THE LONG ISLAND SOUNDER

November 2010

ASHRAE Long Island Chapter, Region 1...*Founded in 1957*

www.ashraeli.org

American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.

Inside this issue:

President's Message

Hello and welcome to the November issue of "The Long Island Sounder". We thank all those who attended the October meeting. Mr. Ken Scherer of Yaskawa America, Inc., provided us with a very informative and interactive presentation on harmonics and power quality considerations when applying variable frequency drives including facts & myths surrounding harmonic distortion.

This month is a joint meeting with SMACNA and will be held on Tuesday November 16^{TH}, the third Tuesday of the month to accommodate all our guests. We welcome Mark Terzigni from SMACNA, Technical Resources. He works with others in the Technical Resources Department to help develop and publish the technical manuals produced by SMACNA as well as providing interpretations to SMACNA standards through the Technical Inquiry Process. The presentation will be on the current industry trends and changes in various codes and standards relating to duct testing including ASHRAE 90.1, ASHRAE 189, IECC 2009. Attendees can receive 1 PDH.

Additionally November 16 will be Membership Promotion, Student Activities and YEA night. Please help us promote the event and invite a new member, or a YEA, Young engineer in ASHRAE, 35yrs and younger. We will be inviting students from the area to join us and learn more about ASHRAE. These are the future of the society and we should provide all the encouragement we can. This month, we are also fortunate to host Spencer Morasch, DRC, Director and Regional Chair of ASHRAE Region 1, who will be observing our meeting and providing any useful feedback to help improve our chapter operations.

With the busy holiday schedule around the corner, please mark your calendars for our Chapter holiday party on December 14. Take a moment to check out our website www.ashraeli.org and take a look at the programs that Carolyn Arote, Program Chair, has scheduled for the chapter monthly meetings.

I thank all our volunteers and members for your dedication and continued support of our society and look forward to seeing you on November 16^{TH}.

Nancy Román
President - Long Island Chapter

CHAPTER MONTHLY MEETING

DATE:	**Tuesday, November 16, 2010*** *** Special date (3rd Tues of Oct)**
TIME:	6:00 PM - Cocktails/Dinner 7:00 PM - Dinner Presentation 8:45 PM - Conclusion
LOCATION:	Westbury Manor South Side of Jericho Tpke. 25 Westbury, NY 11590
FEES:	
Members -	**$40.00 (New fee)**
Guest -	**$45.00 (New fee)**
Student -	$15.00

Reservations requested, but not required.

Call (516) 333-7117

Long Island Chapter Officers & Committees

ASHRAE 2010/2011 OFFICERS

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Board of Governors	**Charles Lesniak**	516.484.1020	516.484.0926	charles.lesniak@leapc.com
Board of Governors	**Steven Giammona, P.E., LEED AP**	516.827.4900	516.827.4920	sgiammona@ cameronengineering.com

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Webmaster	**Andrew Dubel**	516.484.1020	516.484.0926	Andrew.dubel@leapc.com
Nominating	**Michael Gerazounis, P.E., LEED AP**	212.643.9055	212.643.0503	michael.gerazounis@mgepc.net
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PR & Engineering Joint Council of LI	**Peter Gerazounis, P.E. LEED AP**	212.643.9055	212.643.0503	peter.gerazounis@mgepc.net
Golf Outing	**Peter Gerazounis, P.E., LEED AP** **Steven Friedman, P.E., HFDP, LEED AP**	212.643.9055 212.354.5656	212.643.0503 212.354.5668	peter.gerazounis@mgepc.net sfriedman@akfgroup.com

Chapter Monthly Meeting - Program for 2010/2011

September 14, 2010 * At Westbury Manor
Dinner Presentation - Variable Refrigerant Flow Systems
REFRIGERATION NIGHT **1 PDH**

October 19, 2010 ** At Westbury Manor*
Dinner Presentation – Harmonic & Power Quality
Presenter— Ken Scherer
RESOURCE PROMOTION NIGHT **1 PDH**

** Meeting will be held on 3rd Tuesday of the month.*

November 16, 2010 ** At Westbury Manor*
Dinner Presentation - Understanding SMACNA's New Duct Leakage Standard
Presenter— Mark Terzigni-SMACNA National
JOINT MEETING WITH SMACNA
STUDENT ACTIVITIES NIGHT
MEMBERSHIP PROMOTION NIGHT
YEA NIGHT

** Meeting will be held on 3rd Tuesday of the month.*

December 14, 2010
Holiday Party - Westbury Manor

January 11, 2011 ** At Westbury Manor*
Dinner Presentation – Standard 189.1 Standard for the Design of High-Performance Green Buildings
Presenter: Mark MacCracken Distinguished Lecturer

February 9, 2011 ** At Westbury Manor*
Dinner Presentation- Modeling a Sustainable World
Presenter: Lynn Bellenger-President ASHRAE & Distinguished Lecturer
*** Meeting will be held on 2nd **Wednesday** of the month.*
Joint Meeting with USGBC
RESOURCE PROMOTION NIGHT
MEMBERSHIP PROMOTION NIGHT

January/February 2011
ASHRAE Winter Meeting Jan 31-Feb 2
Las Vegas Convention Center
3150 Paradise Road, Las Vegas, NV 89109

February 2011
NATIONAL ENGINEERS WEEK
Feb 20 through Feb 26

March 8, 2011 ** At Westbury Manor*
Dinner Presentation- Emerging Filter Technology
Presenter Paul Deluliis

YEA NIGHT

April 2011
ANNUAL FIELD TRIP - TBD

May 2011 ** Cherry Valley Club, Garden City, NY*
ANNUAL GOLF OUTING
Date TBD

May 10, 2011 ** At Westbury Manor*
Dinner Presentation – Heating system design and applications for condensing, hybrid and sensible heat boilers
Presenter: Donald Pratt – Director of the Reed Institute at Mestek
STUDENT ACTIVITIES NIGHT

June 14, 2011 ** At Westbury Manor*

PAST PRESIDENTS & OFFICER INSTALLATION

August 2011 - Chapter Regional Conference Region I
New York, NY August 18-20

PAOE POINTS FOR 2010/2011

Chapter Members	Membership Promotion	Student Activities	Research Promotion	History	Chapter Operations	CTTC	Chapter PAOE Totals
295	0	0	445	75	795	275	1,590

