



PAE MEP 2040

Climate Action Plan



Letter from PAE's Leadership

At PAE, our vision is a world with clean air, energy, and water for all.

The urgency to create a sustainable future has never been greater—our generation stands at a pivotal crossroads with the responsibility and opportunity to make meaningful change.

Buildings play a central role in the climate crisis. Anthropogenic greenhouse gas emissions total approximately 54 billion tons of CO₂e annually, with nearly 40% stemming from the built environment. This includes 14 billion tons from building operations and 6 billion tons from construction materials. As MEP engineers and leaders in our field, the path to a sustainable climate is in our hands. This is both our challenge and our calling.

PAE has had the opportunity to design some of the world's highest-performing buildings, tackling goals that initially seemed unattainable. These experiences have shown us that the boldest aspirations often lead to the most innovative solutions. The MEP 2040 Challenge embodies this spirit by setting the bar exactly where it needs to be: at zero.

We are proud to present our MEP 2040 Climate Action Plan. In the following pages, we outline the framework we've developed to align our work with the challenge and advance our vision for a sustainable future. It is our hope that this plan will inspire and empower others to take action, moving the building industry closer to a net-zero carbon future.

Together, we can achieve a world with clean air, energy, and water for all.



Christian J. Agulles
PRESIDENT AND CEO



Marc Brune
SENIOR PRINCIPAL







Challenge and Commitment

The MEP 2040 Challenge was issued in the fall of 2021 by the Carbon Leadership Forum. The challenge calls on “all systems engineers to advocate for and achieve net zero carbon in their projects, operational carbon by 2030 and embodied carbon by 2040.” This challenge is analogous to Architecture 2030 and SE 2050. It recognizes that there is an urgent need to better understand and holistically track the emissions footprint of the MEPTL materials and select ones with reduced, net zero, or regenerative emissions.

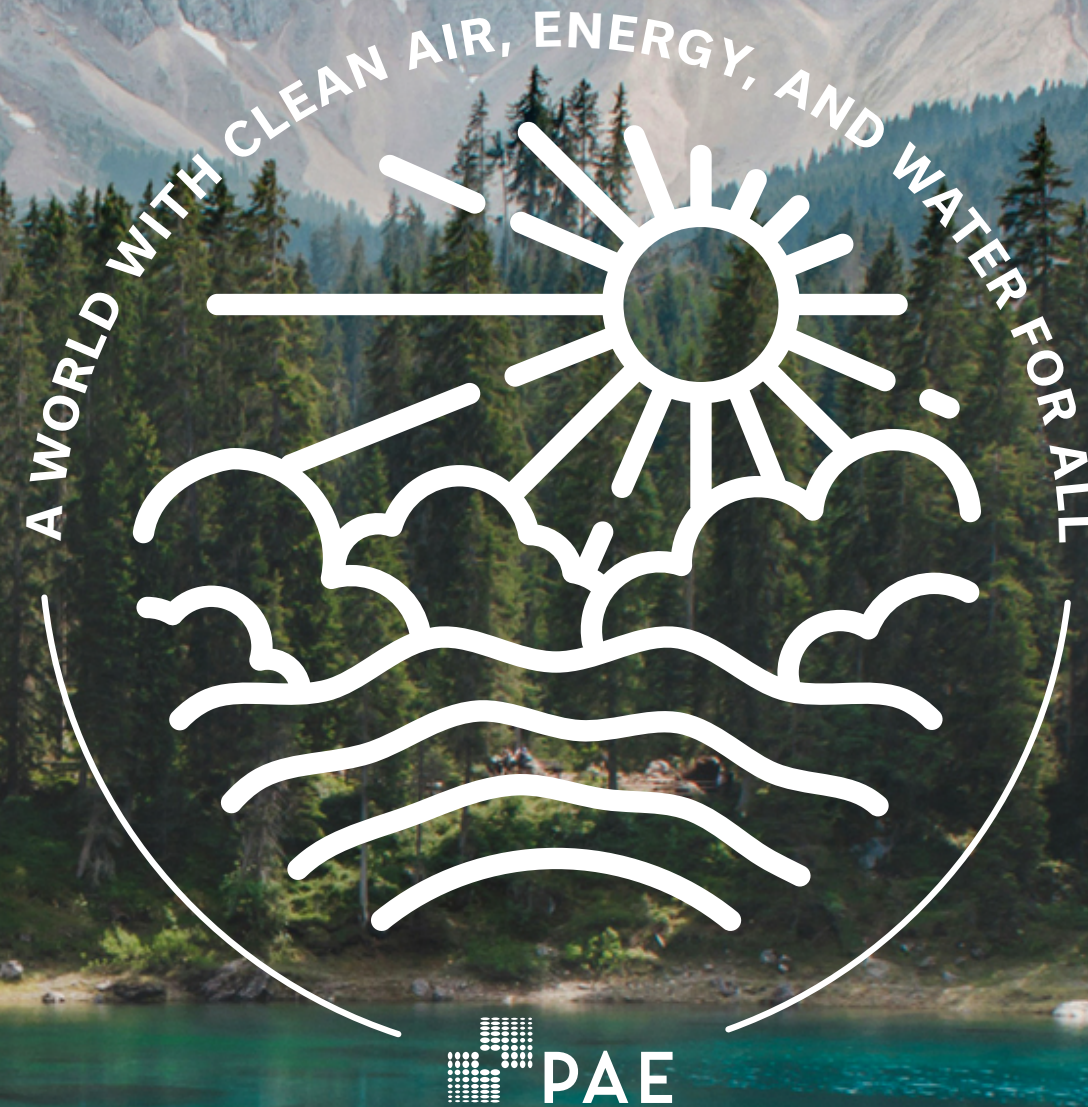
In response, a group of engineers collectively established the MEP 2040 Commitment with an open invitation for MEP firms to join the commitment. The hope is that the movement will radically reduce total carbon emissions associated with building systems through collective action. This movement has grown quickly with 90 signatories as of summer of 2024. PAE was an early signatory in December of 2021.

