



Bromic's *Outdoor Heating Guide* On Sustainable Design Principles

1. INTRODUCTION

Outdoor spaces have undergone a transformation in recent years. Fueled by the pandemic and driven by the general human need to re-connect with the outdoors, functional, fully heated outdoor spaces have been propelled to the top of the priority list for homeowners and commercial operators alike. Across the globe, backyards, patios, rooftops and terraces are being transformed into year-round spaces with the help of outdoor heating technology. With an increased focus on sustainable technologies and energy sources fueling innovation in the sector, the result is more energy-efficient outdoor heating solutions.

At Bromic Heating, we're committed to a sustainable design philosophy that is focused on reducing our overall carbon footprint while contributing to a greener environment. This paper was developed as an architectural guide to demonstrate how an integrated approach based on sustainable design principles can create outdoor environments that can balance the needs of people, planet and the bottom line.

2. THE IMPORTANCE OF OUTDOOR LIVING

“Connecting to the outdoors is a basic human need that we’ve always designed for, and it’s really the success of every project. [...] The more connected you are to the landscape and creating a sequence of experiences that layer into the landscape—and hopefully views beyond—the more successful your projects are going to be”

- Garrett Hoskins, AIA, senior project director at Robert Hidey Architects

There is no question that being outdoors has a positive impact on health and wellbeing. In fact, various studies have confirmed that being outdoors can increase life expectancy, improve sleep quality and reduce cancer risk.ⁱ According to 2020 research by the Cornell University, spending as a little as 10 minutes outdoors will lower our blood pressure and improve our mood and focus.ⁱⁱ

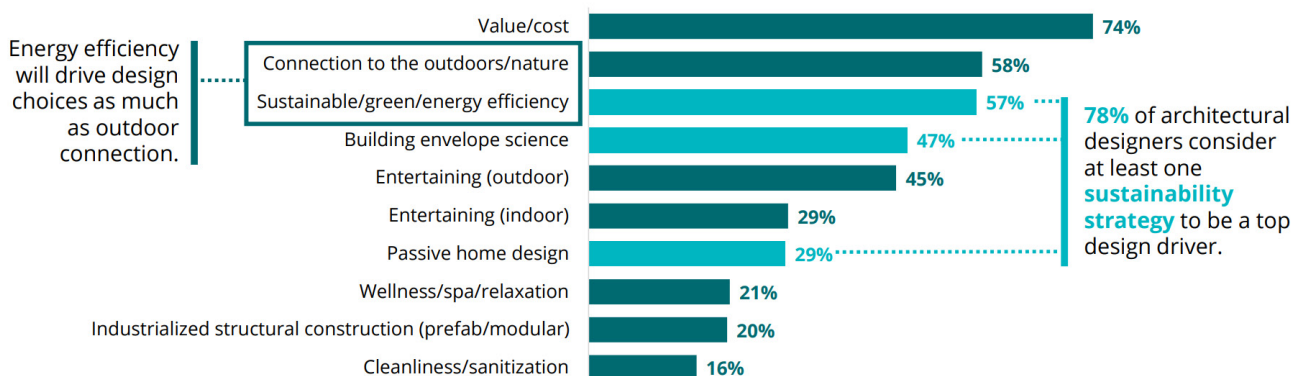
For many people, the outdoors serve as a venue to come together with friends and family or to connect with the larger community. Since the pandemic, being outdoors is no longer just the healthier, but also the safer option. Viruses, such as COVID 19 and other airborne illnesses are more easily transmitted via indoor air circulation than outdoors where even a light wind can reduce the concentration of the virus.ⁱⁱⁱ Functional outdoor spaces were once a “nice to have”, they are now widely considered a “need to have” to ensure both wellbeing as well as health and safety.

