The Building Sustainably Podcast

Episode 3: How Whole Life Carbon Assessments transform industrial sustainability

Host: Emily McGee, Assistant Project Manager, RPS

Guests: Rachel Thompson, Sustainability Consultant, RPS and John Clayton, Senior Director – Engineering, RPS

Intro/Outro - 00:00:05:

Welcome to The Building Sustainably podcast by RPS. Sustainable, resilient development demands a new approach to how we plan, design, and build. We invite you to join us as we explore real-life case studies and offer practical guidance. Here's your host, Emily McGee.

Emily - 00:00:27:

Thank you both for joining to share your knowledge and experience on today's topic of whole life cycle carbon assessments for industrial buildings. I suppose we can start off with introductions. John, do you want to start us off?

John - 00:00:39:`

Thanks, Emily. So my name's John Clayton. I'm Senior Director at RPS and I oversee the building engineering teams in the design division. I've over 30 years' experience of working in the distribution and logistics sector. In our drive for sustainable construction, recently we've shifted our focus on reducing crumb carbon. We've been investigating how we can reuse existing buildings and also reducing carbon in new buildings. I look at how we can reduce material use, specify lower carbon materials.

Emily - 00:01:17:

And Rachel?

Rachel - 00:01:17:

Hi, I am the Sustainability Coordinator. I've been with RPS just coming up to five years now. And prior to that, I was working for a main contractor. So, I was working on site for about 20 years. Always been fascinated and interested in sustainable materials, and sustainable building. And my mainstay with RPS is carbon calculation. So exciting stuff.

Emily - 00:01:41:

Definitely. I'm very well suited for today's conversation then. So I guess to start off with this episode is the initial question of what is Whole Life Carbon Assessments (WLCA)?

John - 00:01:51:

So I guess the first point is to make the statement that the logistics and transport industry is responsible for a significant part, approximately 28% of the UK's total carbon emissions. So to fulfil the UK's 2050 net zero target, we've all got to take action to decarbonise the built environment. So, every stage of construction impacts on the project's carbon emissions. So, by undertaking an assessment of the entire carbon footprint of a built asset throughout a 60-year life cycle, we can get a comprehensive and very accurate understanding of its carbon reduction potential. So, a whole life cycle assessment provides a holistic view of embodied and operational carbon from design construction to demolition. So, looking at upfront carbon, which includes materials, transportation to site, and construction activities, that's important, as well as in-use carbon, which is associated with maintaining and running the building asset through its entire 60-year life cycle. And also end-of-life carbon, which is associated with deconstruction, demolition, and the disposal of the building at the end of its life cycle.

Rachel - 00:03:22:

To add to that, because everything John has said is absolutely spot on, with a Whole Life Carbon assessment, we actually do it multiple times. So one of the benefits, the big benefits of undertaking it or agreeing to have your building go through that process is that it allows us to identify hotspots really early on, so we can then tailor the design going forward to try and get an ongoing reduction right the way through to you know hand over to the client. You're not going to know that unless you do the assessment so you don't just count it once you count it a fair few times for it so it's good yeah

John - 00:03:58:

totally agree Rachel and by taking this sort of iterative approach to these assessments as the building design evolves you can get insight into carbon cost of design choices pinpoint opportunities as the design progresses so really a Whole Lifecycle Assessment really lays the foundation for making informed decisions and then implementing measures across the various aspects of the building design in terms of how it's operated how we can enhance energy efficiency not only of the building systems but all of the materials handling equipment in the logistics facilities and how we can integrate renewable energy systems and also consider lower carbon material specifications**.**

Emily - 00:04:45:

So with the importance that you've highlighted with the WLCAs, are there any industry standards or sort of regional requirements that can be followed with them?

Rachel - 00:04:54:

The industry standard is RICS, so Royal Institution of Chartered Surveyors. That's the standard that everybody in the industry, regardless of their discipline, should be using to measure accurately the carbon of that building throughout its entire life cycle. RICS as a standard has actually been around since 2017. They recently reissued their second edition, which came in late 2023. As of the 1st of July this year, any building now doing a Whole Life Carbon Assessment should use the second edition. A tremendous amount of work has gone into the second edition. I mean, it's a good couple of hundred pages long and it has actually been written by industry professionals. . So everybody has had a say on what should be measured and how it should be measured and what is the best way of reporting it. So it's an incredibly robust standard to use. And basically, if it's not RICS, it's not a whole-life assessment.

Emily - 00:05:54:

So with the RIC standards and also there was the discussion of WLCAs also becoming mandatory. Mandatory in the sort of perspective with that. Would you see that so with WLCA having mandates within the UK? I know that you touched within your report that there were sort of regional requirements that are shown in Greater London. That would you see that mandate becoming more UK-spread or keeping more to regional requirements as we've seen?

