INDUSTRIAL ASSESSMENT CENTERS

Student and Alumni Newsletter

January 2009

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Part of the Solution

The quiet scuttle I have been hearing for many months now seems to be becoming a reality: the highly anticipated economic stimulus plan may include provisions for developing a new "green" workforce and investing in activities that will improve U.S. energy efficiency. A recent article in the *New York Times* (see the *New York Times* link on www.IACForum.org) addresses the stimulus package. The article also suggests that government spending should focus on "existing programs that work…." The Industrial Assessment Centers (IAC) have generated highly qualified energy engineers while improving energy efficiency in U.S. industries for over three decades. I hope that after the recent trend in declining IAC budgets, policymakers will rediscover the vital role that the IAC can play in improving the efficient use of energy by our nation.

Our 2009 newsletter features articles from alumni, current students, and organizations who regularly recruit IAC graduates. Discussions provided by our IAC alumni, who are part of the growing energy-related workforce, illustrate the wide range of career options available in the field of energy efficiency. The IACs at University of Illinois at Chicago (UIC) and Mississippi State also contributed articles on activities of their students and alumni. UIC has provided a nice article on strategies for finding scholarship funding that should be of interest to current IAC students. Finally, in recognition of their continued interest and support of the IAC, we have again included a section that highlights some of the organizations that actively recruit IAC graduates.

As our nation struggles with the economic challenges that lie ahead, I take comfort in knowing that IAC students and alumni will be part of the solution. Please continue to keep me apprised of your whereabouts and accomplishments over the next year. Your frequent updates are testimony to the success of the program.

Michaela Martin, PE
IAC Student Activities
Senior Staff Member
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Join Our IAC LinkedIn Group!

An IAC group has been established within the LinkedIn professional networking website to promote and develop a network of IAC students and alumni. As of December 2008, the group now has 140 members. Please take advantage of this network to share ideas, identify and pursue new opportunities, and make an impact. Joining the IAC Student and Alumni LinkedIn group is by invitation only. If you are interested in joining, please contact Michaela Martin at martinma@ornl.gov or Susie Allen at allensc@ornl.gov.

From the IAC to the ACEEE
Daniel Trombley, Alumni, University of Dayton
(*dtrombley@aceee.org*)

The American Council for an Energy Efficient Economy (www.aceee.org), where I work as an Engineering Associate, is a private nonprofit organization dedicated to advancing energy efficiency as a means of promoting economic prosperity, energy security, and environmental protection. We perform a variety of technical and policy analyses across many areas of energy efficiency, including industry, commercial buildings, transportation, behavior, economics, and policy. As a member of our industry program, I lead several projects, including the industrial analyses for our State Clean Energy Resource Project (SCERP). The main purpose of SCERP is to determine the total potential for energy efficiency in a given state and provide that state with a set of policies to help them achieve that potential. For me, this analysis includes looking at the industry mix in a state, how much energy each industry uses, and which end uses are dominant in each industry and then using economic indicators to forecast how much energy each industry is likely to use 25 years in the future. This lets us know which efficiency measures would have the greatest impact, and where state efficiency programs should focus. Due to ACEEE's long-standing support of the IAC (and my own bias), our policy recommendation inevitably includes state funding for the IAC program, or an even broader IAC-like program.

ACEEE has long believed in the value of the IAC program. In fact, earlier this year we arranged a briefing with the Senate Task Force on Manufacturing to make the case for not only returning the IAC to its former funding levels but for greatly expanding the program. Neal Elliott of ACEEE, Mike Mueller of Rutgers University, and Blake Licht of DTE Energy all spoke about how the IAC program is not only important for the energy it helps industry save but also for providing one of the best sources for training an energy efficiency workforce. Blake, who has hired several IAC alumni, knows that the greatest value of the IAC program is its graduates. To him, an IAC graduate straight out of college has technical proficiency and real world experience that any other engineer would be years away from. (For more information on this briefing and ACEEE's work on the IAC program, please visit http://www.aceee.org/industry/iac.htm.)

From my experience, Blake is exactly right on the benefits of the IAC program. While the assistance IAC audits provide to mid-sized industries is very valuable, the energy saved through their recommendations is small in comparison to the energy savings IAC alumni continually achieve throughout their careers as energy engineers using the knowledge and skills they received in the IAC program. And the knowledge and skills they acquire prepare the graduates for a variety of career opportunities. This certainly held true for me. As I approached graduation from the University of Dayton IAC in December of 2007, I had a host of career options to consider: efficiency consulting, plant energy management, energy modeling, or continuing my education toward earning a Ph.D. In the end I was drawn to ACEEE where I could stay focused on technical analysis while also being involved in their work in public policy, which allows us to "grease the wheels" for the vital work being done by IAC students and alumni in the energy efficiency.

While I no longer work in manufacturing facilities, I rely on what I learned from the IAC every day. I need to know how large energy-consuming systems work in order to identify and analyze the energy efficient technologies and practices applicable to them. Having been in dozens of meetings with managers, presidents, and CEOs of manufacturing companies gives me insight into the process of industrial decision making, which is vital background for our program recommendations. This kind of experience can help you throughout your career as an energy efficiency expert, and on a more basic level, the technical report writing and communication skills you learn in the IAC are vital to any professional career.

As you decide which career path is best for you, it is important to remember that this is important work. Energy costs, pollution, global warming, energy independence, supply disruptions, and nuclear waste disposal are but a few reasons why energy issues are central to national security and environmental protection. Energy efficiency remains the cheapest, fastest, and most effective means to combat these problems, and IAC graduates are uniquely suited to find their solutions.

IAC Alumni Founds Engineering Firm
Jason Knight, Alumni, SDSU
Co-Founder EFM Solutions
(*jknight3679@gmail.com*)

EFM Solutions is an engineering and consulting firm with over 15 years of combined industry experience specializing in energy efficiency, sustainability, and utility programs. EFM Solutions strives to educate California businesses about cost-effective energy saving strategies and technologies that add to the bottom line. EFM Solutions accomplishes this goal in two parts: offering energy audits to both residential and non-residential facilities and implementing energy efficiency programs through California Investor Owned Utilities (IOUs).

Energy audits are the first step toward understanding how to lower energy consumption and reduce operating costs. Many businesses are not aware of how inefficiently their facilities are operating. This is where EFM Solutions steps in, guiding facility managers and helping them make informed decisions. New technologies are constantly being introduced into the marketplace that can significantly reduce energy consumption. EFM Solutions provides the expertise necessary to educate customers on plausible energy efficiency opportunities to reduce energy use and save money.

EFM Solutions also assists local businesses in reducing their operating costs while doing their part to prevent rolling blackouts by performing a Demand Response (DR) audit. On the hottest days of the year, California energy demand surpasses supply and the utilities are forced to cut power to certain areas, commonly known as a rolling blackout. During these days, businesses can reduce a small portion of their load to help the state avoid rolling blackouts. EFM Solutions provides the technical knowledge to businesses so they can respond to these emergency events with minimal comfort and operational sacrifices. EFM Solutions then connects customers with monetary incentives available through the IOUs to help implement load shaving technologies.