2.1 Residential Design Trends

***“Energy efficiency will drive design choices as much as outdoor connection”
- 2021 Annual Survey of Architecture^{iv}***

The focus on outdoor spaces can be clearly witnessed in residential building design. A recent survey conducted by the New Home Trends Institute shows that a connection to the outdoors and nature and outdoor entertaining are projected to be two of the top 10 drivers of home design choices over the next three years. According to the survey, 58% of respondents said connection to the outdoors/nature will be an important influence on their design choices, while 45% said outdoor entertaining will also receive increased attention.^v

Top 10 Drivers of Architectural Designers’ Design Choices in the Next 3 Years



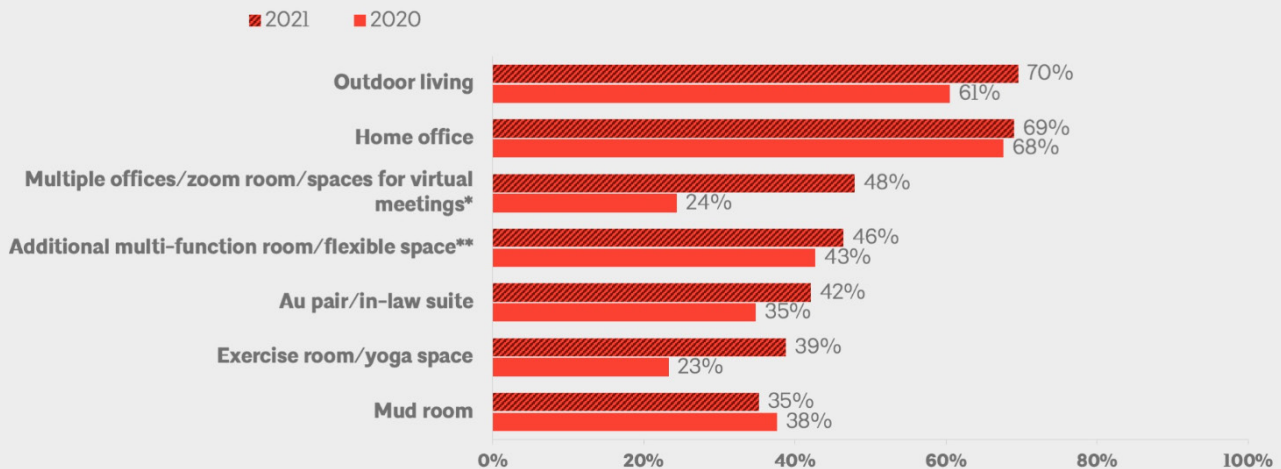
See Appendix for full list.

Source: 2021 Annual Survey of Architecture conducted by the New Home Trends Institute by John Burns Real Estate Consulting, LLC and Pro Builder

This is also reflected in the latest Home Design Trends Survey by the American Institute of Architecture (AIA), which confirms that the demand for outdoor living spaces continues to grow, with a 70% increase in popularity compared to 2020.^{vi}

Home offices continue to remain popular with multiple offices growing in popularity along with outdoor living spaces

% of respondents reporting popularity of room “increasing” minus % reporting “decreasing;” data from Q2 2021 compared to data from Q2 2020



*Multiple offices/zoom room/spaces for virtual meetings was asked as just multiple offices in 2020

**space that can serve different needs (home office, kids space, etc.)

Source: The American Institute of Architects Home Design Trends Survey

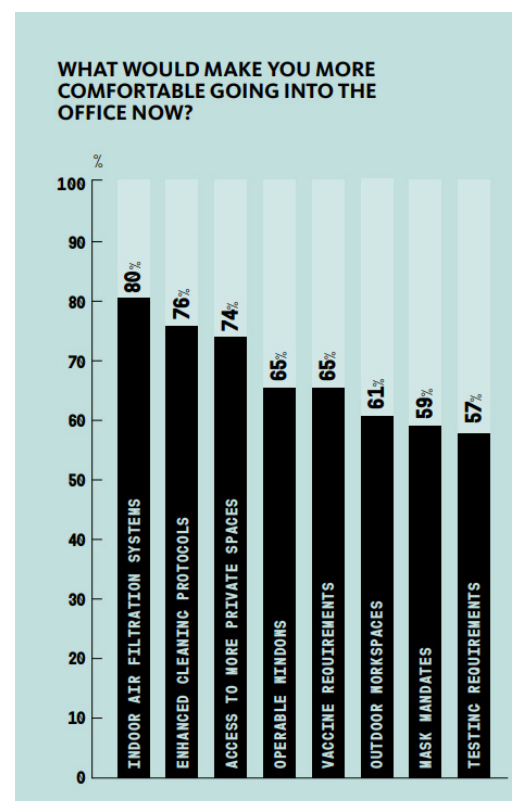
2.2 Commercial Design Trends

“Elevated and landscaped decks and outdoor zones, operable windows for fresh air, and open stairways are the types of enhancements that can increase a building’s value and help developers position their projects as Environmental, Social, and Governance (ESG) investments.”