Rachel - 00:06:22:

I would sincerely hope that it would become UK spread. I sincerely hope that the government basically says that yes, every building, regardless of what building it is, should undergo this type of assessment. But we are not there yet. That hasn't happened yet. So Greater London has said yes, certain building types have to undergo a whole life assessment for planning permission, which is great. I'm thrilled to hear that. But that isn't the case for other local authorities. So, unless they turn around and say, yes, we want this. It's still optional. So yes, we need government to kind of say, please do this.

Emily - 00:06:58:

Give the green light, yeah.

Rachel - 00:06:59:

Yeah.

Emily - 00:06:59:

So, with the standards in mind as well, how would you guys suggest the approach should be when you're reporting the WLCAs? So in terms of taking a modular approach?

Rachel - 00:07:11:

So RICS is the standard to follow, and it is a modular approached standard. So as long as you follow RICS, you're not going to go wrong. Like I said, standard is very prescriptive. So module breakdown, you have module A. This covers things like pre-construction activities, the embodied carbon in materials, the manufacturing processes, energy or water that is used to make your product. It also covers products being taken to site and the energy required to actually install. Then you have Module B. Module B looks at operational values. So, once you've handed the building over to the owner, how much carbon does it actually take to run that building? So, it looks at water use. It looks at energy use. It incorporates renewables. It looks at maintenance strategies. And it looks at replacement materials. So, the robustness of materials is quite key because obviously the less replacements you have, the less carbon you are going to create. Then you have Module C. And module C is all about waste and waste. So what happens to all of those materials at the end of 60 years? How are they disposed of? It takes into account the transportation, recycling, sorting, or landfill or incineration disposals. Then there is Module D. So, module D we declare, but we don't actually make it part of the overall calculation because Module D is things that go beyond the system boundary. So, say, for example, you have a nice warehouse with lots of PV on the roof. It's actually more than the building needs. They could then export that back out. That would be a cavity fall under module D, for example.

Emily - 00:09:04:

So I suppose with the modular approach to it, and there'll be different stages within the building lifecycle itself, as you've explained, like going from your modules to, obviously waste management is usually quite key, and the main hits are in quite a lot of building and construction. With that, would you say there's sort of a guide with decisions then within those modules?

Rachel - 00:09:27:

First off, you do a Whole Life Carbon Assessment four times. Every time you do one, you do all the modules. So you do one assessment, you do all four modules. Do the second assessment, you redo all the four modules over and over again. And it's during those first stages, so concept stage, that we would do a baseline assessment. We then know what we're dealing with. Then that informs the design decisions to reduce the carbon in the hotspots at technical stage design. And at technical stage, we redo the whole thing again. So module A, B, C, and D. Construction stage, that's down to the contractor. There's a lot that can happen between it going from design to contractor. So when the contractor is sort of halfway through the procurement cycle, we would then start to look at the construction stage impacts based on their actual data. So then that gives us another baseline for comparison. And then there's a post-evaluation that is done usually within one year of the building being handed over. And that's a great opportunity to firstly check how robust some of the materials are and also get some real-life data from, like, the building management systems for electricity use and so on and so forth. So it is quite important that we pile up what it is at the beginning. And then, like I said, we will tailor a design to try and reduce that from the baseline as much as possible**.**

Emily - 00:10:48:

Yeah, so I suppose with the repetition as well, collaboration is key then, especially with your stakeholders and the other consultants on the job with that. So in terms of with collaboration between stakeholders, what would you see that the impact is of the WLCAs with the design and construction and having that discussion with them?

Rachel - 00:11:05:

I was going to say, John, do you want to have an opinion on that or do you want me to just carry on?

John - 00:11:09:

In an engineer's perspective, in terms of a whole lifecycle assessment, our, I guess, the biggest impact we can make is in carbon A1. So really focusing on material specifications, reducing material usage, and if

possible, reusing existing buildings. And generally for elements of structure, you know, we normally design with sort of a 50-year design life in mind. If we're looking at a 60-year reference study period, then we just need to challenge that. I would suggest most steel and concrete structures would last the full 60 years, and would have minimal maintenance. However, there are exceptions to that. And industrial and logistics buildings, for example, the external pavements aren't always designed with a 60-year design life in mind. Typically, we might design for 30 years. So, when we're considering Module B in terms of maintenance replacement, we may need to allow for the fact that part or all of the external yards may need to be replaced. So obviously, that could have a major impact on the total life cycle assessment and the carbon footprint of the building. So it's important to think about the 60-year reference study period and how that might impact on design lives and the materials that we choose. And I think engineers need to carefully consider that. When we're designing elements of structure and particular elements that are subject to things like fatigue loading, traffic loading, for example.

Emily - 00:12:41:

Okay, so with those sort of elements in mind, obviously from an engineer's perspective as well, what are the key carbon contributors that you have been seeing within industrial buildings or within industrial and logistics as well that go towards this?

