

# Infrared Testing Pinpoints Causes of Occupant Discomfort

From High-Profile Monthly: Facilities Development News, February 2008

By Peter Brooks, Infra-red Analyzers

A funny thing happened on the way to the “green building revolution”; it turned out that making buildings cheaper to heat and operate also makes them significantly more marketable, and can dramatically boost employee productivity. Even funnier, building owners who have “gone green” with well-designed projects have discovered that these secondary benefits can pay even bigger returns than the profits they realize from energy savings - and they’re laughing all the way to the bank.

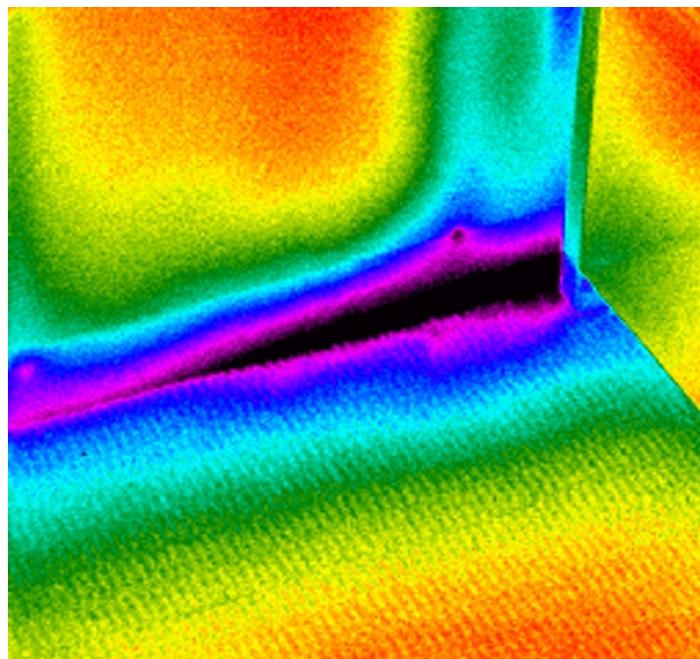
The key to achieving these returns is attention to occupant comfort. Numerous studies report that improving occupant comfort significantly increases productivity. And even a one percent lift in productivity can “provide savings to a company that exceed its entire energy bill”, notes a study called Greening the Building and the Bottom Line. “That [energy efficiency] can lead to productivity gains far exceeding the energy savings gives it a new imperative.” (1)

Property managers can also realize long-term gains from improvements in occupant comfort. “Tenants prefer to renew their leases because they appreciate a building with enhanced comfort, health and productivity...” reflects one green buildings expert, who points out that “higher quality buildings historically have shown lower vacancy rates.” (2)

Occupant comfort is affected by many factors, including room temperature, humidity, airflow, air quality, local radiant temperatures (cold and hot spots), solar exposure, and noise and vibration, as well as the occupant’s activity, clothing, and metabolic rate. Occupant complaints about drafts, cold spots, dampness, and cold or hot temperatures usually indicate that a building is needlessly wasting energy. Locating and correcting the sources of this energy loss can cut energy bills while significantly improving occupant comfort and productivity - a continuing “win-win” for building owners and occupants alike.

Of course, our first response to occupant complaints will usually be to call our HVAC service provider to ask them to correct the problem and resolve the complaint. But if the HVAC components are working properly, there’s precious little our HVAC technician can do. In that case, it’s time to investigate the integrity of the building envelope - everything that keeps the outdoors out and the indoors in.

Sounds like a big project! And it would be, if we had to physically investigate all of the building envelope’s components to find the source(s) of the problem. With infrared thermography we can document the energy performance of the envelope components without taking anything apart. Typically we find that a relative handful of missing, failing, and/or misinstalled components are responsible for a major share of the building’s energy losses and occupant discomfort. Building owners and facility managers use these documented results to develop informed plans for cost-effective repairs.