- Gensler Design Forecast 2022^{vii}

A similar picture emerges in the commercial building industry. New ways of working emerged during the pandemic and have renewed the focus on outdoor spaces. For many businesses, outdoor spaces have become key strategies to entice workers back into the office by helping them transform the office from a space of work into a destination for collaboration and social gathering. Gensler’s Design Forecast 2022 identifies the outdoors as one of four main drivers that will impact the future of office development.

But it’s not just offices benefiting from a move outdoors. Gensler’s Design Forecast also predicts that cultural and public institutions like museums and galleries will renovate outside areas to offer a wider range of attractions and accommodations, essentially becoming extensions of their indoor areas to future-proof their facilities. Similarly,



for hotels and convention centers, seamless integration between indoor and outdoor spaces will continue to be essential to maximize usage and revenue.^{viii}

3. SUSTAINABLE DESIGN PRINCIPLES

“The most sustainable way is to not make things. The second most sustainable way is to make something very useful, to solve a problem that hasn’t been solved.”

- Thomas Sigsgaard, Architect

According to the UN World Commission on Environment and Development “sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”^{ix} The concept is based on the fact that our resources are finite and therefore must interact with the environment in a way that ensures there will be enough resources left on the planet for future generations.

The need to protect our resources has also had a huge impact on the building industry, which faces the unique challenge to meet the demands for safe, healthy, and productive environments, while minimizing the impact on society, the environment, and the economy. Driven by new regulations, greater market demand, and the potential for significant savings, the sector has started to adopt more efficient and sustainable technologies.

One of the most significant contributions to a greener built environment are the five principles of sustainable design as set out by the U.S. General Services Administration:^x

1. Optimize site potential
2. Minimize non-renewable energy consumption
3. Use environmentally preferable products
4. Enhance indoor environmental quality
5. Optimize operational and maintenance practices

These basic objectives of sustainability aim to reduce consumption of non-renewable resources, minimize waste, and create healthy, productive environments. When applied to outdoor spaces, this integrated design approach can significantly contribute to a greener built environment, while providing a healthy, comfortable, and safe outdoor space.

3.1. Optimize site potential

Outdoor heating is a key element in leveraging the potential of outdoor spaces as they allow for increased use of the space throughout seasons, extending usable space without physically extending the built structure. By bringing instant comfort to any outdoor space, designers can redefine the boundaries between indoor and outdoor. But it’s not just private residences that benefit from outdoor heating, commercial premises like hospitality venues were one of the major benefactors of outdoor heating during the pandemic, with many businesses attributing outdoor heating to their survival. With the extended use during months that were

previously unavailable, restaurants can provide services to patrons year-round.

Gensler's Design Forecast confirms that "office buildings must have connections to high-performance outdoor spaces — including areas equipped with mechanical systems, such as radiant heating and cooling to support meetings and focus space" to appeal to today's workers. More importantly, there are significant cost and energy savings associated with maintaining an outdoor commercial area when compared to indoor spaces. Indoor office spaces tend to be climate controlled at all times, in all zones - whether they're being used or not - while outdoor spaces can be heated only when required.

3.2. Minimize non-renewable energy consumption

Energy efficiency applies to every part of the building process, from the materials sourced to the mechanical appliances within the building. Because most facilities lack a viable means of generating 100% of the power from renewable energy sources, space heating - both indoors and outdoors - will always come with an environmental impact. Gladly, there are a number of strategies that can be employed to minimize the use of non-renewable energy sources.

1 The right outdoor heater:

Choosing the properly sized, most effective outdoor heating solution for a space is a vital first step towards minimizing energy consumption. Not all outdoor spaces are the same, so it's important to consider the layout, size and geographical location of the space to ensure the most suitable outdoor heating solution is installed. Locations with mild winters will not need as many outdoor heaters compared to locations in which the temperature routinely drops below 40°F. Another factor to consider are how protected the space is from wind. Semi-enclosed spaces can heat up quicker than open spaces, requiring a less energy-intensive outdoor heating solution. A well-designed outdoor space that has the right number of heaters installed at the correct height and with sufficient power output will ensure that the heaters not only deliver the optimum amount of heat and minimize energy consumed.

