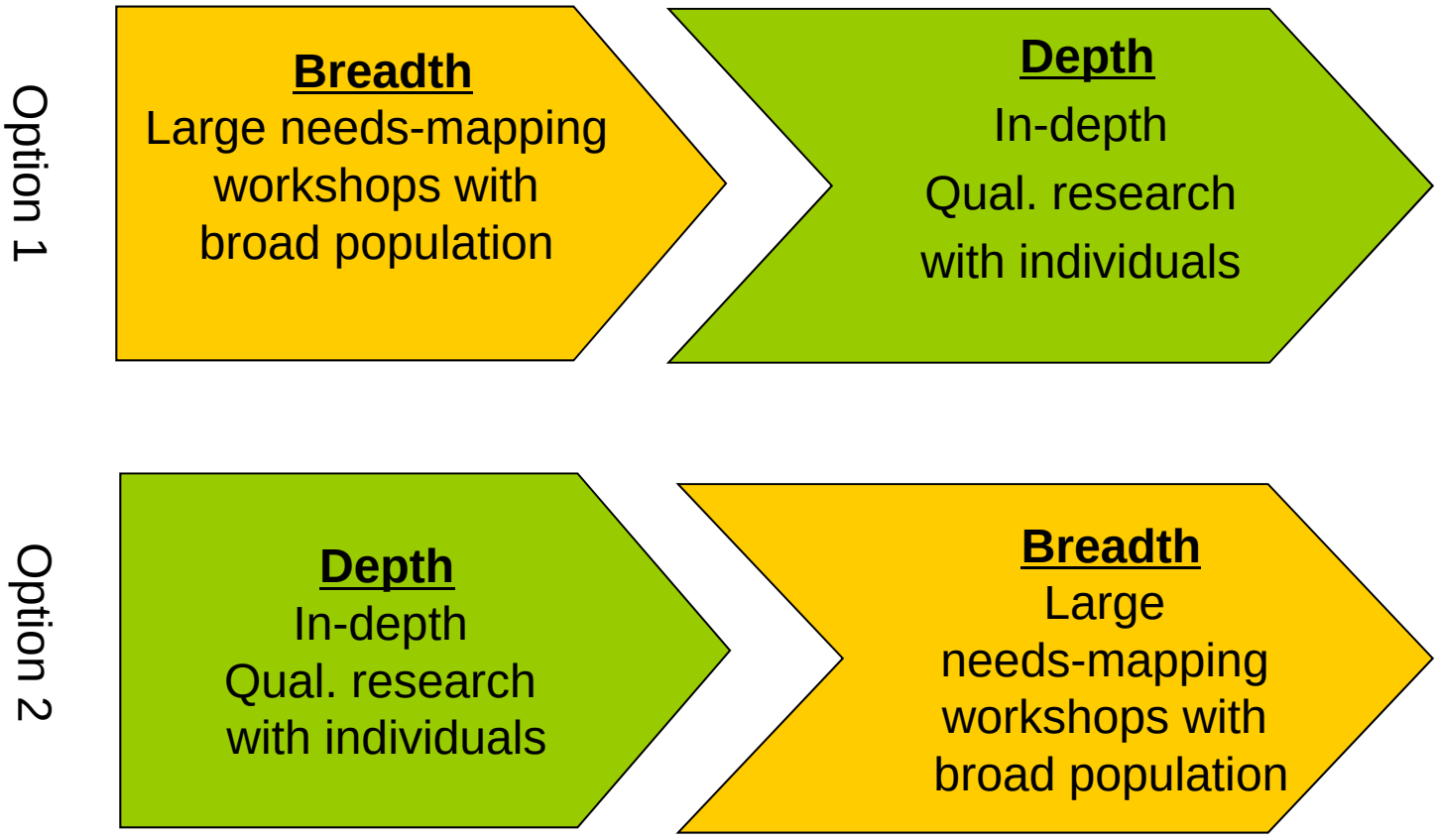
"The diary has made me more heat energy aware – it's made me realise how so much energy use is down to routine."

Challenges

"It was quite boring doing the diary…you're practically writing the same thing everyday"

"Our diaries are quite basic compared to the kind of stuff we have come up with [at discussion]"

Sequencing of qualitative study – Questions

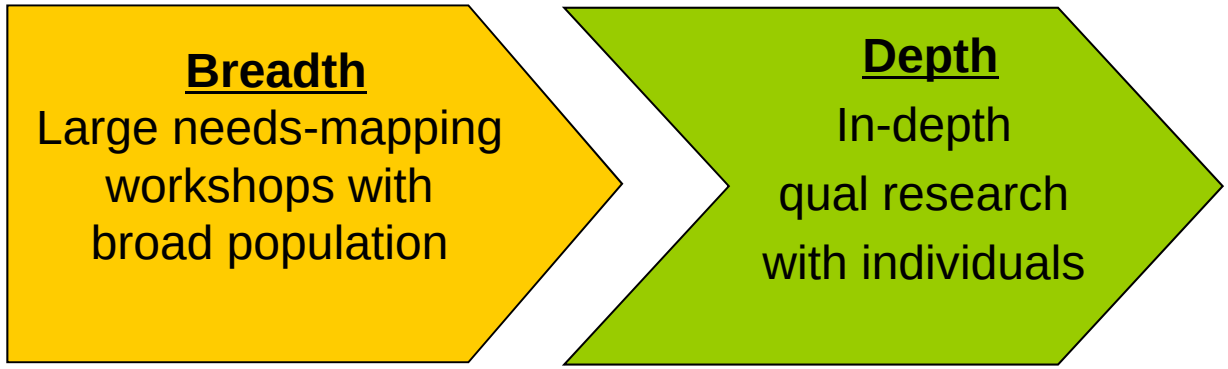


Sequencing of qualitative study – Findings

Option 1 preferred → Group discussions:

- Yielded ***sufficient breadth*** required for Option 1
- Engaged interest in heat energy = ***appetite for monitoring***
- Started critical reflection process – better ***depth of insight*** in monitoring-based qual. interviews

Option 1



Summary of workshop design implications

Tested	Mainstage design implications
Recruitment & engagement	• Employ same recruitment agency/approach • Replicate look/feel of pilot info leaflet; refine content • Clarify broader aims; not market research • £75 Incentive sufficient; venue nb • Monitoring 'pitch'
Topic guide & stimulus materials	• Generation / rationalisation / categorisation / prioritisation • Behaviour-led discussion • Vignettes to be used flexibly
Diary format & sequencing	• Diary before workshops • Clarify diary instructions • Task as in pilot - length & nature
Sequencing of qual study	• Breadth (large group discussions) then depth (in-home individual interviews)

Data Monitoring pilot

Background

- Equipment installed in three properties to test:
  - Installation/decommissioning process and consortium response
  - Resident feedback
  - Performance and process for interview input

Findings

- Effective installation and communication processes
- Robust H&S management (mock incident managed)
- Equipment communicating remotely

