EQUIPPING BUILDING ENGINEERS TO DELIVER NET ZERO

DANICA CAIGER-SMITH AND VIVIEN KIZILCEC
CONSUMER INSIGHT

July 2023

CONTENTS

DISCLAIMER

This document has been prepared by Energy Systems Catapult Limited. For full copyright, legal information and defined terms, please refer to the "Licence / Disclaimer" section at the back of this document.

All information is given in good faith based upon the latest information available to Energy Systems Catapult Limited. No warranty or representation is given concerning such information, which must not be taken as

establishing any contractual or other commitment binding upon the Energy Systems Catapult Limited or any of its subsidiary or associated companies.

1. Foreword - Do you (really) believe in net zero?

Everyone stresses the challenges to achieve net zero. The papers are full of references to it and the building services industry's PRs mention it in every press release. But are we delivering? Not so much.

This report from the Energy Systems Catapult confirms what most of us already knew: The industry is lagging on net zero and more to the point it's not even preparing. This confirms that skilling the workforce is still not an investment that businesses are willing to make, despite the challenges and huge opportunities that this agenda offers.

We have a serious skills shortage and the targets set for 2050 cannot be met unless building services engineers are trained in the appropriate and emerging technologies – upskilling should be a top priority – but this report shows that it is quite the opposite for many organisations.

Despite all the talk around decarbonisation of buildings and the tough new safety culture introduced by the Building Safety Act promising to transform the culture of construction supply chains, this remains an industry fixated on cost and reticent to invest in the improvements it needs to flourish into the future.

There is a huge, missed business opportunity here. The best firms look to differentiate themselves from the lumpen middle ground by scaling up, skilling up and making themselves stand out from the crowd. Some are doing it, but not many.

For example, heat networks represent a £60-£80 billion investment opportunity* to scale up from their current paltry 2% of built environment heating to reach 18% by 2050 in line with net zero targets. To realise that opportunity requires proper investment in skills and training.

Potential
Overall, the built environment is the UK's second biggest source of carbon emissions behind road transport. It is responsible for more than 17% of the UK's total. To keep the country on track towards a net zero economy by 2050, emissions from the sector need to fall by 43% by the end of this decade. The potential for work is colossal – so why are we not embracing it?

The government issues statement after statement about the need for net zero, but it is not capable of delivering it. Delivery is down to individual companies and industries – and individuals. The building services industry has a massive part to play. So why aren't we playing it?

We also talk and talk about reaching out to a new generation of skilled people who can help us transform our businesses by adopting modern digital technologies. We need thousands of people who can harness AI and other transformative techniques, but we are not recruiting them – this report confirms that. Why not?

Overall greenhouse gas emissions are down by 46% since 1990 and in the built environment they fell by 15% in a single year (2008). However, they have pretty much

flatlined since and the recent 2023 Progress Report to Parliament produced by the Climate Change Committee (CCC) said confidence that the UK would meet its climate goals was "diminishing".

The Committee, which was set up under the Climate Change Act to advise the government, highlighted gaps in delivery strategies, funding, and timetables including progress towards the government's target to cut energy consumption in buildings by 15% by 2030 – a target that should be 20% in any case, according to the CCC.

It was particularly critical of the slow pace of heat decarbonisation with just 72,000 new heat pumps installed last year against a target of 130,000, which the CCC said should rise to 145,000 this year.

All of this is affordable and technically doable because we already have the solutions.

The built environment is pivotal – not just because it is such a big emitter but also because it underpins so much of our economic and social activity. The biggest challenge and, therefore, the biggest prize is retrofitting and refurbishing thousands of buildings to make them fit for the future. As well as reducing environmental harm, this will have major social benefits by providing upgraded facilities for work, leisure, healthcare etc. with lower running costs, better air quality and improved comfort.

The government's ambitious £20bn hospital building and refurbishment programme is a case in point because it sets out to improve the "patient experience" and speed up recovery times to shorten waiting lists, while also reducing energy use and carbon emissions.

This is the blueprint, but it won't happen unless the industry develops the necessary capacity and skill – and that requires investment, which is manifestly missing.

Chris Skidmore's Independent Review on Net Zero, Mission Zero, articulates this very clearly: "The Review heard that the fast pace at which renewables need to be deployed across the country carries the risks of bottlenecks for technology parts, materials and skills, with some of these already appearing." (p. 89).

This report is a welcome attempt to pinpoint why; where skills gaps and the lack of a focused 'net zero culture' are holding back implementation, and how regulation and competition can help to drive up standards and move the focus away from cost and onto quality.

We all know what needs to be done and there are lots of examples out there of how to do it – but now we must ask ourselves: 'Do we really want this? Or are we just making all the right noises?'

Sadly, this report suggests there is plenty of noise but little action. Talk is cheap. It's time to step up.

MEHNA 2023

Actuate UK

2. Executive summary

The UK's Net Zero ambitions require a fundamental shift in approach within the built environment. This is currently stymied by an acute skills shortage that hampers the design, development, supply, installation, inspection, and maintenance of legacy, current, new, and innovative systems. Energy Systems Catapult carried out an independent analysis on behalf of Actuate UK examining the context and opportunities related to the issues and has resulted in a report that presents a comprehensive three-part framework to address these challenges: Awareness, Action, and Advantage.

Awareness

The need to deliver Net Zero buildings is more pressing than ever, yet many stakeholders lack a comprehensive understanding of this crucial objective. A significant step towards promoting awareness is defining what constitutes a Net Zero building and how decarbonisation of the sector can lead to achieving the government targets. Definitions need to consider the full lifecycle of a building not just the operational aspect, but also embedded carbon in manufacturing, materials, logistics, and waste management during the build itself.

Clear, universally accepted definitions of Net Zero buildings are vital for stimulating common understanding and fostering collaboration towards shared goals. Furthermore, educating clients about Net Zero buildings' specifications and requirements is crucial for driving demand. Stakeholders should also represent and protect building occupiers' interests to support informed decision-making.

Action

The transition to Net Zero buildings necessitates a framework of targeted activities, regulations, and standards. Trade organisations have a vital role in tailoring these activities to specific sectors as well as government to help educate and drive the industry to deliver. Shared definitions of Net Zero for the industry would reduce ambiguity, decrease risk, and assign responsibility, ; something that Trade Associations can lead on. These include technical skills, transferable skills, effective contracts, regulations, standards, and processes.

Action focus should be on availability and consistency in training, driving lifelong learning, and ensuring high-quality outcomes to upskill the current workforce. However, emphasis on training could also attract the much needed new and diverse talent to the sector and promote the integration and mobility of skills.

Advantage

The current sector commercial competition is primarily cost-driven. However, well-defined Net Zero buildings could stimulate competition based on innovation, customer satisfaction, and outcome delivery. Tools such as league tables, open-access data on building performance, and critical reflection on project delivery could enhance this approach.

This document is marked as confidential

Enabling competition could drive quality, promote diversification, and eventually improve customer choice. A sector that delivers quality Net Zero buildings as standard could offer clients a greater range of options than they currently have. It could also provide a shift from the cost-driven model to a more quality and outcome driven approach.

2.1 SUMMARY OF FINDINGS

There is widespread recognition that the sector needs to change.

Most survey respondents (73%) felt that the sector, as it is now, will not be able to deliver quality Net Zero buildings at scale.

**The current skills gap will continue to grow.**

The majority (68%) of respondents did not feel it was easy for their company or organisation to find people with the right skills, reflecting the skills gap described by interviewees. A similar proportion (63%) did not expect that it would be easy to find staff with the right skills in 5 years' time, suggesting that the skills gap urgently needs addressing. There appears to be an appetite for training related to Net Zero.

The role of behaviour will be more important than ever.

Nearly three quarters of respondents (73%) felt that other factors sometimes take priority over delivering high quality work. Cost and time to deliver were seen to take priority over quality. While the importance currently placed on time to deliver was seen as appropriate for the delivery of Net Zero buildings, responses suggest the current prioritisation of cost over quality should be reversed.

There are varied views about how change should be driven.
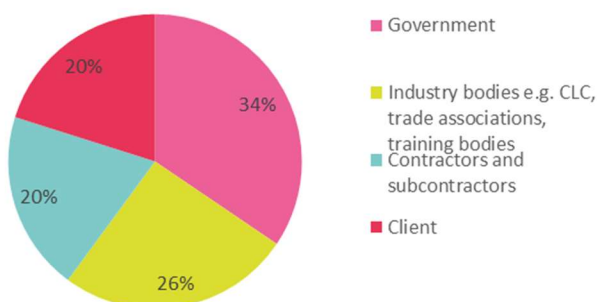
There was no clear consensus among industry experts' respondents about who should drive change. The biggest divergence in views was for government involvement – some felt the majority of the share should lie with government, others felt government should have very little involvement. By contrast, expected involvement of industry bodies, contractors and subcontractors and clients was relatively evenly spread.

This reflects the divergence previously seen among interviewees. Some felt strongly that government *should not* drive change, feeling instead that **Net Zero targets needed to be depoliticised.**

Summary

The transformation to Net Zero buildings isn't just a technical challenge—it requires a profound cultural shift within the sector. This shift must focus on enabling behaviours, creating an environment that encourages collaboration, and a shared understanding of the desired outcomes. By driving awareness, taking decisive action, and harnessing the advantages of a reformed sector, the UK can successfully transition towards a future where quality Net Zero buildings are the norm. Without this, Net Zero targets are not achievable.

2.2 Next steps

Engineering & Building Services Skills Authority Group – ActuateUK, BEEMA, CIPHE, MCS, TICA

A collaboration of industry associations has been formed to provide a credible and authoritative voice for skills across engineering and building services. It will provide analysis based on transparent data captured to provide clarity for skills demand and supply, specifically to add value around new technologies needed for net zero targets. It will enable a single approach to addressing the actions identified.

----

3. What is the problem?

The first phase of this research used a series of three highly collaborative workshops with key stakeholders from the Building Engineering Services Association (BESA) to map out the current situation and its likely contributors.