Beginning in 2009, EFM Solutions will be participating in the 2009–2011 Energy Efficiency Program Portfolio. EFM Solutions will be managing a turn-key Parking Garage Improvement Program in the PG&E territory that aims to reduce over 16 million kWh and 2200 kW in demand annually by upgrading lighting and ventilation systems, respectively.

EFM Solutions would not be in business today if not for the San Diego State University Industrial Assessment Center. Jason Knight, an IAC member at SDSU from 2001–2003, is the one of the founders and lead engineer for EFM Solutions. The latest member to join the IAC team, John Woolsey, was also an IAC student during that same time. Together they help the city of San Diego, the California State University system, and countless other organizations reduce their carbon footprint through energy audits and other energy management techniques learned during their tenure as IAC students.

IAC Experience Proves Invaluable in the Workforce
Matan Marom, Alumni, Syracuse
(*mmarom@gmail.com*)

Six months ago I hung up my hat and prepared to leave the IAC after 5 years of service to the program. Like so many graduating students before me, the future was full of question. Had it not been for my experience at the IAC at Syracuse University, I can honestly say that I would not have had half the opportunities I had upon graduating that led me to where I am now. Even at a time of economic unrest, layoffs, and hiring freezes, I was offered four interviews and just as many job offers right from the start. The support and guidance that I received from our excellent director, Professor Frederick Carranti, as well as from my peers, instilled the confidence and competence that I needed to succeed. I took a job right away with Schneider Electric, a global energy product and services provider whose flagship brand in the United States is Square D. When I first started, I was involved in a variety of projects to familiarize myself with the group. Within my first 2 weeks of employment, I traveled to Fort Worth, Texas, to perform an energy audit with one other senior team member in which my IAC experience was an obvious asset. Being on site was tantamount to so many of the IAC audits I performed in the past, proving that the IAC is far

more than an educational exercise and that it is applicable real-world experience. In the same month, I attended an international training event in Nashville, Tennessee, where I took and passed the Certified Energy Management exam. Since then, I've been involved in a number of interesting projects including hospitals, historic sites, and an alternative energy installation. In addition to field work, I have been actively involved in business development; I've been put in charge of writing proposals to potential clients as well as maintaining our Onyx sales portal. Next month I'll be traveling to Ohio with my manager to give a presentation to a potential client and likely will be traveling back to Texas to sit in on a sales meeting with another large client. All of these opportunities, beyond entry level engineering work, would not have materialized if I had not had the education, experience, and foundation that the IAC provided. Additionally, in the past month I have also been accepted to an MBA program, which I intend to join this spring on a part-time basis. The IAC experience counted towards the minimum 3 years of full-time working experience necessary to apply. This is yet another example of how IAC has given me a leg up and accelerated my career in a way few other experiences could have.

In a very short time, I've learned a lot. If I had to give advice to those still in the IAC program it would be that the IAC is a highly recognized and legitimate program. The work that you do and the time invested at the IAC will come in useful and pay you back many times over once you graduate and start working full time. Too often, I was anxious to leave the IAC and move on, but the IAC is a valuable and rare experience. Take your IAC work seriously and become as involved as you can in your center. Many employers, including Schneider Electric, look to the IAC first and compete for IAC talent. In fact, Schneider Electric will be actively recruiting IAC students during the spring round of hiring (as I'm sure others will be). I would urge current IAC students who are interested in work activities other than energy auditing to apply in the energy field anyway and be vocal with their recruiters about what they want. In my case, I was interested in more of a business role, and my IAC experience and working in the energy field has spring-boarded me much further into my desired career than if I had left the energy field and sought employment elsewhere. It is a booming industry, and despite the costs of energy starting to decline, it will continue to grow in the coming years. These are uncertain times for everyone, the IAC included; however, the IAC experience will surely carry its participants further into their future and make the ground beneath their feet a little bit more solid.

Supporting ORNL's Energy Efficiency Mission
Sachin Nimbalkar
(*nimbalkarsu@ornl.gov*)

I joined the Commercial Building & Industrial Energy Efficiency (CB&IEE) group at the Oak Ridge National Laboratory (ORNL) as a post-doctoral research associate in spring 2008. The CB&IEE group provides support to DOE's Industrial Technologies Program to address energy efficiency challenges across the industrial sector. The work we do provides energy efficiency software tools, training, energy assessment support, and program evaluation support to DOE and ultimately to U.S. industry.

For those who don't know about ORNL, it is a multi-program science and technology laboratory managed for DOE by UT-Battelle, LLC. ORNL conducts basic and applied research to strengthen the nation's leadership in key areas of science, energy, and the environment.

I received my bachelor's in mechanical engineering from Government College of Engineering in Pune, India, and my master's degree (again in mechanical engineering) from Rutgers University in 2005. My thesis was to study performance characteristics of Ranque Hilsch vortex tube at low inlet pressures. I

Oak Ridge National Laboratory, Oak Ridge, TN.

continued my study of vortex tube technology for my doctoral thesis and am planning to defend my Ph.D. work this winter. My professional experience includes working as a graduate engineer for the Center for Advanced Energy Systems and as engineering trainee for Cadbury India Ltd. and Bajaj Auto Ltd. in India. My advisor at Rutgers, Dr. Michael R. Muller, has been a significant presence in my life. His ability to probe beneath the text and the messy charts is a true gift, and his insights have strengthened my studies significantly. Dr. Muller, coincidently, is the Field Manager for the IAC program.

At the lab, I work with Dr. Anthony Wright and Michaela Martin. Tony and Michaela gave me opportunities to visit Louisiana, Pennsylvania, and Wisconsin. In May, I presented results from 450 Save Energy Now assessments conducted in 2006–2007 at the 2008 IETC conference in New Orleans, Louisiana. The discussion at IETC 2008 covered the identified and implemented savings generated to date by this assessment program. In the same month, I attended a Process Heating Steering Committee Meeting at ETAC in Bethlehem. The purpose of the meeting was to gather a team and make progress in the development of DOE's PHAST tool. I have been tasked to research the issue of heat loss through the exhaust gases in Electric Arc Furnaces (EAFs) for the next version of PHAST.

What makes my job at the lab a great job? Professional development opportunities, education level, job growth, travel, salary potential, and the room for innovation…it has it all.

Energy Policy and Law
Will Randall, Alumni, Georgia Tech
(*will_randall@hotmail.com*)

I was a cooperative education student at the Georgia Tech IAC program from 2002 until 2005 while studying industrial engineering. While working in the IAC program, I recognized a lack of communication between the manufacturers that IAC served and the creators of government energy and efficiency policy affecting those manufacturers.

Upon receiving my bachelor's degree, I entered law school so that I could learn the policy and legal issues in American manufacturing. My work in IAC aided my legal education since I had actually seen American manufacturing firsthand and could understand the regulations and case law that affected factories and businesses. Furthermore, I became interested in comparing energy efficiency regulations across the world, as well as the politics of the global energy supply chain.

