GLUMAC

Climate Commitment Action Plan

A TETRA TECH COMPANY

Glumac Climate Commitment Action Plan

WHAT'S INSIDE

CSU Long Beach Parkside Housing
Long Beach, California
This 121,852-square-foot **LEED Platinum** campus housing building is **operationally net positive** and on track to achieve **ILFI Energy Petal certification** in 2024.

How did we get there?

- All electric systems, electric boilers and VRF conditioning.
- Bifacial rooftop solar panels and campus solar for net zero.
- Window sensors turn off the HVAC when opened.
- Cantilevered concrete slabs provide shade from the sun, window rainscreens reduce solar heat gain while allowing for daylight.
- City supplied reclaimed water for flush fixtures, irrigation and all stormwater is infiltrated on-site.
- Reduced embodied carbon of structural materials by 29% through improved concrete, aggregate, and rebar.
- In a survey, 80% of students said that living in a sustainable building was important to them.

Study Areas: VRF low GWP refrigerants and electric alternatives.

Glumac's Climate Commitment & Goals

NICOLE ISLE
Chief Sustainability Strategist

As the U.S. building stock continues to grow, so does the climate impact and risk.

As "Engineers for a Sustainable Future," we understand that technological advancements are forging a clean and resilient future at a pace never seen. And we understand that we are exceptionally positioned to have a measurable impact on carbon reductions through our innovative engineering and consulting.

Now is the time to take a larger share of our projects beyond code and take a holistic look at carbon and human health for all. Codes are ramping up, governments are implementing new policy, and climate change continues to threaten our health and livelihood.

To stay ahead of the market change and adapt to new climate conditions, we need to make deep energy and carbon reductions a best practice on our projects. And we need to prove performance through transparent building reporting and measurable, improved progress.

To help us on our way, Glumac signed on to the AIA 2030 and Carbon Leadership Forum (CLF) MEP 2040 commitments, which commits us to specific timelines to reduce operational carbon emissions to zero by 2030 and embodied carbon to zero by 2040.

Meeting this timeline means improving our designs every year. So, we will leverage technology and process improvements to lower the footprint of our projects. The buildings we design in 2025 must use less energy than the buildings we are designing today, and by 2030 we must strive to meet a zero operational carbon target. This means:

- Designing buildings that use significantly less energy,
- Electrifying heating and hot water systems,
- Incorporating on-site renewable energy to the greatest practical extent,
- And preparing buildings to be operated with renewable electricity.

With the commitment dates nearing, an Action Plan and set of goals is needed to chart our pathway forward. To keep us on track, we defined our 2025 and 2030 goals to progress our designs and hold ourselves accountable.

We also understand that sustainability is holistic in that there are systemic resource and social impacts beyond energy and carbon that we can positively influence in our designs. To this end, we defined additional sustainability goals that are important to us and that we will strive to develop in the next version of this action plan. In the interim, we have provided summary guidance in the Design Synergies section and incorporated best practices for design integration for these topic areas in the Tools section.

Our goal is to engage all Glumac employees as agents of change for a low carbon, sustainable, and clean energy future.

Our Engineering Responsibility

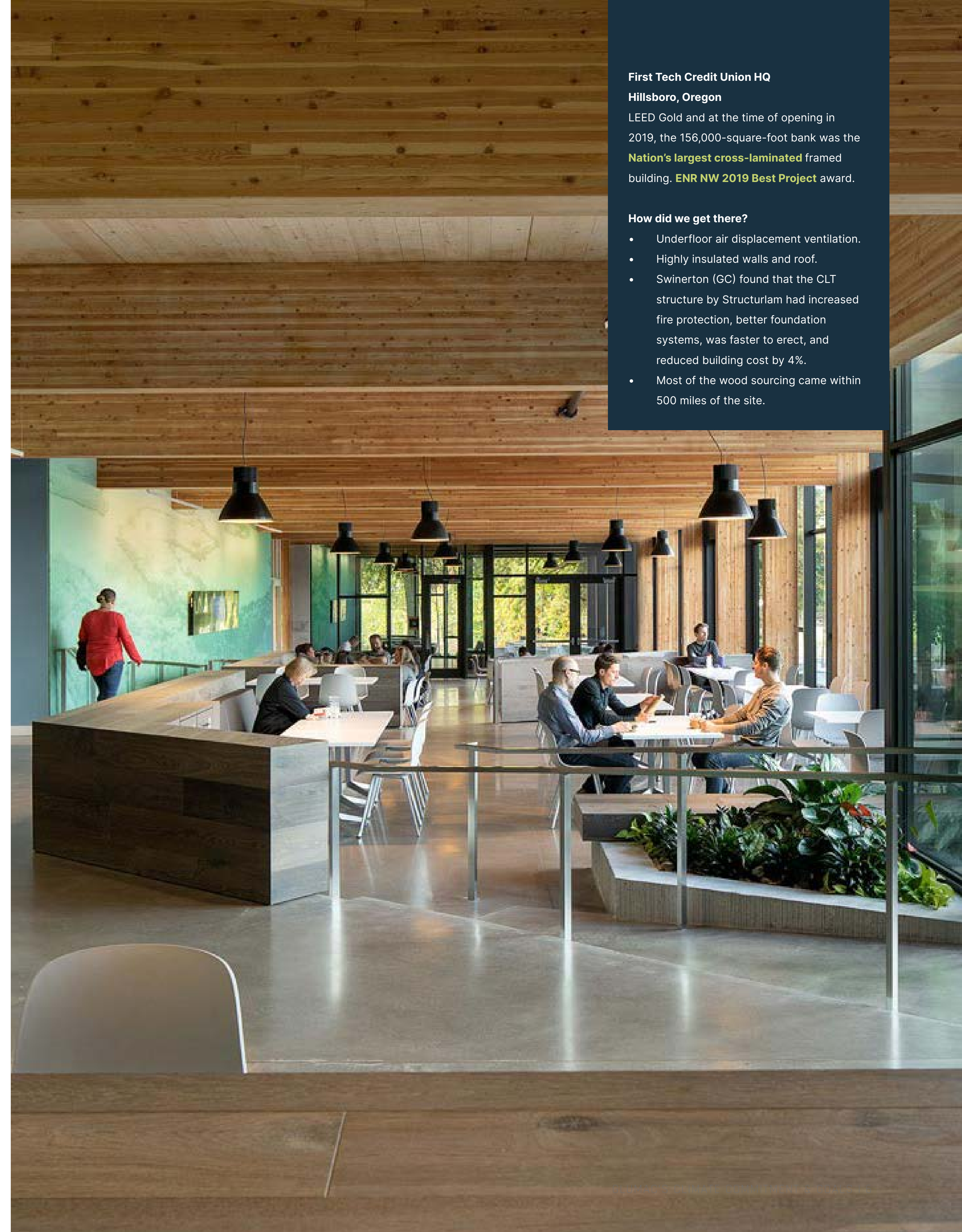
Carbon Drawdown: An Imperative in the Built Environment

JOSEPH FONG I President

NICOLE ISLE I Chief Sustainability Strategist

KATHERINE CUNNINGHAM I Director of Engineering

CHRIS LOWEN I Director of Building Sciences



First Tech Credit Union HQ
Hillsboro, Oregon
LEED Gold and at the time of opening in 2019, the 156,000-square-foot bank was the **Nation's largest cross-laminated** framed building. **ENR NW 2019 Best Project** award.

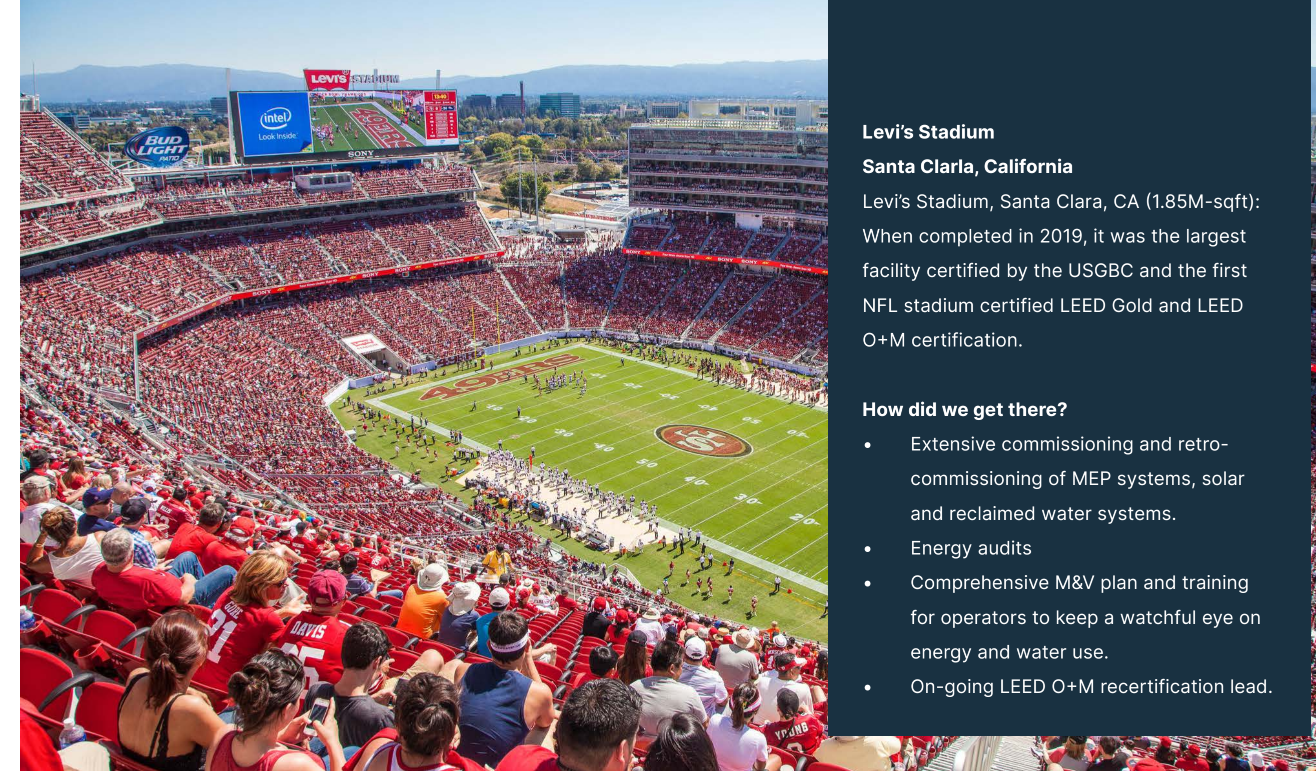
How did we get there?

- Underfloor air displacement ventilation.
- Highly insulated walls and roof.
- Swinerton (GC) found that the CLT structure by Structurlam had increased fire protection, better foundation systems, was faster to erect, and reduced building cost by 4%.
- Most of the wood sourcing came within 500 miles of the site.

CLIMATE COMMMITMENT 2025 & 2030 GOALS

2025 Goals	2030 Goals
Project Management	
100% of projects use the Base Sustainability Checklist to guide their client engagement and designs.	100% of projects utilize the Enhanced Sustainability Checklist to guide their client engagement and designs.
Design Management - Operational Carbon - Meeting AIA 2030 Goals	
100% of qualified* projects provide a Schematic Design Narrative with completed Sustainable Design Features discipline subsections.	TBD
Glumac has provided a pathway for all qualified projects to meet their energy EUI target set in the AIA 2030 DDx platform. To stay on a path toward 2030, 25% of projects need to comply.	Glumac has provided a pathway for all qualified projects to meet their energy EUI target set in the AIA 2030 DDx platform. To stay on a path toward 2030, 75% of projects need to comply.
We guide clients and project teams through the electrification transformation utilizing the engineering Electrification MOU as our guide. Expand MOU to include guidance for electrified transport and clean energy systems. Review, update MOU annually.	100% of new designs, renovations, equipment replacements are fully electrified and incorporate onsite renewable power to the greatest extent possible. All project wishing to be excluded from this requirement shall seek approval from the Director of Engineering Services and will be logged.
Design Management: Embodied Carbon – Meeting CLF 2040 Goals	
Establish an engineering Embodied Carbon MOU with a goal to track embodied carbon for MEP equipment on 100% of qualifying* projects.	50% of Glumac projects use < 50 GWP refrigerants.
Project Reporting	
100% of qualified* Glumac projects have been submitted to the AIA 2030 DDx reporting platform.	New projects are added each year and all active projects are submitted annually.
An annual progress summary is provided to all staff.	
Training	
Training on meeting our climate commitments is conducted annually at all levels of the organization.	

*Refer to Project Goal Setting, Evaluation and Reporting for a definition of qualified projects.



Levi's Stadium
Santa Clarla, California
Levi's Stadium, Santa Clara, CA (1.85M-sqft): When completed in 2019, it was the largest facility certified by the USGBC and the first NFL stadium certified LEED Gold and LEED O+M certification.

How did we get there?

- Extensive commissioning and retro-commissioning of MEP systems, solar and reclaimed water systems.
- Energy audits
- Comprehensive M&V plan and training for operators to keep a watchful eye on energy and water use.
- On-going LEED O+M recertification lead.

ADDITIONAL SUSTAINABILITY GOALS

2025 Goals	2030 Goals
Resilience Goals	
Establish an MOU directing our approach for engineering systems and equipment to be adaptable to local climate change risks.	Goal TBD
Water Goals	
Establish an MOU with a goal to calculate a water budget and assess water reuse systems on all new and existing building projects. Refresh tools and provide training for teams to easily utilize to perform their work.	Goal TBD
Healthy Buildings Goals	
Establish an MOU with two goals: 1) to evaluate and employ advanced filtration media and/or systems on all HVAC designs per the latest ASHRAE indoor air quality standards, and 2) to employ biophilic design strategies in our work.	Goal TBD
Social Equity Goals	
Establish an MOU that helps us make design decisions that benefit social equity and climate justice matters on our projects.	Goal TBD

Organizational Structure

Key to creating a culture committed to sustainable design and climate action, is an organizational structure that supports it.

