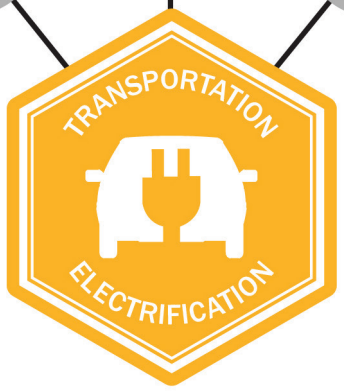

Atelier Ten's
Roadmap to

Absolute Zero Carbon

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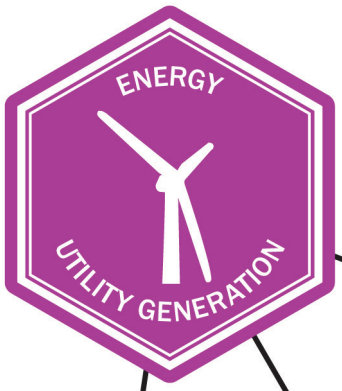

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Absolute Zero Carbon

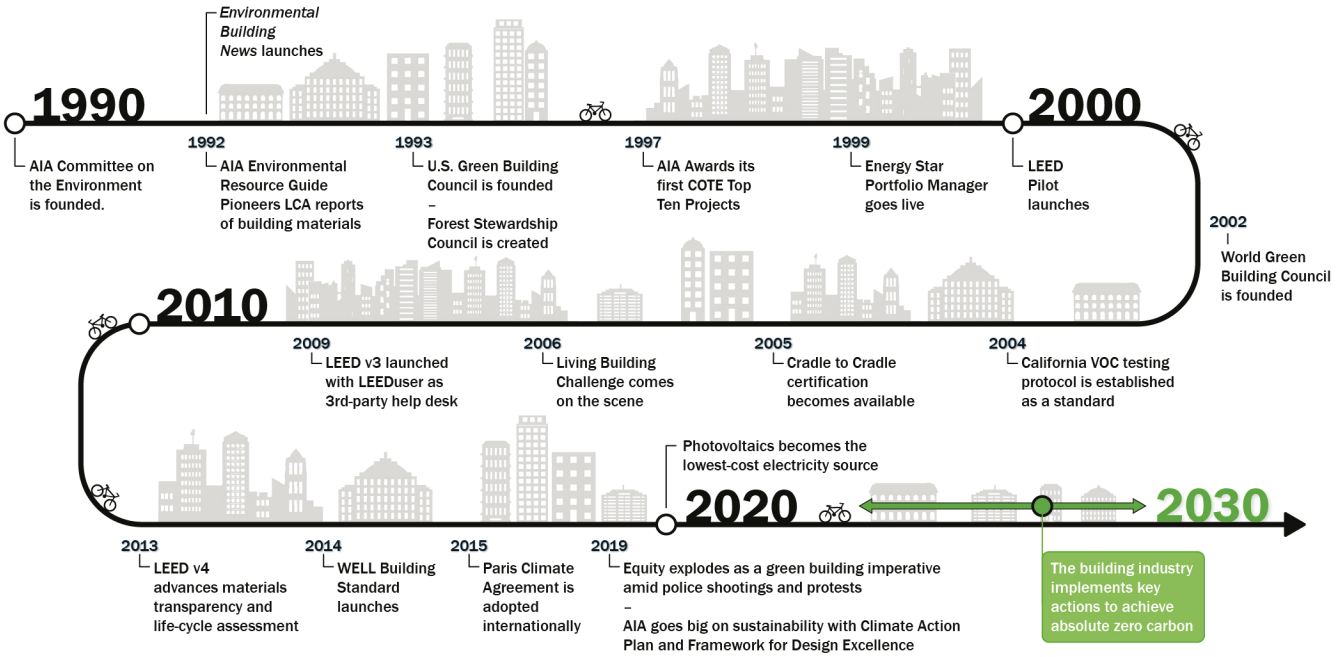
Claire Maxfield, Atelier Ten, August 2023

We're impatient. The latest IPCC report says "the window is closing" for us to avoid the worst impacts of climate change, which is the latest in an escalating series of alarms the IPCC is sending us. It's clear that the clock is ticking and we don't have much time.