3.1 What is the current state of play?

The first workshop mapped out key stakeholders and actors across the supply chain and the interactions between them. The expected and actual behaviours of these different parties at different points was then discussed in terms of:

- Why certain behaviours are (or are not) demonstrated: what values or constraints drive this?
- How and why behaviours have (or have not) changed in the past: what implications might this have for understanding how to drive change in the future?

This helped identify assumptions – for which evidence was then sought before the next workshop – and generate hypotheses for further exploration.

3.2 What outcomes is the current state of play driving?

Evidence and hypotheses stemming from the first workshop were explored, with emphasis on understanding how outcomes were differently impacted by 'things', such as processes, contracts or regulations, and by 'people', i.e. the values and behaviours of different stakeholders and actors.

Conclusions from this workshop centred around the disconnect between what *should* happen within a project and what *does* typically happen. The discrepancy between these helped reveal three factors that could be targeted to help drive change:

- **Complexity:** fragmentation of the market and players within it can lead to unclear roles and responsibilities and, ultimately, a lack of accountability.
- **Lack of enforcement:** a lack of widespread and consistent auditing means there is little incentive to deliver high quality work; a lack of effective enforcement further drives a lack of accountability.
- **Training is undervalued:** training is reluctantly accepted as a necessity rather than embraced as an opportunity to deliver a higher quality and differentiated service, product or outcome.

3.3 Refining the problem statement

The final workshop discussed the three factors listed above to help refine a problem statement and generate hypotheses for further research.

<div style="background-color:#E8447F; color:white; text-align:center; font-weight:bold;">Problem statement</div>

Current and future Net Zero ambitions in the built environment are being hampered due to a skills shortage in the

- *integrated design and development*
  - *supply*
  - *installation*
  - *inspection*
  - *maintenance*

of a range of building systems

4. What needs to change?

To explore perspectives on the revised problem statement and what causes the current situation within the sector, fifteen individuals from across the sector were interviewed. These included:

- Tier 1, 2 and 3 contractors
- Client representatives
  - Those involved in procurement
  - Those involved in specification development
- Those involved in auditing and enforcement
- Governance bodies

Interviewees generally agreed with the problem statement outlined in section 2 and elaborated to suggest an interplay of three key factors:
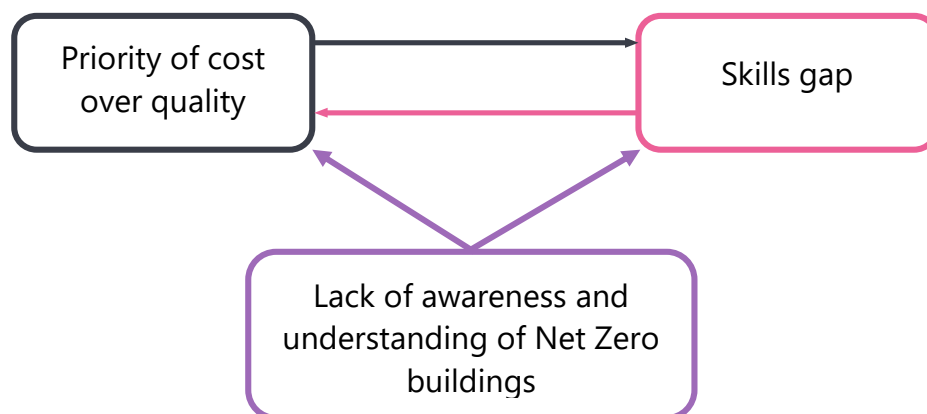
Currently, prioritising cost over quality perpetuates the skills gap – clients are often not prepared to pay more for higher quality or a differentiated outcome, so there is little incentive for employers to invest in training to deliver that. This means competition within the sector is based on price – "a race to the bottom" – which in turn perpetuates the prioritisation of cost.

A lack of awareness and understanding of Net Zero among clients and contractors will increasingly exacerbate this: few clients specify that a building should be Net Zero, so there is little incentive for the supply chain to develop an understanding of – nor the skills to deliver – Net Zero buildings.

4.1 Cost is prioritised over quality

Interviewees unanimously described a sector that is, whether willingly or not, predominantly driven by cost. This is seen to compromise quality directly and indirectly:

- **Directly:** for example through awarding contracts based on lowest costs rather than skill and performance; through switching materials and products for cheaper alternatives;
- **Indirectly:** for example by effectively precluding activities which might enable higher quality delivery; by failing to incentivise and encourage investment in training.

Clients' attitudes and values were seen as setting the agenda for an entire project. A client's heavy focus on cost not only means contracts are often awarded on the basis of the lowest cost, but can "permeate through the whole of the build" leading to quality being compromised in favour of delivering within tight budgets and time constraints. Emphasis on cost is felt to filter down through contractual chains, driving decisions large and small on the way, ultimately resulting in a lower cost but lower quality outcome.

This is exacerbated by project lifecycles and processes that fail to encourage early collaboration. Interviewees shared stories of projects where early collaboration between key stakeholders had helped align expectations, improve quality, identify and mitigate risks and offer better margins across the supply chain, but these examples were highlighted as exceptions to the status quo. Typically, there is little collaboration until later, often after key decisions have been made, limiting the extent to which higher quality and - perhaps ironically – more cost-effective solutions can be explored. Some reflected that while this is often referred to as "value engineering", it is only through earlier collaboration that stakeholders are enabled and empowered to deliver *real* value engineering – thinking flexibly and creatively about what needs to be delivered and how to engineer a solution.

"If we've just agreed it altogether, I've got some decent margin on it. So I'll just deliver you a really good job. And it'll be exactly what you want from the start."

4.2 A substantial skills gap drives cost up and quality down

With contracts awarded based on cost over quality and few opportunities to push engineering boundaries and apply new skills, there is little incentive for employers to invest in training - it "takes people out of the day-to-day running of the business" and "for smaller companies it's very expensive – disproportionately so" given the lack of competitive advantage it offers.

This document is marked as confidential

Interviewees recognised a skills gap throughout the industry. This had been masked by substantial numbers of foreign workers, many of whom have now left the UK in the wake of Brexit. A lack of apprenticeships was also seen as contributing to a skills gap. Several interviewees had entered the industry through apprenticeships and felt that a better support structure was needed to encourage organisations to offer and value apprenticeships.

"It's not easy to find people. And the people that are there are very expensive, because they know there's only a few of them."

The skills gap was particularly notable for its impact on cost. Skilled engineers can be hard to find so often command a high rate – a frustration intensified by their skillset often exceeding the requirements of the job in question.

Some tasks need to be done in a certain way for safety or regulatory purposes. In those instances, higher costs have to be accommodated. But in other instances, tasks may be rushed, completed by someone without the appropriate level of competence or even left incomplete in order to reduce costs.

"You're paying thousands of pounds of this highly skilled engineer to just go round doing menial tasks, like flushing toilets and turning on taps."

Technology and innovation could help overcome some of the barriers the skills gap represents. For example, off-site manufacture is generally less labour intensive. Technology could also help increase efficiency, allowing engineers' time and skill to be targeted where it is more valuable. For example, a shift to predictive maintenance that uses sensors to monitor systems and detect and diagnose issues could help automate processes that are currently done manually.

However, incorporating innovative approaches and technologies in new ways may represent additional costs: to the client, particularly if additional hardware needs to be installed or specialist skills are needed; and to employers who need to invest in training staff to work with new methods and technologies. If the outcomes of that training are valued – by employing organisations and, ultimately, by clients – this may increase uptake of this training, but interviewees generally felt that currently there is little appetite among clients to use innovative approaches and therefore little incentive for employers to upskill their staff.

4.3 Current issues will be exacerbated by an increasing need to deliver Net Zero buildings

The term "Net Zero" was seen as "a buzzword" that "doesn't mean anything". Some reflected that even where it is recognised and the context of the government's Net Zero strategy is understood, there is little understanding of the implications for the sector, little drive to deliver Net Zero buildings and therefore little action or impact – Net Zero is "a priority for another day".
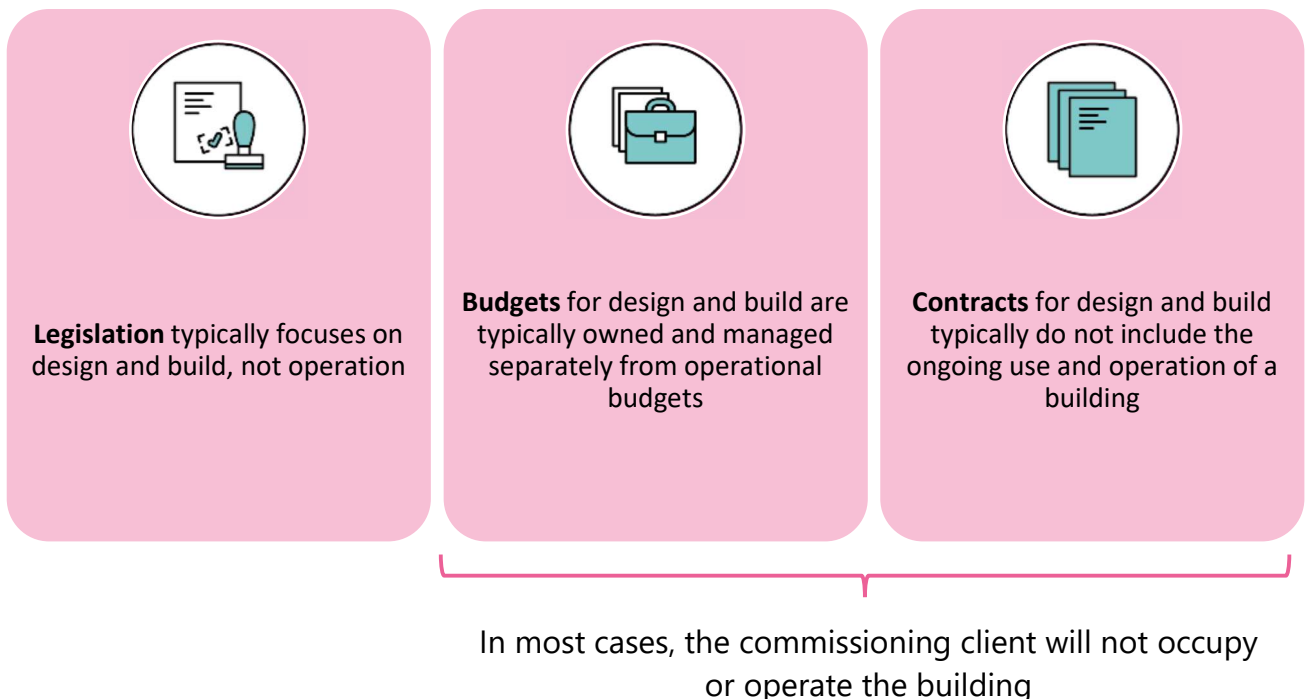
This is perceived to be heavily driven by clients, who ultimately decide whether a building is Net Zero or not. Interviewees reported that few clients specify from the outset that a building should be Net Zero. Fewer still maintain that requirement as a project progresses. The higher prices that Net Zero buildings can involve, whether through systems and materials or through skills and processes, can be a deterrent.

