Knowledge Transfer Network

Modern Built Environment

Building Performance Evaluation

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Agenda

- Background to funding and programme
- The Building Performance Evaluation Programme in the UK
  - Requirements
  - Results
  - Impact
- Discussion
  - Do you/ How do you do Building Performance Evaluation?
  - What gaps are there and what could research do to fill them?

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Background

- The Technology Strategy Board – the funders
  - Low Impact Building programme
- BSRIA and others – evaluators
  - Soft Landings
- The Knowledge Transfer Network for the Modern Built Environment – recruitment and dissemination

BSRIA……..

- A research and technology organisation
- We work with construction and building services companies and their clients to Make Buildings Better
- Member based association formed in 1955
- Specialist group of people doing BPE
- Consultancy for BPE, Soft Landings and instrumentation

The five-stage process

1. *Inception and briefing* Clarify operational outcomes in the client's requirements
2. *Design development and construction* Review past experience, agree targets
3. *Before handover* Prepare for occupation, train FM staff, review monitoring strategy
4. *Initial aftercare* Stay on site to support staff in first few weeks, respond to queries and react to emerging issues
5. *Long term aftercare* Monitor, review, fine-tune, periodic feedback studies for up to three years

Technology Strategy Board vision

For the UK to be

a global leader in innovation

and a magnet for innovative businesses, where technology is applied rapidly, effectively and sustainably to create wealth and enhance quality of life.

Technology Strategy Board
Driving Innovation

Technology Strategy Board

Driving Innovation

Delivery mechanisms

- Single and collaborative investment
  - Single stage e.g. Feasibility
  - Two stage e.g. Collaborative R&D
  - Consortium and competition building workshops
  - Sandpits
- Knowledge Transfer Partnerships
  - Knowledge Base⇔ Associate ⇔ Company
- Small Business Research Initiative (SBRI)
  - R&D projects for solutions that can lead to contracts
- Knowledge Transfer Networks – e.g. MBEKTN
  - Subject Interest Groups – e.g. BPE

Low Impact Buildings

- Industry focussed research programme
- Supporting industry though grant funding (50% or 100%) – projects £50,000 to £1 million
  - **Design and Decision Tools**
  - **Materials**
  - **Building Performance Evaluation**
  - **Innovative Refurbishment**
  - **Design for Future Climate**
  - **Build Process**
  - **Management and Operation**

Technology Strategy Board
Driving Innovation

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- What does it do?
  - Encourages business focussed research – not just in TSB programmes
  - Links industry and university innovators
  - Supports dissemination
  - Investigates new research needs
  - Through workshops, publications, active web platform for discussion and reference