Glumac's Chief Sustainability Strategist works directly with our President and collaborates with the Executive Leadership Team to advance the firm's sustainability vision and mission through business impact and corporate climate commitments. They work together with the Director of Building Sciences and leadership to strengthen consulting expertise, technical analysis, and project performance tracking tools for the firm. The Building Sciences Group (BSG) collaborates with the Engineering Services Team to provide comprehensive sustainability, energy, and commissioning services.

The structure has many benefits. It enables communication to advance firm-wide sustainability objectives. It fosters thought leadership and dissemination of new tools, processes, and training needed to advance disciplines and the means to cross-collaborate on marketing pursuits and new projects. Together, we can move forward to create more sustainable buildings, and we do this through a process called Integrated Design.

San Jose Mineta International Airport Aircraft Rescue & Fire Fighting Facility San Jose, California
LEED Silver and **complied with the City's Net Zero Ready Building and Zero Net Carbon mandates**. ENR 2020 Best Project award.

How did we get there?

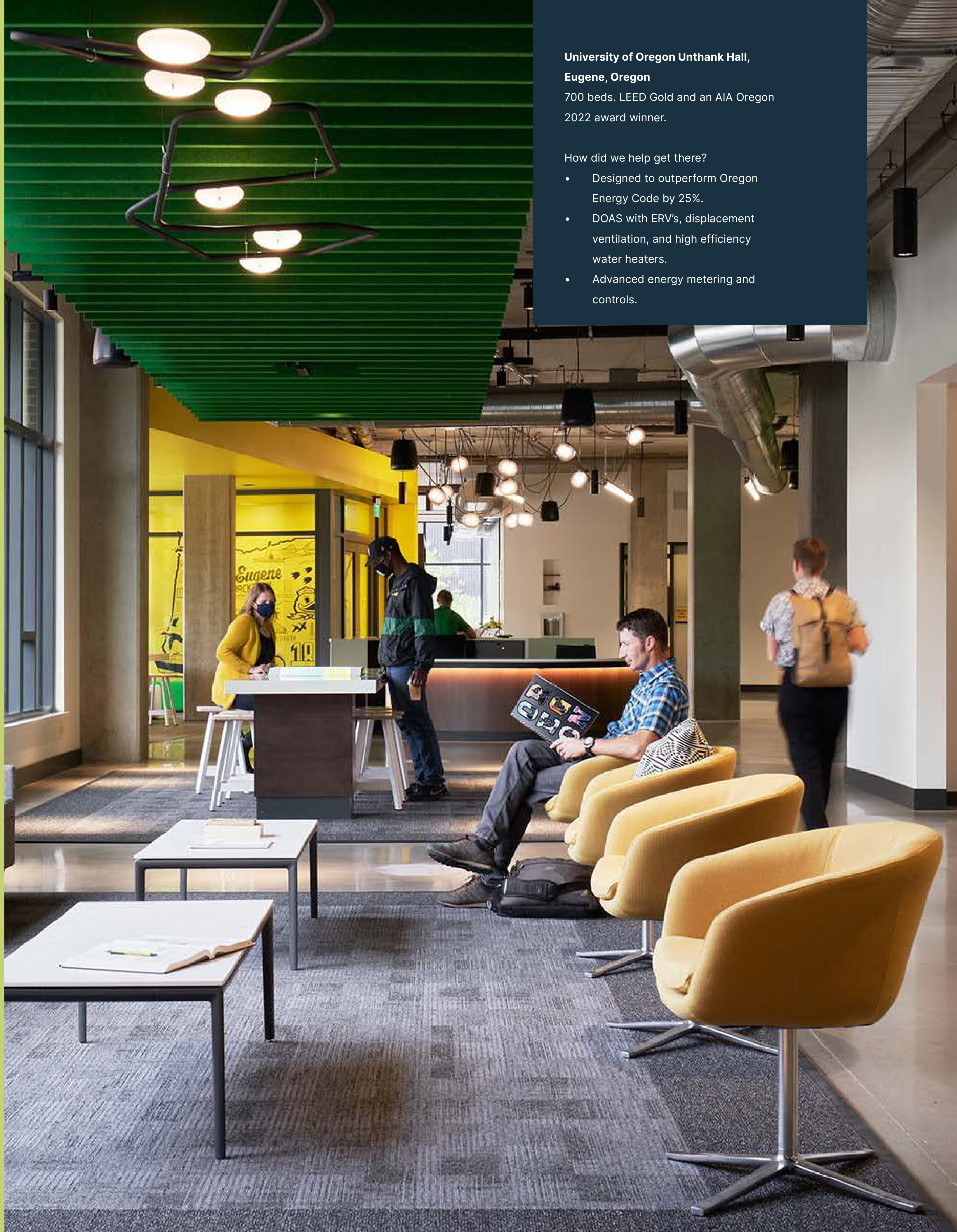
- VRF, all electric systems.
- Solar-ready infrastructure with the potential to power about 25% of the building.
- Regular operations for seven full days in the event of a natural disaster.
- Attention to air quality from detailed envelope sealing and enhanced mechanical filtration.
- Functional performance building systems commissioning.

Study Areas: VRF low GWP refrigerants and electric alternatives.

Achieving Our Commitments

This section covers the steps we take to set our projects up for success, the tools available to help us throughout the integrated design process, and our reporting protocol.

WHAT'S INSIDE



University of Oregon Unthank Hall, Eugene, Oregon
700 beds. LEED Gold and an AIA Oregon 2022 award winner.

How did we help get there?

- Designed to outperform Oregon Energy Code by 25%.
- DOAS with ERV's, displacement ventilation, and high efficiency water heaters.
- Advanced energy metering and controls.

Project Goal Setting & Evaluation

To steadily progress more of our projects toward a sustainable, zero carbon and zero energy future, Glumac signed on to the AIA 2030 Commitment and Carbon Leadership Forum (CLF) MEP 2040 Commitment.

Glumac Industry Climate Commitments

The AIA 2030 Commitment and Carbon Leadership Forum (CLF) MEP 2040 Commitment were established to help the industry understand how much carbon we need to reduce in buildings to act on climate science and government policy. The goals are simple, straight forward, and give us the direction needed to implement this action plan.

AIA 2030 Commitment

All new buildings, developments, and major renovations emit zero carbon by 2030. Achieving zero emissions will require energy efficient buildings that use no on-site fossil fuels (aside from back-up power supply) and are 100% powered by on-site and/or off-site (20% max) renewable energy. Existing buildings have similar goals considering their limitations.

CLF MEP 2040 Commitment

This challenge shares the AIA 2030 goal for zero operational carbon emissions and, in addition, challenges the industry to zero embodied carbon in MEP equipment and refrigerants by 2040.

Glumac Internal Climate Commitments

Electrified Memorandum of Understanding.

Glumac has issued a memorandum of understanding that our Engineering Services Team will propose electrified basis of design heating systems on all projects. If the client desires a gas-based heating system, Glumac will outline the benefits of electrified systems in relation to carbon emissions to assist the owner is making an educated decision should they still desire a gas-based heating system. In cases a client chooses a gas-based system, we will still provide engineering services, that said, we will ensure we start the conversation with electrified options.

Steadily advancing these commitments is important to our success because 1) it delivers on our vision and mission, 2) sets design goals for the company, and 3) aligns with our architectural clients.

Energy Benchmarking Projects

Every project that meets the Qualified Project definition here has the tools available to establish an energy baseline and target early during Concept and Schematic Design.

Qualified Projects include all Glumac projects that have an available baseline for comparison AND:

- Glumac is the Engineer of Record or is providing design information that will influence the project outcome such as design-build narratives, AND/OR
- Glumac can influence design through other services such as peer review, energy modeling, or other performance/sustainability services.

Click Here to Access Glumac's AIA 2030 Guide for Tracking Projects

A link to Glumac's AIA 2030 Guide for Tracking Projects is provided above. The guide is intended to help the Mechanical & Energy Team members enter and report projects through the AIA 2030 DDx online platform. In just 15 minutes, users can enter basic project information and the DDx platform will provide a project EUI baseline, EUI target, and forecast a design reduction on meeting local energy code (or based on an energy model when available). The target EUI is the project's goal to meet AIA 2030 and what Glumac is striving for our projects to achieve.

The guide also provides an easy step-by-step process for reporting projects in the DDx platform. Reporting is annual, so the Mechanical & Energy teams will need to enter the DDx platform and update project information on an annual basis.

To meaningfully make progress toward our AIA 2030 commitment, we need to take strong, immediate and deliberate action toward lowering carbon in our building designs and achieving EUI target scores.

Lawrence Livermore National Laboratory, Livermore, California

Electric Vehicle Charging Engineering Study

What did we Accomplish?

- Assessment of 35 locations across several parking lots identified over 400 possible EV charging locations for Level 2 and/or DC faster charging.
- Selection and prioritization factors included installation cost, minimal disruption to existing infrastructure, and proximity to existing electrical services.
- Developed a campus EV master plan to secure funding.

Tools & Training

> Glumac creates educational opportunities and provides resources for engineers to effectively reduce carbon on their projects. ASHRAE and AIA also provide guidance to support the integrated design process and understand methods and strategies to reduce carbon and advance sustainable design. We draw upon these resources to improve our tools and design process. Here we provide a snapshot of what is guiding us today.

ASHRAE and AIA
Supporting a whole carbon lifecycle approach is guidance from **ASHRAE's Task Force for Building Decarbonization**. Its **Position Document on Building Decarbonization**, and technical resources including a Zero Net Energy and Zero Net Carbon standard, demonstrate that the industry is pivoting to a zero carbon and renewable energy future as the new standard of care in the engineering practice.

In support of ASHRAE's position, is a steady flow of industry leading guidance from the AIA. These online interactive tools can help any team quickly gain perspective on sustainability opportunity, so that we are ready with ideas to share with our architectural and building owner clients.

Framework for Design Excellence: Online graphic portal comprising creative solutions for zero-carbon, equity, resilience, and health.

2030 Palette: Carbon solutions identified at scale.

MEPLT Schematic Design Narrative
Opportunities to incorporate sustainable design into projects is highest during early phases of the project and becomes increasingly hard and more costly as a project progresses. For this reason, the Building Sciences Group and Engineering Services Team have collaborated to ensure that deliverables for these phases are informative and present options to push client's awareness for what might be possible for their projects and what the industry leading sustainable strategies are. Even on projects that do not include specialty services such as Energy and Sustainability, it is expected that Glumac provides basic consulting in this area on every project.

In our MEPLT Schematic Design narrative, each discipline subsection includes Sustainable Design Features that will be included in the project design or further studied and evaluated. Our charge is to provide clients with quality options to hit the goal.

Integrated Design Tools
Successfully integrating sustainable design features on projects requires consistent management of goals throughout all project phases in the design process. Regular team collaboration internally, and externally with the owner and design team is fundamental to successful sustainability consulting on projects. Educating and engaging our clients is paramount to achieving our 2030 goals. To support this process, Glumac has provided simple step-by-step action item lists by design phase. They can be found on SharePoint in the Engineering Resources Folder and on Quick Links.

Our MEPLT Schematic Design narrative offers our clients quality options to hit a project's AIA 2030 target EUI.

The Base Integrated Design List is for all projects to use. This tool is meant to help Project Managers and teams incorporate a conversation about sustainability goals early and engage the client. The Base List includes the top 12 actions every project can take during Schematic Design and Design Development. The list includes links to resources including an example client communication, MEPTL goals and strategies, and a coordination agenda that can all be found in Quick Links too.

There is also an Enhanced Integrated Design List for projects. This list is for projects that begin with climate and sustainability goals or are looking to enhance the sustainable design effort through all project phases. The Enhanced List builds off of the Base List and includes a LEED Excel worksheet and a step-by-step guide for MEP engineers to progress sustainability goals by design phase. The embedded resources in the Enhanced List can also be found in Quick Links.

Through this work, we hope to help you consistently implement the Sustainable Design Features listed in our SD Narrative, on every project, and successfully reduce energy and carbon emissions, so that we can be best equipped to meet our 2025 and 2030 AIA and CLF Climate Commitment goals.

BASE INTEGRATED DESIGN LIST FOR ALL PROJECTS TO USE

1. Identify an internal sustainability champion.
2. Talk to the client about sustainability and their goals for the project [Word Doc: sample client sustainability communication]
3. Incorporate a discussion of sustainability goals and strategies and who's responsible at the internal project kick-off.
4. Ask the architect or owner to include a discussion of MEP sustainability goals and strategies in the project kick-off agenda [Word Doc: Sample client sustainability communication]
5. Use the AIA 2030 DDx online platform to set the project's target EUI.
6. Prepare a Schematic Basis of Design narrative.
7. Discuss with the design team and client if electrified systems and renewable power (on and off-site) are appropriate for the project.
8. Review the linked sustainability strategies for applicability to the project. [Excel Workbook: Sample sustainable MEP goals and strategies]
9. Include sustainability as an agenda item at every internal team coordination meeting. [Word Doc: Sample sustainability agenda insert]
10. Update the Basis of Design to include any decisions to include or not include proposed sustainability strategies.
11. Present sustainability strategies (that carry a cost premium) to the general contractor for their input and pricing.
12. Present sustainability strategies to owner for decision-making.

TOOLS & TRAINING

Webinars & Continuing Education

Many of the learnings from our projects get passed down to our new projects and an increasing number of employees become trained in the process. Training and mentoring each other is a great way to expand our passion for sustainability across the company, but this organic process doesn't ensure everyone benefits.

To make climate and sustainable design education accessible to all employees, Glumac provides the following trainings and resources.

Regional Decarbonization Trainings	2021 – Recorded and Logged on Quicklinks (All Engineering)
Project Manager 101 Trainings on Building Sciences Group service offerings	2022 – Recorded and Logged on Quicklinks (Project Management/Training Videos)
USGBC Silver Membership CEU Educational Content Database	Accessible to all employees who are connected to our membership using their Glumac.com e-mail address. USGBC Education
Glumac Sustainability Matters newsletters	Released quarterly
Glumac Sustainability Quicklinks	Covers carbon, energy, water, health and resilience (Building Sciences/Sustainability)
Virtual Conferences & Post Conference Offerings – Educational Content Access	Accessible to all employees when available (typically for a limited timeframe)
Glumac Personnel Manual – Company reimbursement for sustainable design credentialing	Review Personnel Manual

Our Engineering Services Team continues to identify new trainings as markets mature, for example, in electrification and microgrid and battery systems and technology.

