

Carbon Practice Guide

Life Cycle Assessment (LCA) incites innovation by re-framing the impacts of building materials within the context of their contribution to a building's "Whole-Life Carbon."

Most building product and materials' embodied carbon emissions occur *before* a product leaves its manufacturer's gate. Embodied impacts can be measured and reduced via LCA and Environmental Product Declaration (EPD) data. Together, these provide transparency for carbon-responsive design.

This guide includes a compilation of resources for understanding and reducing embodied carbon through an iterative design process. Focus in this area has potential to reduce emissions across all sectors of industry and offer a lens for deeper engagement of the materials that constitute our buildings.

Perkins and Will Firmwide Research
Innovation Incubator
Jesse Walz & Elton Gjata
June 2020

Carbon Practice Guide

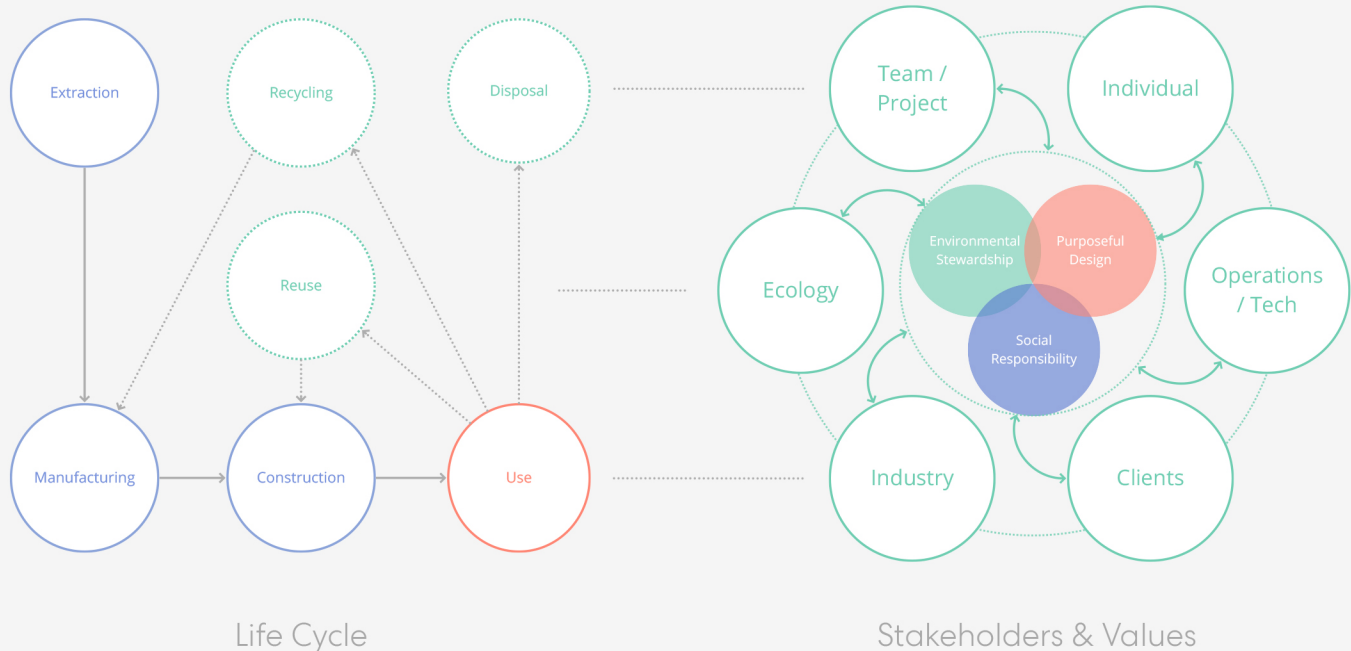
As an outcome of this Innovation Incubator, we've created a "Carbon Practice Guide" within our Digital Practice site to help teams to understand and achieve embodied carbon optimization. Please visit the following link for the firmwide deliverable and content:

digitalpractice.perkinswill.com/quickstarts/carbon-practice-guide

The Carbon Practice guide includes resources for speaking about and reducing embodied carbon and a road map for incorporating LCA into the design process. It also examines the relationship between embodied carbon, supply chain and our built work, and identifies EPDs as a key leverage point to making a difference throughout a larger system.

Keywords: embodied carbon, environmental product declarations, EPDs, Life Cycle Assessment, LCA, Living Design, systems thinking, changemaking, climate, materials, supply chain

Life Cycle & Praxis



Life Cycle, Stakeholders, and Values - digitalpractice.perkinswill.com/quickstarts/carbon-practice-guide