THE COMMITMENT INCLUDES THE FOLLOWING BASIC TENETS:

-  Establish a company plan to reduce operational and embodied carbon across MEP systems.
-  Request low-GWP refrigerants.
-  Request Environmental Product Declarations (EPDs).
-  Participate in MEP 2040 forums and discussion groups.

PAE MEP 2040 COMPANY PLAN

PAE's vision is a world with clean air, energy, and water for all. Meeting the MEP 2040 Challenge is in clear alignment with PAE's vision, and we are excited to formally put forth a MEP 2040 company plan.



MEP 2040 Goals

THE FOLLOWING COMPONENTS HAVE OR WILL BE IMPLEMENTED:



Participate in MEP 2040 Forums

PAE is committed to sharing our knowledge and values. A participant in quarterly MEP 2040 forums since 2022, PAE will continue to send delegates to these online forums.



Contribute to MEP 2040 Working Groups

PAE is committed to collaborating within the MEP 2040 Working Groups to advance the industry toward net zero carbon emissions.

- We are a current participant in the Data, Analysis, and Reporting (DAR) Working Group. The DAR group meets regularly to tackle a variety of topics including refrigerants, new standards, and embodied carbon of MEP systems.
- PAE will continue to look for new opportunities to contribute to industry knowledge and progress through MEP 2040 working groups.



Targeting Net Zero Operational Emissions

We will use the national definition of a Zero Emissions Building as the target for Net Zero Operational Carbon Emissions. The definition is: "a building that is highly energy efficient, does not emit greenhouse gases directly from energy use, and is powered solely by clean energy." To meet this standard, new buildings must achieve an Energy Star rating of 90 or greater, and existing buildings must achieve a score of 75 or greater.

While Operational Net Zero Emissions is a result of a building's systems, achieving this target is an integrated problem requiring the participation of the building owner, other design team members, local utilities, and engineers. PAE will continue to champion net zero operational carbon by showing our clients viable paths to achieve this and working to inspire them to reach these goals.

To meet the requirements of the MEP 2040 challenge PAE will:

- Advocate for highly efficient, grid-interactive, all-electric designs on all of our projects.
- Advocate for on-site renewable energy on all of our projects where feasible.
- Establish a process to record the efficiency of the buildings we design and produce a carbon impact report for all of our projects by 2030.
- Establish training and standards specific to grid-interactive, all-electric design.
- Establish standards to enhance quality and efficiency of all-electric design.
- Advocate for clean electrical grids.
- Provide industry leadership toward grid interactivity.
- Target 80% of applicable projects to meet the national definition of a Zero Emissions Building by 2030.
- Target 80% of projects to be all-electric by 2030.