November Program

You are cordially invited to our November 2010 Meeting…

Dinner Presentation

"Air Duct Leakage "

Presented by

Mark Terzigni
Project Manager, Technical Resources
SMACNA

DATE:	**TUESDAY, NOVEMBER 16, 2010**		
Time:	6:00 PM – Cocktails and Hors D'ouevres 7:00 PM – Dinner Presentation 8:45 PM – Conclusion	**Fee:**	$ 35.00 Member $ 40.00 Guest $ 15.00 Student
Location:	**WESTBURY MANOR** (516) 333-7117 Jericho Tpke (South Side), 3/10 of mile east from Glen Cove Rd., Nassau County, NY. **Directions are posted at @ www.ashraeli.org.**		
Presentation:	The presentation on Air Duct Leakage will address the following: • Definitions and terms used in reference to leakage testing • Misconceptions about leakage testing • Current industry trends and changes in various codes and standards relating to Duct Testing ASHRAE 90.1 - ASHRAE 189 - IECC 2009 • Basic procedures for testing ductwork • Calculations used in duct leakage testing • Differences in the 1st edition of the SMACNA manual and the second edition • How to convert from percent flow to leakage class • How to convert from leakage class to percent flow		
About our Speakers:	As project manager, Mark Terzigni works with others in the Technical Resources Department to help develop and publish the technical manuals produced by SMACNA as well as providing interpretations to SMACNA standards through the Technical Inquiry Process. Industry Involvement: Member of ASHRAE, National Capitol Chapter (Prior member of the Columbus, Ohio Chapter); ASHRAE Technical Committee 5.2 Duct Design (Vice Chairman); Corresponding Member for TC's 5.8 and 7.9 Prior to joining SMACNA, Mark was a Technical Service Engineer for McGill AirFlow LLC assisting the sales staff, customers, and design professionals with technical issues regarding duct construction, duct design, sound attenuation, and leak testing equipment. Prior to his role as a Technical Service Engineer Mark was a Sales Engineer for McGill. Mr. Terzigni graduated from The Ohio State University with a Bachelors of Science in Mechanical Engineering.		

Board of Governors Meeting Minutes

DATE: Tuesday, October 19TH, 2010
TIME: 5:04PM-6:21PM
LOCATION: Westbury Manor
Attendees were Nancy Roman, Carolyn Arote, Andy Manos, Charlie Lesniak, Andrew Dubel, Janeth Costa, Tom Fields, Richard Rosner, Brian Simkins and Steve Giammona.

GENERAL ITEMS: Nancy Roman - We will be honored by having Spencer Morasch attending the November meeting and we should advertise this early. All PAOE points to be updated. A new deadline for the newsletter articles is one week after the dinner meeting to help expedite postings on the web page and facilitate getting the newsletter out on time. All chapter officers and chairs have their MBO's submitted. The November meeting will be a joint meeting with SMACNA and PDH credits will be given. The date for Golf Outing is still be determined.

PROGRAMS: Carolyn Arote – Reviewed the planned November joint meeting with SMACNA. Confirmed Spencer Morasch will be in attendance for November meeting. A presentation will be made to him. The April field trip location and arrangements are still to be finalized but all other programs have been finalized.

RESOURCE PROMOTION: Andy Manos – Full Circle donations have been made and will be complete this month. The2010 product directory is currently displayed on website and will be replaced with the 2011 edition after January.

HISTORIAN: Charlie Lesniak – PAOE points will be awarded for bi-monthly articles and are currently at 75 points. Digitizing of the archives are in the process of being done and a file naming convention is being set up to make finding items easy.

WEBMASTER: Andrew Dubel – Because the website needs to be updated earlier than the newsletter articles for either must now be submitted one week after the dinner meeting for the next months publication. Information from previous events shall be removed such as last years golf outing. The possibility of ASHRAE email address for BOG/ Committee members was discussed and availability and costs will be investigated with the hosting company as well as space for archives, pictures, events and so forth. Current costs for hosting are $19.95 a month.

TREASURER: Janeth Costa – Balance in the main account is $13,118.07 and $8,015.26 is in the money market account. Some advertisers in the newsletter are still behind in their payments and have been removed from future editions.

MEMBERSHIP PROMOTION: Tom Fields – Tom will give us an update on the number of dues paying members at the next meeting and is looking for a good turn out at next months membership promotion night. Tom reported that several opportunities have been brought to his attention where presentations have been requested at schools and he will be looking for volunteers and coordinating same.

STUDENT ACTIVITIES: Richard Rosner - A $5K grant was awarded to Hofstra and a presentation is on Oct 27th@11:15 AM at Hofstra. An open house is planned for Suffolk Community College on Oct 20th from 5:30 to 7:30 on the Brentwood campus at their new HVAC building. We are still looking for donations of past handbooks which are collecting dust in your libraries for use by new student members who do not have a full set yet. Next month is student activities night and students attending will receive a free dinner and membership for one year in ASHRAE. Spread the word about this.

CHAPTER TECHNOLOGY TRANSFER (CTTC): Brian Simkins - Confirmed refrigeration night will be for the May 2011 meeting. Brian will continue to hand out speaker evaluation forms and update PAOE points.

YEA: Charlie Lesniak - Confirmed (2) YEA nights, Nov. and March. Andrew Dubel attended the YEA leadership weekend in Atlanta and announced the program was strong and extensive. He requested a 15 minute pre-lecture for YEA members be given on the topic of the evening's program before the lecture begins to act as a primer. He also mentioned that national has a Facebook page for YEA members to join.

ADDITIONAL GENERAL BUSINESS - Obtaining PAOE points and meeting deadlines to meet PAR. A reminder was made to please submit all articles to Liset one week after the previous meeting.

Having discussed all open issues, the meeting was adjourned at 6:21 PM.

Richard L. Rosner, P.E.
Chapter Secretary, 2010-2011

Research Promotion

Last months meeting was Resource Promotion Night where we recognized last year's donors. I would like to say thank you again to all those that have contributed.

I also would like to thank the companies who have participated in the annual 2011 Product Directory of Manufacturers and their Representatives.

There's still time if you would like your company listed in the directory please contact me. The deadline is December 1st.

The Product Directory has been prepared as a service to all its members and as a service to the local HVAC industry. It will be will be made available to all ASHRAE and non-ASHRAE members at no-cost and can be obtained from our monthly meetings or directly from our web-site.