Annual Reporting Protocol

Using the Glumac Project Checklist Tool (PCT) Glumac Project Managers are required to enter specific project metrics that will be used to report projects. The data is kept as annual records for compliance. As an AIA 2030 Commitment signatory firm, Glumac reports on progress annually through the Design Data Exchange (DDx), with data for projects due by March following the reporting year. The DDx was created by AIA to provide a standardized reporting format for measuring progress both at the firm and national levels. The DDx also serves as a research tool, allowing confidential comparison of project performance based on type, size, climate, and many other attributes. Glumac uses its internal database to auto upload the data to the DDx platform through a bulk upload feature.

In addition to AIA 2030 metrics stored in the DDx platform Glumac's internal database tracks electrification and refrigerants on our projects. This information is available through web-based dashboard tools that can assist with tracking current goals and setting and tracking future goals. This system is in its second year of implementation, and we anticipate it being fully functional at the completion of the 2024 fiscal year.

Qualified Projects:
The following Glumac projects are to be included in annual reporting:

- All Glumac projects that have an available baseline for comparison AND
  - Glumac is the Engineer of Record or is providing design information that will influence the project outcome such as design-build narratives AND/OR
  - Glumac can influence design through other services such as peer review, energy modeling, or other performance/sustainability services.

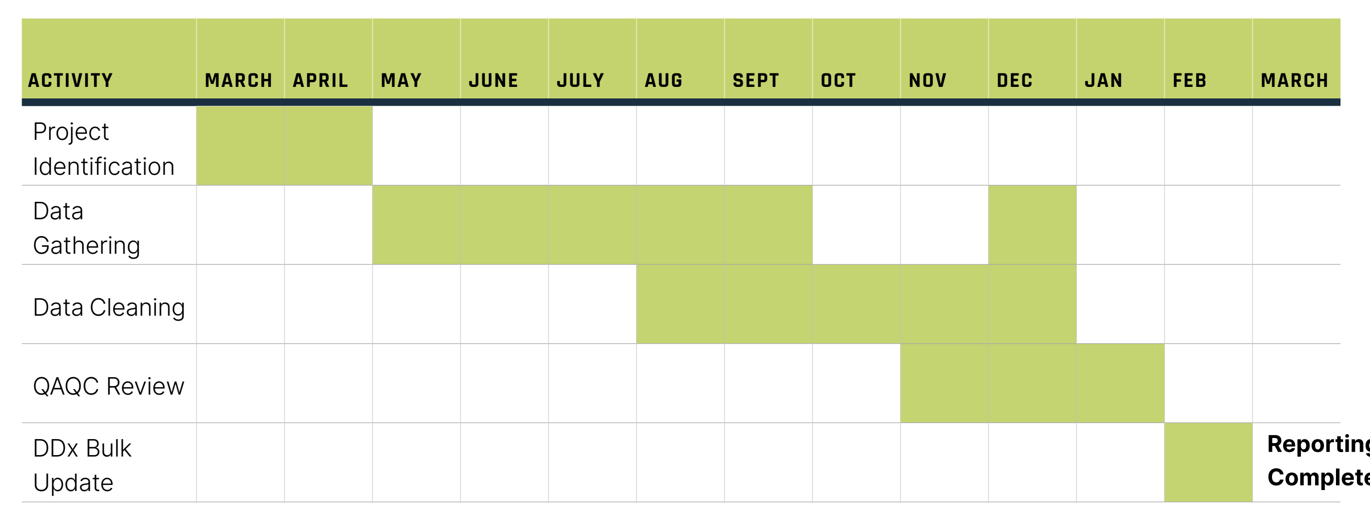
Reporting is updated annually for qualified projects spanning multiple years.

For more information, please reach out to Glumac's Chief Sustainability Strategist.

ANNUAL REPORTING PROTOCOL

Reporting Timeline

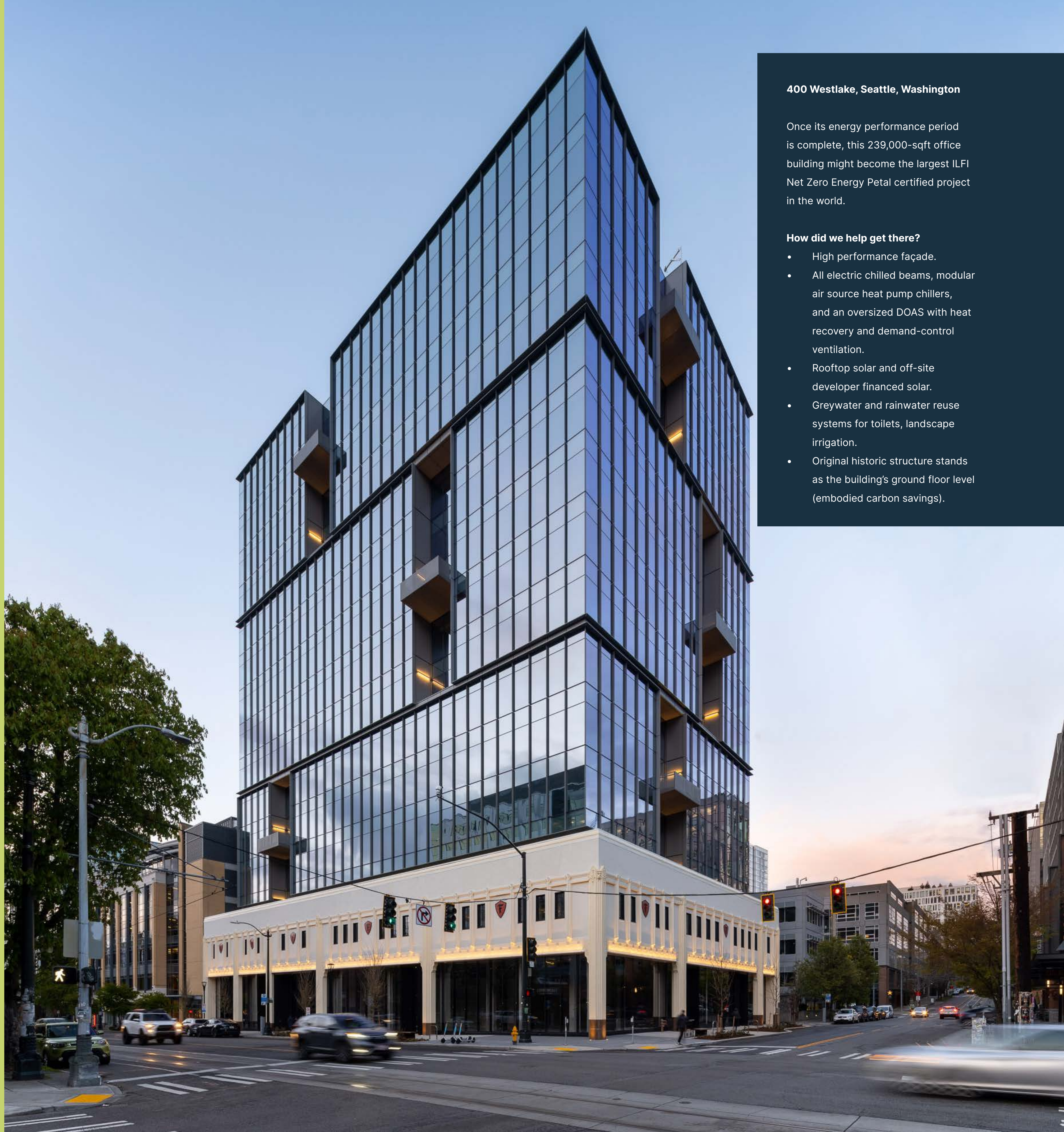
Glumac follows a progress plan to annually report to AIA 2030. Projects are uploaded annually to what is called the DDx Platform and are due in March. Designed annual operating energy is required, actual operating energy is reported where available.



Achieving Design Excellence

This section defines how we work together under the integrated design process taking a holistic approach to reducing carbon and a broad perspective on sustainability to achieve even greater results.

WHAT'S INSIDE



400 Westlake, Seattle, Washington

Once its energy performance period is complete, this 239,000-sqft office building might become the largest ILFI Net Zero Energy Petal certified project in the world.

How did we help get there?

- High performance façade.
- All electric chilled beams, modular air source heat pump chillers, and an oversized DOAS with heat recovery and demand-control ventilation.
- Rooftop solar and off-site developer financed solar.
- Greywater and rainwater reuse systems for toilets, landscape irrigation.
- Original historic structure stands as the building's ground floor level (embodied carbon savings).

The Integrated Design Process

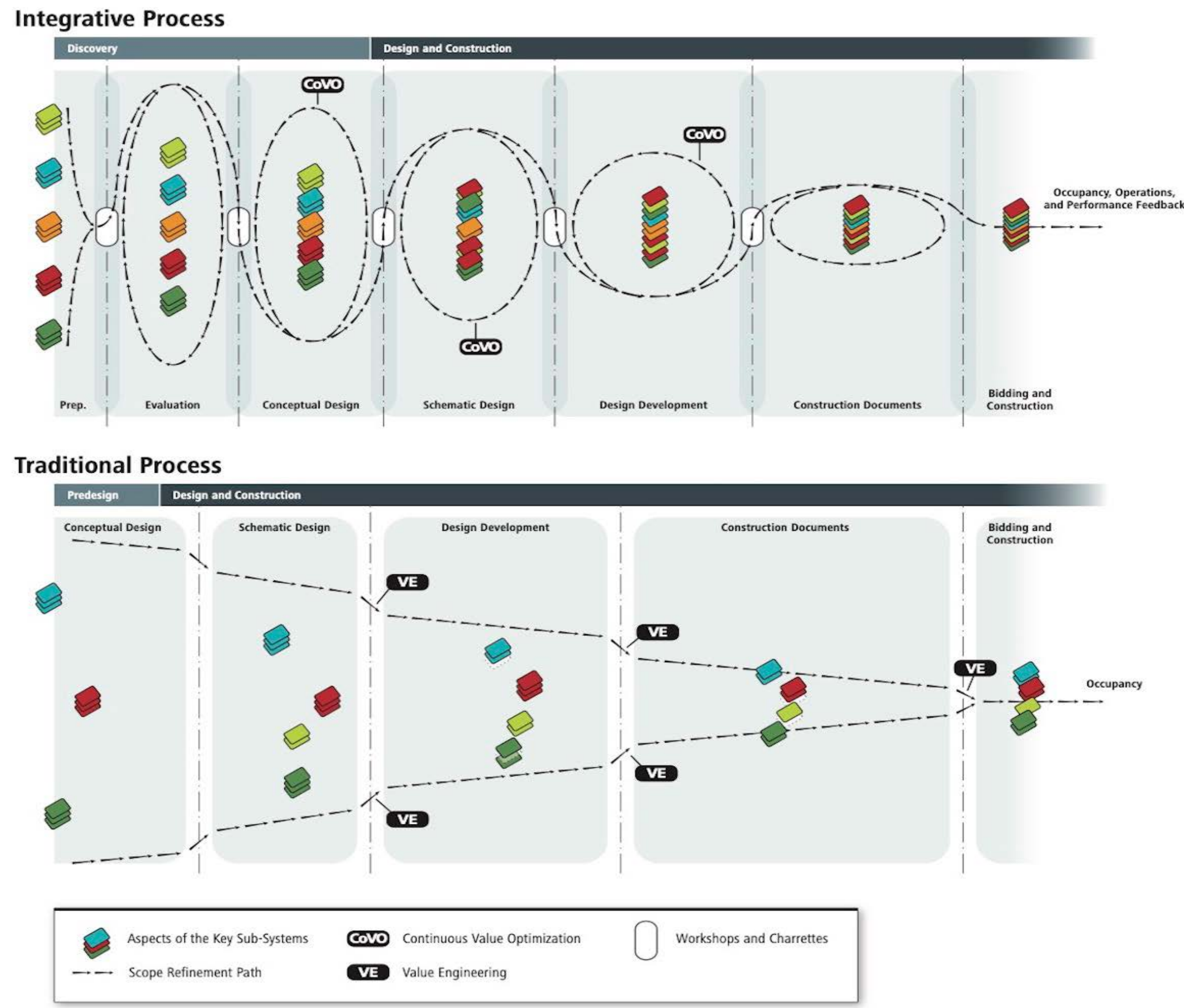
> Across Glumac, employees often repeat that the top reasons for working here are: 1) the people, and 2) our collaborative spirit. We enjoy working together, yet the skill and practice needed to realize multi-beneficial sustainable solutions can begin with great intentions, but overtime, lose momentum and feel messy and vague.

This unfortunate outcome can happen for many reasons, but most often, it's because the process itself is self-limiting as aptly described in the book: The Integrated Design Guide to Green Buildings by 7group and Bill Reed (2009). As the book explains, we're limited by conditioned expectations and preconceptions of what defines a successful process such as speed of completing a phase, ease of identifying costs, ease of code approvals, and parallel reasons that we miss the opportunity to study the project's big issues in an iterative, collaborative manner. Even, with LEED projects, we can find ourselves limiting our thinking to the issues defined by the tool itself, and we often end up designing to the tool. How does this impact results?

- We design without questioning our assumptions, thereby missing opportunities.
- We operate separately, in silos, without understanding interdisciplinary linkages, thereby missing more opportunities.
- We lack alignment around common purpose and a commonly understood integrated process.

So, what does a fruitful Integrated Design Process (IDP) look like? One that operates within the conventionalized set of values that defines projects today, but is uncompromising in our desire to collaborate? A great example that we can use internally and with our clients and design teams can be adapted from a repeated pattern of research/analysis and team huddles or workshops as detailed in the book.