Targeting Net Zero Embodied Carbon

Like operational emissions, embodied carbon emissions is an integrated problem that involves all construction divisions and building stakeholders. It requires addressing emissions at all lifecycle stages including material sourcing, manufacturing, maintenance, and end-of-life.

Much of the embodied emissions focus has been on emissions from the building structure and façade. However, the industry is transitioning to a more holistic analysis that includes impacts from interiors, MEP systems, and the building site.

Initial evaluations of MEP systems are highlighting that MEP impacts are more significant than initially anticipated. Many MEP components are made from high impact materials and have relatively short lifespans resulting in multiple replacements over the life of the building. Additionally, refrigerant leakage from MEP components can be a major driver of a building's emissions over time.

To meet the requirements of the 2040 MEP challenge, all of PAE's projects must target net zero embodied emissions by 2040.

PAE WILL IMPLEMENT THE FOLLOWING KEY COMPONENTS AS PART OF THIS EFFORT:

EDUCATION & WORKFLOW INTEGRATION
Holistic carbon analysis is a new field and the analysis of embodied carbon of MEP systems is in its infancy. We intend to accelerate the understanding of whole-life carbon decision making through internal education sessions about MEP 2040 and strategies to incorporate whole-life carbon considerations into our workflow.

- We will evaluate how to best integrate embodied carbon evaluation in workflows with each service. Each service may have a slightly different approach or areas that can have the biggest impact, though there will likely be considerable overlap.
- We will develop educational sessions about MEP 2040 and how PAE plans to incorporate the additional carbon analysis into our workflow.
- We will integrate the training into our standard Learning and Development offerings.
- We will work to develop a Whole-Life Carbon Quick Reference Guide to empower teams TO consult on low carbon systems.

REQUEST ENVIRONMENTAL PRODUCT DECLARATIONS (EPDS)

EPDs provide critical information to understand the whole-life carbon impact of our design decisions. PAE has already begun requesting EPDs for select projects. Moving forward, PAE will:

- Educate staff about requesting EPDs as part of typical equipment inquiries.
- Create standard project specifications to request EPDs from MEP manufacturers.
- Create a standardized workplan for reviewing EPDs and other LCA declarations. This will include a process for collecting MEP embodied carbon data including existing EPDs, PEPs, and CIBSE TM65 calculations.

REQUEST LOW GWP REFRIGERANTS

PAE has been an advocate for low-GWP refrigerants. We educate our clients about the leakage risks associated with installing distributed refrigerant piping and work to minimize this on our projects. We are committed to continuing this effort as lower GWP refrigerants become available.

- We will create a workplan for reviewing all equipment with refrigerants. This will include calculating and recording refrigerant GWP and refrigerant volumes for our projects.
- Evaluate ways to daylight the refrigerant quantities and global warming impact on all projects. An example may be a schedule that summarizes the net GWP of the refrigerants within a design.
- Include requirements for refrigerant type and quantities to be submitted for all equipment containing refrigerants.

REPORTING

PAE will is working to quantify the carbon emissions and emissions savings from our projects due to our work. We will:

- Track progress toward 2030 net zero operating emissions as a percentage of our projects each year.
- Track progress toward 2040 net zero embodied emissions as a percentage of our projects each year.
- Create a public facing report of our impact.





PAE Living Building

The PAE Living Building, completed in September 2021, is a 58,000 sqft, 5-story office building in Portland, Oregon. The PAE Living Building meets both the operating and embodied emissions targets of the MEP 2040 Challenge nineteen years ahead of schedule. The building itself has an Energy Star score of 98 and generates 100% of its energy from a 133 kW on-site PV array and 215 kW off-site PV array located on an affordable housing building within the same community. The PAE Living Building purchases green power from the local grid at times when its instantaneous power demand is not met by the on-site resources.