The Directory is intended to provide better communications between manufacturers and their sales representatives; engineers who specify products; contractors who purchase and install the equipment; and other interested parties. Product Directory listings are not limited to ASHRAE members and the listings are not to be considered as advertising or endorsement by ASHRAE of any product, manufacturer or representative.

This year's overall resource promotion goal is $2,001,900 with over 75 research projects on board. Our chapter is expected to raise approximately $12,881 towards the overall goal of which we have already raised $2,030. I am hoping I can count on the continued support of all of our past contributors who have generously supported us over the years.
I also look forward to gaining the support of new contributors this coming year. Please help support ASHRAE in any way you can.

I would like say 'thank you' to all the contributors listed below whom have already donated to ASHRAE this year:

INDIVIDUALS

Mr Andrew E Manos
Mr Brian C Simkins
Ms Carolyn Arote
Mr Charles J. Lesniak
Mr Evans J Lizardos
Mr Jerome A Silecchia
Mr John D Nally
Mr Michael Gerazounis, PE
Mr Michael O'Rourke
Ms Nancy Roman
Mr Raymond G Schmitt
Mr Ronald J Kilcarr, PE
Mr Steven D Friedman, PE,HFDP,LEED AP

COMPANIES

Mason Industries Inc

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Research Promotion (Cont'd. from Page 6)

CONTRIBUTIONS CAN BE MADE IN THE FOLLOWING WAYS:

1) You can mail your checks, made out to ASHRAE Resource Promotion, to:

Andrew Manos
ASHRAE Research Promotion Chair
c/o Stony Brook University
Campus Planning, Design and Construction
Research and Support Services, Suite 160
Development Drive, Stony Brook, NY 11794-6010

2) You can bring your check to any of the meetings and give it to me. I will mail it into headquarters.

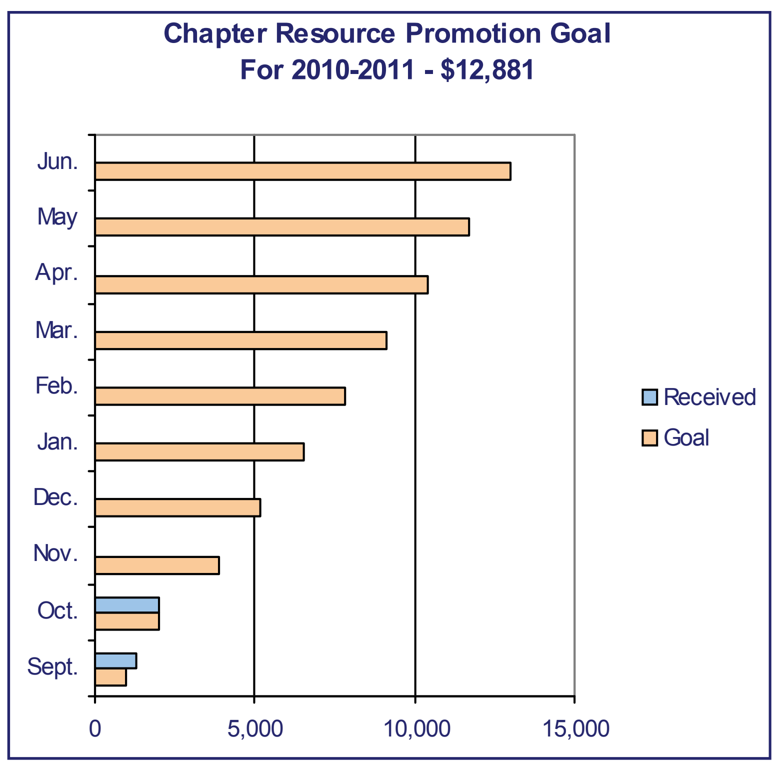
3) You can contribute via paypal from the ASHRAE LONG ISLAND web site just click on the donate button.

4) You can contribute directly on-line. www.ashrae.org
**** Please make sure your accredit your contribution to the LONG ISLAND CHAPTER 006 ****

Thank you again for all your support!

Andrew Manos, LEED AP
Resource Promotion Chair

Nicholas Couture, LEEP AP
Vice Chair



CTTC

Fixing Duct Leaks In Commercial Buildings

In contrast to residences, standards dealing with duct leakage in commercial buildings have existed for many years (e.g. SMACNA's *HVAC Air Duct Leakage Test Manual* [1985]). However, duct leakage is common in certain types of commercial buildings, and in certain system components. Unfortunately, these problems have had little attention.

Examples of this inattention to duct leakage include typical light commercial strip malls. They also include large existing commercial buildings that did not receive adequate duct tightness testing either during construction or when construction, performance, or operation changed significantly. Another issue is inattentiveness to commercial building duct system components downstream of VAV boxes.

This article discusses issues associated with duct leakage in these types of buildings and components, and presents case studies of leakage measurements and repair in these applications.

Building Classification

The question of when duct leakage is significant in a commercial building depends heavily upon the building type and duct system, the location of leakage, and the amount of leakage. Key distinguishing factors between commercial buildings are whether they are similar in size and equipment type to residences, or whether they contain larger, more complex HVAC systems. The first group of buildings is referred to in this article as thermally dominated commercial buildings. The second group is large commercial buildings whose HVAC energy use is more heavily impacted by fans.

Thermally Dominated Commercial Buildings

A thermally dominated commercial building works much like a single-family sunbelt residence, typically conditioned by ductwork located above the ceiling, and connected to small rooftop packaged equipment with fans that often cycle with the call for heating or cooling. In these buildings, the majority of the HVAC energy consumption is for heating and/or cooling the air, rather than the fan.

Large Commercial Buildings

In large commercial buildings, the operation of the fan(s) usually is not in direct synchronization with heating and cooling delivery. The fans typically run constantly, although often not at a constant flow rate, during building operation. In addition, the longer transport distances and control requirements in large buildings also translate into higher pressure differentials experienced by the central fan(s). The combination of these factors translates into a higher fraction of HVAC energy consumed by the fan, even though many of the fans have higher efficiencies than those found in standard packaged HVAC equipment.

Impacts of Duct Leakage

Ducts in the ceiling plenum space may appear to be in the conditioned space but are not. Fan power can be impacted by duct losses even if all the thermal energy returns to the conditioned spaces. As is discussed later, a ceiling plenum space has different energy implications depending on where the insulation is located, and whether the ceiling plenum is used as a return or exhaust duct.

