UK GREEN BUILDING COUNCIL

MAY 2016

Full Report

DELIVERING BUILDING PERFORMANCE

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CAMPAIGN FOR A SUSTAINABLE BUILT ENVIRONMENT

CONTENTS

ACKNOWLEDGEMENTS

PROJECT STEERING GROUP

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- John Davies, Derwent London
- Emma Hines, Tarmac
- Judit Kimpian, AHR
- Duncan Price, BuroHappold
- Sarah Ratcliffe, Better Buildings Partnership

UK-GBC is grateful to project sponsors, Buro Happold, Saint Gobain and Tarmac.

INTERVIEWEES

Interviewees were drawn from the following sectors: Investors, developers, owner occupiers, leasing occupiers, managing agents, facilities managers, professional services, manufacturers and membership organisations.

We would like to specifically thank:
- BRE (Andy Lewry)
- Canary Wharf Group (Dave Hodge, Rita Margarido and Lugano Kapembwa)
- The Crown Estate (Jane Wakiwaka)
- Derwent London (John Davies)
- Hoare Lea (Julie Godefroy)
- IES (Sarah Graham and Naghman Khan)
- John Lewis Partnership (Phil Birch)
- Land Securities (Caroline Hill and Neil Pennell)
- Legal and General (Debbie Hobbs)
- Lend Lease (Hannah Kershaw)
- Marks and Spencer (Kate Neale)
- M J Mapp (Carl Brooks)
- Tarmac (Tim Cowling)
- UPP (James Sandie)
- Wilkinson Eyre (Gary Clark)
- Participants in the UK-GBC seminar at Ecobuild
- Participants in the Edge seminar at Ecobuild

EXECUTIVE SUMMARY

The performance in operation, of the vast majority of our buildings, is simply not commensurate with the challenge of meeting our carbon targets. It also damages our ability as an industry to deliver other positive sustainability outcomes – including providing spaces that enable health, wellbeing and productivity for occupiers.

This Task Group has sought to highlight some process improvements that design, construction and property professionals, as well as occupiers, might adopt to deliver buildings which perform more predictably in operation. These findings have been primarily informed by interviews with UK-GBC members, in addition to desk-based research.

THE BUSINESS CASE FOR DELIVERING BUILDING PERFORMANCE

Crucially for UK-GBC, and for all those with an interest in sustainability, delivering reliable building performance enables the industry to deliver higher building performance. The two are inextricably linked. The benefits of delivering higher building performance are synonymous with the business case for sustainable buildings. There is a growing body of work on this topic and the following section provides a snapshot, drawing on past work from the World Green Building Council and from recent analysis by UK-GBC. Further evidence on this topic will continue to be produced by UK-GBC in years ahead.

Reduced costs

High performing, sustainable buildings can both reduce construction costs and reduce operating costs. This can come from managing both carbon and cost in the construction process through site wide efficiency and waste management strategies, and of course through efficient heating, cooling, lighting and ventilation strategies for the building itself.

Meeting market demand

According to the World Green Building Trends survey, over a third of companies surveyed expect to have at least 60% of their building projects certified green by 2018. A green building certification (BREEAM, LEED etc.) is an increasingly common requirement for global corporate occupiers.

Furthermore, the expectation is that a growing number of occupiers will expect building developers and owners to be able to demonstrate the impact of the building on occupant health and productivity.

Superior financial performance

In 2015 Carbon War Room reported on the relationship between sustainability investment and financial returns of real estate investment trusts (REITs) – Building Returns – Investing in Sustainability Pays Off. The study found that a higher sustainability ranking in the annual GRESB REIT survey correlated to a superior financial performance; in respect of both returns on assets and returns on equity. It also found a significant link between portfolio sustainability indicators and REIT stock market performance and was able to establish, for the first time, that investing in sustainability enhances business performance and lowers risk exposure and volatility.

Employee recruitment, retention and productivity

Surveys regularly show that graduates are increasingly looking for a sustainable and ethical place to work. In a survey of more than 2,000 people in the UK, consultancy Global Tolerance found that 44% thought meaningful work that helped others was more important than a high salary. Not only is a sustainable place to work more likely to attract and retain talent, but it is more likely to get the most from that talent in terms of workplace productivity. There is a growing body of evidence demonstrating the impact of factors such as indoor air quality, thermal comfort and lighting on human health and wellbeing, reducing associated staff costs, and increasing productivity.

FIVE KEY SUCCESS FACTORS IN DELIVERING BUILDING PERFORMANCE

1 ASPIRATION
Setting a simple target – at the very least for energy (kWh/m^2) – helps to create a common language and shared aspirations across the delivery process.

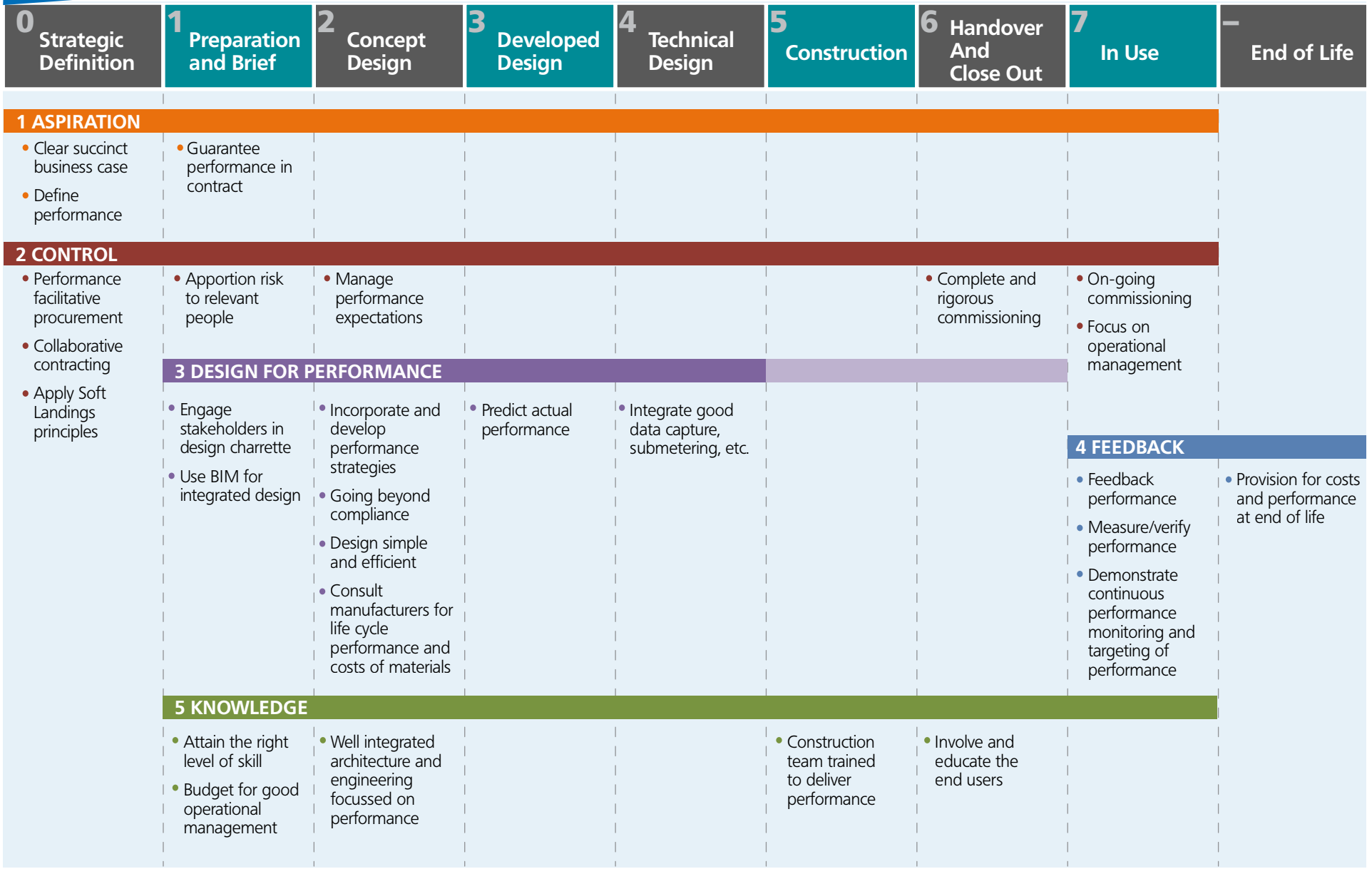
2 CONTROL
Collaborative contracting, with performance guaranteed and control maintained throughout the delivery process helps to ensure predictable outcomes.

3 DESIGN FOR PERFORMANCE
Performance improves when aspirations are not limited to compliance or, in other words, "going for the ceiling, not the floor".

4 FEEDBACK
Reciprocal links and a commitment to monitor and feedback, particularly during the handover process, is vital. So too is giving time for well documented building commissioning. 'Links must be made between operational facilities management (FM) and the design team, and between FM and building occupiers.

5 KNOWLEDGE
Improved knowledge, across the whole value chain, supports good outcomes. This is enabled by participating openly in lesson-sharing activities.

MAPPING THE SUCCESS FACTORS TO THE BUILDING LIFE CYCLE



UK-GBC NEXT STEPS

The UK-GBC membership represents all stages of the design, construction and building operations process, so we can therefore play an important role by connecting up the key players, ensuring that they understand the challenges, and encouraging them to adopt good practice solutions.

