# HEALTHIER, GREENER OFFICE BUILDINGS: THE PATH TO 2030

CLARK PACIFIC

# INTRODUCTION

**As new regulations and industry initiatives raise the bar on sustainability, aggressively reducing the carbon emissions generated by new commercial buildings is mission critical.**

**Construction industry organizations, government agencies, and environmental advocates have established bold goals to reduce carbon emissions and dependency on fossil fuels, with California's Title 24 leading the way.**

Section 6 of Title 24 calls for all new commercial buildings to be zero net energy (ZNE) by 2030. A ZNE building uses renewable power generation or innovative technologies to produce the same amount of energy it consumes or more. Reaching the 2030 milestone, along with other goals for carbon neutrality, requires a holistic approach. Owners must push for buildings to be more energy-efficient to build and operate. And architects are under increased pressure to make buildings more sustainable throughout their lifecycle.

At the same time, occupant wellness has become a focal point for tenants and their workforce. Even before the pandemic, businesses were beginning to reap the employee productivity and satisfaction benefits of operating greener buildings. Now that many office workers have grown concerned about the health of the buildings they occupy, providing a healthier environment is vital to helping ease their fears.

Each new building presents an opportunity to pave the way to a more sustainable future. And while the task before building owners and designers is great, there are already many proven solutions. This guide will outline the new challenges in sustainability and the strategies owners and architects can use to address them.

## THE NEW CHALLENGES IN SUSTAINABLE BUILDINGS: 2030, 2050, AND BEYOND

Buildings account for nearly 40% of all carbon emissions, and the global building stock is expected to double between 2020 and 2060.[1] To limit global warming, industry organizations such as Architecture 2030 and the American Institute of Architects (AIA) have established timelines and frameworks to reduce the carbon emissions generated by buildings by 2030. In addition to the State of California, many local governments, the Biden administration, and organizations like the World Green Building Council (WGBC) are promoting ZNE initiatives, with key milestones falling in 2030 and 2050.

Architecture 2030 accelerated its timeline to 2021 in response to an urgent climate report issued by the United Nations which now aims to limit warming to 1.5*C - a target we are quickly approaching. Similarly, the AIA is calling for ZNE requirements to be moved up to 2022.

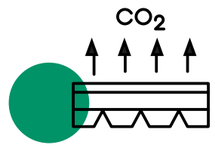
### UNDERSTANDING CARBON EMISSIONS IN THE BUILT ENVIRONMENT

Embodied carbon – emissions produced by extracting, processing, and installing building materials.

Operational carbon – emissions generated to power, heat, and cool the building.

Currently, operational carbon accounts for 28% of global emissions, while embodied carbon contributes 11%.[2] To reduce both forms, buildings must be built more efficiently, with more sustainable materials, and require less energy to operate and maintain.

The WGBC is also pushing to incorporate embodied carbon, the emissions produced by extracting, processing, and installing building materials, into its goals.

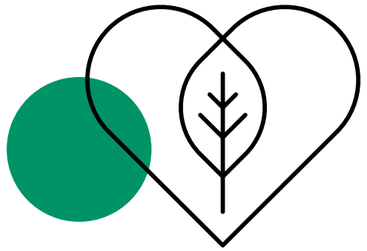


## GREEN BUILDINGS CAN BE HEALTHIER BUILDINGS

Buildings that are good for the environment can also be good for the people who occupy them. In the wake of the pandemic, office workers have developed heightened awareness around how the buildings they occupy influence their health. The new challenges in sustainability provide an opportunity to implement best practices that support occupant health, sustainability goals, and the bottom line. According to the WGBC:

- Workers in green, well-ventilated offices experienced 101% increase in cognitive function.
- Staff performance falls by 6% in offices that are too hot, and 4% in those that are too cold.
- Healthy, green buildings are valued at 7% higher than typical facilities.[3]

With the exception of employee engagement, all of these elements can be addressed, at least to some degree, by building owners, architects, and engineers in the design and construction phase of a project.



**THE WGBC HAS IDENTIFIED NINE ELEMENTS THAT MAKE FOR A HEALTHY OFFICE ENVIRONMENT:**

- **INDOOR AIR QUALITY**
- **THERMAL COMFORT**
- **DAYLIGHTING AND LIGHTING**
- **NOISE AND ACOUSTICS**
- **INTERIOR LAYOUT AND DESIGN**
- **BIOPHILIA VIEWS**
- **LOOK AND FEEL**
- **LOCATION AND ACCESS TO AMENITIES**
- **EMPLOYEE ENGAGEMENT**

# PATHWAYS TO CARBON NEUTRALITY, ZNE, AND BETTER BUILDING HEALTH

Despite the challenges facing the commercial building industry, proven sustainability solutions aren't out of reach. Although much of the industry's progress towards creating a greener built environment has been piecemeal, the new aggressive targets present AEC firms with the opportunity to collaborate and enact meaningful change.

By embracing existing solutions and viewing them from the perspective of the whole building lifecycle, we can meet carbon neutrality and ZNE goals while also improving building wellness.

