DATUM
ENGINEERS

Embodied Carbon Action Plan V4.0

SE 2050 COMMITMENT

Executive Summary

This document intends to outline Datum's Embodied Carbon Action Plan (ECAP) summarizing the internal practices for the year 2024 to continue our efforts for the SEI SE 2050 goals through the following:

- Education: Understanding how building materials contribute to greenhouse gas emissions. and how we as structural engineers can help reduce these emissions associated with structural systems.
- Reporting Strategies: Developing in-house tools and methodologies to create databases compatible with SE 2050 database
- Embodied Carbon Reduction Strategies: Developing key actions and laying out design strategies to reduce embodied carbon.
- Advocacy: Developing educational opportunities to share the value of EC reduction with our clients and share the knowledge to accelerate the adoption of SE 2050 commitment.

Contents

Introduction

DATUM ENGINEERS, INC.

Founded in 1937, Datum has grown into a regional leader in structural engineering and to this day, Datum remains committed to building on our legacy of design excellence, cultivating a passion for architecture and practicing the Art of Structural Engineering.

Datum has an experienced team, many of whom have worked together for more than 20 years. We are dedicated professionals who are committed to our clients and to excellence in our work. We employ over 30 licensed engineers and other professionals in four offices throughout Texas and Chicago to work on signature projects nationwide.

Datum recognizes its responsibility in helping the building design community address the climate change issues and the impacts that our structural systems have on the environment. Datum supports the SE 2050 initiative by Structural Engineering Institute and Carbon Leadership Forum and will work toward the goal of the net-zero embodied carbon by 2050.

Overview

Over the past three years, Datum Engineers has advanced from building foundational knowledge in embodied carbon (2022), to integrating LCA services into project proposals (2023), to shaping industry-wide strategies and policies (2024).

Toward Zero Carbon Workshop Insights

In July 2024, Datum participated in the ASCE-SEI "Toward Zero Carbon" workshop held at Northeastern University, Boston, which brought together national leaders from engineering, architecture, construction, academia, and policy to develop a 25-year roadmap toward zero embodied and operational carbon in the built environment. There were 6 breakout sessions and Datum was assigned to be part of the Breakout session focussed on Architectural and Engineering Design. Each breakout session discussed two key questions in relation to the breakout topic. Then, during the final workshop sessions, the workshop participants voted to prioritize and highlight the key initiatives for the profession and for SEI moving forward.

Key workshop outcomes included:

- Roadmap Development – Establishing intermediate targets, aligning with material-specific and international frameworks, and integrating sustainability as a core design responsibility.
- Standards & Data Transparency – Advancing consistent methodologies for embodied carbon calculation, improving life-cycle assessment (LCA) tools, and ensuring robust Environmental Product Declaration (EPD) data.
- Material & Design Innovation – De-risking adoption of low-carbon materials, promoting reuse/adaptive reuse, and guiding design for deconstruction.
- Policy & Advocacy – Leveraging SEI SE 2050 Commitment Program data to set performance standards, influence building codes, and launch public awareness campaigns.
- Education – Defining "embodied carbon literacy" for graduates, embedding sustainability in licensure exams, and providing continuing education for practicing engineers.

Expanding Impact Through Industry Engagement

Beyond the workshop, Datum Engineers actively advances collaborative industry initiatives:

- Feedback Facilitation – Led outreach to the CLF Austin Hub to collect professional feedback on the City of Austin's *Plan to Transition to Low-Embodied Carbon Concrete*, ensuring stakeholder perspectives shape and strengthen the proposal before presentation to decision-makers.
- Leadership in SE 2050 –Datum's Embodied Carbon Champion, serving as a member of the

SE 2050 Program Mechanics Team, managed the tracking of nearly 140 committed firms and demonstrated the positive impact engineers can make both within their projects and across the profession (See Exhibit H).

- Participated in the Woodworks event, Mass Timber Sustainability: Making a Case for Developers and Owners, in Austin, gaining insights on building the business case for sustainable mass timber, its carbon storage potential, and responsible forest management practices—knowledge that informs our client engagement and design recommendations.

Datum's engagement in these initiatives reinforces our commitment to industry leadership in reducing embodied carbon through design innovation, collaboration, and advocacy—aligning our practice with the 2050 zero-carbon target.