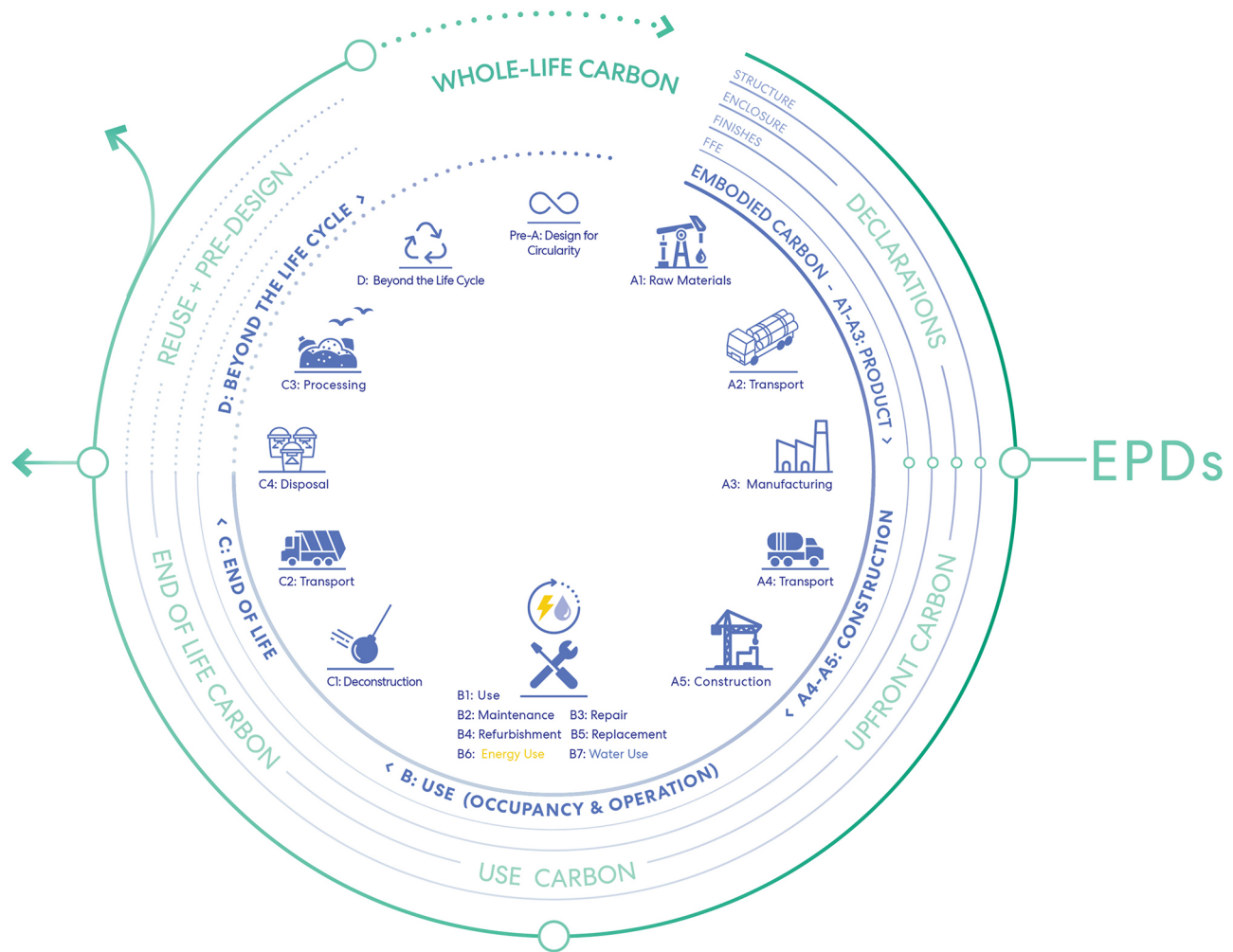
Abstract

Life Cycle Assessment (LCA) incites innovation by re-framing our understanding of building materials within the context of their ecological sources and impacts.

Of these impacts, embodied carbon, or the carbon dioxide equivalent of greenhouse gas emissions over a material's lifecycle (CO₂e), is a primary contributor to global warming. CO₂e can be measured and reduced via Environmental Product Declaration (EPD) data, which reveals that the bulk of CO₂e emissions occur *before* a product leaves its manufacturer's gate.

As architects incorporate LCA and EPDs into the design and project delivery process, we gain leverage to demand substantive emissions reductions in manufacturing. A coordinated effort to request, assess, and make decisions based on EPD data has capacity to affect change in material extraction and production, and in turn, to influence systemic change in all sectors of industry.

Our firm is in a position to serve as a catalyst for adoption of carbon-responsive design across the built environment. Together, we can learn to make decisions based on EPD data, activating the latent potential of supply-chain conscious specification. In turn, we will develop a lens for engaging the myriad nature of the materials that constitute our designs.



EPDs are Data That Allow Us to Make Change - <https://digitalpractice.perkinswill.com/quickstarts/carbon-practice-guide>