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## TAKE A WHOLE LIFE CARBON APPROACH

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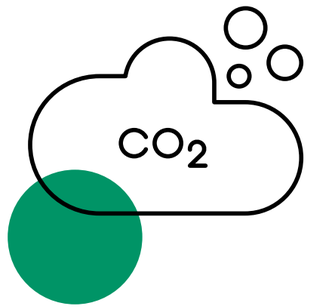
Whole life carbon (WLC) refers to the emissions that a building produces throughout its lifetime – from construction to maintenance to decommissioning. To truly achieve carbon neutrality and ZNE, it's important to look beyond just operational carbon. Designers must consider ways to make buildings more sustainable to construct and maintain.

AEC stakeholders have long used lifecycle assessments (LCAs) to assess the carbon impact of various building materials, methods, and operational factors. And now LCAs are increasingly incorporating embodied carbon. To fill a critical gap in the need for embodied carbon benchmarking and assessment tools, the Carbon Leadership Forum developed the Embodied Carbon in Construction Calculator (EC3).

EC3 maintains a database containing carbon emissions data on thousands of types of building materials. This data, along with sophisticated calculations, allow stakeholders to assess the impact of emissions and reduce them throughout the project. Beyond their usefulness for individual projects, tools like EC3 will enable the broader AEC industry to better understand and quantify embodied carbon.



# IMPLEMENT ENERGY MODELING EARLY

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Energy modeling enables architects to forecast the energy needs of a project and identify the most cost-effective methods to reduce them. When used early in the design process, the investment in energy modeling can pay off quickly. It can uncover opportunities to reduce cost and energy consumption in the construction phase of the project and continue into the operational stage.

While energy modeling is well known, it's often underused or implemented too late, despite its benefits.

**PROJECTS THAT USE ENERGY MODELING ARE 29%MORE ENERGY EFFICIENT THAN PROJECTS THAT DON'T.[4]**

Broader usage of energy modeling also supports the development of grid-interactive efficient buildings (GEBs). GEBs leverage energy-efficient measures (such as high-performance windows and LED lighting), smart controls, and distributed energy resources to optimize energy usage and occupant comfort. GEBs interact with the grid to shift energy loads between onsite sources and the grid and reduce energy consumption based on demand. Like embodied carbon measurement tools, adoption of energy modeling has broader impacts throughout the industry.

As designers become more adept at understanding and refining energy-efficient practices, achieving grid interactivity and flexibility will become feasible for more projects. Systems such as Heavy Thermal Mass Radiant can be leveraged to enable load shifting to further augment traditional GEB strategies.

**IN COMMERCIAL BUILDINGS, FLOOR SLABS ACCOUNT FOR NEARLY HALF OF EMBODIED CARBON.[5]**

## RETHINK THE USAGE OF BUILDING MATERIALS

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Since most sustainability initiatives have traditionally focused on operational carbon, we've already made meaningful progress towards reducing the emissions needed to power buildings. Considerations for embodied carbon must be made in the design phase of the project.

The frame, foundation, façade, MEPF systems and other elements of the building are major contributors to embodied carbon and should be considered.

Identifying strategies to produce these building elements more efficiently, and maximize their lifespan, is vital to reducing emissions. While much attention has been paid to the selection of low-carbon materials, not as much focus has been paid to the impact of how those materials are used. For example, a BuroHappold study found that material choice doesn't impact embodied carbon as much as concrete specification, grid choice, and loadings.[6]

## RETHINK HOW A BUILDING IS DELIVERED

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### HOW PREFABRICATION CAN HELP

One strategy that has already proven to streamline the usage of building materials without sacrificing quality is prefabrication. Prefabrication isn't new, and leading providers have spent decades leveraging the efficiencies and quality assurance techniques of manufacturing to maximize materials usage and minimize waste.

**PREFABRICATION CAN LEAD TO A 4-14% REDUCTION IN TOTAL LIFE-CYCLE ENERGY CONSUMPTION.[7]**

The controlled nature of prefabrication also enables providers to refine their processes and products more easily. For example, many precast solutions are tied together with a concrete topping slab to make the individual components in the structure act as a unit. But the slab often must be thicker than necessary by design to accommodate reinforcing clearances. Clark Pacific has tested un-topped slab units using various joining methods to reduce the unnecessary materials and embodied carbon of the traditional approach.

The project delivery process required for prefabrication also reduces waste. Project stakeholders must collaborate to address design and construction conflicts up front, meaning more time and resources are spent on productive tasks, instead of rework. That means materials, construction equipment, and fuel are used more wisely.

**80%** **OF USERS SAY PREFABRICATION REDUCES WASTE.[8]**

# FOCUS ON HVAC FOR WELLNESS AND ENERGY EFFICIENCY

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By integrating considerations for heating, ventilation, and air conditioning (HVAC) into the design process, architects can significantly reduce energy use and improve occupant wellness and comfort. And there is a lot to consider; the installation, operations, and maintenance of the system, and how it will interact with other aspects of the design must all be weighed carefully.

