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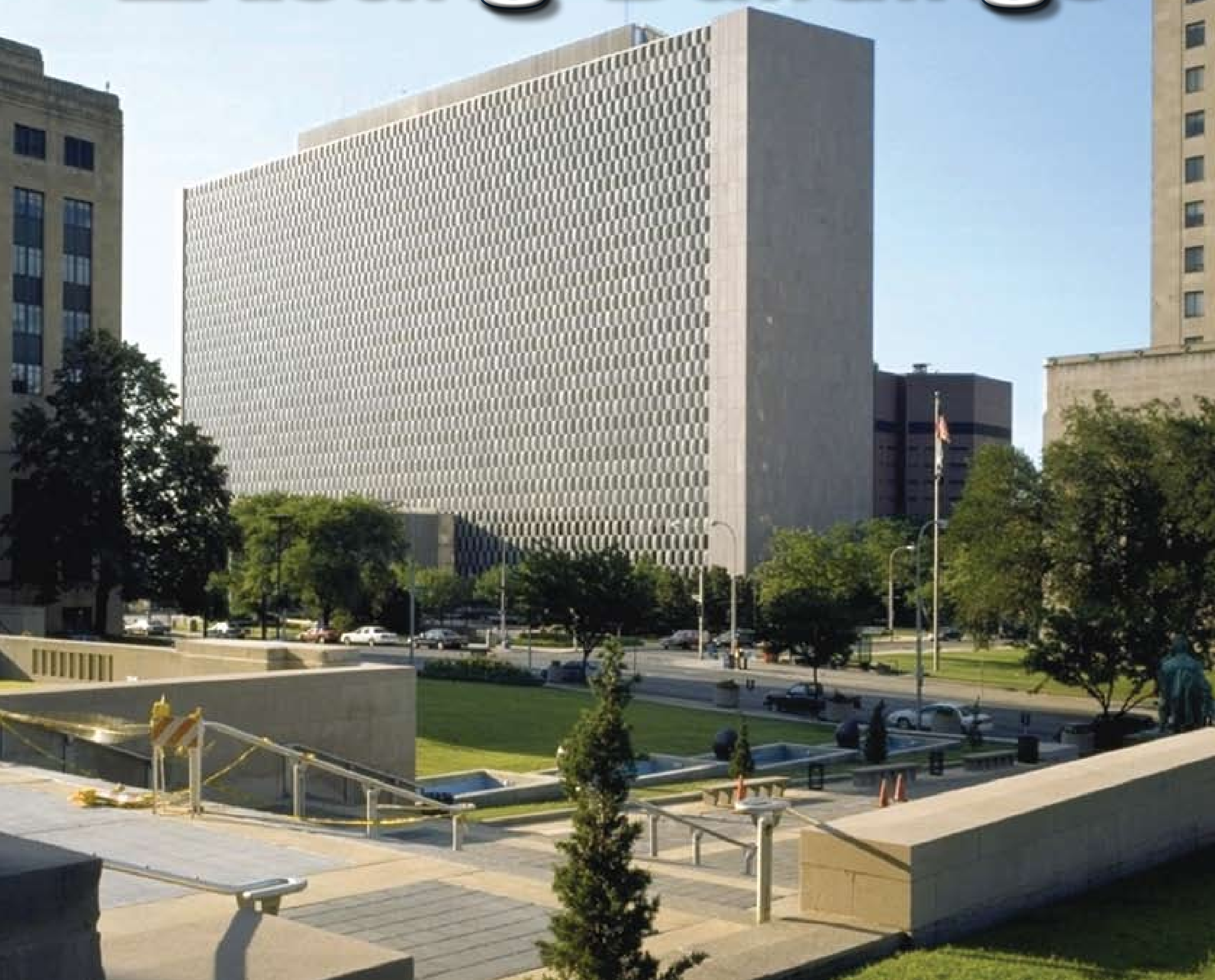
Winter 2009

Energy Efficiency Retrofitting of Existing Buildings

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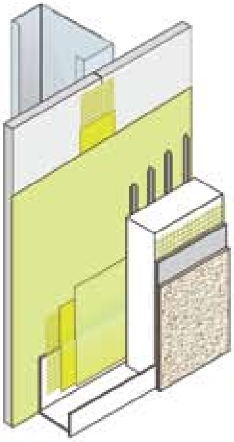

Contents

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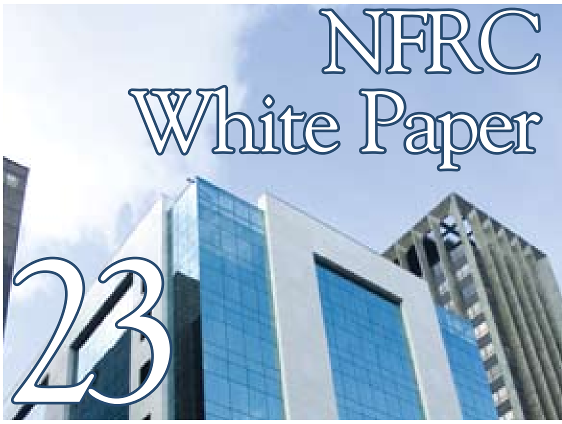
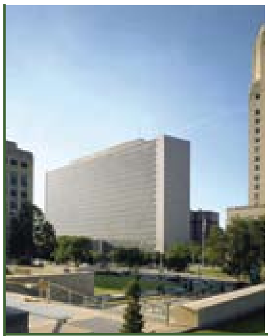


Messages:

Industry Updates:



On the cover: In 1999, the GSA Heartland Region began a $200 million renovation project to modernize the Richard Bolling Federal Building in Kansas City, Missouri. When complete, all 18 floors will have new energy-efficient workspaces, enhanced security features and new lobby areas. *Photo courtesy of Helix Architecture + Design, Inc.*

Henry L. Green, Hon. AIA

Reducing Energy Consumption: Vital

IT IS AN EXCITING TIME to become the President of the National Institute of Building Sciences (NIBS). Within the first few months, I have noted the impressive work of the Institute staff and the various councils and programs. Working with BETEC and its members provides a unique opportunity to explore the critical nature of our buildings systems and how the construction and operation of buildings impacts our daily lives. Making positive improvements in the building enclosure design can offer increased benefits to our society. The efforts of BETEC in this area are unsurpassed.

In a recent letter to House Speaker Nancy Pelosi, I outlined the importance of reducing energy consumption in existing buildings. The 2007 Energy Information Report noted that 40 percent of the nation's total U.S. energy consumption is attributed to buildings. Heating and cooling of buildings account for 32 percent of this amount. Existing buildings comprise the largest segment of the built environment and must be considered in any efforts to reduce our nation's energy demand. It is vitally important to include in any stimulus package being considered by Congress, the need to address reductions of energy consumption in existing structures.

Building and home owners can be the winners in a sustained effort to reduce energy costs. These savings must be achieved through a combination of renovating building envelopes and the installation of energy efficient building equipment. This, however, must be matched with an operational plan that includes building commissioning and maintenance. The proper operation of building environmental systems must be performed in a manner consistent with the original design and construction for the building and the equipment.

It is vitally important to include in any stimulus package being considered by Congress, the need to address reductions of energy consumption in existing structures.

BETEC and NIBS support a comprehensive approach to building design, construction, operation and maintenance. For too long existing building renovations have been neglected in this approach, only being evaluated for a single approach—either equipment replacement or increasing insulation values. A more comprehensive approach that incorporates building envelope improvements (increased thermal protection) and the replacement of outdated inefficient heating and cooling equipment will produce the greatest long-term savings. But this can only occur when the building systems are continually operated in the manner in which they have been designed and installed.

In the letter to Speaker Pelosi, it was noted that:

Society needs to build on the strength of existing knowledge. Building enclosures—their energy efficiency, durability and the indoor environment—are today at a crossroads. On one hand, a large amount of knowledge and expertise is available; on the other hand, old approaches are not as valid as they once were. It is time to create a new vision because the stakes are high. We need this new vision to improve our energy efficiency, maintain energy security and sustain the economy. Savings can be put back to more productive uses even though it will take time to realize full return on investment. Yet, this vision cannot be achieved without a mobilization and education of our society. Unless major public/private initiatives are developed, the strategy based on retrofitting existing buildings will not work. (Energy Efficiency and Durability at the Crossroads. BETEC. August 31, 2008.)

Based on the lessons learned in the post-embargo programs of the 1970s, we can make improvements in our existing building stock by employing our current knowledge in a massive national plan for energy security and energy independence.

As we embark on 2009, I can envision the work BETEC and NIBS can accomplish improving our built environment. Along with the other councils and programs, I am confident we can make a difference. The success of our programs depends largely on the continued involvement and support of our contributors. It is your expertise and knowledge that provides the fuel for these changes and improvements.

Thank you for your dedication, work and continued support.

Henry L. Green, Hon. AIA
President
National Institute of Building Sciences

Investing in Retrofitting Makes Sense

Wagdy Anis, FAIA, LEED AP

It makes so much sense that North America should invest in retrofitting its energy inefficient existing building stock with energy efficient windows, thermal insulation and increased airtightness and the replacement of older HVAC systems with smaller capacity, more efficient new systems, saving energy and creating new jobs in the construction sector.

WELCOME TO THE WINTER 2009 edition of *JBED*, the Journal of Building Enclosure Design!

I would like to tell you about the November 2008 meeting of the Building Enclosure Technology and Environment Council (BETEC). NIBS' new president and CEO Henry Green addressed the BETEC board of direction, to explore ways NIBS and BETEC can be more effective in bringing change to the construction and design industry, and to explore ways in coordinating with NIBS' other project efforts, such as the High Performance Buildings Council.

One of the most important topics discussed during that meeting was the need to focus on the energy efficiency of existing buildings, the demand side of the energy equation. You will see in this edition a detailed description of the ambitious program going on in Canada for the retrofit of energy conserving measures to existing buildings. The simple math of it is that for every dollar spent on reducing the energy consumption of buildings on the demand side of the energy equation, saves the need for two dollars spent on expanding the supply side of the equation.

It makes so much sense that North America should invest in retrofitting its energy inefficient existing building stock with energy efficient windows, thermal insulation and increased airtightness and the replacement of older HVAC systems with smaller capacity, more efficient new systems, saving energy and creating new jobs in the construction sector. Henry Green took this message to Capitol Hill with an admirable display of NIBS leadership; from all of us, thank you Henry! We are hopeful that the new stimulus package will contain the fruits of BETEC and NIBS' efforts in advancing the cause of energy independence and security.

Our BEC family continues to grow! Welcome to Building Enclosure Council number 23, in Kansas City, MO, headed up by Dave Herron.

