

BuPESA –Building Performance Evaluation for Sustainable Architecture

Usability in housing: the need for collective rather than individual learning tools

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Structure of talk

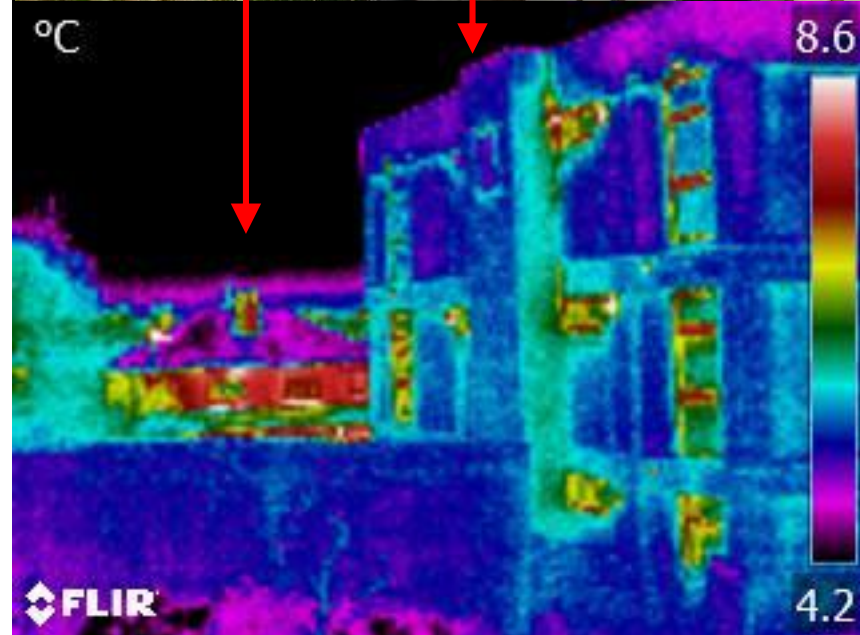
- LILAC case study
- Usability Tool and individual learning
- Social Learning Tool and collective learning
- Social media learning
- Older users
- Creating value through evaluation and collective learning

BuPESA – Building Performance Evaluation for Sustainable Architecture

- Two year EU Marie Curie Project in FP7
- March 2013-June 2015
- £250K grant to investigate two housing developments in Leeds, UK
- Website coming soon (next week!)
- Numerous publications and two tools developed – Usability, and Social Learning

LILAC successes

- LILAC performing better than neighbouring buildings
- e.g heat loss where
Blue = cooler surface = less heat loss



Construction audit

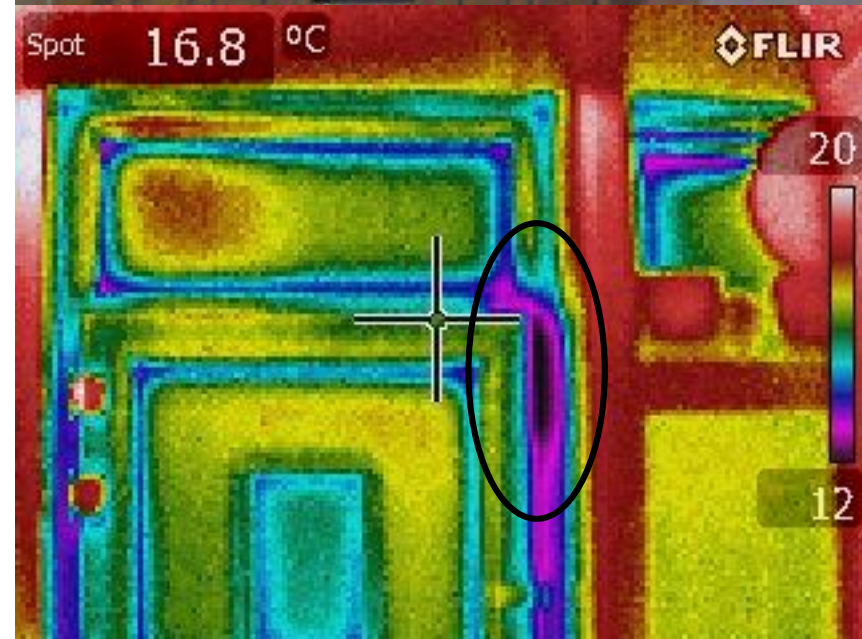
- Strawbale and timber walls and roofs.
- Timber mid-floors
- Block and beam suspended concrete floors
- Triple glazing
- Excellent U-values for external envelope
- Architect not commissioned to do M&E – problems later





