Carbon Now or Later: The Arguments for Delaying Emissions

A new Arup report demystifies the time value of carbon, why it matters, and why we need to be careful with it.

by Elizabeth Waters

Are today's carbon emissions worse than tomorrow's?

Should embodied carbon be a higher priority than operational carbon?

Is temporary carbon storage beneficial?

These are daunting and complicated questions, which most project teams are probably not trying to answer directly. Still, building practitioners do often make decisions—however implicit—based on the impact of emissions now versus later, points out a new Arup report, "The time-value of carbon: An introductory exploration to support better decision making." Whether they intend to or not, designers, engineers, and consultants take a position on the time value of carbon, the report continues, every time they:

- Report the carbon storage benefits of mass timber.
- Evaluate the trade-off between increasing upfront embodied carbon emissions and reducing operational emissions. (Like, whether to install more robust insulation with higher-embodied carbon to reduce heating and cooling loads.)
- Calculate the carbon payback period of installing an onsite solar array.
- Advise clients on the purchase of carbon offsets based on temporary carbon storage.

But what assumptions about the time value of carbon are informing these types of project-level decisions? In the report, authors Will Wild, Jolie Lau, and Mel Allwood lay out the three primary arguments for using a time value of carbon, along with their limits and inherent subjectivities, to help practitioners understand, discuss, and thoughtfully apply the concept.

"I'd be the first to admit this is a narrow topic within a narrow topic within sustainability," reflected Wild, senior façade engineer at Arup, in an interview with BuildingGreen. Nonetheless, the report's message is broadly applicable. It offers a strong reminder of why it's important to understand the assumptions and uncertainties behind commonly used arguments—and, in Wild's words, the need to grapple with subjectivity.

What is the time value of carbon?

The time-value of carbon is the concept that carbon savings today are better (and, therefore, more economically valuable) than carbon savings promised in the future. This is because, due to the urgency of climate change and its escalating risks, "We need strategies that produce large savings quickly," writes Larry Strain, FAIA, in a BuildingGreen op-ed, "and because some reduction strategies result in an initial increase in carbon emissions, we need to pursue strategies that can produce a net reduction within that critical 10- to 20-year timeframe" to meet the targets set by the Paris Climate Accord. As such, he explains, carbon reduction strategies must consider the timeframe of carbon savings along with the amount. Following this logic, there is inherent value in de-

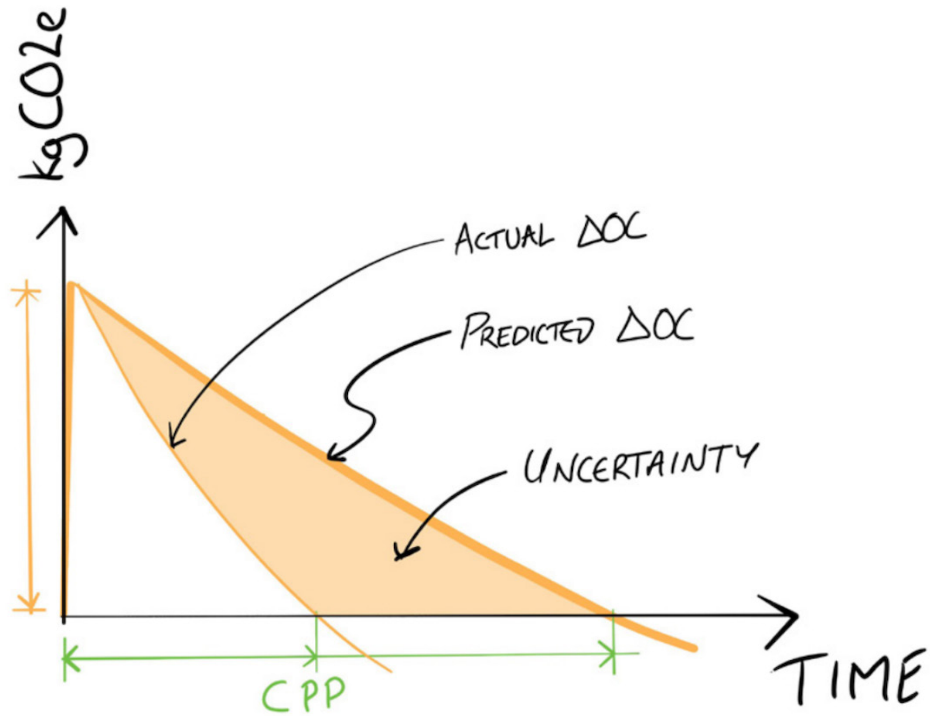

Figure 15
Sketch showing the indicative effect of accounting for the time-value of carbon on the carbon payback period (CPP)

Image: Arup

Whether they intend to or not, project teams often make design decisions informed by an assumed time value of carbon, like when calculating a carbon payback period, the Arup report emphasizes.

laying emissions—for instance, through temporary storage.

Still, according to the Arup report, most mainstream whole-building life-cycle assessments (WBLCAs) do not account for the timing of emissions. Such LCAs, which are sometimes referred to as static, consider all the carbon emitted throughout a building's life cycle to be equivalent in impact.

For example, when using a static LCA to account for the storage of biogenic carbon in a timber product, explains the report, the emissions sequestered in the timber at the beginning of a building's life cycle and those emitted at its predicted end are typically assumed to be the same, canceling each other out and ignoring any benefit that delaying those emissions might have.