In a light commercial strip mall (thermally dominated commercial building), the key determinants of duct leakage energy implications are the degree of leakage, and the location of the ductwork relative to the thermal and air boundaries of the conditioned space. At one end of the spectrum is ductwork that can be seen from within the occupied space, for which there is little energy to be saved by sealing or insulating that ductwork.

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CTTC (Cont'd. from Page 8)

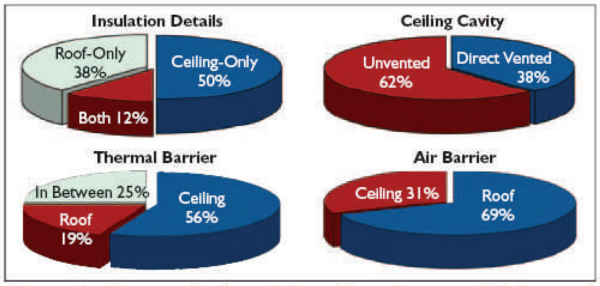

Figure 1: Characterization of the ceiling plenums with ductwork in light commercial buildings.[1] The thermal barrier locations were determined by temperature measurements, where "in between" means that the plenum temperature floated in between the indoor and outdoor temperature.

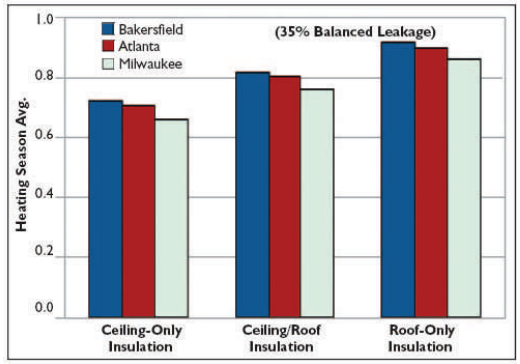

Figure 2: Heating season duct efficiencies calculated using Standard 152-2004 for light commercial ducts located above an unvented drop ceiling.

On the other hand, when ductwork is located above a "T-bar" or plaster ceiling, the thermal resistance of the ceiling relative to the roof is a key determinant of how much energy savings can be realized. The relative tightness of the ceiling with respect to the roof deck also is significant. Field studies in California have shown that the insulation in light commercial buildings can be found on the ceiling, on the roof, or in both places (*Figure 1*), and that a non-trivial fraction of the buildings tested (38%) had ceiling tiles actingas the air barrier of the building due to the installation of turbine vents on the roof that make the roof less airtight than the ceiling.

Figure 1 shows that in older light commercial buildings in California, insulation was located only on the ceiling about 50% of the time, only on the roof deck 38% of the time, and both places 12% of the time.1 According to that report, "in 56% of the buildings the primary thermal barrier was at the ceiling tiles, which implies that the ducts are entirely outside the conditioned space."

Another study indicated that California buildings that received building permits during a time that required roof insulation showed a much smaller fraction of ceiling insulation.2 Interestingly, a limited study in Wisconsin did not have any trouble finding buildings with ceiling insulation.3

To quantify the significance of the location of building insulation and air barriers, ANSI/ASHRAE Standard 152-2004, *Method of Test for Determining the Design and Seasonal Efficiencies of Residential Thermal Distribution Systems*, was applied to the three types of ceiling plenum configurations for Bakersfield, Calif., Milwaukee and Atlanta.* The input parameters to the standard are summarized in *Table 1*, and the results of those analyses are presented in *Figures 2* and *3*.

Figure 2 demonstrates that the location of insulation has a greater effect on energy efficiency than climate has over the heating season. This result was even more pronounced in cooling. *Figure 3* shows the large impact of insulation location upon the energy savings associated with moving from 35% duct leakage split evenly between supply and return, to 6% evenly split leakage (chosen leakage levels based upon field studies described later).

Figure 3 also indicates that the largest percentage savings occur under cooling design conditions, which can be explained by the fact that the ceiling plenum temperature is most extreme relative to the duct system under cooling design conditions.

All of the Standard 152-2004 analyses are based upon the assumption that the fan is cycling with the equipment. The additional energy implications of continuous fan operation, although not incorporated into Standard 152-2004, have been shown to depend upon the duty cycle of the heating/cooling equipment.4 Continuous fan operation has the largest negative impacts at low part load ratios.

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Standard 152-2004 underestimates the influence of insulation location for a light commercial ceiling plenum, as the temperatures in the plenum are not calculated, and the impact of the insulation only is captured via the fraction of duct losses recovered. Efficiencies should be higher, and percentage savings should be somewhat lower for roof-only configurations. However, as most losses are regained (90% regain) in roof-only insulation configurations, these effects should be relatively modest.

Building Floor Area-Cycle	2,000 ft^2 (186 m^2)
Duct Location	Supply and Return Ducts In Unvented Ceiling Plenum
Duct System R-Value	4°F ft^2/Btu/h (0.7°C m^2/W)
Duct System Surface Area	640 ft^2 (59 m^2)
Heating System Capacity	60,000 Btu/h (17 600 W)
Cooling System Capacity	46,000 Btu/h (13 500 W)
Heating System Flow	1,400 cfm (660 L/s)
Cooling System Flow	1,400 cfm (660 L/s)
Duct Material	Plastic Flexduct
Thermal Regains	
Ceiling-Only Insulation	10%
Ceiling/Roof Insulation	50%
Roof-Only Insulation	90%

Table 1: Inputs used for Standard 152-2004 analysis of light commercial duct leakage.

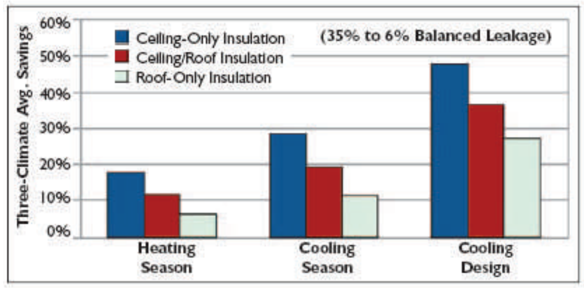

Figure 3: Heating and cooling duct efficiencies calculated using Standard 152-2004 for light commercial ducts located above an unvented drop ceiling (average savings for Atlanta; Bakersfield, Calif.; and Milwaukee).