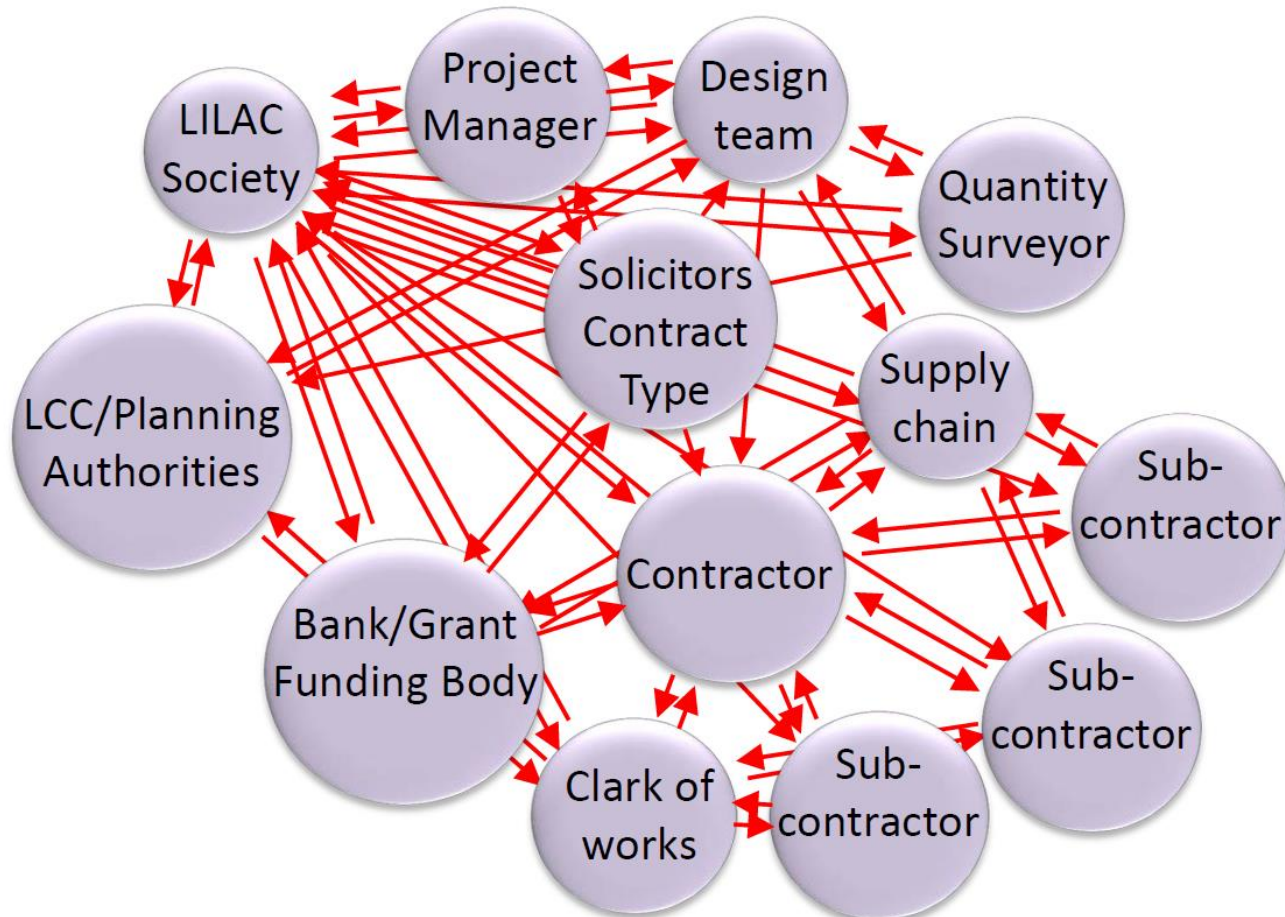
However...

- Hidden issues highlighted through BPE
- Typical issues are air leaks, poor insulation, poor service installations, poor controls
- Multiple ways to learn and improve value - examples





Influences at project level... learning?