For many people, said Wild, this valuation doesn't feel quite right. When using a static LCA to look at carbon payback periods over a fifty- or sixty-year period, he said, you start to question whether placing equal value on carbon saved today with that saved tomorrow or five years from now is the best methodology. "It's not wrong," he considered. "But is it right?"

Dynamic LCA, a loose term for assessments that apply a temporal weighting factor to emissions, seek to address this. In practice, dynamic LCA remains largely academic, explained Wild, but it's beginning to show up—albeit a bit opaquely—in standards and guidance. "That was most interesting to us," he continued, explaining that he and his coauthors hope to offer some transparency into why and how such weighting factors are being applied.

Three arguments for the time value of carbon

In the report, the authors identify and discuss the three primary arguments for placing less weight on future emissions. “Some of these arguments have a long history of debate,” said Wild, adding that none are free of subjectivity or value judgment. “What we’ve tried to do is shine light on both sides of the debate,” he said.

The buying time argument

The authors describe the first argument, the buying time argument, as follows: “In delaying emissions, we buy time to avert these delayed emissions.” In other words, the report summarizes, we could reduce the immediate risks of climate change, giving ourselves time to adapt our systems, develop technology, and mitigate climate change in the long term. The authors characterize this argument as valid and strong, but comment that its strength depends on the nature and length of the carbon storage.

One way to quantify the benefits of delayed emissions, explains the report, is to incorporate the future decarbonization of energy grids into WBLCAs—though how much and how fast they will decarbonize is, of course, uncertain. In the U.K., the Royal Institute of Chartered Surveyors (RICS) recommends this approach in its Whole Life Carbon Assessment methodology, using weighting factors that account for increasing grid and material decarbonization.

Static-time horizon argument

According to the report, the static-time horizon argument holds that “delaying emissions reduces their cumulative impacts between the present and a fixed point in the future.” Time-based weighting factors for future carbon emissions can, therefore, be determined by comparing the projected cumulative impact (called “cumulative radiative forcing”) of carbon emitted at different times.

According to the report, the static-time horizon argument has three primary criticisms:

1. Assigning a “time horizon” ignores any impacts that occur outside of it.
2. Many of the methods coming from this argument account only for emissions from carbon dioxide, excluding impacts from other greenhouse gases. (That said, the authors point to one method, which they call the Hawkins approach, that encompasses other greenhouse gases.)
3. The argument considers only one climate indicator, “cumulative radiative forcing,” when there are others.

According to the report, France’s Environmental Regulations 2020 (RE2020) and industry standards International Reference Life Cycle Data System (ILCD) and PAS 2050 recommend using weighting factors derived from the static-time horizon approach. The authors include these weighting factors in the report’s appendix.

The social time preference argument

The authors describe the social time preference argument as the belief that “we should value the welfare of today’s society higher than that of tomorrow’s.”

This argument comes from the field of economics. Economists use “discounting” to estimate the net-present value of future costs and benefits, based on the assumption that a given cost or benefit will be worth less in the future than it is today. “When applying discounts, you have to choose the rate at which you discount future costs,” explained Wild, noting that a difference of 1–2% can have a massive effect on the results. Although the concept of discounting has been around for a long time, he said, its application to environmental impacts is heavily debated.

The report lays out the rationales underpinning the social time preference argument:

- *Pure time preference* refers to people's tendency to prefer something today over the same thing tomorrow. But as Wild noted, "Quickly it was established in the economics field that if you're factoring in multiple generations, [the preferences of future generations] should not be discounted."
- *The wealth effect* is the projected growth rate of per capita consumption. It assumes that future societies will be wealthier and, as such, will be better able to address costs than we can today. But this argument, too, has come under some debate, said Wild, explaining that "it may be true when you're dealing with things that aren't so systemic" as climate change.
- *Catastrophic risk* is the likelihood that society will collapse, and there will be no one left to enjoy future welfare.

There's a lot of agreement, explained Wild, that we should be using a near 0% discount rate for social time preference in climate decision-making. "That's where our gut is, as well," he reflected.

The time value of carbon in practice

"One of the things we sort of hasten to say when presenting this," reflected Wild, is that "we don't recommend these approaches be applied to [WBLCA]." The goal of WBLCA is to develop comparable, industry-wide datasets that support global harmonization to accelerate emissions reduction, the report explains. Trying to account for the time value of carbon in WBLCA, when the methodologies for doing so are so new and varied, could undermine that effort.

"But there are instances where this can bring a new light to helping clients in making decisions," said Wild, explaining that he and his team use the time value of carbon selectively in their design decision process. "It's something we'd apply discerningly to particular problems," explained Wild, "as a sensitivity analysis of how it might impact design and advice we give to clients." For instance, he said, "we might use it to guide whether we use timber or aluminum in framing" or, as the report suggests, in decisions that involve carbon payback periods.

Still, note the authors, there is a lot of uncertainty and nuance to consider. For example, they warn, using the time value of carbon to account for the benefit of carbon stored in wood could incentivize the overconsumption of timber products. Furthermore, Wild cautioned, "I wouldn't be using it to certify carbon credits. By applying time value, you are divorcing the physical emissions and valuing them. It can be quite difficult when you begin thinking about [carbon] claims that have been sold and credited."

"What we really hope readers take away from this," said Wild, is that "we have to learn how to embrace complexity as we move quickly in this space." Their intention with the report, he continued, is not to tell the building industry what to think about the time value of carbon, but rather *how* to think about it.

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