Upcoming conferences are:

- The National Building Envelope Council of Canada's Conference on Building Science and Technology on May 6-8, hosted by QBEC at the Palais des Congrès de Montreal; discounted reservations are available until March 15; www.cebq.org/NBEC.
- The EcoBuild conference on December 8-10, 2009, in Washington DC, will include a BETEC conference on the energy efficiency of existing buildings (see the full page ad on page 30); www.aecEcobuild.com.
- For 2010, BEST 2 conference planning is well under way by BEC National, with the papers selected and the convention center in Portland, OR reserved for April 12-14, 2010; the conference theme is "A New Design Paradigm for Energy Efficient Buildings"; www.thebestconference.org.
- BETEC / DOE / ORNL / ASHRAE Thermal Performance of the Exterior Envelopes of Whole Buildings XI International Conference, organized by Oak Ridge National Laboratory will be held on December 5-9, 2010, in Clearwater Beach, Florida. This is the building science conference to attend; www.ornl.gov/sci/buildings/2010.

Finally, it is my hope that the National Architectural Accreditation Board will require that architectural education curricula must contain the building science knowledge and the tools needed for practitioners to design energy efficient buildings headed towards net zero energy and zero greenhouse gas emissions.

We hope you enjoy this edition of JBED, and as always we welcome any feedback you may have.

Wagdy Anis, AIA, LEED AP
Chairman BETEC Board,
Chairman, JBED Editorial Board
Principal, Wiss Janney Elstner

Feature

Richard Bolling Federal Building: Modernization and Energy Efficiency Upgrades

By **Michael J. Heule AIA, LEED AP**, Helix / Architecture + Design; **Steve McGuire AIA, LEED AP**, Gastinger Walker Harden Architects; **Paul E. Totten**, PE, Simpson Gumpertz & Heger Inc.; and **Lew Harriman**, Mason Grant

ABSTRACT

This article will discuss changes made to the facade of the Richard Bolling Federal Building located in Kansas City, Missouri. The 1960s constructed eighteen story building with 50,000 sf floor plates spans two city blocks and is clad with a curtain wall that consists of metal panels and glazed portions on its north and south elevations and mainly granite panels on its east and west elevations. See **Figure 1** for a view of a portion of the south facade.

The modernization project involved complete demolition of each floor to remove asbestos containing fireproofing materials from the steel framed structure. The renovation included complete new mechanical, electrical and plumbing systems, public space elevator lobbies, restrooms, and class 'A' tenant finishes. At the exterior, the existing curtain wall could not be affordably reclad; however, elements of a new energy-efficient modern window system would need to be retrofitted into the current cladding system. Because the curtain wall required new structural bracing, the interior surfaces of the curtain wall were demolished and the contaminated curtain wall insulation was abated. This required scope of work provided an opportunity to install new energy efficient features. Operable portions of the curtain wall window system were replaced with a fixed thermally broken high efficiency window system. In addition, the curtain wall bracing required new structural members with attachments to the curtain wall. The attachments unfortunately introduced the potential for a thermal bridge that could result in winter-time window condensation that required thermal analysis to further evaluate. Working with a building science consultant and a thermographer, the design team assessed the short comings of the building's facade from an energy standpoint. This assessment helped the team solve potential thermal inefficiencies, prevent condensation at windows, and bring its expected new energy performance to the level the design team had intended.

The modernization project consists of four phases totaling more than $200,000,000 in construction costs. Phase I and II of this modernization project have been completed and are fully occupied. Phase III is under construction with an anticipated completion in 2010. Phase IV is just starting the design phase with construction scheduled to be complete in 2014.

The project design team for this award-winning building (2008 GSA Citation in Modernization) is a joint effort between Kansas City based firms Helix Architecture + Design in association with Gastinger Walker Harden Architects.

Figure 1. Concept view of new south entrance.

PROJECT DESCRIPTION

The purpose of the modernization project developed for the Richard Bolling Federal Building is to fully abate the building of asbestos fireproofing, completely upgrade building systems, and to assist the tenant agencies in attracting and maintaining the best federal workforce available by providing an exceptional Class A office environment. A tangible result of this modernization project is a Class A office building that exhibits imaginative innovation and design excellence while dramatically improving the quality of the human experience. The tenant occupants of renovated floors have witnessed this transformation first hand with a renewed sense of pride about their new work environment. The project successfully promotes community and education, creating a sense of place and well-being while incorporating energy efficient systems within the rehabilitated curtain wall.

THERMAL ANALYSIS

Thermal analysis was required to evaluate any potential thermal bridging caused by structural upgrades at the windows introduced by the new window attachment into the existing curtain wall system. Analysis was completed by the building scientist using THERM software developed by the Lawrence Berkley National Laboratories.

Initial analysis found that the combination of the attachment of the new energy-efficient window system into the existing curtain wall, and the attachment along window jambs of the new steel structural supports, into the frame of the existing glazed elements of the curtain wall, unintentionally short circuited the thermal break of the window system, and resulted in risk for winter time condensation and loss of energy at the windows. See **Figure 3** for a view of the sill analysis.

The building science consultant then evaluated various insulation strategies to change the thermal path at the window system and its connections working with the design team to determine an aesthetically pleasing way of hiding the improvements. The end result involved the addition of spray foam insulation applied at the window surround between the window system and adjacent finishes, and the introduction of a closure element to hide the insulation. This resulted in a window system that had significantly reduced condensation potential as winter interior RH levels were not intended to exceed 30 percent. See **Figure 4**. The insulation system was evaluated and incorporated at the window sill, jambs and head. As discussed in the thermography section below, it was integrated with the surrounding wall construction insulation system. At the sill, the frame warmed approximately 4 degrees. The thermal models also examined the level of insulation proposed for the remainder of the wall system. The thermal model results were compared to field measurements with thermography which provided excellent correlation to the models.


Figure 2. View of a portion of the new interior tenant space

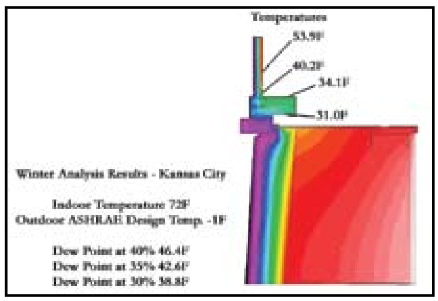


Figure 3. Thermal analysis of the window system prior to thermal improvements.

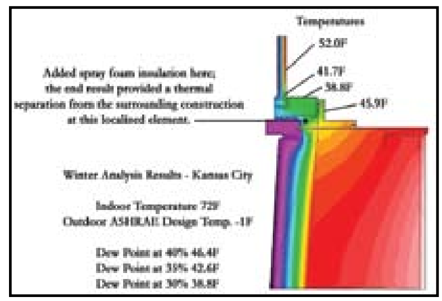


Figure 4. Thermal analysis of the window system after thermal improvements.

THERMOGRAPHY

Stripping all insulation and replacing all operable windows and all window attachment details in the existing, occupied 18-story building provides inherent uncertainty with respect to constructability and thus the thermal performance. Given this large building with correspondingly large energy use consequences, the owner elected to use thermal imaging to help the design team answer questions about the design alternatives with greater certainty, as well as to evaluate thermal models for the new window attachment.

A full-scale mockup of retrofit alternatives was constructed on the 10th floor of the building. The original interior finish and the original asbestos-based insulation were removed. In one four-window bay, two new windows were set in place using the new attachment and structural upgrade design, and two different insulation systems were installed, each surrounding two of the new windows. Alternative 1 was based on rigid board insulation, cut and fitted to the


Figure 5. In-situ mockup of spray foam vs. rigid board insulation retrofit alternatives to validate design assumptions.

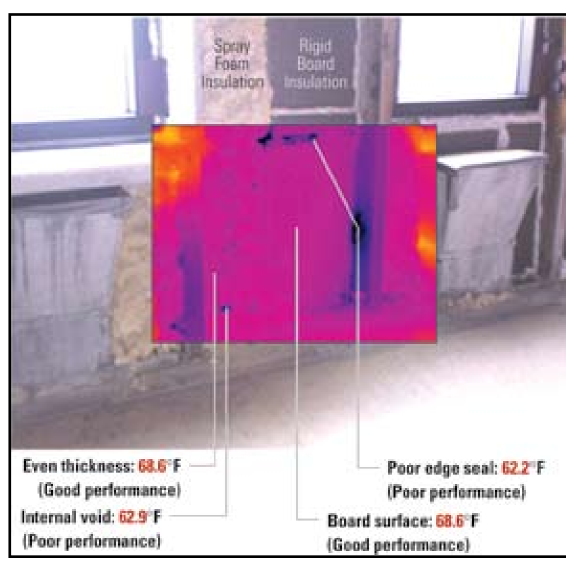


Figure 6. Thermographic evaluation shows that both board and spray-applied insulation systems can perform well—provided the installer takes care to eliminate voids and gaps.

The modernization project involved complete demolition of each floor to remove asbestos containing fireproofing materials from the steel framed structure. The renovation included complete new mechanical, electrical and plumbing systems, public space elevator lobbies, restrooms, and class 'A' tenant finishes.

exterior wall with a spray foam seal and gap-filler around the edges of the rigid board and at all seams. Alternative 2 was based on a continuous layer of 0.5 lb/cubic foot spray-applied polyurethane foam and the surface of the foam was not shaved (**See Figure 5**).

High-resolution thermography was used to analyze the thermal performance of these insulation alternatives under real-world operating conditions. Thermography showed that there was virtually no difference in the performance of two insulation designs provided that the insulation layer was continuous. But, the thermography also showed very clearly the importance of ensuring that all exterior surfaces and all window attachments are covered by insulation (**Figure 6**). Based on this information and constructability factors, the design team decided to use spray-foam rather than rigid board insulation.

Thermography also provided helpful and unexpected information in several other areas.

Figure 7 shows the exterior of the building, highlighting the mockup on the 10th floor. More interesting than the nearly-identical performance of the insulation systems is the unexpectedly high exterior temperature of the window frames compared to the new glazing. This information led to the redesign of the window attachment details to improve the thermal break of the window frame attachment and the thermal modeling

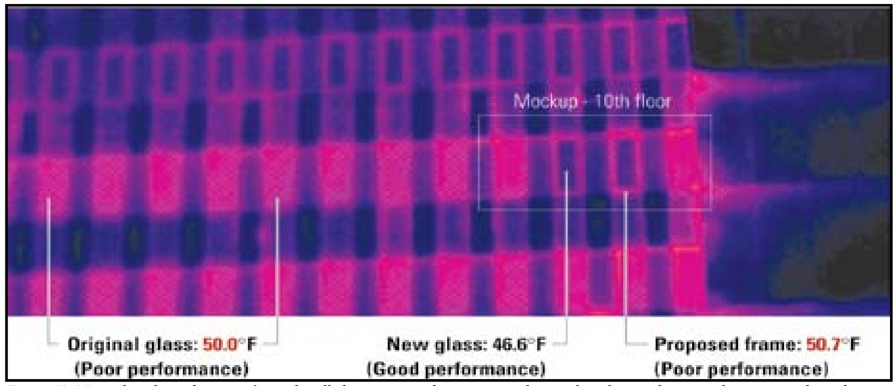


Figure 7. New glazed windows performed well, but new insulation was redesigned at the window attachment to reduce the thermal bridging apparent in this image.

described above, reducing both the risk of internal condensation on cold surfaces as well as reducing the energy leakage in and out of the building.

