HOW MUCH DOES A PASSIVE HOUSE COST

ARTICLE BY TIM DELHEY EIAN, TE STUDIO – www.testudio.com

How To Determine The Cost Of A Passive House?

Most people can relate better to cars than buildings, therefore let me use a quick comparison to break down the challenge of this question for you.

What would you say if someone asked you how much a car costs?

Maybe your first reaction would be to ask what kind of car that someone is talking about. Is it used, or is it new? Is it small, or big? Does it burn gasoline, or is it electric? Was it made in a factory in Detroit, or in some white-glove watchmaker's shop on the border of Italy and Switzerland?

I would take a guess and say that most people would not immediately be able to put a single dollar number on it without further information on the kind of car.
Now you see the dilemma building designers face in answering to this question, given the plethora of building types, options, trim level, finishes and amenities out there.

What About The Use Of Dollars Per Square Foot ($/SF) To Determine The Cost Of A Building?

Back to buildings—and the aforementioned issue of "what is it?". Not only are there a plethora of buildings out there but the definition of both the dollar number and the square foot number in the $/ SF quantifier are not clearly defined in the residential market. So here goes my reply, and an attempt to help you figure out at the actual cost of your project—Passive House or not:

First off, and in my opinion, the $/SF number is almost irrelevant, as long as a building meets or exceeds the owner's expectations. This single number does not say much about a structure, and is not very helpful in establishing budgets. Here are two key reasons why:

1. **There Is No Set Definition For The $-Number Used For The Calculation.**

Two obvious options are cost of construction and the development cost. The first one commonly refers to the actual cost of the build project, whereas the second one includes the entire project cost to the owner including land cost, site work, design fees, financing cost, etc.

The problem here lies in the fact that in some cases the development cost can be significantly higher than the cost of construction.

2. **There Is No Set Definition For The SF-Number Used For The Calculation.**

Two obvious options are the gross square footage and the net-finished area inside a structure. Others are more complex, such as the area calculation commonly used in the real estate industry that adds gross square footage above grade, yet omits any square footage below grade. Last but not least one could leverage the Passive House's

definition of “treated floor area”, which leverages a German ordinance to calculate the useable area inside of structures.

To make matters worse, walls in highly insulated buildings may occupy 20 to 25 percent of the gross SF area in a cold climate. In traditional construction, this number may be only 15%, skewing any comparison between the two.

With both parts of a $/ SF quantifier being variables, it is impossible to arrive at a meaningful number. Using the extremes on both ends, a $/ SF number could easily fluctuate by a factor of 2 or more.

Let Me Give You Another Good Reason Why A $/ SF Quantifier Is Little Helpful:

The added cost to make a PH envelope versus a code-compliant one may be 15% of the cost of construction in a cold climate. For an average $300,000 home this means $45,000 dollars more. The average cost of a kitchen in the same $300,000 home may be $35,000. Now, I have seen clients push the cost of a kitchen (cabinets, counters, and appliances) to near $100,000—even in fairly modest homes. That means an additional $65,000 spent in one room of the house alone, and $20,000 more than a Passive House upgrade would have cost. At the same time, the size of the building may not have changed at all—creating a much higher $/SF number.

Along the same lines, baths can easily range from $10,000 to $40,000 based on fixtures and finishes producing more high-dollar variables that would skew the dollar portion of the $/ SF quantifier and making it once more a poor representation for the cost of the building. Along these lines I want to point out that in general and for most clients it will be much easier to escalate the cost of construction with size of the home, as well as kitchen and bath build-outs than with a Passive House upgrade.

Well, Than How Do We Figure Out How Much A Building Costs?

My recommendation to those wondering about cost is this:

Make a schematic design and write down the basic specs that describe fixtures and finishes. Then build a budget based on cost for main cost-producing groups. Also, do not forget the other components of the development cost. They are often overlooked and can produce hardship during the project if left unconsidered.

