Resource Hub

Building Performance Evaluation:

Undertaking Dwelling BPE

BPN Training Module 3

Delivered by

bpn
Building Performance Network

BPE Training Modules - Introduction

- BPN has produced 5 training modules on domestic Building Performance Evaluation (BPE), funded by Ecology Building Society.
- These form part of a BPE Resource Hub hosted by BPN and sponsored by Rockwool.
- The aim is to help you understand what BPE is, what the benefits are, and how to run a successful BPE project.

Module 1	Module 2	Module 3	Module 4	Module 5
BPE: What, why & the benefits it brings	Planning a BPE: where to start & common techniques	Undertaking dwelling BPE	Data interpretation, reporting & taking action	The performance golden thread: BPE & robust QA

Module 2: Recap

Module 2 covered the following areas:

Module 2

Planning a BPE: where to start & common techniques

- Engaging project participants
- BPE at different project stages
- More detail on common BPE techniques and their purpose
- Timing of BPE

Module 3 builds upon Module 1 and 2 and covers how to undertake BPE.

Module 3:
Undertaking dwelling Building Performance Evaluation (BPE)

Module 3

Undertaking dwelling BPE

- How to undertake BPE
- What aspects you may wish to monitor
- An introduction to how monitoring is conducted

Why do BPE?

Many existing, new and refurbished buildings exhibit large gaps between design aspiration and how they actually perform in use.

- For **self-builders and occupants**, BPE can help ensure the level of energy efficiency, building comfort and usability expected.
- For **developers and contractors**, BPE can help demonstrate that the expected building performance has been delivered in practice.
- BPE also plays an important role in continual improvement.

Understanding what you want to achieve through BPE is key to a successful BPE programme.

Building Performance Evaluation

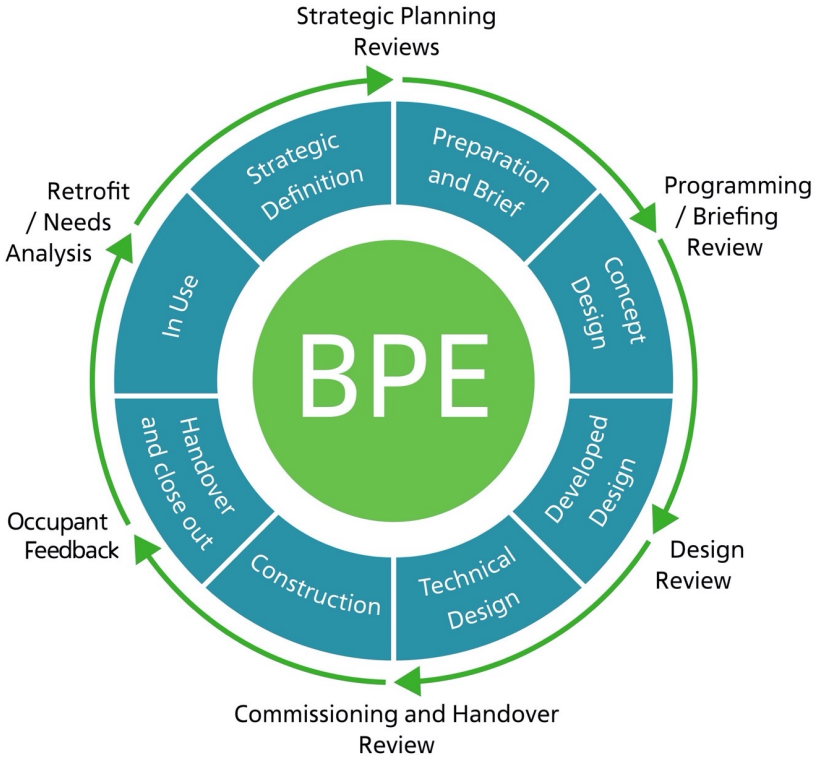
"Gathering of a building's (or premises') quantitative and qualitative performance parameter data and the interpretation of these data against comparators to draw conclusions regarding specific aspects of performance and the overall performance of the building (or premises)"

(Reference: BS 40101:2022, Building performance evaluation of occupied and operational buildings (using data gathered from tests, measurements, observation and user experience) — Specification)

What to do at each stage of the project

Considering BPE at **each stage** of the build or refurbishment process will help ensure that everything is in place to make evaluation efficient and effective.

- The need for BPE should be taken into account from the earliest stages of construction or refurbishment.
- Set out clearly that the building performance in-use will be evaluated, both in relation to the design or refurbishment aspirations and in relation to appropriate comparators.
- Communicate expectations to key stakeholders as early as possible.