LCA Services

Datum utiltizes the Tally LCA tool and EC3 to perform comparative analysis using product specific EPDs. As we explored the process of collaborating with concrete supplier to reduce embodied carbon in a mix design while performing LCA, we learnt several key insights as shared below.

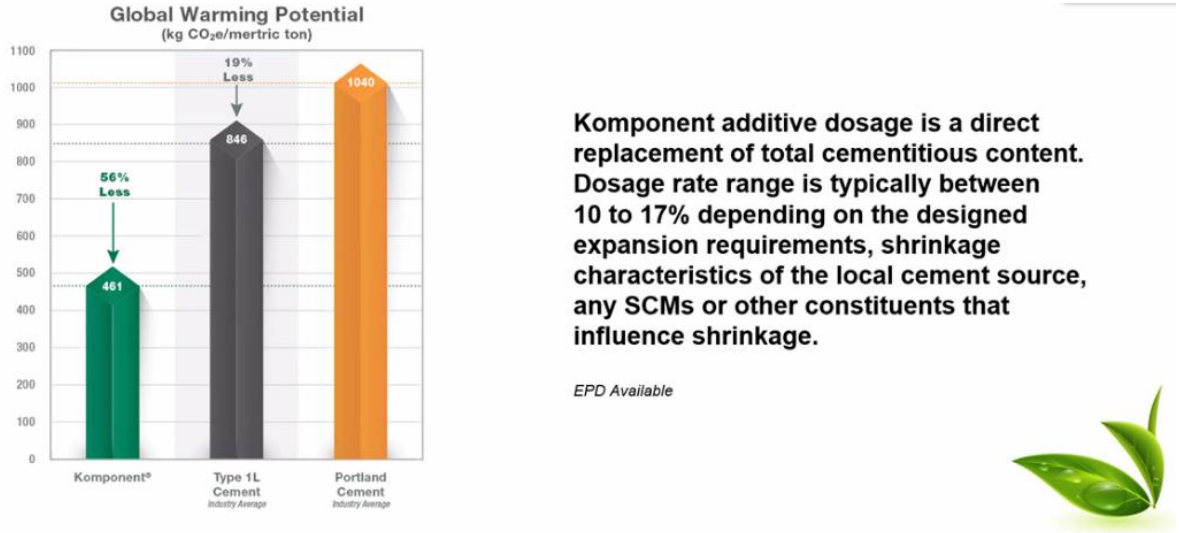
Key learnings:

- NRMCA 2021 GWP values are much lesser than 2019 values because there are around 15-20% fly ash replacements in the mixes that were part of the 2021 study analysis and also the participating plants in the study included around 2000 plants which is less than 25% of the total cement plants out there, so it may not be a true reflection on the nation wide GWP values. Also, the table presented y NRMCA is a good review of GWP impacts of

	Maximum Global Warming Potential Limits for GSA Low Embodied Carbon Concrete (kilograms of carbon dioxide equivalent per cubic meter - CO_2e kg/m^3)		
Specified compressive strength (f'c in PSI)	**Standard Mix**	**High Early Strength**	**Lightweight**
up to 2499	**242**	**326**	**462**
2500-3499	**306**	**413**	**462**
3500-4499	**346**	**466**	**501**
4500-5499	**385**	**519**	**540**
5500-6499	**404**	**546**	**N/A**
6500 and up	**414**	**544**	**N/A**
These numbers reflect a 20% reduction from GWP (CO_2e) limits in proposed code language: "Lifecycle GHG Impacts in Building Codes" by the New Buildings Institute, January 2022.			

specifying high early strength vs standard mix.

- Type K shrinkage compensating cement (TYPE K SCC) technology: It follows ACI 223 (ASTM C845), also called as *Komponent*, which is an expansive cement additive that works in



conjunction with concrete reinforcement to overcome the drying shrinkage and prevent negative volume change; and it is effective in reducing GWP too as it acts a direct replacement of total cementitious content as shown in the image below.

- Fly Ash alternates: EcoMaterial technology's of ash grinding facility in central Texas—the first of its kind in the U.S.—processes bottom ash for sale into concrete markets. Bottom or blended fly ash material is basically the residue that is dropped out of the furnace gas stream and is left at the bottom of the furnace. These used to go into landfills earlier and not utilized as alternatives for cement but now these are recognized and acceptable per ASTM C618-23.