Interviewees reflections on the skills needed to deliver Net Zero buildings reinforces the problem statement outlined earlier: not only is there a shortage of the skills needed for designing, developing, supplying, installing, inspecting and maintaining systems that will support Net Zero buildings, there is a lack of understanding of what those skills are. There was widespread recognition of the need for increased awareness and understanding of *what* Net Zero buildings are, and of how to operate them, but little in between. Without a clear definition of what Net Zero buildings are, it is perhaps unsurprising that there is little understanding of what is needed to deliver them.

4.4 A building's operation is seen as central to Net Zero, but is not central to the design

How a building is operated was felt to be critical in defining a Net Zero building, with most reflecting on energy efficiency in particular (though not specifically zero carbon emissions) but including other factors like maintenance of building services to help prolong systems' lifecycles.

However, operation was felt to be neglected in many ways:

Legislation typically focuses on design and build, not operation	**Budgets** for design and build are typically owned and managed separately from operational budgets	**Contracts** for design and build typically do not include the ongoing use and operation of a building

In most cases, the commissioning client will not occupy or operate the building

Several felt that there is an opportunity to update Building Regulations to support the definition and delivery of Net Zero buildings. This could include increasing emphasis on ongoing operation. While this would require substantial change in how the industry

operates, many reflected that rapid and productive change – while challenging – is possible. Many felt that the heightened attention given to safety legislation following the Grenfell disaster and resulting review of building regulations and fire safety[1] (mentioned by nearly every interviewee) meant safety regulations were becoming more deeply ingrained throughout the project lifecycle including into occupancy of the building. As a result, the supply chain was less likely to compromise on delivery. Incorporating definitions of Net Zero buildings into Building Regulations could support a similar shift towards considering ongoing use of a building.

Summary of key insights

- A prioritisation of cost over quality and an existing skills gap continue to perpetuate each other: competition is based on the lowest price, meaning there is little perceived value in upskilling.

- These issues are already important to address but will become even more so with an increasing need to deliver Net Zero buildings.

- While it is recognised that there needs to be investment in Net Zero skills, there is little understanding of what those skills are. This stems from lack of a clear definition of a Net Zero building.

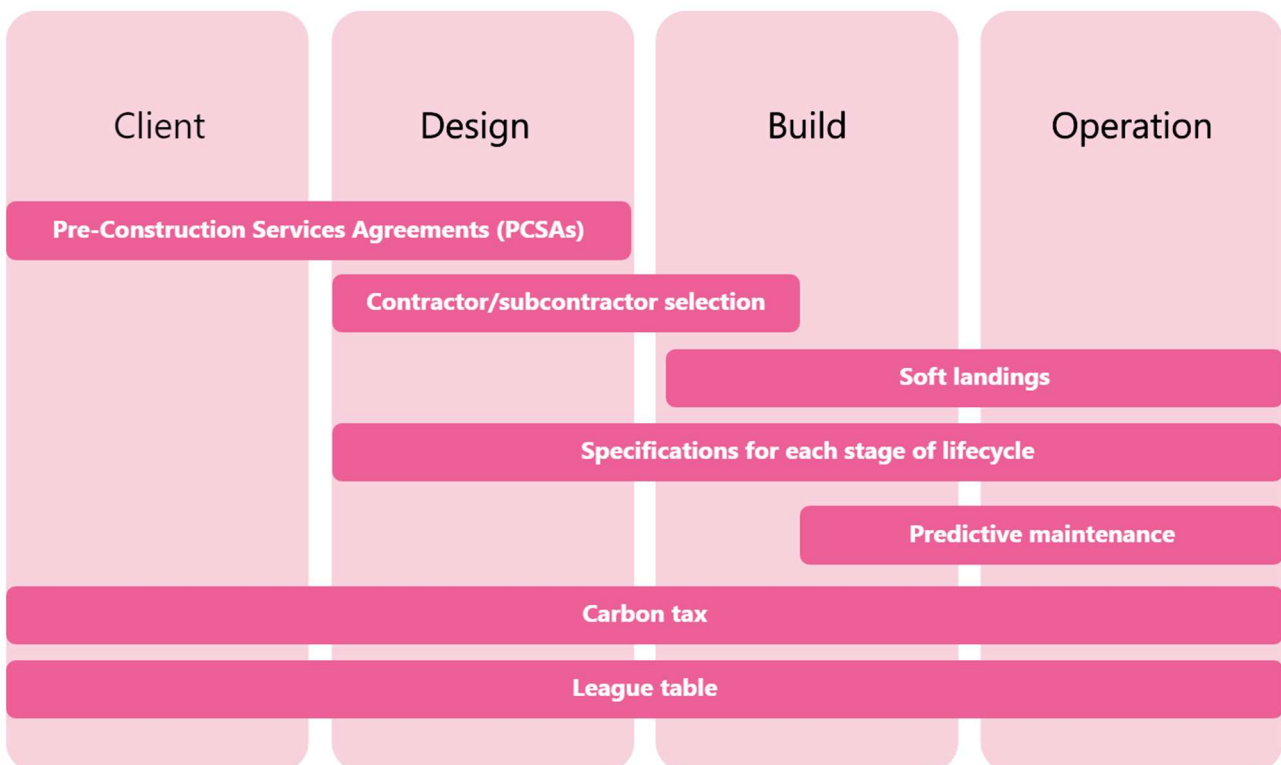---

[1] *Building a Safer Future. Independent Review of Building Regulations and Fire Safety: Final Report.* Dame Judith Hackitt DBE FREng; May 2018.

This document is marked as confidential

5. How can change be driven?

A second round of interviews explored fourteen industry experts' views on potential solutions to address the issues highlighted in section 3. Experts represented a spread of roles, including:

- Tier 1 contractors
- Tier 3 contractors
- Standards
- Government representatives
- Architect
- Manufacturer
- Consultant

Experts were asked to read short descriptions of seven potential solutions prior to the interview. Some solutions were processes or principles that already exist, others were more hypothetical. Importantly, they spanned different stages of a project lifecycle.

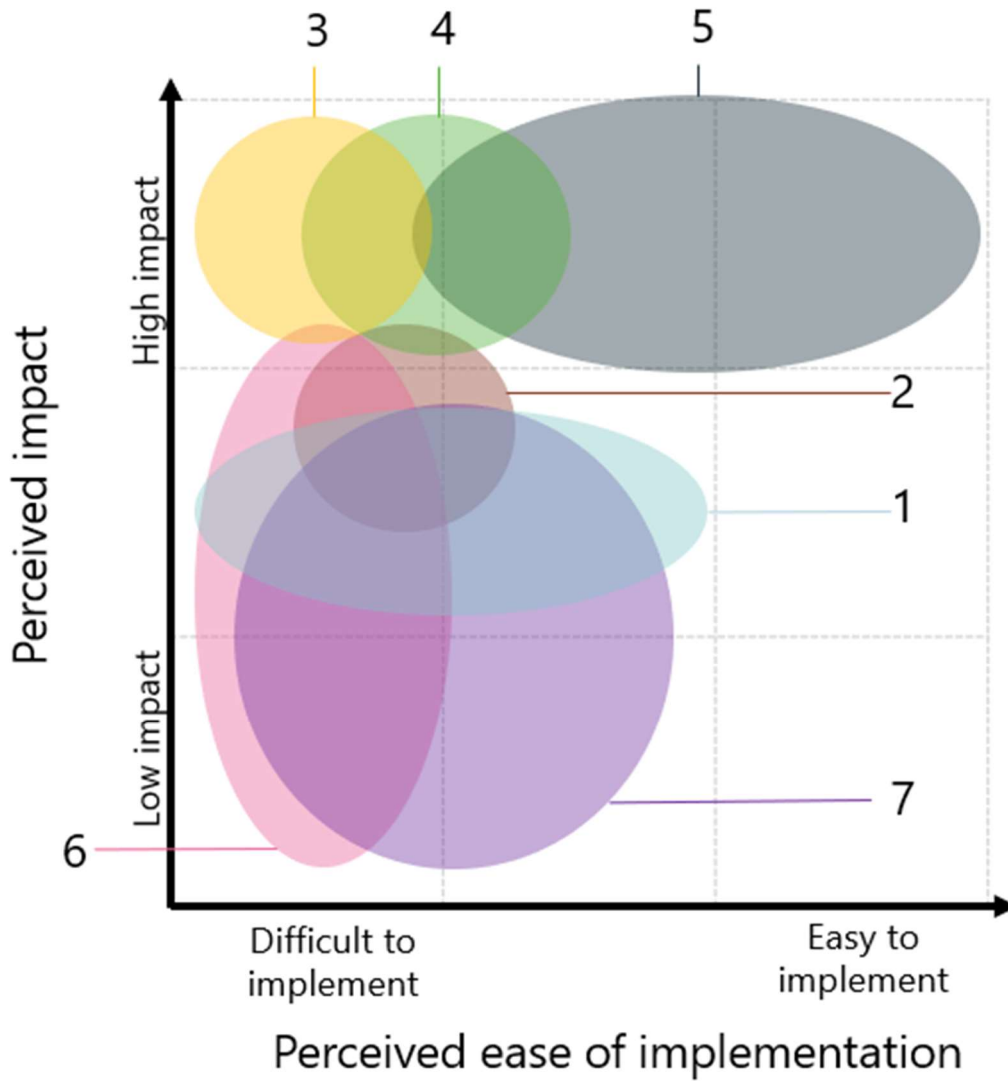| Client	Design	Build	Operation
Pre-Construction Services Agreements (PCSAs)			
	Contractor/subcontractor selection		
			Soft landings
	Specifications for each stage of lifecycle		
			Predictive maintenance
Carbon tax			
League table			

These solutions were not necessarily proposed for implementation. They were selected for discussion so that interviewees could respond to descriptions of tangible solutions rather than more abstract concepts, helping to reveal deeper insight about the causes of issues and the barriers to overcoming those. Interviewees were asked to share their perspectives on:

- Potential impact (positive and negative) of the solution.
- Ease of implementation and what implementation might require.
- Perceived benefits and concerns.

