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## Heating/Air conditioning

Isaac Savage  
Home Energy Partners



**Q: I'm considering the replacement of my heat pump. Could you explain what a "SEER" rating is and how it relates to the overall efficiency of my heating/cooling system?**

SEER stands for **S**easonal **E**nergy **E**fficiency **R**atio. SEER is determined in a laboratory setting to rate the efficiency of the *equipment* only. It is also important to remember that SEER is only speaking to the efficiency of the *cooling* capacity of the HVAC equipment. The heating efficiency is taken into account within the HSPF (heating season performance factor) rating. In our climate, the HSPF is actually more important than SEER, since we use more energy to heat rather than cool.

The main point I'd like for you to understand is that both of these efficiency related numbers refer *only to the piece of mechanical equipment*. There are other components of an HVAC system that also affect the efficiency of the system. Think of it this way: You could buy a Toyota Prius that is rated to get 55mpg, but if you load it down with 5 people, poke a few holes in the gas tank, and never change the fuel filter, you'll be fortunate to get 25mpg.

The SEER or HSPF ratings on HVAC equipment represent the absolute best efficiency that you could ever hope to achieve, assuming the other components are all designed and installed to work in conjunction with this piece of equipment.

Since I don't have room to discuss all of the components in detail, I'll focus on two that typically decrease the efficiency of the system the most: *ductwork and charge*.

The first thing to understand about an HVAC system is that every unit is designed to have a different amount of airflow across the coils (through the unit itself). The standard system requires approximately 400cfm (cubic feet per minute) per ton to flow across the coils. So, if you have a two-ton system, the manufacturer expects it to be installed to move ~800cfm across the coil. This means that the return should suck 800cfm from your house and the supplies should provide 800cfm back to your house. Most systems have ductwork that is undersized, therefore reducing the amount of air that the fan can pull across the coils. If the system mentioned above is only able to pull 600cfm from the house (due to undersized ductwork), then it is not performing at its rated efficiency. Low air flow not only decreases the efficiency of your system, but also creates comfort problems within the home.

Duct leakage also results in a large decrease in your system's overall efficiency. What would happen to the system's efficiency if it was pulling 30% of its return air from the attic, instead of the living space? Do you think it would cause the efficiency to go down? You bet! What if your supply ductwork was losing 25% of its air into the attic or crawlspace? What would this do to the efficiency of your system? This equates to having a hole in the gas tank of your Toyota Prius – not a good idea. Duct leakage also decreases IAQ considerably by pulling in air from unhealthy places.

The last element is the "charge" of the heat pump. The charge relates to the amount of refrigerant in the system. This fluid is the vehicle for transporting BTU's of heat from inside to outside, or vice-versa. If you have too much or too little, the efficiency of your system decreases (not to mention its lifespan). If you decide to replace your ductwork, because you want to increase the amount of airflow across the coils (raises efficiency), and you also

seal all of the holes in the ductwork (also raises efficiency), then you must have your unit's "charge" adjusted to work in conjunction with the increased air flow across the coils. All of these elements are tied together. Ignore one of them and your system's efficiency WILL go down.

Studies show that less than 2% of residential HVAC systems have been properly air-balanced. The average residential HVAC system performs at 50-65% of its rated efficiency, due to the imbalance of airflow, excessive duct leakage, lack of insulation, and improper charge. This means that your brand new 19 SEER unit that is installed onto your old ductwork will most-likely be performing at a SEER rating of 9.5 – 12.5!

For the same investment as a new 19 SEER unit, you could probably purchase a 14 SEER unit AND have your ductwork balanced/retrofitted, resulting in a more comfortable (proper air flow) and healthier (no duct leakage) living environment.

Search for a contractor in your area that understands air-balancing, preferably with a certification (National Comfort Institute is one of the most trusted in the industry). They will be able to look at all of these elements with reference to each other and provide you with an HVAC system that actually performs efficiently *as a system*.