Engagement, Recommendations, & Next Steps

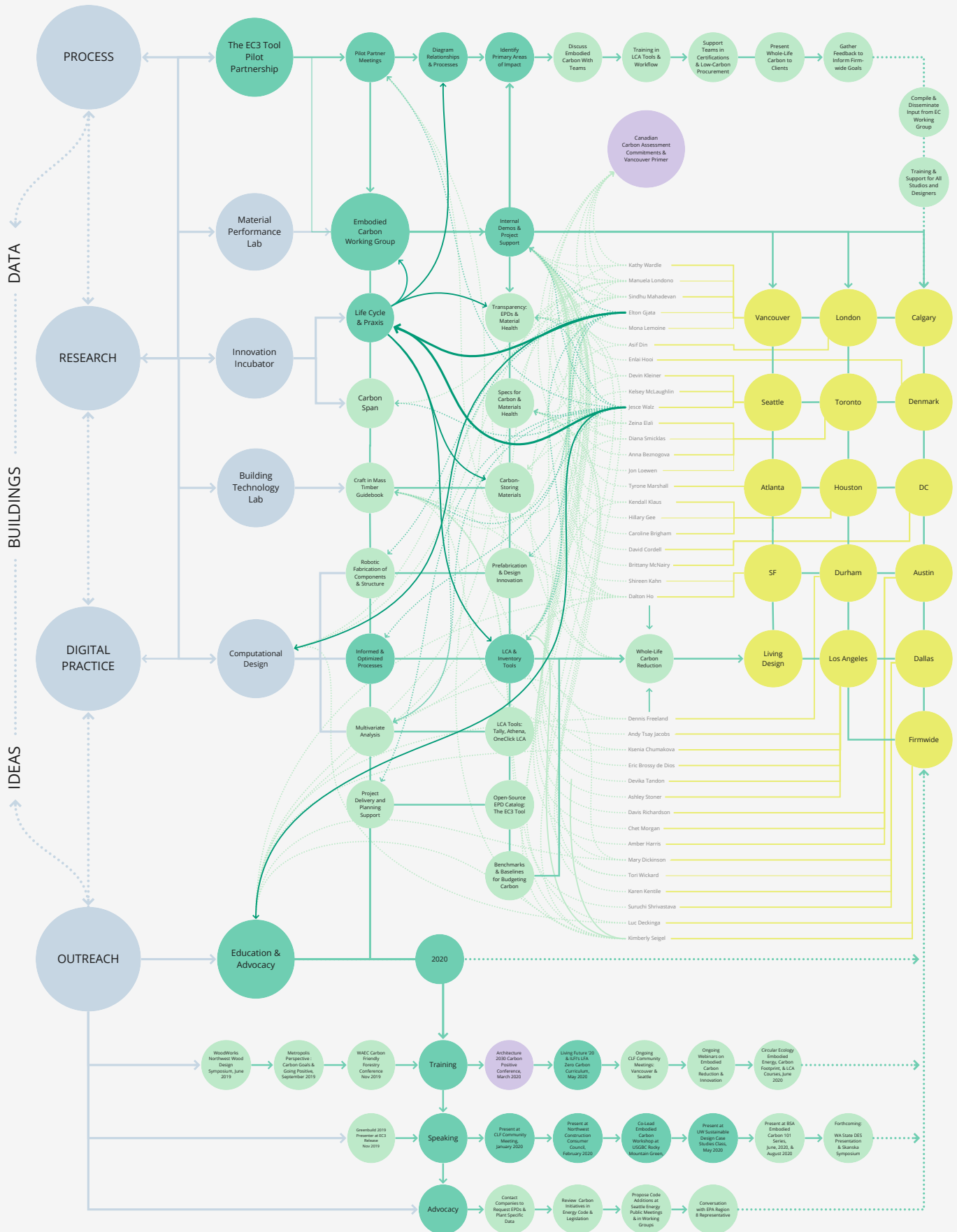
While developing the Carbon Practice Guide, we studied change management, considered approaches to LCA & embodied carbon within the context of our professional experience, and engaged our Research Labs and greater design networks.

Along the way, we noted ideas for facilitation of carbon-responsive design at Perkins and Will and tracked a set of potential next steps for sharing this work.

In addition to the Carbon Practice Guide, an outline of our scope of engagement, a list of ideas and recommendations, and proposed steps for further exploration are included in the following pages.

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Engagement, Recommendations, & Next Steps



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Engagement, Recommendations & Next Steps
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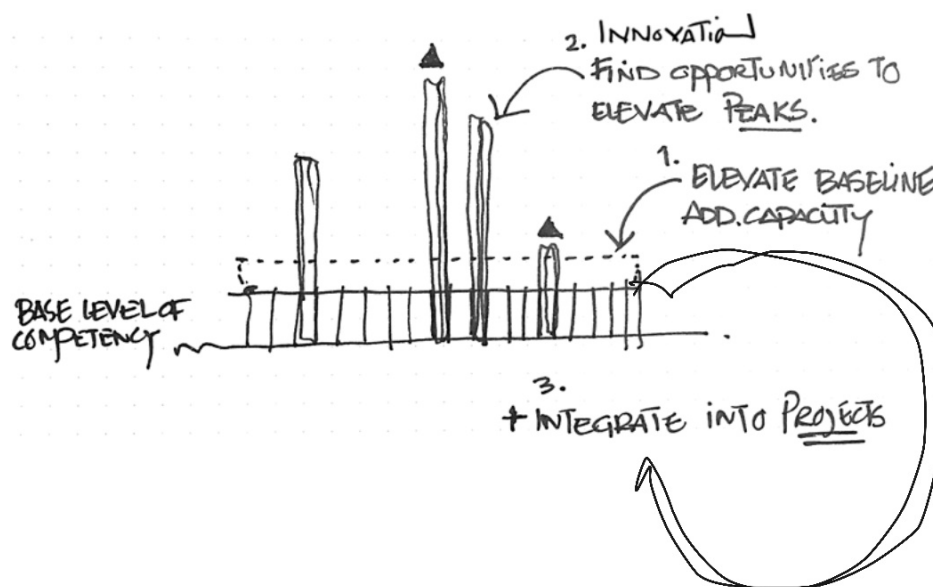
Carbon, Culture, and Values

Among our 2700 designers, there are likely just as many interpretations of our attitude, theoretical approach, and values for our work. While this richness of perspectives is one of our greatest assets, the legacy of our work and the common thread of how we look towards the future is underpinned by our core values of:

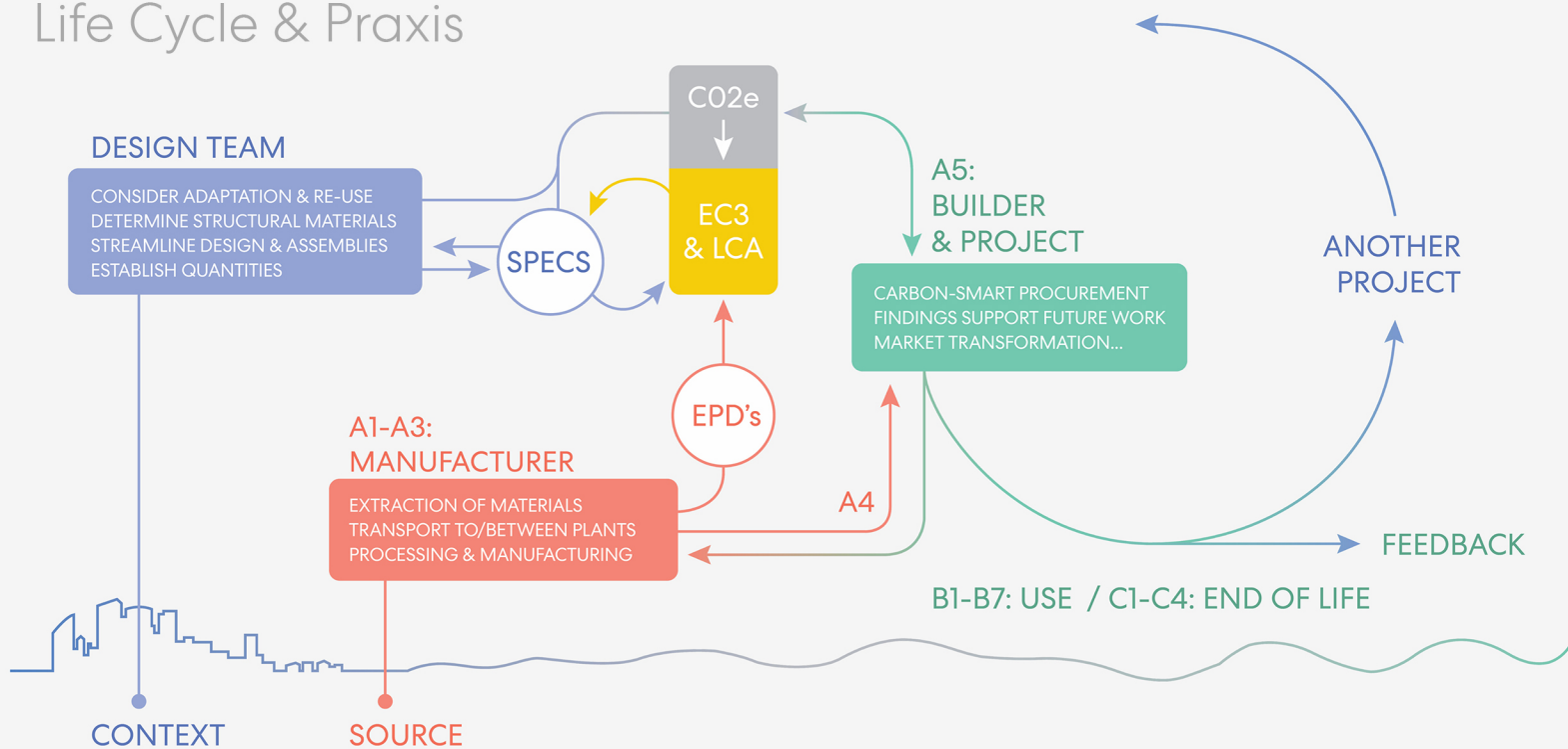
- Purposeful Design
- Environmental Stewardship
- Social Responsibility

LCA and Carbon carry relevance in each of these three core values.

Purposeful design speaks to our philosophy of utilizing material with clarity, honesty, and deliberate intent. We hold a moral responsibility to build using materials that respond to the urgency of the climate crisis, and to further innovation in the building sector. Being more explicit with the source of building materials helps us to understand and mitigate the direct impacts that building materials have on human health, and the inherent imbalance of social justice in the extraction and processing of raw materials.



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Communication for carbon reduction in design - <https://digitalpractice.perkinswill.com/quickstarts/carbon-practice-guide>

Committing to Whole-Life Carbon Reduction

Building on our pilot partnership with the EC3 tool, how can we make embodied carbon reduction a priority across our portfolio, sending a clear and unified signal to our partners and the industry that we will prioritize products that demonstrate transparency through EPDs and innovate to reduce global warming potential across the built environment?

Our existing efforts toward materials transparency and operational carbon optimization have already had a significant impact. Supporting the EC3 tool is a first step at taking a similar stance on EPDs. Incorporating LCA and EPD-based procurement into our design process is a natural next step toward increasing awareness, availability, and specificity of data.

As a practice, some projects will be able to shoot for radical innovation, and that will change the entire system over time. Meanwhile – as a baseline – the urgency of the changes needed to avert climate collapse requires us to make immediate changes to the architecture of our design processes. If we only focus on the exemplary projects, we're missing a huge opportunity to elevate the baseline capacity for all projects. Some projects will embody radical innovation, but all projects at a minimum must embody architectural innovation.

Ideas for baseline and innovative exploration include:

Elevate the Baseline

1. **Begin to report on embodied carbon intensity across our portfolio.** Ask all teams to track a simple bill of materials for their project within the EC3 tool, effective for at whatever phase projects are currently in, and to report out on the project's Embodied Carbon Intensity at each milestone. Compile this data to inform an early set of Firmwide benchmarks and consider pairing embodied carbon metrics with operational carbon to explore "Whole Life Carbon."
2. **Re-frame typical reduction goals in response to highest points of leverage.** Expand our focus from "reducing carbon by X percent from Y baseline," toward "specifying products with the goal of meeting the EC3 Tool's EC Achievable Target." Benchmarks and baselines will change rapidly as this area of work evolves, and some materials have far greater potential for procurement-based reduction than others. The point of highest leverage at present is not necessarily to track precise carbon numbers for every building, but to create a shift in the industry by sending a signal that we will favor specific products that demonstrate lower carbon intensity via EPDs.