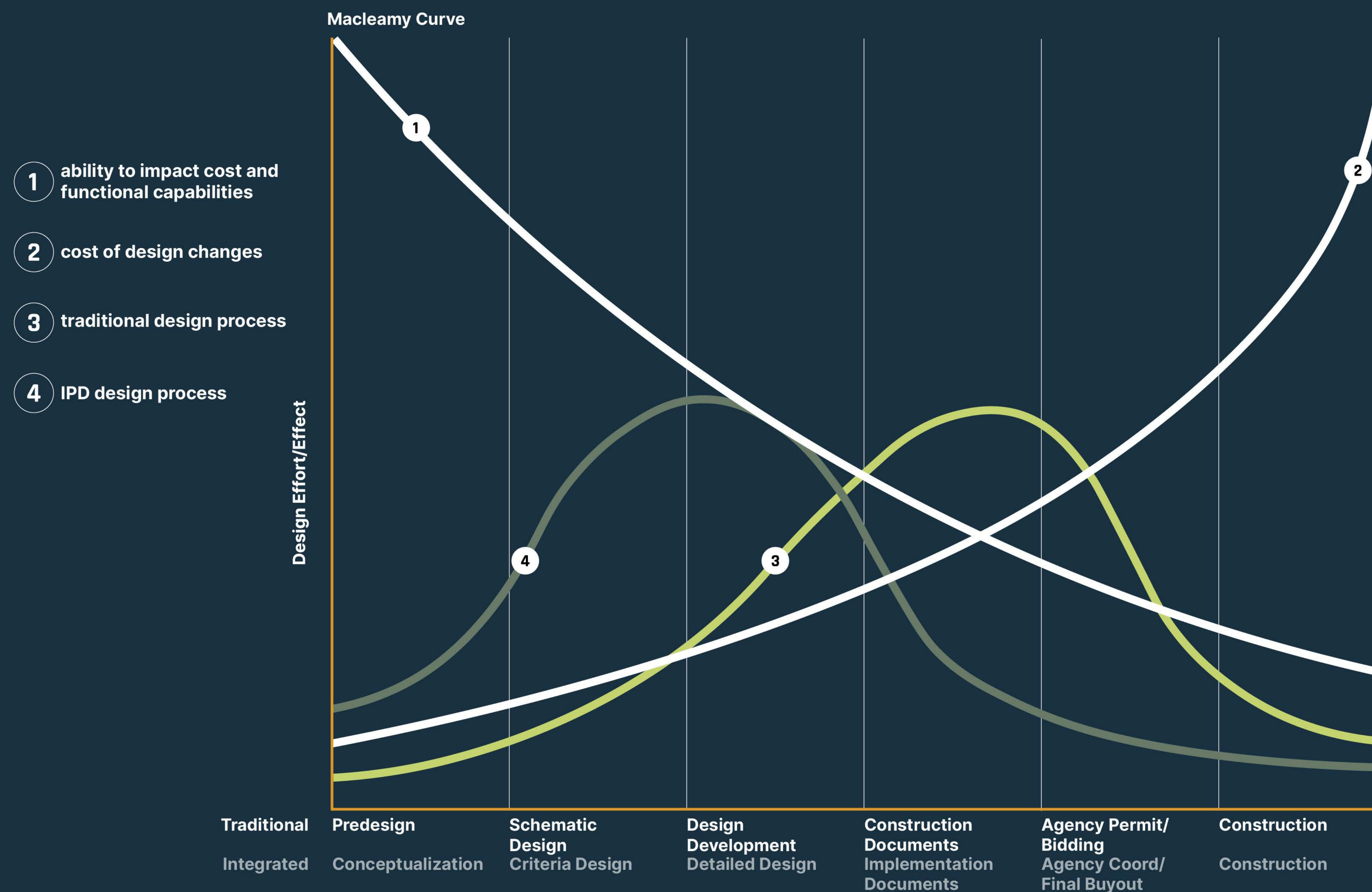
The general form of this repeating pattern is represented in Integrated Process graphic to the right and compared to the traditional design process. **A key collaborator in IDP is the Building Sciences Group (BSG), which touches a large portfolio of projects. The BSG often has insights into goal setting, design strategies, life cycle costs, data analysis, visualization tools, and functional operations at its fingertips. Engaging the BSG early can help establish this patterned process, aid with facilitation, and progress ideas forward.**



Integrated Design Process and Traditional Process illustrating optimal design collaboration compared to the traditional process along the same timeline. Image Courtesy of BuildingGreen, Inc. and originally depicted in the book: The Integrative Design Guide to Green Buildings by 7group and Bill Reed (2009).

- Research/Analysis: Our team internally or in collaboration with the design team initially develops a rough understanding of the issues associated with the project before meeting (e.g., site, electrification, building orientation, solar availability, water uses, embodied carbon budget, indoor air quality, program, budgetary resources, etc.). The intent is for the design process to begin with a common understanding of base issues.
- Huddle or Workshop: Team members come together (or externally with all stakeholders) to share and compare ideas, set performance goals, and begin forming a cohesive team that will function as a consortium of co-designers.
- Research/Analysis: Team members go back to work on their respective issues – refining the analysis, testing alternatives, comparing notes, and generating ideas in subgroups.
- Huddle or Workshop: The team reassembles for a deeper discussion of overlapping benefits and opportunities – for example, how best to utilize the "surplus" product from one system to benefit other systems on a path to net zero (e.g., passive solar, daylight, heat recovery, water reuse, simplified structural systems, etc). New opportunities are discovered, explored, and tested across disciplines, and new questions are raised.
- Research/Analysis: Team members separate again to design and analyze with more focus and potentially with greater benefits accruing. New ideas are uncovered. Subgroups continue to meet as many times as needed. At this stage, the process can start to feel messy with too many items to study, and the potential to consume too much time. To avoid this from happening, revisit the big issues identified during the initial research/analysis stage, focus on the goals, and progress ideas that are nested and can accommodate a package of beneficial integrated strategies. **The more integrated the ideas, the less exposure they have to scrutiny and value engineering.**
- Workshop: The team reassembles once again to further refine the design, to optimize systems being used (building, low carbon MEP systems, renewable power, etc.), measure progress toward performance goals, and integrate other systems connected to the project (health, materials, embodied carbon, habitat, etc.).

The MacLeamy Curve illustrates the notion that the further a project team is through the design process, the greater the cost of design changes. The Integrated Design Process (IPD) works to control costs through early and intentful design collaboration.



The Integrated Design Process, cont.
The pattern continues until iterative solutions move as far as our team would like (or if in collaboration with the design team, as far as the client wishes). The number of huddles or workshops depends on the project scale and scope, but some level of intentional integration should occur a least every two weeks to maintain momentum.

With all of the additional early analysis required, it is often assumed that IDP takes longer; but that is not necessarily true. As described in the book, the overall time from project inception to the delivery of bidding documents can remain the same, but the allocation of effort is redistributed. As a rule of thumb, taking twice as much time during the schematic design (discovery) phase to intentfully establish the collaborative process, set goals, and study ideas, the design development time can be reduced, and construction documents can be cut by over a third. This happens because the construction documents phase is utilized solely for documenting earlier design decisions rather than being encumbered by continuous design changes (as it currently is, in most cases) that can come at greater cost). Using this process in conjunction with Revit BIM modeling, teams can shorten the time required for documentation, resolve design conflicts, and overall, produce higher quality documents.

In summary, our unique sense of camaraderie and desire to collaborate is an intangible foundation to successful design process, and we can take pride in expressing this mindset in the way we deliver projects with our client and design teams as a matter of normal practice. And by adopting IDP's structured methodology, we can stay focused on project goals, and bring high value interdisciplinary expertise to our clients.

Integrated Design Process Case Study

California Department of General Services Natural Resources Headquarters

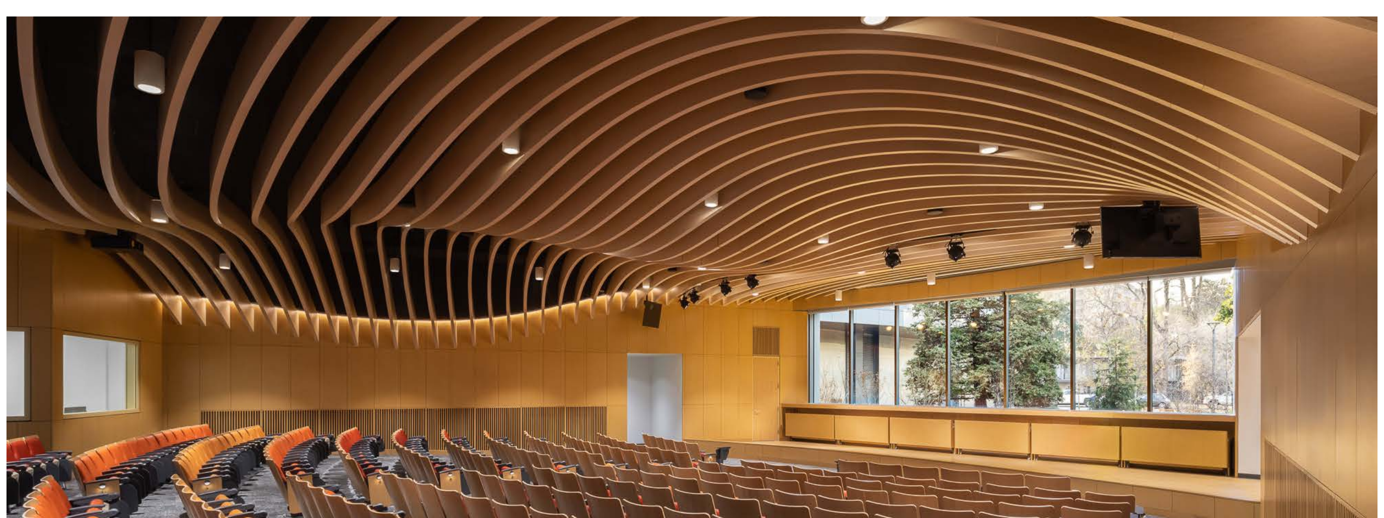
Sacramento, California.

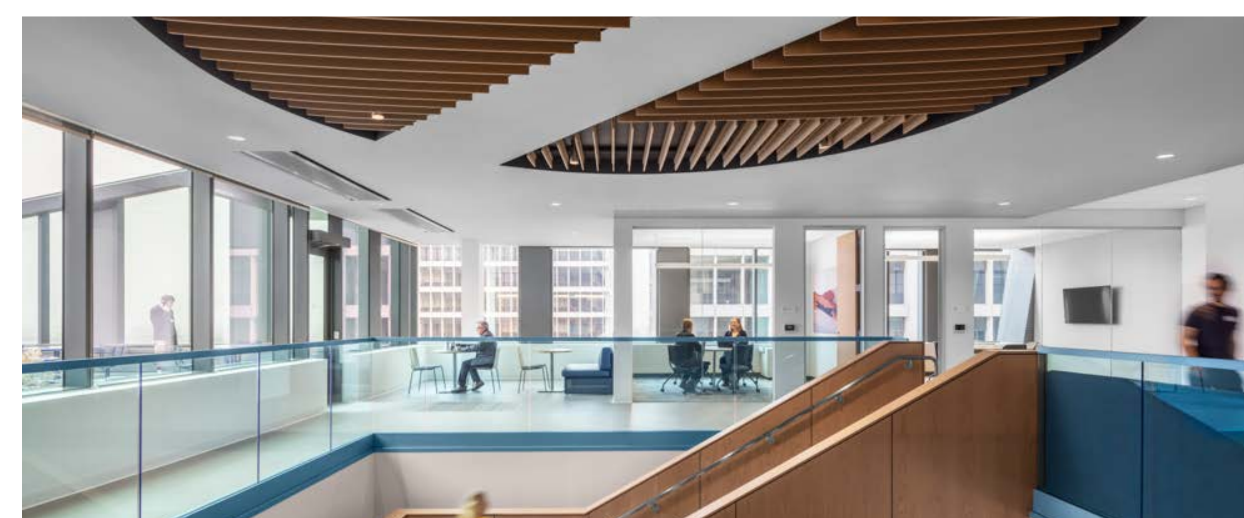
This Design-Build collaboration encompassed a very large team making the integrated design process both complex and integral to the project's success. Members assembled in what was called "The Big Room" to meet several times a week. Two sustainability workshops were held to establish project goals. And several smaller huddle meetings took place through Schematic Design and Design Development phases to progress energy/carbon, site/water, and materials/health strategies that would meet the goals. The huddles functioned to study ideas and share progress on strategies such as greywater reuse, onsite renewables, rainwater infiltration, bird-safe facades, healthy materials, and envelope design and mechanical systems, among others. While not all strategies were implemented, the process provided a holistic view on sustainable design opportunity and valuable cost/benefit information to the owner as they compared options and made decisions.

The California Department of General Services Natural Resources Headquarters is a large net zero energy emissions and LEED Platinum office building standing at 850,000 square feet.

How did we help get there?

- Mandatory EUI goal of <30 kBtu/sf/yr (modeled 28.2).
- High-performance façade.
- Central penthouse AHU's with heat recovery. VAV with low velocity air distribution, and active chilled beams at perimeter walls. Infloor radiant at lobby. Advanced controls.
- Central Utility Plant (CUP) for chilled water, heating and domestic hot water (gas).
- 5,000-gallon greywater collection system.
- 49 installed products have Health Product Declarations (HPD's).
- Comprehensive MEP commissioning.





Taking a Whole Carbon Approach

> With a systems-based mindset, we can take a big picture, lifecycle view of a building and consider the full range of impact and opportunity to specify systems and equipment with lower embodied and operational carbon.

In 2022, ASHRAE released a position document on building decarbonization along with recommendations for moving forward. The paper elevated the urgency to turn climate commitments and goals into action and sets the tone for this Action Plan.

