TIPPING

Embodied Carbon Action Plan

SEI ASCE STRUCTURAL ENGINEERING INSTITUTE | SE2050 COMMITTING TO NET ZERO

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Left: Using a Buckling Restrained Brace system with a vertical mast in the design of Samuel Merritt University Oakland City Center cut the required amount of steel by more than half, without reducing seismic safety.

Our Commitment

Tipping joined the SE 2050 movement in 2021 with our formal commitment to a path of substantive reductions of embodied carbon in structural systems.

Sustainability guides our analysis of every design problem, and is an essential part of every solution.

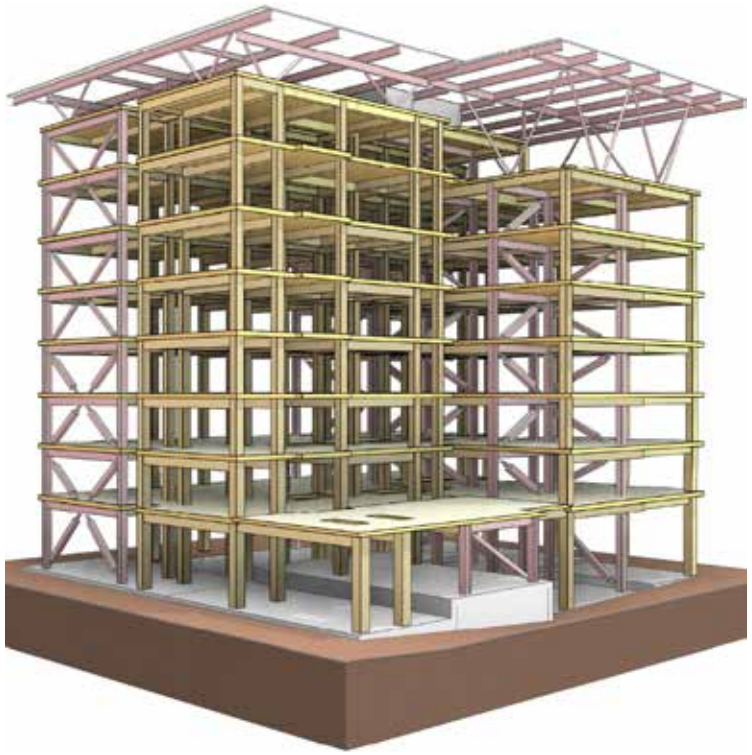
We take a holistic view at the early stages of structural design and we effectively collaborate with other disciplines to reduce the environmental impact of our projects. We strive to reduce the carbon impact of our structures by:

- designing efficient structural systems with minimal structural material quantities;
- designing cost-effective structural systems appropriate for minimizing life-cycle costs;
- detailing for longevity and adaptability;
- utilizing locally sourced materials whenever possible;
- proactively coordinating with the architect and mechanical engineer on key sustainability considerations;
- protecting the building by designing for enhanced seismic performance;
- specifying low-cement concrete and high-recycled-content steel that can meaningfully reduce the greenhouse gas impacts of construction;
- avoiding construction waste and reducing costs; and
- providing expertise in the design of lightweight and longspan structures.

Left: Children's Day School Preschool new mass-timber building

Our Commitment

The SE 2050 Program aligns with Tipping's sustainable design goals and our ongoing efforts to reduce the short– and long–term impact of building construction on the environment.



Tipping is part of the growing cadre of firms who are working to combat climate change through education, embodied carbon reduction, and advocacy.

We continue making progress on projects with measured reductions, advocacy, and sharing of our knowledge and data to accelerate widespread adoption of reduced embodied carbon design strategies for the broader industry.

We make concerted efforts to research and analyze alternative, resource-efficient structural systems and materials to support innovation for the built environment, including

- low-cement concrete and emerging low/zero carbon concrete technologies;
- mass timber;
- resource-efficient wood framing;
- optimized reinforcement grades whenever possible (using higher strength reinforcement);
- unconventional and naturally sourced materials; and
- tensile membranes (architectural fabrics & films).

Left: Currently in design, Woolsey Gardens will be one of the first Type IV-C to be built in California, a code category that allows for timber structures up to 9 stories and 85' tall.

Our Commitment

Tipping joined the SE 2050 movement to be a part of the community of designers actively reducing carbon in our built environment.

