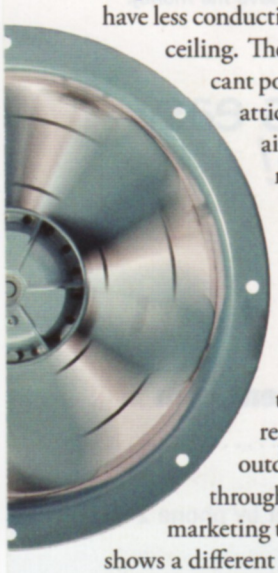
Don't Let Your Attic Suck

Power Attic Ventilators are a Bad Idea

By ALLISON BAILES III, PH.D.

TRADE SHOWS CAN BE both educational and infuriating, and there's one product seen at a lot of trade shows that fits easily into the latter category — power attic ventilators. The variety of this device that's been popular lately is the solar-powered attic ventilator. Using the sun to make the electricity for this fan, however, makes it only marginally better than its grid-powered cousin.

Oh, yes, power attic ventilators probably will keep your attic cooler and that means you'll have less conductive heat transfer across your ceiling. The problem is that a significant portion of the cooling in your attic will be provided by your air conditioner. So, you spend money to buy the fan, to run the fan if it's not solar and then your air conditioning bill goes up, too.



How can that be, you ask? Isn't it supposed to pull that blazing hot air from the attic and send it outside, replacing it with much cooler outdoor air that gets pulled in through the soffit and gable vents? In marketing theory, yes. Building science shows a different result, however.

What really happens is that when that power attic ventilator runs, it's going to pull air from wherever it can find it. Since air takes the path of least resistance, some of it most likely will be coming from the conditioned space in your home. So, basically what you're doing is air conditioning your attic. The longer the fan runs, the more conditioned air it pulls into the attic.

If you have a perfectly air-sealed ceiling, you're not going to have this problem, of course. The reality, however, is that few ceilings are leak-free. Since air needs only a pressure difference and a pathway to move, and your ceiling probably has plenty of pathways, it's best not to enhance any pressure differences that will increase air movement into or out of your home.

In other words, don't install that power attic ventilator. If you have some installed already, disable them so they never run.

Power attic ventilators can cause problems even without air conditioning. One potential problem would be sucking moist, moldy air up from the crawl space into the house. Another would be backdrafting a water heater and putting carbon monoxide in the house. These are real problems from real houses that have really happened.

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If you're tempted to buy one because it's solar-powered and won't increase your electricity bill, go back and read what I just said. These things probably won't save you any money. Even if they're solar, they'll still suck the conditioned air out of your house and make your bill higher, not lower.

Peter Yost over at Green Building Advisor wrote about solar-powered attic ventilators a couple of years ago and laid it out perfectly. He also gave a great quote by Dr. Joe Lstiburek:

"In order for the fan to work, air needs to come from the outside and not be pulled from the house, so this means that the attic ceiling needs to be airtight. If the attic ceiling is airtight, you don't need the fan. Your money is better spent on something else."

If you want to get into the nitty-gritty research data about attics, you can download this paper (pdf) from the Florida Solar Energy Center reviewing the research not only about attic ventilation, but also about sealed attics with insulation at the roofline instead of at the flat ceiling.

The bottom line is that, in most cases, power attic ventilators are a waste of money. In some cases, they can be dangerous because of backdrafting.

Comments from David Butler, *Optimal Building Systems*

Anyone who's even casually studied building science knows that powered attic ventilators are bad news. Here's a collection of articles on the subject:

http://tinyurl.com/4xwgc8d
http://tinyurl.com/m7nrq
http://tinyurl.com/66qq8jv
http://1.usa.gov/9lgj2j

But putting the pressure imbalance issue aside, let's look at some numbers.

Let's say a homeowner spends $400/year to operate the A/C. Ceiling loads typically represent from 10 to 25 percent of the total (based

on having run hundreds of building simulations). So, in this example, the ceiling load represents $40 to $100/year of the annual cooling costs. Of course, these numbers may be lower or higher depending on actual cooling costs, but it's instructive to see where this leads us.

Now, it's well known that radiant gain from the roof makes up well over half of the ceiling load (that's why radiant barriers are cost-effective in hot climates). If we assume half for argument's sake, that means conducted heat loads (e.g., the result of delta-t) account for $20 to $50 of the upstairs cooling costs.

So, how much of this load can an attic ventilator save? Twenty years ago, I had a 2,300 square-foot ranch with two powered ventilators. They were set to automatically come on when the attic temperature reached 95° to 100°. I did some measurements on a couple of 100-degree days and discovered that the fans reduced the peak temperature at the highest point of the attic by about 10° (130° vs. 140°), BUT the temperature at the top of the insulation, which is all that matters, only dropped by about 5 degrees, from 120° to 115°. Essentially, the fan reduced the temperature, but also reduced the normal stratification that occurs in the attic.

With my thermostat set at 77°, the delta-t between the attic and the house was 38° instead of 43° on a 100-degree day, or about 12 percent. On cooler days, the reduction obviously would be less, but to keep this simple, let's assume the percentage reduction remains constant (it doesn't).

Now, 12 percent of $20 to $50 is only $2.40 to $6 a year. That's making the most optimistic assumptions all the way around.

Someone pointed out to me that the fan also reduces radiant gain because the roof temperature might be a few degrees cooler. I didn't have any way to measure that, but even if we assume the radiant reduction is as large as the temperature reduction, we're still only talking $12 a year, at most, in this example.

Now, we need to estimate how much the ventilator costs to operate. Mine consumed about 165 watts each (none of the PAV manufacturers use the more efficient ECM motors and getting wattage specs is like pulling teeth). Let's assume 165 watts for a single ventilator. If the ventilator runs 800 hours, a conservative assumption, that works out to 132 kWh, or about $13 a year at 10 cents per kWh.

So, with the most optimistic assumptions at every step, the ventilator doesn't save any money, let alone pay for itself. These things cost at least a couple hundred dollars installed. And this thumbnail analysis doesn't account for any additional infiltration loads that may be caused by the ventilator. ■

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