Taking a swift stance on carbon tracking and reduction indicates interest in moving away from outdated processes and intensive power sources (the same power sources which in many cases also support operational carbon emissions). While baselines are still directional, we can move forward with the information currently available by asking teams to procure the lowest-carbon option available for each material they've selected to meet project needs, aiming for the EC3 Tool's "EC Achievable Target." This approach targets specification of products whose CO₂e falls within the lowest 20% of those available per material category.

3. **Provide tools, templates, knowledge, and support on how to do the work.** Empower teams to use LCA tools and advocate for increased adoption of EPDs by providing training for use of the EC3 Tool, LCA, and knowledge for speaking with clients and manufacturer representatives to request plant and product specific EPDs.

The Carbon Practice Guide, early exploration by the Embodied Carbon Working Group, and demos lead by our internal embodied carbon leaders are initial efforts to get our teams started. We will continue to update and engage the guide over the coming year.

In addition, we recommend working with Tally or similar LCA software to negotiate licensing to meet our studios' needs.

4. **Make a public commitment to optimization and conversation.** The most important thing that we can do about climate change is to talk about it.¹ Commit to embodied carbon tracking and reduction across our portfolio, and follow this commitment with client conversations and design processes that focus on “Whole-Life Carbon” optimization.

Innovate

1. **Adopt requirements for LCA reporting.** Include environmental impact reporting and LCA as a standard part of DEAR submissions, moving to establish an understanding of supply chain, sourcing, and specifications as inherent to the design process.
2. **Encourage studios to consider carbon commitments.** Our Canadian studios have set precedent in this area, committing to report on Whole Life Carbon for every project. In addition to committing to measuring and reducing carbon, encourage studios to look toward use of carbon storing materials. Provide teams with training on best practices for sustainable timber and tall timber construction and consider establishing a “certified timber first” policy.
3. **Redefine design excellence.** Ask teams participating in DEAR reporting and DLC reviews to demonstrate how understanding of material sources and iterative exploration of carbon intensity can influence a project’s design outcomes. Phase-by-phase questions may include:

Pre-Design:

- Did the team consider upfront opportunities like re-use, disassembly, or pre-fabrication?
- What priorities were established through engaging the client around embodied carbon?
- Where massing and program assessed for carbon optimization?

Schematic Design – Design Development:

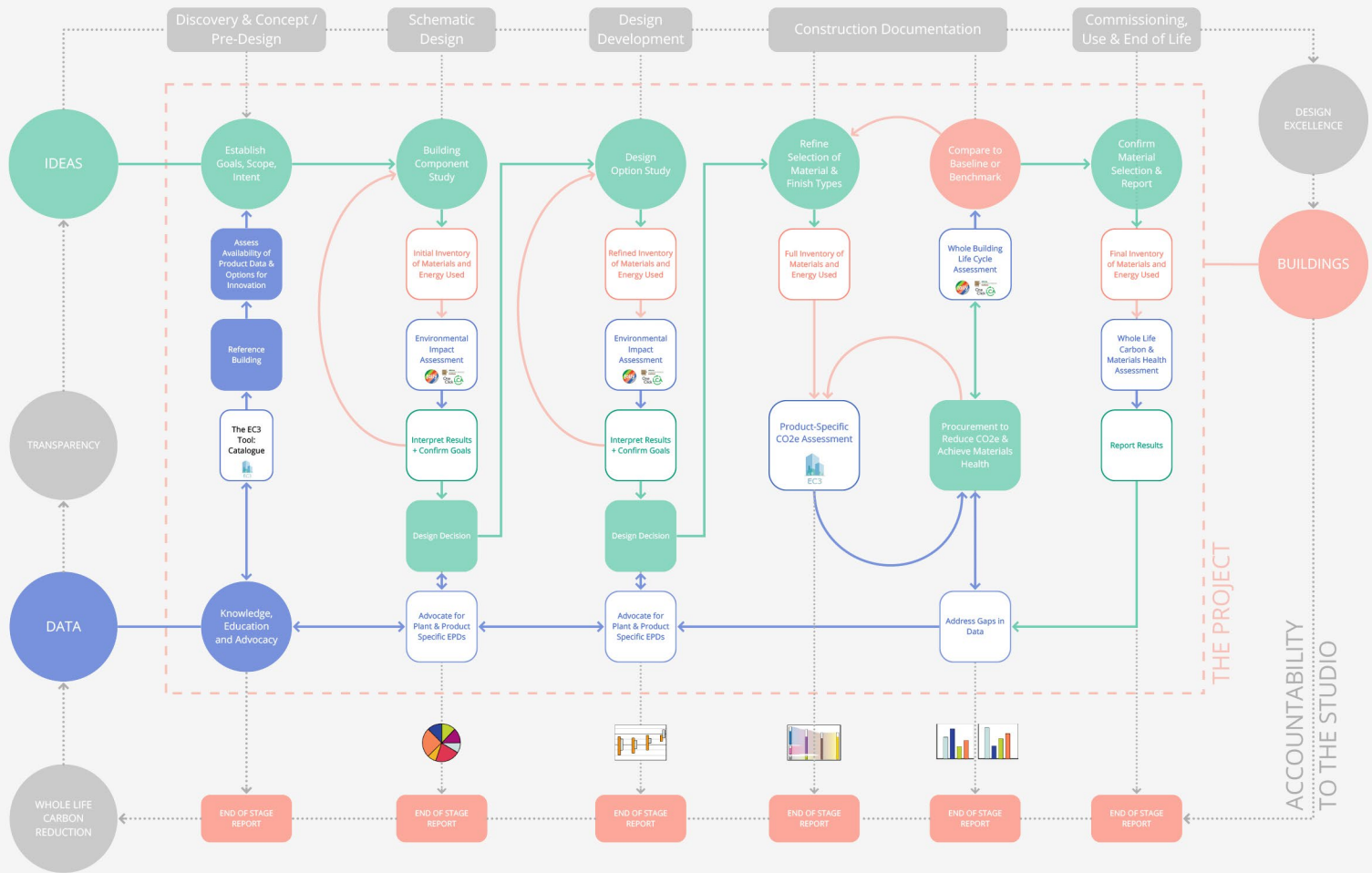
- How did analyses impact structural envelope material makeup?
- Does the project include certified carbon storing materials or salvaged material?
- Did the team consider multivariate impacts (e.g. material toxicity)?
- How did exploration of supply chain and material sourcing influence design expression?