Usability Tool

- 20 minute survey to evaluate the usability of domestic controls
- Previously done by experts, now user-friendly questionnaire

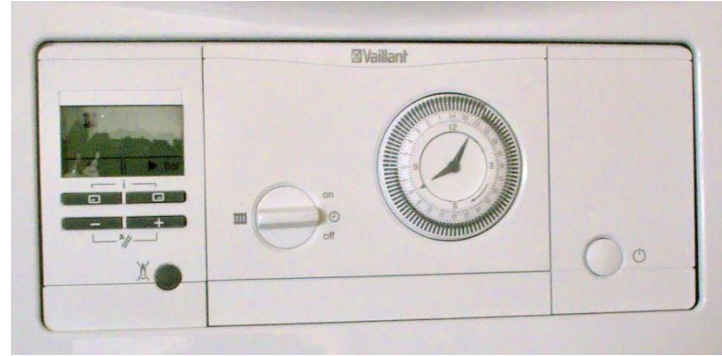
Usability Tool



Electricity & lighting



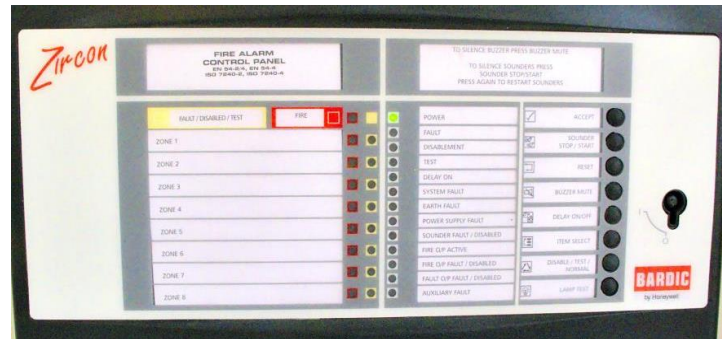
MVHR controls



Central heating & hot water



Renewables controls



Emergency & Maintenance

Central heating & hot water

• Is your home equipped with central heating? Yes I don't know No

If 'yes' please answer the following question and see the tables below concerning usability of different elements of MVHR system:

If 'no' or 'I don't know' please go to the next page

• Are you aware of its maintenance procedure? Yes I don't know No

• Indicate the elements of central heating system:

Tick where appropriate:

	System boiler			COMBI boiler			Room thermostat	Thermostatic radiator valve	Shower & bath controls																					
	Boiler control			Heating & hot water programmer			Heating control switch			Immersion heater switch			COMBI boiler control			Room thermostat			Thermostatic radiator valve			Shower & bath controls								
	Yes	I don't know	No	Yes	I don't know	No	Yes	I don't know	No	Yes	I don't know	No	Yes	I don't know	No	Yes	I don't know	No	Yes	I don't know	No	Yes	I don't know	No	Yes	I don't know	No			
Does it show what it is for?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does its location help to understand what it is for?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is it obvious if you should interact with it?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is it obvious how to use it?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is it sufficiently labelled?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is it easy to operate?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does it show response to your actions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does it allow making sufficient adjustments?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

• Comments on Central heating & hot water:

Central heating & hot water

Usability Survey at LILAC

- Major differences between households in skills to use controls
- Prevailing lack of skills to interact with maintenance controls: gas and water cut off points, fire alarm (apts.)...
- Actioned by LILAC collectively



Maintenance leaflet issued !

**Central
heating &
hot water**

**MVHR
controls**

**Renewables
controls**

**Electricity
& lighting**

**Emergency
& Mainte-
ance**

Recommendations – systems

All controls intended for user interaction should be in convenient location, clearly labelled, visible and intuitive to operate

- access difficulties eg. solar pump pressure cannot be checked ...hidden – hinges instead of screws would make the access easier
- ...better light required or ...collective procedures for meter readings to keep track of consumption