Our ECAP is refining Tipping's approach to reducing embodied carbon through actionable goals that inform decisions being made by our internal teams, and support conversations with our collaborators and our clients. Our firm has ambitious goals for our participation in SE 2050, some of which were realized and some of which are ongoing.

As participants in SE 2050 we have:

- shared evolving practices to reduce embodied carbon;
- investigated existing carbon accounting tools and developed our own tools for carbon accounting;
- promoted our commitment to sustainability and to SE 2050; and
- continued to collaborate for more efficient project designs that reduce embodied carbon.

Tipping Team Carbon Leadership

Bruce Danziger, SE

Ian Kelso, SE

Gina Carlson, SE

Ashley Waite, CE

For our renewed commitment this year, we are excited to expand the number of staff engaged in Team Carbon's internal sustainability efforts to increase our impact. With a larger team, we hope to:

- train project teams to discuss carbon limits and reduction strategies with clients and other stakeholders to improve sustainability;
- continue ongoing research and development into Tipping's rocking CLT shear wall system;
- conduct in-depth research on emerging technologies and diverse sustainable materials;
- collaborate with industry professionals and LCA consultants on GWP limits and the most recent industry EPDs;
- add GWP limits and EPD requirements to Tipping's material specifications to improve sustainability across all project types;
- continue to expand in-house resources like our EPD library, newsletter, and develop additional tools to streamline our carbon accounting process; and
- make real, nuanced design changes towards sustainability by analyzing carbon data trends from our reported projects to date and those upcoming in 2025.

Left: the Tipping office

Education

Tipping has a long-standing tradition as an organization that is committed to continual learning and nurturing the educational development of our staff.

We prioritize internal education by hosting presentations throughout the year to teach the broader office about carbon reduction strategies. The presentations encourage new staff members to gain institutional and technical knowledge about important design approaches. Presentation topics include sustainability code changes, successful projects using emerging carbon reduction technologies, building re-use trends in the Bay Area and Los Angeles area, and strategies to reduce embodied carbon based on material type.

We view our commitment to the SE 2050 movement as an inspiring opportunity to expand the knowledge base of our employees and clients into an area of our practice that is essential for combating climate change.

We are also actively educating employees about the LCA process and strive to provide meaningful context around GWP values for various building materials. Our aim is to deepen our staff's knowledge in the practice of sustainability so they can more effectively communicate with clients and consultants as project goals are being set and monitored throughout the course of the design process.

We will continue to educate our employees by:

- maintaining an internal Slack channel (with Slack being our office's primary form of internal communication) where employees can ask questions directly to Team Carbon and learn about sustainability through posted research articles and videos;
- providing newsletters that focus on embodied carbon reduction strategies for various building materials;
- hosting lunch-and-learns about code changes, building reuse, embodied carbon reduction strategies, and other sustainability related topics that are recorded and provided to new staff as part of our on-boarding program;
- and encouraging all employees to attend external webinars and conferences that focus on sustainable design and emerging technologies by using Tipping's yearly employee professional development allowance.

Left: Tipping Team Carbon leaders Gina Carlson and Ian Kelso discussing a project with colleagues.

Knowledge Sharing

Positive change will come with industry-wide adoption. We strive to incorporate more firm and industry based embodied carbon comparisons into our early conversations with our clients.

At Tipping, we promote our commitment to SE 2050 and our efforts to reduce embodied carbon to our clients. We share our experience and knowledge within our firm and within the design community.

We often begin projects with structural system studies, helping our clients understand the possibilities unique to their project offered by concrete, structural steel, and hybrid mass timber; including a qualitative comparison of each system's embodied carbon intensity. As we build our firm's internal embodied carbon database, we will provide more accurate, Tipping-specific quantitative comparisons of the embodied carbon intensities of the project types and material systems under consideration in these initial discussions.