While I worked in patent law during law school, I decided to pursue my initial interest in manufacturing that brought me to the law. To study global energy supplies, I came to the University of Calgary Faculty of Law in Alberta, Canada, to study for a master of laws in energy and natural resources. Canada is the United States' largest energy supplier; the United States imports oil from Alberta and electricity from Quebec's hydroelectric dams. My thesis will focus on comparative energy regulations and how those regulations could make North American manufacturers more competitive than they already are. When I complete my LL.M. degree, I hope to begin work in energy policy making or consulting in Washington, D.C. Had I not worked in the IAC program, I would not have pursued a career in the energy industry, which will be a keystone in America's economy in the coming decades.

UIC Student Studies Abroad
DIMA Alfawakhiri, UIC
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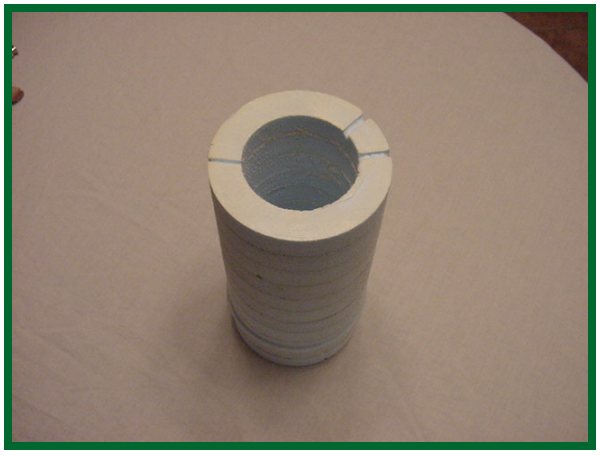
This past summer Dima Alfawakhiri worked on a research project with Ph.D. student Sebastian Lang under Professor Kraushaar-Czarnetzki at the Institute of Chemical Process Engineering at Universität Karlsruhe in Germany. The goal of the project was to design a process to remove trace carbon monoxide (CO) from a hydrogen stream being used as the fuel for hydrogen fuel cells. Carbon monoxide causes hydrogen fuel cells to cease functioning, effectively "poisoning" the cell. This research will help ensure that fuel cells work longer once they come onto the market.

Producing energy through hydrogen fuel cells is attractive because fuel cells are approximately twice as efficient as traditional internal combustion engines. While other methods of hydrogen derivation are being developed, utilizing hydrogen produced from light hydrocarbons (such as methane, propane,

and butane) as fuel for hydrogen fuel cells is preferable to burning the initial hydrocarbons. However, the hydrogen produced from light hydrocarbons is contaminated with large amounts of CO, as well as carbon dioxide (CO_2) and water vapor (H_2O). The majority of CO can be converted to CO_2 using the relatively common water-gas-shift reaction ($CO + H_2O \rightarrow CO_2 + H_2$), but a trace amount of it still remains. A selective oxidation step that converts CO to CO_2 without consuming hydrogen is then required before the gas stream is usable.

During her 9 week internship, Dima prepared 25 various ceramic foam cylinders covered in different metals, called catalysts. Cylindrical foam catalysts can be easily reloaded into hydrogen purification reactors once hydrogen fuel cells become more widespread. This type of catalyst is of interest to this application because it would be easy to manufacture and sell on a large scale.



Foam cylinder

Dima prepared the catalyst samples using several methods. Traditional methods of dip-coating, where the foam sample is dipped into metallic solutions, and drop-wise coating, where the metallic solutions are dripped onto rotating samples in order to better distribute a thin layer of metals, were tried, as well as creative spray methods, where thin sprays were used to even better distribute the metallic solution. Dima began to test activities of the catalysts, the degree to which they are effective in adsorption using Temperature-Programmed analysis methods (TPx). (In absorption, the matter taken in becomes distributed throughout the absorbing material, while in adsorption, the matter collects on the surface and does not enter the interior of the material.) This test runs a known quantity of reactive gas over a catalyst sample. Some of the gas adsorbs to the catalyst, and the difference in inlet and outlet gas concentration recorded by the TPx machine demonstrates the activity, or effectiveness, of the catalyst. Simultaneously, Dima assisted with the construction of the laboratory plant that will be used to test the actual performances of the catalysts. She completed such tasks as assembling and connecting a gas feed system, calibrating mass flow controllers, installing analysis equipment, and pressure testing and repairing the plant.

Since the project is still in its early stages, no test runs were performed in the laboratory plant. The TPx analysis showed that some metallic compounds have better activities and will likely be better at converting CO to CO_2, as was expected. As the project progresses, the laboratory plant will be fully built and test runs with the different catalysts will be performed. Operating conditions for the most promising catalysts will be optimized. It is hoped that a viable process for removing trace CO from a hydrogen stream being used as the fuel for hydrogen fuel cells will be developed.

UIC Students Awarded Hefty Scholarships
Matthew Johnson, UIC
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The students at the UIC-IAC have won over $100,000 in scholarships, grants, tuition waivers, and awards over the last 3 years. To learn the secrets of their success, Matthew Johnson, one of the two UIC-IAC Lead students, sat down with the top three scholarship winners, Dima Alfawakhiri, Samantha Gutierrez, and Jim Lyon.

Where do you find your scholarships?
"Scholarships are everywhere. We have received scholarship information from minority programs, professional organizations, the university, our colleges, our professors, societies, and even from our high schools. The best way to find scholarships is to network as much as possible. Most of the scholarships that we receive are sent to us from other people who know us."—Samantha Gutierrez.

It seems you have a large variety of scholarships to choose from, so how do you narrow the field down to the ones you actually apply for?
"Well, it's definitely quality over quantity. A few things that we look for are cash payouts, tuition waivers,

and a large number of winners. If a scholarship has only one winner, it narrows your chances dramatically. You want to look for scholarships based on your particular needs. For example, Sam and Jim look for scholarships that are based on financial need, whereas I look for the opposite because I do not qualify. You want to look for scholarships that are achievement based rather than talent based. An essay contest is talent based, and there are many people who are better writers than us. However, not many people have the background in scholastics, extracurricular activities, and work at the IAC to compete against us in terms of achievements."—Dima Alfawakhiri

How much time do you put into each scholarship?
"The average for each scholarship is between 5 and 10 hours. However, that time frame is for local scholarships only. National scholarships take at least four times as long because you need to get nominated by the department or college, and once that happens, only then should you start the application process."—Samantha Gutierrez

How do you organize the completion of your scholarship package? What kind of timeline do you follow?
"First, make a list of everything you need. It is important to request recommendation letters early and get dates for their completion. Next, get the transcript request process started. I always request an extra transcript as a just-in-case measure—better to have one extra than be one short. The essay always takes the longest, so it is important to complete the short parts of the process first, such as the application and the resume. Once all the short parts are done, write your essay. It is important to have a few people read over your essay before you submit it. Make sure to set up your timeline so everything is completed a few days before the actual deadline. This gives you (and others) time to read it all over carefully, allowing you to find and fix minor mistakes that always seem to creep into the package. Tracking down the recommendation letters tends to be the most difficult part of the process, so it is important to have the due dates scheduled for at least a week before the actual due date of the scholarship. We go by the rule of having everything done for a date prior to the actual due date of the scholarship, rather than collect it all and send it in on the last day."—Jim Lyon

According to the three scholarship experts, there are six main parts to any scholarship: application, essays, recommendation letters, other materials, financial aid paperwork, and submission. Below are the tips and tricks from Dima, Sam, and Jim for five of these areas.