John - 00:12:55:

So we've looked at a number of different types of logistics facilities. And obviously, as we know now in industrial and logistics, there's all shapes and sizes of types of buildings and they have become quite complex. So we have, as Rachel's mentioned, using sort of RICS guidance, assessed a typical UK developer-based build specification. So, you know, a typical 18-meter clear height facility with the usual external yards. So by taking that 60-year reference study period and looking at the modules that Rachel's discussed, typical breakdown for an industrial facility, we're seeing... You know, carbon footprints of around about 750 kilograms of CO2 per square meter. So that's assuming a 60-year reference study period. And typically, 55% of that figure is associated with the upfront embodied carbon, so Module A. And just over 40, 45% is associated with in-use or operational carbon. So, both upfront and operational in-use, a big contributors and considering a 60-year reference study period, if we look at the embodied carbon upfronts in Module A, it's, I guess, no surprise that concrete is the biggest contributor to that. If you think more industrial logistics, there's a vast amount of concrete associated with what can be fairly thick ground floor, concrete floors, there's the external yards, and then there's obviously the concrete associated with foundations. And the upper floors, particularly if there's mezzanine floors. So concrete contributes about 30% of the upfront embodied carbon in Module A. So really, the focus has to be on looking at how we either reduce and or specify lower carbon concrete, if we're to make any impact on industrial and logistics facilities. So that's the first key thing. The steel frame typically accounts for around for about 20%. So again, looking at how we can reduce steel in terms of its material quantities or look at different ways of manufacturing, we know most of the steel that we get at the moment is through the basic oxygen furnace process. And if we look to electric arc furnace processes, for example, that would play a significant reduction in the carbon footprint of steel. So I think steel and concrete will still have a big part to play in industrial and logistics facilities. It's how we reduce the use and make the embodied carbon less in moving forwards. So the modular approach that Rachel's talked about is really important in identifying hot spots within the buildings and how we can target and reduce and prioritise what materials we look at. So we've talked about the concrete and steel. I guess it's no surprise that the cladding systems, so the walls and the roof curtain, the curtain walls, et cetera, they contribute around about 16%. So the three key things, concrete, steel and cladding, which are all things we know we can look at and start to look at alternative materials.

Rachel - 00:16:26:

It's worth mentioning with the collaboration and the materials kind of aspects, you know, what one discipline does, another discipline has to account for. So you have to talk an awful lot with each other when you're making changes. Sustainable design will, in some respects, only take you so far. A lot of it, as John said, is tied up with the big carbon hitters, concrete and steel. And we are, of course, at mercy on the availability of those materials. So unless our industry actually makes some significant changes to how they produce these materials, you are not going to get a lower embodied carbon figure.

John - 00:17:09:

Yeah, it's a good point, Rach. I think we need to consider where we get our materials from, because obviously transportation plays a huge part, in terms of the carbon footprint. So, we've talked about steel and concrete. You and I have discussed glulam before and how this might replace steel. I think it's an option to look at, but we know, as you've mentioned, that there's no local UK mass production of glulam, which could serve the logistics industry. So, there are examples of industrial buildings with glulam. They're supplied generally by Nordic or Austrian companies. So, we need to consider the impact of how those materials are manufactured and transported to the UK, as well as obviously their front embodied car.

Emily - 00:17:58:

So, I suppose with what we've discussed then already, and as a way of rounding off the discussion on WLCAs, what would you suggest is the way forward in regards of implementing WLCAs as a standard practice? I know we've touched on it, there's some limitations in there, but how would you see going forward on how developers can adopt them within their implementation?

John - 00:18:20:

I would encourage... Developers to adopt whole life carbon assessments on all of their projects. As Rachel's mentioned, we now have a robust format in which to do those through the RICS guidance. I think stakeholders across the industry, investors and users are increasingly looking for transparency and accountability in carbon management across the supply chain. So starting to use whole life carbon assessments starts to address that in terms of how we bring some transparency to carbon footprints of built assets. So it's really important. And as Rachel's mentioned, starting and implementing whole life carbon assessment at the outset of the project is really important because that really helps you focus on how you can make design decisions. And the whole team are involved in that, we know that generally logistics distribution, human construction is normally through design and build. And contractors have a great part to play in looking at and adopting new materials and how they can be realistically sourced from the supply chain. I think that's really important. So yeah, and then ongoing assessment of the assets. Lifecycle footprint through post-construction. And making sure that we've recorded all the information will start to give us a really accurate set of data that we know is realistic. And that next time we can say, look, how can we do that better? How can we improve what we did last time? So I think I would really encourage all developers, all stakeholders to use whole life carbon assessments on the journey towards net zero.

Emily - 00:20:19:

Nice, that's great. Thank you both for your time and sharing your experience and your knowledge with us on WLCAs for the industrial building.

John - 00:20:27:

Pleasure. Thanks, Emily.

Outro - 00:20:33:

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