INDUSTRIAL ASSESSMENT CENTERS

Student and Alumni Newsletter

January 2007

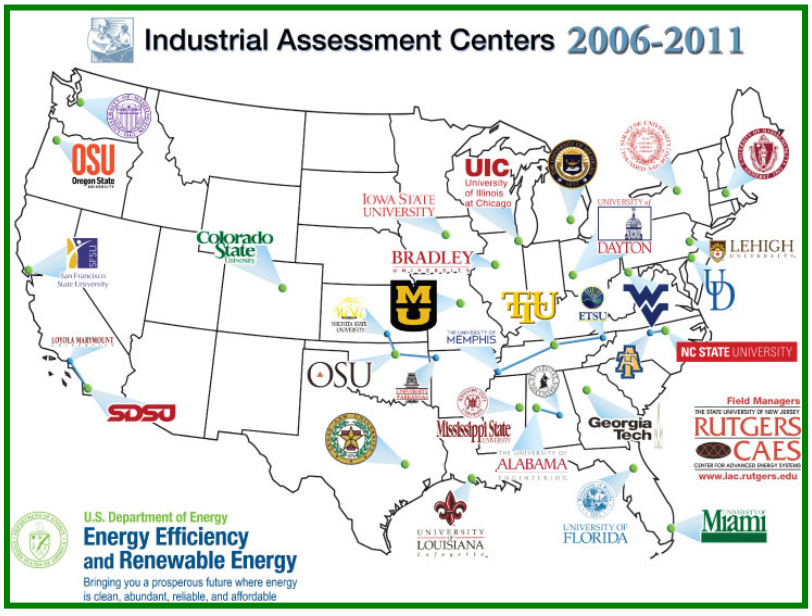
Visit us at www.IACforum.org and iac.rutgers.edu

2007 Update: New Centers, Budget Reductions and IAC Grads in Demand

Greetings IAC students and alumni! This past year was quite eventful for the IAC program – including the re-compete of IAC schools, budget reductions and IAC contributions to DOE's Save Energy Now Initiative. The latest DOE solicitation resulted in awards to 26 ABET-accredited engineering schools. A map of the current Industrial Assessment Centers is found below. We have five new primary centers including the Universities of Delaware, Washington, Missouri-Columbia, Alabama-Tuscaloosa, and Tennessee Technological University. As you'll read in this newsletter, the faculty and students at the new schools have participated in orientation training and are already up and running. Congratulations and good luck to our newly awarded centers!

As I mentioned in last year's newsletter, the IAC program budget took a significant hit in 2007. While the DOE kept the number of centers level at 26, they asked the centers to reduce assessment loads by 50% which resulted in lost opportunities for many great IAC students and faculty. This was also unfortunate for the many organizations who are aggressively recruiting our new graduates and alumni. As we move into the 2008 budget debate this spring, the fate of the IAC is still very much up in the air. I received many inquiries and words of support from our alumni last year and with the IAC's recent contribution to DOE's Save Energy Now Initiative (see story below), I am hopeful that DOE will recognize the importance of the program in the upcoming budget request.

In closing, I would like to remind all soon-to-be graduates and alumni to regularly use the IAC student/alumni website to post resumes and review job postings. Due to the current market conditions, I receive at least three calls every week from corporate recruiters who have immediate needs for IAC engineers. There is no question that the market is hot and your experience and expertise is in extremely high demand. I initially refer all recruiters to our website, located at www.iacforum.org, so it is important to keep it loaded with great resumes and to respond to their job postings. Additionally, I also encourage alumni whose employers are hiring, to post opportunities on the website. If you are uncomfortable posting your resume or your organization's position announcement on the website, please send it to me and I will forward it directly to recruiters, centers or alumni as appropriate.



Michaela Martin, PE, CEM
IAC Student Activities Coordinator
R&D Staff Member
Oak Ridge National Laboratory
martinma@ornl.gov

DOE's Save Energy Now Initiative: IACs Contribute to Astounding Results

Michaela Martin (martinma@ornl.gov)

In 2006 DOE's Industrial Technologies Program launched the **Save Energy Now** Initiative by sending DOE-contracted Energy Experts to the nation's top 200 energy-intensive manufacturing facilities. A large number of these experts were IAC directors, assistant directors and alumni. These experts were selected competitively and hold DOE Qualified Specialist designations in process heating and steam. Additionally, IAC faculty held web-based seminars on topics including Building Energy Efficiency, Boiler Efficiency, CHP and Combustion Systems (see http://iac.rutgers.edu for archived seminars). November 2006 assessment results from 162 plant assessments identified total potential energy cost savings of $395 million (nearly $2.5 million per plant!) and potential natural gas savings of 42 Trillion Btu per year. Six-month implementation reports are currently being conducted by IAC students. For updated information on assessments and training offered through the Save Energy Now Initiative, visit http://www1.eere.energy.gov/industry/saveenergynow/index.html.

Linking Productivity and Energy Savings

Laura Locke (Lockel@ufl.edu) and Dr. Diane Schaub (schaub@ies.ufl.edu),
University of Florida Industrial Assessment Center

When recommending energy saving practices, the University of Florida Industrial Assessment Center recognizes that energy efficiency enhancements can also result in increases in productivity. For example, increased worker throughput due to more temperate working temperatures or decreased absenteeism due to day-lighting enhancements can drastically affect the payback associated with energy savings. Because productivity savings are difficult to quantify, usually only energy savings are included in the cost savings calculations of IAC recommendations. The following article is a summary of research conducted by the University of Florida and published in the 2006 Institute of Industrial Engineering's Annual Research Conference Proceedings. This research is focused on quantifying productivity savings resulting from two of the most common energy efficiency recommendations: lighting and temperature.

