NCI Releases System Performance Study Findings by Rob Falke

What if our customers knew that more than 40% of the Btus that they're paying for don't make into their homes?

What if you knew it was possible to increase system performance by 36%, so that your systems deliver more than 90% of their rated Btus?

Interested?

During the past four months, we at National Comfort Institute (NCI) have conducted a study with a group of our certified contractors to determine the effect and value of HVAC system repairs on the efficiency of installed systems.

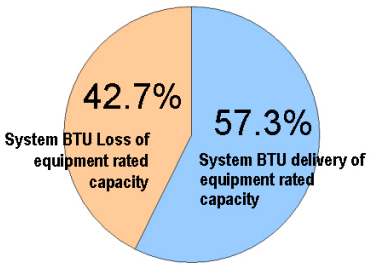
The primary purpose of the study was to identify the current operating efficiency of typical installed residential systems. We also wanted to identify the approximate percent of improvement that each group of repairs made to the system efficiency.

More than 60 contractors participated in the study, providing interviews and live field reports about combustion efficiency and air balancing tests. Some consumers were interviewed to determine their satisfaction with the educational approach to the sales process, the manner the work was completed, and their satisfaction with the final results. Test information from more than 1,000 systems around the country was included in the survey.

All testing was performed using the National Comfort Institute Residential Practical Standards written for HVAC contractors. The rating methods used included our Cooling System Efficiency Rating (CSER™) and our Heating System Efficiency Rating, (HSER™). Nearly all the testing was completed from the summer of 2005 through January, 2006.

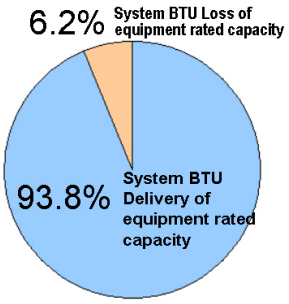
Installed Performance Ratings

Typical U.S. HVAC System Rated Performance



Real system efficiency compares equipment-rated BTUs to the BTUs actually delivered into the home. The survey concluded the typical air conditioning and heating system has an initial average CSER or HSER of 57%. Or, in other words, 43% of the rated BTU didn't make it into the home.

NCI Renovated HVAC System Rated Performance



After the duct renovations were completed and final adjustments such as air balance, refrigerant charge, and combustion efficiency adjustments were made, CSER and HSER ratings averaged 94%. This is a rating 6% below perfect, but nevertheless confirms a 36% increase in system performance.

The Value of Each Repair

Next, we took a look at what changes these contractors made in the systems to get an average performance increase of 36%. This was a very difficult task, because almost every change made in a system has a direct effect on the performance of other components in the system. However, in spite of the challenges, we grouped the repairs into the following categories and determined a percent of the total improvement in system performance for each repair.

Duct Renovation: 32%

Duct renovation procedures accounted for 32% of the total improvement in system performance. Typical repairs included:

Repair or replace ducts showing inadequate tested BTU delivery Add new return ducts or increase existing return duct size Add new supply ducts or increase existing supply duct size Repair damaged or poorly installed duct joints Straighten and extend flexible ducts, increase support and suspension Replace restrictive transitions
Install sheet metal wyes, fittings, and balancing dampers Renovate combustion venting and combustion area pressure defects.

Duct Insulation: 14%

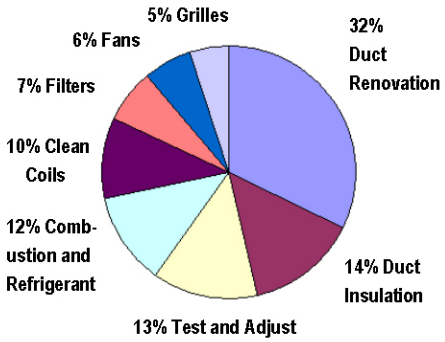
We were surprised to find 14% of the improvement came from adding air distribution system insulation. The need for this insulation came from simple duct temperature loss or gain testing of ducts found in unconditioned space. These simple repairs include:

Insulating any bare metal or air distribution components
Installing R-19 duct blanketing.

Testing and Balancing: 13%

We were pleasantly encouraged to find consumers found testing and balancing to be the most visible and appreciated benefit of system renovation. They rated it so highly because it makes the system providing equal temperatures throughout the home. All the changes made in the system to get it to balance accounted for 13% of the improvement.

Effect of Typical HVAC System Repairs on Performance



This work consisted of:
Testing and adjusting the system per NCI practical standards
Rating the installed HVAC system performance per NCI practical standards after all the renovation and adjusting work is completed.

Combustion and Refrigerant Adjustment: 12%

A change in airflow requires a system refrigerant charge adjustment. Combustion efficiency testing nets out a much larger increase in system efficiency when it's combined with venting renovations, but these repairs were included in the duct renovation portion of the system renovation. Between heating and cooling season these repairs netted a 12% increase.

Cleaning Coils and Heat Exchangers: 10%

Since the contractors included in the survey are constantly measuring BTU delivery, they often found coils that looked clean but were plugged inside the fins. This is one of the reasons the refrigeration charge yielded such a low increase in performance compared to the industry's previous opinions. Charging a system without testing the pressure drop over dirty coils is a weak link in our industry.

Several contractors reported many new high efficiency coils were too restrictive and needed to be replaced for the system to achieve the desired BTU delivery combined with high efficiency (undersized) fans.
Clean air conditioning coils, heating coils, and heat exchangers added an average of 10% to system performance. This was another surprise of the survey.

Changing Filters: 7%

Restrictive filters needed replacing, as determined by pressure testing on a large number of the systems tested. When high performance filtration was needed for the health of the occupants, return air filter grilles or filter housings were added to increase filter surface area and reduce restriction to airflow. By increasing heat transfer in system and decreasing blower motor watts, filters counted for an average increase of 7%.

Adjusting Fan Speed: 6%

Increasing airflow resulted in an average increase of 6% in system performance. Typically, fan speed was increased to achieve required airflow. Fans also needed cleaning and repairs to increase performance. Many fans and fan motors had to be replaced to meet the minimum acceptable system performance standard of 90%, again as set by NCI practical standards.

Repairing or Replacing Grilles: 5%

Our last category was grilles and registers. Defects were identified by airflow and temperature testing, which identified a poor selection of grilles and registers. Many contractors have learned to measure for sloppy connections at boots and grilles using temperature diagnostics. Grille repairs ended the list at 5% savings.

The Moral of the Story

Notice that the results of this survey primarily exclude the effect of equipment on overall system performance. This varies significantly from how the industry has traditionally viewed system efficiency, believing that it was the efficiency of the equipment that determined system efficiency.

Nearly one-third of these system renovations were performed on new construction homes. For these systems, the equipment was existing and nearly new. More than one-third of the systems renovated kept the existing equipment. So in the final accounting, the equipment had zero effect on more than 60% of the systems included in the survey.
The final third of the systems renovated did receive new equipment as part of the system renovation, but let's take a look at what equipment efficiency means in light of this test.

Increasing furnace efficiency from 80% to 90% is only a 10% gain, if the equipment works perfectly. Also, considering the most systems only perform at 60% of capacity, at best, new equipment typically yields only a 6% increase in system performance. So do you replace the filters for a 7% gain, or spend an extra thousand dollars, maybe two, on a new furnace?

The real answer is to fix the whole system and then install the best furnace your customer can afford. The same principle goes for cooling equipment.

What's the moral? On your next service or sales call, really look at the system and be inspired to do more than replace it or just get it running again.