The building industry is slow to adapt, but it has changed quickly in response to sustainability needs. What started with BREEAM 30 years ago and LEED 25 years ago has grown into a field that is conversant in carbon emissions. Professional organizations are calling for climate action around the world, and manufacturers and contractors on the ground are responding to requests for low-carbon products and systems.

But we need to change again – and this time, more quickly. Slow and steady action, long term carbon paybacks, and change driven by regulation will not be enough to act while the window is open. Even net zero energy is no longer enough. **We need to be radical.**

We need to be absolute zero carbon, we need to get there before the window closes in 2030.



RETIRING NET ZERO IN FAVOR OF ABSOLUTE ZERO

The buildings industry has used the concept of "net zero" for some time, and it's a useful construct. It says that over the course of a year, we produce as much renewable energy as we consume. When we pivot to net zero carbon, it's the same idea: now we look at operational carbon (and sometimes embodied carbon) over a year or over a building lifespan. But to safeguard the future we want, we need to do much more. We need to look at carbon emissions coming from buildings beyond today's standard practice, of operational energy use and embodied carbon of structure and shell only.

To drive all our building emissions to zero, there are many new areas that need study and design thinking. **We therefore propose a shift to using Absolute Zero Carbon as our new paradigm, including the following:**

1. **We need to look at all carbon emissions from buildings** beyond today's standard practice of operational energy and embodied carbon from structure & envelope only. We need to include refrigerants, embodied carbon of all materials used on the project, the infrastructure that connects our buildings, the carbon embodied in our MEP and lighting systems, and construction activities like excavation. Many of these areas are only starting to consider embodied carbon and have little or no data available – and yet, despite the lack of data, we have a global imperative to act quickly.

2. **We need to make sure that we are never reliant on fossil fuels**, rather than sometimes using them and then offsetting their use. This means we must align our energy demand with renewable energy supply for every minute of the year, and we must eliminate fossil fuels from our material supply chains. When take this approach, we not only eliminate carbon emissions, but we also unlock important co-benefits.

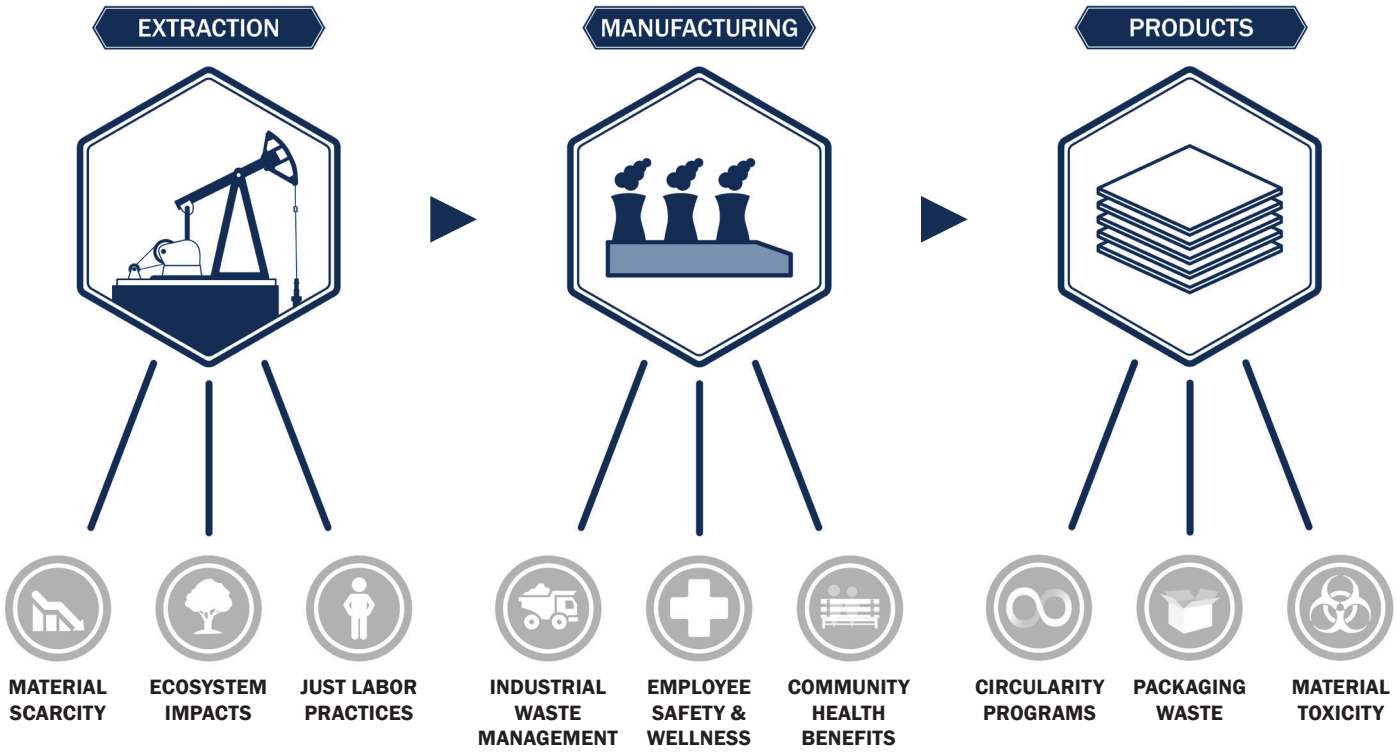
EMISSIONS - OFFSETS = **NET ZERO CARBON**