Environmental temperatures outside the human comfort zone have been shown to negatively affect productivity through mental performance such as creative thinking and problem solving, safety, and physical performance. For example, a study of apparel factory workers reported an 8% productivity decrease when temperatures rose from 23.9°C to 32.2°C. Some common assessment recommendations resulting in productivity savings include insulating boilers or machines that give off extra heat and applying a coat of reflective paint to a rooftop to reduce the absorption of heat in a facility.

The following is a recommendation to insulate a machine located in the middle of a manufacturing facility. See Figure 1. By insulating this machine, energy usage is reduced because the machine will use less heat when operating and the air-conditioning load is decreased since the heat from the machine will no longer add to the room temperature. Productivity

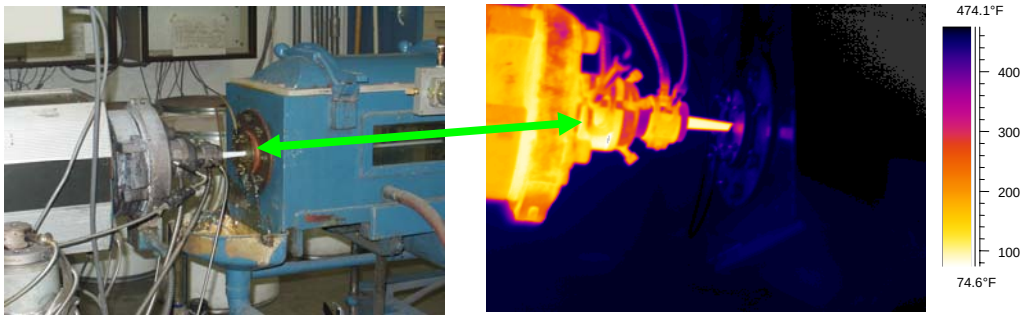


Figure 1. Temperature profile for manufacturing equipment

savings on the other hand result from an allowance reduction in the standard time of a task. Standard time is the measured time with additional time (an allowance) given to compensate for time not spent working. Table 1 developed by the International Labor Organization in 1992 gives the allowances for physical fatigue due to temperature effects. Though the surface temperature of the machine is 140°F, the temperature at the location of the machine operator is

100°F while ambient temperature is 79°F. Using Table 1, the fatigue allowance given at 100°F, is 10% while at 79°F, it is 2%. Therefore, the allowance reduction is 8%. This results in productivity savings of:

PS = Allowance reduction × Hours/shift × Wage/hour × shifts/week × weeks/year
= 0.08 × 8 hrs/shift × $15/hr × 5 shifts/week × 50 weeks/year = $2,400/employee per year

Table 1. Temperature Allowances (%) [1]				
	Temperature °C			
Ventilation and Circulation and Humidity	Below -1	-1 to 13	13 to 24	24 to 38
Adequate ventilation and circulation; normal climatic humidity	10 to 20	1 to 10	0	1 to 10
Nonstandard climatic conditions, causing some discomfort	20 to 25	5 to 10	0 to 5	5 to 15
Very poor ventilation and circulation, fumes, dust, steam, causing irritation to eyes, skin, nose, throat	20 to 30	10 to 20	5 to 10	10 to 20

Lighting has also been shown to have a diverse effect on productivity through alertness and mood, attitude and absenteeism, maintainability and safety. Certain jobs that involve inspection or close detail work can be affected directly by light quality. For example, workers' ability to detect flaws in jet panels at a manufacturing facility of a US defense contractor improved by 20% when daylighting was added to the facility. Common assessment recommendations that experience these savings are installing new skylights or windows, cleaning existing windows, skylights, and lamps, painting walls and ceilings lighter colors, and lowering lamps.

To illustrate the calculations that go into determining the productivity savings, the following example is a recommendation for installing skylights. The energy savings result from having sufficient daylight to turn off a fraction of indoor lighting. Productivity savings on the other hand result from an allowance reduction and are calculated similarly to the insulation example. Using Table 2 below, an allowance reduction of 1% would apply after installing skylights. Productivity savings would be:

PS = Allowance reduction × Hours/shift × Wage/hour × shifts/week × weeks/year
= 0.01 × 8hrs/shift × $15/hr × 5 shifts/week × 50 weeks/year × 50 employees = $15,000/year

This example will also experience absenteeism savings, the calculations of which can be found in the full version of this paper [2].

Table 2. Light Allowances (%) [1]	
Allowance	Category
1	"Normal" lighting (200 to 500 lux in most industries; 500 to 1000 if offices and inspection)
2	Occasional glare is inherent part of job or where substandard or special lighting is required.
3	Work in absence of light or where sight is obstructed; eyes not used or are straining

In conclusion, though difficult to compute at times, environmental temperature and lighting do have a substantial effect on worker productivity. This effect can be calculated through standard time allowances. Despite the fact that studies measuring the effect of temperature or lighting on productivity have found varying results, all agree there is a measurable link between productivity and environmental conditions.

References

1. Konz, S. and Johnson, S. Work Design: Industrial Ergonomics. 5th Ed. Holcomb Hathaway, Publishers, Inc. 2000.
2. Locke, Laura and Schaub, Diane, "Linking Productivity and Energy Savings", Institute of Industrial Engineering's Annual Research Conference Proceedings, May 2006.

UIC Keeps A Busy Summer Schedule

Aaron Hart (ahart3@uic.edu)

Alton Steel Mill Assessment

During summer break, the University of Illinois-Chicago (UIC) IAC team traveled to Alton Steel Inc., a steel mill in Alton, Illinois. The purpose of the visit was to conduct an energy assessment to economize energy usage and ultimately reduce energy costs for the facility. The total energy budget of this facility is approximately $9.5 million annually.

UIC's Alton Assessment Team: Piotr Czarny, Nebojsa Kisic, Rob Miller and Christopher Heckert

The primary products of this facility are steel blooms and billets. Steel blooms are roduced from raw and scrap steel that are melted in this facility's electric arc furnace (EAF). The main EAF at this facility is rated at 66 MW. When the chemical composition of the molten steel has been adjusted to the proper specifications, the steel is poured into the facility's continuous caster. The continuous caster then forms the molten steel into steel blooms.