Later in the project, because of the importance of continuity in the spray foam installation, the team also decided to use thermography to assess the integrity of the installation after one full floor had been retrofitted. Approximately one year after the evaluation of the mock-up, the thermography team revisited the site. **Figure 8** shows one result of that in-progress inspection. In most areas, the spray foam insulation had been evenly applied—but not in all cases. The visual information provided by the thermal imaging was used by the Construction Manager to correct the application shortcomings, and to ensure that the balance of the floors would have an even thickness of spray foam extending across all exterior surfaces and over all window attachment details.

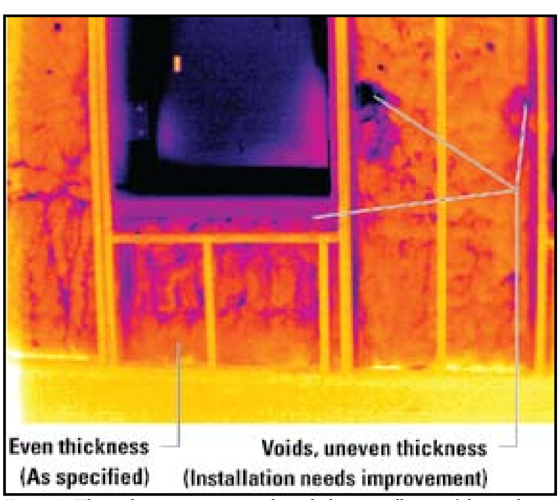


Figure 8. Thermal imaging part-way through the reinstallation of the insulation provided the Construction Manager information on what must be improved to meet the design specifications.

CONCLUSION

Structural retrofits and changes to modernize a building require careful analysis and field follow through. Thermal analysis using two-dimensional heat transfer can be coupled with field validation such as thermography. In addition, two-dimensional thermal analysis tools can be used to evaluate energy short comings and the potential for window condensation. On this project, the entire team worked together to successfully implement thermal improvements to a new window system that blended into an existing curtain wall without major effects on the original aesthetic.

Michael J. Heule, AIA, LEED, is a founding Principal at Kansas City based Helix Architecture + Design. With over 25 years experience, Heule leads the firms sustainability initiatives and is responsible for managing the technical excellence program.

Steve McGuire is a senior project architect at Gastinger Walker Harden Architects in Kansas City, Missouri. A LEED accredited professional, he has been a champion of energy efficient design and high performance buildings for over 30 years.

Paul E. Totten is a Senior Project Manager in the Washington, DC office of Simpson Gumpertz & Heger Inc. He has over 10 years of experience in the fields of structural engineering, building technology and building science. He has concentrated his expertise on the evaluation and analysis of heat, air, and moisture transfer, and the cumulative effect these elements have on building components and building operation.

Lewis G. Harriman III is Director of Research and Consulting at Mason-Grant in Portsmouth, NH. He has 30 years of experience in humidity and moisture control in buildings and industrial processes. He served as the lead author for ASHRAE's Humidity Control Design Guide, and for the ASHRAE Guide for Buildings in Hot & Humid Climates. In 2006, he developed The GSA Protocol for Exterior Building Envelope Inspections Using Thermal Infrared Imaging for the GSA Office of the Chief Architect.

Does My Building Envelope Really Need a Retrofit?

By Kyle Taylor and Larry Elkin

INTRODUCTION

Research of energy efficient design and construction has progressed tremendously over recent years, resulting in more attention paid to how homes will operate under varying climate conditions. However, much of the research is designated toward newly constructed homes, causing widespread application of energy efficient retrofit of existing structures to lag.

Simply focusing our attention on new construction will not produce significant gains in nationwide energy efficiency. In 2006, the U.S. Department of Energy found that roughly 1,654,000 new homes were completed. Comparing that value to 2005 data indicating that there were about 113,300,000 single-family homes in the U.S., brand new homes make up approximately 1.46 percent of total U.S. homes (U.S. Department of Energy, 2007). This percentage could fall even lower as the demand for newly built homes plummets in the wake of the national recession. There are substantial opportunities for energy savings through retrofit of existing structures.

BUILDING ENVELOPE RETROFIT

Building envelope airtightness is generally considered an important component of any energy efficiency retrofit effort. "Recent analyses have shown an enormous energy savings potential through envelope tightening retrofits" ("Residential Ventilation", 2004). Wagdy Anis (2001) stated that 80 percent or more of air infiltration is caused by faulty or careless design and construction of the building envelope. That would equate to four times as much leakage area as purposefully needed throughout the envelope, resulting in varying degrees of wasted energy. Most sources reach the same point, "build tight and ventilate right". It is implied that this should reduce wasted HVAC energy consumption. However, there may be more to this issue than what most sources reveal.

Table 1 – Base-Line Data of Experimented Home	
Year built	1961
Volume	15155 ft^3
Floor area	1837 ft^2
# Stories	1
# Bedrooms	3
# Occupants	3
Base-line pressure	.5 Pa
In-out pressure during HVAC operation	4 pa
HVAC system size	4 tons

Figure 2. Front view of experimented home.

Figure 1. Initiating the Depressurization Test on attached laptop.

BLOWER DOOR EXPERIMENT

I conducted my own blower door experiment (**Figure 1**) as the basis of my high school senior thesis. This experiment was meant to show where air leakage was occurring within the experimented home, and how a retrofit of the envelope would affect the infiltration rates and improve HVAC performance. The home was initially tested twice, once with the air ducts open, and once with them closed. An infrared thermographic camera was used immediately prior to testing as the blower door maintained a constant -5 Pa in order to visually survey the areas causing infiltration. These areas were later caulked over, while summer time energy consumption was monitored and compared to historical energy consumption for the same time period. A final blower door test was then done to see exactly how the leakage rates were affected by the retrofit.

The subject house was a 1961 single-story brick, ranch style home, located in Charleston, South Carolina, which has received no major retrofit construction since being built; however, aluminum framed storm windows were added (age unknown) and the packaged HVAC unit, as well as the crawl space mounted ductwork, was replaced 5 years ago. This type of home represents millions of households across the United States which should share similar leakage characteristics. See **Figure 2**.

Several locations were identified while surveying the home under a negative induced pressure. Typical instances included crevices underneath wall panels, electricity outlets, and appliances inserted through the ceiling such as overhead lights and fans. Lights were turned off roughly an hour prior to examination to hopefully ensure that all heat observed was from hot infiltrating air. All locations were caulked shut upon finishing the initial depressurization tests so that energy consumption statistics could be collected and compared with the corresponding months of the previous year. Several areas of the ceiling were also found to be missing insulation in the attic during inspection, however retrofitting the insulation was not within the scope of the project. **Figures 3 and 4** display the digital and thermographic images of several of the areas that were found to experience infiltration upon inducing negative pressure within the house.

EXPERIMENT RESULTS

The initial blower door test was made with all air ducts open to calculate the leakage areas and flow rates for the whole building

Figure 3. Warm air was found to leak inward where the brick chimney met the walls and ceiling. The red plume (circled) shows a location of substantial leakage.

Figure 4. Air leakage is evident around a typical window. The leakage path appeared to be between the trim and the wall surface.

(envelope and ducts). These data are displayed in **Figure 5** and **Table 2**.

When utilizing the whole building data one must consider that the duct leakage portion of this infiltration value was calculated as if the ducts operate at the same pressure exhibited within the home, when they in fact operate at substantially higher pressures during HVAC operation.

In order to ascertain the impact of duct leakage, a second test was run with the air vents sealed closed. These data that are displayed in **Figure 6** and **Table 3** reflect the leakage characteristics only of the building envelope, which most studies claim is the main cause of excessive air infiltration. If there were no leakage occurring in the air ducts, the results of both tests would be identical. However, the tests reveal that the HVAC duct leakage area is nearly 44 percent of the whole building leakage area.

Tightening a leaky building envelope is generally considered to be an effort that homeowners can readily accomplish to realize almost immediate energy savings. Sherman (2004) estimated that a home often has an approximate total of three square feet of holes throughout the envelope, which if patched closed with twenty dollar bills, would still pay for itself over a year. Not only that, but Sherman and Dickerhoff (1998) reported the trend that homes built after 1980 begin experiencing much lower leakage rates than of previous years. It has also been reported that homes of large floor area typically experience less leakage area that homes of less floor area (Chan, Price, Sohn, & Gadgil, 2003). Despite these reports, the subject building envelope had less than one square foot of leakage area, resulting in a mere .29 ACH average annual infiltration rate. Initially one might expect that this home would be comparatively energy efficient. While it is true that the building envelope is relatively tight, now we must account for duct leakage.

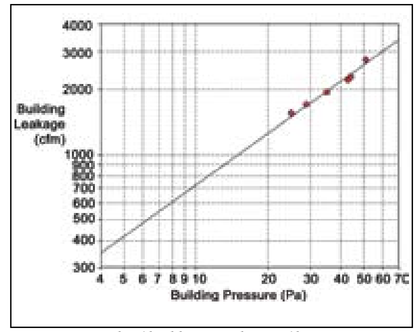


Figure 6. Graph of building envelope infiltration rates.

Early on in the experiment, excessive duct leakage was thought to be a significant issue based on the significant differences in leakage characteristics between the whole building and envelope test results. While the base-line envelope pressure was only 0.5 Pa, the pressure difference across the building envelope with the HVAC system in operation was approximately 4 Pa. So, when the HVAC system was operating, building envelope leakage rate increases from 0.29 ACH to about 1.40 ACH. However, it is not due to massive leakage areas in the envelope. It is due to just about 80 square inches of leakage in the ducts, or about half of one square foot. The ducts are contributing even more to the whole building infiltration than the building envelope.

Observations were made in the crawl space but there was no obvious evidence of loose duct connections or tears in the flexible duct walls. The low height of the crawl space made detailed observations difficult. Nevertheless retrofit sealing of the building envelope areas was attempted to see if this effort alone would result in energy savings. Surprisingly, the retrofit done on areas around the building envelope had no measurable effect on the whole-building air infiltration. Post-retrofit blower door testing showed that the leakage characteristics for the whole building were nearly identical to the pre-retrofit test.