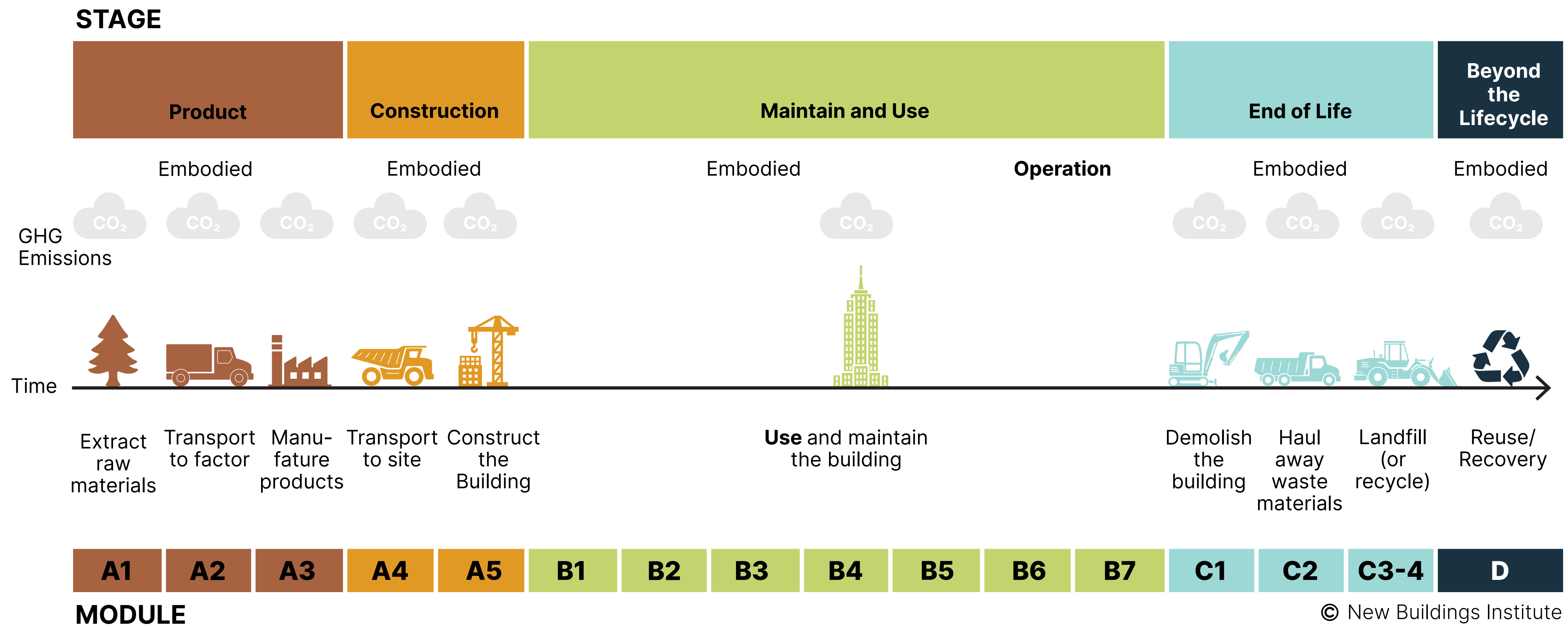
As stated in the paper, building decarbonization encompasses a building's entire life cycle, including building design, construction, operation, occupancy, and end of life. Building construction, energy use, methane, and refrigerants are the primary sources of greenhouse gas (GHG) emissions. GHG emissions are often referred to as carbon emissions to simplify discussions and measured in carbon dioxide equivalents (CO_2e), which stands for the number of metric tons of CO_2 emissions with the same global warming potential as one metric ton of another GHG.

Building life-cycle assessment involves consideration of operational and embodied carbon emissions. Operational emissions are generally from energy use. Embodied emissions include emissions associated with building construction, including extracting, manufacturing, transporting, and installing building materials, as well as the emissions generated from maintenance, repair, replacement, refurbishment, and end-of-life activities. Embodied emissions also include refrigerant releases across the building life cycle.

As MEP engineers, we need to make better choices in design that will lead to a lower carbon building over its entire lifecycle. With a systems-based mindset, we can take a big picture, lifecycle view of a building and consider the full range of impact and opportunity to specify systems and equipment with lower embodied and operational carbon.

The following sections lay out our general approach to lowering operational and embodied carbon emissions on our projects. Design synergies related to resilience, water, health, and social equity are also acknowledged to help provide a more holistic picture of related carbon impacts. The section is not meant to be an exhaustive tutorial nor to cover all aspects of sustainable design. It is meant to provide an overview of where we can meaningfully improve our designs to lower carbon to meet our climate commitments.

The second section of this report provides essential tools to thoughtfully guide the design process covering energy benchmarking, low embodied carbon selection guidance, a link to our Concept and Schematic Design level Basis of Design narrative template, and project process checklist tools.



Above: Building carbon life-cycle stages. As seen in the ASHRAE Position Document on Building Decarbonization, ASHRAE Position Document on Building Decarbonization.

Left: NTT RagingWire Colocation Data Center, Santa Clara, CA: This multi-storied, Tier III facility, comprises 4, 10,000-square-foot hall vaults totaling 16 MW total critical power. It is the first seismic base isolated data center in Silicon Valley

.

What efficiencies were included?

- 66-degree F. chilled water temps, and larger, close approach cooling coils for heat exchange, produce 70-degree F. air supply. The warmer temps mean less energy is used to cool incoming air (economization).
- 16 air-cooled chillers prioritize integral water-side economization serving the high-temp chilled water system, with refrigerant-based cooling as the backup.
- 11-foot-tall fan wall system uses premium efficiency ECM fans to process 2.5M CFM of air.
- Flexible utility connections accommodate a rolling base isolation system (allowing 32 inches of movement in any direction during an earthquake).

Lowering Operational Carbon Emissions

> To meet our climate commitments, we need to be adopting the Low Carbon Design Pathway on all of our projects. It can be adapted to any project, large and small, and tailored to align with our engineering scope of work from new construction, renovations, and tenant improvements.

From our history of energy efficient projects, the Building Sciences Group has honed an energy design process called the Low Carbon Design Pathway.

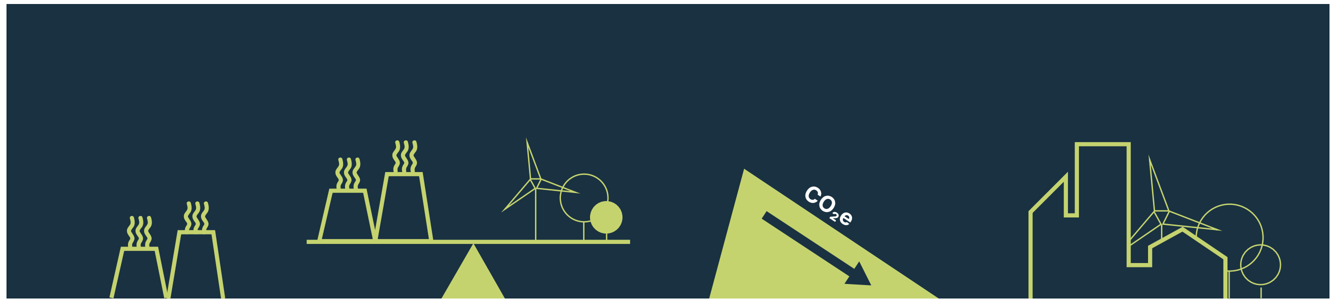
The Low Carbon Design Pathway aims to reduce operational carbon through a process of managing and conserving energy, electrifying systems, and then generating clean energy or sourcing it offsite to operate the building. The process minimizes or avoids the use of natural gas and other fossil fuels wherever possible and prepares the building to receive clean, renewable power as the grid modernizes and becomes cleaner overtime.

To meet our climate commitments, we need to be adopting the Low Carbon Design Pathway on all of our projects. It can be adapted to any project, large and small, and tailored to align with our engineering scope of work from new construction, renovations, and tenant improvements.

To demonstrate incremental reductions in energy use and carbon emissions, it is important that every project establish an energy baseline where available. An energy baseline is a method of benchmarking the building against similar building type and climate. A benchmark provides the project's Energy Use Intensity (EUI) per square-foot annually in kBtu/square-foot/year. With a baseline energy use, the Low Carbon Design Pathway can be referenced to incrementally make improvements to reduce the EUI toward net zero goals.

More on energy benchmarking can be found in the Project Goal Setting and Evaluation section of the report

The Low Carbon Design Pathway minimizes the amount of carbon a building uses over its lifetime, but it does not address the embodied carbon in the MEP systems and equipment we specify. To address this, a compliment to this design pathway is a lens on the embodied carbon impact of our equipment choices. By considering operational carbon and embodied carbon, we can approach decarbonization with a more comprehensive lens.



Defining Carbon Neutral and Net Zero Buildings

Defining a carbon neutral and net zero building can be confusing and ASHRAE and the New Buildings Institute provide definitions for use:

01 CARBON NEUTRAL

A Carbon Neutral building balances its fossil fuel use with carbon offsets, which are sold on the open market and represent the environmental benefit associated with renewable energy production or carbon capture projects.

02 DECARBONIZATION

Improving building efficiency and weaning buildings off fossil fuel by electrifying heating and hot water systems to operate on clean, renewable power is the process of Decarbonization.

03 NET ZERO ENERGY EMISSIONS

A building achieves Net Zero Energy Emissions by producing or purchasing enough emissions-free renewable energy to offset emissions from all energy used by the building over the course of the year.

04 NET ZERO ENERGY

A Net Zero Energy building generates 100% of its demand onsite with renewable energy although there is some scale jumping allowed.

05 NET ZERO CARBON

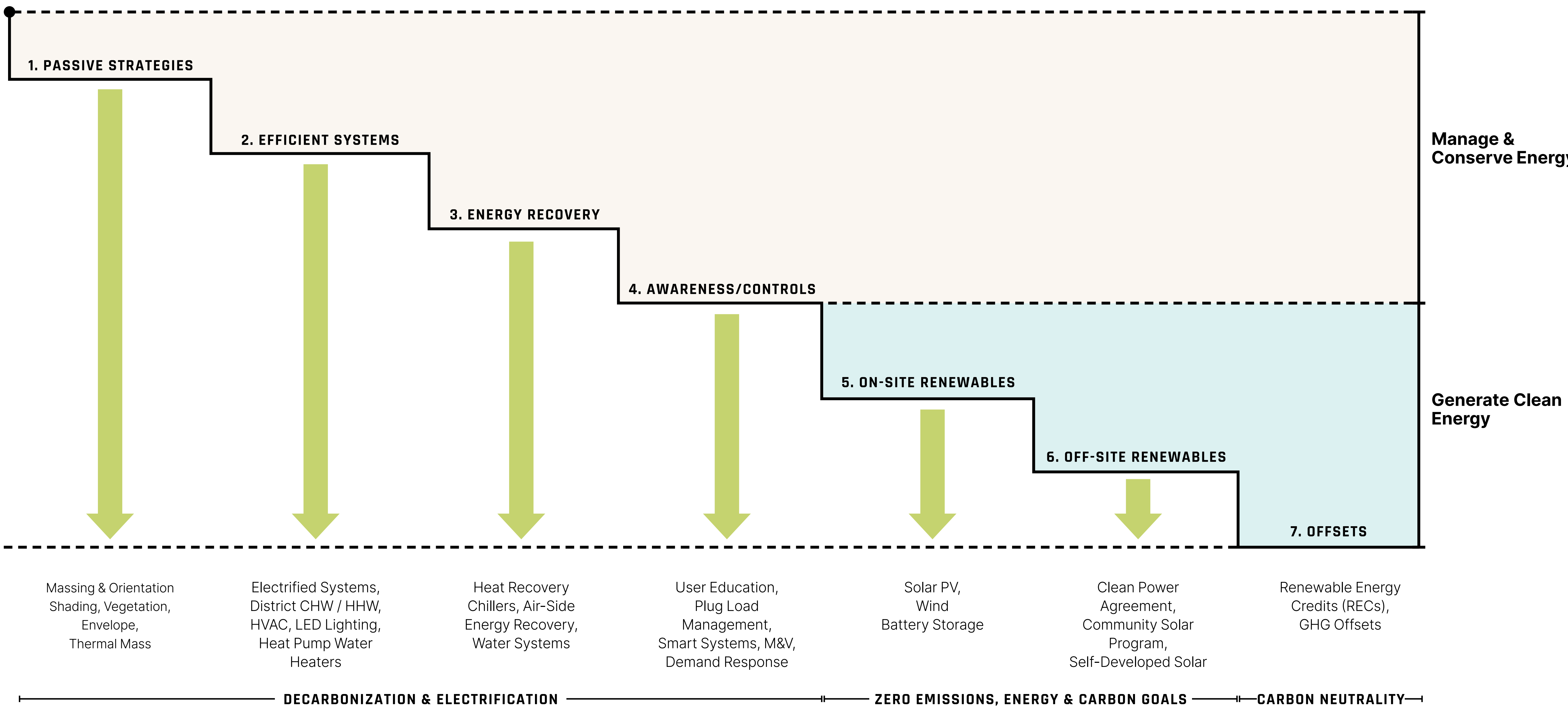
Net Zero Carbon building definitions range from all electric buildings to buildings that also lower embodied carbon and purchase offsets to balance the remaining material impact.

Source: The Vocabulary of ZNE: A Guide to Zero Net Energy Terminology in California

TAKING A WHOLE CARBON APPROACH

Design Pathway to Low Operational Carbon Emissions

There are many ways to introduce sustainable thinking to projects. But to achieve significant operational carbon reductions across the lifespan of a building, we have developed the below pathway to help guide your projects.



Lowering Embodied Carbon

> The embodied carbon emissions associated with MEP equipment can be significant in a building lifetime primarily due to refrigerant use, material use, and replacement rates.

Metals, plastics, and other components emit carbon in their manufacturing process and mechanical cooling systems, particularly VRF systems, can carry high refrigerant loads. The total volume of refrigerant specified is not harmful – only the amount that escapes to the atmosphere, so refrigerant selection, understanding leakage rates, and specifying best practices to minimize leakage during installation, can all help to lower embodied carbon.