These findings and recommendations will inform our ever growing programme of learning and development courses and activities, and we will seek to build momentum through our Sustainability 360 Review Process with Gold Leaf members, and a range of upcoming work on the business case.

KEY RECOMMENDATIONS BY SECTOR

DESIGNERS

- Advocate design for performance, rather than compliance, and help the client understand the difference and the business case for high performance.
- Collaborate with other key players in the value chain to agree on realistic yet ambitious performance targets rather than compliance targets.
- Pursue a feedback process for every project, to examine performance achieved in practice, and compare against original targets in collaboration with design team partners.

CONTRACTORS

- Apply sustainable construction principles and educate the client, communicating the business case for high performance.
- Collaborate with other key players in the value chain to agree on realistic yet ambitious performance targets rather than compliance targets.
- Push performance targets through the procurement process, ensuring consistent standards are met by all suppliers.
- Encourage improved knowledge throughout the supply chain, making use of free resources available from the Supply Chain Sustainability School.

OCCUPIERS

- Ensure that facilities managers measure, evaluate and benchmark operational building performance across a range of performance factors, and share this data with landlords and developers to improve life cycle knowledge.
- Set ambitious yet realistic performance targets within transactional specifications, and engage with agents to ensure these are understood and prioritised.

INVESTORS AND DEVELOPERS

- Make aspirations clear from the outset, by setting performance targets based on consultation with prospective occupiers and letting agents.
- Ensure that actual performance achievements form a critical part of design team selection, and challenge and empower them to go well beyond compliance.
- Set expectations that performance will be central to contracts and encourage collaboration throughout the supply chain.
- Ensure that performance measurement, monitoring and feedback clauses are included within lease agreements.
- Engage with occupiers and letting agents to share lessons learned and to influence specifications of corporate real estate teams.

INTRODUCTION

BACKGROUND TO THE REPORT – THE ZERO CARBON POLICY

It is important to set the context for this particular report, and explain its origins. For several years, successive governments had a target for all newly built non-domestic buildings to be zero carbon from 2019. UK-GBC was a strong advocate for this target and has a long history of engagement with government and the industry on the topic of zero carbon standards.

In 2013-14 a UK-GBC Task Group made a strong economic case for zero carbon, but the government of the time remained decidedly quiet. We had the information on the uplift to Part L in 2013 but no indication of the planned 2016 uplift, let alone 2019. So UK-GBC rallied its membership again and launched a new piece of work in June 2015 to further inform the 2019 standards, including reviewing the contribution of so-called Allowable Solutions.

The intention was to understand the solutions and approaches industry was already pursuing, and to identify those likely to be most effective. It was felt that this could both inform industry – highlighting areas of progress, where leadership is being shown – and keep pressure up on a new Conservative Government, now divorced from their Lib Dem coalition partners.

The sudden announcement in July 2015 of a complete abandonment of the zero carbon policy was not entirely unexpected, but was arguably even worse than we feared. The focus was on homes, but Government made it clear that the non-domestic zero carbon target was also completely off the table.

Coming only one month into the project, it was clear we could not carry on with the same brief. There was still plenty of enthusiasm for the subject, but it was obvious that a focus purely on zero carbon was not going to be particularly helpful.

REFOCUSING ON PERFORMANCE

The group quickly refocused its discussions. There was a legitimate question about how much carbon the zero carbon policy would have saved if we were not delivering more reliable performance anyway. There is an increasingly urgent need to deliver carbon savings from the built environment to meet binding national carbon targets and we therefore need to increase our focus on making our buildings work harder in practice not just in design. If you cannot guarantee an output, targets are only of limited use.

As part of those discussions, the group also recognised that building performance was far broader than just energy and carbon. We know, for example, that how a building operates impacts human health and wellbeing, and productivity of building users.

Building performance simply describes how well a building functions against needs. Those needs vary – for each of the parts of the building life cycle, building performance means different things. Figure 1 illustrates the aspects of performance that Task Group representatives felt to be relevant at different stages of the life cycle. Although scope was widened beyond just energy and carbon, the Task Group suggests that energy actually remains a good proxy for other performance parameters.

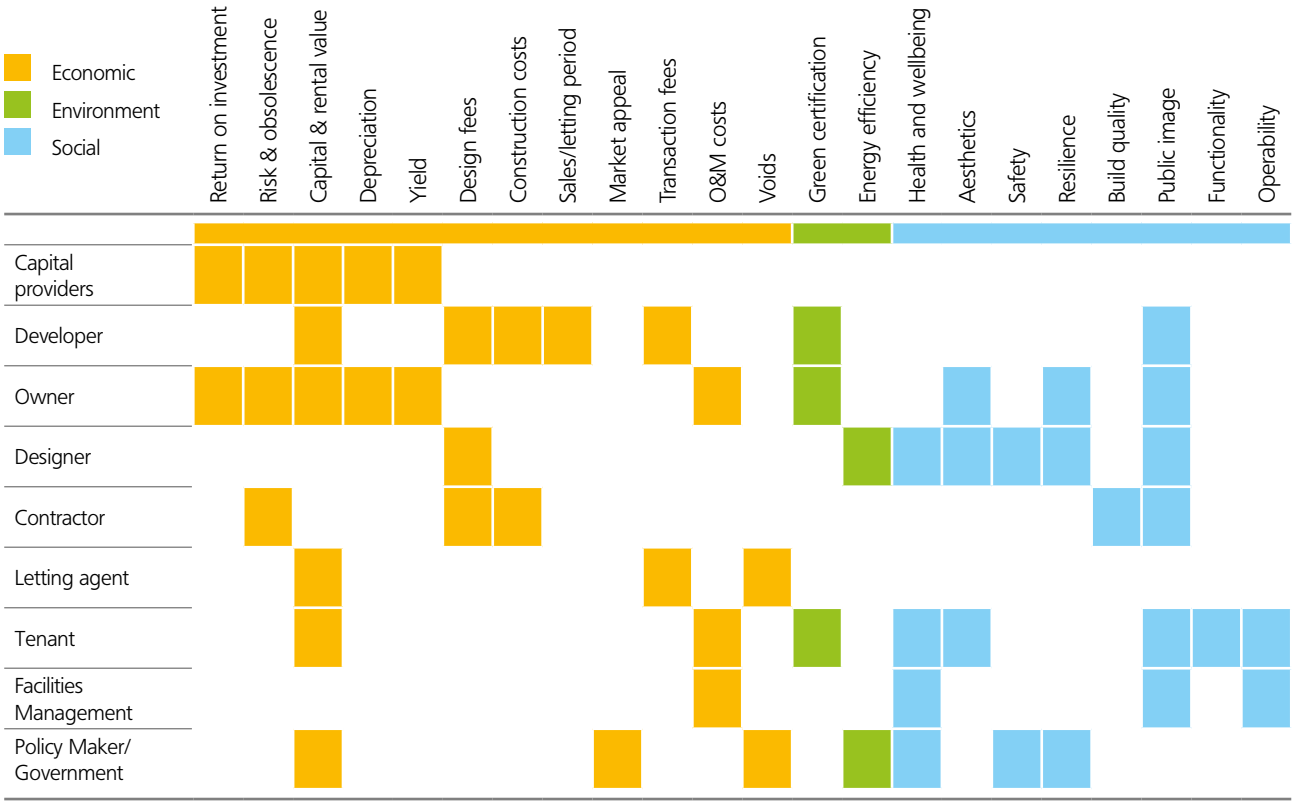


Figure 1: Building performance for different stakeholders (based on Task Group research)

THE PURPOSE OF THE TASK GROUP

UK-GBC therefore reconstituted the Task Group around a new question. How can the industry deliver better building performance and more reliable outcomes? We know that this is technically possible because there are a number of case study examples which demonstrate it is possible to predict the level of operational building performance at design stage, and deliver it post completion. The issue is therefore one of process, rather than technical barriers. Good practice is simply not widespread. The Building Performance Evaluation programme from Innovate UK has highlighted the often significant gap between design intent and reality in use. Yet, we continue to design for compliance rather than ultimate performance, and buildings are not delivering to their greatest potential for building users.

This report presents the results of research – both desk-based drawing upon existing work, and face to face interviews with a series of stakeholders from across the building life cycle – examining behaviours and processes across the built environment that affect building performance. What are the key barriers, and how do we overcome them? We focussed on the commercial sector, as opposed to public sector, but much of the analysis is relevant to both.

We knew that there were a number of different groups already working on building performance, some specifically looking at the Performance Gap (the difference between design and operation) and others with a wider process focus. There is also a plethora of research literature from previous studies and projects, and a number of tools and processes that seek to improve building performance.

Our purpose was therefore to try to cut through some of the "noise", and to highlight some straightforward process improvements that design, construction and property professionals, as well as occupiers, might adopt to deliver buildings which perform more predictably in operation. UK-GBC is almost uniquely placed to do this in that we represent all stages of the construction and property process. We can therefore play an important role by connecting up the key players, ensuring that they understand the challenges, and encouraging them to adopt good practice solutions.

To browse a wide range of resources on Building Performance click here.

OVERCOMING BARRIERS TO DELIVERING BUILDING PERFORMANCE

INTRODUCTION

This chapter is structured around five key factors that determine the success or failure of projects to deliver more reliable performance. In each section we discuss some of the key barriers to delivering performance, and how to overcome those barriers.