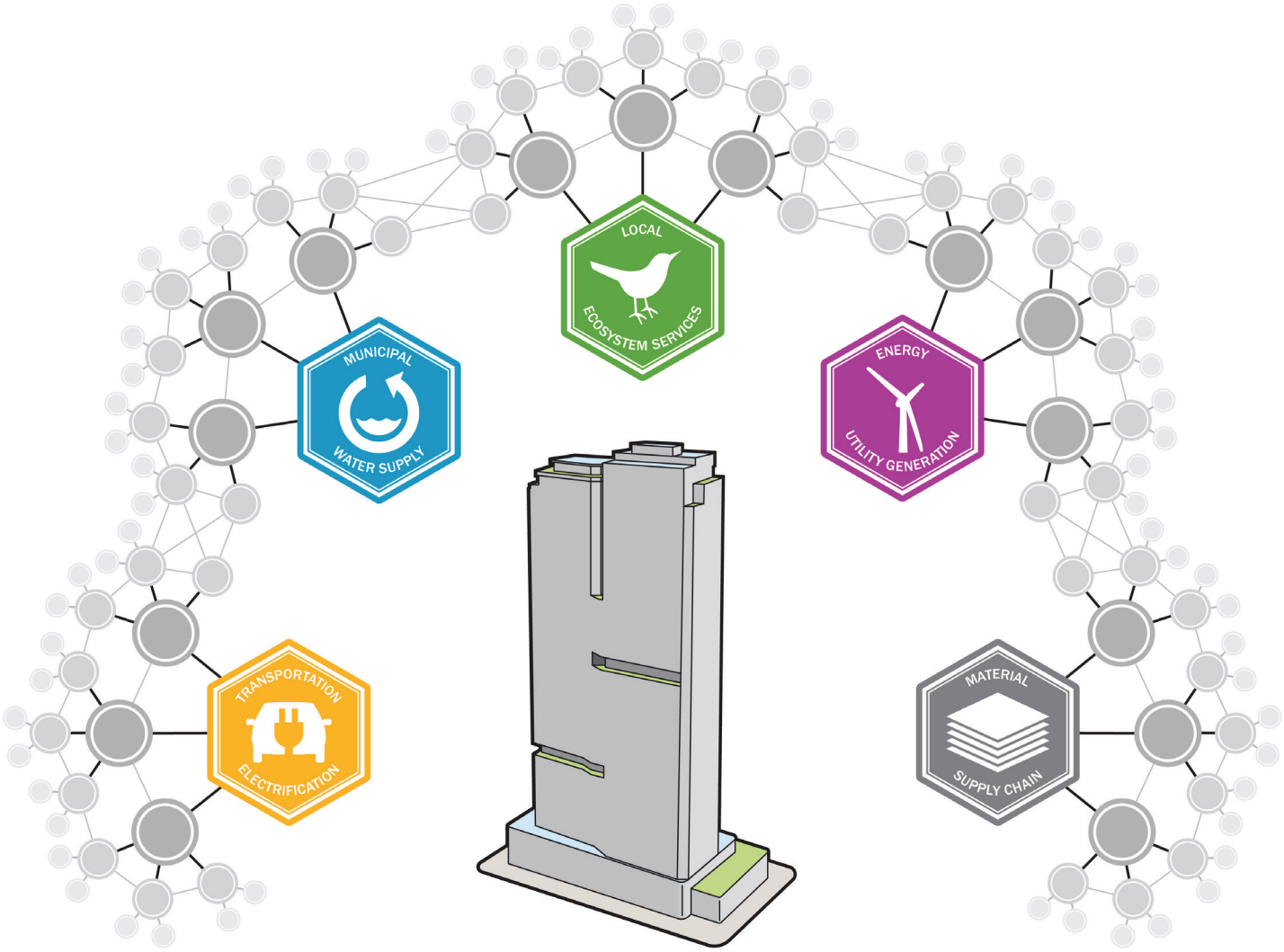
~~EMISSIONS~~ = **ABSOLUTE ZERO CARBON**

