

NIST Report: Continuous Air Barrier Systems Reduce Energy Costs

A ground-breaking report from the National Institute of Standards and Technology (NIST), *Investigation of the Impact of Commercial Building Envelope Airtightness on HVAC Energy Use*, indicates that continuous air barrier systems can reduce air infiltration by more than 60 percent and energy consumption by up to 40 percent compared to buildings typical air leakage. This document contains a summary of the report highlights.

The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Standard 90.1 Envelope Subcommittee is looking to update the building air leakage requirements in the standard to include a continuous air barrier system. The NIST report was prepared in part to estimate the potential energy savings and cost effectiveness of an air barrier requirement.

The study was conducted by Steven J. Emmerich (Building and Fire Research Laboratory, NIST), Timothy P. McDowell (TESS Inc.) and Wagdy Anis (Shepley Bulfinch Richardson and Abbott). It evaluated the energy savings of an effective air barrier requirement for non-residential buildings in five cities representing different climate zones (Miami, Phoenix, St. Louis, Bismark and Minneapolis).

The methodology included blended national average heating and cooling energy prices and cost effectiveness calculations matching the scalar ratio employed by ASHRAE SSPC 90.1. The report states that:

“Despite common assumptions that envelope air leakage is not significant in office and other commercial buildings, measurements have shown that these buildings are subject to larger infiltration rates than commonly believed. Infiltration in commercial buildings can have many negative consequences, including reduced thermal comfort, interference with the proper operation of mechanical ventilation systems, degraded indoor air quality, moisture damage of building envelope components and increased energy consumption.”

The research team selected air barrier systems with components that met material air tightness levels of 0.02L/s·m² at 75Pa (0.004 cfm/ft² at 0.3 inH₂O) and were judged to be consistent with the whole building target used in the energy modeling. Note that the report was not comprehensive in consideration of all types of air barriers.

The NIST study’s findings show that the inclusion of an air barrier system in four sampled types and sizes of building can reduce air infiltration by 60 percent to 100 percent, representing a large reduction in energy consumption and operating costs: potential gas savings of greater than 40 percent, and potential electrical savings of greater than 25 percent compared to the baseline case.

The NIST study recommends further study of building envelope air tightness, including:

- Analysis of costs and potential energy savings from tightening of existing buildings and development of recommendations for existing building stock
- Development of more refined (climate specific, etc.) air tightness targets
- Extended study of other building categories
- Examination of potential interaction between air tightness and other building parameters
- Testing of air tightness in buildings built to a tightness standard (e.g., in Massachusetts) to determine if standards are met in practice
- Development of diagnostic protocols for failures of envelopes that deteriorate IAQ and energy efficiency

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