Application

- Save previous applications, as many have similar or the same short-answer sections (many of the questions are the same, so you can often reuse your answers in whole or in part)
- Type out the applications if possible (using Adobe Acrobat Professional or equivalent, or MS Word if the application is provided in that format), as this makes it much easier to read while at the same time separating you from your peers by giving your application a more professional appearance
- Get to the point and be specific for the short-answer sections (brevity is power when writing the essays)
- Proofread your application and have someone else proofread it

Essays

- Save your essays and reuse portions when applicable (ensure that they are good essays, as reusing bad material is efficient but will not win you awards)
- Play up your achievements and do not be afraid to brag about yourself (as IAC students we are doing extraordinary things, so do not hesitate to tell them so)
- When listing your goals, do not be afraid to be idealistic. Put your visions down even if they are not presently achievable
- For personal essays, write a story and make it interesting
- When writing to an organization, explain any experiences you may have had with that organization and what you gained from those experiences
- Go to the website of the scholarship sponsor and write to their goals
- Include the name of the scholarship in the essay (personalize the essay) whenever possible
- Network with people in the school's scholarship office. Let them know you are interested in scholarships and that you will be a familiar face,

coming to ask about new opportunities every few weeks
- Network with people on the selection committee if possible
- Proofread, proofread, proofread, and have others do so as well

Recommendation Letters

- Pick someone on the selection committee or whose work is close to the topic or organization to write the letters
- Include at least one more recommendation letter than the scholarship guidelines specify, even if no letters are required at all
- If offered a choice between submitting a pre-formatted recommendation letter found in the application packet or a free-form letter written by your professor, always opt for the free-form letter, as it requires more work and demonstrates more commitment by the professor to having you win
- Request a recommendation letter from the head of your department and the head of your college if possible. Academic rank of the recommending professors lends additional credence to any application
- Request recommendation letters from people in different areas of your life (personal, scholastic, and professional)
- Ask for letters early in the process

Other Materials

- Include a resume that fully describes your achievements (i.e., one that has not been cut down to one page)
- For financial-need-based scholarships, include your parent's net worth and a financial aid history including any awards that were previously won, even if this information is not requested or if the scholarship says they will get this information from the university financial aid office
- Network with your financial aid counselor. Let him or her know you are interested in scholarships and that you will be a familiar face, coming to ask for official financial aid paperwork in support of scholarships every so often

Submission Process

- Find out about the scholarship early, start early, meet your deadlines, and finish early
- Gather all of the information first before putting anything into the submission envelope
- Use a large envelope and do not fold anything
- Check with your scholarship office as they may pay for some of the postage costs
- Always plan to submit your scholarship packet the day before it is due
- Determine if the scholarship is due by postmark or must be received by a certain date, and plan your timeline accordingly

"It is important not be discouraged by the time it takes to complete each scholarship. Once you accumulate a collection of essays and applications, the process goes by quicker. The way I think of it is if I work 10 hours on a $1000 scholarship and win, that's $100 an hour I got paid to tell someone about myself. The work is worth the reward in the end." —Dima Alfawakhiri.

UIC Student Studies Micro-Electronic Printing Techniques
Jim Lyon, UIC
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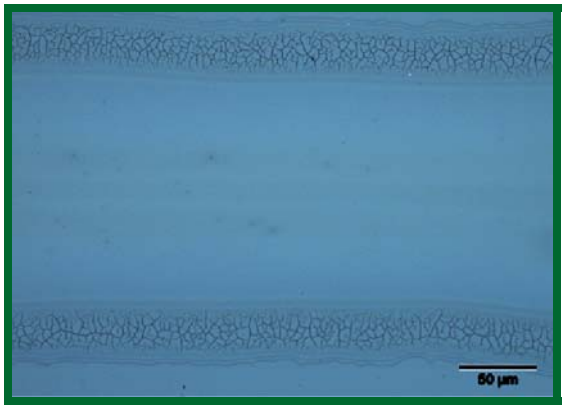
Over the summer Jim Lyon participated in a National Science Foundation research fellowship for undergraduate student engineers at the University of Illinois at Chicago, investigating improvements to present micro-electronics printing techniques, specifically printed-line technology. Currently, many micro-electronic circuit boards are created using photo-lithography, a process in which a plastic board or other surface is coated with a material consisting of conductive particles and a polymer that is designed to degrade when exposed to ultraviolet (UV) light. A mask containing an outline of the desired circuit pattern is then put over the coated material and a UV light is used to destroy the coating in desired areas to create the final circuit board. This process is time-consuming and very wasteful of expensive gold and silver particles, the main ingredients in the conductive particle spray.

Printed-line technology is the process where the nano-particles are applied to the surface only where needed, eliminating the need for the mask, which often takes several weeks to create. In addition to increased speed and reduced cost, printed-line technology allows for the creation of rapid prototypes;

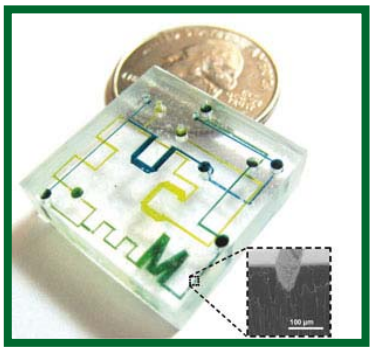
circuit boards can be printed in just minutes in a process similar to that of an inkjet laser printer creating a picture of a circuit board on a piece of paper, only in this case it is nano-particles being printed on a piece of flat plastic. The main disadvantage of printed-line technology is that it cannot draw lines as thin as those created by photo-lithography. Where printed-line technology draws lines that are 100 microns wide, photo-lithography can draw lines approximately 100 nanometers wide. (One micron contains 1000 nanometers.) To give a better idea of these sizes, a nanometer is 80 times wider than the diameter of a hydrogen atom, while human hairs are between 30 microns and 120 microns in diameter.

Jim's research was on how to better control the morphology (the geometry of the lines that are laid upon the surface) in order to make them smoother and more controllable. Using a generic nano-particle suspension, he printed surfaces and then examined the results using a microscope. He found that thousands of small cracks developed at the edges of the lines that were printed. These cracks may be capable of affecting the bulk electrical properties of the printed line, as the many small parallel fissures may be capable of storing charge. Specifically, the concern is that electrons moving forward and backward along the line might fall in to the fissures, resulting in the circuit board not performing as designed. The work done would be useful to an industry that is using printed circuit boards and needed to have precise control over electrical properties of their printed lines. A picture of one of the lines is presented below.

As can be seen, the printed-line is cracked at both the top and bottom edges, creating impediments to the free flow of charge.



The picture below highlights both of the printing processes—an etched channel created through photo-lithography and other channels created through printed-line technology. The chip demonstrates one of the potential advantages of printed-line technology—inexpensive, multilayer microchips. Seen below are two printed-line networks on a commercially available piece of thermoplastic.