Construction Documentation:

- Did the project adapt and follow through to select and specify low-carbon or carbon-storing products through a collaborative process?
- How did material selection inform design outcomes?
- What lessons were learned to inform our other projects?

¹Goldberg, Matthew H., et al. "Discussing global warming leads to greater acceptance of climate science." *Proceedings of the National Academy of Sciences* 116.30 (2019): 14804-14805.

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Project Methodology Workflow - <https://digitalpractice.perkinswill.com/quickstarts/carbon-practice-guide>

Empowering Change through Projects

Architecture has capacity to impact supply chain, public health, power sources, and ecology itself. However, change in this area requires consideration of how to support our teams as they engage carbon reduction. What are obstacles within our current workflow, and what shifts are needed to empower carbon-responsive through our existing structure, project pool, and delivery process?

Change within Teams

1. **Engage in carbon conversation to increase fluency.** Provide education on embodied carbon within teams as needed on every project, empowering staff to share about the value of embodied carbon, our Pilot Partnership with the EC3 tool, and our ability to reduce carbon through intentional procurement - sometimes at no extra cost.

2. **Collaborate.** Engage consultants throughout the design process to gather information on material quantities and performance requirements so that we can think about these in terms of carbon impacts. A bill of materials is required to facilitate decision making; this may come from the Builder, from Tally, or from a well-developed BIM-360 Model, and must include:
 - a. Names or types of materials
 - b. Takeoffs, or quantities of materials (and associated units)
 - c. In some cases, performance characteristics, coatings, and other desired specific information may be studied
3. **Iterate for design optimization and material selection.** Use iterative LCA, beginning with a shoebox model, and continuing through CD's to compare and select:
 - a. Primary Structural Materials (selecting between different materials)
 - b. Design options to compare carbon impacts of various massing strategies and program layouts within selected system
 - c. Envelope system (selecting between different system types)
 - d. Design options for materials within assemblies (e.g. insulation options)
 - e. Finishes – product-specific specification based on EPDs
4. **Specify low-carbon products based on EPD data.** Input primary material types and quantities into the EC3 tool and specify products with intent to meet the tool's "Achievable EC Target." This process can begin as early as Pre-Design to survey options, and must continue through CA. Include alternates or spec language to ensure that products with equivalent performance are procured at buyout.
5. **Advocate for product and plant specific EPDs.** Contact manufacturers where EPDs are lacking; ask that plant or mill-specific data be disclosed. Like an HPD or MSDS, EPDs disclose data on the energy efficiency of manufacturing processes. They contain basic information that we need to continue with our work.
6. **Collect and compile data.** Ask each team to report on their carbon intensity at the end of each design phase and/or prototyping point. Track reductions over the course of the project. Compile data to contribute to a set of baselines that we can commit to reduce from over time, and to share with outside networks and legislative efforts.
7. **Actions for design:** For further steps, please refer to the Carbon Practice Guide's "Actions for Design," digitalpractice.perkinswill.com/quickstarts/carbon-practice-guide/#av_section_24

Organizational Change

Several champions in the Firm are engaging via our Research Labs and an Embodied Carbon Working Group to further our capacity for carbon-responsive design. Some of our studios have set precedent by establishing milestones and carbon assessment commitments that demonstrate clear purpose, drive, and values to demand LCA to be conducted on every project.

This level of conviction and determination demonstrates our Firm's potential to serve as a catalyst for industry-wide adoption of LCA. *However*, aggressive change is unlikely to happen through grassroots efforts alone. A wholesale reconsideration of our design and delivery process is required to provide leadership, accountability, and support for teams. Steps for our Firm to clarify expectations and provide structure for our teams may include:

1. **Acknowledge relationship & realize opportunity.** While supply chain impacts are physically removed from design, they are also intrinsic to it. A first step in the process of reducing embodied carbon is accepting that design is tied to where materials come from. A further step is embracing this reality as an opportunity for inspiration and design excellence. We can utilize the power of narrative and storytelling to bring awareness of environmental impacts into our project goals and perspectives.
2. **Reflect and adapt.** Our Firm has established means and methods to approach impact reduction from our experience with energy modeling, the Precautionary List, and other processes. Overlays from these will be helpful in establishing a path to carbon-responsive design. It is also important to reflect on obstacles to meeting existing goals. Learning from where we've been will inform our future as global leaders in "purposeful design, environmental stewardship, and social responsibility."

In addition to asking whether we can hit a new target, we must investigate why it is difficult for teams to meet established goals. Many individuals come into our practice passionate about sustainability, only to encounter challenges in prioritizing their interests as staff. Successful effort to reduce embodied carbon will require outlining existing challenges and implementing structural shifts to align our processes with our priorities.