2

Radiant heat:

The proper way to heat an outdoor area is through infrared radiation. Radiant heat warms objects, not the air, like the experience of the sun warming the skin. Even though the surrounding air might be cold, the sun's rays will warm the body. Radiant energy is a form of energy that is released by any object that is warmer than its surroundings. It does this by projecting infrared heat onto people rather than moving warm air into the outdoor space. The radiant heat is absorbed by the objects that it encounters, making its molecules vibrate – thereby directly increasing the heat of the object. At Bromic, all our outdoor heaters are based on radiant heat technology, which means they directly heat the object, providing a consistent, even comfort compared to conventional convection heaters which heat the surrounding air.

A common misconception of radiant heat is that because heat rises, the effect of radiant heat is wasteful in the outdoors. The ability to effectively heat people and objects instead of the air means that radiant heaters can provide comfortable temperatures at a much lower energy output settings.

3

Fuel source variety:

Infrared electric, natural gas and propane heaters are all forms of infrared heaters that emit radiant energy. While each of these heaters delivers different levels of energy efficiencies and varies in their impact on the environment, at Bromic we believe it's vital to offer solutions that cover each of these fuel sources to provide architects and designers with an outdoor heater that will maximize the site potential, while minimizing energy consumption for each of their specific design projects.

A **Electric:**

When it comes to converting fuel to heat, it doesn't get any cleaner than electricity. Electric outdoor heaters are completely smell and toxin free and the conversion process does not give off any harmful greenhouse gases or environmentally hazardous byproducts. Bromic's electric outdoor heaters are designed so that heat does not escape through the back or the sides of the heater, with all the energy focused on emitting the heat from the front of the heater, ensuring a directional and highly energy efficient heat transfer.

In addition, all Bromic electric heaters can be paired with advanced controls technology such as a dimmer controller to adjust the heat output in precise

increments depending on the outside temperature. When paired with sustainable power sources such as solar or geothermal energy, Bromic's infrared electric heaters have the potential to reduce the carbon footprint to a minimum. As traditional utilities offer more renewably sourced electricity in a given area, it is within the power of every homeowner and commercial operator to leverage renewable energy for minimizing their impact on the planet.

B GAS:

There are two choices when it comes to infrared gas heaters - natural gas and propane. Just like other fuel types, greenhouse gases such as carbon dioxide (CO₂) are only emitted when the fuel is consumed. Heat is produced when the Carbon and Hydrogen molecules combine with Oxygen during combustion. Compared to other fossil fuels, propane and natural gas emit some of the lowest amounts of CO₂ and are therefore considered cleaner-burning fuels with limited carbon footprints.

Natural gas releases less CO₂ into the atmosphere than propane but does emit small amounts of greenhouse gases like methane during combustion.

Propane tends to be the standard choice for outdoor gas heaters as it contains more than twice the amount of energy than natural gas (2,516 BTUs compared to 1,030 BTUs natural gas per cubic foot). This means propane gas heaters need to burn less gas to generate the same amount of heat. Although the exact amount of fuel an outdoor propane heater will burn depends on the location, type of heater and usage, a 20lb tank will typically last for around 10 hours.

Propane is a by-product of natural gas processing and generally considered a "green" fuel that more eco-friendly. As a liquid gas, it can be stored in portable gas tanks, making it accessible in any location. Outdoor heaters operating on propane do not need to be attached to any structures or walls, providing an invaluable level of flexibility. What's more, propane exists in liquid form while it's in its storage tank. Once it escapes, it becomes a vapor that is quickly neutralized by natural oxidation in the presence of sunlight or knocked down by precipitation. As such, it does not pose contamination risk to soil or water supplies.

4 Energy-efficient design principles:

Early planning and design of the heated outdoor space has a major impact on reducing energy consumption. For example, by creating zones that can be controlled by a controller, each outdoor heater (or groups of heaters) can be switched on or off or dimmed as needed. Not only does this provide custom comfort control for people in each of the spaces, but it also makes the space more energy efficient. Retractable roofs, lattices, vinyl screens or curtains can provide further thermal insulation and energy savings by protecting the area from wind chill and preventing the generated heat from escaping.