1 ASPIRATION
2 CONTROL
3 DESIGN FOR PERFORMANCE
4 FEEDBACK
5 KNOWLEDGE

The applicability of these key success factors across the RIBA building lifecycle stages is mapped in Figure 2 and each is then explored in further detail in the sections that follow.

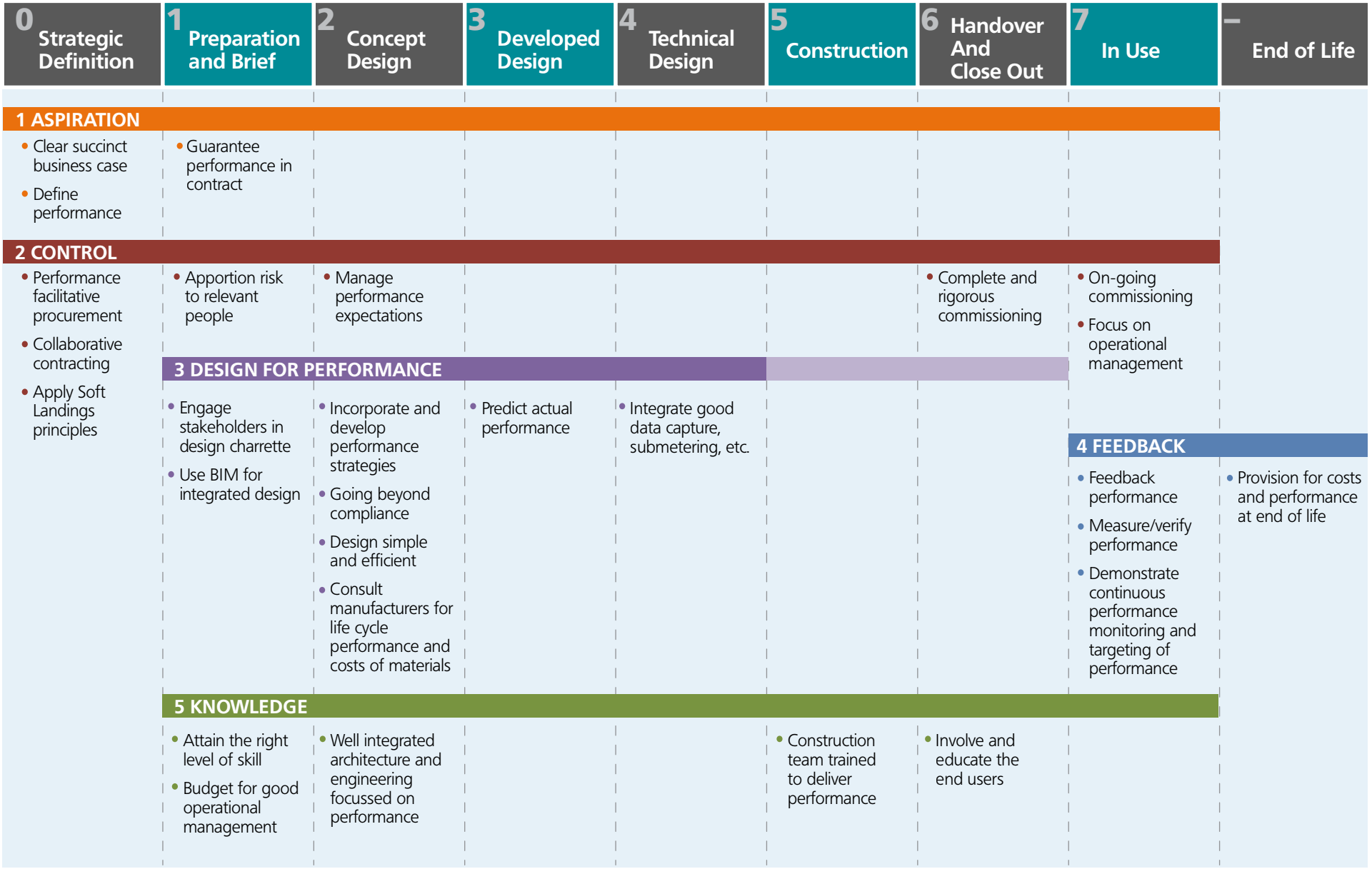


Figure 2: Factors ensuring delivery of reliable building performance, aligned with RIBA building life cycle stages

1 ASPIRATION

Perception of risk and value

Canary Wharf Group noted that there is a misconception in some design teams that a good building performance specification is more expensive than a standard specification. They and others see this as a perception, as well as a knowledge gap. Buildings which perform well do not need to be complex. This has been repeatedly found in post-occupancy evaluation, from the early PROBE programme to the recent Innovate UK Building Performance Evaluation programme.

Research by Judit Kimpian[1] at AHR and Esfandiar Burman[2] at UCL suggests that building performance can decrease with building complexity, and that more expense does not necessarily lead to better performance.

There is also a need to deal with perceived risk in the supply chain. Sustainable buildings are generally perceived to have increased risks – lack of experience in using new technologies and processes risks projects going over budget, taking longer to complete or creating room for mistakes. Without certainty for enhanced returns or profit, stakeholders throughout the supply chain are conservative and stick with what they know.

The business case is, therefore, critical to raising aspirations. Enhanced returns are, after all, one of the most important motivators for many business decisions. So increased performance – which is typically seen as an additional cost by capital providers – often requires justification in terms of rental/capital value uplifts or risk reduction.

The Green Construction Board[3] has suggested there is little belief in differential market pricing, especially in buoyant markets where 'anything will let'. Interviewees for this report believed that many decision makers are not actually aware of the benefits or are not convinced of them. In addition, as Sarah Graham at IES said, "*(Property owner) Decision makers are hanging back to see what their competitors are going to do, nobody is really embracing change as it is not the nature of our industry.*"

However, although there may not be a simple causal link between positive building performance and an increase in market value, the Minimum Energy Efficiency Standards (MEES) regulations (discussed more below) are beginning to impact. It appears that tenants and their agents understand that a good building shell is more likely to lead to better operational performance, so price chipping is beginning to occur on poorer performing assets which are in need of substantial investment to bring them up to minimum standards. This is consistent with the proposition that whilst a 'green premium' is hard to discern, the concept of a 'brown discount' is more accurate.

If we want to see a positive return from good building performance, more work needs to be done with tenants/occupiers to demonstrate the value of building performance, and to enable them to ask the right questions and request the right standards of the building spaces they procure. Hannah Kershaw from Lend Lease noted that occupiers ask about visible performance elements – e.g. cycle spaces, showers. There is a need to explain the occupier benefits of the invisible building performance elements, e.g. air quality, energy efficiency, and to point to tangible benefits.

Setting a target

The drive for building performance needs to be led by the client – usually the owner, developer or occupier. They can drive the expectation and requirement for building performance throughout the whole supply chain: setting objectives, a common purpose and ensuring contract alignment with the expectations and targets.

Interviewees regularly cited the limited influence of architects and engineers on the building projects in terms of performance outcomes or criteria set by the client. The design is mostly guided by client requirements. Debbie Hobbs at Legal and General stressed the importance of support at the C-suite level as it gives others the confidence to press for the required performance levels and leads to productive engagement with the entire supply chain.

1 Kimpian, J., Bull, J., and Burman, E., 2015. *Final Report for Building Performance Evaluations on Pool and Tremough Innovation Centres*

2 Burman, E. 2016. *Building Performance Gap: A Way Forward*, Building Performance Evaluation – Understanding the Performance Gap

3 GCB, 2014: Mapping the Real Estate Lifecycle for Effective Policy Interventions

Targets that can be understood and applied across the supply chain are essential. In our research we typically found that a small set of Key Performance Indicators had been applied, and that these had the resonance we believe to be essential to engage senior management. John Lewis Partnership set KPIs in their Responsible Development Commitments. These are shared with actual and potential suppliers to set clear expectations. The Crown Estate has set operational performance targets across a typology of buildings – offices, retail and residential, within their Development Sustainability Indicators.

Caroline Hill at REIT Land Securities sees a need to educate occupiers and owners so they know what is "good". UK-GBC offers a range of training courses designed specifically to address these gaps in knowledge and understanding. There are also a number of resources available to help those without benchmarks to set them, and working groups addressing particular sectors – such as the Better Buildings Partnership who have a developing set of in-use benchmarks for investors (See reference to Real Estate Environmental Benchmark in Appendices).

Several interviewees thought more shared data to improve benchmarks would help, particularly in the development of industry typologies. There was a call for benchmarks to include information about operating conditions of the buildings from which they are taken to improve their relevance. We found that several interviewees had developed benchmarks of their own for typical projects and scenarios. This included both owner-occupiers, and owners where tenants were unknown at the time of design.

Of particular interest is the NABERS system first developed in Australia, which is discussed under the next recommendation, and the associated Commitment Agreement Protocol (CAP), being developed by Verco, UBT, Arup & BSRIA with cross-industry support. The CAP is specifically designed to bring together clients and players from across the building design and delivery to 'Design for Performance' helping them to set targets and an assessment of performance that extends into the first 18 months that the building is operational.

Having comparable KPIs is very important. The recommendation for a small set of common indicators is not new – a notable example is the 2005 Movement for Innovation (M4i) Environmental Performance Indicators for Sustainable Construction report, chaired by Rab Bennetts. However given that the industry has not been able to agree a focused shared set of indicators yet, **we propose that the industry should champion a single indicator – kWh per m² – and that this is the indicator that should be used to set building performance targets and measure building performance.** This indicator provides a common language for building performance that can span the whole supply chain. It is straightforward to understand for the owner, the occupier, and every part of the industry and is easily comparable as well as linking to running costs, carbon emissions, ESOS and occupier comfort. A particular benefit is that it can be easily monitored through meter readings and requires no complex equipment or personnel.