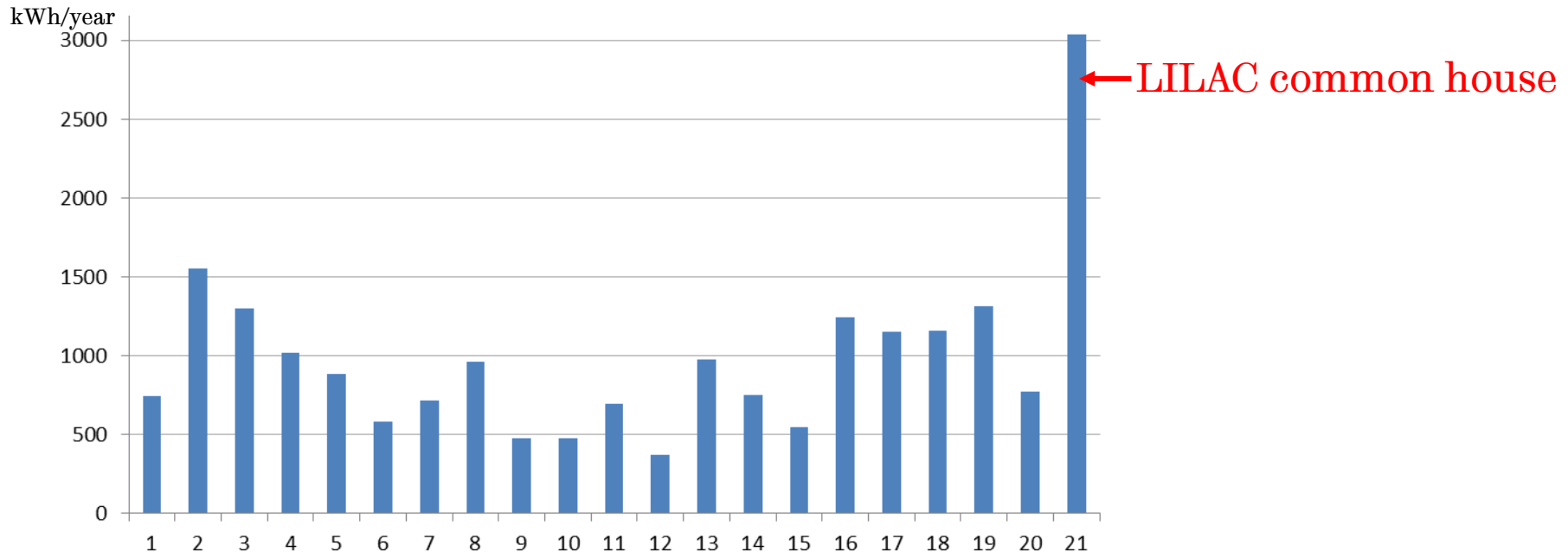
Individual examples of learning

- Engaging with new technologies – PV, Thermal, ModCell
- Variety of different practices by individuals from different backgrounds



Electricity use (taken from grid)

- Over 4-fold variation between households
- Variety of different practices – laundry in Common House



PV – power available for each home

≈ 950 W supplied by PVs per dwelling in the moments of favourable weather conditions: around midday on a sunny day