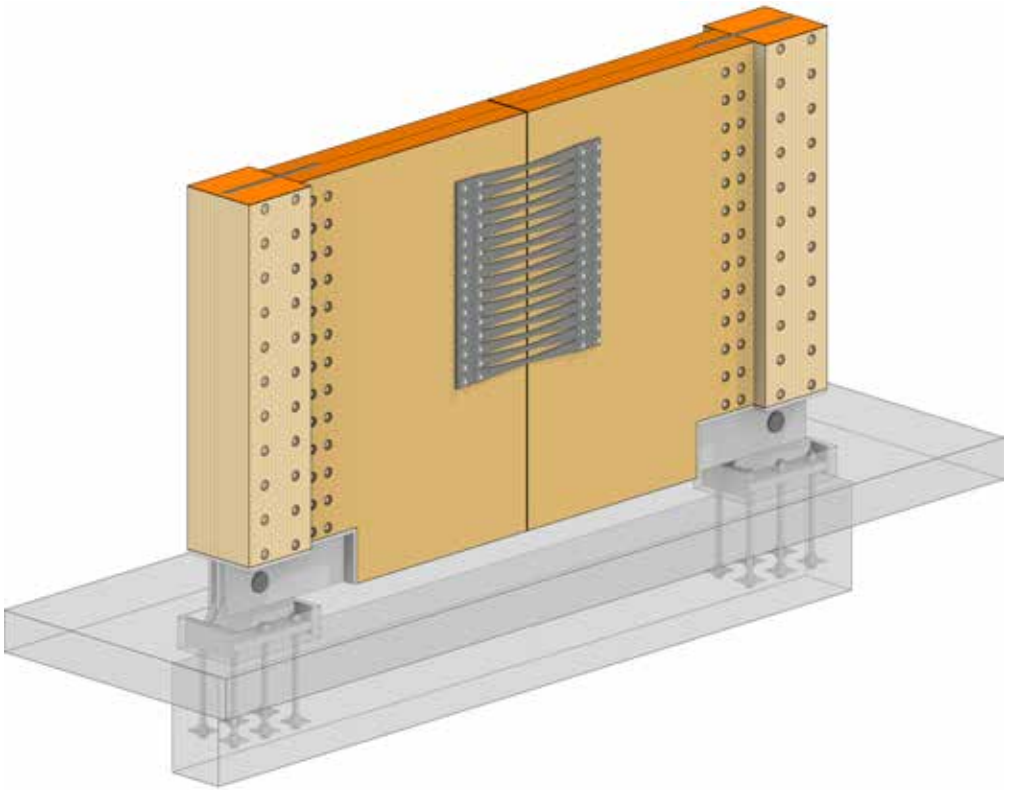
We advocate for sustainable design by actively participating in the following initiatives:

- Sharing our commitment to SE 2050 on our company website and promoting SE 2050 in our external-facing communications
- Ongoing membership in the AIASF and the AIALA COTE
- Teaching students at higher education institutions about sustainable design and embodied carbon reduction
- Presenting to architectural firms about strategies to implement more sustainable practices in design, including mass timber projects
- Participating in panel discussions and speaking at conferences about embodied carbon reduction in projects
- Attending local Carbon Leadership Forum (CLF) events
- Collaborating with an international team of experts to develop and disseminate best practices for embodied carbon accounting and reduction for lightweight tensile membrane structures. The Tensile Membrane Research Institute, cofounded by Bruce Danziger, SE, launched their website in February 2025, featuring research on reducing the embodied carbon of lightweight tensioned membrane structures.

Left: workshop:LEVITAS Ephemeral Forest at the Los Angeles Arboretum.

Embodied Carbon Reduction Strategies

Embodied carbon reduction of structural materials is the ultimate goal of the SE 2050 program, and is a primary focus for Tipping.



In the short-term (< 1 year), we are focusing on building up our internal carbon database to quantify our projects based upon project and material type for both new and reuse (renovation and retrofit) projects. We will also update our project specifications to include limits on GWP to achieve carbon reductions across all structural material types and continue to actively research emerging technologies with the potential to reduce carbon impacts. In the long-term (5+ years), we want to make robust comparisons of our project's GWP averages to industry benchmarks. With our averages confidently established, we will set measurable targets for embodied carbon reduction on all of our future projects and monitor our progress in reaching our long term reduction targets.

We aim to achieve our reduction targets by adopting the following design strategies:

- incorporating performance based specification language, particularly by setting "reach" GWP values for concrete mixes compared to industry standards;
- using high strength reinforcement where allowed by code to reduce overall rebar tonnage;
- proposing the use of mass timber on projects early in the design process;
- educating ourselves on emerging technologies and adopting the use of these technologies in our design;
- recommending the use of grid systems that are appropriate for various building materials to create an efficient structure; and
- seeking mentorship by leading professionals in the industry to refine our reduction strategies by material.