An analysis of the home's energy consumption data confirmed that the building envelope modifications were ineffective. There was no decrease in energy consumption between the time period of 2007 and 2008. **Figure 7** shows how the energy bills compared. Energy consumption data and average recorded climate conditions were taken directly from the SCE&G website. Also note that the average August temperature in 2007 was 3°F higher than in 2008, and the average September temperature for 2007 was 1°F lower than in 2008. The average temperature of July remained the same. Thus, if the temperatures had all remained constant for 2007 and 2008, August would see a wider difference, and September would see an even smaller difference.

Table 2 – Whole Building Infiltration (Envelope and Ducts) Calculations

Airflow at 50 Pa	3327 CFM (+/- 0.5%)
	1.81 CFM per ft^2 floor area
	13.17 ACH
Leakage areas	178.8 in^2 (+/- 2.6%) LB LELA at 4 Pa
Building leakage curve	Flow coefficient (C) = 253.1 (+/- 4.2%)
	Exponent (n) = 0.659 (+/- 0.012)
	Correlation coefficient = .99938
Estimated annual infiltration	131.4 CFM
	.52 ACH
Estimated design infiltration	Winter = 194.3 CFM .77 ACH
	Sumer = 136.6 CFM .54 ACH
Mechanical ventilation guideline	1.0 CFM

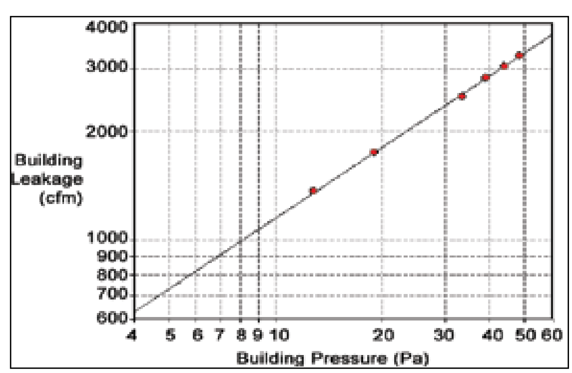


Figure 5. Graph of whole building (envelope and ducts) infiltration rates.

Table 3 - Calculations of Building Envelope Infiltration	
Airflow at 50 Pa	2608 CFM (+/- 2.3%)
	1.42 CFM per ft^2 floor area
	10.33 ACH
Leakage areas	100.3 in^2 (+/- 9.8%) LB LELA at 4 Pa
Building leakage curve	Flow coefficient (C) = 118.2 (+/- 26.5)
	Exponent (n) = 0.791 (+/- 0.072)
	Correlation coefficient = 0.98394
Estimated annual infiltration	73.7 CFM
	.29 ACH
Estimated design infiltration	Winter = 109.0 CFM .43 ACH
	Summer = 76.6 CFM .30 ACH
Mechanical ventilation guideline	29.9 CFM

CONCLUSION

There are surely many homes that are in need of a building envelope retrofit. The study performed at this particular home though, questions the common belief that homeowner installed air tightness improvements will result in significant energy savings. Rather it appears that improved HVAC duct tightness could result in a more substantial improvement in residential energy performance.

While post-retrofit testing and analysis confirms this hypothesis, pre-retrofit testing revealed the likelihood that duct-leakage was the dominant source of air leakage in the home. Therefore, an important conclusion is that accurate diagnostics are an essential component of existing building energy efficiency retrofit.

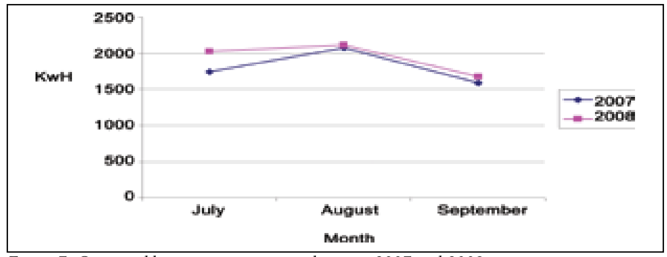


Figure 7. Comparable energy consumption between 2007 and 2008.

Kyle Taylor is a student at Academic Magnet High School in North Charleston, SC., a school which US News recently ranked as the 7th best high school in the nation. This article is a pared down version of a thesis he wrote, based on a year-long project that retrofitted his parents' 40 year old home. All students are required to complete a year-long research project, which culminates in the defense of their thesis. It was written with guidance from Taylor's mentor, Larry Elkin, a Senior Professional Engineer at Applied Building Sciences.

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Building a Future: The Revitalization of the Building Sector in Canada

By Staff at Natural Resources Canada

INTRODUCTION

Securing the planet's energy future in the midst of climate change is a pressing concern. The United States and Canada have a special interest in this area since, according to the UN Framework Convention on Climate Change study, our nations are among the biggest per capita emitters of greenhouse gas (GHG) in the world. Finding new methods to conserve what resources are available and exploring innovative ways of using existing resources are some of the approaches that both the American and Canadian governments are pursuing.

The Government of Canada has consistently made the energy sector a key priority in its mandate, choosing to treat the challenge of climate change as an opportunity to test its ingenuity with regard to energy efficiency. In making an active call to its citizens, the Government of Canada stresses the importance of developing more energy-efficient methods in order to preserve resources.

Through the Government of Canada's ecoENERGY initiatives, many of the advances that Canada has put forward in the area of energy-efficient production are already being realized in practical terms. These initiatives have laid the foundation for many of the services implemented in new and existing buildings across Canada. The vision is for buildings to become self-sufficient in meeting their energy needs.

Most recently, in Budget 2009, the Government of Canada announced further funding to improve energy efficiency. This includes $1 billion for a Clean Energy Fund and $1 billion for a Green Infrastructure Fund. The goal of these investments is to develop cleaner technologies which will help businesses have better control over their energy costs and become more competitive. The Government of Canada's support and direction in advancing energy-efficient design, construction and retrofits, is paving the way for this energy-efficient future.

RENEWAL FOR EXISTING BUILDING

Energy efficiency is a wise investment that pays for itself repeatedly. The Government of Canada's $3.6-billion ecoENERGY initiatives are helping Canadians to use energy more efficiently, boost renewable energy supplies and develop cleaner energy technologies. They are practical programs, helping Canadians and industry take real action to help the environment and reduce their energy bills. They are also a key component in strengthening the Government of Canada's plan to fight climate change and achieve an absolute reduction of 20 percent in GHG emissions by 2020.

Currently, the building sector is the source for 14 percent of end-use energy consumption and 13 percent of the country's carbon emissions. This poses a real challenge for the long-term stability of Canada's environment. But recognizing this challenge and investing in energy-saving initiatives can help reduce annual energy consumption and costs by an average of 20 percent in existing buildings.

The ecoENERGY Retrofit Incentive for Buildings helps Canadians reduce the payback period of their energy efficiency projects and increase their return on investment. Commercial and institutional buildings up to 20,000 square meters (215,279 square feet) are eligible for the incentive. The program encourages the implementation of multiple and proven retrofit measures such as improvements to lighting, heating and cooling systems, as well as building envelopes. Under this initiative, organizations such as schools or hospitals can lower their utility bills and help improve the environment while creating a more comfortable space for students, patients and employees alike. And the shorter payback period of some of these measures can help compensate for the longer payback of others, making it possible for savings to be invested in future retrofit projects.

The retrofit incentive is based on the lowest of three amounts: $10 per gigajoule (277.8 kilowatt hours) of estimated annual energy savings; 25 percent of eligible project costs; or $50,000 per project ($250,000 per organization). The estimated payback of the investment needs to be at least one year after taking into account similar incentives from other sources.

The application process involves arranging for a pre-project energy assessment before an application is submitted. The average approval period is six to eight weeks, and after written approval is received, the project can be started and eligible costs can be incurred. The time allocated to complete the project is 12 months, or 18 months in the northern territories, and the Government of Canada pays the eligible amount after completion of the project and verification of the work.

In addition to the incentive, Natural Resources Canada (NRCan) offers other complementary activities for existing buildings such as Dollars to $ense workshops, that highlight ways in which costs can be lowered, efficiency can be increased and GHG emissions can be reduced. Also offered are RETScreen® Clean Energy Project Analysis Software for screening, or assessing, the viability of renewable energy technology (RET) applications, as well as online case studies and technical publications.

Furthermore, NRCan's Office of Energy Efficiency is consulting with provincial governments and other stakeholders to continue developing a voluntary rating and labeling system for existing Canadian buildings. This system will help building owners compare the energy performance of their commercial and institutional buildings with similar facilities in their region or across Canada. According to an NRCan 2007 online survey, 86 percent of respondents expressed support for the labeling of commercial and institutional buildings in Canada and thought that these labels should serve as a benchmarking tool for comparison with similar buildings.

REINVENTION FOR NEW BUILDINGS

As well as providing incentives to retrofit existing buildings, the Government of Canada is consistently working to improve standards of energy efficiency in new buildings. NRCan is working with other levels of government to encourage the adoption of more stringent energy codes and update the Model National Energy Code for Buildings (MNECB). This code provides the standards by which new buildings are measured before construction. Currently, a performance of 25 percent more energy-efficient than a MNECB reference building is a common target in the marketplace, and can be achieved cost-effectively in most building types. This benchmark is a pre-requisite for the Leadership in Energy and Environmental Design (LEED) certification and for financial incentives in some provinces.

Following an "Integrated Design Process", where design professionals worked closely together, NRCan found that final costs could be reduced by performing cost/benefit analyses at the whole building level, a key approach for optimizing the value of energy-saving solutions.

The $53.8 million dollar Jean Canfield Government of Canada Building in Charlottetown, P.E.I. is one of the most environmentally friendly buildings ever constructed by the Government of Canada. Photo by Carol Penner.

RENEWABLE TECHNOLOGIES

Another advantageous program is the ecoENERGY for Renewable Heat program, which increases the amount of renewable thermal energy used and created and contributes to cleaner air by using alternative fuels to heat space and water. Currently, space and water heating accounts for 65 percent of the energy used in commercial buildings in Canada. The Government of Canada offers up to $80,000 to those in the industrial, commercial and institutional sector who install active energy-efficient solar air or water heating systems in new or existing facilities. This incentive applies to new buildings or retrofits and encourages the use of more energy-efficient heating in a cost-effective manner.

Many Canadian provinces have undertaken various projects to help their government achieve its energy-efficiency goals. The province of Ontario's Sustainable Ottawa Community Energy Co-operative's Solar H2Ottawa program received government funding towards the implementation of solar water heating systems. In Les Serres du Saint-Laurent, Quebec, a commercial greenhouse is now being heated by renewable energy from landfill gas.

CANMETENERGY RESEARCH

With over 450 experts and a century of experience, CanmetENERGY is Canada's leading knowledge centre for scientific expertise in clean-energy research and technology development. Working with the energy industry, academia and environmental stakeholders on clean energy research, development, demonstration and deployment, its goal is to ensure that Canada is at the leading edge of clean-energy technologies to reduce GHG emissions and improve the health of Canadians.