Or



>1200 W

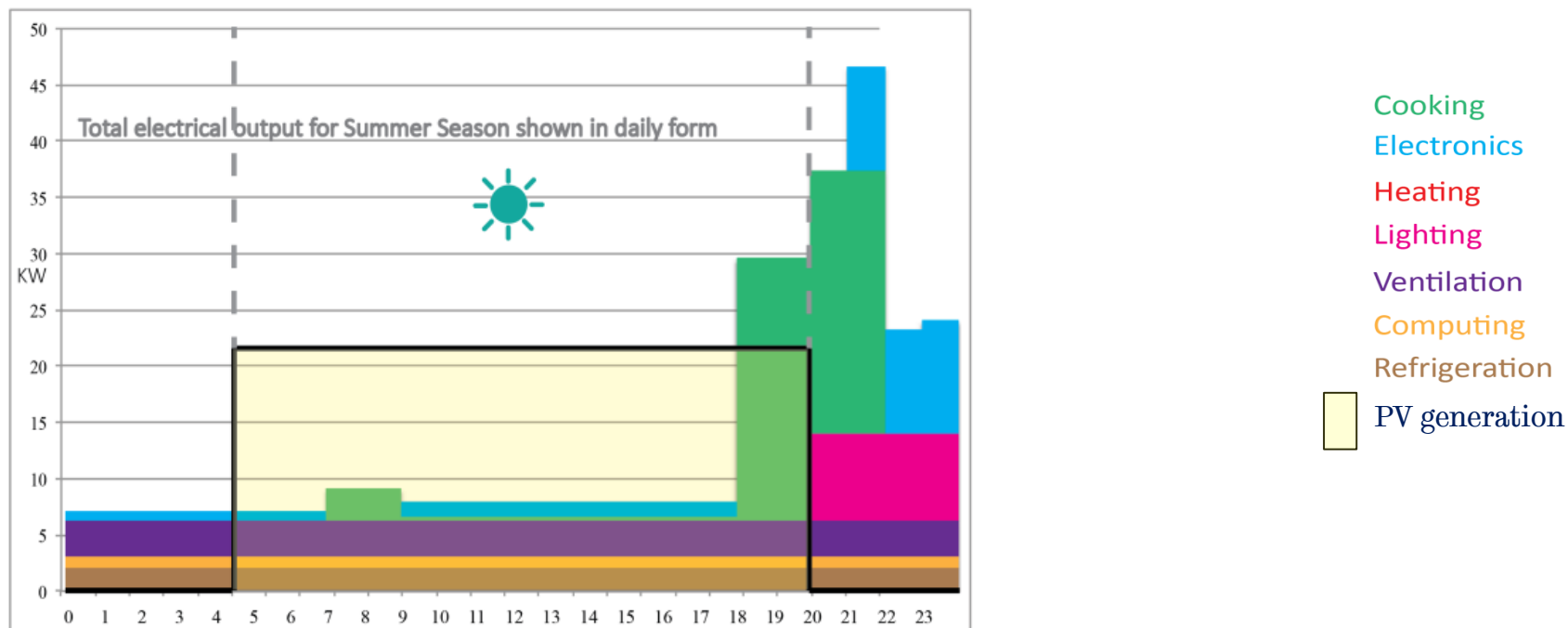
PVs: raising awareness through BPE

- No direct access to the roof though maintenance needed – capital savings deferred to revenue costs in the future
- Considering permanent roof anchors for future access...
- Critical issue for solar panel maintenance and cleaning
- Thinking how to optimise energy performance in use



Load shifting energy use over 24 hours

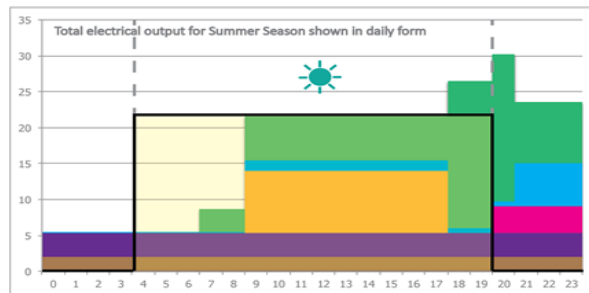
Electricity isn't always used when it's generated by PV...



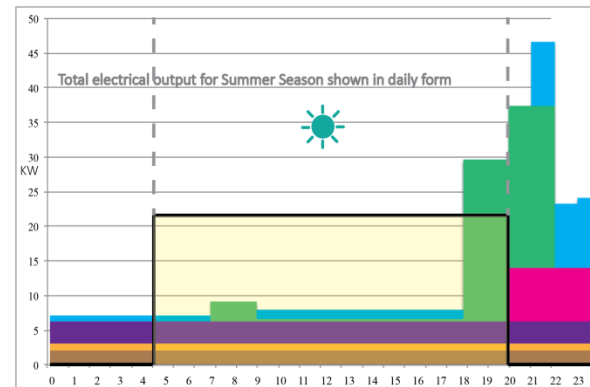
24 hours: Dwelling A

Adjusting energy uses to optimise PV

... major differences between homes depending on occupancy patterns and other factors



24 hours: Dwelling B



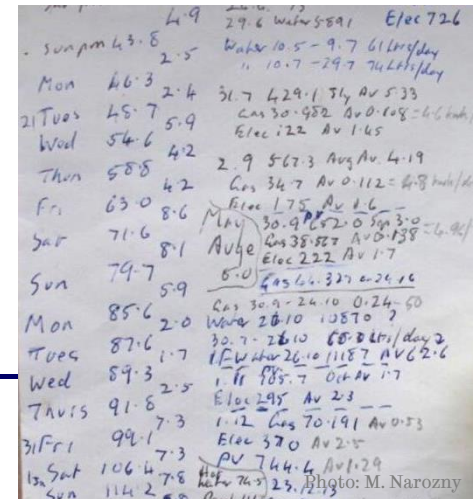
24 hours: Dwelling A

- Cooking
- Electronics
- Heating
- Lighting
- Ventilation
- Computing
- Refrigeration
- PV generation

...I don't understand how the PV system works but it makes a tremendous difference.' Dwelling B Resident

Home use learning through...