Case study: WWF Living Planet Centre

The Living Planet Centre, WWF's new UK head office located in Woking, Surrey, is an exemplar building for sustainable new build offices and demonstrates how far-reaching sustainability objectives set by the client act as drivers for the whole project team and beyond to engage and collaborate from a very early starting point.

WWF set out a clear vision, including a number of aims such as "Towards Zero Carbon" and "Towards Zero Waste". They also targeted BREEAM Outstanding (Design and In Use).

On energy, at the design stage the predicted energy consumption was 26.7 kWh/m²/yr for heating, cooling, lighting and hot water plus 48.17 kWh/m²/yr for appliances, giving an energy target of 74.87 kWh/m²/yr. Energy and occupancy data from the first year was used to generate a base line and then benchmarked against the Better Building Partnership's Real Estate Environmental Benchmark. Results show that the kWh consumption is below both the typical practice and the good practice BBP benchmarks. WWF has also set up an internal environmental performance working group to reduce their operational energy targets.

The Living Planet Centre is an example of what can be achieved with a set of simple drivers and a fully engaged project team working in collaboration from a very early stage in the project. The final building fulfils WWF's vision and delivers quantifiable sustainable outcomes but also has repercussions for how high clients set their ambitions and where they perceive value in the future.

Full case study details, click **here**.

Case study:
Wessex Water Operations Centre, Bath

Wessex Water's headquarters building was handed over back in July 2000 but remains an exemplar in terms of building performance, standing the test of time. Energy, materials, transport, biodiversity, comfort, water consumption, waste management, community and conservation were all placed under close scrutiny and a specialist was appointed to oversee the team's initial concepts to ensure a holistic view of sustainability was embedded in the building. An energy target exceeding the recognised 'best practice' was agreed at 100kWh/m^2/year.

Handover of the building was critical to its success. Wessex Water's Project Manager and Facilities Management briefed the teams on the new building and its features before occupation. 'No surprises' was the aim. A collaborative and teamwork approach to overcome any issues was a significant factor in quickly identifying and resolving issues resulting in significant energy savings and also a very high level of satisfaction amongst staff.

Having set out to deliver a building which would re-define sustainable office design, Wessex Water wanted to be able to demonstrate that they had indeed achieved all they had set out to achieve. A process of post-occupancy monitoring and reporting took place over a three year period.

As a result of the monitoring work improvements were implemented to systems, to the building fabric and to some working practices, which eventually resulted in a 30% reduction in energy consumption of the core office areas and the targets set at the start of the project being achieved. Electricity consumption was reduced over the three years by approximately 20%. Anecdotal evidence has shown that there is a very high level of satisfaction amongst staff leading to reduced absenteeism and higher productivity. Recruitment and retention indicators are also believed to be good.

2 CONTROL

Delivering good building performance requires good control of the procurement and delivery process; an integrated project delivery approach; and client commitment to validating operational performance. This helps to sidestep common issues, such as unmanaged risks and responsibility, lack of early design involvement, and uncontrolled value engineering that comes from a fragmented supply chain – which are explored further below.

An overview of identified barriers over the delivery process is given in Figure 3 below. Segmentation of the supply chain can amplify these barriers and creates many difficulties for the responsibilities stakeholders face. Fundamentally, in a fragmented supply chain the responsibility for providing a reliable performance is diluted throughout the building life cycle.

Fragmented industry

Several interviewees observed that consultants are increasingly only required for Part L compliance and M&E energy assessments, and are not asked to provide technical advice, the responsibility for which is passed to contractors. Contractors tend to be experts on buildability and cost, but less so on the creative design side. Several interviewees believed that contractors tend to see technologies as risky, so price them out or pass the specification onto manufacturers, who tend to see their specification only in isolation. Emma Hines at Tarmac observed that involving suppliers as early as possible in the design phase enables them to understand where their contribution fits in to the wider project and to provide the optimal response. It also helps the project to gain the most value from the whole supply chain.

The fragmentation problem also exists at the interface between shell design and fit out. Jane Wakiwaka of The Crown Estate pointed out that during lease negotiations where legal teams and prospective occupiers do not understand the requirements or benefits of (sustainable) fit-outs, or where green leases are specified, they may be struck out if considered a risk to the occupier. In addition, as we discuss under key success factor three, a *mis*fit-out can undermine all of the design work done for the shell and core systems.

Operationally, there is a risk that building operators will perceive that a gap between compliance modelling and actual measured operational performance is simply due to this difference in scope, and will not investigate further. Yet it could be a problem with equipment, controls or operation which could be rectified as part of the building commissioning or servicing process.

Most interviewees emphasised the importance of Post Occupancy Evaluation, and co-operation between the occupier and building owner as being extremely important to get the most out of the design work. Neil Pennell from Land Securities observed the need to get tenants to understand and buy in to site wide energy strategies, while Canary Wharf Group provide a sustainability guide to their tenants to guide the fit out, and in some cases may include conformance criteria in the lease conditions. Several of our interviewees employ environmental or sustainability tenant liaison managers to enable this collaboration, and to elicit feedback from tenants to improve future design work.

Speculative developments

According to several interviewees, the UK has a higher proportion of speculative developments than Europe, Australia and the US. Speculative development often has a short-term focus, and developers are mostly concerned with minimising cap-ex costs to increase yield and profit from an early sale. The occupier is unknown, and building performance above legal compliance is generally not demanded since the actors in this type of procurement are not involved in the operation of the building. Location is considered key, yet the building is likely to have a considerable lifespan. This reinforces the function of building regulations to act as a back stop.

However, speculative builders also have to find a market, and although this part of the market may seem like "laggards", increased demand from the buyers of speculative buildings and their occupiers will eventually bear fruit. Systematic gathering of feedback and data from buildings in-use will reveal the financial benefits of good building performance and increase demand from the buyers of speculative buildings and their occupiers.

0 Strategic Definition	1 Preparation & Brief	2 Concept Design	3 Developed Design	4 Technical Design	5 Construction	6 Handover & Close Out	7 In Use	- End of Life
OWNER					CONTRACTOR	CONTRACTOR	OWNER	
CAPITAL PROVIDER							FM	
DEVELOPER								
	ARCHITECT						OCCUPANT	
		SERVICES ENGINEER						
		MANUFACTURER						
ASPIRATION								
• Lack of incentives for performance	• Lack of performance criteria • Lack of life cycle approach	• Complexity of design	• Business case is not modelled		• Contractor has no incentive for performance	• Speed to market is essential	• Lack of on-going performance targets	
CONTROL								
• Performance inhibiting procurement method	• Lack of ownership	• Lack of early stage design modelling	• Uncertainty in modelling		• Changes after deign, "Value Engineering"	• Ratings do not represent performance • Poor commissioning • Design intent not included in BMS set-up	• Lack of post occupancy evaluation • No on-going building performance programme • Not clear who is managing the building	
DESIGN FOR PERFORMANCE								
• Inadequate skills in project team • Lack of common performance parameters that cover the whole project life cycle • Conflicting target	• Lack of clear roles and responsibilities	• Knowledge gap within design team • Speculative development, occupier unknown	• Design to compliance	• Lack of performance modelling		• Limited information transferred to operations • Lack of commissioning engagement from design		
FEEDBACK								
• Lack of feedback from operation	• Lack of input from FM to design	• Little consideration for end user					• Difficulty of sharing data	
KNOWLEDGE								
• Risks and unforeseen costs are feared • Decision makers are unaware of benefits of performance							• Lack of skills for optimising building performance • Occupant behaviour • Poor management practice • Understanding systems by operators/ occupants	

Figure 3: Barriers identified and assigned to different building life cycle stages, categorised in different types of issues

Value engineering

There was particular concern about problems with value engineering from several of our interviewees and in the literature review. A number of interviewees made the point that value engineering is different to 'penny pinching'. Mark Allen from Saint Gobain noted that *"the purpose of value engineering in construction is to re-design or change construction build-up to remove challenges or save cost whilst retaining the same performance and functionality, therefore following these principles, value engineering should take place before on site construction."*

Julie Godefroy at Hoare Lea is undertaking a study of building performance and procurement routes and contract types, funded by Innovate UK[4]. The study indicates that on several occasions, design changes had been made, particularly to building services, BMS, and control systems, without a detailed review or understanding of the impact on building performance.

This fits with Green Construction Board findings that many schemes initially aspire high performance, but that design characteristics are compromised during the development process to reduce cost. In the case of buildings with complex systems, such as low carbon technologies, value engineering does not tend to take out the main technology, but it often takes out the controls or associated design details (e.g. thermal stores) that help make it work well. This is partly because this associated equipment was not detailed in the design and tender documents.

Sarah Graham at IES observed that at the point where the contractor comes on board they often get very scant information. They look at the information they have got and make an assessment as to how the building is put together, and they price it on that basis. They take a risk because they don't have enough information to ensure themselves that compliance can be achieved. Especially in a Design and Build (D&B) contract, where they are required to take on the responsibility, they will start from scratch again.