To lower carbon emissions from equipment and refrigerant use, we can influence outcomes by:

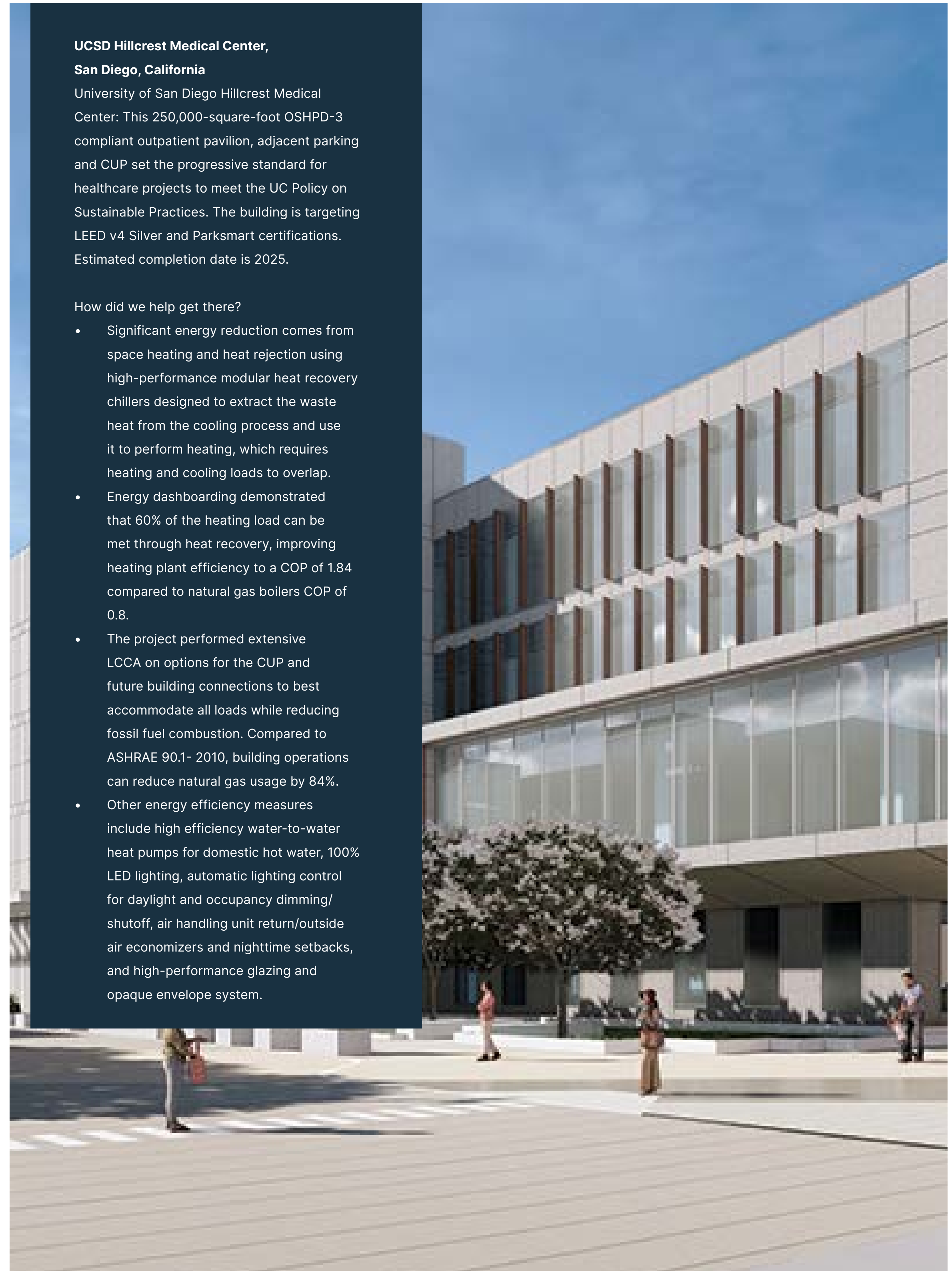
- **Requesting low-GWP refrigerants** when designing systems to reduce or eliminate GHG emissions. Low GWP refrigerants can be specified and provide the same level of performance in a piece of cooling equipment as its conventional baseline refrigerant. Discussing refrigerant options with manufacturers and vendor representatives can help identify options and advocate for further progress in the MEP industry for low GWP refrigerants.
- **Requesting Environmental Product Declarations (EPDs)** in MEP, Lighting and Low Voltage equipment specifications. EPD's are not as widely available for engineering and lighting equipment, so it's important to keep asking for it to show manufactures and vendor representatives that this information is needed to make design decisions. Advocacy leads to more prioritization, and the development of new EPD's will accelerate.

To help advance our understanding of embodied carbon in MEP equipment, the Sustainability Team co-leads the Carbon Leadership Forum's Data, Analysis & Reporting group. They work to educate, harvest industry data, and build helpful tools for the reporting process. Three new resources found on their website include:

- **Educational Intro Slides:** Tutorials to understand, calculate, compare, and reduce the carbon footprint of MEP systems.
- **Beta Refrigerant Impact Calculator:** Calculates leakage rates when installed, on an annual basis and loss at end of life. Considering the vast amount of loss for some equipment, the environmental impacts can quickly add up to a significant portion of the embodied carbon for an entire new building.
- **TM65 Embodied Carbon in Building Services Calculation Methodology (2021):** A calculation methodology for MEP systems.

RESOURCES WE CAN USE TO MAKE LOW EMBODIED CARBON CHOICES

Data Sources	What is Provided
Product Data Sheets	Equipment manufacturing location (regional / US made material) Quantities and volume of major material types (e.g., types of steel, plastics)
Refrigerant Impact Data	Refrigerant type and volume Global warming impact (common metric)
Environmental Product Declarations (EPD)	If available for a piece of equipment, an EPD may contain all the information listed above. Here is a link to a recently updated EPD.



UCSD Hillcrest Medical Center, San Diego, California
University of San Diego Hillcrest Medical Center: This 250,000-square-foot OSHPD-3 compliant outpatient pavilion, adjacent parking and CUP set the progressive standard for healthcare projects to meet the UC Policy on Sustainable Practices. The building is targeting LEED v4 Silver and Parksmart certifications. Estimated completion date is 2025.

How did we help get there?

- Significant energy reduction comes from space heating and heat rejection using high-performance modular heat recovery chillers designed to extract the waste heat from the cooling process and use it to perform heating, which requires heating and cooling loads to overlap.
- Energy dashboarding demonstrated that 60% of the heating load can be met through heat recovery, improving heating plant efficiency to a COP of 1.84 compared to natural gas boilers COP of 0.8.
- The project performed extensive LCCA on options for the CUP and future building connections to best accommodate all loads while reducing fossil fuel combustion. Compared to ASHRAE 90.1- 2010, building operations can reduce natural gas usage by 84%.
- Other energy efficiency measures include high efficiency water-to-water heat pumps for domestic hot water, 100% LED lighting, automatic lighting control for daylight and occupancy dimming/ shutoff, air handling unit return/outside air economizers and nighttime setbacks, and high-performance glazing and opaque envelope system.

What is an Environmental Product Declaration (EPD)?
An EPD is a "nutrition label" for a product's environmental footprint. Just like with a food nutrition label, you need to know what you are looking for to know whether a product is healthy: looking at an EPD on its own won't tell you whether or not a product is good for the environment.

EPDs provide environmental data based on a life cycle assessment (LCA) that is independently verified in accordance with ISO 14040 and ISO 14044. EPDs may report a variety of life cycle impacts in addition to global warming potential (GWP), such as acidification, eutrophication, ozone depletion, and smog formation. EPDs also typically include additional manufacturer and product data, such as ingredients, manufacturing processes and locations, and resource use.

Source: Guidance on Embodied Carbon Disclosure

Design Synergies

> Important to lowering carbon emissions on our projects is an understanding of how carbon intersects with other areas of sustainable design we can influence.

This section aims to address resilience and climate adaptation, water, health, and social equity. General guidance is provided to provide broader perspective on lowering carbon, so that we can take a holistic mindset to our project teams and position ourselves to help our clients achieve greater results.

Again, this section is not meant to be an exhaustive tutorial nor to cover all aspects of sustainable design. It is meant to provide an overview of where we can meaningfully improve our designs to lower carbon to meet our climate commitments.

Further guidance is provided in Section 2: Design Implementation.

Low Carbon Case Study

Credit Human Building, San Antonia, Texas

The all-electric building utilizes VRF conditioning tied to a central water-cooled condenser system. The system connects to a ground source heat pump with 150 wells. Instead of gas boilers, natural soil temperatures create heating and hot water. Heat is also rejected to the ground at all times of the year, limiting the use of the cooling towers. We have found that the cooling towers shut off regularly and it's saving a lot of water. To top it off (literally!), the rooftop solar system can produce 1 MW of power offsetting 40% of the building demand.

The owner (Silver Ventures) wanted to disprove that reducing energy and carbon and going all electric is too expensive. From their perspective as construction progressed, individual systems did not pencil out, but collectively looking at the total package, Silver Ventures anticipates a 7-year payback.

It's worth noting that VRF is a highly efficient solution and thus greatly reduces carbon emissions at the grid level, but its extensive refrigerant use is an embodied carbon and climate issue as it's a potent and top greenhouse gas. The refrigerant is piped throughout the building and is often site built versus factory built posing a refrigerant leakage risk. Knowing the developer wanted the flexibility of VRF for tenant use, we limited its use to each floor and used a water-cooled condenser system to connect each floor to the geothermal.

Credit Human's floor space actually uses in-slab radiant heating instead of VRF. This was a smart owner-occupied decision that further reduced refrigerant use.

Large tanks store 130,000 gallons of recycled water, the tallest tank having been salvaged from a local brewery. Recycling water onsite further reduces carbon by decreasing pump energy use that the utility would have used to distribute domestic water to the building from miles away.

Resilience and Climate Adaptation

> As MEP engineers and building science consultants, the systems we design can be pushed to their operational limits during these times. Therefore, designing systems that can adapt to changing conditions over the lifespan of the building is now an important factor for most of our projects.

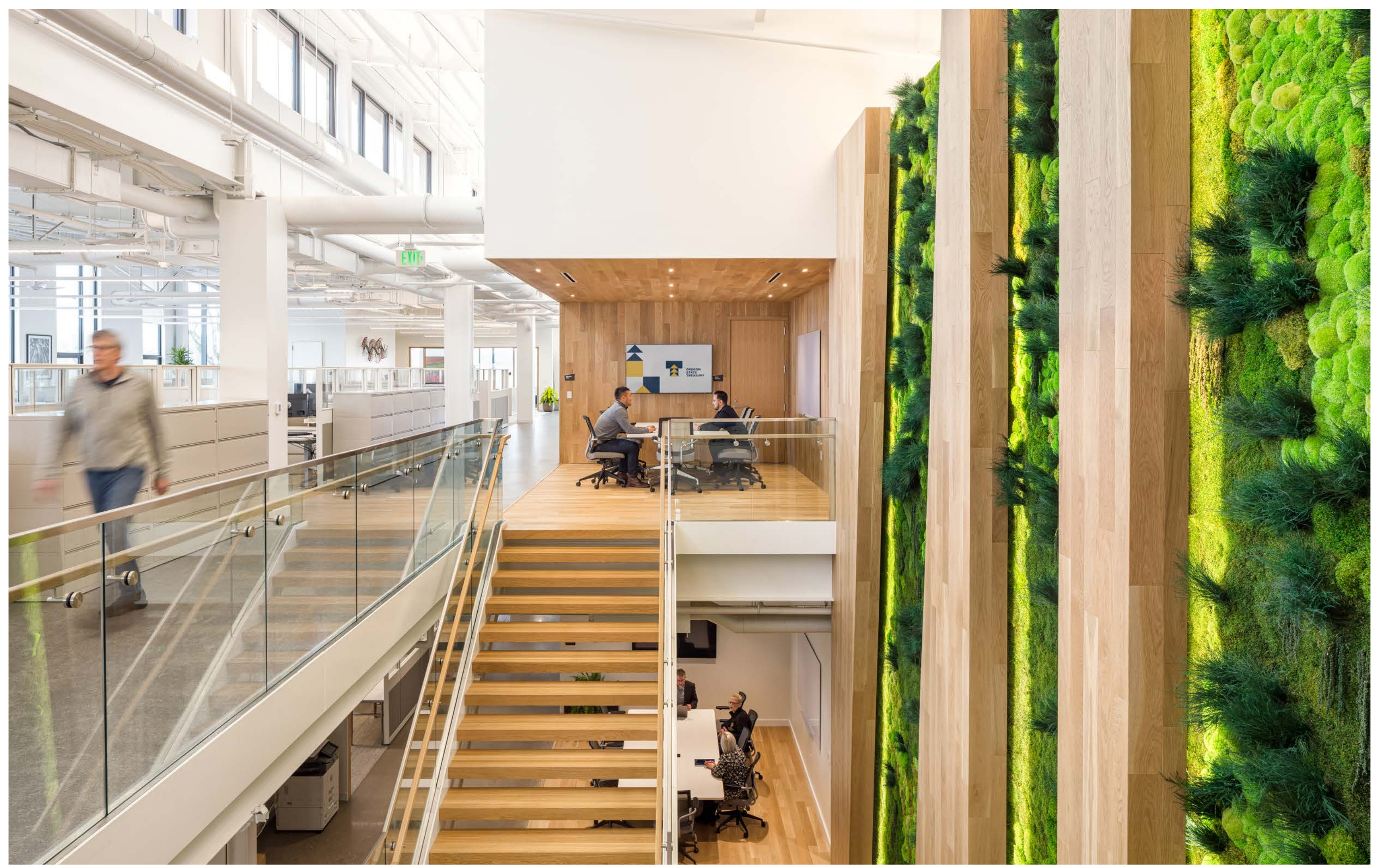
Increasingly, communities struggle to keep people comfortable and safe during extreme climate events and natural disasters. Extreme heat, wind, rainfall, wildfires, and winter storms are increasing in number and duration causing power disruption, water shortages, flooding, property damage, and in the worst cases, loss of life.

Most of our projects are in the communities we live in, and therefore, we are aware, firsthand, of the climate issues impacting us, and so do our local clients. Discussing the issues upfront helps to broaden the design lens to take a pragmatic, responsible approach to our designs combining adaptation with sustainable solutions.

Glumac's Building Sciences/Sustainability Quicklinks includes a short list of online webpages to help you explore the natural hazard and climate risks for your project area. There are also a few links to USGBC LEED resilience planning and credit opportunities that can be applied to any project regardless of whether it pursues certification.