- Regular monitoring of own consumption – **one person**
- using on line resources, manuals or getting professional advice – **some people**
- trial and error & random chatting to neighbours (or maintenance team members) – **everyone**



Handwritten energy consumption log showing daily readings for Gas, Water, and Electricity (Elec) over a period of days. The log includes calculations for averages and differences between days.

Day	Gas	Water	Elec	Notes
Mon	46.3	2.4	31.7	4.29.1 3.4 Av 5.33
Tues	45.7	5.9	30.9	4.52.0 5.9 3.0
Wed	54.6	4.2	35.8	4.7 1.7 1.7
Thurs	58.8	4.2	35.8	4.7 1.7 1.7
Fri	63.0	8.6	35.8	4.7 1.7 1.7
Sat	71.6	8.1	35.8	4.7 1.7 1.7
Sun	79.7	5.9	35.8	4.7 1.7 1.7
Mon	85.6	2.0	35.8	4.7 1.7 1.7
Tues	87.6	1.7	35.8	4.7 1.7 1.7
Wed	89.3	2.5	35.8	4.7 1.7 1.7
Thurs	91.8	7.3	35.8	4.7 1.7 1.7
Fri	98.1	7.3	35.8	4.7 1.7 1.7
Sat	106.4	7.8	35.8	4.7 1.7 1.7
Sun	114.2	6.8	35.8	4.7 1.7 1.7

'... [learning from] people who have information... but it's **changeable information... you end up with a lot of myths, things that were repeated around...**'

Home use learning – individual

- Varied level of interest in technical side of home use control

*‘It’s just such a **low priority...**’*

...but without capacity to control (and interest in) the technology installed:

- faults can stay unnoticed
- ‘myths’ settle and are not challenged – habits develop



Proper and corroded
solar thermal fluid – no
system feedback
signalling fault...

Interviews revealed...

- Prevailing perception of **empowerment and capacity to tackle any issues identified**

'...I think it's normal that we haven't quite figured out bits and pieces. It's just an evolving thing and we haven't finished yet making it.'

- Considerate behaviour towards neighbours visible in numerous ways
- Two households question the affordability

Social Learning Tool

To provide understanding of
low impact home collective learning
happening within LILAC

- a community challenged to make the most of the
potential that low carbon housing offers

Social Learning Tool - steps

- analysis of internet based home use focused content & activities – with your consent...
- draw on existing interviews
- focus group to discuss findings and collective learning practices
- co-production workshop – SL Tool for enhanced learning process

Before learning

User Learning and Adaptation Process

Social Learning Research tool / scope

Building group identity, ethos, structure

Observational Learning

Development of New Ideas

Attention

Retention

Reproduction

Motivation

Decision making

Identifying Home Use Champions

Awareness of goals

Social Pressure

identifying areas for development

Seeking solutions

sharing experiences within the group

storing lessons learned for future reference

Identifying methods for Sharing & storing home Use lessons for reference

Benchmarks

Following and Understanding Own E&W use

Pioneering ethos

Savings potential on E&W bills
Understanding of the Systems Installed and Maintenance procedures

Skills to interact with controls

Troubleshooting

Forward Thinking

Good & Bad Home use habits

Exploring different ways of finding solutions

Supporting champions' development

Individual trial & error

Peer to peer learning

Learning from External experts

Learning from www

Direct group learning: Meeting/workshop/other

Social learning within the group using Internet based tools

Social learning within the group using Internet based tools

Storing lessons in paper form

Storing lessons in digital form 'on site'

Storing lessons in Internet based form

Focus group/ Co-production workshop

Survey

Emails Content & thread analysis

Snag list/Problems Reporting analysis

Twitter content analysis

LILAC www analysis (updated, visited)

DWELL Software

Directing where and how Action research ???

Home use learning - collective

Maintenance task team takes '*...responsibility to ensure that everyone has an understanding of how the houses function,*' and plans to '*facilitate communication between the uninformed and the people with knowledge...*' Maintenance team member

This can work well...

- Lots of technology related knowledge as well as **low impact living tips** to share across the development...