With a vision of working towards near and net-zero energy buildings, CanmetENERGY is undertaking research and development aimed at placing the best energy-efficient technologies into the built environment. In order to balance energy production with energy use from the grid over the course of the year (net-zero), it is essential to incorporate market-feasible renewable energy technologies to reduce conventional energy needs to as "near zero" as possible.

For years, CanmetENERGY has been working on the development of intelligent buildings research to ensure buildings are operated at optimal levels, allowing for an easier conversion to net-zero energy buildings. Research and development partnerships have allowed CanmetENERGY to use leading-edge tools, expert system development platforms and testbench for testing advanced control algorithms. Many tools were developed to monitor building performance, help operators detect and diagnose operational problems with the building's systems and manage future demand for energy. Re-commissioning and ongoing commissioning is made possible by CanmetENERGY's Diagnostic Agent for Building Operation (DABOTM) tool. The software enables the continuous collection and analysis of building data, and provides visual warnings of faulty system operation.

Ongoing STT activities also address barriers for net-zero building design, advanced technology integration and industry valuation of energy performance over asset lifetime. Research is focusing on establishing a range of feasible near-zero technical solutions for representative building types across Canadian climates. This includes the development of new net-zero design methodology and tools for developing integrated solutions at the whole building level.

Ultimately, CanmetENERGY's goal is to provide industry with the technology and knowledge solutions necessary to make the radical breakthroughs required for reaching net-zero energy levels. From designing 10 to15 percent better than MNEBC minimum requirements to going beyond 65 percent levels, CanmetENERGY's research is defining a position in net-zero energy building development.

CONTINUING EFFORTS

To help the Government of Canada reach target energy efficiency goals in the commercial buildings sector, two government agencies—The National Round Table on the Environment and the Economy (NRTEE) and Sustainable Development Technology Canada (SDTC)—released a report in January 2009 titled, Geared for Change. This report on policy recommendations recognizes that the commercial buildings sector contributed roughly 75MtCO2 emissions in

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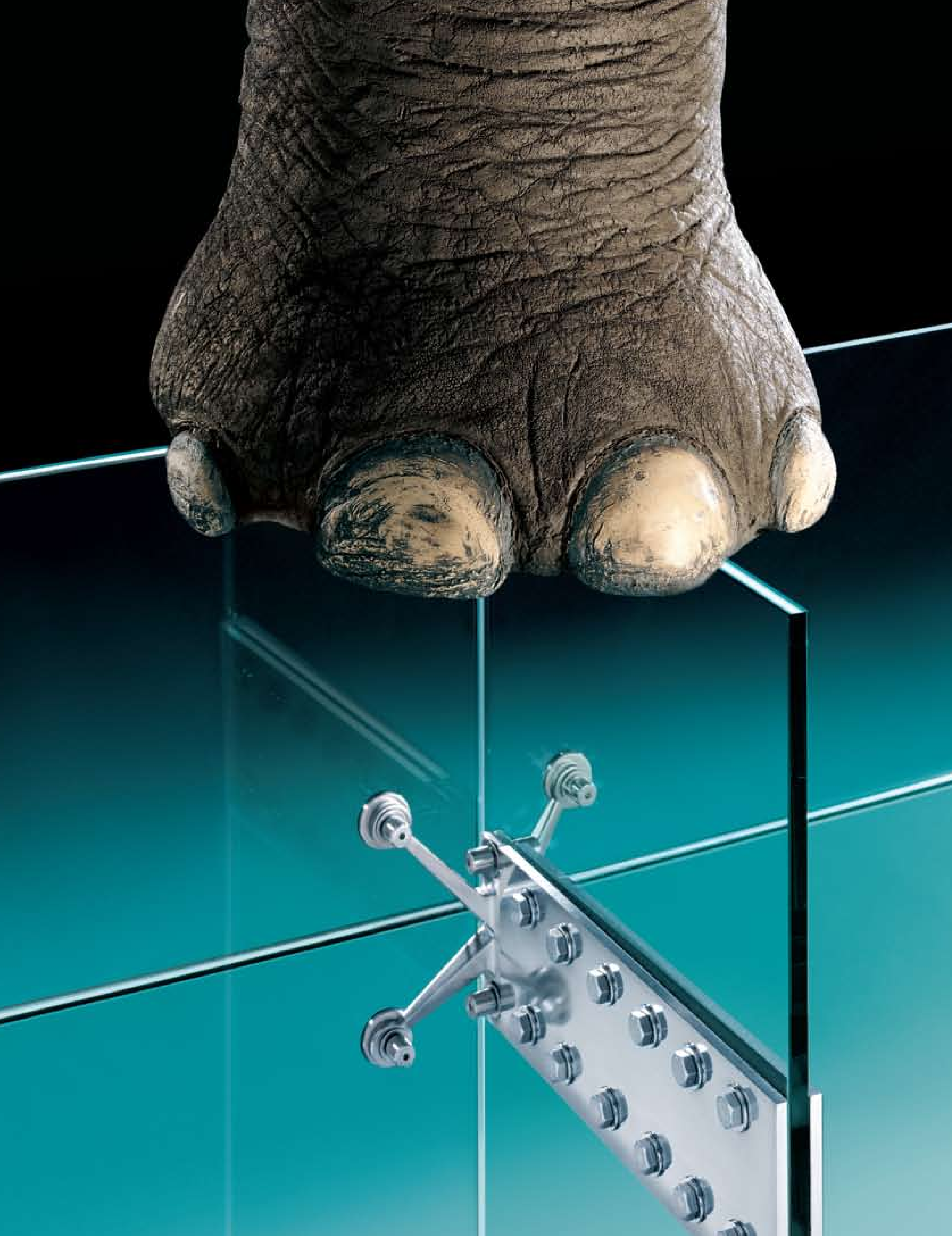

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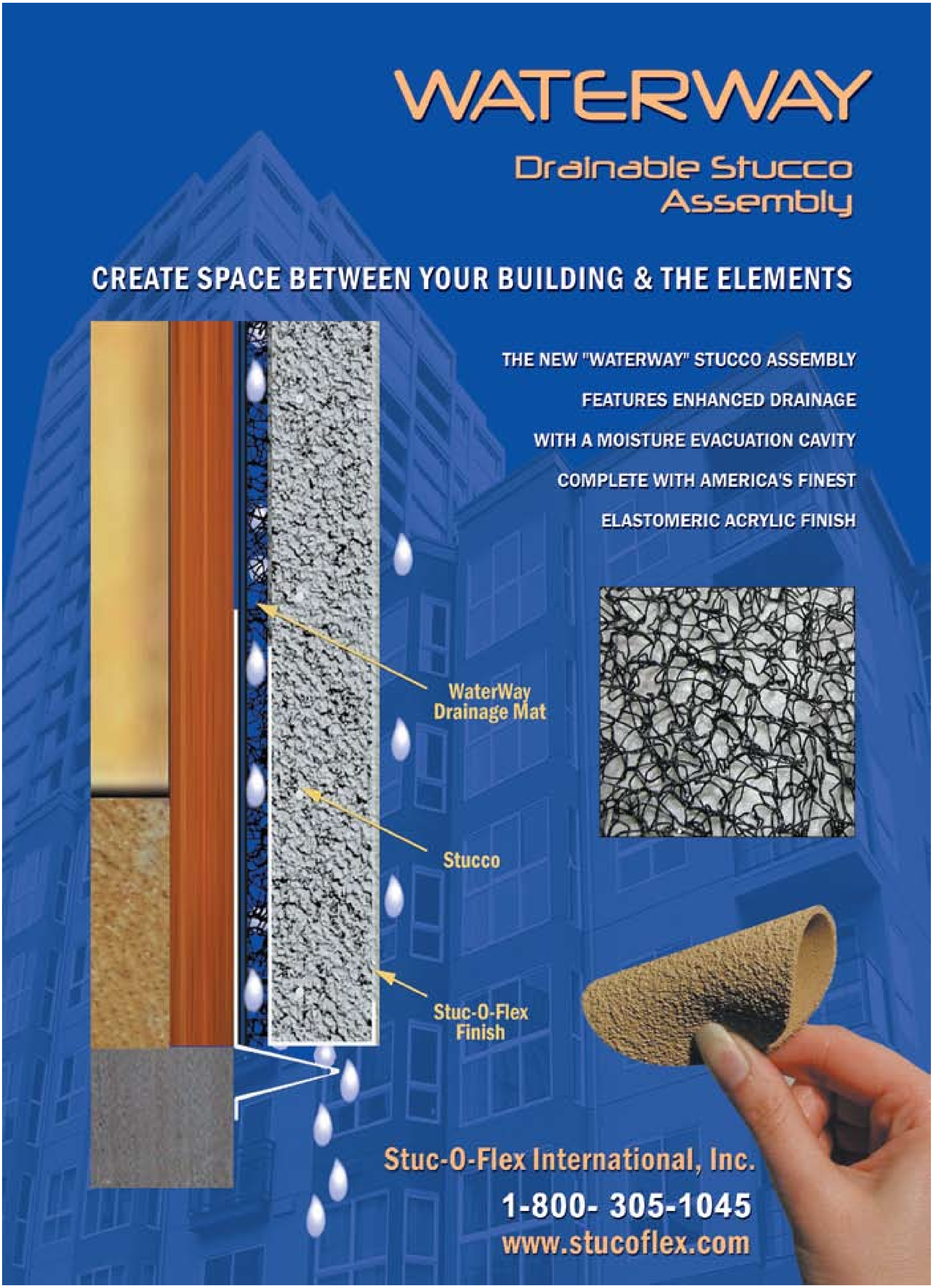
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Continued from page 17.

2008 and it identifies a policy roadmap as a main objective to meet a reduction target of 53MtCO2 per year by 2050.

The agencies suggest specific strategies to reach projected energy reduction goals. Research reveals that building codes can dramatically reduce CO2 emissions: thus, in the US, 79.6MtCO2 were reduced in 2000 through their use. Targeting subsidies is important to ensure that incentives are available for energy-efficient technology production. The agencies also stress the importance of utilizing information programs to drive voluntary actions. Combined with policy, voluntary actions can increase effectiveness and help the market transition into a more regulated framework.

The Government of Canada is leading by example in these directions through its participation in the Federal Buildings Initiative, which aims at making government buildings more energy-efficient. This program has generated over $40 million in annual energy cost savings to date, while cutting greenhouse gas emissions by 285 kilotones.

The Government of Canada has also committed to exceeding LEED standards for its own new buildings. In April 2008, one of the most environmentally friendly federal government buildings was officially opened in Charlottetown, Prince Edward Island. The Jean Canfield Government of Canada Building is a showcase for many innovative environmental technologies, including reducing heat absorption with a reflective roof, recycling rainwater to reduce water usage and powering the building with wind turbines. This innovative building has the LEED Gold Rating as its target.