WHY BOTHER WITH SMALL POTATOES?

Some may ask: Why bother with smaller sources of emissions? This is small potatoes! Focus on the big emitters. That was our guiding principle for decades. But we are designers and systems thinkers and we see how all sources of emissions are part of larger systems. Each of these so-called small emitters is linked to a whole network of industry, energy, infrastructure, and land use that isn't yet performing in a sustainable way. By radically transforming each element of our buildings, we also transform these sectors. Our buildings are the levers that allow us to transform entire industries.

For example, buildings rely heavily on the use of plastics including vinyl. They make up a small portion of our buildings by weight or volume and barely register in a whole-building LCA. But they are made from oil (the ethylene in vinyl comes from oil or natural gas) and are therefore inextricably part of our reliance on fossil fuels. Furthermore, we've known these plastics contain ingredients that are bad for human health and have especially high risk for those who manufacture them, usually in depressed socio-economics regions, which is a pressing equity concern. We use them for finishes that churn often, even though they'll last forever in the landfill. Yet they persist as part of standard practice. Pulling this material out of buildings would accomplish several sustainability goals in one fell swoop, despite being "small potatoes" from a carbon perspective.





‘Each of these so-called small emitters is linked to a whole network of industry, energy, infrastructure, and land use that isn’t yet capable of performing in a sustainable way.’

CARBON TUNNEL VISION?

Those of us in the sustainability world are used to thinking about competing values. Most of our clients care about sustainability...but sometimes they care more about other values like cost, aesthetics, or speed. Even within sustainability there's always been ample debate about which topics to prioritize most highly: energy, water, health, etc. Prioritizing these values on each project has always been an important part of our process. And as concern about climate change increases, some voices have reasonably asked if our field is becoming too narrowly focused on carbon emissions. What about all the other sustainability and equity issues that also need our help?

