Conclusions

It is commonly assumed that lower pressure duct systems are preferred for use in central residential heating and air-conditioning systems because they will result in greater airflow rates and cooling and heating capacities with PSC blowers and lower fan power draws with ECM blowers. Results from the 48 annual building energy simulations and life cycle cost analyses using a number of blower types, ductwork materials, and duct designs meeting a range of specified external static pressures in the two model homes described herein suggest the following:

1. Lower airflow rates and heating and cooling capacities caused by excessive system pressures (e.g., total external static pressure of 1.10-1.15" w.c., or 275-288 Pa) introduced by duct designs with high static pressures in the model homes with PSC blowers yielded substantial increases in HVAC energy use compared to the same systems operating with lower pressure duct designs (e.g., total external static pressure of 0.50-0.55" w.c., or 125-138 Pa).
2. HVAC energy impacts of the same systems using ECM blowers were not as large as those using PSC blowers because although ECM blowers draw more power to maintain nearly constant airflow rates and heating and cooling capacities at higher pressure drops, fan power was a small portion of the overall HVAC energy use.
3. When the initial costs of lower pressure duct designs were taken into account over a 15-year or 30-year life cycle, lower pressure duct designs generally yielded life cycle cost savings relative to the highest pressure duct systems, particularly in homes with PSC blowers and particularly when making comparisons with constant ductwork materials (i.e., comparing flex only or rigid only).
4. Lower pressure duct designs combined with ECM blowers can also yield life cycle cost savings over the highest pressure duct designs, although the magnitude of savings was typically lower than with PSC blowers and varied depending on specific duct design details and contractor cost estimates.
5. Specific details in contractor duct designs and cost estimates intended to meet specific external static pressures can have a large influence on the impacts that ductwork designs can have on HVAC energy consumption and total life cycle costs in residences.

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