Scoping considerations

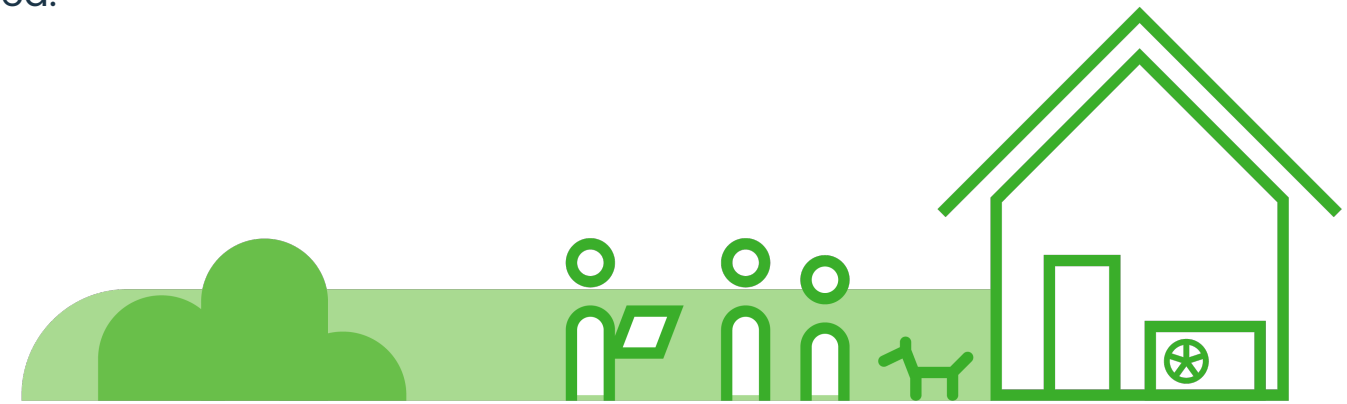
As discussed in Module 2, BS 40101 states BPE can be either Preliminary, Light, Standard, with optional Investigative assessment.

Usually, it is sensible to undertake some form of initial investigation to help "**hot-spot**" the areas for further investigation.

Where a dwelling is pre-existing, investigative BPE may be used to delve into particular problems or concerns that have been noted.

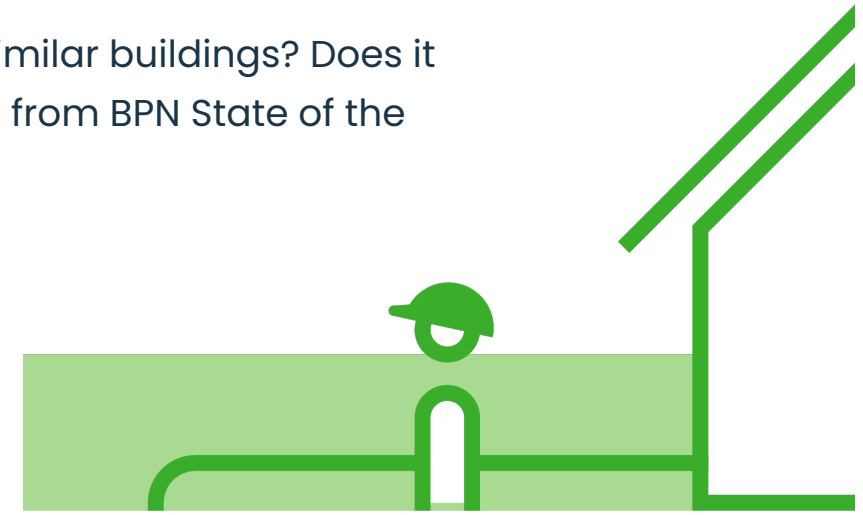
What do you want to evaluate?

Be clear about what you want to evaluate and why. Considering priorities and potential issues can help focus your BPE and indicate the appropriate level of data collection and monitoring.



What are your comparators?

- **The design brief and specification**: Does performance in-use meet the design aspirations and specification?
- **Industry standards**: Does performance in-use meet a particular industry standard (e.g. Passivhaus certification, RIBA 2030 Challenge or EnerPHit)?
- **Other similar buildings**: Does performance in-use match that of other similar buildings? Does it equal that of other high-performing buildings of the scale and type (e.g. from BPN State of the Nation Review of Performance Evaluation of Housing)?



Engaging BPE experts

You may choose to project manage the BPE programme yourself or engage a BPE practitioner, depending on the complexity and budget of the project. Some aspects of BPE (e.g. air tightness and heat loss testing) will likely require specialists. Architects, retrofit coordinators, building performance evaluators can assist, as well as specialist building performance testers.

