

Forbes

Passive Houses Grapple With Rising Temperatures

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The Bahnstadt promenade at sunset

“It’s a paradise for children.”

It’s a comment you commonly hear about Bahnstadt, a developing neighborhood tucked behind the main train station in Heidelberg, Germany. There’s a play space just about everywhere, and along the promenade that runs through the length of the neighborhood, the playgrounds are themed around farms, trains, and firefighting.

As well, Bahnstadt is stuffed with nine daycare centers, 340 kindergarten spaces, and numerous well-maintained green areas, for a population of roughly 6,000 and counting. The streets have also been designed to be friendly to pedestrians and pedallers of all ages and mobility levels (though there's [continuing tension](#) between drivers and those who want to reduce the space and speed given over to cars).

Many of the housing units in this development, which is about 2/3 finished, have been designed for families. Unsurprisingly, then, Bahnstadt has a young population: 21% of the residents are under 18.

While residents marvel at how family-friendly Bahnstadt is, city officials and environmentalists often give kudos to Bahnstadt's energy efficiency. Bahnstadt is among the world's largest Passive House districts. Passive House is a certification issued by the Passive House Institute in Germany for buildings, including non-residential ones, that [have been designed to be as close as possible to airtight](#). The result is more consistent internal temperatures and thus lower needs for artificial cooling and heating, along with lower carbon emissions.

Bahnstadt uses at least [80% less energy for heating](#) than a comparable city district, according to the City of Heidelberg, which is responsible for the Bahnstadt development. As for the energy-related CO₂ emissions, one estimate is that for the average Bahnstadt resident these are only [6.5% of the average Heidelberg resident's](#).

The environmental credentials are impressive, but there's one aspect of the design that particularly worries some residents. It's a concern across the passive design movement more broadly, as temperatures advance [staggeringly quickly and dramatically](#) around the world.

The cooling dilemma in Bahnstadt

Kai Golücke, a kind, fast-talking lawyer, lives with his wife and three kids in a minimalist five-bedroom home (about as big as any Bahnstadt unit gets). He acknowledges that some critics find Bahnstadt a bit sterile in comparison to the charming historical center of Heidelberg, but “it’s 90% perfect for us,” he says of their home, which is just a stone’s throw from his office. “You’ll never get 100%.”

The remaining 10% has a lot to do with the heat. Heidelberg is [one of the hottest cities in Germany](#); and Bahnstadt, which contains a lot of concrete, is warmer still than central Heidelberg.

The summer of 2023 was unseasonably warm. The Golücke family left their top-floor terrace unused because it was unbearably hot out there. And inside, “the heat is really a problem,” especially on the ground floor, with family members constantly opening and shutting doors.

The trees in the neighborhood aren’t mature enough to provide shade, and the heat has also impaired their growth. Golücke believes that the Bahnstadt designers were underestimating the extent of climate change, and even more greenery should have been included.

Some residents have installed air conditioning. This isn’t prohibited, but the Bahnstadt planners have attempted to forestall it by reducing overheating in the first place. The complex’s larger buildings, including the Passive House movie theater, use district cooling. In this network, a cooling center cools water using solar-generated electricity and ice storage, then distributes it locally. This system leads to [substantially lower CO₂ emissions](#), according to the City of Heidelberg.



A completed canal section in Bahnstadt

Another water-based cooling measure, which would benefit everyone in Bahnstadt, is canals. These are helping reduce outdoor temperatures a bit, but they have yet to be constructed across the neighborhood. Angie Klocke, a gregarious retiree, is looking forward to the canal being built in her part of Bahnstadt. She, like Golücke, didn't move to this carefully planned neighborhood for its environmental bona fides. She wanted to be surrounded by people, including children: "I need the people, not the trees."

While she's less interested in the technical features of the Passive House design, "the Passive House works very well" in her light-filled apartment, she says. She barely uses heating (which in Bahnstadt is powered by wood waste).

Klocke, who reports paying EUR 915 a month (approx. US\$ 975) for her 560-square-foot apartment, doesn't have cooling devices. To stay comfortable in the summers she's learned to change her patterns: she opens windows in the evening, and is careful about when she takes down her blinds. On a sunny afternoon, many blinds across Bahnstadt are drawn shut.