In addition to steel casting, this facility also operates a milling operation. Before the steel blooms can be milled, they must first be cooled after being casted and inspected for quality. The steel blooms are then sent to a natural gas fired walking-beam reheat furnace so they can be hot milled. The steel blooms are reheated to 2,100°F and then milled to a desired size.

Currently, the main electric arc furnace exhausts 180 MMBtu/hr of energy. The assessment team proposed the installation of a heat recovery steam generator (HRSG) in order to reclaim the waste heat to create steam. The steam generated from the HRSG can be sold to a neighboring facility in order to generate additional revenue. The total annual revenue increase from this recommendation is $2.6 million. With an implementation cost of $12.5 million, this recommendation will have a simple payback of about five years.

Due to the inefficiencies of the current natural gas fired reheat furnace, the IAC team proposed the installation of a more efficient furnace. The proposed furnace is equipped with a recuperator that will be capable of preheating the combustion air of the furnace to 700°F. Along with new refractory and advanced combustion and chamber controls, the proposed furnace will be almost twice as efficient as the current model. The savings that will result from the installation of the proposed furnace are $1.5 million annually. With an implementation cost of $6.8 million, this recommendation will have a simple payback of about 4.5 years.

In all, the report generated by the IAC team identified five recommendations that, if implemented by this facility, will increase total revenue by $2.6 million and result in a cost savings of $2.5 million annually. With an implementation cost of $12.5 million, the increased profit and utility cost savings will pay back in a little over four years.

Coal Gen Expo

During the summer break, three UIC undergraduate students from the IAC program traveled to Cincinnati, Ohio to attend the Coal Gen Expo. The Expo is the main event for the coal industry, bringing together professionals from several engineering fields to discuss the latest topics affecting the design, operation and maintenance of coal-fueled power plants.

Milos Stefanovic and Neb Kisic discuss the Coal Gen Expo in the IAC office

The three students, Borko Andric, Milos Stefanovic, and Nebojsa Kisic, initially developed interest in coal gasification technology through a combined

heat and power (CHP) design project in one of their classes. They recognized the potential of coal gasification technology and decided to use their knowledge and interest to develop a Senior Design project in early 2007. As they advanced towards the next stage of their project,
they realized that coal gasification technology is not yet employed to its full potential, and for that reason information pertinent to their project was not readily available online or through published articles. In addition to possibly providing the needed information, the Coal Gen Expo was an opportunity for them to make valuable contacts with engineers in the coal gasification field.

In order to attend the Expo, the students first had to secure the funds for the trip and admission. The first sources of money and support considered were DOE, the local ASHRAE chapter, and the organizers of the Coal Gen Expo. However, DOE was unable to assist them in this project, ASHRAE funds had already been depleted in support of a previous student trip to Quebec, Canada, and the Expo organizers were not able to provide student passes at reduced cost. Upon realizing this, the students revised their approach. They realized the only way to get sponsors was to identify and highlight the mutual benefits of the trip to those organizations. They requested that UIC's Department of Mechanical and Industrial Engineering extend Senior Design project funds one semester ahead of time. Next, they turned to the Midwest CHP Application Center (MAC) and identified the tie-ins between the proposed trip and work the MAC was conducting. The MAC agreed to help sponsor the trip in order for the students to bring back knowledge of the technology that could be further developed by the MAC's professional staff. Finally, the IAC came up with the additional funding to bridge the final gap.

During the Expo, the students attended various sessions on advanced coal power generation technologies and discussed their Senior Design project with the coal gasification technology experts. Even though they went into the Expo knowing the basics of CHP design and coal gasification, they were surprised by the extent of design aspects they had not considered before. They learned about the difficulties that coal users are faced with when it comes to complying with continuously changing EPA standards. The students believe that coal gasification offers one possible answer to the questions regarding use of dirty coal.

For the students, this trip was a great learning experience, introducing them to many aspects of coal gasification while teaching them how to identify and pursue funding sources. Furthermore, this proved to be a valuable opportunity to establish contacts with engineers in the coal gasification field and continue to develop their professional networks.

IAC Alumni at home in Kentucky

Sieglinde Kinne (s.kinne@louisville.edu)

IAC Alumni, Sieglinde Kinne and Sri Iyer, have found a home at the Kentucky Pollution Prevention Center. Kinne is a graduate of Colorado State University, where she worked in the IAC program in 2001 and 2002 and participated in 29 audits. Iyer received a master's degree from Bradley University and worked in their IAC program from 2003 to 2004, participating in 23 audits. Because of their experience with auditing industrial facilities, both were hired at KPPC, Kinne in June of 2004, and Iyer in February of 2005.

Sieglinde Kinne, CSU-IAC Alumnus with the KY P2 Center

KPPC at the University of Louisville provides free technical assistance to help Kentucky industrial, commercial and public sectors with pollution prevention and energy efficiency. The center's mission is to facilitate and promote the proactive implementation of management systems and technologies to improve environmental performance as well as improve the competitiveness of organizations and businesses in the Commonwealth of Kentucky. KPPC's Energy Efficiency Program began in 2001 due to client

interest in the area and the demand for energy services, and it has been growing ever since.

Since June 2004, KPPC has provided energy efficiency services for 14 industrial facilities, seven commercial facilities and 27 public sector buildings. The center also provides training and bill analysis. Louisville, Ky., has undertaken a commitment to environmental leadership called the Partnership for a Green City. In this partnership, Louisville Metro Government, the University of Louisville and the Jefferson County Public Schools are collaborating on various environmental initiatives. KPPC's energy team has been instrumental in facilitating a committee to address energy use in the 500-plus buildings belonging to the three organizations.