Duct Leakage in a Large Commercial Building

In large commercial buildings, several mechanisms exist by which energy use is impacted by duct leakage and conduction losses. One mechanism is the effective short circuiting of heating and cooling energy back to the return prior to reaching the desired zone. This short circuiting means that the fan has to move more air to meet a given load, thereby increasing the fan energy non-linearly.5

At the most basic level, fan power increases with fan flow raised a power between 2 and 3, stemming from the fact that fan power scales with the product of fan pressure differential and flow, and that the pressure differential increases with the flow raised to a power between 1 and 2. Using the power 2.4 from Franconi et al.,5 a 15% leak translates to a 40% increase in fan power. A secondary impact of the increased fan power is an increase in cooling load associated with the heat generated by the increased fan power, resulting in higher cooling energy use.

Another mechanism by which duct losses in large commercial buildings increase energy use stems from the fact that thermal losses to the return air are not all recaptured by the building or the HVAC system. Some fraction of return air typically is exhausted from the building, thereby throwing away that fraction of the supply air thermal energy lost to the return airstream. This fraction of air exhausted can be as high as 100% in buildings such as laboratories, hospitals or casinos.

Other factors that determine the energy impacts of duct leakage or conduction losses include the use of ceiling plenum returns and the use of induction VAV boxes. The use of ceiling plenum returns vs. ducted returns tends to increase the energy impacts of supply duct leakage, as all of the losses to a ceiling plenum return go directly to the return/exhaust, whereas a larger fraction of the supply losses are likely to be drawn into the conditioned spaces before being pulled into ducted returns.

The degree to which supply losses make it to the conditioned space in ducted return systems depends upon the pressure in the ceiling plenum relative to the conditioned space, which in turn depends somewhat upon the ratio of supply to return duct leakage.

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CTTC (Cont'd. from Page 10)

In the case of ceiling plenum returns, most of the energy lost to the ceiling plenum tends to be returned or exhausted due to the larger effective UA value (thermal conductance) of the return/ exhaust airstream as compared to the UA value of the ceiling. In this type of construction, fan powered or system powered induction boxes tend to reduce the energy impacts of supply duct leakage, as the airflows drawn from the ceiling plenum reduce the fraction of the supply losses that are returned to the system fan. The induction flows can be thought of as a form of recovery of supply duct losses.

To place these energy flows in perspective, consider that a return airflow of 0.85 cfm/ft2 (4.3 L/s/m2) has an effective thermal conductance of 0.92 Btu/h/°F per ft2 of floor area (5.2 W/°C/m2). Assuming that the ceiling area is equal to the floor area, this conductance should be compared to a ceiling thermal conductance of 0.32 Btu/h/°F (1.8 W/°C), corresponding to a 0.75 in. (1.8 cm) thick acoustical ceiling tile. On the other hand, induction box flows can be less than, equal to, or greater than system fan flows, depending on the load of the space.
Supply losses to ceiling plenums also affect economizer and terminal reheat coil operation. For economizers, the colder return air temperature associated with supply air cooling losses to the return air decrease the use of economizers controlled by return air temperature, decreasing the temperature at which outside air is introduced. For terminal reheat coils, assuming that the minimum settings at the VAV boxes are not adjusted, supply duct leakage reduces minimum airflows at the coils, thereby reducing reheat coil energy use during minimum air operation.

One final consideration with respect to ceiling plenums is that thermal recovery of supply losses by conditioned spaces does not necessarily improve matters during simultaneous heating and cooling, where cooling losses can be recovered by zones that require heating, and vice versa.

Although all of these effects have not been quantified on a systematic basis, Franconi et al.,5 uses detailed building and system simulation to provide a reasonable quantification of the impacts of duct leakage in a large commercial building, calculating a 60% increase in fan power due to 20% duct leakage split on average equally between upstream and downstream of the VAV boxes. Those simulation results also show little impact of part load ratio on the percentage savings. Diamond et al.,6 measured an increase in system fan power of 25% to 35% due to increasing duct leakage from 5% to 20%.

Uncontrolled Airflows

Another impact of duct leakage in commercial buildings that is not discussed in this article is that of leakage on uncontrolled airflows and pressures.7 The impacts of these uncontrolled airflows often are much larger than the energy implications of that leakage, ranging from depressurization causing moisture damage in walls and backdrafting of combustion equipment, to transport and disperse of chemical or biological pollutants.

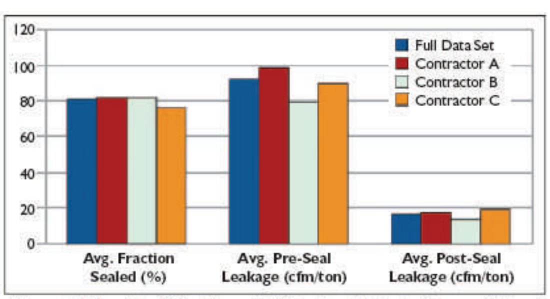

Figure 4: Results of Southern California pilot test of aerosol-based duct sealing in light commercial buildings, where cfm refers to measured leakage cfm at 0.1 in. w.g. (25 Pa) duct pressure.

Continued on Pg. 12

CTTC (Cont'd. from Page 11)

Field Measurements of Duct Leakage

Published measurements of duct leakage in light commercial buildings have generally been limited to Florida and California. Delp et al., summarizes duct leakage results from Florida and
California, expressing the leakage in terms of effective leakage area (effective hole size) per unit floor area. The reported values were 0.053 in.2/ft2 floor area (3.7 cm2/m2 floor area) for 25 California light commercial systems, 0.039 in.2/ft2 floor area (2.7 cm2/m2 floor area) for 39 Florida light commercial systems, and 0.019 in.2/ft2 floor area (1.3 cm2/m2 floor area) for California residential systems. Although the size of the holes in the ducts is a convenient tool for comparing construction quality, it has to be combined with the pressures across the leaks to determine their impact on energy performance. Delp et al., also presents a comparison of measured fan flows and supply grille flows for 35,000 ft2 (3250 m2) of light commercial floor space in California, which indicated 1.24 cfm/ft2 (6.3 L/s/m2) at the fan, and 0.92 cfm/ft2 (4.7 L/s/m2) at the grilles, or supply duct leakage of 26% of fan flow.