There was consensus on most topics, though some differences in opinion on others. There was generally little difference in the views of experts from different parts of the industry.

This document is marked as confidential

5.1 Changing behaviour is challenging but essential

The following visual represents interviewees' perceptions of the potential impact and ease of implementation of the solutions discussed. This is intended as a qualitative summary of a vast amount of detail. Three key insights emerging from this discussion are outlined in this section.

1. Pre-Construction Services Agreements (PCSAs)
2. Non-cost criteria for contractor / subcontractor selection
3. Soft landings
4. Specifications made for – and met at – each lifecycle stage
5. Smart tech enabling predictive maintenance and monitoring
6. Carbon tax
7. League table

5.1.1 Focus on ongoing operation could have great impact

The solutions that were expected to have greater impact were those that involved a fundamental shift in how buildings are designed, namely that the ongoing operation of a building should be considered from the outset. In particular, soft landings contracts, a requirement to make and meet specifications for each stage of a project lifecycle and the use of smart technology were considered impactful because they would require project teams, including clients, to define and design how a building would be operated efficiently and effectively and deliver in accordance with that. Importantly, this focus should be ingrained from the outset of any project.

Many interviewees suggested that designing and planning for a building's use and operation should be driven by a focus on the outcomes that should be delivered. In terms of Net Zero buildings, that might be metrics around energy consumption or carbon emissions, for example, but there would also be other factors depending on the type of building, the client and anticipated occupiers. For example, one interviewee described that for a hospital building, patient recovery time might be a key outcome.

5.1.2 Behaviour change makes implementation more challenging

Central to designing and planning for a building's operation was the idea of early collaboration between different stakeholders to understand the required outcomes and work together to engineer solutions that would meet those. Interestingly, Pre-Construction Services Agreements (PCSAs), which allow early involvement of the contractor to contribute to the design, were not seen to be as impactful, despite enabling similar early collaboration. Some interviewees recognised the intent of PCSAs but emphasised that they needed full client engagement and careful management in order to ensure they supported positive, productive behaviour.

What differentiated PCSAs from the solutions that were expected to have greater impact was a perception that the latter promoted positive behaviour by investing project teams in outcomes (notably, longer-term operational outcomes) while PCSAs invested stakeholders in the process. Investment in operational outcomes represents an immense culture change for the sector, but one critical to Net Zero – operational outcomes are viewed as central to Net Zero and must be valued by clients if they are to value the different skills, costs, technologies and approaches that might be need in order to engineer for and deliver those outcomes.

5.1.3 Shortcuts to changing behaviour don't promote the fundamental culture shift needed

Legislative change was viewed by some as a quicker route to change, although others felt that the route to developing and implementing legislation could be slow. Government involvement in driving change was frequently referred to as "a carrot and stick approach" that might encourage the desired behaviours and outcomes but which wouldn't support

the fundamental culture shift and change in values that would be needed for lasting change.

Reactions to the idea of a carbon tax illustrate this well. Some interviewees felt that a carbon tax would be effective – with cost widely recognised as a driver of behaviour, a tax that disproportionately impacts higher-carbon buildings was seen as an effective mechanism for encouraging Net Zero buildings. However, others felt that while a carbon tax might discourage high carbon buildings, it would lead to focus on meeting a certain threshold, rather than driving an ongoing ambition of increasingly reducing carbon.

It is important to note that government involvement was a polarising topic. Some felt that change would not happen without government setting the agenda, on the basis that the sector itself would not change unless policy and legislation mandated it. Others strongly opposed government involvement, feeling that "if anything, Net Zero targets need to be de-politicised". These individuals felt that government ownership of Net Zero targets led to a perception of uncertainty and instability that discouraged industry from long-term commitment to Net Zero strategies. The perceived threat that targets and the surrounding policy might change was seen to be preventing the industry from driving progress, doing nothing until required being preferable to driving progress in what might turn out to be the wrong direction.

5.2 Disruption could drive rapid and powerful change

The solutions outlined so far represent the industry making steady and relatively proactive

"[Tech innovators] are actually out there creating consumer products that they believe are going to change the face of how people buy homes. They're doing that not from the perspective of a land-first developer – because most developers make their money out of land. They're coming at it from a tech company perspective – 'we're going to use the latest tech to completely transform how people live in their home, use energy...'."

changes to how it works. For that to be effective, stakeholders need to see value in changing, for example value in the competitive advantage that change could bring. Some interviewees reflected that reactive change, perhaps to an external threat, could bring about very rapid and powerful change. In these instances, change is needed to maintain a viable business. One possible source of such a threat could be the technology sector. Companies like Amazon or Tesla could disrupt the market by offering novel approaches

to building design – these might be Net Zero by design and, through a consumer-centric offering, could represent greater value to clients.

This document is marked as confidential

Summary of key insights

- A fundamental shift in how buildings are designed that considers ongoing operation from the outset could drive progress towards the delivery of quality Net Zero buildings.

- However, such a shift requires early and ongoing collaboration between stakeholders. It also requires all parties to be invested in the building's operational outcomes. These two factors represent a substantial change from the current culture and ways of working.

- Change should encourage continued progress towards a Net Zero ambition, both from the sector as a whole as well as organisations within the sector. While legislation may bring about results by discouraging unwanted behaviour and outcomes, it may not be powerful enough to promote ongoing positive and

6. Is the sector ready for change?

An online survey explored views on the building services sector (and individual roles and organisations within the sector) now and in the future, in the context of delivering Net Zero buildings. This survey sought to validate key insights, including:

- There is a lack of awareness and understanding of the need to deliver Net Zero buildings.
- Cost is prioritised over quality.
- An existing skills gap needs to be addressed.
- The role of behaviour, in particular collaboration, will be more important than ever.
- There is widespread recognition of the need for substantial change in the sector.
- There are differing views about how change should be driven.

The survey was distributed via Actuate UK member organisations, with 280 respondents from across the sector.

6.1 There is an opportunity to increase awareness and understanding of the need to decarbonise buildings

A slight majority (56%) felt they knew "a lot" or "a fair amount" amount the need to decarbonise buildings to meet Net Zero targets, but nearly a quarter (24%) reported only knowing a little and one in five (20%) knew hardly anything or had never heard of this.

This document is marked as confidential

Awareness of the need to decarbonise buildings to meet Net Zero targets

■ Never heard of this   ■ Hardly anything, but I've heard of this

■ A little   ■ A fair amount
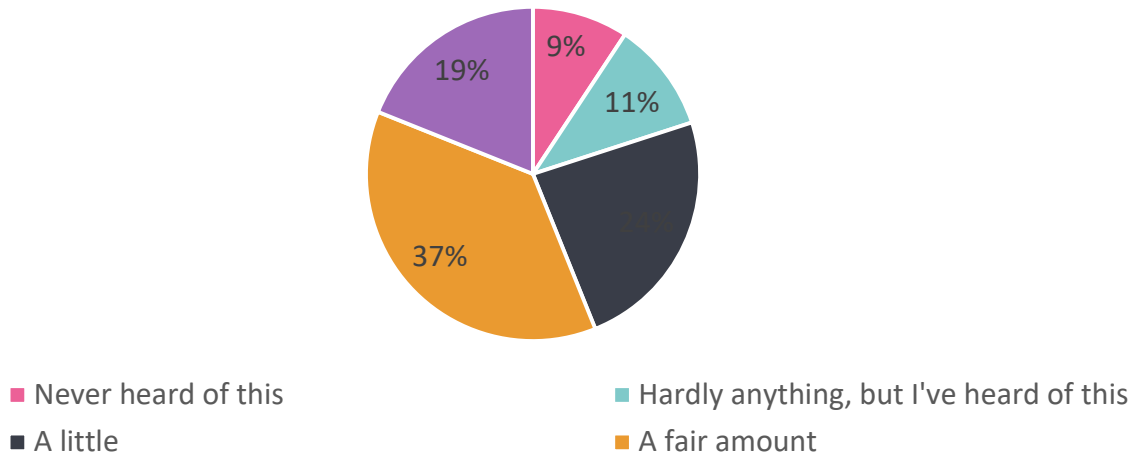
A lack of awareness may be an easy barrier to overcome, though, with climate change something that the vast majority (80%) reported being concerned about.

I am concerned about climate change

80% strongly agree or somewhat agree
8% neither agree nor disagree
**11%** somewhat disagree or strongly disagree

The vast majority agreed that industries (86%), government and authorities (85%) and individuals (81%) have a responsibility to tackle climate change, suggesting that those working in the sector could be engaged on a personal as well as a professional level.

This document is marked as confidential

To what extent do you agree or disagree with each of the following statements?