"The IAC experience that Sieglinde and Sri brought to the center has paid dividends and value-added to our energy efficiency services," says Cam Metcalf, KPPC's Executive Director. "They were able to hit the ground performing E2 audits and have now honed their skills to provide additional technical assistance through pilot demonstrations and deployment of the practices and technologies they identified in the audits."

University of Dayton Industrial Assessment Center Receives Award from Ohio's Governor Taft

Bill Eger

On November 15, 2006 the University of Dayton Industrial Assessment Center was honored by the governor of Ohio to receive a 2006 State of Ohio Governor's Award for Excellence in Energy. The award recognizes individuals, businesses, industries and organizations from the state of Ohio that have implemented innovative approaches to increasing energy efficiency, protecting the environment, and improving Ohio's economic competitiveness.

Becky Blust (Assistant Director) and Kelly Kissock (Director) pose with Ohio Governor Bob Taft

The UD-IAC was one of six organizations to receive this award. Dr. Kelly Kissock, director of theUD-IAC said, "I was honored to receive this award on behalf of the students and people who have worked very hard to advance and support the Industrial Assessment Center program." It is through this hard work and immense dedication of all past and present students, and administrators alike, that the reception of this award was made possible. Current UDIAC student Dan Trombley summarized, "It is great to see recognition go to such a valuable program!"

Advancing Clean Fuels in Volunteer Country

Jonathan Overly (jgoverly@utk.edu)

With a lot of help from working partners, I founded the East Tennessee Clean Fuels Coalition (ETCFC) in early 2002. Since then, there have been good times and there have been hard times, but this has turned into the most rewarding job I've ever had.

Jonathan Overly, exec. Dir. of the ETCFC, accepts the designation plaque from David Waldrop, the U.S. DOE designating official during our ceremony on October 12, 2004 in the Great Smoky Mountains National Park.

The coalition focuses on getting alternative fuels in use in the 33 counties that are a part of East Tennessee. Our greatest successes to date have definitely come in the networking/outreach and biodiesel arenas where we have significant connections to folks all over the area now and have succeeded in getting 25 public biodiesel stations in place... not to mention growing biodiesel (as B100) consumption from 0 gallons in 2003 to 800,000 gallons in 2005 (and we expect to hit roughly 1.5 million gallons in 2006). For us, success is all about reaching out to find partners, and that is what has been the primary catalyst in our fairly fast rise from designation in 2004 to receiving a national coalition of the year award in 2006.

This kind of job takes some thick skin and a strong desire to make a difference. I find myself sometimes recognizing that I'm talking to a stop sign and I need to quit! You have to try on almost

every front to make a believer and actor out of almost all that cross your path, and you end up winning some and losing some. What seems to be the grease for the wheel is recognizing who's a stop sign, and who's a green light. Find those that in their heart want to do good and want to do something and help them find out what it is that they can effectively do within the confines they have.

On almost a weekly basis I end up talking to fleet managers that basically say "I can't pay anything more for fuel." They cannot break out of the mentality that although diesel prices have gone through about $1.50 price swing in 1.5 years, they believe that the price of diesel is the only fuel price that exists in the world. Thankfully, I also speak with more open-minded, forward-thinking fleet managers that just get it: they see the bigger picture and understand that our foreign oil (and oil period) dependence and environmental degradation situations need attention, and that we can't wait for the federal government to save us. It takes local actors; Actors for Change. I don't know if that old saying *Think Globally, Act Locally* has a better application than our transportation sector's (and country's) addiction to oil.

Jonathan worked with the IAC at the University of Tennessee for four years, conducting assessments at 35 plants. He graduated in 1997. He is now the Executive Director of the East Tennessee Clean Fuels Coalition.

University News Briefs

University of Alabama-- The University of Alabama was awarded one of five new centers in the U.S. Department of Energy's Industrial Assessment Center program. The Alabama Industrial Assessment Center (AIAC) began operation at the start of the Fall 2006 semester and continues to ramp up. The Center is housed in the Mechanical Engineering Department and is directed by Dr. Keith Woodbury (ME). Dr. Robert Taylor (ME) and Dr. Gary Moynihan (IE) are assistant directors.

The AIAC recruited and hired six students. Blair Clinton is a mechanical engineering graduate student and serves as the Lead Student. Four undergraduate mechanical engineering students, David Reeves, Dimos Triantafillu, John Lindley, and Byron Randall, and one undergraduate industrial engineering student, Jenna Cook, complete the team.

Tuskegee University is a partner center in the AIAC. Mechanical engineering professor Dr. Essam Ibrahim directs the Tuskegee center. Dr. Ibrahim is recruiting students, and the Tuskegee center will become operational in January 2007.

Drs. Taylor and Woodbury attended the training for new center directors at Rutgers University in October. In addition, Dr. Woodbury attended a Compressed Air Challenge "Advanced Management of Compressed Air Systems - Level 2" training in Upper Darby, PA, and Dr. Taylor attended the DOE PHAST qualified specialist certification training in Downey, CA.

We've gotten a big boost from our neighboring center at Mississippi State University. The MSU IAC agreed to let some of our AIAC team "shadow" them on an assessment. In late October, Drs. Taylor and Moynihan and lead student Blair Clinton, accompanied the MSU team to a plant near Tupelo, MS. This exercise was tremendously beneficial to the AIAC personnel, and we are indebted to our friends at MSU for this big assist! In the following weeks, the AIAC is planning to accept an invitation from the MSU IAC to visit them and tour their center.

The AIAC is exploring the possibility of co-hosting a workshop on Fundamentals of Compressed Air Systems at the University of Alabama. This would be held at UA through the Compressed Air Challenge.

As our research and planning progresses here at the new center, we look forward to facing the energy challenges presented to us by the industries in Alabama. The staff here at the Alabama Industrial Assessment Center is excited about opportunities involved in conducting successful assessments to meet the energy management needs of our clients.

Bradley University-- Bradley University IAC student Eric Ross served an EPA internship at Mitsubishi Motors and discussed his experiences in a presentation at the 2006 IAC Student Meeting in Washington DC.