Strengths/Weaknesses of approach

- Minor lessons learned (surface cleaners, record sheet)
- Processes and support effective for main trial
- Minor software glitches, resolved mid-pilot
- Assessment ongoing

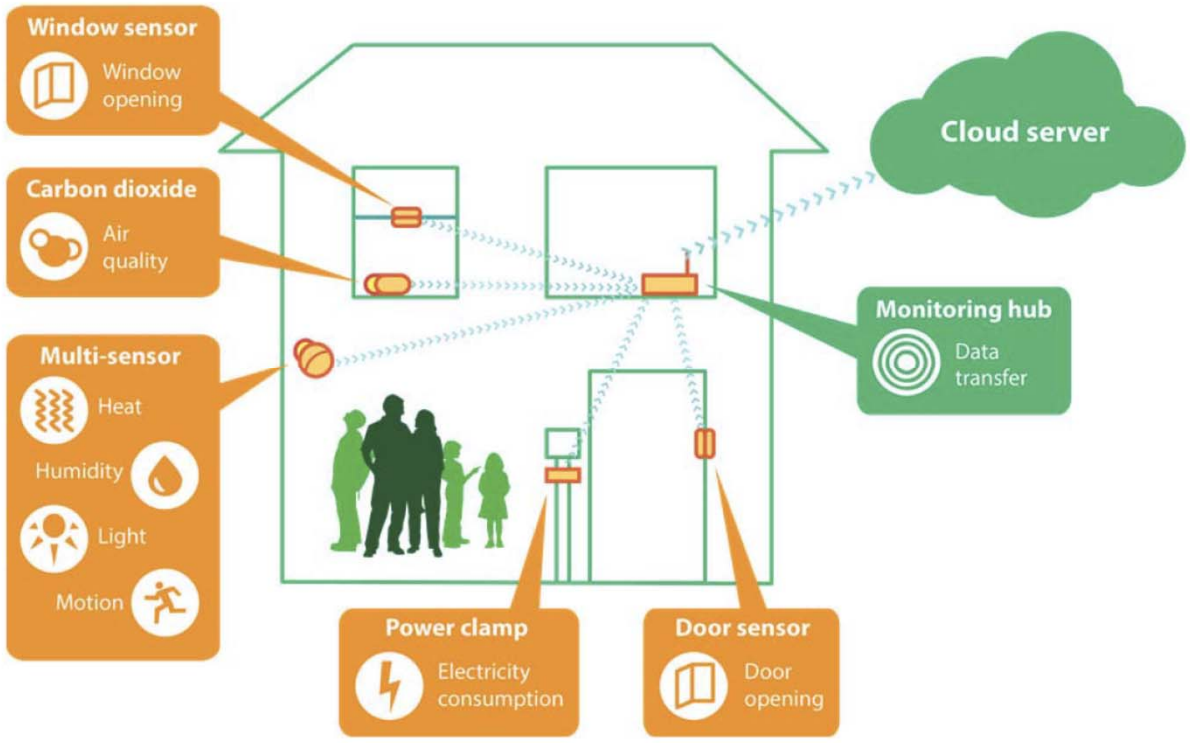
Data Monitoring pilot

Still to come

- Data to be reviewed and inform interviews
  - Early data reviewed
  - To be assessed against aims
- Walkround interviews to take place
  - UCL analysis to inform NatCen interview script
- Decommissioning and resident feedback
  - Decommissioning 4th February
  - Lessons learned from decommissioning and residents
- Ongoing testing of CO_2 and hot water proposals
- Feedback agreed at a later date

Data available so far from pilot

- Multi-sensor data:
  - Temperature
  - Relative Humidity
  - Occupant Presence
  - Luminance
- Door opening
- Three dwellings
- Two time periods:
  - 14th Jan-20th Jan
  - 22nd Jan-24th Jan



Disclaimer

The logger system development, its installation and the analysis were all carried out at a rate which is known to introduce errors.

A software glitch delayed delivery of the logged data. This analysis is very preliminary and needs to be questioned!

No analysis of radiator sensors has been undertaken because their data can not be accessed remotley.

However useful lessons heave been learnt.

Missing data for multi-sensors (temperature, relative humidity and luminance)

38% of all data is missing

Additional data is erroneous or strange

Out of 17 installed multi sensors, 7 were found to have sufficient data loss that the monitored period could not be reliably interpolated from the logged data

	Node	Logged period		Logging Interval (s)	Number of readings		
		First Reading	Last Reading		Observed	Expected	Missed
H1	3	14/01/2013 10:31	20/01/2013 19:24	1680	53	328	84%
H1	11	14/01/2013 10:42	20/01/2013 23:41	1680	200	337	41%
H1	15	14/01/2013 10:15	20/01/2013 23:48	1680	337	338	0%
H1	19	14/01/2013 10:46	20/01/2013 23:34	1680	298	336	11%
H1	23	14/01/2013 10:24	20/01/2013 22:30	1680	208	335	38%
H1	27	14/01/2013 10:25	20/01/2013 23:54	1680	337	338	0%
H1	3		24/01/2013 09:02	1680	62	91	32%
H1	11	22/01/2013 14:55	24/01/2013 08:57	1680	89	91	2%
H1	15	22/01/2013 14:35	24/01/2013 09:06	1680	90	92	2%
H1	19	22/01/2013 14:58	24/01/2013 09:08	1680	88	91	3%
H1	23	22/01/2013 14:42	24/01/2013 08:46	1680	72	91	21%
H1	27	22/01/2013 14:41	24/01/2013 09:11	1680	86	92	7%
H2	3	14/01/2013 14:56	19/01/2013 03:55	1680	230	234	2%
H2	7	14/01/2013 15:33	19/01/2013 03:58	1680	215	233	8%
H2	11	14/01/2013 14:58	19/01/2013 03:54	240	534	1634	67%
H2	15	14/01/2013 15:00	19/01/2013 03:54	240	303	1634	81%
H2	19	14/01/2013 14:59	19/01/2013 03:56	240	1534	1635	6%
H2	27	14/01/2013 15:01	19/01/2013 03:58	240	1257	1635	23%
H2	3	23/01/2013 14:08	24/01/2013 19:10	1680	63	63	0%
H2	7	23/01/2013 14:36	24/01/2013 19:11	1680	56	62	10%
H2	11	23/01/2013 13:43	24/01/2013 19:18	240	93	444	79%
H2	15	23/01/2013 17:19	24/01/2013 17:22	240	64	361	82%
H2	19	23/01/2013 13:45	24/01/2013 19:17	240	440	444	1%
H2	27	23/01/2013 13:43	24/01/2013 19:15	240	423	443	5%
H3	6	14/01/2013 13:23	19/01/2013 18:08	240	1779	1872	5%
H3	8	14/01/2013 13:22	19/01/2013 18:09	240	1782	1872	5%
H3	9	14/01/2013 13:25	19/01/2013 00:09	240	7	1602	100%
H3	10	14/01/2013 13:33	19/01/2013 17:10	240	357	1855	81%
H3	12	14/01/2013 13:24	19/01/2013 18:09	240	1668	1872	11%