- ■ Individuals have a responsibility to tackle climate change
- ■ Government and authorities have a responsibility to tackle climate change
- ■ Industries have a responsibility to tackle climate change
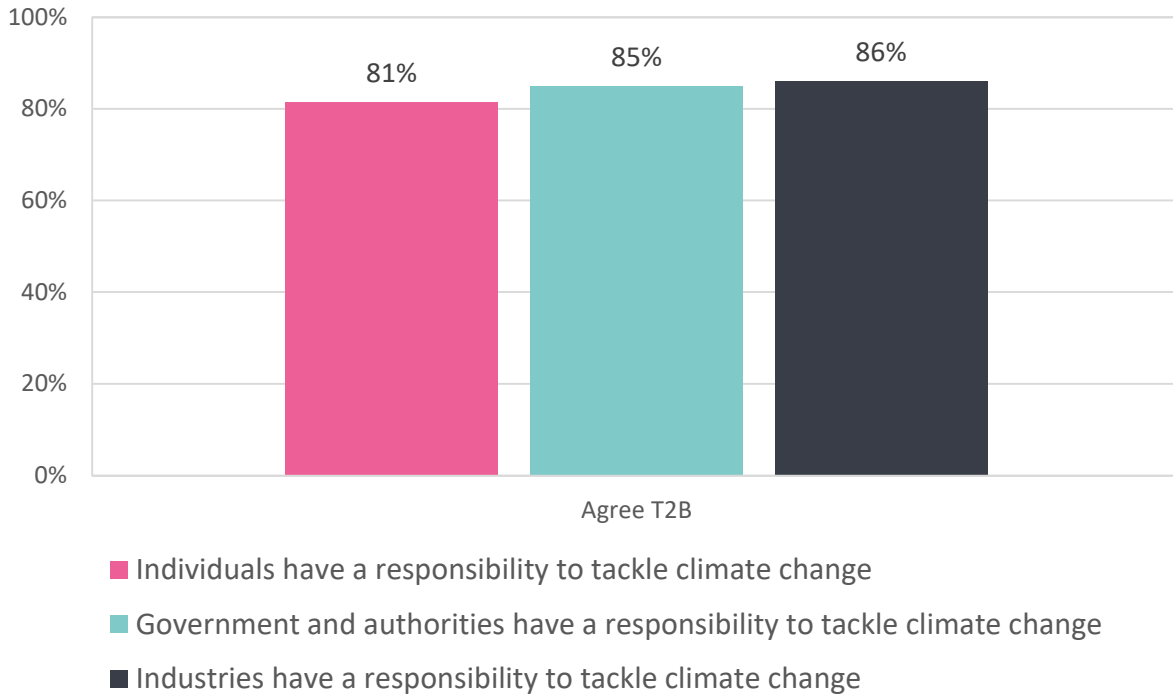
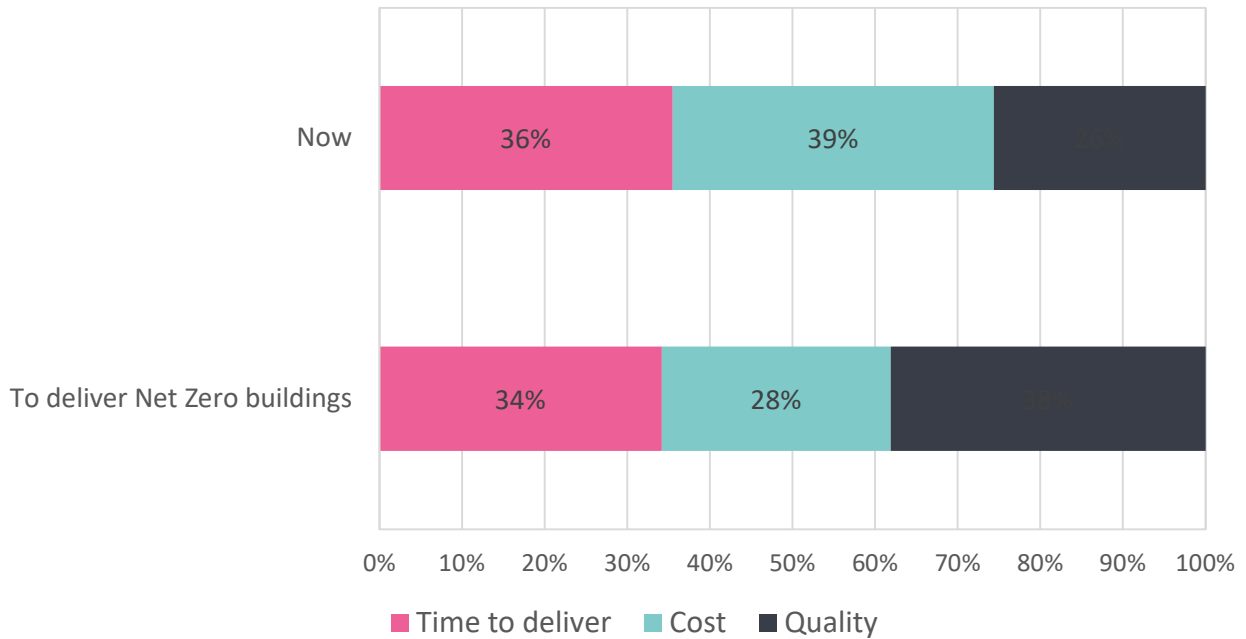## 6.2 More emphasis needs to be placed on quality

Despite the majority of respondents reporting that they as individuals and that their company or organisation are known for delivering high quality at work, fewer than half (46%) of respondents felt that the sector as a whole is known for delivering high quality work.
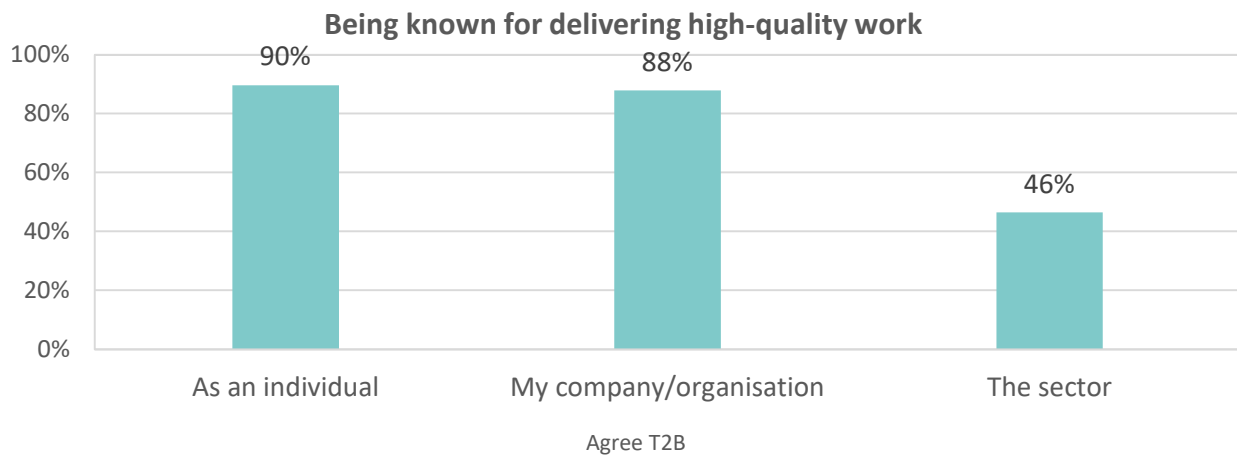
Nearly three quarters of respondents (73%) felt that for the building services sector, other factors sometimes take priority over delivering high quality work. Cost and time to deliver were seen to take priority over quality. While the importance currently placed on time to

deliver was seen as appropriate for the delivery of Net Zero buildings, responses suggest the current prioritisation of cost over quality should be reversed.
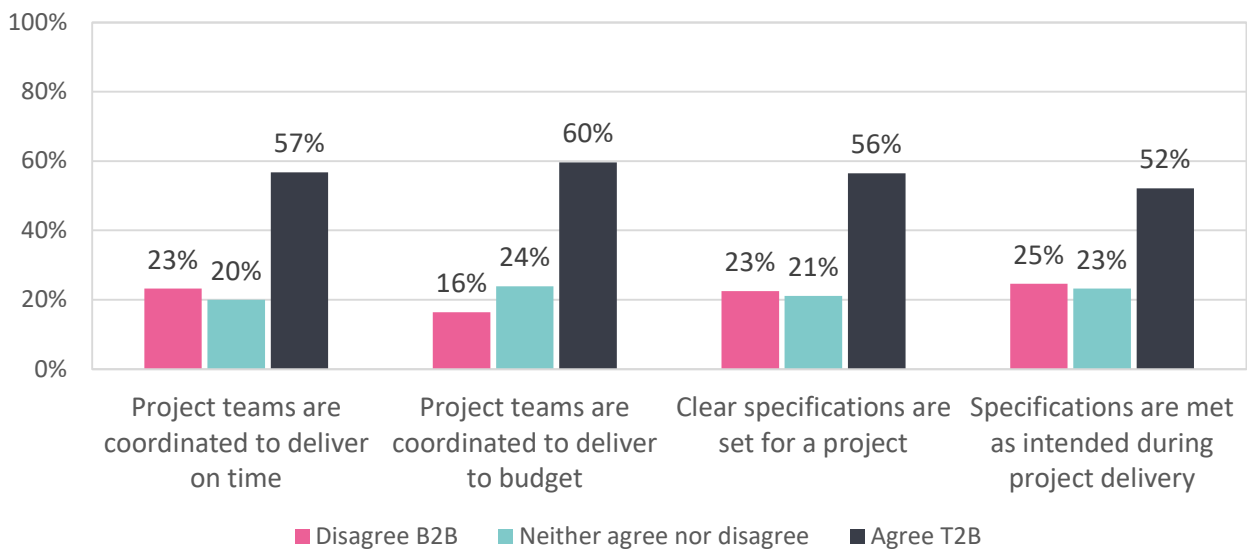
Perceived importance placed on time to deliver, cost and quality

Now
- Time to deliver: 36%
- Cost: 39%
- Quality: (36%)

To deliver Net Zero buildings
- Time to deliver: 34%
- Cost: 28%
- Quality: (38%)

Legend: ■ Time to deliver ■ Cost ■ Quality

6.3 The role of behaviour will be more important than ever

While a small majority agreed that project teams are coordinated to deliver on time and to budget, and that clear specifications are set and met as intended, a substantial minority did not.