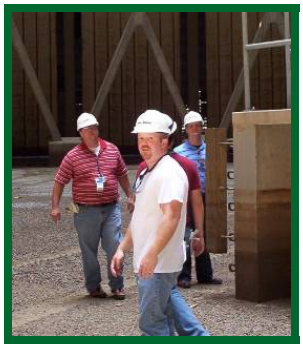
On this particular chip, the blue (U) and yellow (C) channels on different layers mix on a third layer to form the green (M) channel. One portion of the green channel was created using photo-lithography. The black and white inset presents a cross section of the etched channel created on the same chip by photo-lithography, as seen under a microscope.

Spotlight on Mississippi State University

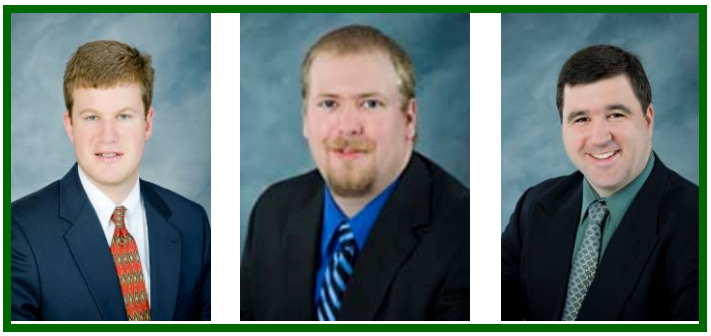
Mississippi State University Industrial Assessment Center Student Workers and Staff Engineers Become Qualified Specialists

The Mississippi State University Industrial Assessment Center (MSU-IAC) hosted in 2006, 2007, and 2008 four Industrial Technologies Program (ITP) qualified specialist training workshops: Qualified AIRMaster+ Specialists, Qualified Pumping System Assessment Tool (PSAT) Specialists, Qualified Process Heating Assessment and Survey Tool (PHAST) Specialists, and Qualified Steam Tool Specialists.

Jeremy Childers, a former MSU-IAC staff engineer and undergraduate student worker, became a qualified specialist in compressed air, pump, process heat, and steam. Chad Wheeley, a former MSU-IAC undergraduate student worker, became a qualified specialist in process heat and pumps.



Chad Wheeley



Ben Wright **Jeremy Childers** **Rhett Graves**

Rhett Graves, a former MSU-IAC undergraduate student worker and current research associate at MSU, became a qualified specialist in compressed air. Ben Wright, the current MSU-IAC staff engineer and former undergraduate student worker, became a qualified specialist in compressed air. In addition, Ben Wright recently completed ITP's 1-day steam end-user training.

Recent Mississippi State University Industrial Assessment Workers Are Employed in the Energy Sector

Jeremy Childers**,** a former MSU-IAC staff engineer and undergraduate student worker, completed a Master of Science degree in mechanical engineering in July 2008 and is currently employed with Honeywell. Chad Wheeley, a former MSU-IAC undergraduate student worker, completed a Master of Science degree in mechanical engineering in December 2007 and is employed by Tennessee Valley Authority (TVA) Nuclear Division in Chattanooga, Tennessee.

Kudos for Mississippi State University Industrial Assessment Center from Cooper Power Systems

The following message sent by Joe Draughn, senior manufacturing engineer for Cooper Power Systems, expresses his appreciation for an energy assessment conducted at his company's facility on September 9, 2008, by the MSU-IAC.

On behalf of all of us here at Cooper Power Systems in Lumberton, MS, I would like to express our appreciation to the MSU Industrial Assessment Team led by Mr. Ben Wright for conducting an assessment of our facility.

The skilled, professional manner in which the exercise was conducted was truly impressive. It is comforting to know that MSU is still turning out great engineers like when I attended. I expect great things in the future for all the members of the assessment team.

Please call me if you need further information. I am looking forward to seeing the results and recommendations of the assessment.

Best regards,

Joseph Draughn

The photograph was taken at Cooper Power Systems after the assessment. On the left side starting at the bottom are MSI-IAC student workers Nate Kober, Michael Johnson, Clarke Bozeman, and the MSU-IAC staff engineer Ben Wright. On the bottom right side is Dr. Richard Forbes, Professor Emeritus and Assistant Director of the MSU-IAC. The other persons in the photo are members of the senior management at Cooper Power Systems in Lumberton, Mississippi.

University Briefs

University of Alabama. Former Lead Student Blair Clinton completed 20 assessments and was granted an IAC certificate in July 2008.

Bradley. Bradley has had six students earn IAC certificates in 2008.

Colorado State. The Colorado State University IAC continued providing customers in Colorado and New Mexico with quality industrial assessments in 2008. We've been to two window manufacturing plants, two cabinetmakers, and a satellite manufacturer, to name a few. We've also developed a strong reputation of service to one of our large local manufacturers—the Woodward Governor Company. Their CEO had high praise for the program as he accepted a local environmental leadership award and touted the many energy efficiency opportunities they had implemented, in part from the CSU-IAC work.

The CSU-IAC also continued its strong tradition of graduating qualified, highly valued engineers in 2008. Our lead student, Ravi Singaraju, now works for Lockheed Martin in Schenectady, New York, where he provides support engineering for some of the U.S. Navy's nuclear submarine fleet. Another student, Amanda Borin, landed a job as a wind resource analyst with Garrad Hassan in Portland, Oregon. This year also saw long-time student and former lead student Doug Hopper move on as he finished up his research toward attaining his Master of Science degree in mechanical engineering.

So this is a transition year for the CSU-IAC. We've got nine new students—all juniors—who are eager to learn about energy efficiency and continue the tradition of the CSU-IAC as we move into our 25th year of operation.

University of Dayton. The UD-IAC has had a very productive year full of interesting audits and research. The center had a busy fall semester with eight 1-day assessments. These assessments included a variety of mid-sized industries ranging from rubber flooring to steel barrels. Additionally, the UD-IAC is looking forward to reaching a milestone of completing over 800 audits later this year.

The UD-IAC is currently being staffed by a small team of graduate and undergraduate students. Despite a small team, the center has been able to complete its demanding schedule while maintaining a high quality of work. The center is optimistic about bringing in new students in the spring semester. Currently, Tom Wenning has been managing the lead student position. Both Tom and fellow student Steve Mulqueen will be graduating in the near future with master's degrees in mechanical engineering. Tom is scheduled to graduate in May 2009 and Steve in December of 2009. Both will graduate with over 30 completed audits and are hoping to pursue careers in energy consulting.

Six of our students graduated this past year and have gone to work for various energy organizations. Kazim Mirza and Arun Balaji went to work for EMCOR Energy Services. Shuihua Hu works for Siemens Power Generation. Dan Trombley heads the industrial programs at ACEEE. Charlie Schreier and Peter Kleinhenz joined Go Sustainable Energy, a successful energy efficiency company founded by UD-IAC alumni John Seryak.

Along with conducting energy audits, the UD-IAC continues to conduct research and publish work. Current paper topics include industrial boiler operation optimization, wind power feasibility in Ohio, and efficient electrification of rural third-world communities. More information regarding the UD-IAC team research and audit data can be found at http://www.engr.udayton.edu/udiac/.