Left: 3D rendering of Tipping's R&D effort to develop a Rocking CLT Shear Wall system.

Carbon Tracking and Reporting

Tipping has an established practice model to produce efficient, innovative designs and smart solutions that reduce both cost and embodied carbon.

We continuously evaluate carbon accounting methodologies and tools that integrate carbon reduction opportunities into our existing practice methods. We believe that rapid and accurate material quantity and carbon estimates during the initial phases of design provide one of the most effective opportunities for carbon reduction. It allows us to have focused conversations with clients regarding sustainability goals for their projects, and how material changes may impact their building's overall global warming potential.

While a nimble carbon estimating process during early design maximizes opportunities for impactful reductions, a more detailed process must also be deployed later in design to confirm initial estimates and validate the efficacy of reduction strategies and design decisions. Tracking this data allows us to make more informed design decisions in future projects.

To support our carbon tracking and reporting efforts, we will:

- continue to train employees on how to perform prescriptive carbon accounting using submitted EPDs showing GWP values for A1-A3 stages of the product. We do not perform LCA on projects internally. Prescriptive carbon accounting can occur at any stage of the project and uses tools that we have internally developed (this includes using Revit models and BlueBeam software to obtain estimating quantities and an excel template to estimate embodied carbon);
- expand our EPD library for more accurate GWP estimates by requesting EPDs to be submitted early on in the project;
- create tools and share resources with employees to facilitate carbon tracking efforts;
- perform carbon accounting on at least five projects each year;
- establish reporting methodologies to facilitate comparisons;
- analyze GWP results of similar project types to create reduction strategies office-wide;
- adopt targeted reduction strategies based on project type;
- initiate sustainability conversations with clients early in the project; and
- where project scope includes external LCA consulting, we will work with LCA consultants to provide accurate material estimates for structural systems.

Left: Tipping performed prescriptive carbon accounting on our Hacienda Heights seismic retrofit project.

Elective Documentation

The education, reporting, reduction, and advocacy electives are described in the elective documentation checklists below:

Education Elective Checklist				
Item No.	Elective Description	Completed	Ongoing	Upcoming
E1	Provide a narrative of how the Embodied Carbon Reduction Champion will engage embodied carbon reduction at each office.	X		
E2	Present at least (1) webinar focused on embodied carbon and make a recording available to employees.		X	
E3	Incorporate embodied carbon education in your onboarding process for all new employees.	X		
E4	Train all of your firm's structural engineers on the core concepts and skills required to measure, reduce, and report embodied carbon.		X	
E5	Initiate an embodied carbon interest group within your firm and outline their goals. This group may more broadly address sustainability, but they must include embodied carbon.		X	
E6	Create an Embodied Carbon digital resource wiki and/or forum on your firm's internal website for staff to create, share, and discuss Embodied Carbon educational resources.		X	
E7	Propose other actions promoting embodied carbon education and describe their value: Newsletters		X	

Education Elective Summary by Item No.

E1. Our Embodied Carbon Reduction Champion(s) will continue to educate the office in embodied carbon strategies through lunch-and-learn presentations, informational newsletters, and through internal Slack communication. They will empower employees to learn more about embodied carbon reduction and how to carbon account on various projects.

E2. Lunch-and-learn presentations are recorded and are made available to new and current employees. This past year, we created presentations that focused on CAL Green code changes and how-to carbon accounting on projects using the prescriptive approach and in-house tools that have been developed. **Next year, we intend to host three presentations to educate the staff on sustainable practices.**

E3. Watching an introduction to embodied carbon video is incorporated into the onboarding process for new employees.

E4. We produced a "How To" Manual to train the firm's staff on best in-house practices to measure and report embodied carbon for our firm's projects. We made the "How To" Manual available to employees and recorded a lunch-and-learn webinar instructing staff about the practices contained within the "How To" Manual. **We will continue to educate our employees on how to reduce embodied carbon on projects.**

E5. **This year, we intend to expand our Education team and to set goals for the year which include expanding our EPD library and reaching out to industry professionals to learn more about embodied carbon in various materials.** This group will also be involved in a new out-reach campaign to engage with various LCA consultants and industry suppliers to validate assumptions around GWP requirements and current industry best practices.

