

Simplifying Passive House Design

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The leading standard for home efficiency, it can come off as a daunting challenge, but it doesn't have to be.

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What is a Passive House?

For those invested in sustainable building, there's a good chance you've heard of Passive House before. While it's often thrown around as a catch-all for energy efficient homes, it actually refers to a specific design standard developed to create buildings that are energy efficient, comfortable, affordable to operate and ecological for the environment.

By design, a full-fledged Passive House is able to maintain a comfortable temperature with minimal intervention. Due to their air-tight building envelopes, Passive Houses are also constantly drawing in fresh air from the outside environment to replace stale, indoor air, so it's not only a more efficient way to construct a home, it's a healthier way, as well.

However, there is often a stigma associated with Passive House design. With its rigid criteria, many have come to associate a Passive House as a blocky, utilitarian space that is challenging and expensive to construct.

There is some truth to that—Passive Houses are slightly more expensive and can be challenging to get fully certified. However, as Sarah Jefferys, Principal of Sarah Jefferys Design points out, pursuing the standard doesn't have to be an all or nothing scenario, nor do aesthetics and comfort need to be sacrificed in the name of efficiency.

Understand the Basics and You're 95% of the Way There

Jefferys acknowledges the biggest challenge can come at the last leg. However, she also believes professionals shouldn't feel compelled to go 100% on all their projects. In her experience, reaching 95% compliance is doable and still offers an incredible efficiency rating over traditional housing (around 65%). All it requires is a basic understanding of some core principles.

The biggest consideration should always be the positioning of the home. House placement and window placement should always take advantage of the sun and shade for passive heating and cooling benefits, and it should take priority in the planning phase of a new build. Once the position has been set, that will then dictate other elements of the home such as window placement, room organization and whether or not additional systems such as geothermal heating or solar can be made available.



According to Jefferys, positioning is one of the most important aspects of Passive House design, despite not being immediately apparent.

One of the tricks Jefferys suggests is having south facing windows or doors with retractable overhangs or specialized shading. That way, during the winter, they can act as passive heating elements, while during the summer, the overhang can be extended to filter out direct sunlight.

Insulation is the next step. Ensuring that there is a constant thermal breakage between the studs and the outside wall is key (most houses have studs placed directly against an exterior wall, which becomes a cold sink in the winter). Jefferys also suggests securing the roof first before following through with the rest of the house, as the roof is the largest source of heat loss in a home.

After that, ensure that the house is airtight and you've addressed some of the most important areas of Passive House design already.

Don't Feel Constrained with the Interior Design

In the beginning, Jefferys notes, Passive Houses did tend to stick to a specific design. However, materials and building sciences have come a long way since then. Windows, for instance, were once the bane of these buildings due to their low insulative factor. However, now, with the development of triple-glazed windows, these portals to the outside world can be almost as insulative as a traditional wall.

Combine that with a better understanding of placement and positioning, and windows have instead become one of the greatest assets to a Passive House, instead of being its enemy.



Continual innovation and refinement have also driven down the cost over the years. What used to be a 15-20% additional investment on top of new building costs is now down to 5-10%. That, Jefferys notes, can easily be recouped through efficiencies in a span of about two to three years.

The materiality of the interior design is far less restrictive, as well, with the only caution being: avoid materials that can be thermally conductive—so stone and dark colors are out. However, Jefferys notes this opens the door to plenty of warm, natural options like wood and terracotta for flooring. Concrete, too, provides a durable, stone-like replacement for countertops and hearths.

Instead of being limited to singular options, interior designers have an opportunity to play with rich hues, variable textures and biophilic materials to create spaces that fit perfectly in with modern design tastes.

Use Technology to Your Advantage

Adding in an efficient heating and cooling system, such as a heat pump, can drive down costs even further, says Jefferys. While it all depends on the location, she states that a geothermal heat pump is a great heating system to pair with the home, though an electric heat pump can be just as effective. With rebates offered by the Inflation Reduction Act, the systems are now more affordable than ever.



The New Oceanfront House in Friendship, Maine is a unique case where an offsite solar array is used to power the house while funneling excess energy into the town's grid.

The addition of solar is welcome, as well, but Jefferys cautions that a traditional rooftop system won't be enough to power the entire house. She also only recommends it for clients with budget to spare, as the addition of a solar system could easily contribute an extra 25% to a project's overall budget. It translates to even more energy savings, but it comes at a cost.

One piece of technology, however, that Jefferys states will always be critical to a Passive House is mechanical ventilation. Specifically, professionals are going to want to employ an ERV—or Energy Recovery Ventilator—as part of the home's systems. These components re-

use the heat contained in outgoing air exhaust to maintain a constant temperature as new air is added.

Final Thoughts

Jefferys voices an opinion shared by many who have worked on the Passive House standard, and that is it shouldn't be interpreted as an all or nothing rule. Much like any building standard, it's incredibly valuable as a guide to better building, and even if it can't be fully achieved on a project, that doesn't mean it should be abandoned altogether.

The strategies discussed here mainly relate to new builds, though can be applied to retrofits in certain cases as well. However, to achieve much of what a Passive House demands in a retrofit, a heavy gut renovation may be required, which could be off-putting to clients. This is especially true if the house is older and bears a distinct design that the owners may wish to preserve.

There are some tricks, though, that Jefferys has learned in her time working with the standard. For instance, while retrofitting townhouses in New York, she found that adjoining houses are incredible insulators, providing a strong base to work with. Additionally, running with this idea, she states that parts of a building can be Passive House compliant, which can be easier to achieve.



In this situation she uses an example of a four-bedroom home with only two bedrooms being used throughout the year by the homeowners. Once the main living area has been identified, the other sections of the house can be isolated via a thermal break. Once that's done, the defined living area can be built to Passive House standards separate from the lesser used sections of the home.

Additional Resources on Passive House Design

For those interested in learning more about Passive House construction, Jefferys states that the [Passive House Institute](#) offers incredible guidance and insight. Additionally, the [Passive House Accelerator](#) offers educational materials on their website for those interested and even delivers weekly presentations for professionals.

For more inspiration on Passive House designs, we have additional articles covering the build of [Wayne Turret's Passive House in Greenport, New York](#), as well as the United States' first Passive House certified hotel, [the Hotel Marcel](#).