LOCATION: Portland, OR

SIZE: 58,000 sqft

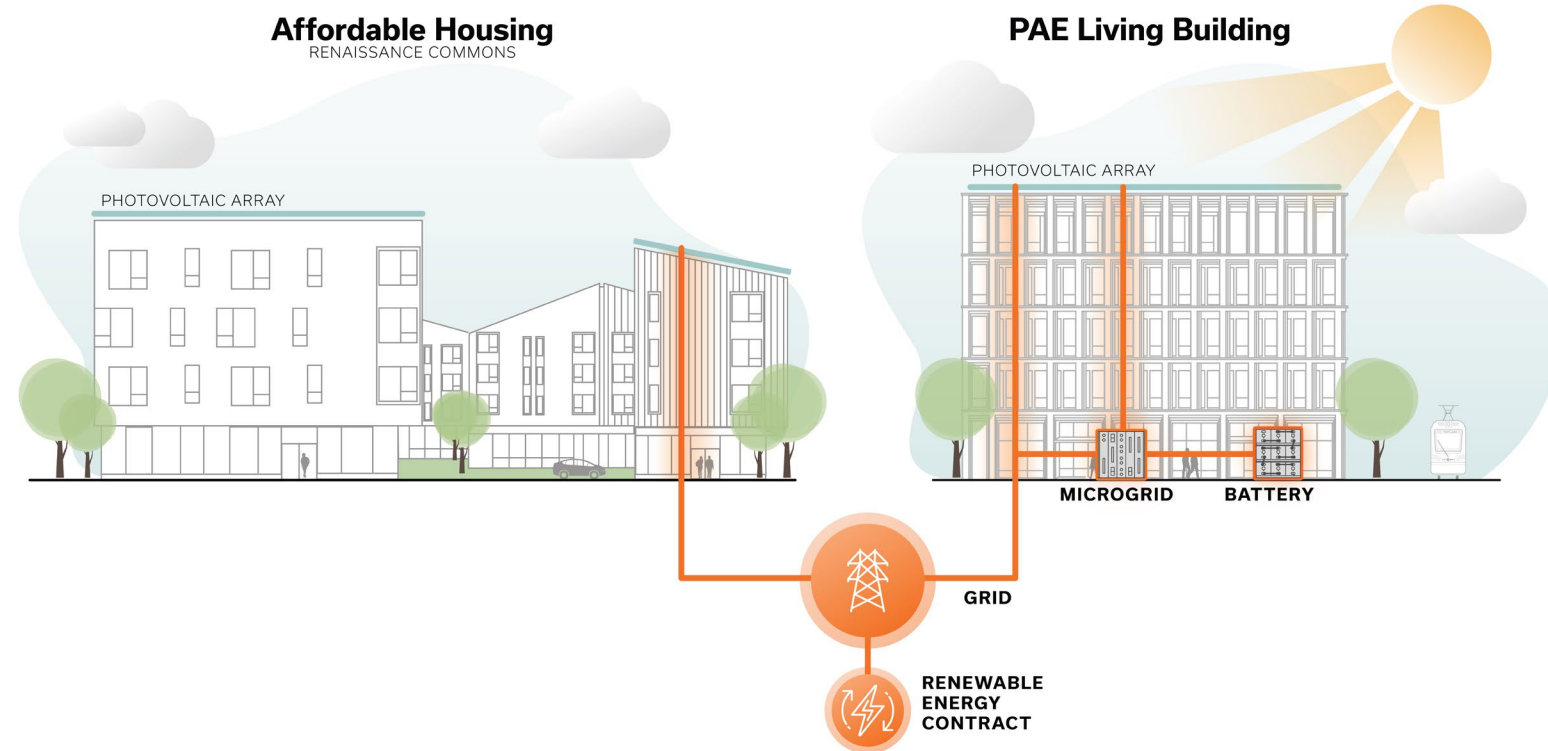
EUI: ~16.5 kBtu/sqft/yr

ON-SITE SOLAR PV: 133kW

OFFSITE SOLAR PV: 215kW

GRID-INTERACTIVE: Yes

EMBODIED CARBON: 2,100 tCO₂e



Several structural systems were considered for the building. Ultimately, a wood structure was selected as it reduced the carbon footprint and dramatically improved the biophilic nature of the space. Further carbon offsets were purchased to balance the building's upfront embodied carbon. The embodied carbon of the MEP systems was estimated but not calculated in detail. This is an identified gap in 2040 reporting. While tools were not in place to fully estimate the MEP embodied carbon of the building at the time, several strategies were used to minimize embodied emissions over the life of the building including:

- Optimized envelope and natural ventilation strategies to limit the size of mechanical systems
- Strategically limited ductwork to the core of the building
- Minimized refrigerant piping, mostly limited to main building chases
- Utilized brazed fittings to reduce refrigerant leakage

The PAE Living Building includes a microgrid system and is enrolled in the local utility's demand response program. The efficiency of the building's systems and the ability to modify load in support of the local utility's need makes this an example of a Grid-Interactive Efficient Building and a model for other buildings striving for resource efficiency and grid-optimized design.

EMISSIONS CRADLE THROUGH CONSTRUCTION