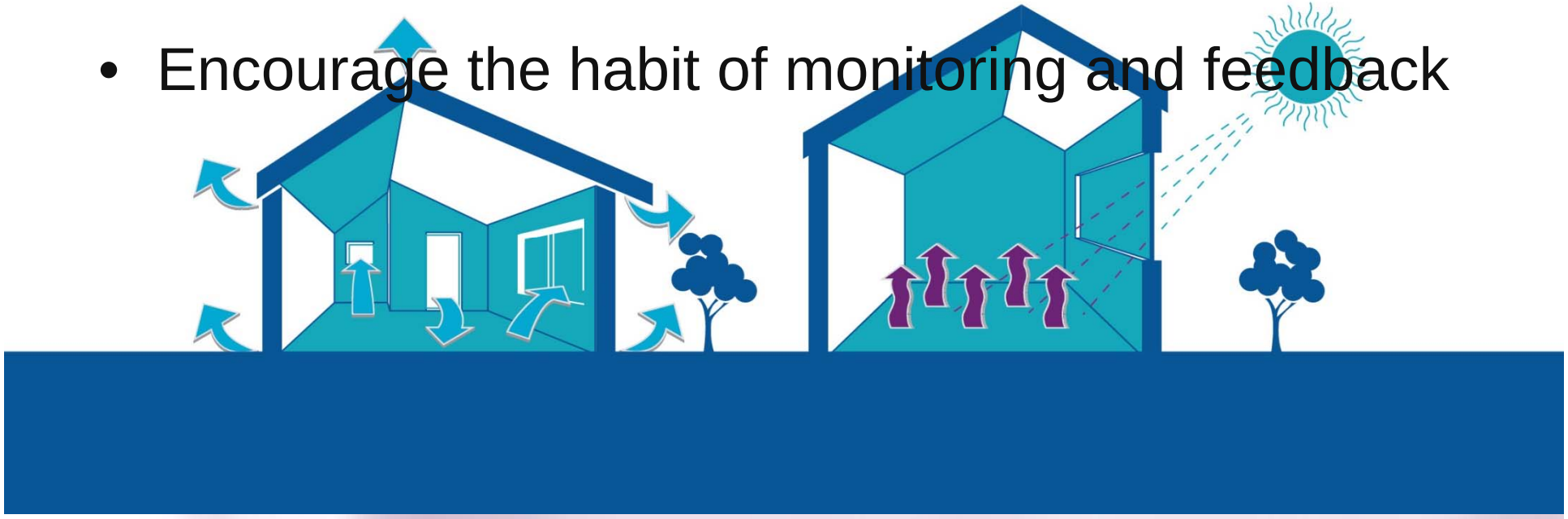
www.modernbuiltktn.co.uk

Building Performance Evaluation programme

- 72 construction projects
  - 6 months monitoring immediately after handover AND/ OR
  - Two years on going monitoring
- 2 year rolling programme
- Project team and a support evaluator
- Energy, satisfaction and process evaluation

Programme Objectives

- Learn what works and what does not work in low impact buildings
- Develop and modify tools for evaluation
- Identify where research and guidance may be needed
- Encourage the habit of monitoring and feedback



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Domestic studies
Post construction and initial occupation

- Typically carried out within a 3-6 month window spanning practical completion and early occupation
- Process evaluation and design & construction audit
- Fabric performance testing
- Services performance testing
- Hand-over processes and initial occupant studies
- Evaluation and interpretation of data and information captured
- Comparison with design performance

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Non domestic post construction

- Design data and metering strategy
- Arrangements for managing delivery of design intent, sign-off and commissioning plans and procedures
- Plans for occupation and handover data
- Test results (e.g. air pressure tests, commissioning records)
- Technical performance, occupant satisfaction, management and energy use, during the six months after handover

Capture findings and identify possibilities for improvement

Results workshop with members of the client, occupier, design and building teams

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Domestic studies - in use

- Over two years
- Post occupancy evaluation using surveys, observations and interviews
- Monitoring of internal and external conditions (e.g. temperature, humidity, CO2)
- Energy consumption (and generation)
- Services performance
- Evaluation and interpretation of data and information captured
- Comparison with design performance

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Non domestic in use studies

- Assessment of annual energy use over two years and analysis of energy demand profiles
- Occupant satisfaction survey and structured reviews with occupants and management
- Technical review of building and equipment performance
- Performance and usability of controls and BMS
- Reliability, maintenance and maintainability
- Comparison with results from other buildings

Investigation of issues arising and suggestions for improvement

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Tools used

- Based on work by Zero Carbon Hub and from the “PROBE” research studies in late 90s.
- Occupant studies
  - Building Use Studies methodology from Usable Buildings Trust and Arup
- Energy usage
  - DomEARM for domestic studies
  - TM22 (revised specifically for this project) for non domestic studies
- Co-heating protocol e.g. from Leeds Metropolitan University


Discovery


Camden Passivhaus
Nearly two years post occupany
General satisfaction and success
You CAN do Passivhaus in the UK, but……

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Camden Passivhaus

- Achieving Passivhaus in UK is difficult – requires a champion and good site supervision
- Make the air barrier explicit on the drawing
- Seek out designers and contractors who are familiar with the technology
- Late changes should be communicated in drawings
- Co-heating tests may have large errors because of solar gains
- Provide a straightforward manual