Delaware. The University of Delaware IAC got a lesson in time management this year, having fallen behind on our schedule and having to complete 22 assessments from February to September. We did complete all the assessments, which was quite a trial by fire for our new center. We assessed plants ranging from metal forming to paints to even a brewery, which was a lot of fun! While doing all this we managed to help kick off the University of Delaware Energy Institute, a collection of centers doing energy-related work at the university. It's still fascinating to see how practices from an "energy cheap" era that are easily corrected continue to be seen. One of our favorite recommendations this year, which is being implemented, was the replacement of open steam jet heating to avoid freezing of

lines and tanks at a company, with steam tracing that will save 11,300 MMBTU of natural gas annually. While such practices are usually attributed to a "it's always been done this way" mentality, we see strong motivation for energy efficiency at the plants we visit, although we did have a plant where we calculated they had steam leaks totaling 49,500 MMBTU/year, which we're beating on them to fix.

Besides our assessment activities, we're starting to get some good research going, and we presented work on radiative losses from "boilers" (although our first experiments were on tea kettles!) at the Director's meeting. We showed that a shiny boiler, having a lower emissivity, has 4% lower radiative losses than a darkened boiler with a high emissivity. We got this idea after doing the assessment at the brewery, where they keep the steam kettles shiny for appearance since they have tours; but it appears that practice may have an energy-saving advantage as well.

In all, a great year for energy efficiency!

Florida. At the University of Florida IAC, our graduated students have become in demand by industry all over the country. Some of them are working for DOE in Washington, others for Lockheed Martin in Orlando, for Anderson Consulting, for Johnsons Controls in Tampa, Florida Power and Light, etc. We have been told by our students themselves that they felt the experience with the IAC helped them get their jobs, and that they are applying all they learned in the IAC. A common denominator is that those who have found jobs in the energy industry are those graduates or undergraduates who have written and/or published a research paper, attended a conference, or developed an independent project. The ones who have done even better are those who have attended the IAC Lead Students Training Meeting, as organized by Michaela Martin. No question about the excitement and great impact that the UF-IAC program is having on our students and the local industry.

Georgia Institute of Technology. Jay Rudd has been selected to represent Georgia Tech at the upcoming 2009 lead student meeting in Washington, D.C.

The University of Illinois at Chicago. Over this past year the UIC-IAC has been extraordinarily busy, conducting regular and large IAC assessments as well as working in support of professional engineering projects held by the Energy Resources Center (ERC), UIC's professional engineering consulting arm and the UIC-IAC's organizational parent.

UIC-IAC students worked on identifying opportunities to improve the efficiency of compressed air systems at two U.S. Air Force bases. At one of the bases, in addition to the cost reductions associated with reduced energy usage, the recommended measures will improve plane start reliability, resulting in reduced diesel fuel usage (45,500 gallons per year, $148,000 savings), reduced jet fuel usage (1.1 million gallons per year, $2.8 million savings), and reduced ground crew labor hours (1,820 hours per year, $45,000 in savings).

In the last assessment of the 2008 fiscal year, the UIC-IAC assessed Miller Brewing Company's largest plant, located in Milwaukee, Wisconsin. Aside from the idea of assessing a brewery, the sheer size of the plant ($18 million annual energy spend), the applicability of and client desire to install clean heat and power (CHP) and the potential to assess two other plants made taking on this opportunity an exciting challenge. The UIC-IAC is still working on the analysis and expects to submit the final report to the client prior to Christmas of 2008.

During this past year the UIC-IAC upgraded its computer hardware and software tools for the first time in the center's history, receiving new computers and wide-screen monitors that were ordered to the center's specification. Each team member now has his or her own computer workstation, and because of careful acquisitions leading up to receipt of the new equipment, most have dual-monitor setups, which have proven to be highly popular. A picture of one of the workstations is presented below.

Most importantly, the idea for the new equipment came from the team in the form of a proposal outlining the advantages and disadvantages of continuing on with the outdated computers. Approval of the new hardware was made contingent upon several performance marks that the team had to meet or exceed in order to justify the expenditure. The team, in effect, had to earn the new equipment and did so over the course of nearly 9 months of work in support of both ERC and IAC projects.

Currently the UIC-IAC is supporting an ERC assessment of the Egan wastewater treatment plant just outside Chicago. While the plant is relatively small, with a $2.5 million annual energy spend, the applicability of CHP and the presence of anaerobic digesters, which produce methane gas for use in the facility's boilers, make this an unusual opportunity. Additionally, the client's long history of environmental stewardship and willingness to commit significant amounts of capital to projects with longer paybacks mark this project as a nice change of pace. If this project goes well, the UIC-IAC will have an opportunity to work on other plants, including the second largest wastewater treatment plant in the world, located just southwest of Chicago.

Iowa State University. David Werner will attend the 2009 lead student meeting for Iowa State.

Lehigh University. The Lehigh University IAC has been very active during the past year, undertaking a broad range of assessments. These included an elevator plant, foundries, a battery plant, aluminum wire plants, and a water plant.

In February, Lehigh-IAC lead students YiJun Yang and Timothy Guider attended the IAC student meeting in Washington, D.C. During the meeting, the Lehigh-IAC exchanged energy audit experiences and shared some energy-savings calculations with students from other centers. They also applied self-developed software from other centers to Lehigh's calculation system.

During the months of May through August, Tim Guider served as an intern for the Electrotechnology Applications Center (ETAC) in Bethlehem, Pennsylvania. ETAC conducts energy assessments for clients in Pennsylvania from both the industrial and commercial sectors. On one of their assessments at a university, YiJun Yang joined them as part of a cooperative program. The summer experience not only expanded the Lehigh-IAC team's knowledge of energy assessments but also brought this industrial assessment program to the attention of many manufacturing companies and local government representatives.

This fall, the Department of Energy Industrial Technologies Program (ITP) gave two Energy Champion awards and five Energy Saver awards to Lehigh-IAC clients.

Many high-tech energy conservation recommendations provided by the Lehigh-IAC team were recognized by plant personnel. For example, the team recommended the use of an infrared oven to metal-refining companies to improve the heating efficiency, a high-efficiency regenerative oxidizer to a printing company to reduce the energy use involved in destroying volatile organic carbons (VOCs), and exhaust hoods with automatic vent controls to a laser cutting operation to improve the ventilation system in a metal-handling company.

University of Louisiana–Lafayette. Bimaldeep Kaur participated in 12 assessments and earned a certificate in 2008.

University of Massachusetts. IAC student Palmer Yurica will represent UMass at the 2009 lead student meeting.

University of Michigan. Kyle Rademacher served as lead student and participated in 15 assessments before graduating in May 2008.

University of Missouri. Over the past year, the role of the Missouri IAC has been amplified both on and off campus. The center has lost some familiar faces and gained a new one, Yunpeng Ren, a mechanical and aerospace engineering graduate student who recently arrived at the university. Over the summer the center performed energy audits for a Kansas City manufacturing company at three of their facilities. The students focused on improving the

process heating systems employed by the paint lines at the facilities and were able to identify energy savings that resulted in a 10 to 15 percent reduction in annual energy usage. The knowledge gained by our students has been transferred on to the university as well. Jason Fox, an undergraduate student in the center, recently co-authored a grant proposal for the Rocky Mountain Institute's "Accelerating Campus Climate-Change Initiatives" that was accepted and will bring the experience of the Rocky Mountain Institute to our campus and greatly benefit our efforts to further sustainability.

