# SEEING CLEARLY

## A Roundtable Discussion on the Embodied and Operational Carbon Impact of the Façade

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# PANEL

Reducing embodied carbon is one of the key challenges facing our industry. As the discussions around minimising the embodied carbon in the building frame mature, attention is turning to other elements of the build. Core Five hosted a roundtable discussion with industry experts to discuss how embodied carbon in the facades can be accurately assessed and minimised.

**David Gabe**
Partner
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**Adam Ashbridge**
Associate
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**Jonathan Wilson**
Associate Director
Arup Facades

**Laura Solarino**
Facade Engineer
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**Gary Ledger**
Technical Director
Kawneer

**Kieran Mallinson**
Director
Colorminium

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# WHAT ARE THE CLIENT DRIVERS?

As the government continues to drive the sustainability agenda forwards and legislative deadlines creep up, the focus within the construction industry has started to shift towards achieving net zero solutions. The legislation is clear – Net Zero by 2050, written into the Paris Agreement and supported by the Climate Change Act. It is no surprise that in response to the legislation, client drivers are shifting with a focus on both the embodied and operational carbon outputs of their developments.

Adam Ashbridge, Associate at Core Five, set the scene by describing what Core Five are seeing. "For a new build scheme the facades typically account for around 20% of construction cost and a similar 15-20% of the embodied carbon. These can both increase significantly on reinvention schemes where the existing frame is being re-used. We look at schemes where the "developer's dream" is to deliver a best in class space, that minimises embodied and operational carbon, and keeps costs within the necessary parameters for the appraisal. Achieving the developer's dream requires a focused team, collaborating from the offset!"

Kieran Mallinson, Director at London façade specialist Colorminium, asked what the developer feedback on the industry's progress was. "Are they seeing an increase in rental premium for low carbon buildings?"

David Gabe, Partner at Core Five, answered "Sustainability and low carbon has been a vocal part of the initial Client brief for some time but didn't always come through in the written brief after challenges to the budget. Now it is a firm fixture on page one of corporate Annual Reports and this, alongside policy and a collective drive to do better means it is staying at the top of our Clients priorities, particularly in the office sector. It doesn't necessarily get a direct value placed against it, it is the cost of not doing it and delivering a building with a potential short shelf life which is critical. The cost of not letting an asset, or the delay in letting an asset, far exceeds a small premium to the Capex expenditure at the outset."

Jonathan Wilson, Associate Director of Arup's façade team, agreed. "Two years ago everyone was saying that they want Net Zero but weren't doing much about it. But now, especially with Commercial schemes, it's become a key driver. Additionally the planning authorities are asking for much more to be done early on. For a large scale recent scheme with Southwark we've done extensive embodied carbon studies prior to planning being submitted, which we wouldn't have had to do before."

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Partner
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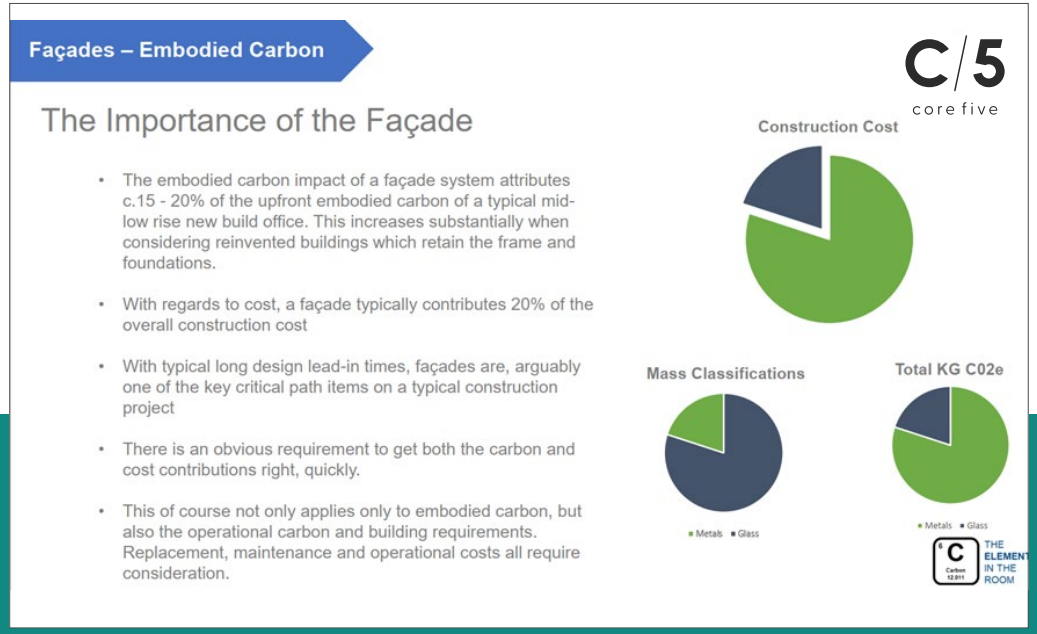