CONCLUSION

Change starts at home, and the Government of Canada's support for energy-efficient projects is bringing new building practices to the forefront. But rapid change requires many hands, and the partnerships the Government of Canada has undertaken on its journey to energy efficiency—partnerships with industry, academia and other governments—have been integral to its success.

For more information on Canada's energy saving initiatives, visit the Natural Resources Canada website at www.nrcan-rncan.gc.ca.

NFRC Component Modeling Approach (CMA): White Paper

By Ray McGowan

COMMERCIAL FENESTRATION ENERGY RATINGS

ASHRAE 90.1, Section 5.8.2, requires fenestration energy performance to be determined using NFRC 100 and 200. The performance indices (U-factor, SHGC and VT) generated must come from a laboratory accredited by a national authority such as the National Fenestration Rating Council, Inc. (NFRC). The primary exception to this rating requirement allows for manufacturers to assign default values from an ASHRAE appendix. However, these defaults are unlikely to meet the ASHRAE prescriptive requirements.

Anecdotal evidence indicates many fenestration manufacturers are not providing energy performance values according to the Section 5.8.2 requirement. For example, in some instances, manufacturers may only be providing the center of glass values for the IG unit. Others may make simple calculations to include frame performance with IG performance. And still others may follow AAMA 507, which piggybacks on the NFRC 100 and 200 standards.

The AAMA 507 procedure generates IG performance according to NFRC 100 and 200, but combines it with the frame thermal performance in an overly simplified manner that is unlikely to be accurate. In addition, no third party verification is required, which is not the case in the NFRC rating procedure. Recently, several AAMA 507 proponents attempted to add this procedure to the IECC as an alternate to NFRC 100 and 200 but that effort failed largely because of the missing third party verification that code bodies prefer. Any fenestration performance lacking the actual NFRC 100 and 200 generated indices is unlikely to be accurate.

The NFRC currently offers a commercial fenestration rating procedure that has been largely ignored by the industry. The primary reason for this is its lack of expediency necessary for commercial projects. NFRC's current rating system works well in the residential market since common products are mass produced and are rated by product line or model. However, commercial projects are highly specialized with specific product designs for individual buildings requiring project-based ratings. The NFRC recognizes the difficulty this presents and has nearly completed a new rating procedure more amenable to the commercial fenestration industry. This new rating procedure is called the Component Modeling Approach.

NFRC'S NEW COMMERCIAL FENESTRATION ENERGY RATING PROCEDURE

The NFRC's Component Modeling Approach (CMA) program will address the needs of the nonresidential fenestration market while still maintaining consistent, credible and reliable performance ratings. Though the current nonresidential program offered by the NFRC (Site-Built program) provides consistent and reliable energy performance ratings for code enforcement purposes, it does not address the issues associated with preliminary project bidding and/or design needs, project customization, or the need for size-specific product ratings. These are issues specific to the commercial market which will be addressed by the CMA program.

The NFRC Site-Built Program is currently referenced in the State of California energy code (Title 24) and partially meets the needs of the commercial fenestration industry. This program will remain as an alternative program to CMA at this time. However, the State of California will be revising its energy code in 2009 and will reference NFRC's CMA program. NFRC's current residential Product Certification Program will also continue to be administered for the residential industry segment. NFRC is developing a new CMA Product Certification Program to ensure accurate, credible ratings for the new CMA method.

NFRC'S NONRESIDENTIAL OR CMA PRODUCT CERTIFICATION PROGRAM

NFRC's current nonresidential/site-built certification program was developed in 1999. It was designed to address field-glazed or

The NFRC's Component Modeling Approach (CMA) program will address the needs of the nonresidential fenestration market while still maintaining consistent, credible and reliable performance ratings.

field-assembled fenestration products. The program parallels NFRC's residential Product Certification Program by using current computer simulation and modeling tools, accredited laboratories and licensed certification agencies. A standardized specimen is used for validation testing. And in lieu of the NFRC label, a Label Certificate form was developed to communicate and verify fenestration system performance and third-party certification for building code compliance purposes.

In 2002, the Component Modeling Approach (CMA) procedure was developed to address some of the process limitations of the Site-Built program. The CMA product certification program is currently under final development and is targeted for implementation in 2009.

CMA PROCEDURE: HOW IT WORKS

Briefly, component performance data are used for obtaining overall product performance employing NFRC's CMA Software Tool (CMAST).

The three primary components used are:

- Glazing: Glazing optical spectral and thermal data from the International Glazing Database (IGDB);
- Frame cross-sections: Thermal performance data of frame cross-sections; and
- Spacer: Keff (overall conductivity) of spacer component geometry and materials.

CMA PROCEDURE: HOW CMA WILL IMPROVE NONRESIDENTIAL PRODUCT CERTIFICATION

The scope of the CMA program is to develop a new nonresidential certification and rating procedure for fenestration products that will yield accurate energy performance data for use in code compliance and for meaningful building energy analysis. The certification and rating program shall be credible, simple, cost effective, fair, uniform and useful.

The CMA program will allow for different segments of the fenestration industry to obtain standardized energy performance ratings for fenestration components and component systems including glass, spacers and frames. These systems will reside in electronic libraries that will be easily accessed by those who wish to determine and/or obtain NFRC energy performance ratings (U-factor, SHGC, VT) for entire window, storefront and curtainwall systems.

CMA outputs will include a standardized bidding tool for building specifications, exporting capabilities for energy analyses and an NFRC Label Certificate for code enforcement and specification confirmation.

CMA CERTIFICATION PROGRAM OVERVIEW

1. Program rates whole fenestration products according to NFRC 100 and 200.
2. The three components (glazing, spacers and frames) that make up a fenestration product shall have performance values that are NFRC-approved and maintained in an NFRC Approved Component Library database.
3. An Approved Calculation Entity (ACE) shall calculate the values for the fenestration system using the CMAST and the approved component library.
4. A Specifying Authority seeking product certification shall contract with an ACE. The Specifying Authority specifies the fenestration products and systems and specifies suppliers to be used on a project to meet design and performance requirements. This Specifying Authority is responsible for taking any corrective actions necessary if the final assembly does not conform to the product rating.
5. Once the energy indices for a fenestration system(s) has been generated for a specified project, the Specifying Authority agrees to an NFRC License Agreement and is then issued a CMA Label Certificate for the project which lists the certified systems and their ratings.
6. The Approved Calculation Entity (ACE) shall use the CMA Software tool on behalf of the Specifying Authority to generate a label certificate for a specified project.
7. The ACE is an entity approved by NFRC to carry out certified energy calculations of fenestration products using the CMA.
8. CMAST calculates the energy performance indices (U-factor, SHGC and VT) prior to generating the label certificate.
9. Information from the label certificate will be maintained in the NFRC Certified Products Directory.
10. NFRC-licensed agencies will review ACE calculations for accuracy and will conduct random documentation audits of projects that were granted label certificates.

NFRC'S CMA CERTIFICATION VS. AAMA 507

- CMA offers third-party certification by way of its product certification program. AAMA 507 does not.
- In the CMA program, the NFRC ACE generates a Label Certificate directly from CMAST. In AAMA 507, the manufacturer generates a Certificate of Compliance (a template is provided in AAMA 507) with no third-party oversight.
- The CMA methodology uses performance data for a specified glazing and framing system whose components have been simulated per NFRC 100 and 200 to obtain a whole product U-factor, SHGC and VT rating. The AAMA 507 methodology, on the other hand, uses U-factor, VT, and SHGC values obtained from simulations conducted per NFRC 100 and NFRC 200 and the manufacturer interpolates among different actual system sizes and glass/spandrel options to arrive at an overall glazing system U-value, VT and SHGC for a configuration required by a given contract.
- CMA offers public access to information about product performance that is critical to market transformation and is required by ASHRAE, CA Title 24 and IECC. AAMA 507 does not.

CMAST FUNCTIONALITIES

In general, CMAST :

- Has client-based and web-based functionalities.
- Allows for access to a central database of NFRC-approved components maintained on the central server.
- Provides energy performance ratings at NFRC standard size and actual size.
- Allows for the saving and storage of data:
  - Frame and glazing assemblies;
  - Spacer Keff;
  - Fenestration systems; and
  - Project information.
- CMAST will be able to:
  - Maintain libraries of component data;
  - Define projects;
  - Assemble components; and
  - Calculate whole product ratings.
- Assemblies generated in the software prior to whole product calculation:
  - Center of Glazing assembly;
  - Spacer and edge seal assembly; and
  - Frame assembly.

SOFTWARE OUTPUTS

- Project data and fenestration system performance data for a project can be exported for use in bidding, energy analysis, determining specifications, etc.
- Product Certification and issuance of an NFRC Label Certificate for code compliance.
- Public directory of approved components, certified products and other label certificate information.

SOFTWARE DEVELOPMENT AND PROGRAM TIMELINE

- CMAST development project began in May 2007.
- Fensize, the precursor of the CMA software was designed in 2002 by current CMAST contractor, D. Charlie Curcija.
- CMAST Prototype Testing (client based) – July 2008.
- Alpha testing (network/synchronization) – October 2008.
- Program and Technical documents approved – November 2008.
- CMAST deployment – January 2009.
- Six-month Pilot Project to begin in February 2009 and conclude in August 2009.
- Full implementation of program – August 2009.

OUTCOMES

- User-Friendly Tool – Established component libraries and user-friendly CMA software application allows general user to assemble components, configure whole products and obtain performance calculations.
- Building Energy Analyses – Fenestration energy performance data for projects can be readily exported for use in EnergyPlus.
- Bidding Tool – Product calculations can be exported for bidding purposes and determining specifications.
- Code Compliance – Label certificate issuance is expeditious and cost-effective.
- The CMA Product Certification Program provides for a uniform, standardized and accurate rating methodology that incorporates third-party oversight and quality control.
- Information access – A public directory of approved components, certified products and other label certificate information is available on-line in real time for quick and easy access and verification as required by ASHRAE, IECC and CA Title 24.

ABOUT NFRC

The National Fenestration Rating Council, Inc. (NFRC) is the only nationally recognized leader in providing energy performance rating procedures and certification, and labeling programs for windows, doors, skylights and related attachment products. NFRC develops and administers comparative energy and related rating programs that serve the public by providing fair, accurate and credible energy performance information on fenestration products.

NFRC provides:

- Standardized methods for determining energy performance;
- A “level playing field” for comparing fenestration products; and
- Accurate third-party product certification information on fenestration performance.

Incorporated in 1990, the NFRC is a not-for-profit, 501(c)(3) organization. NFRC resides in Greenbelt, Maryland with fourteen employees including an Executive Director who reports to the Board of Directors and a Deputy Executive Director who is responsible for the day-to-day administration.