'dark outside' option

daylight option



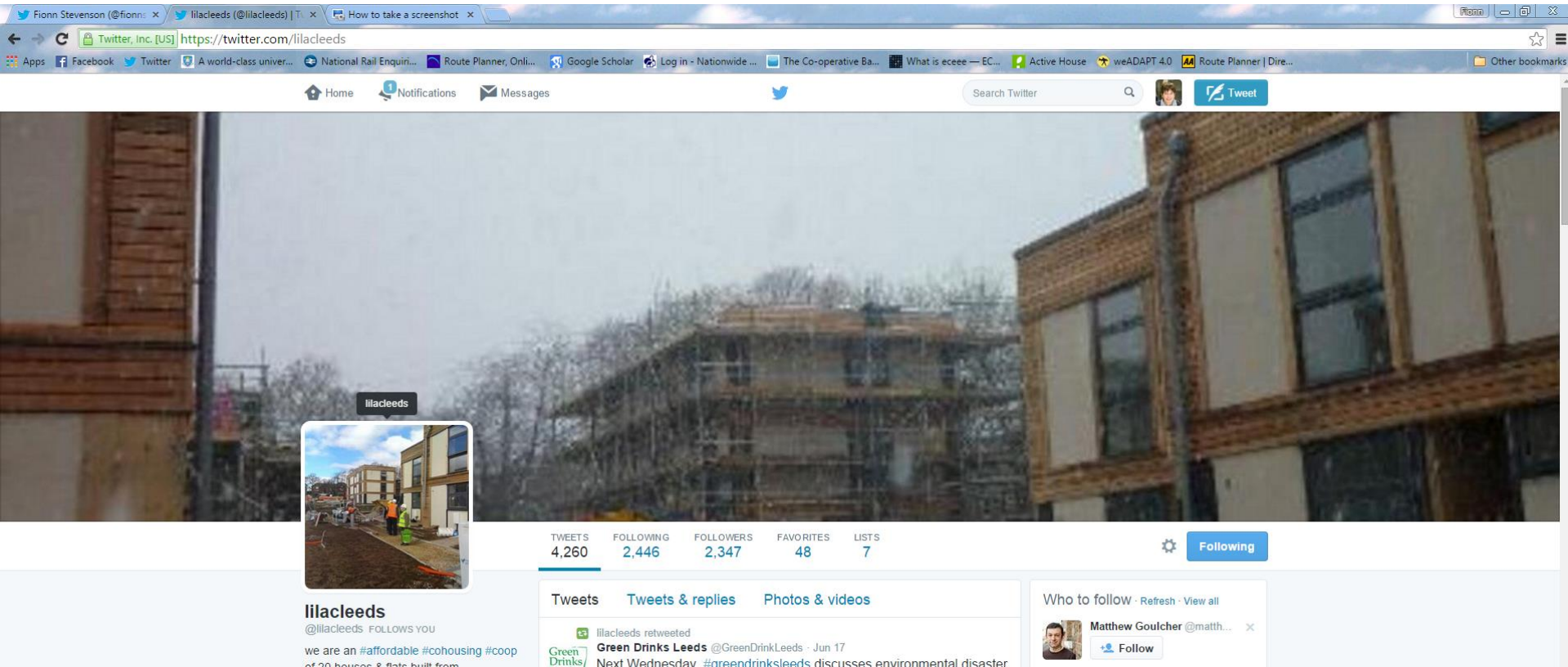
Action learning implemented

- Big ones: MVHR recommissioning, ducting insulated
- ...and smaller ones too: pipes around hot water tank insulated – less heat loss in winter + less overheating in the summer



LILAC social media

- Very outward facing – marketing the idea
- Twitter and Facebook accounts



Twitter profile page for @lilacleeds. The profile picture shows a construction site with a building under construction. The header shows the profile name 'lilacleeds' and a 'Following' button. The statistics bar shows 4,260 tweets, 2,446 following, 2,347 followers, 48 favorites, and 7 lists. The main content area shows a tweet from 'Green Drinks Leeds' retweeted by 'lilacleeds'.