Procurement models

Julie Godefroy's research for Innovate UK found that, on average, the procurement route does not seem to have a significant impact on building performance. When looking at 'best' and 'worst' performing cases though, most of the 'best' performing[5] buildings in the research sample are a result of traditional contracts, where the design responsibility remains on the client side. On the other hand, most of the 'worst' were from D&B or PFI contracts. While the research is on-going, it currently points to the following factors to help address this: keeping the design responsibility client side as late as possible, or setting out very clear performance criteria in the contract and review performance regularly, with a client-side monitoring role.

There is also support from this research for appointing clerks of works, whose appointment has tended to become less common over the years but who often prove extremely valuable. This supports our first key success factor. Continuity in team members also appears to be a factor in helping building performance; although it is acknowledged that this may be difficult to enshrine in contracts, clients and project teams should be encouraged to retain key team members on board where possible.

Performance-based procurement has become more popular as it is able to demonstrate significant gains in performance whilst being cost competitive. It describes the requirements in terms of outcomes rather than specifying how the work is to be accomplished. A clearly defined performance goal will focus efforts and orient stakeholders in a common direction, increasing the chance to successfully meet them. This will make sure that performance is driven through the building life cycle. When goals are set, more effort is given to understand the impact of design decisions, it becomes necessary to carry out performance modelling, ensure that building fabric is constructed to a high standard, systems are properly commissioned and that the building is operated as efficiently and effectively as possible.

4 As part of the Innovate UK Building Performance Evaluation Programme, Julie Godefroy has recently investigated the potential impact of procurement routes on building performance (evaluated through energy and user feedback)

5 with performance defined by four parameters: thermal energy consumption, electrical energy consumption, user comfort, user satisfaction

NABERS

A regularly cited example of performance-based procurement is the National Australian Built Environment Rating System (NABERS) mentioned earlier in this report, a system that includes many of the necessary processes to achieve reliable building performance. For example, NABERS includes a guarantee for performance, a rating and definition that creates a common language amongst stakeholders, incorporates a "design for operation" process and requires recurring verification of performance in operation, and in addition it separates the base building and any tenant.

This scheme was originally voluntary, but it became mandatory for landlords of commercial office buildings with a net lettable area of 2,000m^2 to disclose a NABERS rating when it was leased or sold – applying a $110,000 penalty for the first day without a disclosure, and subsequent fine of $11,000 per day. It is now considered as a differentiating factor for public recognition, which led to increased investment in high rated buildings. Over 72% of the Australian national office market has now been rated with either a base building or whole building rating. Factors behind the success of the tool are largely attributed to its ability to differentiate between the base building and tenants energy end uses and strong government support. Fewer tenant energy ratings have been undertaken, something that is discussed below. The Commitment Agreement Protocol project (highlighted above) is seeking to learn from Australia's success, translating this experience into a model that will work in the UK Market.

Regardless of the procurement method taken, a collaborative approach, i.e. Collaborative Contracting should be employed. Such an approach promotes sharing of information, risks and responsibilities between parties. As Hannah Kershaw from Lend Lease observed, no individual party wants to take the risk on their own, we need to share it across the project. Jane Wakiwaka from the Crown Estate took this further; suggesting *"It needs to be about empowering different people in the supply chain to take ownership, rather than just saying it needs to be M&E design or architectural design – it needs to be more than that. It's more about embedding the approach within the design process. It needs everyone."*

Case study: The John Lewis Partnership approach to delivering building performance

The John Lewis Partnership requires building projects to meet the requirements of its Responsible Development Framework (RDF). The RDF covers common built environment themes such as energy efficiency and operational waste but also emerging areas such as health and wellbeing and climate change adaptation. Operational emissions and operational waste have been identified as material risks for the John Lewis Partnership. As such, and where relevant, building level measures addressing these areas are factored into the design of new/refurbished premises.

To tackle a multi-format estate, the John Lewis Partnership benchmarks different types of buildings within its estate. These benchmarks have been calculated by measuring energy intensity of refrigerants, energy required for lighting, heating and cooling, and other parameters.

Performance standards are set prior to the commencement of the store development process and are communicated with the relevant supply chain stakeholders (internal and external). The focus is maintained throughout the delivery and commissioning of the store by appraising performance at each work stage. Life cycle cost analysis is playing a larger role in appraising the implications and risks of design variations and changes. Value engineering activities aim to show savings across the lifecycle of the asset, not just capital expenditure, so operational performance in energy and resource use forms a key part of the evaluation.

Sustainable Development Manager at the John Lewis Partnership, Phil Birch, identifies that establishing good relationships across the store delivery and operation lifecycle is key to success. This includes the relationship between Landlord/Developers and Tenants, and between the Property team and the Branch Managers who oversee the operation of the store and the everyday actions of Partners working in the building. There is an increasing focus on Post Occupancy Evaluation and user engagement to continuously improve performance. Awareness raising and training is being provided more frequently to shop Partners to close the loop between theory and practice.

3 DESIGN FOR PERFORMANCE

There are clear links between this key success factor and the two which precede it. With a performance target in place, there is a need to make an accurate prediction of building performance. However, a building design is based on thousands of input parameters, some of which have extensive background research while others are based on only best-guess values. In the early design stage in particular these values have a major influence on the design and its final performance, so the further the assumptions are from the actuality, the further awry the building performance. Although the building use and operating patterns may only become apparent later in the building process, making change to design is expensive and difficult for contractors to accommodate, particularly on a fixed price or developer risk contract.

It is obviously much more difficult to predict the use of a building when the tenant or occupier is unknown. For a developer-owner, this is perhaps less of a problem as they know the type of tenant likely to move in and can refer to benchmarks from previous developments. As discussed in the previous chapter, several commentators mentioned the UK having a higher proportion of speculative 'quick turnover' buildings than many other countries. We again come back to the increasing interest being taken by financiers. Although the initial developer may not take too much interest in lifetime building performance if they are self-funding, subsequent owners are likely to come under scrutiny as they secure finance. Designing to model specifications and benchmarks is likely to improve the operational building performance.

Incompatible fit out is another issue. Sometimes the design intent of the owner or developer is hard to translate to an occupier whose focus is on a standard, replicable fit out which places primacy on, for example, bright artificial lighting. Other examples given in interviews included tenants who did not like to use facilities such as grey water systems, which stood idle, or who introduced catering facilities which were not anticipated in a building. In a customer focused industry this can be difficult to tackle. Discussions earlier in the design process can at least enable these requirements to be understood and accommodated and avoid wasted resources. Over time, benchmarking the performance of buildings with additional electrical load demands means that future buildings do not need to be over engineered for a worst case scenario that does not occur.

John Davies from Derwent London observed: *"The biggest hole that we see is from the time that (a property) is handed over from the contractor to the recipient, what you find is that the system is not tested and set up properly. That gets exacerbated when people move in and do the fitting out. This situation effectively erodes any thinking you did during the design".*

Case study:
Keynesham Civic Centre, on behalf of Bath and North East Somerset Council

AHR has completed the new Keynsham Civic Centre and One Stop Shop for Bath & North East Somerset Council (B&NES) in 2015. In addition to providing the Council with high quality offices, civic facilities and public realm, which will reinvigorate Keynsham town centre, the project is on course to be one the lowest energy consuming public buildings in the UK, targeting an Display Energy Certificate (DEC) A operational rating.

The new development has replaced 1960s buildings to provide 68,000sqft council offices, a library and one-stop shop, 20,000sqft retail, two new pedestrian streets, a market square, car parking and highways improvements. At the heart of the brief was Bath & North East Somerset Council's objective of creating a highly efficient, robust and flexible building that would minimise energy consumption and maintenance while providing first class civic facilities and a high quality workplace embodying a 'one council' culture.

AHR built on extensive in-house research and worked closely with Environmental Engineers Max Fordham to develop a pioneering strategy for achieving the target set out by B&NES: it is the first in the UK to implement BSRIA Soft Landings to contractually target an exemplary DEC A rating, which it is expected to achieve in 2017 once it has been in use for two years. This rating will confirm Keynsham Civic Centre as one of the lowest energy consuming public buildings in the UK. The project has already achieved energy cost savings of over 96% during the first year of its operation.

Keynsham Civic Centre has recently won a number of prestigious awards including RIBA South West Award, RIBA South West Sustainability Award, and British Council for Offices Corporate Workplace and Innovation Awards for the South West, Thames Valley & South Wales region, testifying that energy performance contracting is not only effective at closing the performance gap but is great for architecture.

"Keynsham has a low carbon, flexible office space which builds on current best practice for naturally ventilated low energy buildings." Derek Quilter, Divisional Director: Property & Project Delivery

The limitations of regulations and rating schemes

On energy performance specifically, Sarah Graham at IES noted that legislation may not be a sufficient driver alone for occupiers. Under schemes such as the Carbon Reduction Commitment (CRC) and the Climate Change Levy (CCL) it is often seen as easier to just pay the tax as energy costs are such a small proportion of total running costs in non-industrial building sectors. Both UK-GBC's interviews and research suggest that there is a much more powerful case to be made through the health and wellbeing/productivity benefits of buildings that perform well. We need to communicate and promote this to the right people – in particular owners, occupiers and letting agents. The work done by UK-GBC and WorldGBC through Better Places for People (www.betterplacesforpeople.org) is one such vehicle.