University of Miami. Alexandra Bonilla earned an IAC certificate in March 2008.

Mississippi State University. Awarding Mississippi companies with Proactive Energy Saving Efforts, the state of Mississippi (the Governor's Office and the State Energy Office) hosted the Mississippi Energy Coordinators Association (MECA) Conference and Expo on October 9, 2008, in Vicksburg to recognize and award energy savings in manufacturing facilities, schools, utilities, businesses, universities, nonprofits, and other entities. Five manufacturing facilities in Mississippi were recognized for energy savings and received DOE ITP SEN awards and state of Mississippi awards.

The Mississippi State University Industrial Assessment Center conducted energy assessments for four facilities in 2007 and 2008. An Energy Savings Assessment (ESA) steam assessment was conducted at Tronox and Bowater Newsprint.

2007 Energy Saver:
Bowater Newsprint, Grenada, Mississippi

2007 Energy Champion:
Davis International, Okolona, Mississippi
Grenada Manufacturing, Grenada, Mississippi

2008 Energy Savers:
Tronox Hamilton Pigment, Hamilton, Mississippi
Energy Conversion Systems (ECS), Pelahatchie Mississippi

Motice Bruce, Director of the Mississippi State Energy Office, presented to John Sauls, an engineer with Energy Conversion Systems, a DOE Energy Saver award and a Mississippi award for energy savings at the annual Mississippi Energy Coordinators Association (MECA) meeting.

North Carolina State University. Co-lead students Justin Gibides and Michael Simon will be attending the 2009 IAC lead student meeting.

Oklahoma State University. We continue to work with our affiliates at the University of Arkansas and Wichita State University. Our join assessments have been both rewarding and challenging. We work closely with our regional Manufacturing Extension Partnership (MEP) organizations: the Oklahoma Alliance for Manufacturing Excellence, Arkansas Manufacturing Solutions, and Mid-America Manufacturing Technology Center (Kansas). One of our most interesting assessments this past year was conducted at a foundry located in a small town of a few hundred people in northeast Oklahoma. We worked with the Oklahoma Alliance to perform an assessment that focused on a new melting system for the plant. Our $1.5 million recommendation for a new three-phase melting system was estimated to provide a 60%+ improvement in the foundry's energy intensity. We worked with the USDA Office in Stillwater to help the client apply for a $250,000 grant (as a rural manufacturer) from the USDA Renewable Energy Systems and Energy Efficiency Improvement Program to soften the initial investment. A few months ago we were informed that one of our U.S. senators from Oklahoma informed our client that the grant was approved. This assessment experience involved several meetings beyond the on-site assessment and turned out to be one of our most educational experiences (out of over 750 assessments). Our students got to see firsthand how teamwork beyond the center pays off.

Oregon State University. The past year has been a highly productive one for Oregon State IAC with many successes to note. One of the more exciting developments has been work started on setting up a Revolving Loan Fund (RLF). An RLF is based on a fairly simple concept. The fund starts with an initial amount of money that is used to fund sustainability and renewable and energy efficiency projects. The money that is saved through these projects is reinvested back into the fund, creating essentially a snowball effect where more projects can be funded and the initial loan can be repaid. The Oregon State IAC, in collaboration with Portland State University and OSU administration, has started working to set up and organize an RLF to perform these types of projects on each school's respective campuses—the goal being to move both campuses toward becoming completely sustainable and energy efficient. Support has been tremendous, with the administration, faculty, staff, and students getting very excited about the current progress.

San Diego State University. SDSU had three students meet the qualifications for IAC certification in 2008.

San Francisco State University All four of the SFSU students receiving IAC certificates in 2008 completed at least 13 assessments.

Syracuse University. The Syracuse University IAC has, once again, enjoyed an extremely productive and educational year. Now entering its ninth fiscal year, the center is operating better than ever, with team members hard at work pursuing new Assessment Recommendation (AR) ideas that involve the use of various new technologies. The SU-IAC worked closely with the Onondaga County Water Authority to develop an understanding of its pumping systems. This effort was to explore the possibility of expanding the IAC mission into municipal facilities. In addition, the center partnered with the Syracuse Center of Excellence in Environmental and Energy Systems to assist Corning Incorporated in understanding some of its high-temperature heat recovery issues. In team news, lead students Ross DiLiegro and Wade Willatt took part in conducting a comprehensive greenhouse gas emissions inventory for Syracuse University, as part of the American College & University Presidents' Climate Commitment. Currently, SU-IAC students are at work on special projects in high-temperature imaging, data analysis, and energy harvesting. They are very active in soliciting new clients and engaging with local and regional development agencies. As usual, the center expanded its knowledge base by adding students Kelly Farmer, Michael Jones, Philip Gwyther, and Chris Buttitta to the team.

Tennessee Tech. After graduating, lead student Brian Traylor accepted a job with U.S. Engineering. Ben Hassler, who is working on his master's degree in mechanical engineering, is our new lead student. Three of our experienced students graduated in December with bachelor's degrees in mechanical engineering: Ray Bowker, Dustin Boyett, and Jimmy Kitchens. Student Matt Beard's National Guard unit is being redeployed to Iraq in early 2009. Our hopes and prayers for his safe return home are with him and his family.

University of Washington. The University of Washington IAC celebrated its second anniversary in operation this summer. The center is pleased to welcome a new co-lead student, Alex Berres, who will lead the center in conjunction with present lead student Anthony Simon. The UW AIC's future outlook can be summarized as a move toward strategic partnerships and in-depth training.

Alex Berres interned at a large local utility last summer and recognized the need for tighter integration between utility planning and energy efficiency. Working with electric distribution planners and energy management engineers, he developed a framework to defer major distribution capacity expansion through demand-reducing energy efficiency projects. As the electric infrastructure in Washington ages, there is increased need for alternative capacity upgrade solutions. With Alex's leadership, our center is poised to support the needs of utilities and consumers in easing capacity concerns.

The UW-IAC has also fostered a close relationship with both the Washington State Department of Ecology's Technical Resources for Engineering Efficiency (TREE) and the Washington State University Extension Energy program. Through associations with private sector and university research organizations, the center has identified technologies of interest to the pulp and paper, composites manufacturing, and food processing industries. To pursue energy savings in those and other

industries, the UW-IAC has furthered contacts at regional and national trade associations and industry efficiency consortiums. In addition, the center has been working toward implementing a case study in these fields.

Training has also been a primary focus for the UW-IAC. Anthony Simon has accelerated the training process by attending multiple DOE Best Practices training workshops to bring expertise to colleagues. Through its partnerships with the Energy Extension Program, our center has worked toward developing customized training sessions for its membership in the present academic year.

West Virginia University. The Industrial Assessment Center at West Virginia University (WVU-IAC) has had a great year of energy assessments. The WVU-IAC conducted two "hybrid" assessments for Large Energy Users (LEU). The facility personnel were trained on-site on the use PHAST and AirMaster+. The assessment reports for the two facilities contained PHAST and AirMaster+ models and reported energy savings, which were verified using standard IAC energy efficiency techniques. The reports also focused on QuickPEP, MotorMaster+, 3E Plus, SSST, and other Best Practices Software tools. The assessments and reports were well received by the facilities. The facility personnel scheduled follow-up meetings with Director Dr. Gopalakrishnan and lead students to facilitate a plan for implementation.