TWEETS	FOLLOWING	FOLLOWERS	FAVORITES	LISTS
4,260	2,446	2,347	48	7

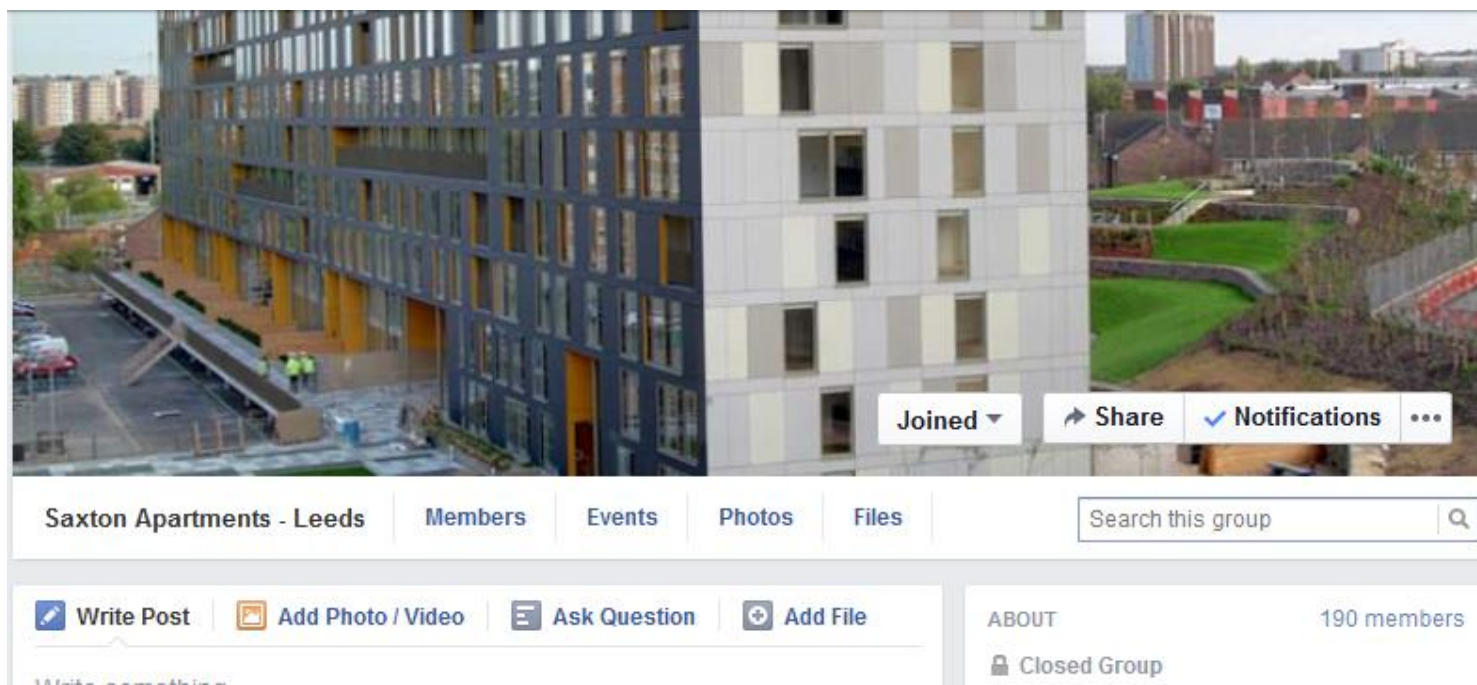
Who to follow - Refresh - View all

- Matthew Goulcher @matth...
Follow

Saxton residents Facebook group

Closed group expanding – 190 members Nov 2014

- support with current home use issues
- strategic advice seeking



Joined ▾ Share ✓ Notifications ⋮

Saxton Apartments - Leeds Members Events Photos Files Search this group 🔍

Write Post Add Photo / Video Ask Question Add File

ABOUT 190 members

🔒 Closed Group

Collective Learning through Social Media

Potential for wider engagement due to significant differences within both case studies in:

- energy use
- understanding and skills to interact with controls
- achieved comfort levels



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Ancion Court TSB BPE – Older users





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Energy Day

connect
housing 
homes, communities, cultures

At Ancion Court...
...For Ancion Court

You are warmly invited to take part
in Ancion Court's *Energy Day*.





Ancion Court – User engagement

- How does the heat pump work and how is the building saving energy?
- What lessons have been learnt so far from the detailed monitoring project?
- Help to choose better heating controls for the future – **test out different models** and have your say on which ones work best for you.

Very hands on housing developer **adding value!**



Creating value through evaluation and collective learning

- Building Performance Evaluation provides baseline
- Feedback to design team and residents creates learning loop
- Action learning interventions create **collective learning**
- Far greater leverage on value than individualised learning
- **Improved performance = improved value**



Recommendations for Dynamic Learning to add value

- Occupants willing to learn more about technology
- BPE needs to become compulsory not optional
- Collective learning of home use issues needs to be more structured in housing policy, design and practice
- Collective learning needs to be repeated in order to 'stick'



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Fionn Stevenson talking with Glasgow tenants in 1990 about usabilitysome things have been around for a while -just need to catch on!

Thank you.