ASHRAE's position Document on Climate Change includes recommendations for increased design temperatures. Under Quicklinks, users can navigate Climate Explorer. Through the Climate Charts module, Climate Explorer allows you to select and download average heating/cooling degree days for a specified period of years. Cal-Adapt allows you to do the same, but there may be a small fee.

The Building Sciences Group also houses resources and tools to share. The Sustainability Team has a Resilience Planning Toolkit that can help a team quickly identify and prioritize natural hazard and climate risks and track design strategies for further study and implementation. Additionally, the energy team can incorporate climate adapted weather files into their building models to simulate future heating/cooling loads and profiles and subsequent design considerations for envelope and MEP systems.



Resilience Case Study

Oregon State Treasury Building - Salem, Oregon
The new 33,770-square-foot Oregon Treasury Administrative Office Building is designed to meet the highest level of resilience and has been distinguished as the highest rated US Resiliency Council (USRC) Platinum building in Oregon and first USRC base isolated structure in the United States. In addition, the building is designed to mitigate risk and loss of operation and functionality after a 9.0 seismic event with the ability to withstand other disruptive events such as pandemic and climate induced events (flooding and poor air quality from forest fires).

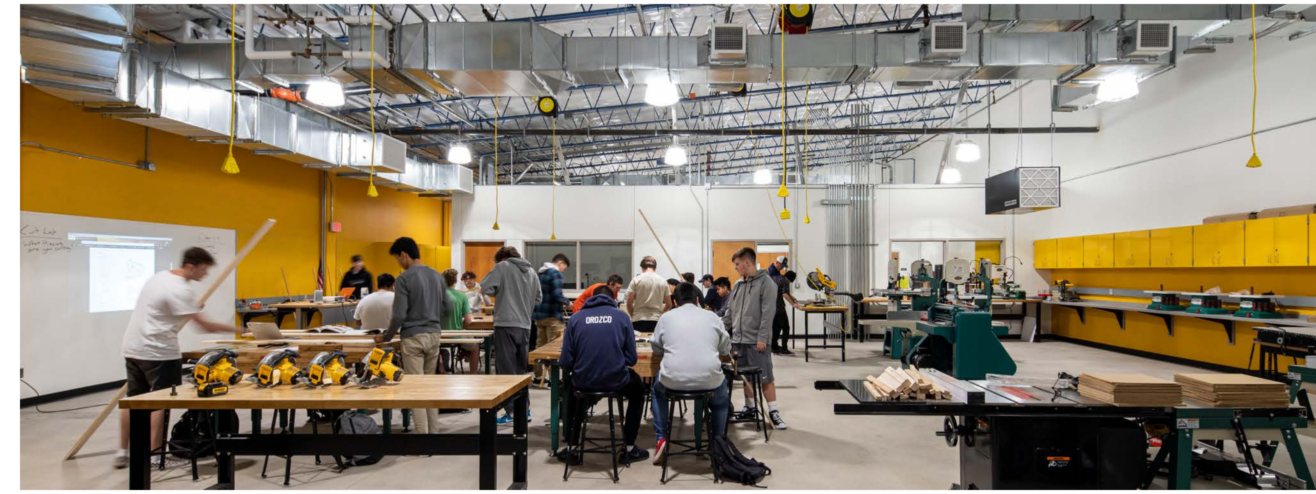
With a life expectancy of 100 years, the facility is designed to be net-positive energy, completely independent from the electrical grid, sourcing energy from its own operational microgrid and energy management systems (battery energy storage system, photovoltaics, and generators). All the systems and design features implemented in this high performing building are critical for the Department of Treasury to function and serve their constituents, financially supporting state and public agencies, as well as millions of Oregonians who rely on uninterrupted operation after a significant seismic event. The Oregon Treasury Administrative Office Building has been featured in a New York Times article and was an Oregon AIA 2030 award recipient in 2022.

DESIGN SYNERGIES

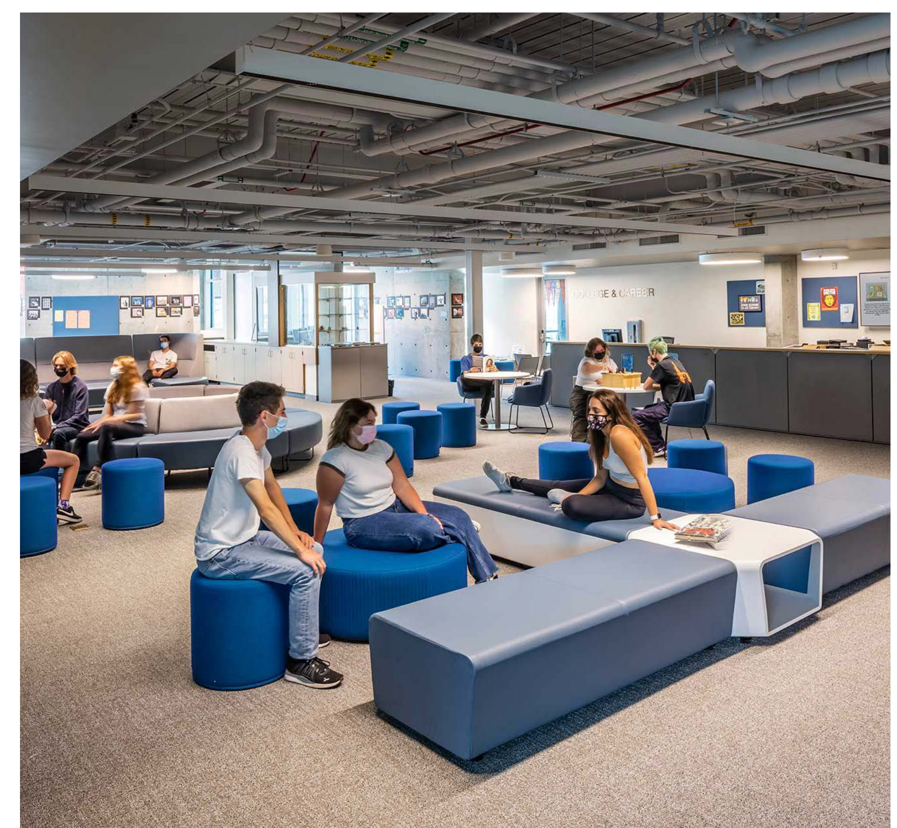
In 2023, Glumac completed an EPA guideline for schools to prepare district facilities for extreme heat and smoke. The matrix below was extracted from the guidelines and serves as a helpful, general matrix for school and commercial projects and an example of how we can provide resilience guidance on our projects.

	COVID	Smoke (Wildfires)	Heat Waves	Heat & Smoke
PM 2.5/PM 10 Filtration	MERV 13	MERV 13	Code Minimum MERV 13 Recommended	MERV 13
Enhanced Air Scrubbing	Ultraviolet Light (Optional)	Carbon Filters	N/A	Carbon Filters
Cooling Capacity	Increased Ventilation	N/A	Meet Increased Design Day Conditions	Meet Increased Design Day Conditions
Heat Capacity	Increased Ventilation	N/A	N/A	N/A
Fan Performance	Overcome Increased Filtration Pressure Drop	Overcome Increased Filtration Pressure Drop	Achieve Max Supply Design Airflow	Overcome Increased Filtration Pressure Drop & Achieve Max Supply Design Airflow
Max Temperature Equipment Concerns	N/A	N/A	125F for DX Equipment	125F for DX Equipment
Ventilation	Enhanced Ventilation to Achieve Recommended Air Changes	Occupant Density Based Ventilation	Occupant Density Based Ventilation	Occupant Density Based Ventilation
Equivalent Air Changes	2 ACH Min 4 ACH Good 6 ACH Very Good 8 ACH Excellent Recommended 5-6	N/A	N/A	N/A
Building Pressurization	N/A	N/A	N/A	Positive
Portable Filtration Changes	Benefit	Partial Benefit	No Benefit	Partial Benefit

Heat and Smoke Ventilation System Guidance for Schools and Commercial Buildings. Source: Schools as Community Cleaner Air and Cooling Centers. EPA and Glumac collaboration 2023. Schools as Community Cleaner Air and Cooling Centers | US EPA



Above: Tigard High School, Tigard, Oregon
Left: Creekside Net Zero High School, Tigard, Oregon
Below Left: Malibu High School, Malibu, California
Below Right: Tualitin High School, Tualitin, Oregon



The Water – Carbon Nexus

> Important to the whole carbon approach to integrated design is the energy and carbon emitted in water systems especially at scale. From embodied to operational carbon, energy is used across the water lifecycle to generate clean potable water for building supply and waste conveyance needs.

For this reason, studying strategies to reuse water and supply less carbon intensive non-potable water for greywater and blackwater needs is an important step in the whole carbon design approach.

To do this, we can calculate the supply and demand needs of a project in early design and identify collection and reuse opportunities from rainwater and greywater sources. Then, we match collection and reuse volumes with regulatory approved supply needs. Various water scenarios are then identified and through the integrated design process, further developed. Equipment options are also evaluated for lower embodied carbon.

Reusing water at the building level can increase the building's energy and carbon emissions due to filtration and circulation (site emissions), but we can incorporate the emissions reduction from pumping less potable water to the building (source emissions) to demonstrate an overall reduction in carbon.

Carbon emissions factors for a particular water district can be found through a few methods and used to calculate impacts on your projects:

- Utility Reporting (Portland Water Bureau does this for example)
- Shared data through the Climate Registry: **The Climate Registry - Water Energy Nexus**
- State/agency reporting
- Academic research.

For areas where municipal supplied potable water is pumped long distances, a carbon reduction case can be calculated for reusing water within the building, especially for larger sized systems. Similarly, a case can be made for reusing water at the building level in communities with combined storm and sewer systems because these systems are increasingly burdened by development and flood occurrences which can cause sewage overflows – an expensive problem to mitigate.


First United Bank of Fredricksburg
Fredricksburg, Texas
The first full mass timber structure in the nation to use southern yellow pine cross-laminated timber (CLT) panels.

How did we help get there?

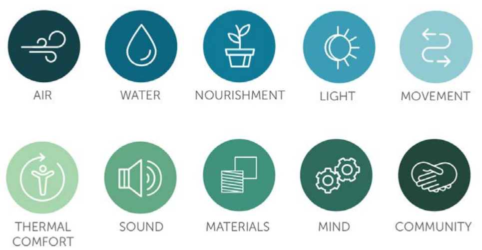
- Rainwater harvesting
- Rooftop solar panels are designed to offset 130k kWh annually to achieve Net Zero Energy

Healthy Building Design

> Building occupants notice when a building looks or feels healthy. It could be the fresh smelling air, the thermal comfort, natural daylight, and/or great tasting water, among a range of other strategies. The International WELL Building Institute first established an industry recognized definition for a healthy building through the WELL Certification Standard, which provides strategies that span 10 building design and operational concepts.

The WELL Standard is free and available online and it is a wonderful resource to review for healthy building strategies on projects regardless of whether certification is pursued. Use it as a source for design inspiration, goalsetting, and strategies to discuss with your project teams.

You can access WELL online here: **Standard | WELL V2 (wellcertified.com)**



Ten Concepts of WELL v2

The Fitwel Standard is another, similar healthy building certification program that owners pursue. It is often employed as a more inexpensive, streamlined option to WELL. Fitwel resources are also available online, but they are not as easily accessible as WELL for project planning purposes.

This section aims to address the nexus between carbon emissions and indoor air quality as a critical area of health building design that commands our expertise. Future versions of the action plan may be expanded to include engineering emissions associations with thermal comfort, lighting, water quality, and biophilia among other design areas.

Indoor Air Quality

The Covid-19 pandemic has accelerated our awareness of methods to protect indoor air quality for optimum human health.

For commercial and residential buildings, COVID amplified the effectiveness of MERV 13 filtration for filtering out pollutants and minimizing the spread of pathogens, particularly for recirculated air conditions. Lower filter numbers are insufficient and high filter levels are expensive to replace for the marginal benefit and are best reserved for medical facilities. MERV 13 filtration is our basis of design minimum standard.

Regarding ventilation, ASHRAE 62.1 compliance is the minimum standard in our basis of design. During Covid, we promoted increasing ventilation rates to dilute indoor air and control the spread of pathogens in addition to opening windows to naturally ventilate spaces. During this time, new data also emerged, and with it, the industry reinforced what was largely known, but less quantitatively understood, that filter type impacts ventilation rates and the resulting volume of air reaching spaces. With the ever pressing need to keep occupants healthy, a consistent calculation methodology was needed to prove ventilation air supply volumes. In addition to ventilation, the methodology would also help the industry more accurately calculate fan power needs and associated energy use and carbon emissions. It would enable us to fine tune buildings to not only supply sufficient fresh air, but program space occupancy and vacancy sensors to more accurately direct ventilation rates when it benefits the number of people in a space.

In 2023, ASHRAE released Standard 241 which established this calculation methodology. The standard was the culmination of several years of work by the ASHRAE Epidemic Task Force chaired by William (Bill) P. Bahnfleth, who closely advised Glumac on best practices in the time leading up to the standard's release.

Whereas ASHRAE 62 dictates the minimum amount of ventilation we need to bring into a space, ASHRAE 241 goes a step further to consider the effect of both outside air and filtration to determine how a space gets diluted with clean air, termed equivalent air changes per hour (eACH). **We suggest 4-6 ACH with MERV 13 filters results in an equivalent air change rate that's better than general ASHRAE 62 ventilation with lesser filtration.** ASHRAE 241 will now help building owners understand when to either increase air flow, increase filtration, or a combination of the two to get more dilution in building spaces.

The Engineering Services Team is currently working on a draft air quality guidance document based on ASHRAE Standard 241, and the recommendations therein will be incorporated into our standard Basis of Design Narrative templates.

The following technologies are presented because they provide benefit in bacterial and virus reduction, among other health benefits. The range of benefits differs by filtration system demonstrating the need to identify early in design any outdoor air quality concerns, seasonal issues, building user needs, and client goals to propose the best system.