Colorado State University-- Colorado State University has completed almost 600 assessments in the Mountain West area (596 to be exact). We revisited New Mexico and Wyoming, as well as road trips through more remote areas of Colorado. The theme for manufacturers this year was crystallization from chocolate to sodium bicarbonate in foods, to glass, concrete, asphalt, and polymers for less palatable items. The food theme continued for two dairies (including ice cream!), soda, cereal, and containers of plastic, metal, and pressed paper cups. We included some more high tech manufacturers of robotics and printed circuit boards. This spring we hosted an energy efficiency teleconference sponsored by the Northwest Food Processors Association and put on a Save Energy Now workshop in Denver as well as participating in the Save Energy Now web cast.

Colorado State IAC Team

AirMaster+ has become more useful to us for determining air leaks from pressure reduction profiles, as well as PSAT for pump analysis at several plants. MotorMaster+ and 3EPlus still function as mainstays to verify feasible energy saving ideas. Our most productive lighting AR is doubtless changing from 400W metal halide fixtures to high bay fluorescent fixtures, and we have found a good 28W fluorescent replacement for the 34W T8s. We have pursued biofuels and geothermal alternatives. We have found a renewable solar energy alternative in recommending photovoltaic cells in Colorado and New Mexico, since Amendment 37 legislation in Colorado provides rebates from the largest electric utility that virtually guarantees a payback in less than 3 years. Every plant has roof area, especially over the warehouse, and we can almost always recommend at least a 10 kW system.

During this transitional period, our staff has been maintained at three graduate students and five undergraduate students, with all but three returning from the previous year. Two of our graduated seniors and a graduating senior were able to find professional work in the energy efficiency industry. Also one of our current students has reached the milestone of 100 plants. Continued weekly training programs cover the software, dataloggers, and recommendations we use regularly. Last year, we also invited Ms. Leslie Beu-Siemens, one of our recent graduates that now works for Siemens Building Technologies to visit with the current CSU IAC staff and talk about her job and how it relates to the IAC experience. We are looking forward to another great year and completing our 600th plant visit.

University of Dayton-- Over the years, the UD-IAC has provided energy conservation, waste reduction productivity improvement advice for Ohio's industries. Last year, the UD-IAC supported the Save Energy Now (SEN) program by performing 5 SEN assessments.

UD-IAC Team (left to right Peter Kleinhenz, Daniel Trombley, Bill Eger, James Penrod and Rizwan Syed)

At the UD-IAC, the SEN assessments were performed in a slightly different way than conventional IAC assessments. On SEN assessments, one student member of the team would train plant personnel in the PHAST and SSAT Best Practices Software tools. During this training, the student would explore possible energy savings opportunities. In the mean time, the rest of the team would analyze different areas like compressed

air systems, motor systems, and pumping systems for possible energy savings opportunities. The response from our SEN clients about the training was encouraging and we expect very good implementation rates.

Apart from IAC field work, the UD-IAC has been very active writing technical papers. We aim to publish 9 technical papers by end of summer 2007. The papers would be presented at various national conferences and journals. Further, Dr. Kissock is offering a combined undergraduate and graduate level course called Energy Efficient Manufacturing, which is taught using the UD-IAC assessment format. The main focus of the course is to show students how to identify and quantity opportunities to reduce industrial energy use. The students also get opportunity to do real time projects by doing one-day assessment at local industry. For further information visit:
http://www.engr.udayton.edu/faculty/jkissock/http/EEM/EEMmain.htm

The University of Dayton would like to congratulate Bill Eger on graduation and a successful two and a half years with the UD-IAC program. In April, Bill was awarded the Dr. Henry Chuang award for his significant contributions to energy-efficiency and energy conservation during his impressive 50+ assessments.

University of Delaware—The University of Delaware is one of the new centers selected in the recent IAC solicitation. The director is Dr. Keith Goossen.

University of Florida-- The UF IAC has enjoyed another hurricane-free year! Besides our regular audits, we have been involved with research on roof coatings and with linking productivity and energy (see article within this newsletter). Also, the UF IAC has signed a contract to work a university in Peru to help them establish an IAC-type program in their country. Work will begin next spring.

Georgia Institute of Technology-- The Georgia Tech IAC is looking forward to the start of a new fiscal year with half of the plants trips already lined up. As we face the new fiscal year, many of the current IAC students are nearing graduation and preparing to move on to their promising new careers. We will be sorry to lose the valuable contributions of these students. New students will be starting in January.

University of Illinois-Chicago—University of Illinois-Chicago IAC Student Paul Nigro has been awarded an IAC certificate and three more UIC students have met the requirements to receive certificates in March 2007.

Iowa State University-- This has been a productive year for the Iowa State University IAC. First, undergraduate, Trevor Gilbertson recieved his IAC certification. Alex Rodrigues, Som Shrestha, and Mirka Deza, completed the Fundamentals of Compressed Air Systems and Advanced Management of Compressed Air Systems levels of compressed air training. Alex also went to Ann Arbor, MI and got certification in process heating. Iowa State has also named a new lead student, Justin Walker. Justin will be entering graduate school for Industrial Engineering in Spring, 2006.

Lehigh University-- Lehigh University's Industrial Assessment Center (LUIAC) hosted an energy savings workshop on July 7, 2006, in partnership with the Department of Energy's Save Energy Now (SEN) Program. Approximately fifty people, representing 25 local industrial companies, participated in the Workshop, along with representatives from the Department of Environmental Protection of the state of Pennsylvania. The Workshop focused on common energy saving practices for industry and the validation for the cost savings calculations used to justify the expenditures. The format of the Workshop was such that representatives from industry were given the opportunity to ask specific questions pertaining to the energy use of their respective facilities. Industry representatives were able to give valuable insight through their first-hand knowledge of many of the energy saving projects.