Dr. Gopalakrishnan, along with Dr. Xingbo Liu of WVU, is working on providing quality assurance for the Chinese translation of QuickPEP. Dr. Gopalakrishnan conducted a number of Energy Saving Assessments (ESA) under the Save Energy Now program in the areas of process heating and compressed air.

The U.S. DOE recognized Osram Sylvania as Energy Champion, while Crown Cork Closures, Fireline, Inc., Menasha Packaging, Quebecor World, and Union Electric Steel received recognition as Energy Savers.

Lead student Subodh Chaudhari became a qualified specialist in process heating along with former IAC lead student Dr. Deepak Gupta. Dr. Gupta worked at the WVU IAC as a staff member during the summer of 2008. Subodh Chaudhari and Rajas Hatwalne attended the lead student meeting held in Washington, D.C., during February 2008. Lead student Subodh Chaudhari made a presentation about WVU-IAC's China energy assessment experience and QuickPEP analysis done for the Chinese manufacturing facilities.

The annual workshop held on April 11, 2008, focused on saving natural gas and electricity costs in industry. The response received from industry was overwhelming, with representatives from 41 different manufacturing facilities attending. The feedback received by the team was excellent. Lead student Subodh Chaudhari presented an invited talk on "Common Industrial Energy Efficiency Measures" to industry personnel at an energy seminar arranged by Arbon Equipment Corporation in Canonsburg, Pennsylvania, during October 2008.

Three IAC students, Jadeja, Muniswamy, and Song, defended their theses and problem reports and graduated. They subsequently accepted jobs in industry. All three students were involved in manufacturing productivity improvement research. Dr. Gopalakrishnan worked with the Siemens Building Technologies student recruiter to provide employment opportunities for the IAC students.

Dr. Gopalakrishnan and his graduate students authored three articles in peer-reviewed journals and one article in a conference proceedings. Dr. Gopalakrishnan served as the Energy Efficient Manufacturing session chair at the Society of Automotive Engineers (SAE) International World Congress.

Recruiter's Corner

Because of their specialized and highly sought after training, knowledge, skills, and abilities, IAC students and alumni are heavily recruited throughout the energy sector. Listed below are corporate profiles of several companies that routinely post positions on the IAC web site and actively recruit IAC students and alumni. For more information on these and other prospective employers and opportunities, see the career section of the IAC Student and Alumni web site at http://www.iacforum.org/iac/app?service=page/RecruitersCorner.

Harshaw Trane is a major HVAC company committed to enhancing the environment with high-quality, high-efficiency HVAC equipment and providing integrated comfort systems. Trane currently has opportunities available for engineers.

Contact Bruce Thomas, HR Recruiter, 502-753-7833

ERS, Inc. is a leading engineering firm staffed by experienced energy professionals. Our objective is to assist utilities, government, and large commercial and industrial end users solve complex energy and resource problems in a cost-effective manner. ERS focuses on client needs, developing solutions that reduce costs while simplifying day-to-day operating requirements.

ERS, Inc. has hired five IAC alumni.
Contact Recruiting, 978-521-2550

Cascade Energy Engineering is a consulting firm specializing in industrial energy efficiency projects. We are industry leaders in evaluating, implementing, and commissioning of these projects. We work strategically with corporate clients to implement broad energy management plans focused on industrial energy efficiency. Cascade serves a broad array of industries, including food processing and distribution, oil and gas, pulp and paper, and chemical industries. We also serve a wide range of electrical energy efficiency demand-side programs wherein utilities or public agencies assist their industrial customers in implementing energy efficiency projects. Cascade is focused on providing excellent technical work and customer services. This emphasis, along with heightened awareness of energy and energy costs within industry, has allowed Cascade to grow steadily since its inception in 1993. We have a highly skilled and loyal engineering staff. Marcus Wilcox, president of Cascade and one of its founders, is an IAC alumnus. Cascade has offices in Portland, Oregon; the Salt Lake City, Utah, area; and Walla Walla, Washington.

Cascade Energy Engineering has hired one IAC alumni.
Contact Dan Brown, 503-287-8488

NORESCO is one of the nation's most experienced energy service companies that builds self-funding energy efficient infrastructure improvements and renewable energy installations for a wide range of educational, government, commercial, correctional, public housing, and industrial customers. NORESCO hires and retains a highly skilled, multidisciplinary team of energy engineers, project managers, sales executives, construction managers, and measurement and verification (M&V) engineers. Headquartered in Westborough, Massachusetts, we have offices located throughout the United States and currently have openings for engineers across the country. We recognize the great value of your IAC energy auditing experience as we continue to look nationwide for talented engineers to join our growing team.

NORESCO has hired one IAC alumni.
Contact Anthony Sclafani, 760-533-2175

The Cadmus Group is a dynamic environmental consulting firm headquartered in Watertown, Massachusetts. Our energy services team assists clients including EPA, utilities, and private companies with energy efficiency and renewable energy projects throughout the United States and around the world.

The Cadmus Group has hired one IAC alumni.
Contact Lauren Mattison, 617-673-7107

Aerotek Inc., one of the leading providers of engineering and engineering support professionals in North America. Due to our growth, we're constantly on the lookout for qualified professionals to place in contract, contract-to-hire, and permanent placement positions across a number of different industries. We know it's more than just your day-to-day responsibilities that can make or break a job. It's the support you get. That's the reason Aerotek CE offers a variety of benefits including medical, dental, optical, 401k, and many more. Don't put your career in the hands of just anyone, put it in the hands of a specialist. Join the Aerotek CE team! Allegis Group and its subsidiaries are equal opportunity employers.

Aerotek Inc. has hired 10 IAC alumni.
Contact Renee Coyier, 503-403-1917

Enovity, Inc. is a sustainability consulting firm that provides customized energy and operational solutions for high-performance buildings. Based in San Francisco and with offices in Irvine, Seattle, and Phoenix, Enovity has provided California state and local governments, utilities, and school districts with functional solutions for energy efficiency. Our firm specializes in commissioning, energy engineering, sustainable design, facility operations, and maintenance and energy efficiency incentive programs.

Enovity, Inc. has hired three IAC alumni.
Contact Pamela Boyes, 415-974-0390

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IAC Database: Mike B. Muller, mbmuller@caes.rutgers.edu, database location: http://iac.rutgers.edu

Calendar of Events and Training

2009 IAC Lead Student Meeting, February 5–6, 2009, Washington, D.C. Proceedings may be found at http://www.IACforum.org

ASHRAE Winter Meeting (Net-Zero Energy Design), January 24–28, 2009, Chicago, http://www.ashrae.org/events/page/1925

Industrial Energy Technology Conference (IETC), May 15–19, 2009, New Orleans, http://esl.eslwin.tamu.edu/ietc/home.html

AEE World Energy Engineering Congress 2009, November 4–6, 2009, Washington, D.C., http://www.energycongress.com/

DOE Industrial Technologies Program Qualified Specialists and End-User Training, throughout 2009, http://www1.eere.energy.gov/industry/bestpractices/professional_development.html