A much larger data set of light commercial duct leakage areas was acquired in a pilot test of duct sealing for electric demand reduction in Southern California. The average measured presealing leakage for 364 light commercial duct systems tested in this study was 0.03 in.2/ft2 floor area (2 cm2/m2 floor area), calculated based upon assuming 340 ft2 of floor area per ton of air-conditioning capacity (9 m2 per kW cooling capacity).

Existing Large Commercial

Considerably less published scientific data exists on duct leakage in large commercial buildings as compared to light commercial buildings, mostly due to the extra difficulties associated with making leakage measurements in these buildings. One difficulty in large buildings is their size and accessibility, leading to much higher measurement costs. Another difficulty with duct leakage measurements in large commercial buildings is the temporal variability of fan, branch and leakage flow rates.

As it is generally impractical to seal all the diffusers simultaneously and measure leakage flow under a presumably uniform duct pressure in a large commercial building, one way of avoiding the size issue is to measure the leakage of a sample duct system branch. This technique involves isolating the branch at the VAV box, and thus does not provide a measurement of leakage upstream of the VAV boxes. Several techniques for measuring duct leakage upstream of the VAV boxes based upon closing those dampers are the subject of current research, as is a technique that determines branch leakage flow by subtracting the sum of diffuser flows from a branch flow measurement under a representative flow condition.

The duct leakage value needed to evaluate the appropriateness of sealing is the percentage of fan flow being leaked. As noted earlier, this can sometimes be measured directly, but often is based upon separate measurements of duct leakage area and operating pressures. In large buildings, this process is complicated by the variable operating conditions of different parts of the system. Specifically, leaks upstream of the VAV dampers generally see a relatively constant pressure determined by the pressure setpoint of the system fan. Therefore, the flow through these leaks is relatively constant in absolute terms, but variable as a percentage of fan flow.

On the other hand, the flows through leaks downstream of the VAV dampers vary almost proportionally to the branch flow rate (leaks vary with duct pressure to the power 0.6, whereas branch flow varies with VAV box pressure to the power 0.5). Thus, downstream leaks represent a relatively constant percentage leakage. The variations in pressures seen by leaks that influence the leakage fl ows are further compounded by spatial variations in leakage levels (e.g., leaks at diffusers vs. at VAV boxes) that make the variations in pressure more important. Another key issue in large commercial duct leakage is the large variability of the results to date. Researchers at Lawrence Berkeley Laboratory measured duct leakage in six large commercial buildings, three of which showed 5% leakage, while the other three showed 15%, 17% and 25% supply duct leakage.

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Wile duct leakage measurements are limited, test and balance reports that include fan flow as well as diffuser flow measurements could be used under certain circumstances. One limitation of these measurements is that some test and balance protocols are single pass, whereby each diffuser damper is adjusted on the spot to produce the desired flow. A similar problem occurs when VAV boxes are not all opened simultaneously during testing, which is a fairly common protocol. In both cases, the difference between the fan flow and the sum of diffuser flows is no longer a good estimate of duct leakage (generally underestimating leakage).

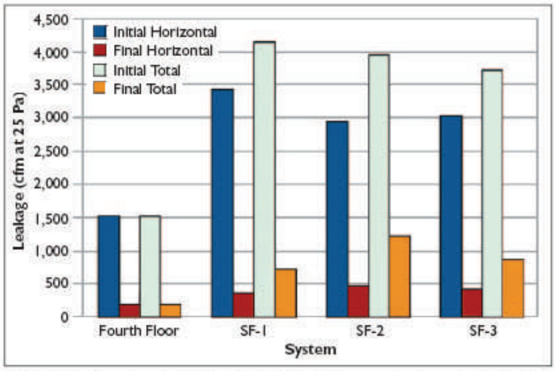

Figure 5: Summary of initial and final leakage measured by fan pressurization of each duct system in a 78,000 ft² (7200 m²) commercial office building. Totals include leakage in vertical shafts and unsealed horizontal runs in the penthouse mechanical rooms for SF-1, 2, 3.

Duct Sealing in Commercial Buildings

A recent development in sealing duct leakage in commercial buildings involves a technology that seals leaks from the inside out. This technology, known as aerosol-based sealing, works by pressurizing a duct system with a fog of sealant particles. By temporarily blocking the diffusers, the sealant laden air is forced to the leaks. Maintaining mild turbulence keeps the sealant particles suspended until they reach the leaks. The pressure maintained within the duct system causes the air to accelerate as it exits through the leaks, causing the particles to be flung against the walls of the leaks when they cannot turn as sharply as the accelerating air.8,9,10 Due to its ability to access leaks without accessing the exterior of ductwork located above a ceiling, the aerosol based sealing technology has been used during the last few years to seal duct leaks in light and large existing commercial buildings.

Light Commercial Sealing Results

Figure 4 summarizes the results of a field study in southern California of aerosol-based duct sealing in light commercial buildings. The systems sealed are located in San Bernadino, Riverside, and Orange counties, and were screened by the HVAC contractors to have ceiling insulation below the ductwork. Of the 360 systems sealed, 300 had complete data acquired, including data on the size of the equipment.

The average equipment size was 3.9 tons (14 kW) and the median size was 3.5 tons (12 kW), with the smallest unit having 2 tons (7 kW) of capacity, and the largest 12.5 tons (44 kW). As indicated in *Figure 4,* all of the HVAC contractors had approximately the same level of performance, sealing approximately 80% of the leakage encountered, which resulted in duct systems with leakage of approximately 16 cfm/ton of cooling (3.4 cm2 per kW of cooling) after the process.

In addition to showing that the technology could seal a significant majority of duct leakage encountered in these types of existing buildings, this field study also demonstrated that the sealing process could be performed on a production basis, with one contractor regularly sealing 10 to 15 tons (35 to 53 kW) of cooling equipment per day at a single site with one crew.

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Large Commercial Sealing

The aerosol-based sealing technology also has been used on a production basis in a large commercial building. The technology was used to seal all of the ductwork in a (~40-year-old) 78,000 ft2 (7200 m2) four-story commercial office building in which duct leakage for the constant volume systems had been identified by test and balance reports. *Figure 5* summarizes the initial and final leakage measured by fan pressurization during the sealing process for the ducts connected to the three penthouse supply fans that serve the east, west and central sections of the building, as well as for the ducts from two rooftop packaged units serving the fourth floor.