Given their lack of detailed knowledge there is an understandable situation in which owners, occupiers and investors assume that good building performance automatically follows compliance with building regulations or with accreditation rating schemes such as BREEAM whose sliding scale of accreditation is straightforward to understand. This creates the so-called "design for compliance" approach. As Neil Pennell at Land Securities noted, there is a tendency to treat regulations as a ceiling, rather than a floor. Even if projects delivered results with a percentage improvement above Part L, most people outside the technical community would not understand what this meant or the relevance to them. However even when Part L conformance or improvement is delivered, it does not relate to operational building performance as shown in Figure 4.

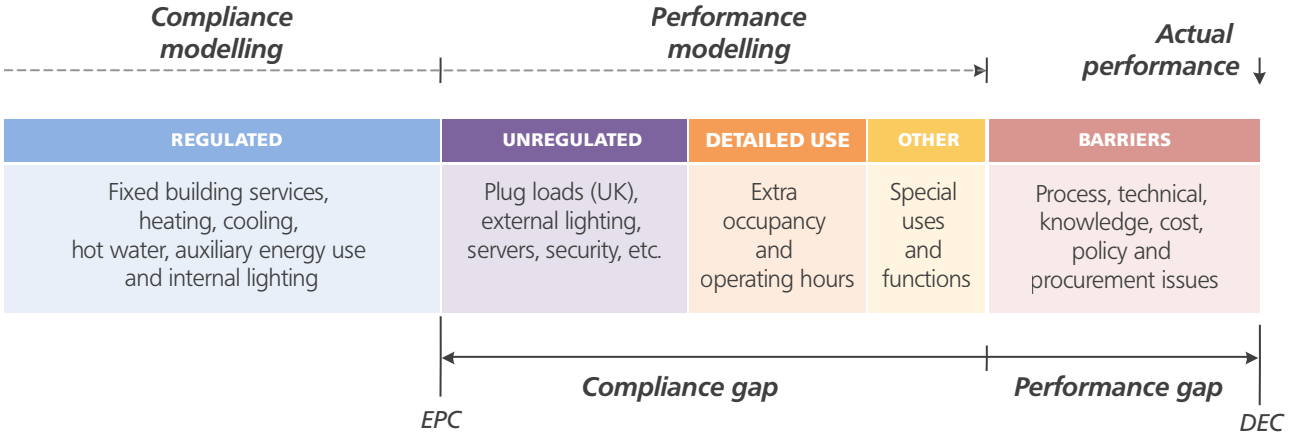


Figure 4: Representation of compliance modelling and its exclusion of different end-uses in energy calculations of a building (adapted from van Dronkelaar, 2016[6]).

BREEAM

BREEAM accreditation is now broadly considered an inherent part of the expected specification for new prime assets. Most interviewees observed that BREEAM has a valued place in the design phase and concentrates minds across the supply chain. However, to be of most value, BREEAM assessments for new build must be followed up with post construction reviews, to check that the elements set out in the design (and any other undertakings or commitments made to achieve BREEAM credits) have been delivered in construction. BREEAM In Use provides a helpful way to benchmark operational performance once the asset is occupied, but is not a building design tool. However it is viewed as a common language amongst stakeholders and is a good driver to push the design performance of buildings in many ways above that required by the regulatory framework.

EPCs and DECs

Energy Performance Certificates (EPCs) are based on a theoretical assessment of how the building is going to behave using standard operating conditions, not actually representing operation. Display Energy Certificates (DECs) are based on operational energy use, and are therefore considered a more accurate reflection of the actual energy performance of buildings, and are more often included in project performance criteria. Although DECs are mandatory in public buildings, they are not currently compulsory in privately owned premises. As such there is currently limited transparency around the operational performance of buildings at an asset level, reducing the market pressure for improvements to be made.

The VolDEC (Voluntary DECs) initiative is trialling them in the private sector, with investors such as Legal and General and LaSalle Investment Management recognising the need for greater transparency around the operational energy performance of their assets. It is currently being expanded to shopping centres with the British Council for Shopping Centres. VolDECs benchmark energy, water and waste at the operational phase and, if trials prove successful, could become an important voluntary performance driver in the absence of a regulatory approach. A current limitation to DECs is the inability to separate the base building independent of the tenants in multi-tenanted property. This makes it difficult for owners and managing agents to assess the energy performance of the building without taking into account tenant behaviour. If this shortcoming can be addressed, we may we see a greater level of support for putting DECs on a mandatory footing.

6 van Dronkelaar, 2016: A review of the regulatory performance gap and its underlying causes in non-domestic buildings

MEES

The Minimum Energy Efficiency Standards (MEES) regulations mean that from April 2018, properties with the lowest EPC energy ratings of F and G cannot be let subject to certain exemptions. According to research by Knight Frank, this relates to approximately 20% of non-domestic properties.

Although this relates to design rather than operational performance, it is raising the overall profile of energy performance in the minds of owners and investors. Typically, those investors that own large portfolios of property are not engaged in the day to day management of their assets, so rather than scrutinising the energy performance of specific buildings, they will ask their managing agents to report on portfolio trends. In this way they can understand the risk profile of their whole portfolio and use this information to inform their investment and divestment decisions, and their asset management and refurbishment strategies.

MEES will also help drive the market in a positive direction by encouraging greater use of Green Leases, greater control on tenant fit-out, and the installation of measures to improve EPC ratings that also have a beneficial impact on operational performance.

ESOS

Organisations that qualify for the Energy Savings Opportunities Scheme (ESOS) must carry out ESOS assessments every four years. These assessments are audits of the energy used by their buildings, industrial processes and transport to identify cost-effective energy saving measures. ESOS currently requires a proportion of site audits, and many participants therefore are doing detailed operational assessments of individual properties within their portfolios. Importantly, DECs provide a compliance route, which encourages take-up and improves understanding of operational performance and benchmarking. The ESOS process itself requires Board level sign off so it is bringing the issue of energy use (and associated building performance) to the attention of Senior Executives.

GRESB

Several commentators also noted the increased market penetration of GRESB (the Global Real Estate Sustainability Benchmark) as investors have taken an interest in longer term asset value, resilience and performance. Although on a fund level, not asset level, this is nonetheless encouraging as it suggests that it is no longer just “pioneers” and “early adopters” who are involved but that the mainstream is being drawn in through peer influence across the wider investment community, whether or not they understand the business case.

4 FEEDBACK

Reciprocal links between operational facilities management (FM) and the design team, and between FM and building occupiers are thought to be particularly important to the success of a project in delivering building performance for several reasons:

- enabling essential building commissioning (and having the time and collaboration to do this)
- ensuring the operational team know how the building is intended to work, (particularly when the FM team is brought in from outside the design process)
- verification of the building performance (not just assuming buildings never work as designed)
- feedback and measurement of operational performance through post occupancy evaluation to create benchmarks to inform future buildings (and to learn what doesn't work)
- training the occupiers about how to use the building features (rather than trying to over-ride automatic systems).

Several interviewees commented on the importance of building commissioning, observing that it often falls short and as a result the design of a building is not provided as intended. John Davies from Derwent London observed that the biggest risk to building performance is at the handover from contractor to recipient. Systems that are not working correctly deteriorate faster, use more energy and negatively impact occupant comfort when heating and cooling loads cannot be met.

Arguably commissioning is one of the most cost-effective strategies to reduce energy use and costs in buildings. One of the problems is that it is often squeezed into a timetable as under informed occupiers expect a perfectly performing building from the start. Jane Wakiwaka at the Crown Estate remarked on challenges associated with the consistency of training across Facilities Managers, particularly with personnel changes following initial building handover. Legal and General have identified a similar issue and now record and video commissioning and training so a permanent record is available and accessible to staff.

Debbie Hobbs from Legal and General noted that FM managers need to understand and be willing to use available technology. She said *"For one of our new developments I am trying to work out if the building is performing to the initial design, the AMR system, consisting of 300 meters including optimum front-end for monitoring and targeting was turned-off by FM employed by the managing agents because 'They don't normally do things like this', instead they manually read the meters and key that into their system."* Sub-metering, now mandatory in the UK, is needed to understand consumption patterns. However, sub-metering is often failing to capture this essential information as it is commonly not appropriately configured. Extra attention during commissioning of sub-meters is therefore an important aspect during the handover of the building.

Any technology is only as good as its user. Interviewees suggested that complex technologies and controls should only be specified if it is clear at investment stage that the higher cost of design, construction, commissioning and maintenance/operating costs are likely to be met over the life-span of the building. BIM offers great potential to help FM understand the design intent of the building, as it will prevent loss of information, mistakes and supports communication between stakeholders, but it requires the teams to have the necessary skills to make use of it.

Verification of the building performance is also seen as critical. One of the primary benefits of public disclosure of performance is education of decision-makers, owners and tenants. Such performance provides valuable feedback in terms of benchmarks that they can use to inform new projects, support valuation of a property as it becomes more integral to the real estate market and highlight benefits of living and working in a particular premise. This supports the business case. It is important to understand that an underperforming building does not necessarily mean it is failing, rather the monitoring of performance raises awareness of the potential for improvements.

Post-Occupancy Evaluation (POE)

We discussed earlier the problem of assuming that efficiency issues are caused by the performance gap. James Sandie from UPP observed that new kit is often not robust and the "fail" position is very inefficient – e.g. low flow toilets. It is essential to monitor performance to pick these issues up. Carl Brookes from M J Mapp believed it is easy to place too much reliance on face value statements about how a system will behave and that Post Occupancy Evaluation is crucial.