Concrete Sustainability Landscape

In the initial years of commitment, Datum's focus was primarily on concrete material as there was a growing application of technologies like Carbon Cure and Type 1L (or PLC) cement in Texas. Type IL (PLC) cement became the statewide norm in Texas, offering 8–10% CO_2 reductions with minimal specification changes. In 2024, Texas saw significant momentum in reducing embodied carbon in construction, particularly for concrete and steel. The City of Austin led with a plan to transition to low-embodied-carbon concrete, emphasizing project-specific EPDs and kg-CO_2e/m^3 targets, while UT Austin secured $3.27M in EPA funding to expand EPD availability across regional manufacturers.

To effectively understand the GWP values for concrete mixes, we engaged in conversation with the Director of Sustainability Initiatives from National Ready Mixed Concrete Association (NRMCA). Datum also hosted an internal seminar on the NRMCA Concrete Carbon Calculator—a tool launched in 2024 to help quantify and reduce the embodied carbon of concrete in building and paving projects. The session covered how the calculator automatically benchmarks impacts, accounts for carbon sequestration potential, and compares proposed mixes against a pre-determined carbon budget. Using Environmental Product Declaration (EPD) data, the tool enables teams to evaluate low-carbon alternatives, adjust mix designs to meet project-specific performance requirements, and verify compliance with sustainability goals.

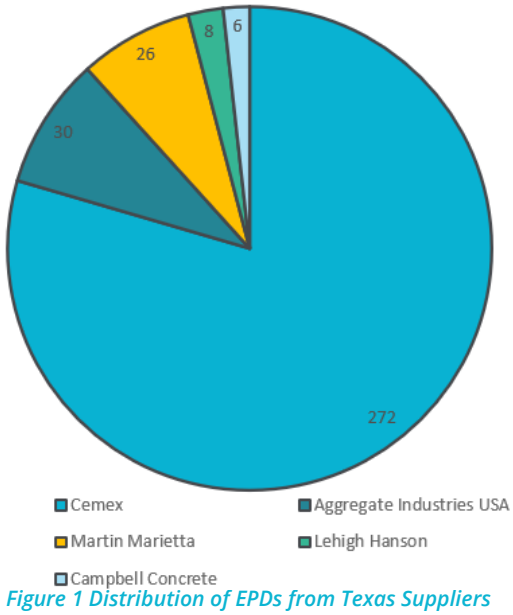


Figure 1 Distribution of EPDs from Texas Suppliers

As the sustainablity focus is growing, the number of concrete mix EPDs availability in Texas grew exponentially from 50s to over 300 EPDs over 2022, although the number of suppliers offering this range of EPDs were only 5 (as shown in the pie chart above in *Figure 1*) indicating that many other suppliers were yet to employ the sustainablity practices.

Education

As part of the first year commitment requirements, Datum sent an internal email announcing Datum's commitment to SEI SE 2050. (See Exhibit A) and also sent a newsletter to our clients announcing the commitmment. Swarna Karuppiah, located within Austin office, is the current embodied carbon reduction champion for Datum (See Exhibit B for profile). For our education efforts, webinars by external organizations like NRMCA, CLF etc are attended by the sustainability EC point of contact. As required, more webinars will be presented on EC and its measurement tools to broaden our understanding on embodied carbon practices by structural community. There is ongoing work on Internal Guide to develop LCA study tally tool for PMs who are looking for guidance on LCA proposal and for engineers who are looking for guidance on using Tally.

Electives

- ☑ Provide a narrative of how the Embodied Carbon Reduction Champion will engage embodied carbon reduction at each office. See Exhibit C
- ☑ Present at least (1) webinar focused on embodied carbon and make a recording available to employees. This could be created internally, pulled from an external source (with permission), or pulled from a publicly available source such as the Boston Society for Architecture . Include this resource in your orientation and on-boarding program. Completed
- ☐ Train all of your firm's structural engineers on the core concepts and skills required to measure, reduce, and report embodied carbon. (Ref. SE 2050 Resources)
- ☑ Incorporate embodied carbon education in your onboarding process for all new employees.
- ☐ 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. See Exhibit D
- ☑ 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.
- ☑ Engage with a CLF Regional Hub. This could mean:
    - Attending presentations or working sessions and reporting back to the firm
    - Co-chairing a hub - Datum's Embodied Carbon Champion is co-chairing Austin Hub
- ☐ Provide narrative outlining plans for minimum (2) firm-wide presentations per year on the topic of embodied carbon.
- ☐ Propose other actions promoting embodied carbon education and describe their value.