LUIAC published an article entitled "Save Energy Now", regarding popular energy recommendations, in *Flow Control* in August, 2006. With IAC funds from ORNL, an LUIAC graduate student, Bhaskar Vempati, presented a research paper at the

International Mechanical Engineering Congress and Exposition (IMECE), Orlando, Florida, in November, 2005. He was also a co-author on a research paper in the *Journal of Fluids Engineering* and on a research paper at the IMECE conference in 2006.
In other news, the following LUIAC students will graduate in May, 2007, receiving their IAC certificates: Bhaskar Vempati (Ph.D.), Yijun Yang (M.S.), Christopher Shages (M.S.), Alok Moroka (B.S), and Ka Wai Kwok (B.S). Yijun Yang will continue his Ph.D. studies at Lehigh University.

University of Louisiana-Lafayette-- This year has gone by far more smoothly than last. The hurricanes, Katrina and Rita, did not let us schedule any assessments for most of the Fall semester, which made us very busy in the Spring. In contrast, by the end of this fall semester we will have already finished half of our assessments, which includes working with 2 MEP's. Although, we are only averaging about one assessment a month because of our reduction in assigned assessments. We do miss visiting the number of companies we did in previous years, but as many of us are graduating, we are making good use of the extra time we have. Next year we will be looking forward to an almost entirely new staff.

The Louisiana Lafayette IAC Team

Loyola Marymount University—Loyola Marymount has had 10 students meet the Department of Energy requirements for IAC certificates in 2006.

University of Massachusetts—Dr. Lawrence Ambs has retired as director if the University of Massachusetts Industrial Assessment Center. Former Assistant Director Dr. Beka Kosanovic has been named as the new director.

University of Michigan-- Four members of the University of Michigan's Industrial Assessment Center earned IAC student certificates this past year: Shangchao Lin, Marie Wolbert, Eric Schlichting, and Devin Rauss. Shangchao has since graduated from UM and is now a Ph.D. student at MIT. The IAC has been busy with energy assessments, many working to help local automotive-related manufacturers improve efficiency and remain competitive. Our center director, Professor Arvind Atreya, presented the May 4th, 2006 National IAC Webcast Lecture, titled "Optimizing Combustion Systems." This webcast is available for viewing at: http://iac.rutgers.edu/lectures2006/arch_lectures.php

Since much of our center's work deals with process heating, it is of interest that both Professor Atreya and our center's assistant director, Professor Margaret Wooldridge, had some of their research work presented at The Combustion Institutes's 31st International Symposium this past summer in Heidelberg, Germany. IAC graduate students Won Chan Park and Bradley Zigler also participated in the conference.

University of Missouri-- The newly established Missouri Industrial Assessment Center is up to full steam in the "show me" state. Officially opened in September 2006, the Center is located in the University of Missouri-Columbia, and currently has 15 staff and associates, including five faculty (Director and Assistant Director, Technical Specialist, Education Specialist, and an Outreach Coordinator), five graduate students (three staff and two associates) and five undergraduate student staff. The current student staffs involve students majoring in industrial engineering, mechanical engineering, chemical engineering, physics, as well as management.

Despite the fact that the Center is only a few weeks' old, it has attracted a lot of attention from various sectors in the state, and has received a large number of enquires and assessment requests, clearly demonstrating the significant level of

interest and needs for the services offered by the IAC Program in the state of Missouri. Although the Center, in close collaboration with Missouri Department of Natural Resources, has carried out four previous energy audits, its first official IAC assessment will be conducted on the 30th in November. The Center plans to carry out 12 assessments in its first year of operation.

The Center has established an extensive partnership with the Missouri State Department of Natural Resources, the State Department of Economic Development, the University of Missouri Extension, and the Missouri Manufacturing Extension Partnership (MEP) center. In addition to the preparation for its first assessments, the Center has also been active in areas of MEP collaboration, education and outreach activities. Since the center's opening, we have had a member of meetings with the Missouri MEP Program, and established a joint strategy to deliver a more comprehensive range of business services and solutions to the manufacturers in the state (to help clients to become more competitive through achieving lean production AND energy efficiency and waste minimization). Working with MU Business Development Programs, the Center is in the process of developing and delivering four workshops on industrial energy efficiency to the manufacturing companies in the state, between Dec 2006 and Feb 2007 (Columbia - December 8; Rolla - January 30 2007; Kansas City - February 5th 2007, St. Louis - February 19th 2007).

We have also written an academic paper to promote our IAC activities, entitled: *Promoting Awareness of Industrial Energy Efficiency and Waste Reduction in the University Students Population*. This has been accepted by the Conference of American Society of Engineering Education, and will be presented and published in June 2007. Finally, we have developed a rather cool (we think) MS Project template for the project management of assessment planning and execution. If any of you are interested in it, please let us know and we will be more than happy to sharing it with you!

So, all in all, the young Missouri IAC is now truly up to full steam!

We want to send our warm greetings to our fellow IAC faculty and student colleagues in the other states and, if any of you happen to be in the Show Me state, you will always be welcome to visit us here at MU!

University of Miami-- During the 2005-2006 year, the University of Miami coordinated efforts with the South Florida Manufacturers Association (SFMA) as well as the Florida Chamber of Commerce. Our data logging capture process continues to deliver precise data for quantifying exact energy consumption and energy savings. We have also extended our data logging strategy to address specific decision makers' concerns. By focusing on these areas, we have been able provide valuable insight into current and proposed manufacturing and energy management practices. This past year has been quite successful as our average company energy cost savings was about $100,000.

We are also bidding farewell to one of our IAC graduate students who started working at Chevron Corporation in Fort Lauderdale as a Measurement & Verification Specialist. Two IAC graduate students, nearing completion of their Masters degree, are currently working on their theses and are focusing on solar energy and photovoltaic cell technology. One new graduate student joined the center this year and is now fully trained. She has already taken a lead role on several reports and projects.

Mississippi State University—3 students from MSU's IAC have met all of the requirements for certificates in 2006.