Most interviewees, in fact, stressed the importance of Post-Occupancy Evaluation. It can assist in verifying other metrics not related to consumption, such as indoor environmental quality metrics and the wellbeing of occupants. The Crown Estate has a commitment to undertake POE for the first three years in all new commercial buildings, as outlined within the Development Sustainability Principles. The measurement of performance is essential to verify performance and identify areas that are underachieving. It enables reconfiguration where possible by operational management, but when fed back to the design team also helps them to learn what works and those areas that have been less successful. Public and portfolio data collection will support benchmark development, fundamental for setting out performance requirements.

Caroline Hill from Land Securities thought that collaboration between landlord and tenant is key to good building performance. Canary Wharf Group noted the importance of co-operation by tenants in collecting POE and operational information. They described the establishment of their Tenants Environmental Forum as an excellent way to help close the information loop, both in supporting their tenants (and their workforces) in how to operate the building but also collecting information about what works and what does not and building occupier buy-in. The Tenants Environment Forum also provides an opportunity to gather and share information.

Carl Brookes from M J Mapp stressed the need to spend time with the actual people who will be managing the property. He wryly commented that *"introducing multiple humans is a problem in getting a building to function as designed!"* Although design has a major influence on building performance, as design features become more efficient occupant behaviour and operational management becomes more significant. Tenants are rarely involved in the design of a building. According to research by Bill Bordass, clients and their design teams must take into account the occupiers' capabilities to manage a building and its engineering systems[7]. Conversely occupiers should not take a building for granted, but need to be aware that commissioning and management is an important aspect of a well performing building.

We could learn lessons from the approach of collective data collection and benchmarking used in the USA. Here the Commercial Building Energy Consumption Survey (CBECS) provides a nationally representative source of statistical information on energy-related characteristics, consumption, and expenditure for the nation's 5.6 million commercial buildings totalling 87 billion square feet of floor space. In addition, there is the Building Performance Database (BPD) which is the largest publicly available source of building performance data in the USA. There are a number of UK datasets such as the Better Building Partnership's REEB (see appendix B) but these are voluntary. More case studies and benchmarks would help to increase coverage and representativeness.

7 Bordass et al., 2001: Assessing building performance in use 5: conclusions and implications

Case study:
Costa Coffee, Wrekin Retail Park, Telford

At Wrekin Retail Park in Telford, developer Hammerson and occupier Costa invested collaboratively to create a zero carbon Eco Pod, which opened in April 2015. The Eco Pod includes passive ventilation and high performance building materials that naturally manage temperatures, as well as 28kW of photovoltaic panels that produce clean power for the building, offsetting a proportion of the energy used by the coffee making equipment.

Both parties recognised the benefits of a high performing building and agreed to an open book approach to the costs and benefits, so that they could overcome any split incentives. The developer agreed to fund the enhanced shell and occupier agreed to an increase in rent based on the expected energy cost savings. This created a cost neutral investment for both parties and was key to unlocking this project.

It is vital for occupiers and developers to work together to deliver on efficiency objectives, as the design and construction of the building is typically led by the developer, whilst the fit out and operation are led by the occupier. At Wrekin Retail both developer and occupier had strong sustainability visions. Costa shared detailed information about how much energy the store would use, so that Hammerson could inform the design team and engineers about the future requirements of the building. This level of insight is unusual at such an early stage and enabled the design team to optimise the plans for efficiency.

Costa is now monitoring the performance of the Eco Pod, so that it can incorporate lessons learned into other new builds. Operational performance data so far shows that the Eco Pod is delivering on design expectations overall, achieving 6.1 kg/CO_2 per m^2 per annum, 118% better than the Building Regulations 2013 Part L requirement of 34.3 kg/CO_2 per m^2 per annum. However, a year's data across all four seasons will be needed for full consideration of each sustainability feature.

View the full case study **here**.

5 KNOWLEDGE

Knowledge and skills are intrinsic to the discussion above. All sections of the building process have a role to play, and improvement is an issue for each. There are also collaborative elements where improved knowledge is required across the whole buildings process, for example through case studies, how to share benefits and common indicators. Enhancing understanding of the role that each part of the supply chain plays, not only within stakeholder groups but across them, will facilitate more meaningful conversations around how to achieve sustainable outcomes. We reiterate some of the key points here.

Financer/owner/occupier

As we have seen, the financer/owner/occupier can have a large effect on the performance outcome of a building. Collectively, we need to better communicate the business case for good building performance, and help this sector understand how building performance can be defined in the brief and what can be achieved. This would be supported by the simple kWh/m^2 metric discussed earlier. Our research and interviews align with Carbon Trust recommendations that the financer/owner/occupier should consider appointing a specialist with responsibility for driving performance throughout the project[8].

To support the uptake of well performing buildings, developers/owners need to be engaged to adopt new methods for capturing a property's value and understand the life-cycle benefits of a highly performing asset. This includes ensuring tenant satisfaction, maintaining occupancy levels or reducing voids, and also in terms of reduced obsolescence. Early adopters in this arena are already taking steps to address this, such as Legal and General who have trained all property fund managers and asset managers on building performance related issues.

Letting agents

Letting and other transactional agents and surveyors play a critical role in building performance as it is they who value and market buildings, Sarah Ratcliffe from the Better Buildings Partnership observes that they *"shape the appeal of buildings to potential investors/owners and occupiers"*. Other interviewees noted that there is a need to build knowledge about the business case within the letting agent community and to get them on board. One interviewee specifically observed that letting agents advise owners about what specifications to aim for when refurbishing and building new space, while also advising tenants about what to ask for. They therefore drive the market from both sides, and could really change the market's thinking if they were equipped to give advice on improving building performance.

Operations staff

Operations staff need to be motivated, skilled and incentivised to realise the desired levels of building performance. They are an important stakeholder in the supply chain, but tend to be underrepresented. It is essential to communicate the business case for good building performance to those in the organisation responsible for budgeting building operation. However, as Frankel et al's research suggests, operational teams in organisations are given limited resources to carry out the needed activities to attain a running well-performing building, and budgets available in organisations do not reflect the actual investments required for effective operations[9].

8 Carbon Trust, 2012, Closing the gap – Lesson learned on realising the potential of low carbon building design

9 Frankel et al., 2015: Getting to Outcome-Based Building Performance

Tenants

Considering tenants are the layman in terms of building performance, it is important that they are educated in using the building and its systems to satisfy their own needs of health, comfort and safety, effectively, efficiently and safely. There is a lack of understanding by occupants/operators of how systems are designed to be used, especially so when designers and contractors are not involved after the building is completed. In many cases the performance of a system is largely dependent on the engagement by building operators and tenants.

However, Canary Wharf Group noted that tenants are increasingly setting their own energy performance targets, although reporting on metrics of indoor environmental quality and occupant satisfaction remain relatively rare. The question is how to encourage the majority to follow these "early adopters" by convincing them of the benefits and feasibility of delivering building performance.

Canary Wharf Group noted that it would be ideal if every business had an environmental manager or dedicated resource for environmental issues. Many small businesses do not and this makes them harder to engage on building performance. Occupants have a substantial influence on the performance of a building by handling controls, such as those for lighting, sun-shading, windows, set-points, and office equipment. People are different and their behaviour in relation to energy consumption varies. Managing this requires tenant organisations to undertake awareness raising of their own – and to make their own business case for staff to accept that building commissioning will create a better medium term result than a quick "DIY fix" of altering settings or bringing in under desk heaters.

Without case studies and building data which are building owner/user friendly, it becomes difficult for decision makers to know what to ask for. Canary Wharf Group also wanted to see measurement and data in a format that occupiers understand and so they can see how it is relevant. John Davies of Derwent London added: *"More often than not, in particular in new buildings, people are not willing to hand over data to a collective source."* Nearly everyone we spoke to stressed the importance of case studies. Yet compiling transparent case studies, with genuinely useful lessons learned and data, is notoriously difficult.

Construction

During construction, robust checking and testing is necessary to ensure that the quality of construction is maintained[10]. On site workmanship needs to adapt and be trained to increasing levels of complexity in building construction. Some is about improving practice (e.g. not puncturing airtight barriers), some is about installing technologies correctly.

The lack of skills for understanding and making correct use of technology is a continuing bug-bear for our interviewees. Comments about AMRs were noted in the previous section. James Sandie at UPP was one of several who noted that BMSs were rarely set up properly. This is repeatedly found in post-occupancy evaluation studies, including the PROBE and Innovate UK's BPE programme. Julie Godefroy ironically observed: *"the buildings that do not report problems with the BMS are typically those that do not have one."*

The whole supply chain requires collaborative design and working skills in order to determine the performance targets for the building and to work together to deliver them. They also need to establish feedback mechanisms to better understand how buildings performance and how technologies and processes affect this performance. 'Soft' influencing skills will be key to encouraging clients to undertake data sharing. Related to this a number of our interviewees noted the "translation" issue – being able to talk a language that clients and occupiers understand and making the building performance debate comprehensible and relevant across the industry.

Overcoming complexity

We found during our research that there is a great deal of research and tools intended to upskill the industry, and a number of working groups active in the building performance arena. We included a summary of these in the appendices. We would like to encourage industry to coalesce behind current initiatives and work to improve the tools and information available rather than further fragmenting the conversation – cross industry collaboration is one of the key requirements for delivering building performance.