*Image: Core Five summary of relative proportions around façade cost and embodied carbon.*

# THE PUSH / PULL BETWEEN OPERATIONAL AND EMBODIED CARBON

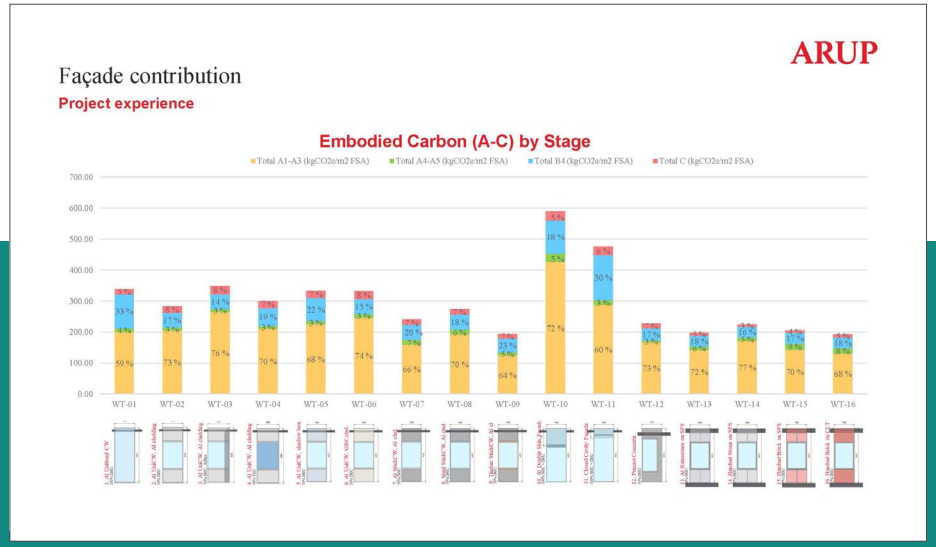


*Image: Arup have developed a tool to compare the embodied carbon of various façade systems on a Façade Surface Area basis*

As with any action, an equal reaction is all but guaranteed and carbon is no exception to the rule. The push/pull conflict between optimising the operational carbon outputs whilst minimising the embodied carbon inputs is indeed a delicate balancing act. Making the right choices at early design stages is pivotal to achieving net zero and right choices are often underpinned by good data paired with intelligent analysis and advice.

Laura Solarino, Façade Engineer at Arup, talked the panel through some of her recent research. "We developed an internal tool in collaboration with industry partners to look at the embodied carbon of various façade systems on a Façade Surface Area (FSA) basis, allowing us to examine the facades alone from the rest of the building. The systems analysed show a range of 200-350 kgC02/m2 FSA for typical systems and 450+ kgC02m2 FSA for double skin systems. Very few systems sit in the lower values necessary to achieve the London Energy Transformation Initiative (LETI) 2030 embodied carbon targets, and so there is definitely work that needs to be done."

Arup's Wilson added "Active double skin systems such as CCF facades may have higher upfront embodied carbon as they have layers of glass. But when considering operational carbon, daylighting, adaptability and the lack of need for fixed shading, they may be the best solution for a project when everything is looked at in the round. So it isn't a simple comparison." Core Five's Gabe took this further. "This tension between operational and embodied carbon is one we are seeing frequently. Another example is around openable windows. For a building to perform efficiently and minimise operational carbon there is a real pressure to include openable elements to the facade. But this adds more materials, in particular the framing which will typically increase the embodied carbon."