Elective Documentation

E6. Our Education Initiatives team maintains a SE 2050 Slack channel, with Slack being our office's primary form of internal communication. The channel currently hosts the following resources:
- a. Links to the SE 2050 website, published papers, articles, and internal and external presentations
- b. Tips for adopting sustainability language into project specifications
- c. Carbon accounting tools and methods for tracking embodied carbon on projects
- d. Research into material and technology advancements regarding sustainable design.

E7. We have published several internal SE2050 newsletters that have been shared office wide and to clients upon request. This is valuable as it creates a reference for employees to return to. **We intend to provide at least one newsletter this year.** Newsletter content includes topics on:
- a. Focused strategies for carbon reduction related to various structural materials
- b. Upcoming Carbon Leadership Forum (CLF) events
- c. Links to relevant sustainable design articles and/or videos
- d. Updates on Tipping's carbon accounting tools and practices
- e. A "What you can do" section with tips on how each staff level can make a contribution to carbon reductions practices
- f. Quick facts related to various sustainable resources

Left: Tipping staff on a site visit at Children's Day School Preschool, getting an in-person look at mass timber construction

Reporting (Tracking) Elective Checklist				
Item No.	Elective Description	Completed	Ongoing	Upcoming
T1	Submit a minimum of (2) projects per U.S. office with structural engineering services to the SE 2050 Database.		X	
T2	Compare the embodied carbon emissions from multiple projects across your firm. Analyze and document what data or pieces of information are most important and communicate the findings to your firm.		X	

Reporting Elective Summary by Item No.

T1. Last year, we submitted (2) projects to the SE 2050 database. **We intend to submit at least (2) projects next year.**

T2. Last year, we focused on carbon accounting on similar building types to create a Tipping "baseline" on a specific project type. We discovered that concrete GWP values vary significantly depending on region, cementitious material replacement, and concrete strength. **We intend to continue to analyze this further and to share findings with the office this year.**

Elective Documentation

Reduction Elective Checklist				
Item No.	Elective Description	Completed	Ongoing	Upcoming
R1	Set clearly stated, firm-wide reduction targets in the short-term (<1 year) and long-term (>5 years).	X		
R2	Update your specifications to incorporate embodied carbon performance. Include embodied carbon in your submittal review requirements.			X
R3	Collaborate with your concrete supplier to reduce embodied carbon in a mix design below an acceptable baseline (e.g. NRMCA regional baseline values). Discuss what you found and what it means in your market.			X

Reduction Elective Summary by Item No.

R1. In the short-term, we are focusing on building up our internal carbon database to quantify our projects based upon project and material type for both new and reuse (renovation and retrofit) projects. We will also update our project specifications to include limits on GWP to achieve carbon reductions across all structural material types and continue to actively research emerging technologies with the potential to reduce carbon impacts. In the long-term, we want to make robust comparisons of our project's GWP averages to industry benchmarks. With our averages confidently established, we will set measurable targets for embodied carbon reduction on all of our future projects and monitor our progress in reaching our long term reduction targets.

R2. **This year, we are focusing on incorporating embodied carbon into our specifications, with the concrete Specification being the highest priority.** We have already begun changing the concrete Specification language for some projects, and we plan to make these changes typical for all projects.

R3. **We are actively working with contractors on some projects to establish GWP baselines for concrete construction.** We have found that GWP values are greatly impacted by cementitious material replacement and concrete strength. Through our experiences, we have learned that low GWP mixes may not be the most suitable for horizontal construction. We have learned that using a weighted average approach, as allowed by ACI 3213-24, is the most appropriate for new construction projects.

Left: The HOPE Center and Berkeley Way Housing was one of four pilot projects in the Bay Area Low-Carbon Concrete Codes Project by Bay Area Air Quality Municipal District, and is Multifamily GreenPoint rated Platinum.

Elective Documentation

Advocacy Elective Checklist				
Item No.	Elective Description	Completed	Ongoing	Upcoming
A1	Describe the value of SE 2050 to clients.		X	
A2	Publicly declare your firm as a member of the SE 2050 Commitment however you see fit (e.g. on your website, LinkedIn, or other social media).	X		
A3	Collaborate with your concrete supplier to reEngage with structural material suppliers in your region to communicate the importance of Environmental Product Declarations (EPDs) and low-carbon material options.			X
A4	Propose alternative methods for advocacy and describe their value: External Presentations		X	

Left: Principal Leo Panian presented the benefits of green concrete to a multi-disciplinary audience at the 2020 Design Colloquium.