To what extent do you agree or disagree with each of the following statements?

	Disagree B2B	Neither agree nor disagree	Agree T2B
Project teams are coordinated to deliver on time	23%	20%	57%
Project teams are coordinated to deliver to budget	16%	24%	60%
Clear specifications are set for a project	23%	21%	56%
Specifications are met as intended during project delivery	25%	23%	52%

Legend: ■ Disagree B2B ■ Neither agree nor disagree ■ Agree T2B

Only about a quarter of respondents (27%) agreed with all four of the statements shown above, suggesting an opportunity to establish productive behaviours more consistently across the sector.

While views were largely similar across different types of roles in the sector, it should be noted that Tier 1 and 2 contractors were significantly more likely than Tier 3 contractors to agree that specifications are met as intended during project delivery (64% vs 44%, respectively), again indicating an opportunity to encourage more consistency across the sector.

As discussed earlier, interviewees emphasised the importance of collaboration and indicated that typical project lifecycles do little to promote collaboration. This is reinforced by survey respondents – about half (53%) felt that there is collaboration between different parties in a project team, with fewer than half (42%) feeling that project processes and contracts support collaboration.

To what extent do you agree or disagree with each of the following statements?
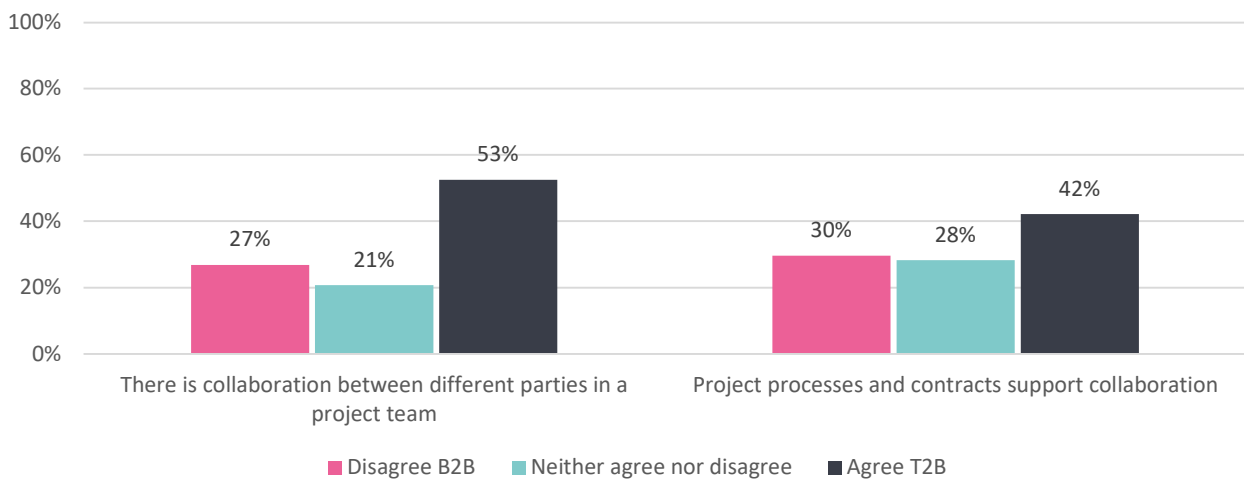
One of the benefits of early collaboration highlighted by interviewees was better understanding and mitigation of risks. With fewer than half (45%) of survey respondents feeling that potential risks are understood early on in a project, collaboration could play a key role in addressing this. This could have positive impacts later in the project lifecycle – interviewees reflected that better understanding of risks early on could help in controlling budgets, timelines and quality.

To what extent do you agree or disagree with each of the following statements?
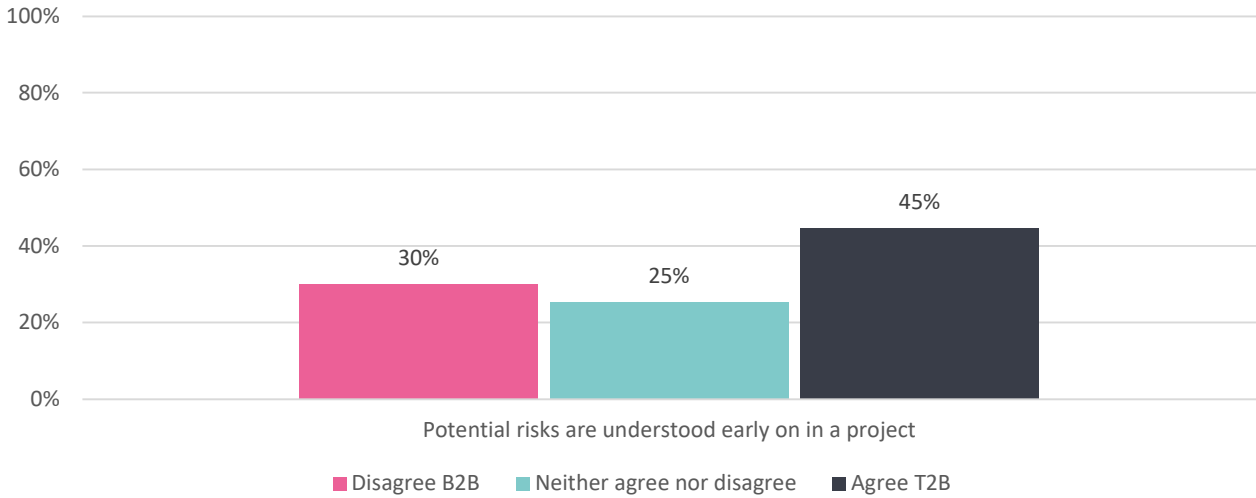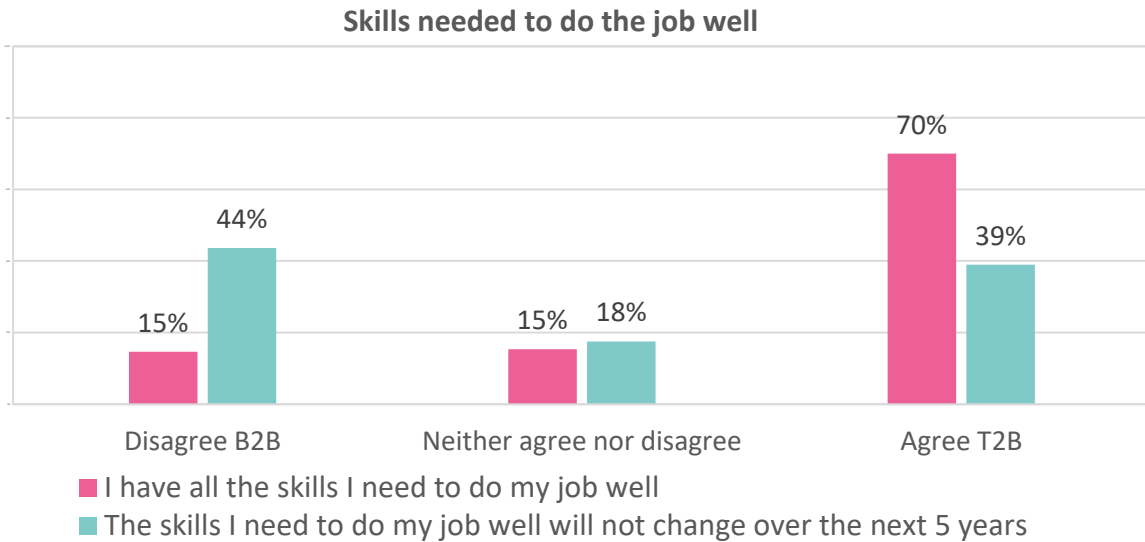

6.4 The current skills gap is expected to grow

The majority (68%) of respondents did not feel it was easy for their company or organisation to find people with the right skills, reflecting the skills gap described by interviewees. A similar proportion (63%) did not expect that it would be easy to find staff with the right skills in 5 years' time, suggesting that the skills gap urgently needs addressing.

While the majority (70%) of respondents felt that they currently have all the skills they need to do their job well, when asked to consider a future where the sector supports the delivery of quality Net Zero buildings, nearly half of respondents (44%) felt that the skills they would need to do their job well would change over the next 5 years.

Skills needed to do the job well

- 15% / 44% — Disagree B2B
- 15% / 18% — Neither agree nor disagree
- 70% / 39% — Agree T2B

■ I have all the skills I need to do my job well
■ The skills I need to do my job well will not change over the next 5 years

There does appear to be an appetite for training related to Net Zero. Respondents were asked "if you could learn one new skill that would help you with your job, what would that be?" and could answer in their own words. Responses varied in terms of topic and the level of awareness/expertise wanted.

- Topics included Net Zero, data and digitalisation, project management and health and safety, as well as sector-specific skills.
- Responses ranged from wanting a general awareness or understanding through to training of very specific skills.

About one in five gave a response related to Net Zero, carbon or energy. These varied:

- Some wanted to build general awareness and understanding, for example "understand impact of government's ambition to decarbonise" and "what I can do to help the organisation I work for move towards Net Zero".
- Some mentioned specific technologies, skills or qualifications, for example "proper design of air source/ground source heat pump systems including heat loss calculations" and "Low Carbon Consultant accreditation".
- Some wanted to understand how to implement Net Zero within projects, for example "how to persuade clients to consider...climate change implications when making buying decisions.

Responses also suggested a recognition among the current workforce of the importance of behaviours and culture – about 1 in 10 mentioned skills relating to these.