Examples of strange data

- Sensor H1 S15 always logs 15C and 248 lux
- H1 sensors S19 and S27 seem to be in sync with each other on temp and it records max lux 1 hour after sunset?
- Kitchen H2 sensor S19 spikes to 50C (the max value).
- Living space H2 Sensor S27 spike at 0C (not the minimum) from 2:38 to 2:46
- H3 sensor 12 spikes at -17C at 1am when outside at -0.5C.
- Hallway sensor (in H1?) seems to be one hour out of sync from light level comparison with daylight hours

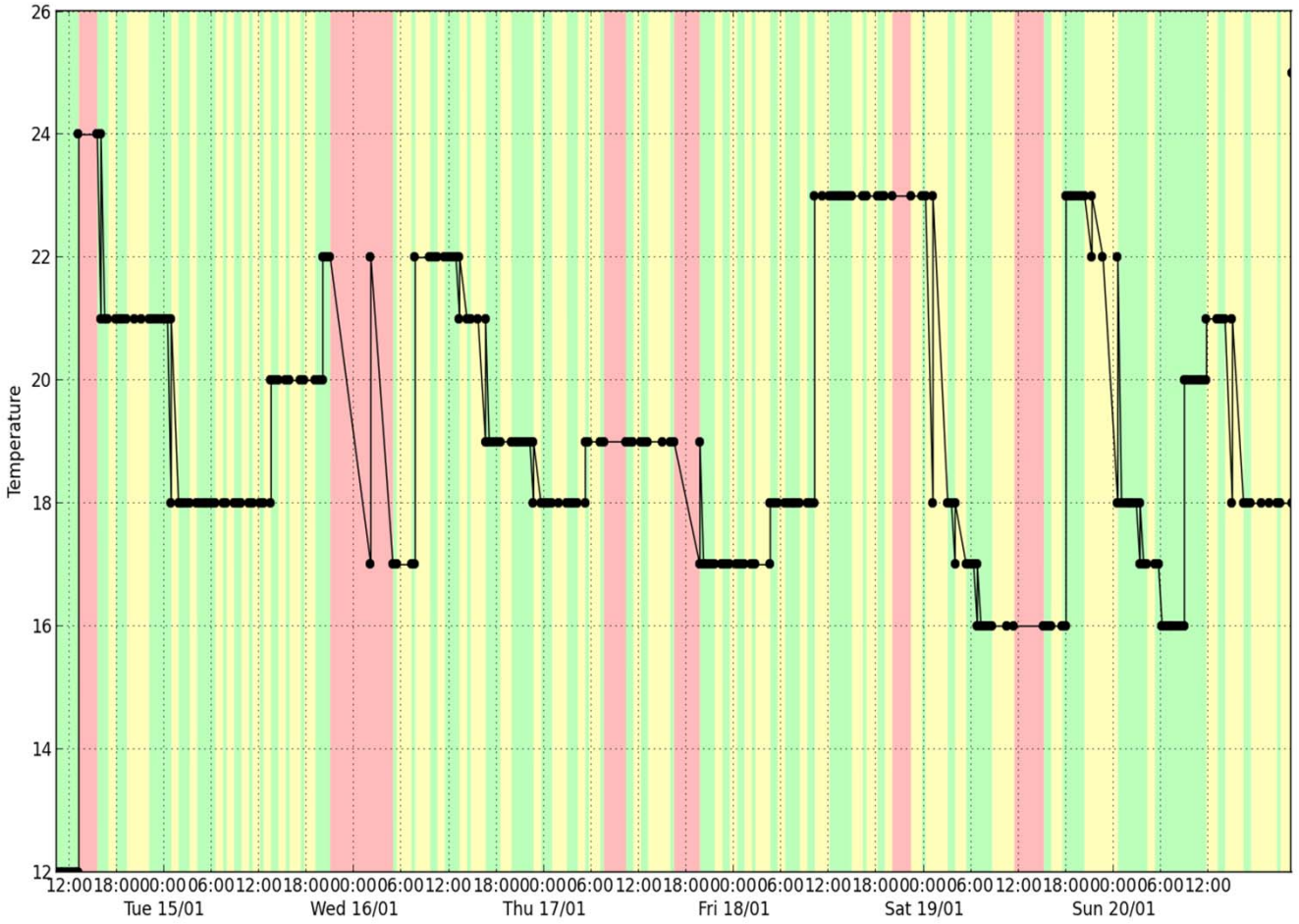


Figure 1 – Logged temperature data from H1 node 23. Black dots show the logged data points, regions highlighted green have no missing data, yellow regions have missing data but all of the points are within 2 hours of each other and so can be interpolated, red regions have periods of more than 2 hours with no data received, and so cannot be reconstructed.