At the beginning of this paper we made the point that information needs to be in the right language for owners, financiers and occupiers. Interestingly several of the people we spoke to made the point that those engaged in the building performance debate tended to speak to each other rather than the whole industry, and to use a complex

10 Morant, 2012, The performance gap – non domestic building: final report (CEW1005), AECOM

approach and language that was hard for those not engaged – but in the same industry – to understand. Soft landings was described as too complicated, some research critiqued it as making a theoretical point rather than relating to understandable situations, and as one interviewee told us: *"Industry struggles with non-quantitative issues that keep changing. There are layers of guidance, documentation and policy. We need something that is going to make all of that easier, not add to it."*

We hope we have gone some way towards this by bringing out the key success factors in simple language in this report, and encourage others to act similarly. Approaches that help to crack some of the problems in delivering building performance may not deliver perfection or be completely comprehensive, but they will improve the overall situation.

Case study: Cheshire Oaks, Marks and Spencer

Opened in August 2012, Cheshire Oaks is M&S' multiple award winning, biggest eco-store. It's designed to be the most carbon efficient, premier M&S store to date with an architectural and design strategy that addresses several areas of sustainability at once – water, energy, waste, biodiversity, community and materials.

For the first year of operation an exhaustive, independent Building Performance Evaluation (BPE), part funded by the Technology Strategy Board, was undertaken on the store. The building's environmental performance was evaluated by experts in sustainable buildings from Faithful+Gould, and the impact of the sustainable features on the customers, staff and local community was assessed by senior researchers from University College London. The store exceeding almost all expectations set by industry experts and has become a shopping destination which is providing undeniable benefits to the local community and economy.

The success of Cheshire Oaks continues. Last year, Simons Group were awarded the Building Award's new 'The Test of Time' award for Cheshire Oaks, a category for buildings which have been operational for over 2 years and exceed expectations.

CONCLUSION

It is clear delivering building performance requires more work to be done with all sections of the supply chain. We believe that the business case exists, as illustrated by existing examples of good buildings that benefit occupiers. The main obstacle is that the benefits are not being communicated sufficiently compellingly nor to the right audiences within mainstream owner/financier/occupier sectors. Case studies targeted at these sectors which speak their language are highly desirable.

There is a call for greater data sharing amongst the technical community to enable better benchmarking, but this is not an excuse for inaction as many developers and designers are creating working models themselves. Building regulations provide an essential 'backstop', and measures such as BREEAM and EPCs have a role to focus the supply chain and provide an improvement over 'business as usual', albeit without an operational focus. The MEES legislation around EPCs and lettings, GRESB and ESOS are garnering board level attention. Speculative developments may make up the 'rump' of the property market, but supply chain and market pressures can be expected to influence this sector.

We also see the provision of training as crucial for all parts of the supply chain in order that they have the knowledge and capability required to drive higher performance standards. Those already seeking a leadership position will provide some 'pull' to the industry, but to 'push' the majority we need to ensure key players have a solid understanding around sustainability in the built environment, and the relevance to their role and organisation in delivering solutions.

There is also an important leadership role for Board Executives and others in senior management positions:

- The Boards/Executives/C-Suite of most organisations procuring space (as owners, funders or occupiers) are not sufficiently engaged in the building performance debate, and in many cases nor are their agents and other advisors whose technical knowledge is varied. Yet investors and occupiers are absolutely key to driving building performance. They sanction procurement processes, empower their advisors to act in particular ways, and have the ultimate sign-off on decisions. In essence the building owner and funder have a key role to "push" the requirement for building performance down through the supply chain, and the building occupier provides the "pull" as the end user.

- The built environment sector makes the debate far too complex for the majority of Boards (and politicians) to understand or wish to engage in, and this is likely to be off-putting. Most board members will not understand "Part L", let alone the more complex arguments the industry engages in. The industry has to move its approach and language towards the C-suite, rather than expecting the C-suite to come to them.

- Good building performance is simply about integrated design and attentive management – which are relevant in all buildings be they complex or fairly ordinary. There is a tendency to equate building performance with exemplar green buildings, and this need not be the case. Exemplar buildings most likely appeal to the leadership/early adoption segment of owners and occupiers for their reputational and values based benefits, but possibly not to the majority. In reality, any target is better than none and should have benefits, so it's worth encouraging a target-based approach at all stages, and stressing the everyday business benefits.

To address this important need for leadership, and better enable further engagement from Board Executives, we have prepared a C-Suite Headlines paper as a stand-alone document also provided at the end of this report. We hope that this will help to guide discussions between clients and their advisors, and enable the aspiration of better building performance to be driven from the very top of client organisations.

In this report, we also put forward five key success factors for all those involved in the property and construction process to take away and implement.

1) Aspiration

Expect a building that performs as required in use. Setting a simple target – at the very least for energy use (kWh/m^2) – should help create a common language and shared aspirations across the delivery process. This is relevant to all sectors, but it is particularly incumbent upon **investors and developers** to drive this.

2) Control

Contractual control throughout the delivery process is crucial. Collaborative contracting, with performance guaranteed and control maintained throughout the

delivery process helps to ensure predictable outcomes. Again, **investors and developers** can set expectations, but those in the **supply chain** should take greater ownership during procurement. There is a role for **lawyers** to support these aspirations, rather than revert to a default position of least-risk.

3) Design for performance

Do not design simply for compliance. Performance improves when aspirations are not limited to compliance or, in other words, "going for the ceiling, not the floor". There is a responsibility on **architects and engineers,** not just their clients, to educate and advocate, making the business case for higher performance – including the benefits of sustainable design on staff productivity.

4) Feedback

Reciprocal links and a commitment to monitor and feedback, particularly during the handover process, is vital. So too is giving time for well documented building commissioning. Links must be made between operational facilities management (FM) and the design team, and between FM and building occupiers. By definition, there are shared responsibilities **across the value chain**, particularly during the handover process.

5) Knowledge

Improved knowledge is needed across **all professions** in order for each part of the supply chain to play its part in delivering building performance. Every organisation has a responsibility to assess the knowledge levels of staff, involve **HR teams** and identify training needs. Organisations also need to participate more openly in lesson-sharing activities.

C-Suite Headlines

INTRODUCTION

The research for this project showed that the debate about building performance is not engaging the very board members who need to drive the aspiration to have their new building space perform well in operation. This short paper sets out what we believe are the key headlines to take to a non-expert Board who are not necessarily engaged in the detail of property procurement, so they will have the confidence to mandate their professional teams to procure a building that performs well for the occupier and the owner.

Definition of good performance

Building performance describes how well a building functions against your needs. Most visibly for the occupier this would include being secure, waterproof, accessible, and providing space for the number of people and the processes that an organisation needs for its operations. Less visible elements include energy efficiency, occupier health, workplace productivity, carbon emissions and resilience of the building when in use.

The business case

Most new buildings come without any prediction or assurance as to the less visible performance elements. Occupiers are expected to take financial risk in terms of energy costs and the staff productivity drops that occur with heat, lighting and indoor air quality problems. So the financial benefit resulting from moderately efficient, comfortable buildings is substantial as staff are usually the biggest organisational asset, and operating expense. Other benefits include carbon reductions and brand enhancement.

Case studies and research from offices, retail, and the hospitality sector all show that where operational performance targets are set on the client side as part of the design brief they are deliverable, and although it requires a change from traditional practice, it does not necessarily equate to additional construction costs. Good building performance often translates to less complexity. It is technically possible to target ambitious energy efficiency but this is not a requisite – any target is better than leaving the operational performance to chance.

Building regulations and BREEAM do not necessarily translate to good operational performance

Building regulations, BREEAM/LEED and Energy Performance Certificates offer a form of quality assurance, but they only measure the performance of the *shell* of the building – i.e. before the occupier moves in and before fit-out. The water, heating, lighting and electrical consumption figures are modelled against a hypothetical building and not on how you are going to use and fit-out your space, or the equipment that goes in it.

FIVE IMPORTANT STEPS TO ACHIEVING GOOD BUILDING PERFORMANCE

Aspiration – set target(s) for operational building performance early in the design process.

Research suggests it is best to set a few high level, simple targets that can be translated across the supply chain. An experienced design team can advise on this using benchmarks and an understanding of your operations.

Control – ensure that the procurement and delivery process is set up to deliver operational performance at every stage

Ensure that the requirement to meet operational performance targets is included in all contracts that govern the supply chain. Ensure that performance against the top level performance indicators is monitored throughout the process and reported to the senior level. Where the supply chain is fragmented there is an increased risk of contract incentives becoming misaligned with operational targets or client intent not being properly understood.

Design for performance – understand how the building will be used as early as possible in the design process.

The more certainty around the building's fit out, uses and operating models, the more accurate the design can be. The shell of the building and the fit out need to work together to deliver building performance, and need to be designed to manage heat gain, energy demand and occupation patterns.

Enable feedback – buildings need to be tuned when in use, and post occupancy evaluation helps continuous improvement.

Typically a building needs to be configured over up to 2 years to get optimum performance. This includes programming management systems over different seasons, optimising controls and monitoring data to ensure there are no malfunctions or user errors, and teaching occupiers how the building works. Excellent documentation is a must, as staff move on.

Assemble the necessary knowledge and skills.

Ensure that your organisation and delivery partners are appropriately skilled. The Board do not need to be experts, but having a client side advisor with experience in good building performance and the mandate to deliver predictable building performance is essential. The willingness and ability to deliver to operational performance targets should form part of the procurement assessment, and ideally your team should have previous experience of integrated working across the supply chain.

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