- Some implied existing challenges, for example "to create a genuinely collaborative environment…where everyone properly focuses on the solutions and outcomes and doesn't care who takes the credit".
- Some implied recognition of opportunities for improvement, for example "design or commissioning workshops to understand exactly what the client has asked for, not an architect or consultant's interpretation" and "client interactions…to understand their aspirations and needs from the sector and determine where they are on their journey."

6.5 There is widespread recognition that the sector needs to change

Once again reflecting the findings from the interviews, most survey respondents felt that the sector, as it is now, will not be able to deliver quality Net Zero buildings at scale.

The sector, as it is now, will not be able to deliver quality Net Zero buildings at scale
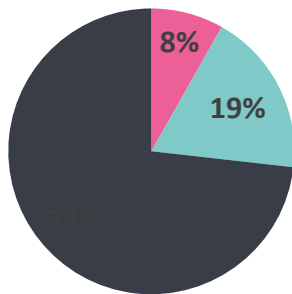
■ Disagree B2B ■ Neither agree nor disagree ■ Agree T2B

When asked to consider what would need to change in order for the sector to deliver quality Net Zero buildings, most agree that the sector will need to change in the next 5 years (88%). About two thirds (68%) felt that their company or organization would need to change, while just over half (56%) felt that their role would need to change.

Importantly, when considering change at company or organization level or at individual role level, similar proportions expected that change will be needed and that change is likely to happen. However, at sector level, while the vast majority (88%) of the sample agreed that change would be needed, a much smaller proportion (65%) felt that the sector would be likely to change.


Expected change in the next 5 years

This document is marked as confidential
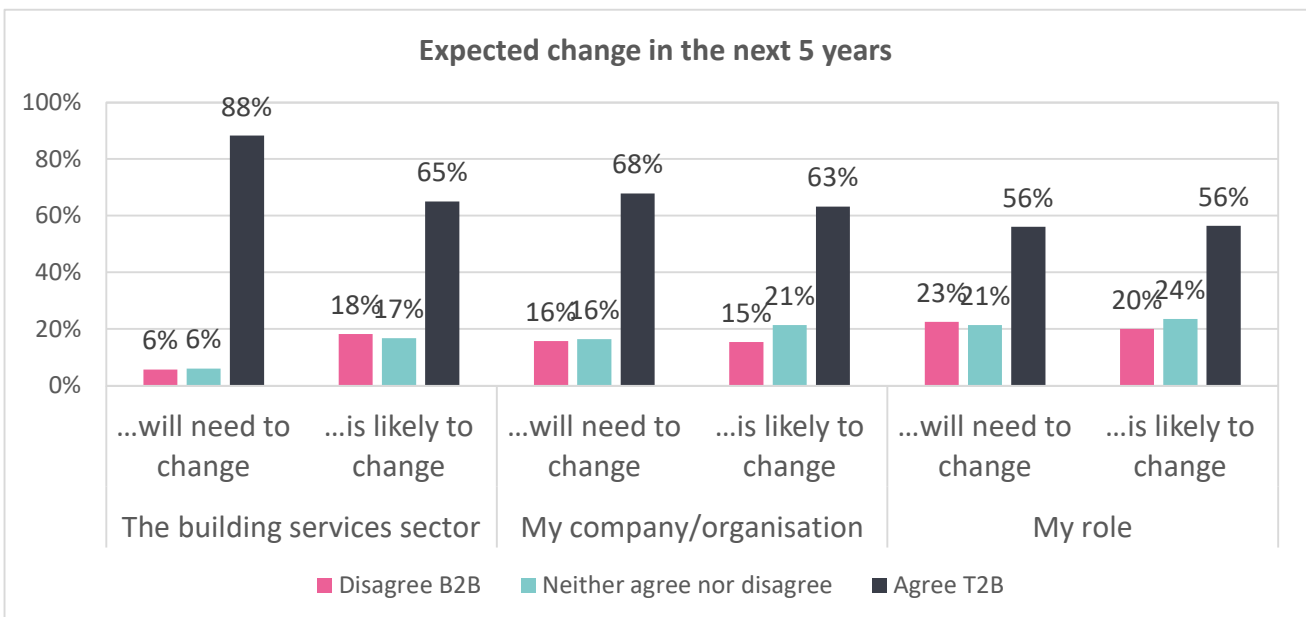
This reinforces the views of several interviewees that the sector is unlikely to drive change itself.

6.6 There are varied views about how change should be driven

Like the experts interviewed, there was no clear consensus among survey respondents about who should drive change. The biggest divergence in views was for government involvement – some felt the majority of the share should lie with government while others felt government should have very little involvement. By contrast, expected involvement of

To what extent do you think each of the following should be involved in driving this change?
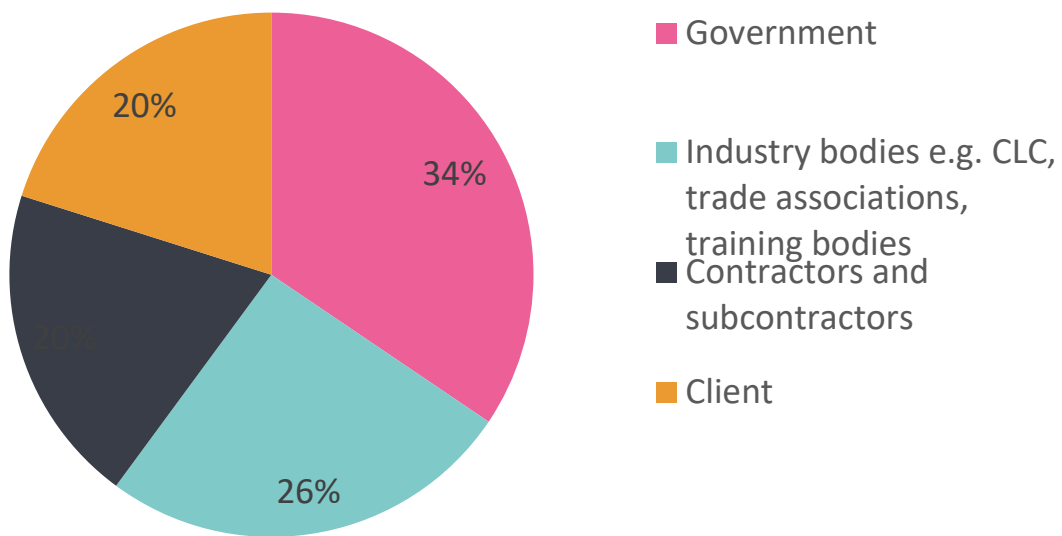
- Government
- Industry bodies e.g. CLC, trade associations, training bodies
- Contractors and subcontractors
- Client

34%
26%
20%
20%

industry bodies, contractors and subcontractors and clients was relatively evenly spread.

This reflects the divergence previously seen among interviewees. Some felt that government should drive change – notably, this was often because it was felt that industry would not drive change on its own and so government intervention would be needed. Others felt that government *would not* drive change and some felt strongly that government *should not* drive change, feeling instead that Net Zero targets needed to be depoliticised.

Summary of key insights

- The sector is not seen as well-equipped to deliver quality Net Zero buildings.
- There may be an appetite for a focus on Net Zero: most are concerned about climate change and, when asked what one skill they'd like to learn, one in five mention something related to Net Zero.
- There is an expectation that change will be needed at sector level, at company or organisation level and at individual role level.
- But there is uncertainty about who will drive change: government, industry bodies, contractors and subcontractors and clients are all expected to play a role, but there are varied views about how or why different parties could be involved.

7. How do other sectors seek to achieve and quality assure competency?

A combination of qualitative interviews (two in the oil and gas sector and three in the education sector) and desk research explored how the oil and gas sector and education sectors seek to achieve and quality assure competency. Recommendations were extracted for how learnings could be translated into the building services sector.

7.1 Regulation and competition could drive consistency and quality of training

Training within the oil and gas industry, like the construction industry, often focuses on meeting minimum requirements. Within the education sector, regulation and competition drive quality far beyond this. Direct interaction with the end user (students) and emphasis on delivering learning outcomes to ensure their employability drives competition between institutions, promoting an ongoing focus on quality. There are also processes in place to raise and address complaints from students. These can lead to recourse on an individual basis or on a larger scale.

- The oil and gas industry has a mix of industry-wide regulation and self-regulation, similar to construction.
- In the education sector, regulation and accreditation ensures consistency and shared requirements across institutions and courses, while competition for students and investment drives quality.

7.2 An increasing focus on soft and transerable skills is needed

Within the education sector, a focus on giving students what they need to become employable and giving industry what it needs to build the future workforce is driving an increasing focus on soft or transferable skills that support the integration of technical skills into industry.

There is also some shift towards taking into account prior knowledge and experience and the need for a more flexible approach towards training.

The oil and gas industry is considering how to build 'mobility' - including reskilling and the transfer of existing skills - into its future workforce.

7.3 A 'rebrand' could draw attention to and promote a new, proactive direction

The oil and gas industry has historically brought about change reactively e.g. in response to significant disasters. However, with its past business not viable in a Net Zero future, it is proactively considering and shaping how it will change. The political environment, shareholder pressure and, to some extent, customer pressure have catalysed the focus on how the sector needs to change.

There is widespread recognition that the current oil and gas workforce is not equipped to support the change and the future of the sector. There is investment in and progress towards understanding what is needed to build the future workforce: *what* and *why* are well understood and established, with focus shifting now to *how* to build that workforce.

A shift in language and branding is reinforcing the shift in focus, with language relating to "energy" and "transition" replacing "oil and gas".

Summary of key insights

Regulation and competition could drive consistency and quality of training.
The education sector is focused on delivering learning outcomes that ensure students' employability within the sector, with competition for students driving institutions to develop differentiated, high-quality courses.

An increasing focus on soft and transferable skills is needed.
A joint focus on equipping students for employment and providing industry with the skills it needs emphasises the importance of soft and transferable skills that help support the integration of technical skills into industry.