Flexibility is also critical, as office environments need to be adaptable for a diverse group of occupants and functions.

## WHY RADIANT SOLUTIONS FIT THE BILL

There are several innovative high-efficiency systems to choose from, with variable air volume (VAV) or variable refrigerant flow (VRF) systems being common in many new commercial buildings. However, radiant systems, which dominate construction in Europe, are growing increasingly popular in the United States, particularly in ZNE buildings.

The most common type of radiant systems transfer heat through the floors via a hydronic system distributed throughout the building. They're more efficient than forced-air systems, and don't require high-maintenance equipment like fan coil filters, motors, or terminal units. Radiant systems are also good for occupant health. With a dedicated outside air system (DOAS) that provides 100% fresh air at a neutral temperature and reduced air flow, allergens can't move around the space as easily. Because radiant systems use sensible cooling the system does not generate condensation. This eliminates drain pans and condensate lines which promote mold growth, require time-consuming installation, and are unsightly to look at.

# FOCUS ON HVAC FOR WELLNESS AND ENERGY EFFICIENCY

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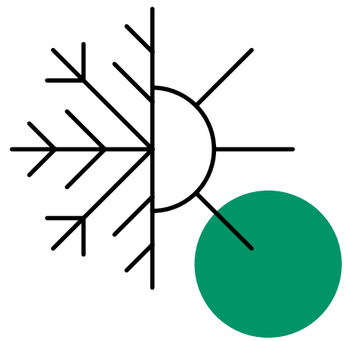
- **OUT OF 26 ZNE COMMERCIAL BUILDINGS, 42% USED RADIANT HEATING OR COOLING.**
- **OFFICES WITH RADIANT COOLING USE 31% LESS ENERGY THAN THOSE WITH NON-RADIANT HVAC SYSTEMS.**
- **OCCUPANTS IN RADIANT BUILDINGS ARE MORE LIKELY TO EXPRESS SATISFACTION WITH TEMPERATURE LEVELS.[9]**

High thermal mass radiant systems take these capabilities even further by allowing the building mass to be used for thermal storage. Thermal energy can be pumped into the slab during times when it is desirable to draw energy from your onsite solar or the grid.  This energy is then slowly distributed to the space through the day to ensure optimal comfort while reducing energy demands during less desirable times of the day. By solving for energy efficiency, occupant wellness, comfort, and flexibility, radiant systems reduce the complexity of common HVAC challenges designers must address.



## PURSUE INTEGRATED SOLUTIONS

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Project stakeholders can't achieve goals for carbon neutrality and ZNE by working in silos. Occupant comfort, cost, and sustainability can sometimes feel like competing needs. In order to successfully implement innovative solutions, it's important to understand how these needs are impacted throughout the project lifecycle. And that requires designers, engineers, and contractors to work together to establish goals, share information, and continually provide one another with feedback. For example, radiant heating and cooling solutions require an integrated design approach to maximize the system's cooling efficiency.

This integration can come about by using building information modeling (BIM), particularly at higher levels of maturity, as well as integrated project delivery, design/build, or design assist construction processes. And it can also come in the form of integrated solutions, such as prefabrication. The traditional fragmented, sequential approach to construction leads to miscommunications, rework, and unnecessary waste. Any process or solution that is inherently collaborative will support the problem-solving needed to address construction's sustainability challenges.

### COMBINING FAMILIAR SOLUTIONS TO MEET NEW CHALLENGES

The new challenges in sustainability place a lot of pressure on building owners and designers. But you don't have to start from scratch. Existing solutions enable you to make meaningful progress towards achieving Title 24 compliance, as well as meeting milestones set by the 2030 Challenge and other industry initiatives. Renewable energy, occupant expectations, and regulatory demands will continue to evolve. By embracing and continually refining tools and resources available today, you can prepare for the demands of the future.

## INTEGRATED SOLUTION SNAPSHOT: THE NETZERO BUILDING PLATFORM

The NetZERO Building Platform combines the mechanical and structural systems into a single prefabricated product. By leveraging the efficiencies and quality control of prefabrication with the energy savings and wellness benefits of radiant heating and cooling, building owners and architects can reduce their carbon footprint and improve building health without high costs. It's a grid flexible, cost-effective solution that delivers a turnkey ZNE-ready building.

**LEARN MORE ABOUT THE NETZERO BUILDING PLATFORM.**

## LEAD THE WAY WITH CLARK PACIFIC

For decades, Clark Pacific has been a leading manufacturer of prefabricated building systems. We are transforming design and construction by delivering high-quality, cost-effective buildings with less risk. Clark Pacific paves the way for prefabrication as a smarter, safer and more efficient way to bring great designs to life. Clark Pacific collaborates with construction owners and design-build teams to develop and deliver prefabricated building systems for commercial and institutional projects of any size and complexity.

To learn how our experts can help you navigate the future of construction, contact us.

**1-800-350-0306 • info@clarkpacific.com**

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