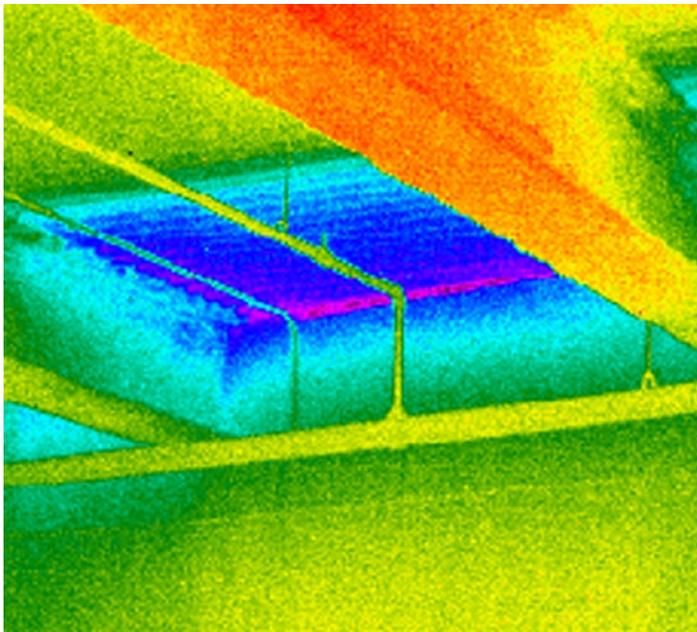


*Infrared image pinpoints infiltrating cold air at base of wall that makes this office uncomfortable to work in.*

Building envelope components create energy losses when they allow air or excessive amounts of heat energy to enter or escape the building. In most cases, air leakage is by far the biggest source of both energy loss and occupant discomfort. A recent report by the National Institute of Science and Technology (NIST) finds that air “[i]nfiltration 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.” (3)

Leaking air escalates “stack effect”, a convection-generated airflow inside buildings that increases with the difference between indoor and outdoor temperatures. With a leaky building envelope, stack effect causes drafts and erratic indoor temperatures (especially in high winds), and can make some zones difficult or impossible to heat comfortably. And of course, wherever air is leaking, water can too, threatening early failure of other building components and setting the stage for potential mold infestation.

The next time an employee complains that “a cold wind” is blowing past her desk, or a tenant calls to say that ice is forming in a corner of his bathroom, it may not seem like an opportunity to boost your long-term profits. But, according to owners who have tackled their building envelope problems to improve energy efficiency and occupant comfort,



*Cold air infiltration between foundation wall and ceiling deck contributes to stack effect, causing drafty, hard-to-heat interior spaces.*

that’s exactly what it will be - an invitation to make more money by wisely investing in property improvement.

The first step will be to get reliable information about the current performance of the building envelope. Professional infrared building envelope testing is by far the most cost-effective solution, providing a “big picture” view that pinpoints the causes of energy loss and occupant discomfort. When conducted prior to the design of retrofits and renovations, infrared testing gives building owners the information they need to maximize their return on investment.

1. *Greening the Building and the Bottom Line: Increasing productivity Through Energy-Efficient Design*, Joseph J. Rohm (EPA), William D. Browning (Rocky Mountain Institute), 1994  
[http://www.rmi.org/images/PDFs/BuildingsLand/D94-27\\_GBBL.pdf](http://www.rmi.org/images/PDFs/BuildingsLand/D94-27_GBBL.pdf)

2. *A Blueprint for Green Building Economics*, David Gottfried, Environmental Design + Construction, July 11, 2003, reprinted: Metropolitan Partnership for Energy  
<http://www.buildsagreen.org/info/A%20Blueprint%20for%20Green%20Building%20Economics.doc>

3. *Investigation of the Impact of Commercial Building Envelope Airtightness on HVAC Energy Use*, S. J. Emmerich, S. J.; McDowell, T.; Anis, W. NISTIR 7238; June 2005  
<http://www.fire.nist.gov/bfrlpubs/build05/PDF/b05007.pdf>

Infra-red Analyzers, Inc.  
65 Lyman Drive  
Williston, VT 05495  
800-879-1964  
[www.iranalyzers.com](http://www.iranalyzers.com)  
*Testing Excellence Since 1984*

#### **About the Author**

*Peter Brooks has more than forty years of experience with facilities, including fifteen years in residential and commercial construction and contracting. A Certified Thermographer with over twenty-five years experience providing infrared services, Brooks is a recognized expert in Nondestructive Testing who has trained thermographers at the national level in the methods and techniques of infrared testing. Mr. Brooks is president of Infra-red Analyzers of Williston, Vermont.*