3.3. Use environmentally preferable products

The composition of materials that are used in a product are a major factor in the environmental impact it will have over its lifetime. One of the major benefits of using products made with highly durable materials is that they will not need to be replaced or repaired as frequently, resulting in less maintenance, less waste and lower pressure on the global supply chain. Materials such as stainless steel, for example, are vastly superior to other metals as they can withstand severe heat, but also temperatures far below freezing, and can resist against corrosion. This is of particular importance for products like outdoor heaters, which need to withstand extreme heat and are regularly exposed to the elements, such as rain, snow or salt spray.

Bromic outdoor heating collections are all made from 304 grade stainless steel for premium longevity and durability. In addition, Bromic also offers outdoor heaters in marine-grade 316 stainless steel for marine and coastal environments. By choosing quality components, we can ensure that our products are able to last season after season (often lasting a decade or more), in contrast to conventional mushroom heaters, which often need to be replaced within one or two years.

3.4. Enhance indoor environmental quality

Indoor environmental quality (IEQ) refers to the quality of a building's environment related to the health of occupants within it. IEQ is determined by many factors, including lighting, heating, air quality, and moisture control. Poor air quality is typically caused by toxic materials that release harmful gases and particles into the air. To improve indoor air quality, it's important to bring enough fresh outdoor air into the building to ensure the pollutants are diluted and therefore less harmful. Due to the COVID 19 pandemic, IEQ has become more important than ever, making it a key focus for companies as they aim to create more comfortable, healthy, and productive spaces.

One of the easiest options to enhance IEQ is by integrating outdoor spaces into the design to ensure a regular flow of fresh air. The installation of large windows, sliding doors, fully retractable roofs or separate outdoor structures can all contribute to IEQ, while allowing occupants to reconnect with their natural environment. Biophilia - the innate human instinct to connect with nature and other living beings - is already becoming more embedded in architectural designs as it has been proven to support cognitive function, physical health, and psychological wellbeing.^{xii}

With any outdoor design, it's important to respond to the human need of thermal comfort as it's not only closely linked to our health, wellbeing and productivity. Thermal comfort is ranked as one of the highest contributing factors influencing overall human satisfaction in buildings^{xiii}. With the expansion of our social, working and cultural spaces to the outdoors there now is a clear requirement for outdoor heating technology that delivers thermal comfort to external environments to ensure people's wellbeing, health and productivity are maintained outside of the home. From public gathering spaces and work areas, to outdoor dining and private patio spaces, outdoor spaces can easily accommodate the majority of routine activities when they're equipped with Bromic's radiant outdoor heaters.

3.5. Optimize operational and maintenance practices

Sustainable operations and maintenance practices focus primarily on the actions of building occupants, and encompass safety, health, comfort, and productivity. Optimizing a building's operating and maintenance practices will contribute to improved working environments, higher productivity, lower energy costs, and prevention of system failures. By specifying Bromic's fixed outdoor heaters, designers can simplify maintenance requirements and reduce product life-cycle costs. Made with high quality stainless steel and fully sealed heater bodies, Bromic outdoor heaters do not require harmful chemicals for cleaning, making them a cost-effective outdoor heating solution that is both safe for people and the planet.

Operational automation can further contribute to efficiencies and allow for accurate tracking of energy consumption. With more advanced controls technology, precise thermal comfort can be engineered. Controls Bromic outdoor heaters can be as simple as on-off control, more advanced dimmer control, or powerfully leveraged with Smart Home automation through the latest home and building automation systems. These state-of-the-art systems will ensure that outdoor heaters will automatically be switched on or off at pre-set temperatures, specific times of the day or only when people occupy the space.

Conclusion

Outdoor spaces will continue to expand their importance in the of residential and commercial design concepts. The impact on health, mental wellbeing and social connectivity is undisputed.

By choosing radiant outdoor heating technology with high heat transfer efficiencies and pairing it with a sustainable design approach, architects and designers can create functional outdoor spaces that deliver comfort, safety and wellness while minimizing the impact on the environment.

About Bromic Heating

Bromic outdoor heaters are recognized all over the world for superior design and performance. From luxury hotels and leading restaurants to distinguished outdoor kitchens and exquisite backyards, Bromic outdoor heaters deliver the perfect balance of performance, reliability and beauty.

Available in our distinctive collections, every Bromic outdoor heater is constructed from premium materials to deliver outdoor heating products that provide the perfect balance of performance, reliability, and beauty.

www.bromic.com

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