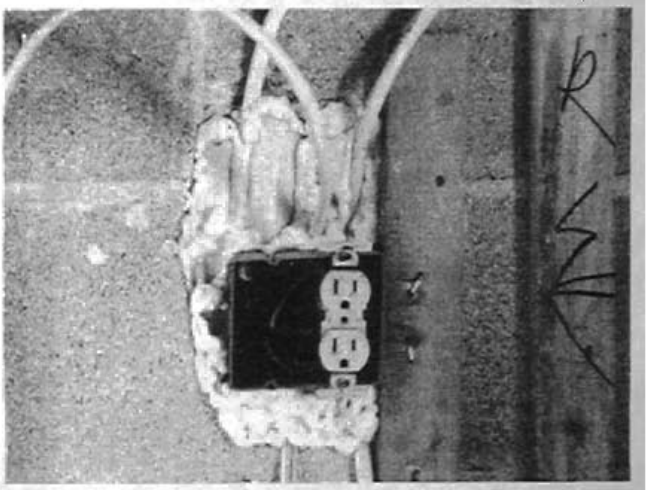

PEP house doctor (left) demonstrates that leaks through interior walls, floors, and stairwells are so numerous that they are virtually impossible to seal unless dealt with at the source—usually in the attic and basement. Sealing and insulating between conditioned and unconditioned spaces gets rough around a gaggle of mechanical runs (top left). Here clever combinations of foam, films, caulk, and insulation tidy up where pipes penetrate from house to garage. A recess for an electrical box cut into a party wall "with a sledgehammer" (above) gets plugged up with foam and scraps of rigid insulation. PEP house doctors make fast work of these thermal glitches during two or three housecalls during construction.

ing cavities that act as room-sized heat exchangers relentlessly pumping heat out of a building even if there is no direct leakage from indoors to outdoors. A related problem is the reduction in wall R-values when the air flows through fibrous insulation. While this phenomenon has been reported many times in the research literature, it is generally overlooked since it defies accurate prediction.

In addition to their effect on energy bills, the impact of convective loops can be gauged, says Gadsby, by measuring attic temperatures before and after sealing off bypasses such as chases and partitions, or it can be roughly modeled from the temperature difference and the height of the loop. A small soffit over a kitchen cabinet may not look like much, says company president David Brown, until you discover that it's drawing air from all kinds of wall and ceiling spaces.

"In multifamily," he says, "we sometimes find the bathrooms stacked one on top of the other and the whole thing forms one giant convective loop." In many cases, PEP finds interior partitions colder than outside walls. Since the cooling effect of a loop is only partly due to direct air leakage, even a completely closed cavity such as a masonry party wall can cause problems. One cure in the case of a masonry party wall is a solid course of block at the ceiling level, isolating the airflow within the heated space. This, of course, is most easily accomplished during new construction.

Fiberglass insulation alone will not block these escape routes for a building's heat. Gadsby often points out to his customers that, while fiberglass works well to filter air in their cars and furnaces, it does a lousy job of stopping airflow in their walls. As evidence, he cites many instances of air leakage leaving blackened traces where it passed through fiberglass insulation. Infrared scanners tell the same story, he says, when they show heat leaking around and through fiberglass insulation—even the massive batts in a superinsulated ceiling. For that reason, the PEP partners prefer blown insulation over batts. With loose fill, they believe, the airflow paths are circuitous enough to stop short any airflow.

In general, PEP contractors go after the multiplicity of ways conditioned spaces get thermally hooked to unconditioned spaces. The more complex the building form, the more elusive the connections can be.

The bottom line

Energy retrofitting reduces drafts and cold spots and, according to PEP, produces some unanticipated benefits such as fewer rodent problems and frozen pipes. Still, to sell the service to the big buyers—the developers, housing authorities, and government agencies—it has to show an attractive return on investment. Says Gadsby referring to conventional weathersealing treatments, "To do a job for $1200 that's going to save $50 a year is just not the way to do business."

In some cases, the savings are spectacular. For example, in a 1982 retrofit, PEP spent three months retrofitting the 450-unit Glenhardie Condominium Complex near Valley Forge, Pa., for $62,000. The 20-building development already had its insulation and heating system upgraded when it went condo four years earlier. After three months of house-doctoring, consisting solely of attic work, the annual heating bill was reduced from 2093 to 1329 therms of natural gas, resulting in a first-year savings of $40,600, not including the $9,300 tax credit.

More typical is a recent proposal to the Baltimore Housing Authority, in which PEP agreed to treat apartments for $550 each while they were undergoing rehab. PEP's work would be staged over two to three visits. With annual heating bills in this housing stock running $1200 to $1300, the simple payback would be under three years. In terms of infiltration alone, says Gadsby, recently built townhouses generally measure in at about 10 to 15 ach at 50 Pascals before house-doctoring and are sealed down to about 6 after.

Costs are held down by providing the service in a one-day blitz, or, in new construction, in a series of quick hits. In general, PEP can do more effective work for less money during new construction or rehab than with retrofitting, since the problems are more visible and accessible. According to Brown, if they can get in during construction "the cost to the homeowner or builder is one-half to two-thirds of what it would cost to retrofit and you're probably going to save an extra 5 to 10 percent."

Despite the benefit of PEP's energy overhaul, selling the service to the developer remains the toughest challenge. Says Brown, "We recently did a full analysis and proposal on 128 units for a large property management firm. When a company manager read the proposal a month later, he told us 'Great proposal, but could you answer one question—what's house doctoring?' "