A quick (and certainly incomplete) example:

DEVELOPMENT COST =
site cost $
+ setup cost $
+ erosion control $
+ site work, site restoration $
+ COST OF CONSTRUCTION
- *$ for footings and earthwork*
- *x SF window @ $/ SF = $*

- *x SF wall envelope @ $/SF = $*
- *x SF slab assembly @ $SF = $*
- *x SF roof assembly @ $/SF = $*
- *kitchen $*
- *bath $*
- *bed room and living space SF @ $/SF = $*
- *mechanical systems $*
- *electrical system $*
- *other building related cost $*

+ GC fees $
+ Design fees $
+ Finishes and furnishings $
+ Holding and/or financing cost $

Everybody Else Is Using $/ Sf, So What If I Insist?

If it has to be a $/ SF number, start with what is commonly assumed in your area to build a **quality building**. Make sure you understand what $-numbers and what SF-numbers are used. We recommend using the net useable area inside the structure—meaning total cost of construction divided by the entire net amount of conditioned square-footage inside the insulated building envelope—finished or not. **A Passive House is always a quality building!** Therefore, it will not compete in the rock-bottom market where quality is sacrificed for quantity and first-day cost. So, starting from the cost of a quality building, add 10-20% to the cost of construction, and maybe another 5% to the typical cost of the design fees. Please note that very small buildings as well as high-end buildings can exceed this number by a factor of 1.5 to 2 due to their specifics. Over time, and with volume and experience both numbers will decrease, as examples in Europe have shown. For early projects however, I feel that this is a reasonable approach.
FYI, after 15 years of Passive House construction, the average Passive House in Germany only commands a couple of percentage points in added first-day cost. However, the basic German building code is more demanding than building codes we have seen in the US—allowing just code-compliant buildings to be cheaper.

Suggestion: Passive House Costs Less, And You Pay For It Differently.

Another important point when talking about cost of a Passive House is this one: Passive House is based on a return on investment model that negates upwards of 2/3 of operating costs for utilities for the life of the building. With quality construction also come longer component life cycles—offering further reduction in overall cost of ownership. Over time therefore, a Passive House will be the cheapest structure one can own. While the first-day cost may be slightly inflated, subsequent operating cost is substantially lower and much less exposed to a volatile energy market. Many of the Passive House improvements will return their investment in half the life of a typical mortgage, or less.

Case studies in Germany have shown that the energy savings of a Passive House alone can pay for the cost of construction over the life of the mortgage. Since none of us know

exactly what energy costs will do in the future, this is all based on highly educated guesses. However, Passive House really shines when we get to the point of uncertain availability of fuels. With its low consumption, it can be fueled in many different ways and be more flexible than conventional buildings without major retrofits. The fact that its building envelope is already maximized also means that future retrofits to save energy are very unlikely. Therefore, these upgrades to conventional buildings can be marked as future savings of a Passive House.

Okay, How Much Does It Really Cost?

On a final note, whatever it "really" costs to design and build a building (Passive House or not), that is its real cost. We always tend to think that it can be done for less. In the end however, only the actual costs are relevant. When looking at early prototypes we need to realize that they are more expensive, and that this can and will change over time as people become more familiar with Passive House, and products and services become available locally to cater to its construction.

In the meanwhile, most of us look at our investments in different ways. Sometimes we look for return on investment (a fiscal return), sometimes for things that we enjoy (that may not have any fiscal return). Sometimes we look to benefit the planet or others, and other times, we invest in health or comfort for ourselves. Passive House delivers on many layers of health, comfort, sustainability, financial return, or conscience. The real cost of it have to be put in perspective with all of this in mind. Often, it becomes more a matter of priorities than a matter of ability. And for those who think they cannot afford to build a Passive House I offer this thought: You may not be able NOT to afford it. Or as a friend of mine likes to put it: "I am too poor to be cheap".

What Is My ROI?