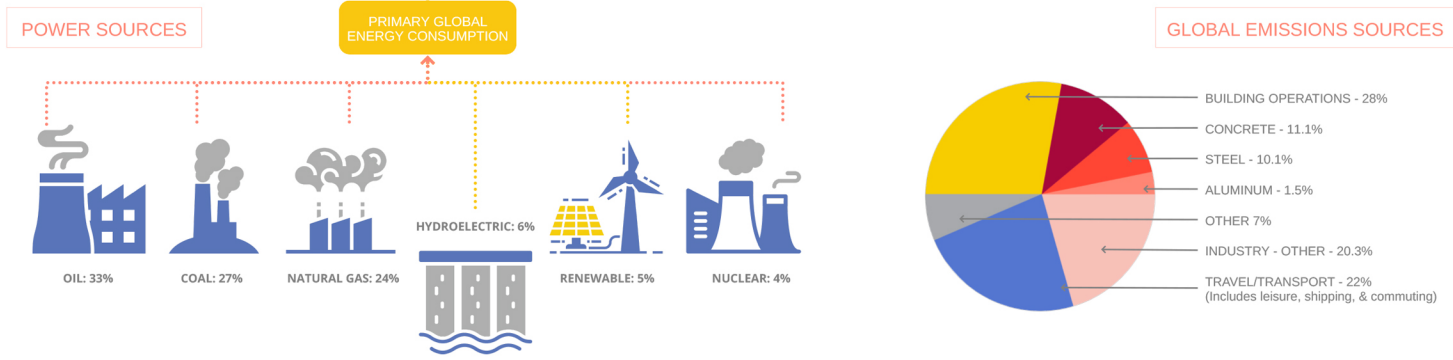
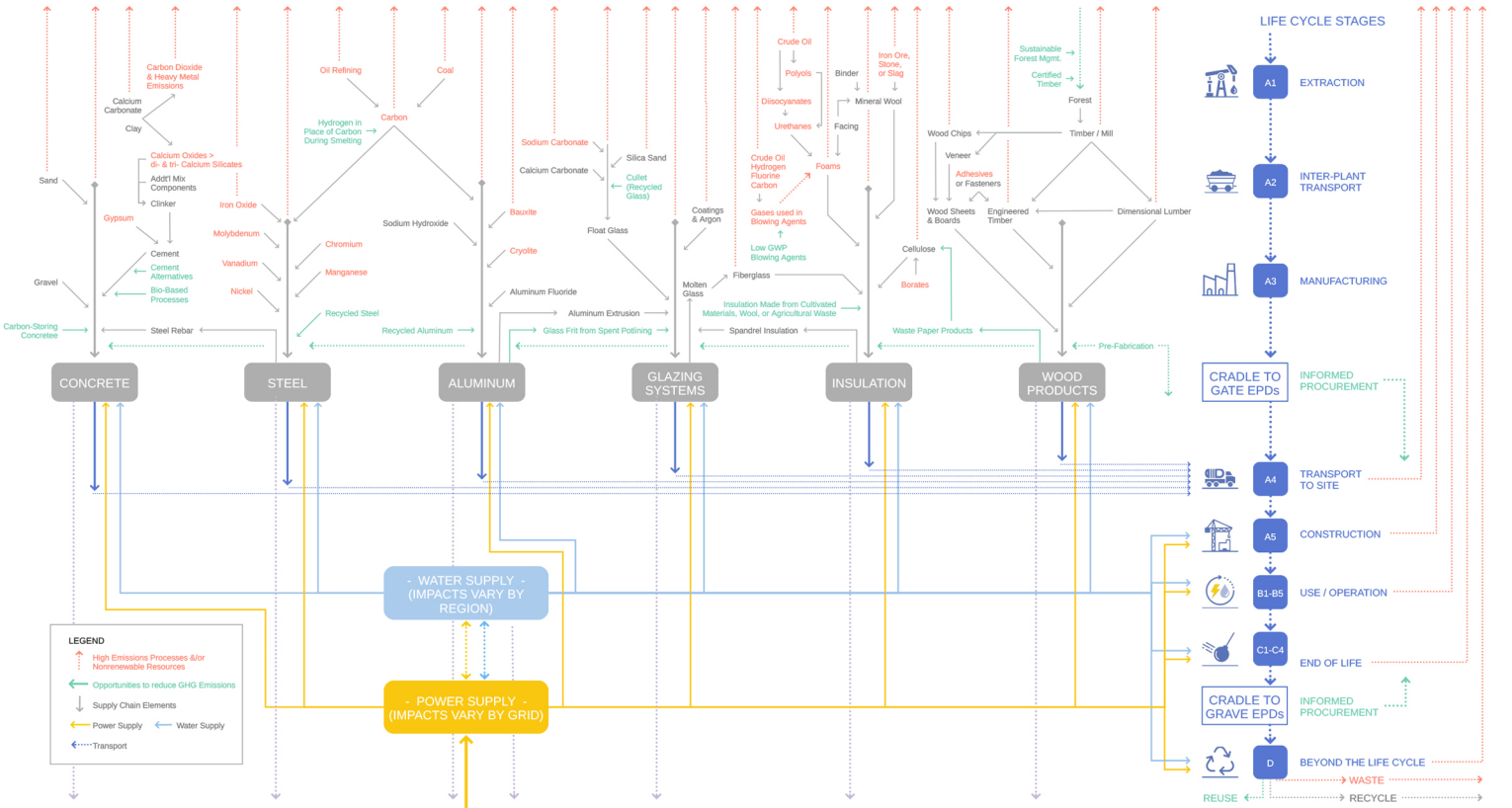
3. **Establish accountability.** Make a clear decision about what metrics teams are asked to report on across all projects at specific phases, and provide direction on Firmwide values, priorities, and minimum expectations to studios and teams. Both our existing grassroots efforts and leadership commitment are required to prioritize change.
4. **Connect sustainability leaders to leaders in project delivery.** Under “next steps” below, we outline initial presentations and potential connections to facilitate partnership between carbon, Living Design, and project delivery.
5. **Provide mentorship and space to explore.** Architectural offices are renowned for pushing designers to the limit. Without clear priorities, we set goals without providing the tools, bandwidth, or budget to honor the values which underpin our practice. Through Living Design, our Firm has opportunity to re-frame our priorities, starting with communication between team members across all levels (from entry level to Partner), emphasizing the value of Living Design as a driver for aesthetic decisions.