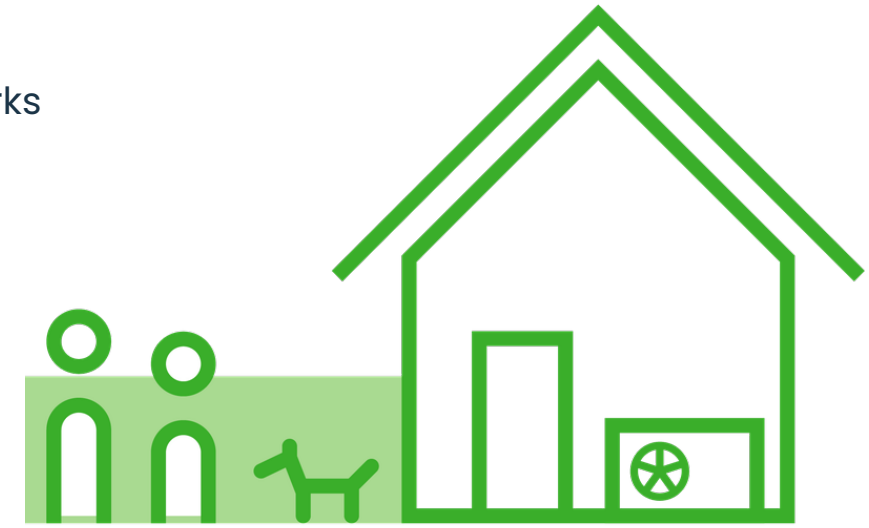
Procuring your BPE expert

- Clearly set out the objectives you wish to achieve, what you want to know and why.
- Summarise any specific issues or aims.
- Engage the BPE expert early - several aspects of BPE require long-term monitoring and forward-planning.

Working with occupants

It is important to remember good performance of the dwelling in-use, with and for the occupants living in it, is the ultimate purpose of BPE. This means that it is important to:

- Understand what occupants want from the building
- Work with occupants to understand any issues currently being experienced
- Minimise disruption to occupants during BPE and associated mitigation works
- Maintain an on-going feedback loop with occupants so that you understand how the building performs long-term



Monitoring and testing - Quantitative

There are many aspects of building performance that you may wish to evaluate. Which tests you use will depend on what aspects of BPE you want to evaluate. Common tests include:

- **External environmental conditions:** External environmental conditions will influence what performance your building can achieve.
  - Test: Data from local weather station(s).
  - Timing: Ideally prior to commencement AND for periods of other testing.

- **Airtightness:** Unwanted drafts and uncontrolled airflow through a dwelling can cause heat loss and occupant discomfort.
  - Test: Blower door or Pulse test.
  - Timing: Ideally when envelope closed but before internal finishes installer. Prior to handover; any time.

- **Energy use:** Ensuring energy use is as expected can limit energy use and cost. Additionally, high energy use can be an indication of other issues.
  - Test: Energy use data.
  - Timing: Any time. 12 months of data is preferable to give a full picture.

Monitoring and testing - Quantitative

- **Thermal bridges**: Understanding thermal (or cold) bridging can help identify and avoid locations of heat loss and resulting colder surfaces which are often linked to mould formation.

- Test: Accredited Construction Details or Thermal bridge analysis. - Timing: Design stage and during construction.

- **Heat loss:** Understanding how the building fabric performs in terms of heat loss and retention can be useful for reducing heat loss and increasing energy efficiency

- Test: Co-heating, dynamic co-heating or in-use measurement to calculate the Heat Transfer Co-efficient.
- Timing: When sufficient difference between internal and external temperature.

- **Water use:** Ensuring water use is as expected can limit water wastage and cost. Additionally, high water use can be an indication of other issues.

- Test: Water use data. - Timing: Any time. 12 months of data is preferable.

Monitoring and testing - Quantitative

- **Ventilation rates:** Ensuring ventilation system and ventilation rates are as intended can help keep air fresh and prevent build up of pollutants, moisture and odours.

- Test: Volume air flow rate or visual inspection (for natural ventilation and cross-flow). - Timing: Prior to handover.

- **Indoor Air Quality:** Ensuring air quality is good and pollution minimal will help protect human health.

- Test: Internal air quality sensors. - Timing: Varies depending on preliminary BPE assessment results.

- **Overheating analysis:** Ensuring that the dwelling is not susceptible to overheating and, if it is, understanding the causes can be very important to attaining comfortable temperature.

- Test: GHA overheating tool. - Timing: Hot summer, for 3 months

Monitoring and testing - Qualitative

- **Site visits and inspections:** Visiting the dwelling at important stages of the project can give insights that cannot be gained from documentation and testing alone.

- Purpose: Check how design targets are being implemented. - Timing: Throughout construction and handover.