Ranulf Road
User

This house is a Passivhaus. The term passivhaus refers to an advanced get the lowest energy consumption and best comfort. This guide has been design by Alan Clarke and bere:architects for you (the user) to

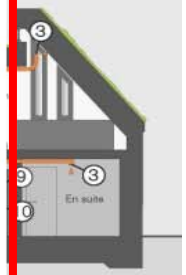
⑥ Solar tank and boiler control panel

This should be set for all-day-long because the ventilation system is designed to provide gentle continuous heat. It can't give a quick boost like radiators can. The space heating is controlled with the panel in the dining room (4) and not via this panel.

Ranulf ro

① Heat rec

construction
de air intake



all amount of
air supply and
s in the shower
for the towel
boiler normally
is automatic
on the

② Fresh air vents

The fresh air (pre-warmed in winter) is supplied by the heat recovery unit and delivered to the bedrooms and living room using these fresh air vents. The heating system (10) is automatic but you can adjust the fan speed (4) manually with the wall mounted panel in the dining area. This will keep the air fresh during a party or intensive cooking.

⑤ Thermostat

The thermostat in the ing room sets the tem ature in the room. 20 C is the normal t perature, but you d turn it down ou away for a few r just for a few hours energy.

⑧ Hot water from the sun

In summer almost all the water in the solar tank is heated by the sun shining on the solar panel on the roof. In winter the panel can heat the bottom half of the tank and the boiler is used to top up the temperature. This means there is always hot water available in the tank even on a cloudy day.

⑪ External blinds control (for summer cooling)

In summer the outside blinds minimise solar gains from the sun. These come down automatically in the summer when sunny but can also be manually operated with use of the controller. The controllers have two programs; one blind operation or all together. If it's too windy outside the blinds will retract to prevent them being damaged. NOTE: A waterproof controller needs to be kept outside to avoid you becoming stuck outside in sunny conditions (11a).

③ Extract air vents

These vents remove possible stale and damp air from the kitchen, bathroom and utility room. The heat recovery unit saves heat, which saves money. The ventilation runs continuously all year round but special motors have tiny energy consumption. The extract air vent filter in the kitchen needs to be cleaned about every 3 months.

⑥ Solar tank and boiler control panel

This should be set for all-day-long because the ventilation system is designed to provide gentle continuous heat. It can't give a quick boost like radiators can. The space heating is controlled with the panel in the dining room (4) and not via this panel.

⑨ Hot water temperature

Hot water is always ready in the tank this is due to the tank being very well insulated so that the water will not cool down overnight. On cold cloudy winter days most of the hot water will be provided by the integrated boiler above the tank .

⑫ Windows (for summer cooling)

To keep the internal temperature cool in the summer utilise the cooler night temperatures by leaving the windows open in the secure "tilt" position overnight. If it's hotter outside in the day you can shut the windows and external blinds and then turn the heat recovery ventilation to summer by pass using the user settings on the control panel (4) to keep cool inside. Refer to page 4 of the heat recovery ventilation unit manual.

bere:architects

For further information regarding theee features:

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Delivered with 'Details from passive Houses' by IBO Book


Crawley Library
A good building performance analysis identifies issues that hold back efficient and effective use of the building