Why?

- Based on 2030 climate goals; we don't have time to wait; now is the time to reduce carbon impacts across the board.
- Material impacts are significant. They can be reduced by selecting products that take less energy to make. This involves shifting our ask for sustainability up the supply chain and pressuring industry to clean up their processes.
- The open-source data available via the EC3 tool makes it possible for our each of our teams to attempt embodied carbon reduction through procurement.
- Acting across our portfolio in collaboration with our partners will send positive feedback loops beyond the AEC industry, incentivizing manufacturers of concrete, steel, aluminum, timber, and glass toward cleaner power sources and processes.
- Understanding of materials' ecological impacts will enhance our design processes. Materials are more than products. Each material has an ecological context and story of manufacturing; this story may inform our designs and enrich our expressions.

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BUILDING SECTOR GREENHOUSE GAS EMISSIONS



Building Sector & Supply Chain Links to Global Emissions - <https://digitalpractice.perkinswill.com/quickstarts/carbon-practice-guide>

Next Steps

Internal Presentations & Connections

A key next step for our efforts is to share ideas with internal forums and gather feedback for refinement of the Carbon Practice Guide. We hope to facilitate conversation about and action around embodied carbon among our network and to engage in strategic follow-up to inform carbon-responsive design.

Groups we've begun to engage or have heard recommendations to engage include:

- **Material Performance Lab Embodied Carbon Working Group:**
Share the Carbon Practice Guide, present, and gather feedback: July 15 2020
Recommendations from the group to Kathy Wardle for Living Design: July 15 2020
- **Innovation Incubator Committee:**
Presentation available upon request
- **Vancouver & Seattle Studios:**
Two presentations or one combined presentation, dates TBD
- **Living Design Leadership Council:**
Monthly meeting by invitation, contact - Kathy Wardle, date TBD
Potential to support the Living Design Playbook, contact - TBD
- **Digital Practice:**
Tool-focused presentation & ideation, consider potentials for automation & widespread training,
contact – Elton Gjata, date TBD
Share tasks for inclusion in Microsoft Planner Pull-Plans, contact – Matt Peterman
- **Technical Design Community (TDC) + Design & Delivery Directors:**
Investigate connections between sustainability and technical design leaders Presentation
optional, contacts – Elton Gjata and Mark Walsh
- **Firmwide Material Specifications Call:**
Monthly call on specs + embodied carbon and materials health, contacts –
Holly Jordan, Devin Kleiner, & Tori Wickard, next monthly call – June 24 2020
- **Operations:**
Share Carbon Practice Guide & presentation, contact – Leigh Christy, date, TBD
- **Marketing & Design Leadership:**
Recommendation from Tyrone Marshall & Mary Dickinson to further develop marketing collateral
for pursuits, client conversation, and Leadership
- **Energy Lab:**
Monthly call, contact – Elton Gjata, date TBD
- **Building Technology Lab:**
Complete research on timber and carbon for opening chapter of “Craft in Mass Timber –
Guidebook,” contact – Jesce Walz and Andy Tsay-Jacobs: July 2020

Documentation

The final section of the Carbon Practice Guide includes a space for documentation. We've gathered rules of thumb, embodied carbon caveats for varying material types, tips for communication to reduce carbon, and step-by-step instructions for using Tally, Athena, One-Click LCA, and the EC3 tool. We will continue to enter this information into the site's documentation section over time.

Project Delivery Analysis

Through this Innovation Incubator investigation, we've identified project delivery method as an intervention point for introducing embodied carbon into our teams' workflows. As noted above, we have begun to connect with the TDC, Living Design Leadership Council, and others to better understand project delivery at Perkins and Will. Questions include:

- What are key stages and milestones throughout our delivery process?
- What aspects of the process does each group own? Where is there fragmentation?
- How can project setup and kickoff include a brainstorming session with sustainability leaders alongside technical design leaders?
- Where are greatest needs to further baseline competency, efficiency, or automation?
- What milestones and reporting are already common? Can these be adapted to include more specific tools or metrics and end-of-project reports?

Public-Facing Engagement

The Engagement Map within this document visualizes both internal and external partners we've connected with over the past six months through training, public speaking, and advocacy. Our Seattle and Vancouver studios are involved with local Carbon Leadership Forum Communities, and since November 2019, Kimberly Seigel, Dalton Ho, and Jesce Walz have engaged in ongoing presentation at local and national conferences and workshops. As an extension of our Pilot Partnership, the founders of the EC3 tool have suggested ideas for sharing the Carbon Practice Guide, such as a public-facing recording of our narrative around carbon, or a potential Perkins and Will sponsored online carbon guide.

Looking Forward

Our Firm has opportunity to build upon our status as leaders in research and materials health to initiate adoption of carbon-responsive design across our portfolio, and to follow this commitment with widespread public communication. Our network extends beyond North America, reaching as far as Denmark, Shanghai, Lebanon, and beyond. We have great capacity to affect change simply by setting precedent.

We appreciate your time in considering these ideas and welcome your recommendations for sharing and continuing in this work. Thank you.