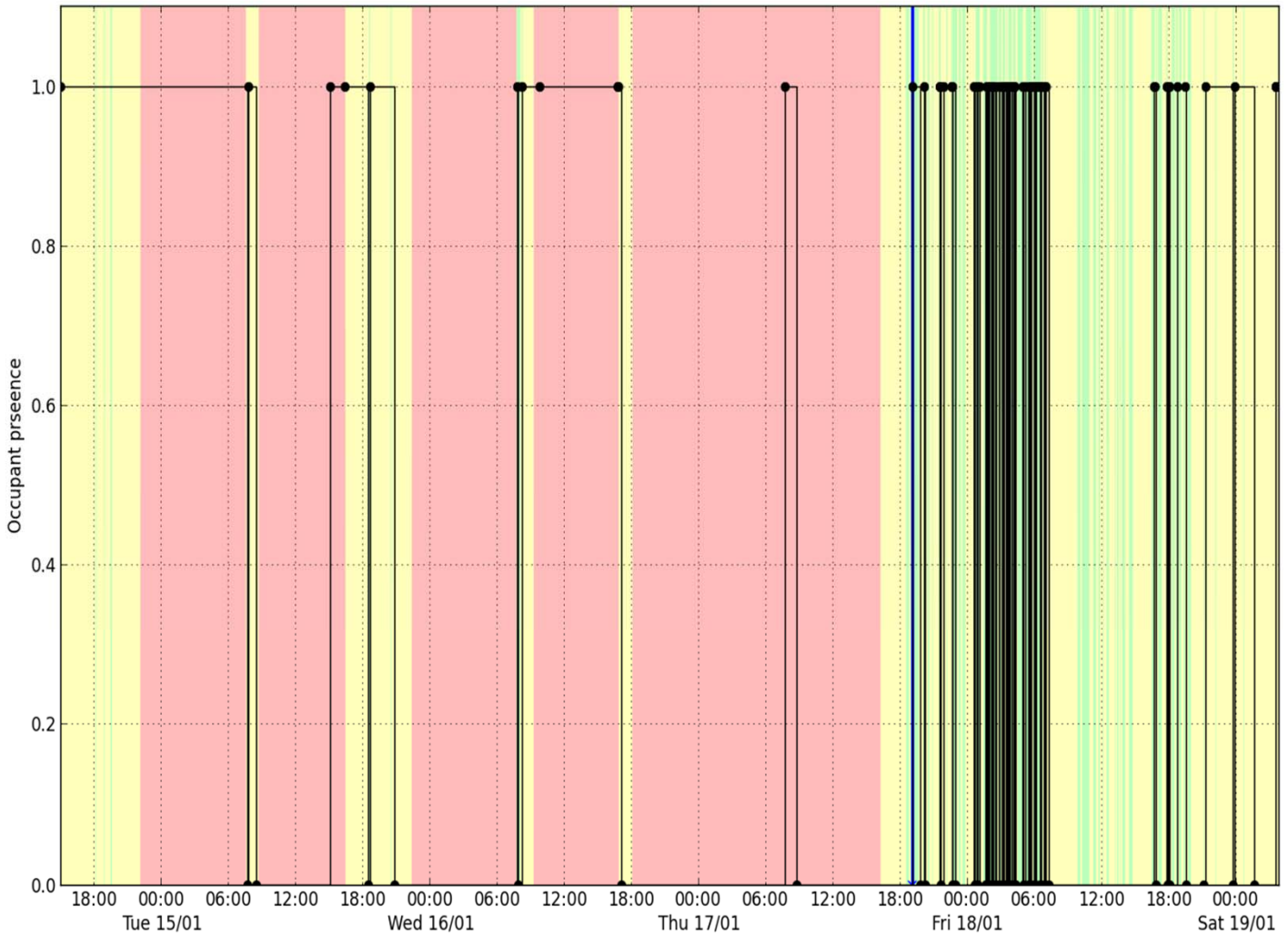


Figure 2 – Logged occupancy data from H2 sensor 15, the shaded regions show the status of the temperature data from the same multi-sensor (regions highlighted green have no missing data, yellow regions have missing data but all of the points are within 2 hours of each other and so can be interpolated, red regions have periods of more than 2 hours with no data received, and so cannot be reconstructed).

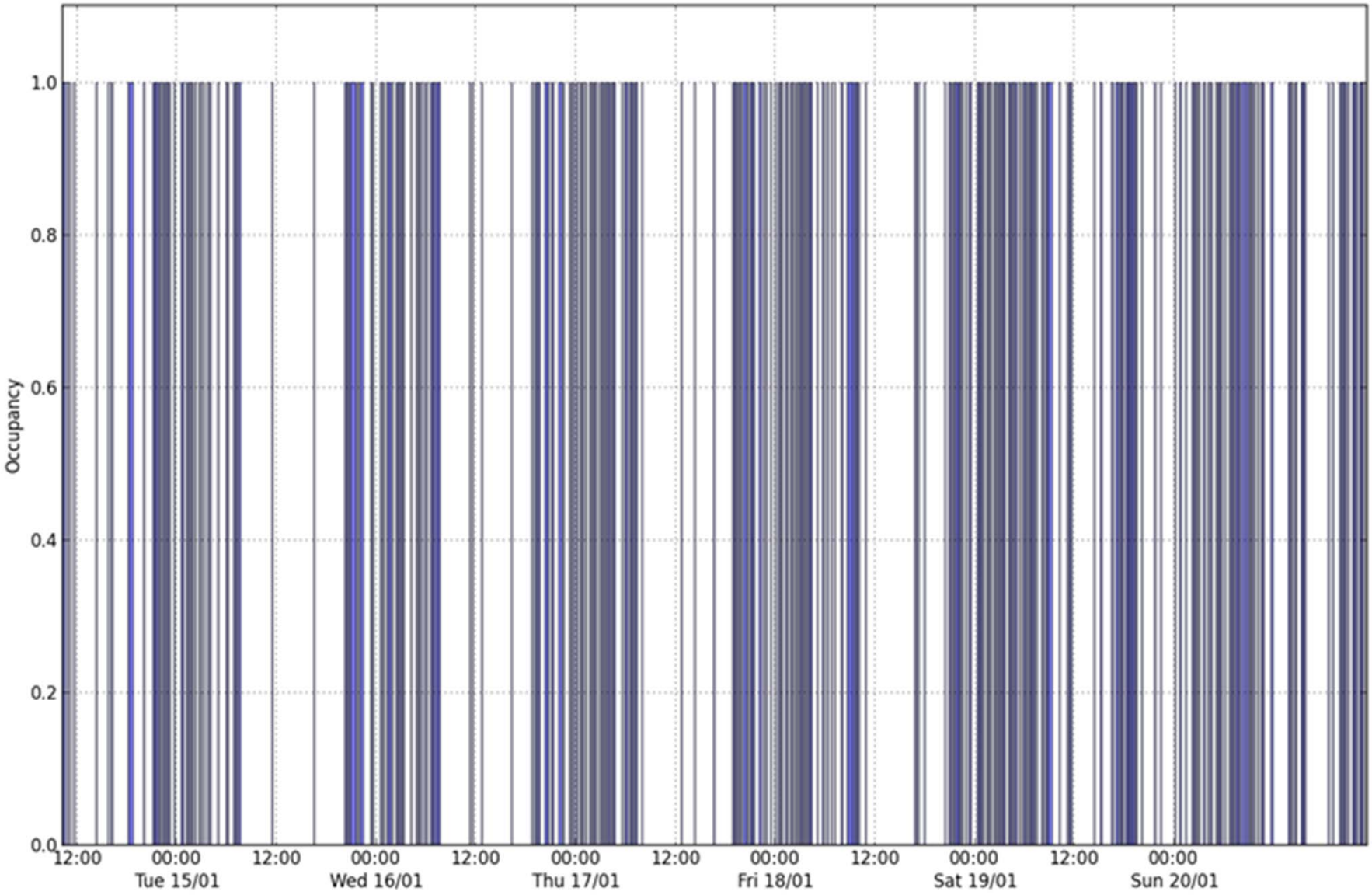


Figure 3 – Raw motion sensor data for the master bedroom, H1.