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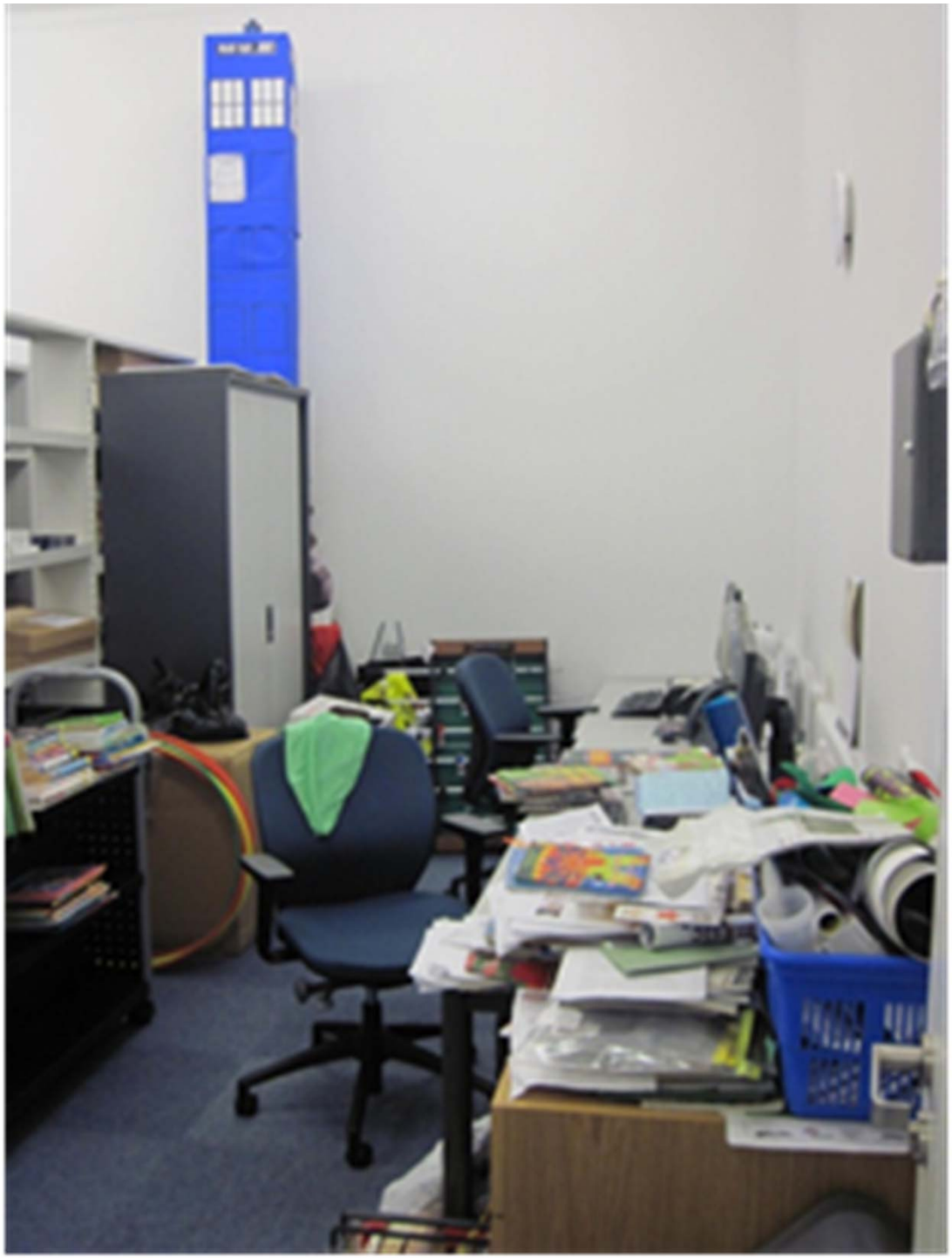
Crawley Library

- Inadequate handover training and documentation and frequent FM staff changes compromised the effectiveness of low carbon technologies.
- Lack of proper system commissioning and installation led to the underperformance of systems and construction defects.
- Occupants had a lack of understanding of the building sustainability features.
- “Unplanned changes to space usage to meet new needs” led to poor internal environmental conditions.