Reporting

Requirements

- Provide a narrative on how your firm plans to measure, track, and report embodied carbon data.

  Datum is calculating EC for structural materials using the Tally LCA tool as it allows us to easily coordinate with our clients who use similar tools. We extract quantities through Revit model using Tally during the DD and/or CD phase as needed. Datum focuses on performing preliminary LCA for the phases A1 to A3 using manual take-off and for LEED requirements, we focus on performing comparative analysis using Tally for all the stages from product to end of life. An internal white paper on EC measurement using Tally has been developed and published.

- Describe the internal training for embodied carbon measurement you provided or will provide.

  Datum's internal sustainability team has presented a white paper on Scorekeeping and LCA tools in 2021. The LCA tool, Tally basic license, is available internally for EC measurement. A webinar on Tally was presented to the staff to develop a basic understanding of the tool to perform LCA on different types of projects depending on the building functions and materials.

- Submit an annual minimum of (2) projects per US structural office but need not exceed (5) total projects for the frm to the SE 2050 Database

  Datum performed LCAs on 2 projects this past year and submitted its data to the SE2050 database.

Electives

- For multi-office firms, describe how each office is measuring and reporting embodied carbon. For single-office firms, describe how different project teams or managers are measuring and reporting embodied carbon.
- 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.
- Propose other actions that promote the reporting of embodied carbon data and describe their value.

Embodied Carbon Reduction Strategies

As part of the first year commitment, the goal was to educate ourselves on what EC is, how to measure it, the tools available and how to apply those tools in our projects. The EC reduction targets are not set internally because we do not have LCA performed on all our projects to gather enough data for setting benchmarks. For second year of commitment, we introduced LCA services as part of the proposal for LEED specific projects. With few data points currently available to quantify embodied carbon reduction, we are referencing carbon budget based on CLF and NRMCA baselines for implementation of EC reduction. For the third year of commitment, see the section 'LCA Services' for the narrative on the key learnings.

At the end of each year of commitment, updates will be made to the ECAP to incorporate the learnings and improve the methodology to approach the carbon neutrality goals.

The current elective chosen is to improve our standard specifications to incorporate ways to reduce EC reduction. The improvement in the specifications will be ongoing throughought the commitment program. More electives will be chosen as we layout goals and will try to add one additional elective each year.

Electives

- ☐ Submit a Circular Economy Narrative describing how a project supports the circular economy. This can be done by incorporating re-use or design for deconstruction into at least one project.
- ☑ Develop and implement a workflow that makes it easier to make early design decisions based on embodied carbon. In Progress
- ☑ Update your specifications to incorporate embodied carbon performance. Include embodied carbon in your submittal review requirements.
- ☐ Communicate the embodied carbon impacts of different design options to clients with creative and effective data visualization. You are welcome to include these visualizations in your Elective Documentation, though it is not required if your firm would prefer to keep marketing materials private.
- ☐ Compare different design options with embodied carbon as a performance metric during the project concept phase. Explain what you did and what the results changed (if anything).
- ☐ Participate in a LEED, ILFI Zero Carbon, or similar project design charrette and speak to potential design considerations impacting embodied carbon.

- ✓ 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. (See the Overview section)
- ☐ Have an Environmental Product Declaration (EPD) created for a project. Get a project or client to require the creation of an Environmental Product Declaration (EPD) that did not exist before.
- ☐ Incorporate sustainably harvested biogenic materials in at least one project.
- ☐ Propose other embodied carbon reduction strategies and describe their value.

Advocacy

As part of our avocacy efforts, we have shared our commitment through a Dallas newspaper publication to encourage the structural firms in Texas to come forward and take part in changing the trajectory of bulding design and shared on LinkedIn to accelerate the adoption of the commitment program. We have also presented as one of the speakers of NCSEA Webinar on the topic of Net-zero carbon (See Exhibit E). Datum has presented the SE2050 commitment to UTAustin ArchE Community on Earth Day April 22nd, 2022 (See Exhibit F). Datum's EC champion organized a few webinars for CLF Austin Hub as a co-chair of the Hub to share SE2050 commitment in Austin, and, also guided AEC Solar Decathlon team at UT Austin for incorporating few sustainable practices besides guiding on the structural framing of the challenge.