Advocacy Elective Summary by Item No.

A1. We actively communicate the importance of sustainability to our clients and we explain the value of our participation in SE 2050 to them. We work closely with Architects and Mechanical Engineers to create sustainable systems that meet the client's needs. We recommend using sustainable building materials, and we encourage more efficient architectural grid systems for structure.

A2. Tipping is delighted to be involved in the SE 2050 Commitment Program. We have highlighted our participation on our company website to spread awareness of this initiative to the general public.

A3. **As part of our out-reach initiative this year, we intend to engage with structural material suppliers like Cemex and Central Concrete, Nucor steel, and others to learn more about their low-carbon material options that can be used in the Bay Area and Los Angeles regions.**

A4. In 2024, we presented carbon reduction strategies to a group of students at SFSU, led a Lunch Think table on lightweight structures at the AIA|LA COTE annual symposium, and presented carbon accounting for lightweight structures to the International Association of Spatial Structures (IASS) Working Group 6 (WG6) Tensioned Membranes annual 2024 meeting. **This year, we will continue to participate in external conferences and will educate emerging design professionals about the importance of sustainable design.**

Lessons Learned

Over the previous year, we have learned many valuable lessons regarding embodied carbon reduction that will inform our strategies in the coming year.

- Establishing firm specific embodied carbon project type baseline averages will take several years.
- Monitoring reduction targets based upon firm specific embodied carbon project type baseline averages will also take several years.
- Comparing our projects' embodied carbon to industry averages is possible and we are seeing an early trend (with limited data so far) that our projects have less embodied carbon compared to the averages. This underestimates the impacts of high seismicity (for most of our projects) on embodied carbon average baseline quantities.
- We have been following the developments in policy (AB 2446, CALGreen, Danish embodied carbon limits for buildings, etc.) with the anticipation that code requirements will help us guide our projects towards solutions that significantly reduce embodied carbon. Our goals are to stay ahead of policy in specifying and helping develop more sustainable structural engineering solutions that reduce embodied carbon.
- The amount of information available can be overwhelming and we strive to curate this information to help our staff learn more effective methods to reduce embodied carbon on our projects.

- Conversations with contractors are ongoing and trying to get contractors on board with our SE 2050 goals is challenging. Getting contractors, clients and design teams to align as early as possible on projects is necessary.
- Multiple projects that have architects with lofty sustainability goals are requesting that we insert GWP requirements into our specifications (GWP maximum values for various structural materials to achieve project sustainability targets). An example is our concrete specifications where instead of specifying 'recipes' we are being asked to specify maximum GWP values. Validating what is supplied for actual performance (e.g. finishing requirements) could require additional construction time that may have not been anticipated leading to costly change orders. This is a challenge for us to transition from very specific specifications to more general performance based specifications. As we move towards more performance based material specifications with GWP limits, this requires more intense collaboration with LCA consultants, industry material suppliers, and contractors to check that what regionally can and will be delivered to the site aligns with expectations for schedule, budget, performance and quality.
- Sometimes sustainability goals are in conflict with commercial goals and we need to balance both. As engineers, our leverage often comes from providing high quality technical knowledge so that our clients can make the best informed decisions. Gathering and distilling high quality data to empower us to give high quality advice is how we aspire to balance our sustainability and business goals.
- Sustainability and carbon reduction efforts are improved by collaboration across disciplines, industries, and project sectors, but effective knowledge sharing and communication can be challenging and complex. We have learned to especially value and nurture the professional and personal relationships that support our collective sustainability goals.

Left: The Conta Costa County Administration Building was built with low-carbon concrete, cutting CO_2 emissions by 30% compared to conventional methods.

TIPPING

Founded in 1983 | State of California SBE | County of Alameda Certified SLEB | 40 total staff | 17 licensed Structural Engineers | 60+ affordable housing projects | 60 Excellence in Structural Engineering Awards | 2 Living Building Challenge projects | 22 LEED Platinum projects | 26 LEED Gold projects | 6 projects with LEED innovation points from Tipping innovations | 9 Net-Zero-Energy projects | 9 AIA COTE Top Ten green projects | Signatory of SE 2050