Gary Ledger, Technical Director at Kawneer also noted that the life span of the materials needs to be taken into account for an accurate assessment. "During initial construction the glass might only be 20% of the embodied carbon, but if glazing units need replacing throughout the lifespan of the building then it becomes a much higher proportion."

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**Jonathan Wilson**
Associate Director
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# BALANCING CARBON WITH DESIGN ASPIRATIONS

Whilst finding the sweet spot between embodied and operational carbon is a key factor for net zero, building form and design aspirations will also play a key role. Much like design economics relating to cost, the parameters around optimising carbon are introducing a whole new chapter to the architect's playbook when it comes down to design.

Arup's Solarino highlighted the importance of building form. "Targets on a building level are usually measured on kgC02e/m2 GIA. However, buildings will have a different ratio of GIA to façade area so that puts us in a challenging position: different solutions will be best suited for different buildings not only based on what system achieves the lowest carbon solution, but because the geometry of the building will influence the facade carbon budget. Understanding this relationship is key to selecting the right façade system for the building.

Core Five's Ashbridge compared this back to costs. "This is similar to what we see with costs where different buildings and typologies will have different Wall:Floor ratios which drive different £/sqft costs even for the same façade solutions. A lot of architects will hear these conversations about simplifying for carbon or cost reasons and shudder. The question is where should the compromise sit, and how can we find suitable compromise which achieves the intent of all parties?"

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**Adam Ashbridge**
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**Kieran Mallinson**
Director
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Arup's Wilson was optimistic. "Of course some element of architectural feature needs be retained, but there are some quick wins that can be made. No one wants a box with no windows though that would be the lowest carbon solution. On a recent project just reducing mullion depth made a substantial improvement on the embodied carbon. Combining this with specifying aluminium that has a high recycled content and is produced by hydroelectric power gave us a 26% reduction from the base."

Kawneer's Ledger concurred the importance of appropriate sizing. "On our Product Range comparison for mullions there is almost a 3x difference between the lowest and highest kgC02 per linear metre, it can make a big difference."

The panel then discussed the difference the finish applied to the aluminium can make, which is particularly important given the focus on the circular economy. Arup's Wilson set out the position. "Both aluminium finished with an anodised finish and a Polyester Powder Coating (PPC) can be recycled, but anodised is more complex."

Colorminium's Mallinson took this forwards. "Exactly, anodised can be recycled but is harder and more costly to strip as, in layman's terms, it's burned into the surface. For those reasons we are seeing a trend to avoid anodising. However we need to agree the palette of finishes and any implications of them before it gets locked in at the planning stage and it becomes too late. Otherwise we have to go backwards to go forwards."

# INCONSISTENCY IN STANDARDS

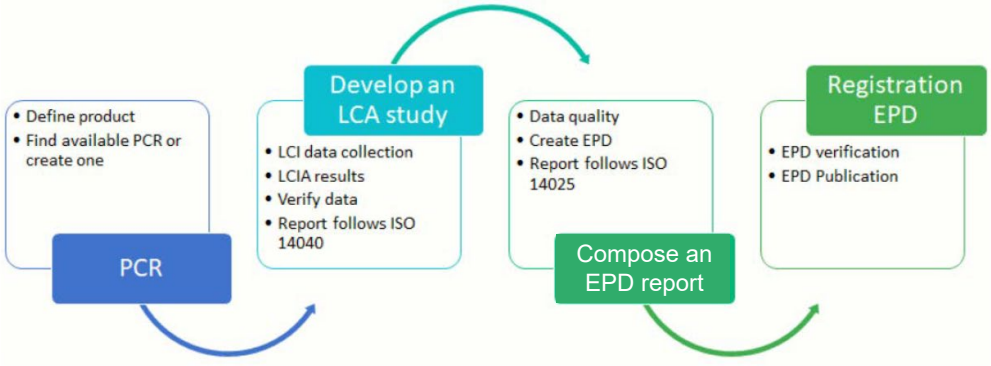


*Image: Kawneer summarised the process of producing accurate and reliable Environmental Performance Declarations*

> *The challenge is always commonality and comparability. For example we include the aluminium pre-treatment and powder coating processes, but is it always included in other declarations? Should we be reporting windows and doors by common sizes and curtain wall by m2 or by kg?*

**Gary Ledger**
Technical Director
Kawneer

Optimising performance requires measurement and scrutiny of the details, all athletes know this and the theory is tried, tested and proved time and time again. The only way to do this, however, is to strive for consistency in both the standards and methodology of measure.