Datum will continue to engage in EC reduction conversations with sustainability advisors from various client firms and collaborate with their AIA 2030 goals and will also engage in conversations with MEP consultants to achieve their commitment towards MEP 2040 goals and other stakeholders involved to achieve this collective goal of net zero carbon emissions. We will seek more opportunities to organize presentations on the value of the SE2050 commitment to clients who are working towards the same mission of improving building design and construction practices to tackle climate change impacts.

We have been working with clients and owners to find more opportunities to address the reduction of embodied carbon and make decisions keeping in mind the sustainability goals of the projects. We have shared our commitment to SE 2050 on our company website (See Exhibit G).

Electives

- Give an external presentation on embodied carbon that demonstrates a project success or lessons learned. Get connected at a CLF regional hub near you and be sure to post the recording.
- Mentor a firm new to the embodied carbon space. Describe how you identified their needs and what improvements were made.
- Engage with structural material suppliers in your region to communicate the importance of Environmental Product Declarations (EPDs) and low-carbon material options.
- Engage with local, state, and federal governments to communicate the importance of low-embodied carbon procurement and construction policies, and provide expert testimony to this effect.
- Propose alternative methods for advocacy and describe their value.

Appendix

Exhibit A

I'm thrilled to announce that we have officially named Swarna Karuppiah, PE, as Datum's Sustainability Champion.

This is an area of our practice and our industry that is growing in importance – and for good reason. Swarna played an important role in our successful Sustainability 1.0 efforts, and is actively working on version 2.0 to raise our game in being able to execute Life Cycle Cost Assessments on our projects to measure performance and help our clients achieve sustainability goals.

Swarna also took the initiative and prompted us to sign on to the SE2050 **Commitment** in its first full year, pledging to work collaboratively in our industry to reduce embodied carbon in our projects to net-zero by the year 2050. This is a big deal. It's ambitious, and it's the right thing to do as stewards of the world we live in. Swarna will be sharing more about what this means for us at the Engineering Roundtable meeting (everyone is invited) on Monday, November 8 at noon.

We will be making an announcement for the world outside our walls, but I wanted you to hear it here first.

Thanks, Swarna, for your initiative and efforts.

Exhibit B

Associate

swarna@datumengineers.com

Swarna joined Datum in 2016 and was recently promoted to Associate. She has a can-do attitude and is dedicated to her profession and her role in the firm. She has gained valuable experience in the design of cultural buildings, office, healthcare, and research facilities. Her project experience includes; The Dallas Holocaust Museum, Highland Park Presbyterian Church, BSA Harrington Cancer Center, and Texas A&M University MREB 2. She has been very active in several professional organizations including; Leadership Collective, Austin Chapter of AIA, Sustainability and SE 2050 Committee Member, ASCE, and awarded the NCSEA Young Member Summit Scholarship.

Swarna received her Bachelor of Science in Civil Engineering from Indian Institute of Technology, and her Master's in Structural Engineering at the University of Southern California.

Exhibit C

Roles & Responsibilties of Embodied Carbon Champion:

- Keep track of education on embodied carbon – attend webinars/seminars, workshops or conferences.
- Conduct focussed group discussions on EC strategies.
- Develop in-house tools with the Datum's sustainability chapter to strategize reporting.
- Share all resources from SE 2050 website firm-wide.
- Coordinate ECAP progress between all the three offices and make annual updates to the ECAP documentation.
- Develop a feeback system on the commitment program to address any improvements if needed.
- Identify and promote advocacy opportunities within our AEC community and universities.

Exhibit D

Goals of Datum's Sustainability Chapter:

- The internal chapter will engage in education efforts and strategize on resource developments like White Paper, Tally Learning and other resource tools.
- Review of ECAP documentation for annual updates and address any improvements if needed.
- Coordinate advocacy efforts within the interest group to reach out their respective project teams.

Exhibit E

The Structural Engineer's Role in Getting to Net Zero

Overview

HAVE AN ATTENDANCE CODE? SIGN IN TO ENTER IT.

This live web event has ended. Thank you for attending.