This is a very popular question. I alluded to it above. Interestingly enough, a lot of people ask this one right away. I am not sure if they asked the appliance sales person when looking at the stainless steel upgrade, or the SUV dealer when looking at the bigger vehicle the same question ;) Fair enough though. I always say there are not stupid questions, only stupid answers—so here is my quick take on it:

ROI for a high-performance building shall be calculated on the added incremental investment for an air-tight envelope, more insulation, and better windows and doors ONLY!.

All other components are needed to make a conventional building, anyways. Therefore, it makes no sense to scrutinize the whole thing—and people traditionally don't. As stated earlier, a lot of the components needed to "get there" are incremental upgrades with incremental costs (maybe 10-20% more than conventional construction at present, and 5-10% mid term). On the imaginary $300,000 home, this means maybe $45k of incremental cost for upward of 2/3 less operating cost for life, as well as twice or more the life span for some components (such as high quality windows and doors, etc.), plus the negation of energy upgrades in the future. My educated guess is that by the time the first replacements (for i.e. windows, mechanical equipment, etc.) start to happen, the

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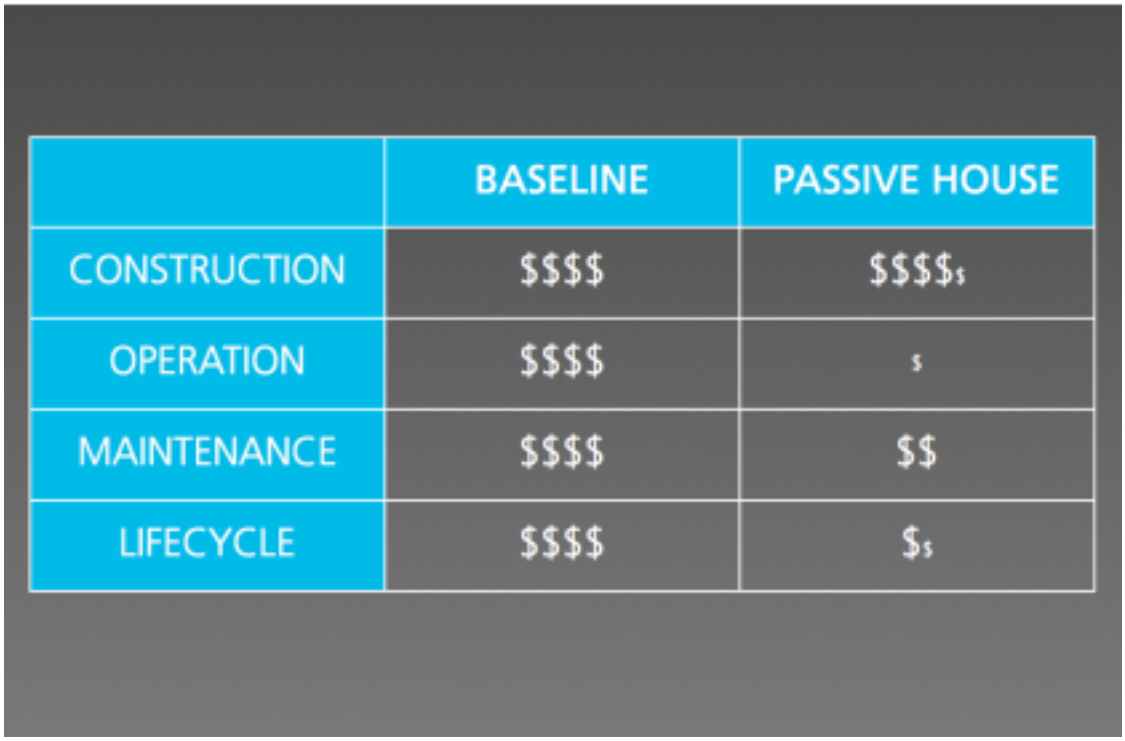
ROI discussion is done and then some. More importantly, should we ever face an energy shortage due to supply issues or extreme cost hikes, Passive House is easily fueled in many ways, and offers some survivability out of the box (especially in cold climates where its passive solar potential may provide a suitable environment for people even without energy input). It therefore does not only provide financial ROI but also an insurance policy for an uncertain energy future.