ROOM NOT IN USE = No motion sensor for more than 1 hour

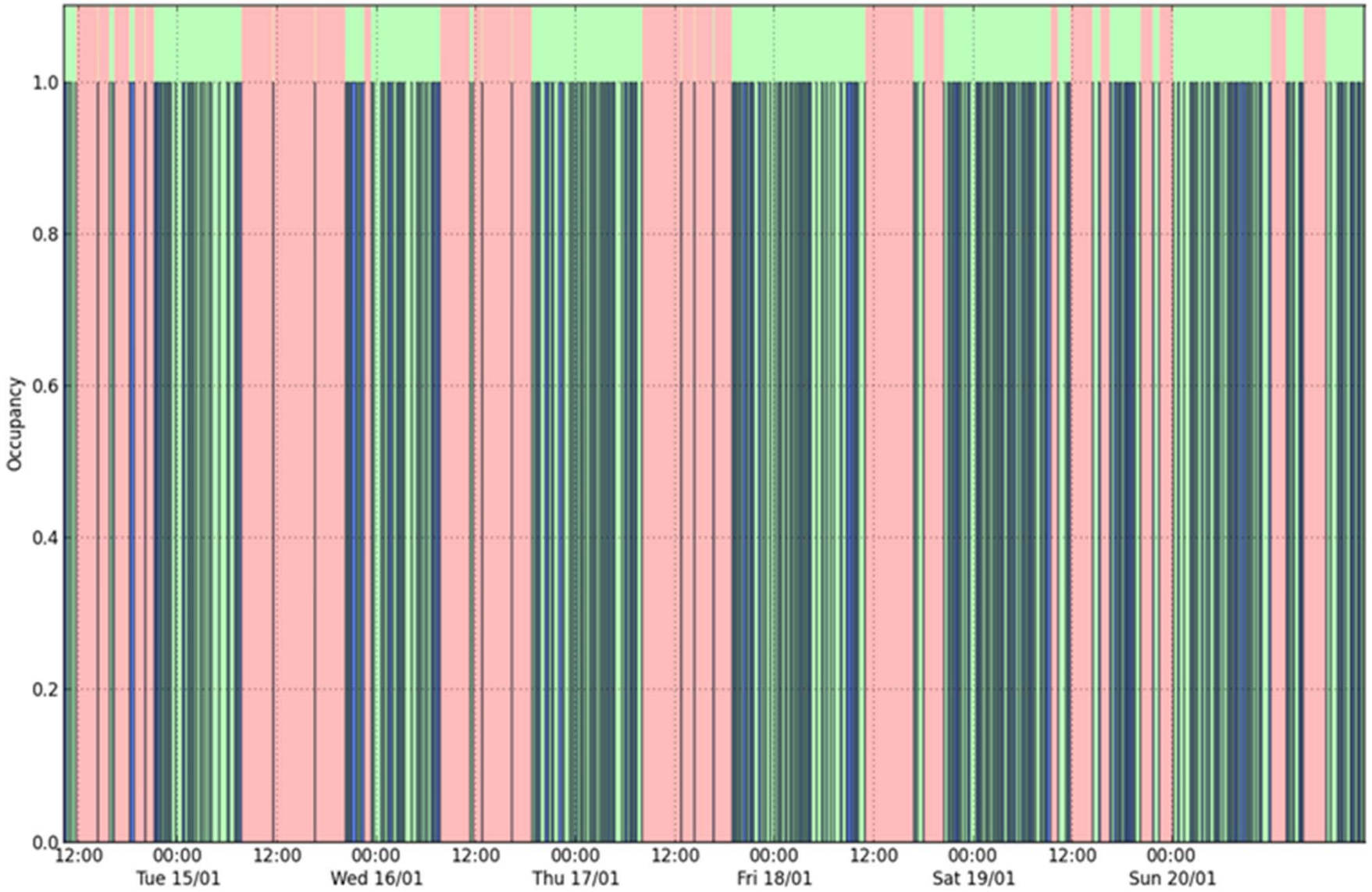


Figure 4 – Raw motion sensor data superimposed on estimated “room in use” (green areas indicate room in use, red areas indicate room not in use)

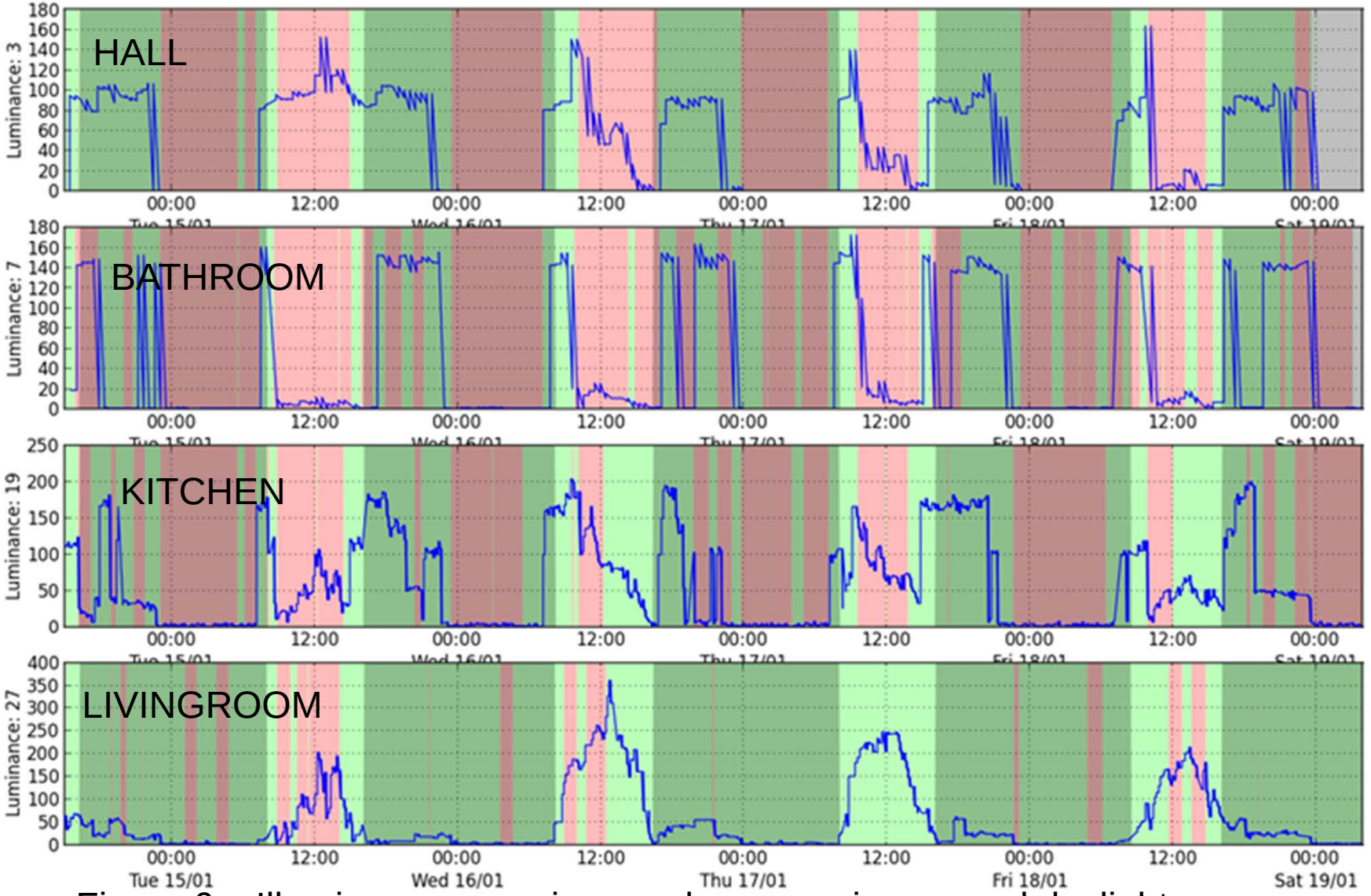


Figure 6 – Illuminance superimposed on room in-use and daylight availability for spaces in H2
RED Not in Use
GREEN in USE
DARK - night