FILTER COMPARISON CHART	MERV 13+ & HEPA Filters	UVGI	Activated Carbon
Effectiveness Against Viruses	Very Good	Good (Depending on Contact Time)	Poor
Effectiveness Against Bacteria	Excellent	Good (Depending on Contact Time)	Poor
Removes Gases (Radon, Formaldehyde, etc.)	Not Effective	Not Effective	Excellent
Eliminates Odors	Not Effective	Not Effective	Excellent
Effectiveness Against Pet Dander	Excellent	Not Effective	Not Effective
Effectiveness Against Pollen	Excellent	Not Effective	Not Effective
Effectiveness Against Mold Spores	Excellent	Good	Not Effective
Effectiveness Against Dust Mite Excreta	Excellent	Poor	Poor
Cost Per Cartridge	Moderate	Moderate	Cheap
Cartridge Life Expectancy	2-3 Years	1 Year	3-12 Months

Key

Not Effective	Poor	Good	Excellent

Social Equity and Inclusion

> Sustainability is about making changes in our buildings and communities that protect our planet and promote quality of life for all. The concept is best captured in the triple-bottom line, which balances people, planet and profit equally.

During project planning and in preparation for the initial kick-off meeting, it's a great time to take a triple bottom line approach to our thinking and consider social equity and inclusion in addition to environmental and economic variables. USGBC has been working to increase awareness by offering credit opportunities that project teams can implement regardless of whether a project pursues certification.

USGBC LEED Social Equity Pilot Credit opportunities can be found at the links provided here:

- **All-Gender Restrooms WEpc147**
- **Inclusive Design INpc125**
- **Social Equity within the Community IPpc89**
- **Social Equity within the Project Team IPpc90**
- **Social Equity within the Supply Chain IPpc144**

Other certification standards have social equity and inclusion credits as well to incorporate on projects. Reach out to a Sustainability Team member for more ideas.

The Meyer Memorial Trust Headquarters is Oregon's First LEED v4 Platinum building. This 19,800-square-foot office garnered 16 design awards from AIA COTE, AIA 2030, Fast Company, Metropolis, USGBC, and Forest Stewardship Council, among others.

- Moved MEP equipment from the roof to the attic freeing up space for a 50kW solar system.
- Roof orientation and saw-toothed design lets in daylight while optimally generating solar energy. Energy dashboard by eGauge.
- High performance envelope with fiberglass framed windows.
- OAS, with ERV's and VRF conditioning.
- Anticipated 66% energy cost savings over the ASHRAE 90.1-2010 – equivalent to an EnergyStar score of 99.
- Activated carbon filter, plus MERV 13 filtration. IAQ testing.
- Comprehensive MEP commissioning
- Biophilic interior design.

Study Areas: VRF low GWP refrigerants and electric alternatives.

Social Equity and Inclusion Case Study

Meyer Memorial Trust Headquarters, Portland, Oregon
This project is an excellent example of triple bottom line thinking placing equal emphasis on environmental and social benefit.

Mission-driven project goals:

- Embody the change we seek.
- Inclusive & collaborative process that centers community voice.
- Center equity by creating access to opportunities for historically marginalized communities and tribes.
- Minimize harm.
- Steward resources thoughtfully
- Be accountable & transparent.
- Social equity & inclusion achievements:
- Built a diverse team comprised of female and black leaders.
- Located the building within a marginalized community it serves.
- MWESB participation (Goal 30% / Actual 55%)
- Diverse CA workforce participation (Goal 30%/Actual 54%)
- 100% of wood products sourced locally, from Pacific Northwest fabricators and forests. (50% FSC-certified, 50% BIPOC businesses, and 58% small businesses).
- Comprehensive biophilic design connecting occupants to nature, community, and culture.
- All spaces and furniture went beyond ADA requirements to accommodate different body types and abilities.
- Rotating art collection created by BIPOC Oregonians that reflects a diversity of cultures and languages.
- Large community spaces designed for partnerships and engagement with the public.

Outreach & Operations

Sharing our knowledge with the building industry helps add to the market momentum to decarbonize. At the same time, we need to be accountable for our own carbon footprint. This section explains how we are progressing both areas.

WHAT'S INSIDE

City of Los Angeles
Existing Decarbonization Work Plan
Glumac is working with City of Los Angeles to create a leading-edge 12-year Building Decarbonization Work Plan for City owned municipal facilities. The Building Decarbonization Work Plan will provide a plan for transitioning existing municipal facilities to be carbon neutral by 2035

How are we helping to get there?

- Identify GHG emissions reduction opportunities
- Working with LADWP to establish a strategy for on and offsite solar to provide city facilities with access to 100% clean energy.
- Developing custom building decarbonization tracking tool that integrates with the city's asset management system.

TK Elevator Tower, Atlanta, Georgia
216,292 square feet.Tallest elevator research, testing, and training center in the United States (420 feet tall). LEED Gold and ENR Best Project 2022.

How did we help get there?

- Water cooled VRF with decoupled DOAS for ventilation.
- Smart electrical distribution with fully metered panels.
- Large portions of the building are unconditioned.

Study Areas: VRF low GWP refrigerants and electric alternatives.

Building Advocacy & Knowledge-Sharing

Glumac's employees are active in the community sharing our projects and ideas. We speak at conferences to spread our knowledge and learn from others. We engage with industry partners to advance design and advocate for more progressive codes. We do this work to support our projects and help us achieve our company goals.

Carbon Leadership Forum
Glumac is a Gold sponsor of the Carbon Leadership Forum and our Sustainability Team co-leads the Data, Analysis and Reporting work group. We regularly attend and engage in sponsor and workgroup calls.

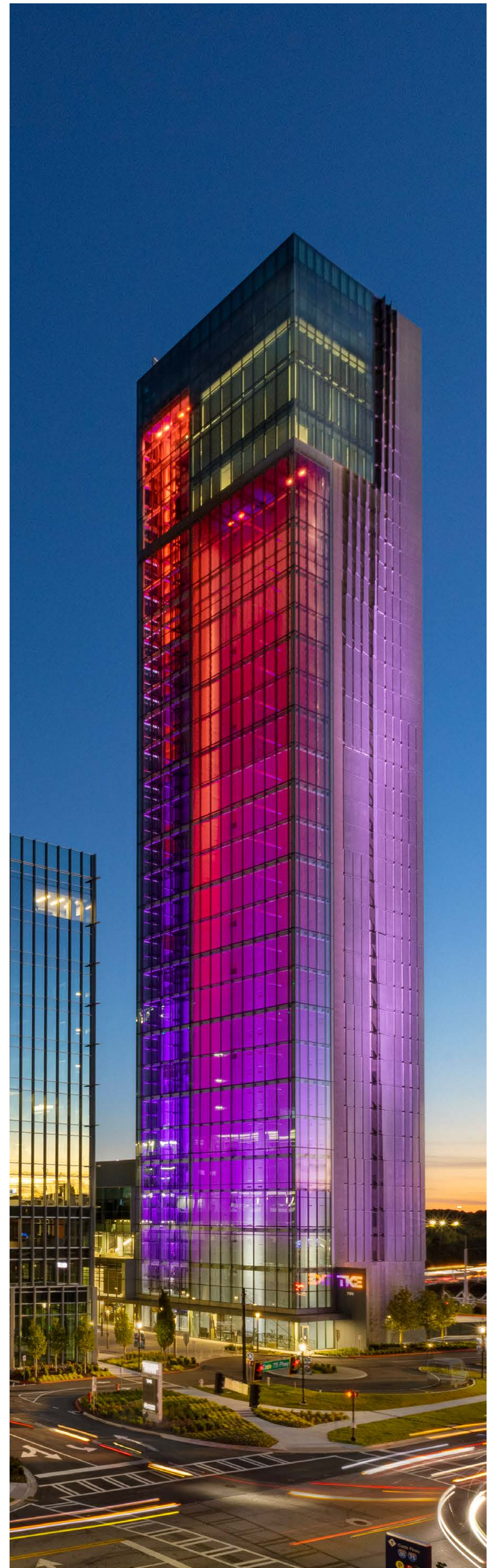
International Living Future Institute
Glumac is a longtime annual sponsor of the International Living Future Institute and a founding member of the Biophilic Design Initiative. In collaboration with the Initiative, Glumac was a reviewing member of the Biophilic Design Toolkit and assists with workshops during the annual conference.

US Department of Energy – Appliance Standards and Rulemaking (ASRAC)
Glumac is the only professional engineering firm in the federal working group to advise the DOE on commercial equipment standards. As a member of the Advisory Committee, we also have voting rights to advance decarbonization and energy efficiency across a range of systems and designs.

Energy Code Cycle Public Comments
Glumac's Energy Team regularly attends state and local energy code public meetings and provides input on draft code language. Covers, California State Title 24, Seattle Energy Code, and the International Energy Conservation Code (IECC).

Glumac is contracted to support the California Energy Commission (CEC) for 2025 codes and standards development as well as software development.

Conferences
Glumac is an active speaker at sustainable design conferences nationwide. The Building Sciences Group and engineering colleagues regularly speak at leading conferences: Greenbuild, Living Future, ASHRAE Building Performance Analysis Conference, and Net Zero, among several regional conferences located within the regions we work.



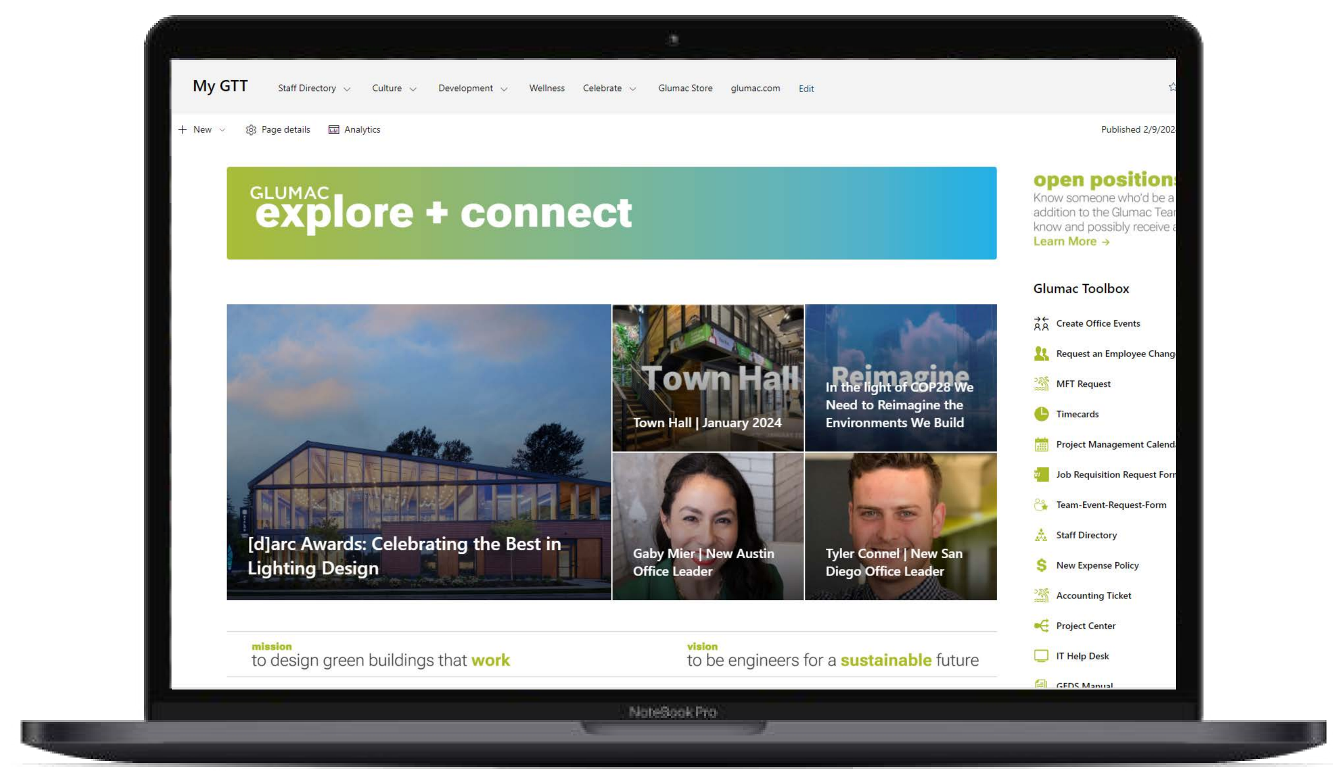
Business Carbon Footprint

Glumac is in the middle of assessing its approach to reporting the carbon footprint of its operations under a remote work scheme. The company released an Annual Sustainability Report in 2019 and 2020, and they addressed these objectives:

- Company carbon and water footprint and projects to reduce it.
- Policies and programs to create a diverse and inclusive culture.
- Policies and programs to promote employee health and well-being.
- Policies and programs to increase engagement and support local communities.

After that time, leadership pivoted from annual reports to annual data contributions to support Tetra Tech's firmwide Sustainability Scorecard. The Scorecard is released annually on Earth Day and available on the Tetra Tech website.

The company will continue to contribute data on business operations and community volunteerism to Tetra Tech's Scorecard. We are also considering restarting our own efforts to publish an independent company report for 2023 business operations, including the purchase of carbon offsets. We believe this is important because of its tangible value to employees and our clients, and visibility into our impact and areas to improve.



Our internal intranet, my.glumac.com highlights office events, people, industry engagement, and volunteer opportunities including the popular Giveback Program.

LEAD AUTHOR

Nicole Isle – Chief Sustainability Strategist

CONTRIBUTORS

Michael Adams - Regional Energy Director
Alex Baumgardner - Strategic Communications Manager
Kameron Beeks – Director of Market Sectors
Brian Berg - Director of Mechanical
Alissa Feucht - Senior Sustainability Strategist
Chris Lowen – Director of Building Sciences
Lou Niles - Senior Sustainability Strategist
Kat North - Graphic Designer
Brian Stern – Director of Energy
Ante Vulin – Senior Sustainability Strategist
Max Wilson - Commercial Sector Lead

OUR SERVICES

Mechanical
Electrical
Plumbing
Lighting Design
Technology Integration
Sustainability Consulting
Energy Consulting
Commissioning

engineers for a **sustainable** future