DESCRIPTION

Embodied carbon has become a major topic of conversation within the A/E/C industry. Low-carbon construction is entering our design conversations and building codes with structural engineers being looked at to reduce their project's embodied carbon and with the first low-carbon concrete code in the US adopted in Marin County, California. Additionally, through the SE 2050 commitment program, structural engineering firms like Holmes and Datum Engineers are committing to reach net zero embodied carbon structures by 2050. With the push for lower embodied carbon structures, structural engineers play a vital role in getting to net zero. This presentation will explore advances the structural engineering profession is making toward net zero embodied carbon structures, discuss the top actions structural engineers can take to reduce the embodied carbon in their projects, and discuss how structural engineers can make wiser design choices to reduce emissions.

- Course will award 1.5 hours of continuing education
- This course is Diamond Review approved in 49 states. New York does not accept hours from recordings.

CONTRIBUTORS

Megan Stringer, S.E., LEED AP BD+C

Megan Stringer, S.E., LEED AP BD+C, is an Associate Principal with Holmes. Motivated by our impact on the built environment, Megan is at the forefront of reducing structural embodied carbon. She champions Holmes' SE 2050 commitment and gets sustainable structures built at impressive scales. Megan has overseen North America's largest mass timber project at the Microsoft Silicon Valley Campus, utilized low-carbon concrete pours at Intuit, and performed many life cycle assessments. She also serves as Vice President of the Structural Engineers Association of Northern California.

Swarna Karuppiah, P.E.

Swarna Karuppiah, P.E., is an Associate with Datum Engineers, Inc. in Austin, Texas. She has gained valuable experience in the design of cultural buildings, offices, healthcare, and research facilities and currently, serves on the SEI Sustainability and SE 2050 Committee to study the overall embodied environmental impacts of building materials and systems.

January 18, 2022

Tue 12:00 PM CST

DURATION 1H 30M

This live web event has ended.

$250.00 - $300.00

Add to Cart

NCSEA Office
ncsea@ncsea.com
312-649-4600
ext. 200

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Exhibit F

Datum Engineers
1,292 followers
10mo •

Our very own Swarna Karuppiah, P.E. and
UT Architecture Professor Juliana Felkner gave a fabulous presentation today on sustainability and methods of measuring a building's carbon impact!

Exhibit G

Sustainability and the Race to Net Zero

Datum Engineers supports the SE 2050 commitment initiative developed by the Structural Engineering Institute and the Carbon Leadership Forum and will work towards the goal of transforming the practice of structural engineering to achieve net-zero embodied carbon by 2050.

SEI ASCE STRUCTURAL ENGINEERING INSTITUTE | SE2050 COMMITTING TO NET ZERO

We are Engaged

Datum proudly supports the mission of the SE 2050 commitment as envisioned by the Structural Engineering Institute of the American Society of Civil Engineers. As one of the first 70 engineering firms nationwide to take on this bold challenge, we are committed to transforming the practice of structural engineering by prioritizing the reduction of embodied carbon through the use of less impactful structural materials. Our approach is holistic, firm-wide, project based, and data-driven.

Exhibit H

Luke Lombardi • 1st
Structural Engineer and Sustainability Consultant
1yr •

Shoutout and thank you to Swarna Karuppiah, PE who has been an indespensible member of the SE 2050 Program Mechanics Team!

In addition to her leadership as Datum Engineers Embodied Carbon Champion, Swarna has supported the Program volunteer effort by managing tracking of the now nearly 140 firms commited (see here: https://lnkd.in/gRwT92A)! She is a great example of the positive impact you can have on your projects and in the industry.

More of her work and actions by Datum in their ECAP! https://lnkd.in/dGqpvfz5

If you're interested in contributing to the SE 2050 Program or interested in joining one of our working groups (https://lnkd.in/d-ZchdB4), please email us at contact@se2050.org.

And keep an eye out for the SE 2050 Annual Report--coming soon!!

Annabel Shephard, PE Martin Torres, PE Luke Bastian Genevieve Graham

SE 2050 Commitment Program Team

SE 2050 was developed and is managed by a dedicated group of volunteers. All members of the team are members of the SE 2050 subcommittee of the SEI Sustainability Committee and bring each a unique perspective and level of expertise to SE 2050. The team is broken down into subgroups managed by a subgroup leader and the Leadership Group. The different subgroup areas of focus are:

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