North Carolina State University-- The NCSU has had an interesting year reaching a variety of manufacturers, ranging from beer to pantyhose. The NCSU IAC has welcomed several new students in the program, and sent several graduates to the

workforce and to other schools to further their academic studies.

Dr. Herb Eckerlin has assumed the leadership role as Director and Dr. Stephen Terry is now the Assistant Director. Former Director, Dr. Jim Leach, has stepped down to pursue other research interests, but will stay connected to the NCSU IAC in the future. We certainly wish him well.

The NCSU IAC won the Center of Excellence Award this year at the 2006 Annual Director's Meeting in Washington, D.C. in August.

The staff at the NCSU IAC plans to continue working with manufacturers this next year through the IAC program, working with North Carolina A&T University and Shaw University to reach additional students. The NCSU IAC is part of a joint collaboration with the IAC's at Georgia Tech and Mississippi State, and the State Energy Offices of Georgia, Mississippi, and North Carolina. This program will provide additional training and in-depth assessments to a variety of manufacturers and provide research money for several energy related projects.

Oklahoma State University-- This past summer was a busy one in Stillwater. We had the distinction of having two of our IAC students successfully defend their Ph.D. research work. On August 14, Wisit Kumphai defended his research regarding energy indices for small and medium-sized plants ("Energy Index Decomposition Methodology at the Plant Level"). Then, on August 15, Robert Scott Frazier defended his research regarding value-based energy assessments ("An Exergy Diagnostic Methodology for Energy Management in Manufacturing"). Needless to say, we are all very excited to see our IAC working in both the real world and in the academic world.

Oregon State University-- At the OSU IAC, we have recently completed our 500th report. Dr. Greg Wheeler, OSU IAC Director, got the ball rolling at Oregon State in the late '80's and with the help of Assistant Director Joe Junker, the OSU IAC continues to succeed in producing unique reports and quality analysts.

Early last summer, the OSU IAC hired 10 new team members, including mechanical, civil, and chemical engineering students. Because of the large influx of new employees, the center's two veterans, Jeff Gagatko and Wayne Johnson, where able to help our center's new employees spend the summer training hard and where able to revamp our program and start fresh. We're proud to say that all of these team members are still with us and doing very well. Almost half of them showed such strong performance that they are now leading reports.

One of our newer team members, Yuming Qui, has recently been awarded the honor of Oregon State University's College of Engineering 2005-06 Outstanding Graduate Teaching Assistant Award. During the summer we were able to make several changes to constructing our reports. We started by making the review process digital by utilizing the 'Reviewing' toolbar in MSWord. We also separated our recommendations into two distinct sections; a Narrative, and a Calculation Methodology. The Calculation Methodology contains all the equations, calculations, and other technical matter pertaining to the recommendation. The Narrative consists of an easier, more attractive presentation of the recommendation and is targeted to a more general audience. We have also added tabs to these two sections and others to help readers navigate our report.

San Diego State University-- The past year has been exceptionally busy and unique for the IAC students and faculty at SDSU. As a graduate student in mechanical engineering, Anthony Sclafani was appointed as the lead student. Ryan Miller graduated with his BSME in spring '06 and began graduate school at Cal-Poly San Luis Obispo after obtaining his IAC student certificate. IAC students Ara Abnous and Crosby Johnson have been hired by Hamilton Sundstrand's design of gas turbine air propulsion unit's team.

In entrepreneurial news, Dave Richards and former lead student Nicole Kennard have formed New Leaf Biofuel; a San Diego based biodiesel production company that focuses on improving the environment, waste management, and also community outreach by hosting workshops with such clients as San Diego City Schools.

Speaking of community outreach, the SDSU IAC held workshops last spring and summer in conjunction with the Association of Energy Engineers and the San Diego Regional Energy Office to inform engineers and facility managers about the SDSU IAC, the SEN program, and current information about natural gas prices and the resulting effects on CHP installations in southern California.

San Francisco State University-- We would like to start by thanking our directors Dr. Ahmad Ganji, Dr. Shy-Shenq Liou, Dr. Anthony Wheeler and Dr. Ricardo Valverde for their insight and guidance throughout the year. And also take a minute to thank the students at the San Francisco State University IAC center. Through hard work and dedication by all members of our IAC center, our funding has been renewed for 2007.

This last year brought us to many exciting and challenging locations, such as Odwalla Juice Company and Christopher Ranch, the largest and smelliest garlic producer on the West Coast. We even performed three separate audits, all for GraniteRock, at various locations and conducted a comprehensive presentation incorporating all three sites.

SFSU IAC Team

IAC students and faculty conducted a DOE Sponsored Boiler Efficiency Workshop to inform past and future clients on boiler efficiency and PG&E rebates. Pacific Gas and Electric Company (PG&E) hosted the workshop at one of their training centers in Stockton, California and R.F. MacDonald Co. co-hosted the event proving invaluable information on boiler energy saving techniques.

We are proud to announce, several of last year's graduating students Amit Kanungo, Lawrence W. Nu and Sasha Spoor have received jobs at RLW Analytics, Nexant, and Nexant respectively. RLW Analytics, Inc. is a recognized industry leader providing innovative analytical, engineering and market research consulting for energy companies and end users. Nexant helps clients unlock the value of their energy assets by enabling them to make informed decisions with greater confidence, speed, and reliability.

Last but not least, our current IAC student Yin Yin Wu has been awarded the 2006 AEE/Siemens' Scholarship from the Foundation of the Association of Energy Engineers. Congratulations Yin Yin!

Tennessee Technological University-- The TN 3-Star Industrial Assessment Center is a joint effort among Tennessee Tech University, East Tennessee State University, and University of Memphis. We are a new IAC and are pleased to be joining with other universities across the country in this effort. Since we are a new center, we have been very busy promoting the IAC in our area through local newspaper publications and by creating a brochure and website. Dr. Currie, our assistant director, will also be featured on our local PBS station to discuss the new IAC.