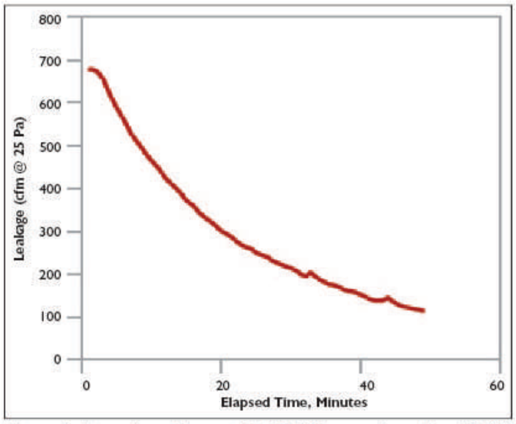

Figure 7: Example sealing profile (third floor northwest in a 78,000 ft² [7200 m²] commercial office building).

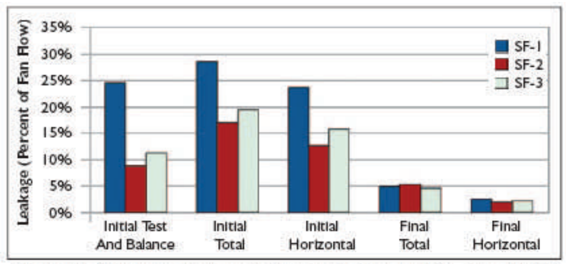

Figure 8: Summary leakage before and after sealing in a 78,000 ft² (7200 m²)commercial office building, computed based upon fan flows from a test and balance report, using measured diffuser flows for initial test and balance results, and measured leakage cfm at 0.1 in. w.g. (25 Pa) duct pressure for all other results.

Figure 6 summarizes the percentage of leakage encountered that was sealed for those same duct systems. The distinction between horizontal and total leakage was made because the total leakage measurement included measurements of leakage in sections with various controls and dampers that were scheduled for replacement and, therefore, not sealed. The horizontal duct sections were all externally insulated sheet metal, and the vertical shafts were all internally lined sheet metal ducts with cross-sectional dimensions of approximately 3 by 4 ft (0.9 by 1.2m).
The sealing for each section in this building, as for all other aerosol sealing applications, is displayed during the sealing process and recorded for future reference by the computer control systems used for all applications. *Figure 7* shows a typical sealing plot for a ductwork section being sealed. All of the duct sealing added up to 25 separate injections and sealing plots (similar to *Figure 7*) for this building.

The leakage of the penthouse systems in this building, expressed as a fraction of fan flows from the test and balance report, are presented in *Figure 8*. These results suggest that the 0.1 in. w.g. (25 Pa) reference pressure for fan pressurization is on the high side for this building, as the leakages based upon measurements at this pressure are all higher than the leakages calculated from diffuser measurements in the test and balance reports.

On the other hand, the author was unable to determine why the 0.1 in. w.g. (25 Pa) reference pressure seems more appropriate for SF-1 as compared to SF-2 and SF-3, and does not have detailed information on the accuracy of the test and balance reports.

Overall, the leakage of the horizontal duct sections was reduced to 2% to 3% of fan fl ow, and the overall leakage was reduced to less than 5% of fan flow, even including the unsealed duct sections.

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Summary and Conclusions

Ducts in commercial buildings leak, particularly in light commercial buildings, which appear to leak more than residential ducts, at least in California. In large commercial buildings some duct systems leak, while others do not, making detection of duct leakage a key activity.

Duct leaks are worth sealing in light commercial buildings whenever the ducts are located above an insulated ceiling. The situation is more complicated in large commercial buildings. Examining large commercial duct leakage from an energy perspective leads to the following considerations: higher leakage, higher exhaust air fractions and ceiling plenum returns make sealing more attractive, whereas induction terminal boxes and ducted returns make sealing less attractive.

This article demonstrates that aerosol sealant injection can seal ductwork leaks successfully in light commercial and large commercial existing building applications.

Brian Simkins
CTTC

Membership

It was great to welcome new members last meeting. I hope that this is a recurring theme. This month's chapter meeting will be quite active, as it a joint meeting with the Long Island Chapter of SMACNA. It is also our Membership Promotion, Student Activites, and Young Engineers in ASHRAE nights. There will be excellent opportunities for all to network and make acquaintances. Please encourage any people associated with the HVAC&R community to attend this meeting. As always, membership applications are available online at www.ashrae.org/members.

As it is also Student Activities Night, I want to let our senior students know about the Smart Start Program. It is the best way for ASHRAE student members to continue receiving the many member benefits of ASHRAE after finishing college. The program allows new graduates to pay only $20 for the first year of membership after college, $50 for the second and $50 for the third. This is a $420 savings. Upgrading from student to associate member allows you access to all ASHRAE has to offer, including annual copies for the ASHARE Handbook, the ASHRAE Journal, and various other publications and services. Please contact me with any questions regarding the Smart Start Program.

Thomas Fields, PE, LEED AP
Membership Chairman

Young Engineers in ASHRAE (YEA)

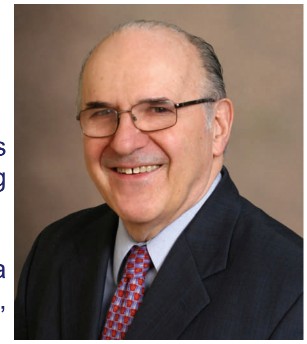
Hello to everyone, this year our chapter is starting a new committee that ASHRAE started. It is called YEA, Y-E-A or "Yea" both pronunciations work. It stands for Young Engineers in ASHRAE. The purpose of YEA is to help bring in younger engineers to participate in ASHRAE both at the local levels and national levels. Joining YEA is simple, if you are under 35 and filled out your birthday properly when you enrolled in ASHRAE you are automatically signed up. YEA has its own section under the ASHRAE website with a newsletter, information, blogs, and Facebook information. The web-page is also shows personal Bios of contributions of the younger members under "New Faces of ASHRAE". The website for the YEA blog is www.ashraeyea.org/ this blog contains news posts, videos and information resources. Please take a look at this website. Our chapter is planning two meeting nights geared towards YEA. These nights will be our November and March monthly meetings, so please attend.