Kawneer's Ledger set out their approach, and the challenges they see for the industry. "We have always used a minimum of 80% recycled content for our aluminium billets, and are driving towards being carbon zero in operation ourselves. In recent years we've already achieved significant reductions in our energy usage and waste, despite expanding revenue by 40%, and are looking at introducing our own solar PV arrays and CHP hydrogen generators for clean energy. We have 3rd party generated Environmental Product Declarations, but the challenge is always commonality and comparability. For example we include the aluminium pre-treatment and powder coating processes, but is it always included in other declarations? Should we be reporting windows and doors by common sizes and curtain wall by m2 or by kg? Although recently helped in part, by the introduction of BS EN 17213:2020 for the production of EPDs for Windows and Doors. The equivalent standard for curtain walling is still in development. So we have some way to go yet".

Arup's Wilson agreed the inconsistency challenge is not just limited to production of EPDs. "In the carbon assessments at the early stages of design you're not always comparing eggs with eggs, what you get is different between different consultancies. And they often go up the closer you get to construction. Someone needs to be checking they are consistent and accurate."

Core Five's Gabe responded, describing what they are doing to help improve this. "We recently launched a new service called Embodied Carbon Optimisation which proposes that we track the carbon from start to finish, alongside the costs and in the same way. Beyond this the whole life carbon assessment goes into the planners and they have a small number of independent parties that check it. From there on there is no consistent requirement to provide evidence of achieving it, though we think this is likely to change. We are working with some innovative Clients who are setting their own requirements and these are, in many cases, more robust than those of the Planners."

Colorminium's Mallinson mentioned the challenges for the wider supply chain. "What Gary has shown for how advanced Kawneer are in the carbon documentation is very impressive, but there are a whole number of façade treatments that happen outside glazing to make cities like London the architecturally vibrant places they are. The supply chains for the more artisan products like terracotta, corten, zinc are no way as advanced as this, and there's a long journey to go."

# LOW CARBON PROCUREMENT

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**Laura Solarino**
Facade Engineer
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Addressing the carbon impact of the external envelope at early design stages offers great progression where low carbon drivers exist, though simply discussing the element in the room is not enough. The works still need to be procured and delivered both on budget and within the sustainability targets set.

Arup's Solarino described a recent project in which carbon was one of the key factors for the appointment of the successful façade contractor. "We asked for a range of embodied carbon information as part of the tender process, including EPDs and projected total carbon emissions. It wasn't an easy process: the façade contractors' initial response was to consider it secondary, but in the end we achieved the desired results. The tenderers provided quite similar submissions and because of the project drivers and client's aspirations, their approach to carbon became decisive. In the end, the successful tenderer wasn't the one who provided the lowest carbon assessment, rather the firm who gave us the most confidence to prove their ability to demonstrate the client's targets could be achieved."

Core Five's Gabe "We see specifications with embodied carbon targets and challenging performance metrics, and being honest we do see some kick back on these from the supply chain. I'm not sure we'll be able to say "hit that number and prove it" for some time but there is an opportunity to work together collaboratively to understand what can be done and how we can make sure the result aligns with the requirements. Maintaining some flexibility on the carbon targets for getting people on board is important, but we need to make sure people have the expertise and the understanding of what is required to meet the targets."

Colorminium's Mallinson gave their view. "Once the design is set in stone with the traditional model it is very hard to unpick it later. We are seeing a shift in procurement models to far earlier on and much more collaboration, as from a commercial perspective it is important to limit risk, especially with a very fractured supply which is very far flung. So where some decisions or design aspects lock in certain parts early on it's great to be part of that discussion earlier so the implications are fully understood."

# WHO WE ARE


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