We have been ordering supplies and equipment needed for the first of many assessments. We at TTU have hired four students and our first industrial assessment is scheduled for December 18th.

TTU's New IAC Team

In addition, we are working with many electric and gas utilities as well as the TN Department of Economic and Community Development to develop a partnership across TN to help industries across

our state conserve energy and ultimately improve their bottom line.
Also, we have an Energy Efficient Commercial and Industrial Lighting workshop scheduled for November 20th in Memphis, TN.

Texas A&M University-- The Texas A&M University IAC has enjoyed a long run of interesting assessment visits and none more interesting than the 800 cow brute per day slaughter plant with which activities began in 2006. The year was also marked by visits to a number of larger plants which were overflow from the Save Energy Now visits announced by Secretary Bodman. In particular, we were able to visit some large semiconductor plants normally outside our size range which provided interesting HVAC problems that usually are not encountered. Our chemical engineers discovered in these plants that isopropyl alcohol could better be used in thermal oxidizers than in providing waste that the plants must pay contractors to remove!

Students remain the backbone of the program and during the year we said goodbye to Lead Student Luke Hargrove who was replaced by Andy Hanegan. Andy Hanegan is a graduate student in mechanical engineering who is pursuing a thesis comparing energy use indices obtained from data in the national IAC database maintained at Rutgers University.

Texas A&M has long had a policy of employing 10 or more students during the long semesters so there would be two teams of students and no student then had to attend every assessment visit. With the reduced support and visits available this year, for the first time our staff will be at a level of about six students for the spring semester, and only five visits are planned—enough to wind our visits up for the year.

Texas A&M has outstanding students who seem always to obtain some significant scholarships graciously made available through local chapters of the Association of Energy Engineers, and 2006 was no different. The North Texas chapter in the Dallas-Ft. Worth area and the Lone Star chapter in Houston have provided superb scholarships and we appreciate their support of our IAC students very much.

We are looking forward to good interaction with the MEP folks in Texas. Texas has great need for DOE services in the industrial area because it uses almost 20% of the industrial energy expended in the US. In fact, of the plants involved in the recent Large Energy User contact program, 240 were assigned to the Texas A&M IAC—all located in Texas!

Even with our significant reduction in student numbers, we find we still must employ some new students in the spring and we are enthusiastic about welcoming these new student employees on board. So, we are looking forward to that first assessment visit in January—but it will not be a slaughter house this time!

University of Washington-- The Industrial Activities Center at the University of Washington has started its activities with a series of weekly presentations by political, industrial, and academic leaders involved in energy efficiency. The presentation topics ranged from paper mills (the largest industrial energy consumer in the State of Washington) to litigation cases, to energy demands of data centers for information technology companies. The campus responded with enthusiasm: many departments were represented in the audience, the auditorium was completely filled every time, and the post-presentation questions and discussions usually lasted for about 30 minutes. Several speakers are now assisting with the process of forming an advisory board for the center. Meanwhile, the IAC is building partnerships with existing organizations. The strategic presentation about the new IAC at a semi-annual conference of the Center for Processing Analytical Chemistry held in Seattle in November 2006 was heard by representatives of about 40 companies and led to several budding initiatives, mainly in food processing and forest products industries.

West Virginia University-- This year has been really exciting for IAC-WVU. It performed nine "Save Energy Now" (SEN) assessments.
The annual workshop titled "Reducing Natural Gas Usage in Industry" was well received by all the attendees. With more than 20 people from different industries attending the workshop, the feedback

score of 4.08 (on a scale of 1 to 5 with 1 being the worst and 5 being the best).

The center was represented by the IAC directors and lead students at the IOF-WV Day at the State Capitol in Charleston. They explained IAC activities to the West Virginia Manufacturers. Several other presentations were made by the directors and students at different venues to explain the IAC and DOE/ITP activities.

IAC students Deepak Gupta, Bret Crowder, and Raviraj Chavan completed their MS degree in Industrial Engineering. Deepak developed energy efficient machining economics model and continued as a PhD student. Bret Crowder accepted a position in American Woodmark Corp. Raviraj Chavan accepted a job in energy field in Philadelphia. IAC students Katherine Taylor and Amber Staud accepted job and internship respectively.

Dr. Gopala helped a student on developing software tool for energy balance system in boilers. Other IAC students are encouraged and many are already working on different topics related to energy efficiency in industry.

IAC Program Contact Information

Newsletter Editor and IAC Student Activities Coordinator: Michaela Martin, martinma@ornl.gov
U.S. Department of Energy, IAC Manager: Lisa Barnett, lisa.barnett@ee.doe.gov
Rutgers IAC Field Management
Director: Dr. Mike Muller, muller@caes.rutgers.edu
Manager of Technical Operations: Don Kasten, Kasten@caes.rutgers.edu
IAC Database: Mike B. Muller, mbmuller@caes.rutgers.edu, database location: http://iac.rutgers.edu

Calendar of Events and Training

- **2007 IAC Lead Student Meeting,** February 1-2, 2007, Oak Ridge National Laboratory, Oak Ridge, TN. Proceedings may be found at www.IACforum.org.
- **ASHRAE Winter Meeting (with Energy Focus),** January 26–31, 2007. Dallas, TX. http://www.ashrae.org/events/page/562.
- **Industrial Energy Technology Conference (IETC)**, May 8-11, 2007, New Orleans, http://ietc.tamu.edu/
- **ACEEE Summer Study in Industry,** July 24-27, 2007, White Plains, NY. http://www.aceee.org/conf/07ss/07ssindex.htm.
- **AEE World Energy Engineering Congress 2007,** August 15-17, 2007, Atlanta, GA. https://www.aeecenter.org/Shows/
- **DOE Industrial Technologies Program Qualified Specialists and End-User Training**, throughout 2007, http://www1.eere.energy.gov/industry/bestpractices/training.html.