Angie Klocke is careful about shading on sunny days

Passive cooling beyond Bahnstadt

Indeed, low-tech measures like shading systems and window opening can be [surprisingly effective means of passive cooling](#). This has been seen in other residential complexes in similarly housing-starved cities, including London's much smaller-scale [A House for Artists](#) (which uses passive measures but isn't Passive House-certified).

A House for Artists is an unusual 12-apartment project that since December 2021 has provided reduced rent to its artist residents, who devote some of their time to community creative programs. Given the aim of community building, energy considerations had to sit alongside artistic and social factors.

"We set out to create climate-resilient homes, suited for rising temperatures," explains Astrid Smitham, a cofounder of [APPARATA](#), which designed A House for Artists. These included shading of shared balconies and walkways, and cross-ventilation through large windows.

“This was put to the test not long after the building was occupied”, with record-setting heat in the summer of 2022. According to Smitham, when the outdoor temperature reached into the high 90s, residents reported that the temperatures in their apartments stayed much cooler, between 79 and 82°F, even without using fans.



A covered shared balcony that provides shading to the windows

The A/C problem

There are many reports of Passive House buildings that essentially no longer require heating, even in cold climates, like Scotland’s [Shetland Islands](#). But replacing cooling altogether is a trickier proposition.

Beyond A House for Artists and Bahnstadt, some architects are acknowledging that even with the best building insulation and shading, air conditioning may be necessary [because of heatwaves](#). It may seem antithetical to passive design principles. But air conditioning is allowed in a Passive House if it keeps within certain conditions, according to Ben Caine, director of the architecture practice [Leanhaus](#) in Perth, Australia. Caine explains that the aim is to reduce overheating beyond 77°F to less than 10% of the time. “This can be as little as 1/10th the cooling demand of a conventional house,” Caine says.

Alternatively, his designs can use small fans with duct work to transfer cool air between parts of a house. “These are very cost effective, quiet and easy to install,” according to Caine.

Boston’s luxurious [Winthrop Center](#), a privately developed skyscraper with both offices and residences (including a dedicated pet program), is very different in feel to A House for Artist’s artistic and social housing experiment in London, or the medium-rise, part-social housing neighborhood of Bahnstadt in Heidelberg. But all share passive design features. In October, Winthrop Center’s office portion became the world’s biggest office space to be Passive House-certified.

The project cost a whopping \$1.35 billion. According to the developer, Millennium Partners, the cost to develop the office portion was [2 to 3% higher than the cost of a comparable project](#). Cost savings are expected over time, as energy bills will be lower thanks to design features like triple-pane windows and greater insulation.

Active cooling is still needed, in the form of horizontal [fan coil units](#). But according to Brad Mahoney, Millennium Partners’ director of sustainable development, “the amount of heating and cooling we are providing can be reduced by up to 10 times. Existing buildings use 150% more energy than Winthrop.” It’s not necessarily an either/or situation, as Passive House standards can reduce the need for active cooling devices without completely eliminating the need for them.

Architect and Passive House designer Caine believes that air conditioning, powered by solar energy, “is a cost effective and responsible way to augment the comfort” of a Passive House.

Cost-effectiveness is important given the higher upfront costs of many passive designs, even away from high-end extremes like Winthrop Center. “We are always trying to provide the best balance of cost and performance to make Passive House standard homes accessible to more people,” Caine explains. He believes that integrating air conditioning with solar panels can bring down costs compared to “overly thick and expensive wall systems.”

Even where air conditioning is powered by renewable energy, [more powerful passive cooling](#) is a pressing research area, given the climate conundrum that A/C is heating up the planet even as it keeps individuals cool.

Innovation and imagination will be critical to resolve this. As the architect Smitham cautions, “Our homes have to be designed fundamentally differently to be suited a hotter climate. Indeed, much can be learned from [hotter climates where passive measures have been in play for centuries](#), such as decks, verandas and solar shading.”