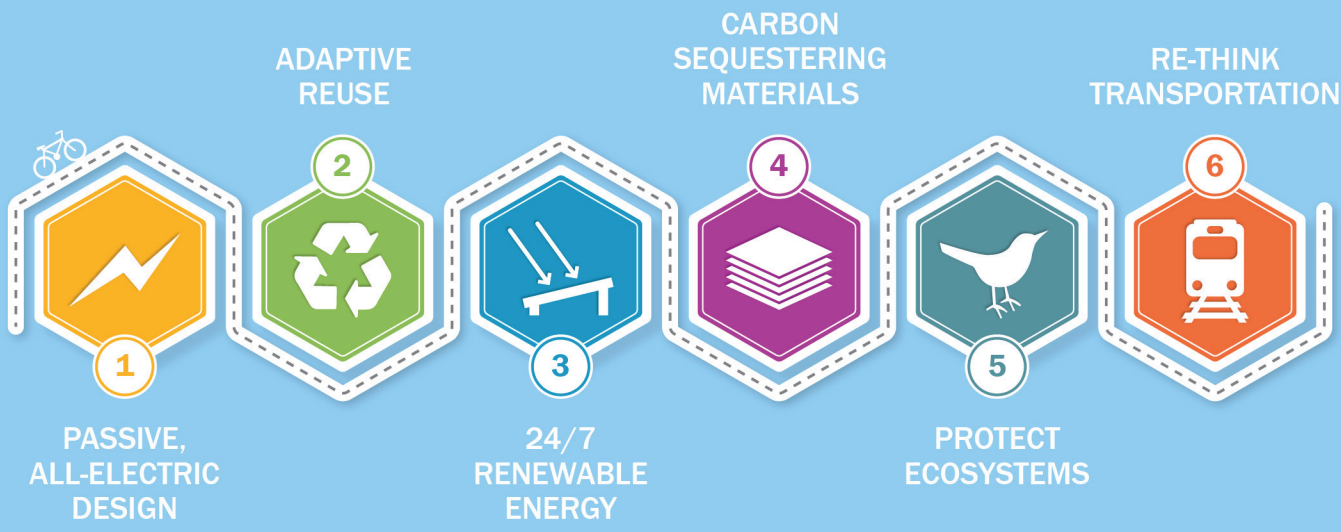
More and more we realize that, by fixing the systems propping up our high-carbon environment, we can simultaneously improve outcomes for other sustainability issues. If we do this right – **if we reform our built environment in a way that is absolute zero carbon – we can also reform it to solve for ecosystem improvements, better health and wellness, improved equity, and more humane places.** For example, if we design radically passive buildings, we know we'll also improve health and wellness through improved daylighting, thermal comfort, visual comfort, and connection to the outdoors. When we solve for 24x7 renewable energy, we also tackle resilience and grid stability. In our quest for zero carbon materials, we'll deal with issues of ecosystem health, waste and circularity, toxicity, and environmental justice. Our roadmap to Absolute Zero Carbon specifically calls out the co-benefits of each step to ensure that in making a zero-carbon built environment – we also make a better planet for ecosystems and people.

THE ROADMAP

So where does this lead us? **To Absolute Zero Carbon buildings. This means they are zero carbon in all aspects:** operational, embodied, refrigerants, construction, infrastructure, and landscape. They are not net zero; **they are zero carbon every minute of every day, from conception to operations.** They may use on-site and off-site measures; we're part of a network of infrastructure and we should use it to help us wherever we can. In the short term this means efficiency coupled with offsets, but in the long term we need to get to zero carbon without emitting carbon in the first place.

Atelier Ten's goal this year was to draft, together, a roadmap to make Absolute Zero Carbon possible. We dedicated all of our U.S. staff -- 67 sustainability consultants all using their prodigious brainpower -- to a hackathon and ongoing research to crack this problem. We identified and began research on every challenge that stands in the way of Absolute Zero Carbon buildings. For many issues, the initial steps are well understood but deep research and design thinking is needed to get all the way to zero. Each topic we studied could, no doubt, fuel a PhD's worth of research – but we don't have that kind of time. We need to move fast!

Because this may seem like an overwhelming goal, we created a simple roadmap – just six steps to take each time we design. Every building, development, and masterplan needs to have:



1 Radically passive, all-electric design that eliminates energy use and makes us resilient. Get your massing right, electrify, and use both passive and active strategies to get to ultra-low-energy operations. Use those exact same measures to make sure we can weather the blackouts, extreme weather, and increased temperatures which are undoubtedly coming.

CO-BENEFITS: **Resilience, health & wellness**
ATELIER TEN'S CURRENT RESEARCH: **Zero carbon refrigerants, carbon capture at project scale, popularizing the use of marginal emissions factors in design.**

2 Adaptive reuse that is as good as new construction on operational carbon, and better on embodied carbon. Repurposing existing buildings not only saves carbon, it helps us limit our sprawl and preserve open space which is critically needed for carbon sequestration. When faced with sites that have exiting structures, we need to take seriously the question of how they can be repurposed rather than razed.

CO-BENEFITS: **Placemaking & community**
ATELIER TEN'S CURRENT RESEARCH: **Emissions from construction beyond A4-5; embodied carbon of seismic upgrades; acceleration of adaptive reuse, including shopping malls, commercial to residential conversion etc.**

3 24/7 renewable energy so we never rely on fossil fuels, even when grid connected. This can be on-site, off-site, linked to microgrids and energy storage, and can use PV or less-common technologies like green hydrogen. Studies on procuring 24x7 renewable energy are starting to happen at the utility and corporate scale and need to become part of the energy concept of each of our projects.