In addition to its Board of Directors, NFRC has voting members. Membership is open to organizations and individuals with an interest in the production, regulation, specification, use or promotion of, or development of technology related to the energy performance of fenestration products, and may include corporations, associations, other businesses and not-for-profit organizations, and government agencies.

Committee members are selected from the membership and are responsible for the establishment of NFRC procedures and programs which are presented to the Board of Directors for final approval before implementation. Subcommittees are formed from the membership at the discretion of the appropriate Committee Chairperson and with the approval of the Board of Directors. Subcommittees are responsible for tasks given to them by the Committee as they relate to the development of specific programs or procedures. Task groups are formed by Chairpersons of the Subcommittees and are comprised of NFRC Members and non-Members that are responsible for researching and developing specific issues assigned to them by the Subcommittee Chair.

WHAT DOES THE COMMERCIAL FENESTRATION INDUSTRY GAIN BY THIS PROGRAM?

- The commercial fenestration industry will have access to a uniform, user-friendly, standardized tool for obtaining the energy performance ratings of commercial fenestration products.
- Standardized energy performance ratings will greatly assist in marketing the energy efficiency of commercial fenestration products similar to the highly successful ENERGY STAR Windows program. Communicating standardized and validated performance ratings will improve the opportunity for the industry to market and install high-performance, value-added fenestration products in much the same way that the residential fenestration market has been transformed.

WHAT DO NFRC STAKEHOLDERS GAIN BY THIS PROGRAM?

- Code officials will now have the code required means to enforce energy codes.
- Architects will be empowered to design more energy efficient buildings.
- Building owners will have lower operating costs with higher performance envelopes.
- Consumers will have a more comfortable and productive work environment.

CONCLUSION

The NFRC will release CMAST in January of 2009 and will have the software available for public use the latter half of 2009. NFRC encourages the fenestration industry to begin developing more accurate fenestration ratings using this tool. NFRC staff and some its members are eager to assist new users to begin this process. Jessica Ferris, CMA Program Manager of the NFRC staff is the primary contact for CMA matters. She can answer questions and assist new users on the application of the new CMA procedure. In early 2009, several selected projects in California will begin using the tool as part of NFRC's CMA pilot project. NFRC hopes to gain insight on the operation of the new procedure and will continuously improve the process as it does with all of its other rating procedures.

Ray McGowan is Technical Services Manager at the National Fenestration Rating Council. He can be reached at rmcgowan@nfrc.org, 6305 Ivy Lane, Suite 140 Greenbelt, MD 20770-6323. For more information on the NFRC, go to www.nfrc.org.

BEC Corner

BOSTON

By Jonathan M. Baron, AIA, LEED a.p., Shepley Bulfinch

The Boston-BEC continues to meet monthly (except for August and December) for one and a half to two hours at the BSA headquarters in Boston's Financial District. Recent presentations have included Building Science, Insulated Composite Backup Panels and Cladding Systems by Keith Boyer of Centria; Detailing the Window/Wall Interface by Vince Cammalieri of Simpson Gumpertz & Heger Inc.; Air/Moisture Barriers; and EIFS by John Edgar of Sto Corp. We typically have 20 to 30 attendees at our meetings, and there is always spirited discussion with the presenters.

The BEC-Boston is conducting its second Building Enclosure Award, this time with a focus on residential buildings. The call for entries was released in the fall of 2008, with the award to be announced in April of 2009, coinciding with Boston's Residential Design and Construction trade show. The award will go to the residential building that best demonstrates innovation in design through the craft, science and engineering of high performance building enclosures in New England.

We are also putting together a window flashing event to be held in March. The challenge will consist of several teams tasked with the design and installation of a chosen air barrier assembly onto a preassembled 4' by 8' panel that will include a window penetration. The panels will then be tested for both air leakage and water penetration.

Upcoming meetings will focus on field testing windows and curtain wall, the NFRC's pilot program in Massachusetts for CMA rating of commercial windows, results of DOE grant testing, spray polyurethane insulation, and day lighting research being performed at MIT. More information about our current initiatives as well as future and past meetings can be found at our website, www.bec-boston.org.

SYMPOSIA & WORKSHOPS / CALL FOR PAPERS

TITLE: Symposium on Condensation in Exterior Building Wall Systems
DATES: October 10, 2010 - October 11, 2010
LOCATION: Grand Hyatt San Antonio San Antonio, TX
DEADLINE FOR ABSTRACT SUBMITTAL: May 10, 2009
DEADLINE FOR PAPER SUBMITTAL: January 10, 2010

ABOUT THE EVENT

Papers are invited for a Symposium on Condensation in Exterior Building Wall Systems, sponsored by ASTM Committee E06 on Building Construction and its Subcommittee E06.55 on Exterior Wall Systems. The symposium will be held October 10-11, 2010 (Sunday afternoon and Monday morning) in San Antonio, Texas, in conjunction with the October 10-13 standards development meetings of Committee E06.

This call for papers seeks contributions on the following topics related to condensation control in buildings:

- Development of analytical methods and standards that predict condensation;
- Application of standards to material design and building systems;
- Pracical experiences and lessons learned regarding condensation control; and
- Current problems in the industry pertaining to the sometimes conflicting goals of condensation control and new energy and/or environmental trends.

To participate in the symposium, presenters/authors must submit online the Abstract Submittal Form and attach a 250-300 word preliminary abstract no later than May 10, 2009.

More information and the Abstract Submittal Form can be found at www.astm.org. Additional information about the symposium is available from Symposium Co-Chairmen Bruce S. Kaskel, Wiss Janney Elstner & Associates. Email: bkaskel@wje.com; or Robert J. Kudder, Raths, Raths and Johnson, Willowbrook. Email: rjkuddder@rrj.com.

COLORADO

By Linda M. McGowan, P.E., A.I.A., Building Consultants & Engineers, Inc.

In October 2008, BEC-Colorado celebrated its third anniversary with average attendance at our monthly meetings increasing from an average of about 18 to an average of about 31 attendees. Our monthly meetings are usually held the first Wednesday of the month at the offices of Fentress Architects in Denver. The following is a list of the meeting topics held this past year:

- Current Research on the Benefits of EIFS Systems presented by John Edgar, Senior Technical Services Manager with Sto Corp.
- Infrared Imaging as a Forensic Tool presented by Peter Champe, Preservation Specialist with Atkinson-Noland & Associates, Inc.
- Evaluation of Corrosion in Concrete Structures presented by Tore Arneson, P.E., with Vector Corrosion Technologies.
- Recent Changes in Statutory Case Law and Their Effect on Professional Liability presented by David McLain, Esq. with Higgins, Hopkins, McLain & Roswell, LLC.
- Sustainability in Masonry Construction presented by Chris Bupp with Hohmann & Barnard Architectural Services.
- Synthetic Stone Veneer: Why Problems Occur and How to Avoid Them presented by Edward Fronapfel, Principal with Professional Investigative Engineers.
- Proglaze ETA - An Engineered Transition Assembly presented by Peter Poirier, Technical Director for the Glazing Solutions Group and Rich Degitis, District Manager both with Tremco Commercial Sealants & Waterproofing Division.
- Glazed Aluminum Curtain Walls presented by Charles Kilper with Heitmann & Associates, Inc.
- Fundamental Moisture Control Principles for the Building Envelope (and Drag Racing!) presented by Maria Spinu, Ph.D., LEED AP® with DuPont.
- Understanding the Critical Elements of Air Barrier Systems presented by Dave Allen with Grace Construction Products.

FEDCON® '08 PRESENTATIONS

The National Institute of Building Sciences presented FEDCon® '08 on Tuesday, December 9, 2008 at the Washington Convention Center in Washington, DC. FEDCon was co-located with AEC-ST® Fall and Ecobuild® Fall conference and exhibition. This year's program was endorsed by the Architectural Engineering Institute, the Associated General Contractors of America, and the Construction Management Association of America.

FEDCon provided an opportunity for federal agencies to present their construction programs to the building community. The agencies' presentations outlined the construction budget for the current year, planned budgets for future years, predominant building types to be designed, regional/international construction information, plans and directions of the design/construction program, significant areas of interest, and other useful information for private sector architects, engineers, general and specialty contractors, and product manufactures who have an interest in providing their services or products to the federal construction market.

The presentations from FEDCon are available for download at www.nibs.org/fedcon.html.

Also in October 2008, BEC-Colorado hosted its second annual half-day building enclosure seminar, with over 110 attendees. The seminar topic was The Ins and Outs of Building Envelopes: Best Practices for Following Air, Heat, and Moisture. Steve Easley with Steve Easley & Associates presented the first two sessions on Better Design & Building Practices: Reducing Water and Moisture Problems in Commercial Buildings and Reducing Construction Defects in Multi-Family Housing and Selecting High-Performance Window Technologies for Light Commercial Buildings. The third session was presented by Susan Raterman, CIH, President of the Raterman Group, Ltd. on Mold: Prevention is Cheaper than the Cure. The BEC-Colorado would like thank our sponsors for their support.

Planning for our monthly meetings and the 2009 BEC-Colorado Fall Seminar continues, with a particular focus on air barrier systems, details, and testing for the 2009 calendar year.

MINNESOTA

By Judd Peterson, AIA, Judd Allen Group

The BEC-Minnesota has had a busy fall! We have focused on dealing with current issues, expanding our interests, and assembling a team with assets that President Obama and the new administration might put to good use through the NIBS Institute.

In September 2008 we put together several authorities on foam insulation and fire resistance materials and detailing, and we discussed the impact of foam insulation in exterior walls and masonry cavities. The authorities included Cary Robertson and Rockford Boyer, Roxul representatives, to make a presentation about mineral wool in exterior wall cavities, and to discuss the range and impact of IBC Chapter 26 interpretations; Tom Moorman, Dow Representative, to discuss Thermax and extruded polystyrene use in exterior wall cavities with respect to the requirements of Chapter 26; Kevin Slattery, Edwards Sales and Dow representative, to discuss extruded polystyrene use in exterior wall cavities with respect to the requirements of Chapter 26; Derek LaBossiere and Mark Dietz, Superl, to discuss field experiences and recommended detailing for fire safing and insulation at exterior wall cavities, and insight as to how to meet slab edge requirements and how to isolate flammable insulations within the exterior wall.

In October 2008 we tried a stimulating new tack with Adam Skare, representative with Daktronics, giving a presentation on LED lighting technology and how to incorporate the systems into and onto the exteriors of buildings.