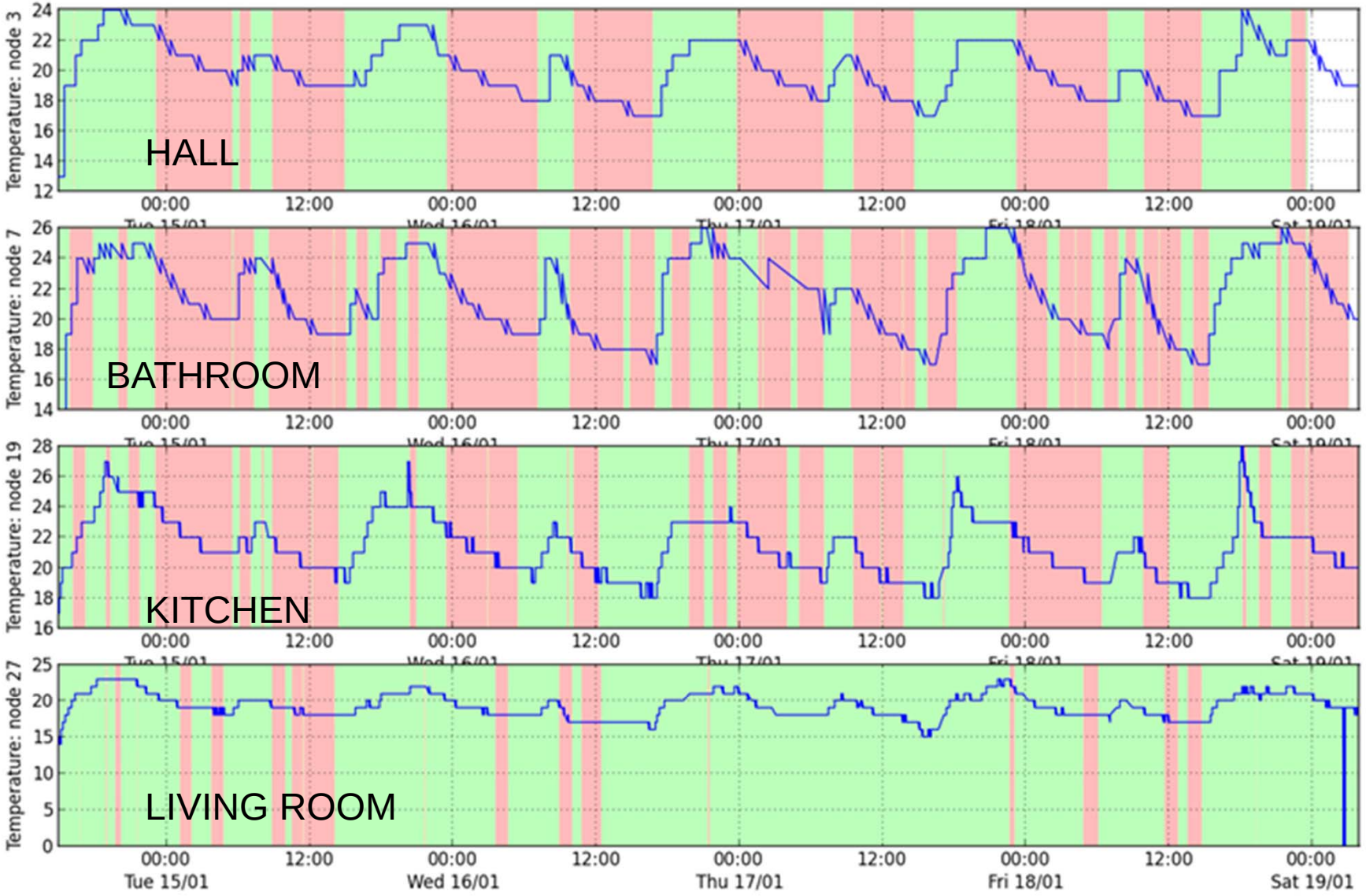


Figure 9 – Temperature vs room-in-use estimate, H2

Impact of external temp

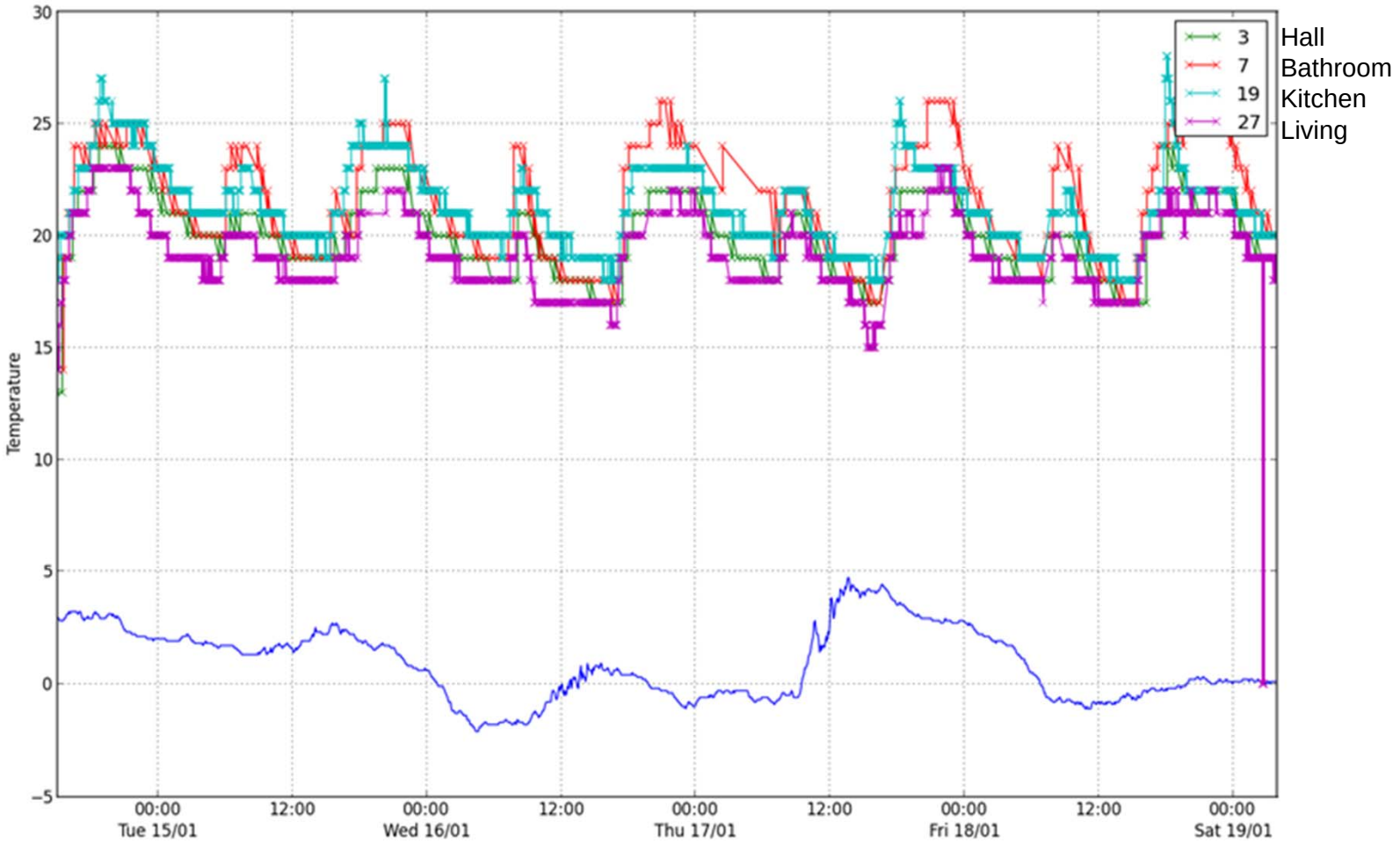
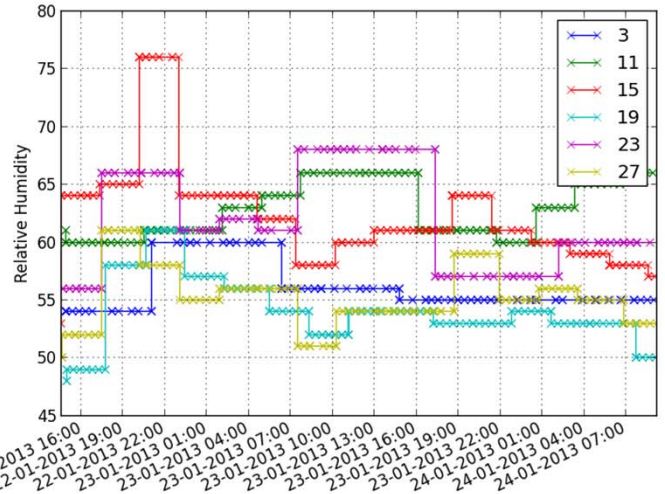