- **Occupant comfort and satisfaction:** Obtaining insight into occupant comfort and satisfaction can provide useful information to inform all aspects of BPE.

- Purpose: To obtain feedback from occupants. - Timing: Prior to refurbishment works, summer and winter after.

Commissioning and handover

The commissioning and handover phase can have a significant impact on ensuring the systems are running correctly, but also on how well occupants understand and are able to use them.

Commissioning

- Confirm relevant tests have been performed and the target performance levels attained
- Check relevant equipment has been adequately commissioned and is in working order
- Ensure any BPE issues are remedied before Practical Completion wherever possible

Handover

- Explain any ongoing or future monitoring and evaluation to occupants
- Check occupants know how to use any controls or monitoring equipment relevant for them
- Create a building user guide to ensure sufficient information on how to use controls and equipment is available.

Red flags

Warning signs or "Red flags" can give an indication of problems with the current building performance. Many of these can be identified through occupant surveys and feedback.

- Lack of response from design/build team.
- Anomalous results for one dwelling of sample.
- Anomalous results for one aspect.
- A rushed commissioning or handover.
- Large quantities of occupant feedback where only a few words would suffice.
- Occupant feedback which is contrary to the intended outcomes of a project.
- Occupant feedback on topics other than BPE.

See the guidance for more details on dealing with Red Flags.

Ongoing performance evaluation

BPE brings most benefits when it is an ongoing process. Ongoing BPE can:

- Ensure that any mitigation measures that have been implemented continue to be effective.
- Highlight any new performance issue that have occurred.
- Demonstrate continued delivery of required quality for building assurance.

There are three things that will influence the ongoing good performance of a dwelling:

1. The external environment.
2. Changes to the building fabric, upgrades and maintenance.
3. Changes in occupancy and how occupants use the building.

Future innovation

Given the broader context of the global and UK climate policy and changing industry practices, better building performance in-use will be essential in future.

Monitoring technologies are evolving. Data collection is becoming easier and more sophisticated (using machine learning, AI and advanced data collection methods). As a result testing and equipment will become cheaper over time. Data standards are also advancing.

Be aware that new technologies and techniques are transparent; data is robust and repeatable with reported error margins; and the data produced is suitable for offering the assurance required.

Ways of sharing and communicating data are evolving at a rapid pace. See Active Building Centre Research Programme's IoT Infrastructure and Data Repository: https://abc-rp.com/what-we-do/data-monitoring/

Data analysis

Once monitoring and testing is complete, you will need to undertake data analysis.

- Collecting, storing and structuring data, with consideration to GDPR
- Interpreting data, and
- Reporting

are all important parts of a BPE programme.

Module 4 will cover this in more detail.

What have we covered?

- BPE Training Module 2 - recap
- Introduction to Module 3
- How to undertake BPE
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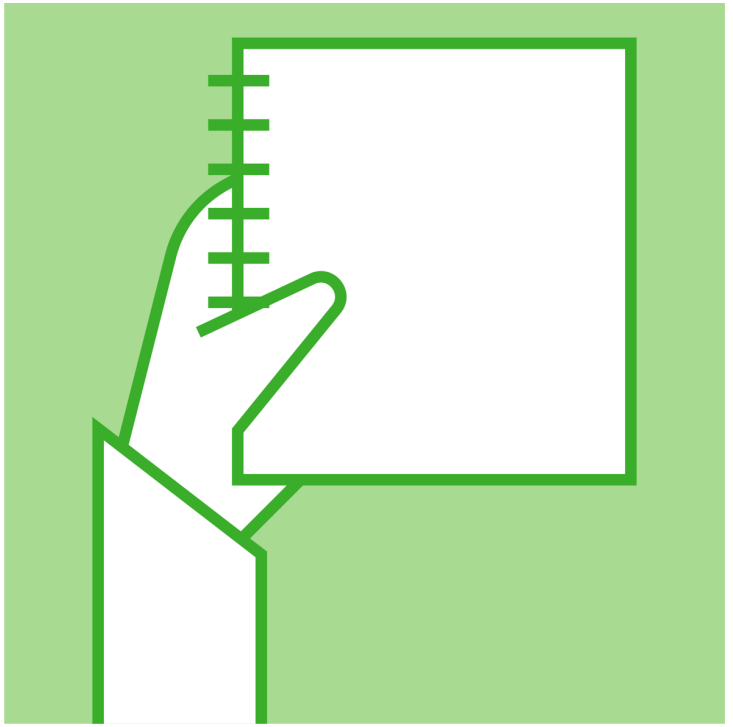

Find more on all of this at the BPN Resource Hub:

building-performance.network/

Resource Hub