CO-BENEFIT: **Resilience**
ATELIER TEN'S CURRENT RESEARCH: **Optimized energy storage at buildings and district scales, optimized on-site PPA agreements, new renewable energy procurement methods, grid energy tracking to verify 24X7 renewables.**

4 Carbon sequestering materials. Mass timber is a start, but we need to go beyond and find other sequestering materials to bring our embodied carbon to zero without offsets. We must use this transformation to eliminate materials that cannot be made sustainable, reduce waste, and improve the livelihoods of the many workers involved in materials manufacturing. This step is the biggest challenge and the furthest from market-ready.

CO-BENEFITS: **Ecosystems health, waste & circularity, toxicity & health, & environmental justice**
ATELIER TEN'S CURRENT RESEARCH: **Better data on as-built embodied carbon savings; zero carbon steel & concrete; embodied carbon of façade assemblies, MEP systems, lighting systems, construction & excavating; infrastructure; next-generation bio-based materials; wood sourcing for local economy & social justice; reducing material waste; modularity & circularity.**

5 Protect functional ecosystems and rehabilitate developed landscapes so they sequester carbon and support habitat. Landscape can sequester carbon over time, taking us from Absolute Zero on day one to carbon positive. Landscape carbon sequestration is most meaningful if we can think beyond individual parcels to the neighborhood or regional scale.

CO-BENEFIT: **Ecosystem health**
ATELIER TEN'S CURRENT RESEARCH: **Landscape carbon sequestration, ecosystem services, design for biodiversity, long term maintenance techniques for soil health**

6 Serious attention to transportation. Reliance on single occupancy vehicles (SOVs) undermines our good work on the topics above. Vehicle electrification will help, but we also need to phase out SOV use as our primary form of transportation. We must take more seriously the ability of our projects to be connected via mass transit, bikes, and new forms of micro-mobility. This affects everything from site selection to our willingness to build parking as part of many projects.

CO-BENEFITS: **Air quality, environmental justice, & urban design**
ATELIER TEN'S CURRENT RESEARCH: **Smart vehicle charging controls, vehicle to grid technology, infrastructure to support passenger and freight vehicle electrification, micro-mobility to improve mass transit access, zero carbon parking facilities**

We need to take these steps on each and every project, do it all with great design that's worth the impact, and in a way that creates a more just and humane built environment.

This is the condensed list: behind each of these six points is a series of technical challenges, emerging technologies, and a carbon strategy needed on every building and infrastructure project; it will require persuasion throughout our industry; and great design thinking. As designers, we have the tools needed to make this positive change for the planet, but success will involve working together with architects, engineers, owners, contractors, material suppliers, landscape designers, ecologists, economists, urban planners, and more. **Join us.**

Claire Maxfield, LEED Fellow

As managing Director of Atelier Ten's San Francisco office, Claire is a recognized leader in sustainability. Her expertise in green buildings marries technical excellence with a strong design and environmental ethos. With over 20 years in the industry, Claire has been a leader in the decarbonization movement and led some of the firm's most ambitious and globally recognized projects. Claire's extensive expertise in climate-responsive architecture, thermal and visual comfort, façade optimization, advanced energy and water reuse systems, and carbon management has advanced the firm's technical expertise, research, and strategic direction.

Kristen DiStefano, LEED AP BD+C

Kristen is an Associate Director of Atelier Ten's San Francisco office. As the director in charge of Atelier Ten's Carbon Management practice and a leader in the Masterplanning practice she has advanced Atelier Ten's approach to reducing operational and embodied carbon emissions. She balances her technical expertise in carbon reduction strategy with big picture guidance for large scale projects. Kristen has lent her sustainability expertise to over 100 projects and has successfully led some of Atelier Ten's most ambitious work.

Amy Leedham, AIA, LEED AP ND

Amy is the leader of Atelier Ten's Carbon Practice and a registered architect. Combining her expertise in building science and architecture, Amy has greatly advanced the firm's approach and process to reduce the carbon impact of our projects. Amy has managed projects of all scales with a wide range of ambitious goals including net zero energy, zero water waste, occupant health and embodied carbon. She advocates for sustainability beyond her project work and is a member of the AIA National 2030 working group.

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