Is A Passive House Affordable?

In discussions I often hear people use the term affordable to describe a building that is cheap to build. The cost to build a building has a connection with its performance and the cost of operation and ownership down the road. Most sustainability measures—and I mean that in a financial regard as much as an earth-friendly one—are pay-it-forward ideas. Therefore, a cheap building will likely not be a particularly sustainable building. Rather than defining affordability by looking at first day cost, I tend to favor a long-term look at all of the cost it takes to build, own, and operate a structure. The reduction of this overall investment to a number that is financially sustainable for the owner would be my preferred definition for affordable housing.

Any calculation of affordability shall include not just operating cost (such as utility cost) but also maintenance cost, and the cost of performance upgrades as needed in standard construction to keep pace with conservation needs and comfort wants at the time.

Without sustainability measures and a long-term approach, affordability can easily be spoiled by volatile operating cost and uncertain, or unreasonably expensive upgrade costs in the future.

In addition, the value of structures in the U.S. is almost entirely derived by comparison and therefore very disconnected from how much it cost to build, operate or maintain. In my opinion, the cost of construction, and even the development cost as calculated on

day 1 are often irrelevant—especially after 10, 20, 30, or more years of occupancy. Nonetheless, first day cost figure into the overall cost of ownership and therefore do need to be looked at. The question is how any first day cost inflation produced by Passive House measures stack up over time.

Having said all that, cheap buildings can only have a small chance to be great performing buildings that negate operating and maintenance cost over time. Most of them will be significantly more expensive to own and operate, and ultimately be very expensive buildings. I think their cost to the environment and society, which the aforementioned calculation does not even consider, may exacerbate this.

Smart sustainable designs like Passive House on the other hand can be focused to target ongoing cost over time. Passive House actually provides tools for designers to create measurable results and effectively negate up to 2/3 or more of operating energy—for the life of the structure.

As a result, I think that affordability should only be judged based on a mid to long-term analysis. I believe that Passive House can deliver great affordability for the foreseeable and unforeseeable future. It minimizes both operating cost, as well as the amount of future upgrades and maintenance, as its performance goals require durable and robust construction that meets an absolute performance goal.

Can It Be Financed?

This question is based once again on common client feedback regarding discussions they have had with their lenders. In many cases, lenders point out the value that the neighborhood can support as a practical constraint.

This is all too often the case and can be very limiting. It affects any construction activity and is not a specific issue for Passive Houses. However, the increase upfront cost of a high-performance building may negatively impact the discussion.

At the end of the day, however, financing options really depend on the lender. Some are able to use the significant reduction in operating cost as an asset to lend against. It may take the right lender and a bit of creative thinking to pull a project like this together. In many cases, however, I have seen the real challenge be the ability to pull together financing for any project in the first place, and not specifically for the added cost to make it a green, high-performance project.

In most neighborhoods it does cost more to build new than to buy used, much in the same way that a new car is more expensive than a used one. In some neighborhoods the difference can be significant. If the decision to lend is purely based on neighborhood value, only owners who can afford to pay cash can feasibly build in many neighborhoods. So in short, if we can agree that a decent neighborhood deserves new people to come in and make an investment, **we have to get beyond the point of the simple neighborhood cost comparison** and agree that in some cases, a new home will cost more than an old, used home—but at the same time represent a greater value

and asset to the owner, society, and the lender.

In addition, we need to take a closer look at total cost of ownership over a given lifecycle or time-period, which may show that **a more expensive home may be the cheaper home in the long run**, and therefore present a **more desirable proposition for future owners**, which in turn are likely to pay more for it. That is of course, if the added cost went towards things that actually reduce the total cost of ownership. The two main investment categories that will produce this kind of cost advantage are the cost of operation (mainly energy and other services), as well as the cost of maintenance (materials and systems) including replacement cost. I would call this resource and risk management, and ultimately sustainability. I think that sustainability is worth something, and propose to lenders to recognize that.