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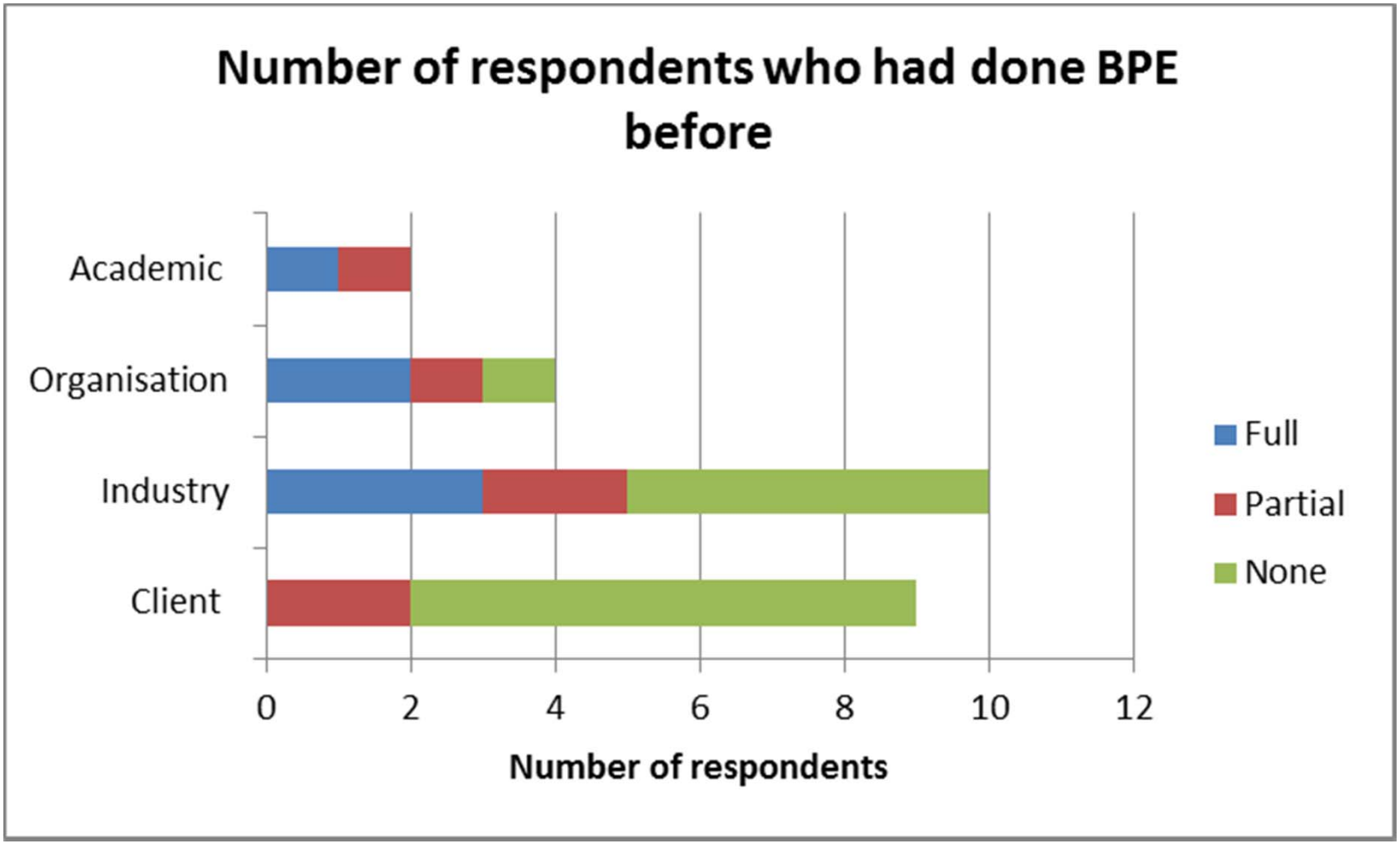
Building Performance Evaluation – Impact survey



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The impact of the programme

- Three respondents have already added BPE to their portfolio
- Twenty will do more work in the future outside the programme
- Of the 20 who will do more work, five had done BPE work before, the other 15 had not
- Extrapolating, market growth – possible £4 million per annum just from the participants

Building Performance Evaluation programme

https://connect.innovateuk.org/web/building-performance-evaluation

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- Do you do Building Performance Evaluations?
- How do you do Building Performance Evaluation?
- What gaps are there?
- How can we fill them?

Thank you

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