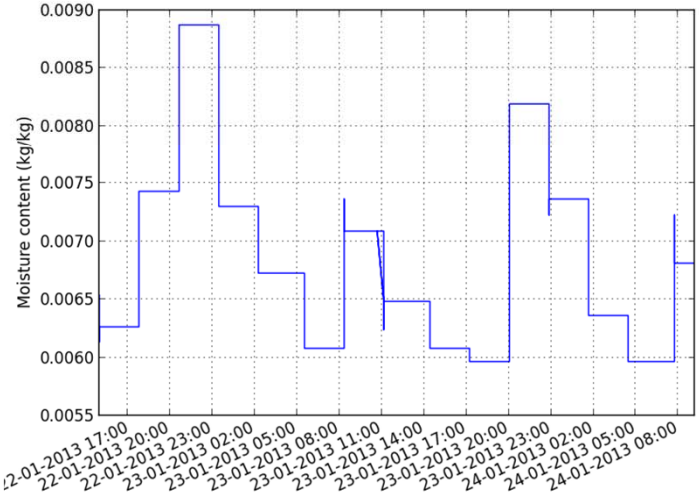
Figure 11 - Internal and external temperature, H2, period 1

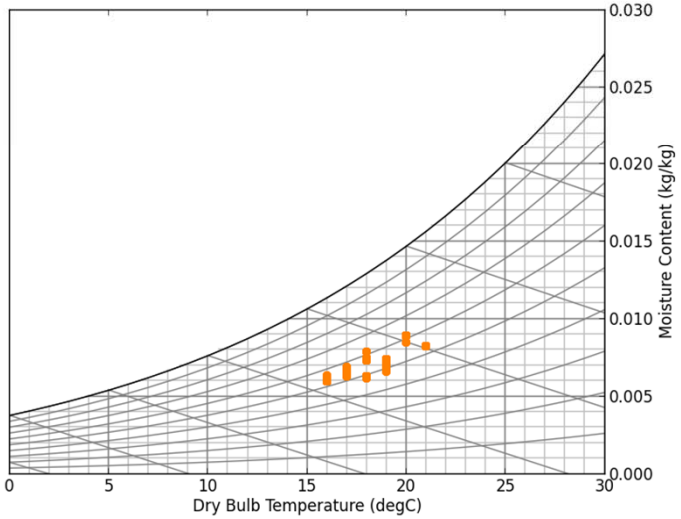
House 1 – Logged RH– latest data file

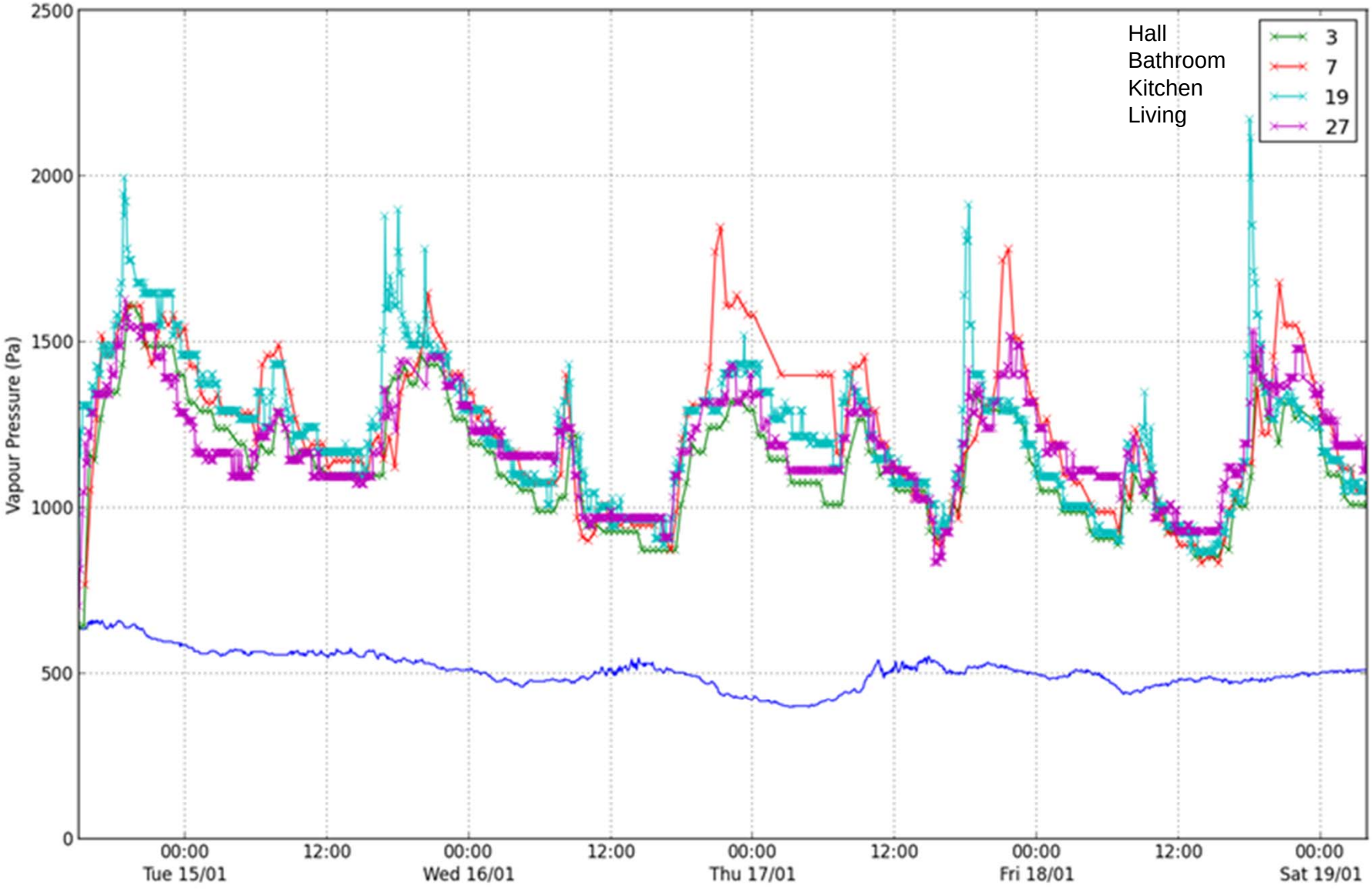
Logged relative humidity for each space can be combined with temperature to calculate air moisture content