Charles Lesniak
YEA Chairman

Long Island Chapter - Past Presidents

1958	H. Campbell, Jr. PE	1984	Raymond Combs
1959	Clyde Alston, PE	1985	Edward W. Hoffmann
1960	Sidney Walzer, PE	1986	Jerome T. Norris, PE
1961	Sidney Gayle	1987	Abe Rubenstein, PE
1962	William Kane	1988	Michael O'Rouke
1963	Louis Bloom	1989	Mel Deimel
1964	Milton Maxwell	1990	Robert Rabell
1965	Will Reichenback	1991	Gerald Berman
1966	Joseph Minton, PE	1992	Donald Stahl
1967	Irwin Miller	1993	Ronald Kilcarr
1968	Walter Gilroy	1994	Jerald Griliches
1969	Charles Henry	1995	Walter Stark
1970	William Wright	1996	Joe Marino
1971	Louis Lenz	1997	Norm Maxwell, PE
1972	Ronald Levine	1998	Alan Goerke, PE
1973	Henry Schulman	1999	Frank Morgigno
1974	Myron Goldberg	2000	Michael Gerazounis, PE, LEED AP
1975	John N. Haarhaus	2001	Ray Schmitt
1976	Richard K. Ennis	2002	Steven M. Stein, PE
1977	Kenneth A. Graff	2003	Andrew Braum, PE
1978	Evans Lizardos, PE	2004	Claudio Darras, P.E.
1979	Albert Edelstein	2005	Craig D. Marshall, P.E.
1980	Ralph Butler	2006	John Nally
1981	Robert Rose, PE	2007	Peter Gerazounis, PE, LEED AP
1982	Timothy Murphy, PE	2008	Steven Friedman, PE, HFDP, LEED AP
1983	Leon Taub, PE	2009	Steven Giammona, P.E., LEED AP

History



For this month, I thought about interviewing someone.

I decided to interview **Mr. Evans Lizardos** of Lizardos Engineering Associates

Q. What made you become an engineer? My dad, who was in maintenance and service, was instrumental in directing me to enjoy the aspects of design rather than maintaining and servicing the mechanical building systems.

Q. Where did you go to school, and when did you graduate? I graduated in 1960 with a Bachelor of Mechanical Engineering from what was then The Polytechnic Institute of Brooklyn, which is now NYU Polytechnic.

Q. When and where was your first engineering job? I started as an office boy in a civil engineering consulting firm (Bogert & Childs) in 1953, and started college at night in September 1954. In June 1956, I went to the largest MEP consulting firm at that time (Guy B. Panero) as a draftsman. In November of 1960 I went to R.L. Stinard, which became Piccirillo & Brown as a design engineer, and eventually grew to the position of Associate. In 1965, I started Lizardos Engineering Associates with my brother in the basement of my home.

Q. What were two of your most memorable projects that you worked on? What were two of the most interesting projects you worked on? In its 45 years, the firm has been fortunate to attract and work on many diversified projects. The practice has received awards from ASHRAE and the American Consulting Engineer Companies (ACEC). As an example:

1. The 2,000 kW cogeneration plant for Kingsbrook Jewish Medical Center in Brooklyn, NY.
2. The 15,000 Ton central chilled water plant at Wyeth Pharmaceuticals in Rouse Point, NY.
3. The Stroh Beer plant in Allentown, PA

Q. What national and chapter activities did you partake in ASHRAE? I have been through the Chairs of the Long Island Chapter of ASHRAE and the Chapter President from July 1978 to June 1979. On a national ASHRAE level, I have been involved and granted the following:

1. Fellow and Life Member
2. Distinguished Service
3. Distinguished Lecturer
4. 1999 Handbook Chair
5. Technical Committee TC6.1
6. Technical Committee TC10.9

Q. How has the industry changed in your tenure? In my career that started in 1953, I have seen the following changes.

1. Hand drafting to CADD
2. Catalogs & Engineering data on the internet.
3. E-Mails
4. Cell Phones
5. Computers

Q. Which technology has made the biggest change to the industry? Computers and their continuing growth every year in what they can do.

Q. What do you think will be a game changer with the industry? The growth of our industry; in which MEP construction cost represented less than 15% to 25% of total project costs and now represent 35% to 50% of the total project cost.

Q. Where do you see this industry going? Green is the way to go, but first costs still rules in most projects.

Q. any pearls of wisdom of wisdom to the current engineers out there? Tell your children to become engineers in our field because there will be shortages of talented engineers in our work force, as there is now.

Please remember to send in any old ASHRAE photographs, papers, articles, and speeches of people who have been through the Long Island Chapter of ASHRAE. I would like to upload this information to our chapter's website.

Charlie Lesniak
Chapter Historian

Student Activities

The **November** meeting will be the first Student Activities Night for this year. Please encourage any engineering students, high school students heading into engineering programs or faculty to attend. This is a wonderful chance for them to network with local professionals in the field gathering much insight. Members keep an eye out for any students attending this meeting or any meeting and introduce yourself. Involving the students now will lead to active members in the future.

Applications for the Long Island Chapter Scholarships have been sent to the various college student advisors and to several high school programs. Scholarships are available to well rounded students who show an interest in pursuing a career in engineering. Deadline for applications is May 1, 2011. Applications are available by emailing me at rrosner@nassausuffolkea.com . Completed applications can be returned via email or mailed to:

Richard L Rosner, PE
NSEA Suite 103
801 Motor pkwy
Hauppauge, NY 11788

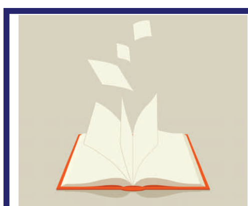
The second Student Activities night this year will be in May. We have picked May as this will be when we will present scholarships to students. Last year we gave away three scholarships and this year we hope to do the same. There are many scholarships available through ASHRAE and are not limited to our chapters commitment, please go online to view many of the scholarships and other resources for the students using the links provided below.

Quick Links to Student related topics:

ASHRAE Long Island Links to various Scholarships	2011 Student Design Competition
ASHRAE Student Zone	Careers & Internships
Senior Undergraduate Project Grants	Student Activities Educational Resources
Young Engineers in ASHRAE	ASHRAE National Scholarships

Richard L. Rosner, PE
Student Activities Committee Chair

Anita B. Singh, LEED AP
Assistant Student Activities Committee Chair



Donate your old Handbooks

Please bring your old handbooks to the meetings for donations to our student members who do not have complete sets at this time. Rich Rosner will be collecting them.

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