A 'rebrand' could draw attention to and promote a new, proactive

8. Summary

Drawing together the findings from the five research activities outlined in this report, we put forward a framework for driving change that can be considered in three parts - awareness, action and advantage.
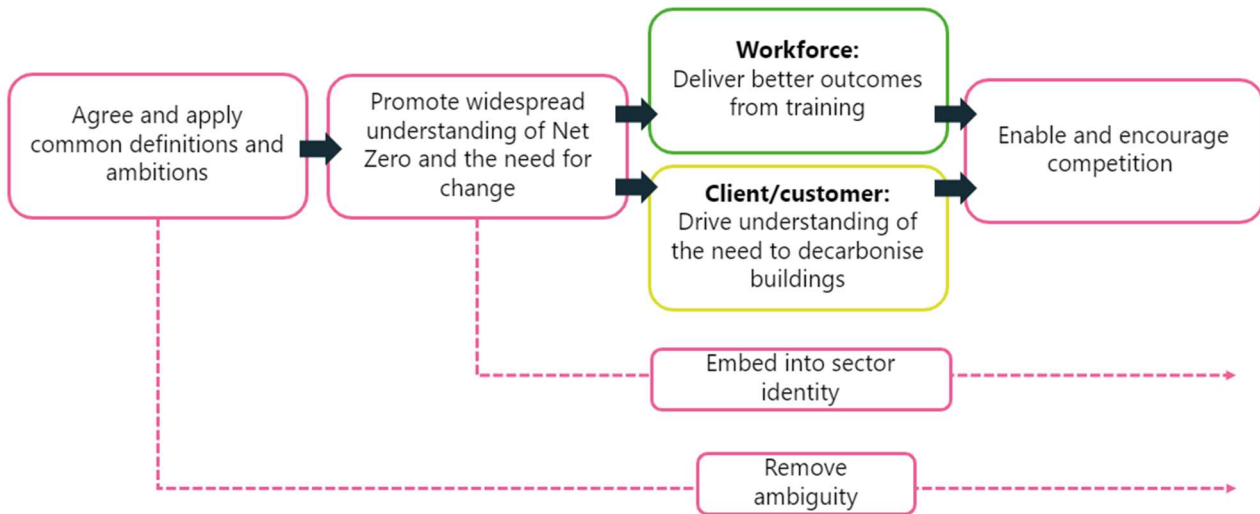
8.1 Awareness

There is a clear need to drive awareness and understanding of the need to deliver Net Zero buildings. However, this needs to be delivered alongside a clear and shared definition of Net Zero buildings. Common definitions need to be agreed and applied, along with recommendations of how key aspects might be validated or measured.

The operation of a building was seen as central to the definition of a Net Zero building. Ensuring operation is considered from the outset of any project represents a substantial but essential shift from the way the sector currently works. Processes and behaviours that encourage early consideration, definition and planning of the technology, integration, building management and maintenance will all be critical for delivering Net Zero buildings. Crucially, different stakeholders should collaborate early to engineer solutions that deliver the intended outcomes.

Several interviewees reflected that definitions of a Net Zero building could (or should) encompass more than its operation. Other factors can be categorised as follows:

- The **embodied carbon** in materials was seen as a significant contributor to carbon emissions.
- The **logistics** of moving materials (and people) to and from sites was also mentioned.
- Coupling these together, some recognised that transporting excess materials to site and **waste** materials from site contributed to carbon emissions through both transport and embodied carbon.

Ultimately, regardless of what definitions of Net Zero entail, common definitions and ambitions that can be consistently applied from the outset would support shared understanding, collaboration in delivering shared goals and remove ambiguity as the sector grows to deliver quality Net Zero buildings.

8.1.1 Drive client understanding of the need to decarbonise buildings

It is critical to raise awareness among the workforce of the need to decarbonise buildings, but equally critical to raise awareness among clients – without demand for Net Zero buildings, there is little incentive for action.

It will be important to:

- Educate clients about what to ask for and how e.g. outcomes with associated definitions and metrics; processes; contractor and subcontractor requirements.

- Support clients in applying new definitions, tools and approaches.

- Drive awareness and understanding among end users (e.g. homeowners, commercial tenants) to stimulate demand for Net Zero buildings.

- Consider the customer as well as the client - represent and protect end users' interests (e.g. support informed decisions; enable recourse for issues).

8.2 Action

A framework of activities, targets, regulations and standards could drive steady and productive progress in the sector. This could be supported by different stakeholders in different ways. Trade organisations could help tailor activities to specific parts of the sector, for example on the basis of type of company or specialism.

Basing such a framework on shared definitions of Net Zero buildings would help to remove ambiguity, reduce risk and enforce responsibility, both in terms of the delivery of Net Zero buildings and outcomes as well as in terms of ensuring investment in training to ensure the workforce has the skills required.

8.2.1 Shift focus to outcomes and engineering solutions that deliver those

Investing time and effort in defining required outcomes and engineering solutions that deliver those will require the right skills and the right tools:

- **Skills:** including technical skills and the soft, transferable skills and behaviours that will be required to effectively embed technical skills into project delivery.
- **Tools:** including, but not limited to, contracts, regulations, standards and processes that support the efficient and effective delivery of quality Net Zero buildings.

Tools should facilitate the right activities at the right time, for example early collaboration, risk assessment and solution engineering, and with the right people, i.e. those who are able

----
This document is marked as confidential

to advise and collaborate on not just components, but on their interaction, integration and operation as part of larger systems within buildings. Both these factors will require skills to embed technical expertise within the project.

8.2.2   Promote consistency in training

Focusing regulation or standardization on training, rather than performance, could help:

- Ensure higher-quality training that leads to higher-quality outcomes.
- Drive lifelong learning.
    - o Offer flexibility in training design and delivery, for example offering modular courses that make continued professional development more accessible for individuals in, or moving into, the sector and reduce barriers for employers.
    - o Promote integration and mobility of skills (and experience) within the sector and from outside the sector.
- Attract new and diverse talent to the sector.

8.3 Enable and encourage competition

Competition in the sector at the moment is largely driven by cost. Clear definitions of Net Zero buildings and deliberate reflection on how they are most successfully delivered could enable and encourage competition. Driving productive competition on relevant and objective metrics, e.g. use of innovation, customer satisfaction or delivery against outcomes could be supported through tools such as league tables, open access to data about building performance and critical evaluation of project delivery.

Enabling competition could not only drive quality, but promote diversification and ultimately customer choice. Not only would this support the delivery of Net Zero buildings, it could enable a sector that delivers quality buildings that are Net Zero as standard, with the capability, understanding and expertise to offer clients a greater range of choice than they currently have.

This document is marked as confidential

9. Licence/Disclaimer

LICENCE/DISCLAIMER
Energy Systems Catapult (ESC) Limited Licence for Equipping Building Engineers to Deliver Net Zero
Energy Systems Catapult is making this report available under the following conditions. This is intended to make the Information contained in this report available on a similar basis as under the Open Government Licence, but it is not Crown Copyright: it is owned by Energy Systems Catapult. Under such licence, Energy Systems Catapult is able to make the Information available under the terms of this licence. You are encouraged to Use and re-Use the Information that is available under this Energy Systems Catapult licence freely and flexibly, with only a few conditions.

Using information under this Energy Systems Catapult licence
Use by You of the Information indicates your acceptance of the terms and conditions below. Energy Systems Catapult grants You a licence to Use the Information subject to the conditions below.

You are free to:
- copy, publish, distribute and transmit the Information;
- adapt the Information;
- exploit the Information commercially and non-commercially, for example, by combining it with other information, or by including it in your own product or application.

You must, where You do any of the above:
- acknowledge the source of the Information by including the following acknowledgement:
- "Information taken from Equipping Engineers to Deliver Net Zero, by Energy Systems Catapult";
- provide a copy of or a link to this licence;
- state that the Information contains copyright information licensed under this ESC Licence.
- acquire and maintain all necessary licences from any third party needed to Use the Information.

These are important conditions of this licence and if You fail to comply with them the rights granted to You under this licence, or any similar licence granted by Energy Systems Catapult, will end automatically.

Exemptions
This licence only covers the Information and does not cover:
- personal data in the Information;
- trademarks of ESC; and
- any other intellectual property rights, including patents, trademarks, and design rights.

Non-endorsement
This licence does not grant You any right to Use the Information in a way that suggests any official status or that Energy Systems Catapult endorses You or your Use of the Information.

Non-warranty and liability
The Information is made available for Use without charge. In downloading the Information, You accept the basis on which Energy Systems Catapult makes it available. The Information is licensed 'as is' and Energy Systems Catapult excludes all representations, warranties, obligations and liabilities in relation to the Information to the maximum extent permitted by law.

Energy Systems Catapult is not liable for any errors or omissions in the Information and shall not be liable for any loss, injury or damage of any kind caused by its Use. This exclusion of liability includes, but is not limited to, any direct, indirect, special, incidental, consequential, punitive, or exemplary damages in each case such as loss of revenue, data, anticipated profits, and lost business. Energy Systems Catapult does not guarantee the continued supply of the Information.

Governing law
This licence and any dispute or claim arising out of or in connection with it (including any noncontractual claims or disputes) shall be governed by and construed in accordance with the laws of England and Wales and the parties irrevocably submit to the non-exclusive jurisdiction of the English courts.

Definitions
In this licence, the terms below have the following meanings: 'Information' means information protected by copyright or by database right (for example, literary and artistic works, content, data and source code) offered for Use under the terms of this licence. 'ESC' means Energy Systems Catapult Limited, a company incorporated and registered in England and Wales with company number 8705784 whose registered office is at Cannon House, 7th Floor, The Priory Queensway, Birmingham, B4 6BS. 'Use' means doing any act which is restricted by copyright or database right, whether in the original medium or in any other medium, and includes without limitation distributing, copying, adapting, modifying as may be technically necessary to use it in a

different mode or format. 'You' means the natural or legal person, or body of persons corporate or incorporate, acquiring rights under this licence.