Eventually can compare this to external data (not done yet)








Hall
Bathroom
Kitchen
Living
3
7
19
27
Vapour Pressure (Pa)
2500
2000
1500
1000
500
0
00:00
Tue 15/01
12:00
00:00
Wed 16/01
12:00
00:00
Thu 17/01
12:00
00:00
Fri 18/01
12:00
00:00
Sat 19/01

Effect of Sensor Resolution (T+/- .5C)

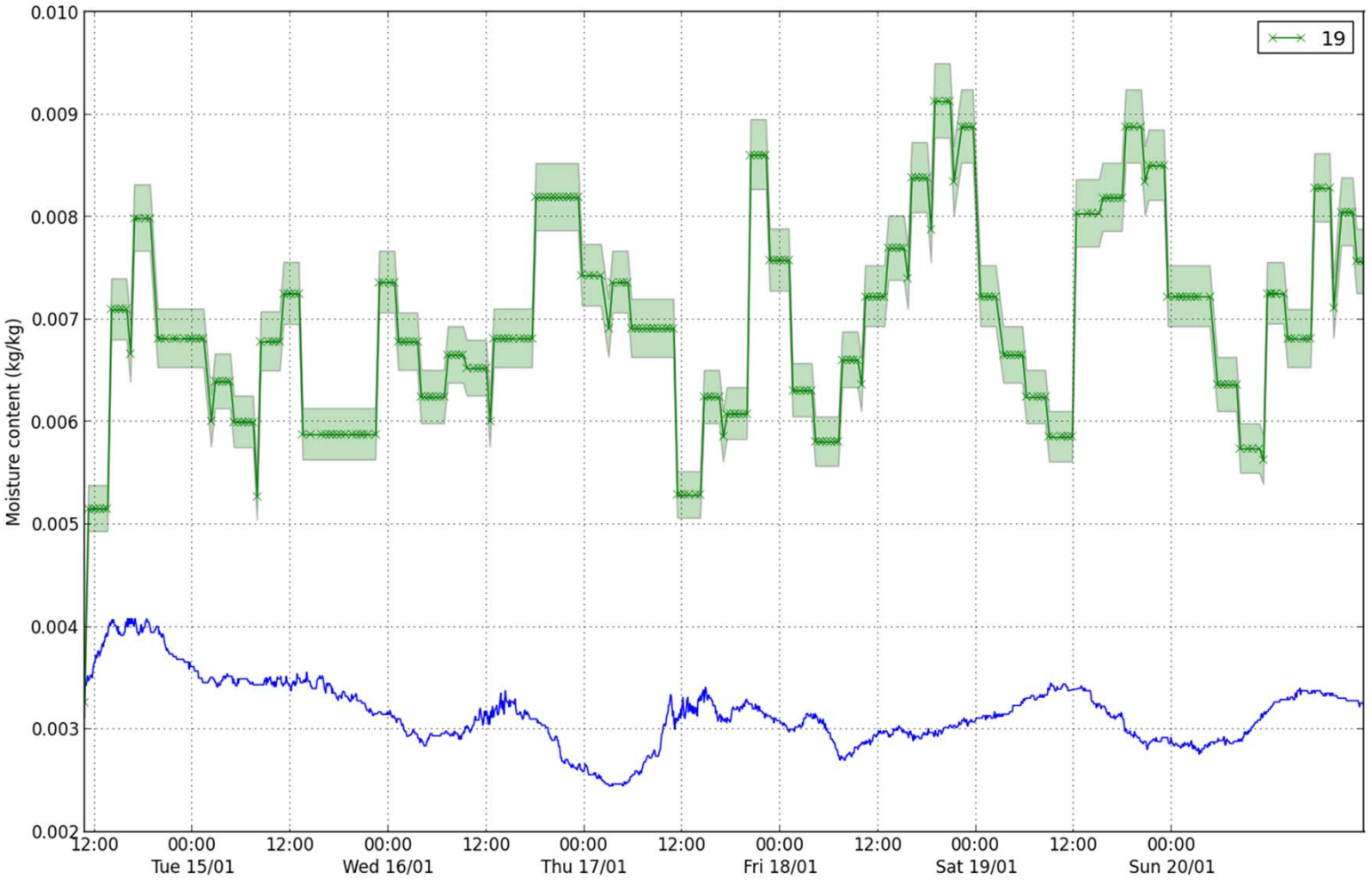


Figure 14 – Effect of sensor resolution on moisture content calculation, H1, period 1

Lessons learnt (for discussion)

- All sensors should be calibrated.
- Temperature logged at intervals less than 1C.
- Sensors should be fully checked as fully operational before being left in the home.
- All sensors should be checked for correct operation on a daily basis.
- Development work is required for the motion sensors and their analysis to obtain useful data.
- Logging periods need to be consistent between sensors in a room to make maximum use

Lessons learnt continued

- Light sensors need to be calibrated to different lights in the room upon installation?
- Combination of light, moisture and presence sensors may be able to determine occupancy, this involves considerable development.

Conclusion (for discussion)

- The pilot has proved useful to identify potential future problems and start to investigate the usefulness of the data.
- Considerable development work is required regarding sensors, their installation and communication between the sensors and the main hub before they can be relied on to produce good quality data i.e. accurate and 98% availability.
- In part, this was the aim of the pilot project. The challenge is to demonstrate that this can be achieved in time for the full trial and to allow good quality discussion of results with occupants.

Afternoon workshop structure

1. Overall design decisions

2. Deliberative workshops
   a) Sample design & recruitment
   b) Workshop structure and sequencing
   c) Substantive focus

3. Monitoring data and walk round interviews

Thank You