Following our attendance at the November 2008 BETEC Board meeting in Washington, DC, we met to discuss the national energy and building performance issues raised at the meeting, and we had a round table discussion about the capabilities of various teams of personnel here in Minnesota that would be able to help our nation meet future energy and performance goals. Among those at the roundtable, including Betti Iwanski and Gary Nelson of the Energy Conservatory, Jim Larson of Larson Architectural, David Bryan of AmerIndian Architects, Mark Josephs of Henry Company, Steve Pedracine of Minnesota Lath & Plaster Bureau, there were many suggestions and recommendations for those who have been

12TH CANADIAN CONFERENCE ON BUILDING SCIENCE AND TECHNOLOGY
May 6-8, 2009
Palais des congrès de Montréal (Convention Center)
Montreal, Quebec, Canada
www.cebq.org/NBEC.htm

involved in measuring and improving building performance here in Minnesota.

Of particular interest is the work John Weidt, Brian Wass, Tom McDougall and David Eijadi of The Weidt Group have done to develop software to measure and document the relative energy performance of over 5,000 commercial and public buildings around the state of Minnesota on the B3 Energy Project for the state, and rank the buildings according to need to improve. We believe this software and data can be extrapolated and put to immediate use nation-wide. We also discussed successful energy improvement programs performed on residential buildings by Sheldon Strom of the Center for Energy and the Environment, including the noise abatement insulation improvements to address airport noise but also affecting building performance, and research work and data developed by John Carmody, Director of Center for Sustainable Building Research, University of Minnesota. And finally, we discussed energy audits and improvements enabled by our local Xcel Energy, with assistance from private firms such as Honeywell and Johnson Controls, to fulfill state requirements to encourage and improve building performance. Our BEC is in the process of tabulating the capabilities of various groups around our state that may be able to furnish assistance to our government on a national level to meet our 2030 goals for energy efficiency and reduction of carbon emissions.

We're looking forward to supporting a serious surge of energy efficient projects and building enclosures in the coming year.

DOWNLOAD PAPERS FROM BEST1 CONFERENCE

The first in a new series of biennial, international conferences, BEST1: Building for Energy Efficiency and Durability at the Crossroads took place June 10-12, 2008, at the Minneapolis Convention Center.

The three-day program explored related aspects of building enclosure performance: energy efficiency in buildings, including separate presentations on fenestration; and Bugs Mold and Rot IV, continuing topics from earlier conferences on indoor air quality, moisture control, and building durability, especially walls, windows, and roofs.

The program and access to the papers presented at the conference appear at www.thebestconference.org.

Stay tuned to future issues of JBED to learn more about BEST2, April 12-14, 2010, hosted by BEC Portland.

PORTLAND

By David C. Young, PE, RDH Building Sciences Inc.

The summer of 2008 saw the first Flashing Rodeo event in the Portland area. Five teams, made up of architects, engineers and contractors, were each given a 4'x8' plywood-clad wall complete with a 2'x3' rough opening. Each team was tasked with designing and installing a window rough opening flashing assembly. Installations were then followed by water testing per ASTM E-1105. Suppliers and manufacturers participated by donating a number of weather resistive barriers, flashing and sealing products. The windows, locally donated by Mercer Industries, Inc. had an aluminum frame and perimeter nail fin. Walsh Construction provided the venue and donated materials and their time to construct the wall mock-ups.

The challenge was to create a drainable rainscreen installation rather than simply sealing the nail fin to the perimeter. All teams were able to successfully design and install their assemblies and all installations passed the water testing at a differential pressure of 12 psf, which approximates a 77 mph driving rain. Next year's challenge will include a window without a nail fin. We wish to thank all of the sponsors who contributed with materials, products, venue, food and beverages. The event was a great success.

The theme for the 2008/2009 season of BEC seminars is High Performance Buildings. The focus is on tight enclosures and improvements in thermal, mechanical and ventilation systems, with the goal of improving energy efficiency. To date we have had seminars focused on air barriers, thermal barriers and the importance of make-up air in ventilation. In 2009 we will tour some of the projects currently in construction in Portland that include high performance enclosures and tour some recently completed photovoltaic installations.

In addition to the high performance influence BEC promotes in Portland, our recently elected mayor, Sam Adams, has been quoted in his inaugural speech as saying, "…our goals are tough but doable. Make Portland the greenest city on earth."

Portland is also proud to be hosting the BEST2 Conference. Save the date for this event, scheduled for April 12 through 14, 2010.

BEST 2 CONFERENCE

APRIL 12-14, 2010
PORTLAND, OREGON

CALL FOR PAPERS

This conference encourages all who are involved in the design and construction of new buildings and the renovation of existing infrastructure to put forth their very best efforts to achieve high performance buildings that significantly contribute to weathering both the energy and economic turmoil that our country will face in the coming years.

AREAS FOR CONSIDERATION

Energy efficiency and durability
Fenestration and lighting
Moisture effects
Control of indoor environment
Innovative materials and systems

IMPORTANT DATES

ACCEPTING ABSTRACTS

ABSTRACT NOTIFICATION:
Febuary 28, 2009

PAPERS DUE:
August 15, 2009

For full details go to
www.thebestconference.org/call.php

The Power of Energy Efficiency: Plug the Holes in the Ship

By R. Christopher Mathis

SMART AS WE ARE, we are failing to plug the holes in our ship.

Buildings (homes and commercial buildings) consume over 40 percent of our nation's energy—more than any other sector of our economy. Reducing their energy consumption is easy. Most of these lessons we learned during the post-embargo days of the mid- to late-seventies. And most of the technologies needed are BORING. Insulation. Air sealing. Better windows. Duct sealing. Water heater blankets. More efficient appliances, furnaces and air conditioners. BORING.

Not sexy like windmills. Not cool like hydrogen vehicles. Not trendy like methane recovery, ethanol and solar. We want to put all these new, cool technologies on the deck of our energy planning "ship" while we ignore the holes beneath the waterline.

Energy efficiency is boring by comparison. Hard to get excited about old, proven technologies. But is it? I think we have failed to deliver the truth about the Power of Energy Efficiency. If we fully knew this power, I suspect that we would behave differently.

RESIDENTIAL EXAMPLE #1

We have about 120 million existing single family homes in the US (US Census data).

We build about one to two million per year (NAHB Annual Construction Statistics). That is about one percent new each year.

So 99 percent of the "holes" in our ship are existing buildings. About half of these homes have single or double clear glass (EIA data and Ducker data overlay).

That makes about 60 million homes.

What if we just changed the windows with current code minimum windows? Not the best windows we have available. Not the coolest technology. Just the boring stuff that has been available for 20 years and is now the code minimum.

Windows drive the air conditioning loads in homes and buildings (DOE and LBNL data).

Replacing the average home with new windows would save about one ton of peak air conditioning per home (REMDesign and Energy Gauge modeling).

Some would save more. Some less. But on average—about one ton.

- 1 ton is 12,000 Btu/hr.
- 1 ton of AC requires about 1 kW of peak electricity.
- Simple math: 60,000,000 x 1 ton x 1 kW = 60,000,000,000 Watts = 60,000 MegaWatts.
- That is 300 – 200 MW coal fired power plants.
- Or 100 – 600 MW super coal plants.
- Or 30 new 2000MW nukes.
- Permanently.

Just by changing the windows.

THE REST OF THE STORY

What if we also did the other boring stuff? Insulate, air seal, water heater jackets, improved HVAC? How much more might we save?

Oh, and where do we GET these boring energy efficiency technologies? Answer: from US companies that have been making this stuff for decades. Familiar names like Andersen, Marvin, Pella, and just about every other window company in America. They all have it. It is required by code. American companies. Home-grown solutions. Employing people now. Neighbors.

Who is going to install these windows? Answer: people in your neighborhood. Contractors, builders, window installers. Local people. Jobs we cannot "outsource". Putting people to work.

Oh, and these companies and people will pay taxes on the products and for the work, for the raw materials, for the installation labor. Contributing back to our economy.

And the utilities? They should invest in this plan now. It provides immediate and better peak power management than any peaking power plant they could build. Oh, they will still build power plants, but why not plug the holes in the ship first?

Fixing people's homes is a permanent solution. The heating, cooling and peak loads are permanently reduced.

Yes, there will be further derivative benefits. Air quality will improve. Our nation's energy security will improve. People will have reliable jobs and new skills. Tax revenues will go up. US factories will be kept busier longer.

Let's plug the holes in the ship with these boring, proven, home grown energy efficient technologies. Let's do it now. For everyone's benefit.

Christopher Mathis is the President of Mathis Consulting Co., located in Asheville, NC. He can be reached at chris.mathis@charter.net or at www.thesciencebehind.com. Please note, this piece is the opinion of the writer and does not necessarily reflect that of the NIBS or BETEC.

What if we just changed the windows with current code minimum windows? Not the best windows we have available. Not the coolest technology. Just the boring stuff that has been available for 20 years and is now the code minimum.

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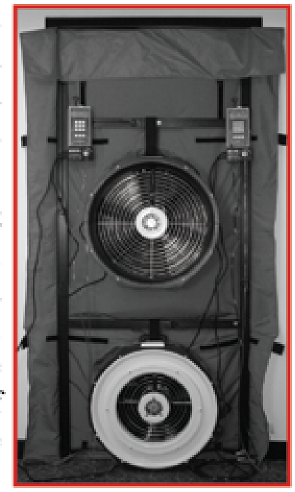
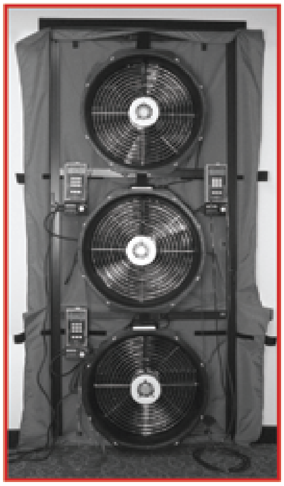
Airtightness Testing - Not Just for Homes Anymore



Airtightness testing of homes has been around for more than 20 years. Various energy programs and fluctuating energy bills have provided homeowners an incentive to improve the airtightness of their homes. Energy tax credits can also be received by the homeowner but only if the house airtightness has been verified that it is less leaky after remodeling than before.

In England, airtightness testing of buildings over 10,000 square feet was the first regulation initiated to reduce energy consumption. Efforts to make commercial buildings more energy efficient in the U.S. has only recently been incorporated into various "green" initiatives. Tests of commercial buildings show that they tend to be more leaky than the average house, based on air leakage per square foot of surface area. That means that commercial buildings are less energy efficient than the average house.



To measure the actual airtightness of a large building means more air is needed to maintain a reasonable test pressure. The Energy Conservatory, a leader in airtightness testing, has kits available to directly measure more than 18,000 cubic feet per minute of air leakage. Multiple kits and fans can be used simultaneously to generate more air for accurate and reliable measurements of air leakage for testing before and after retrofitting.

For more information on multi-fan systems contact The Energy Conservatory at 612-827-1117 or visit our website at www.energyconservatory.com.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