

Carnegie Mellon University

WINTER 2015

# CEE NEWS

CMU.EDU/CEE

## INNOVATION IN EDUCATION

SHAPING THE NEXT  
GENERATION OF ENGINEERS





## CEE NEWS

EDITOR & DESIGNER  
Mireille Mobley

### WRITERS

Natasha Saidikowski  
Sophie Wodzak  
Mireille Mobley  
Tara Moore  
Daniel Tkacik

### PHOTOGRAPHY

Kai Fan  
Mireille Mobley  
Qian Zhang

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Dear Alumni and Friends,

This issue of CEE News focuses on innovations in our undergraduate and graduate education programs, including perspective on the scope and progression of the changes in our curricula, and stories about the experiences of particular students with in our department. The flexibility that we introduced more than a decade ago into both our undergraduate and graduate programs has served our students well, as you will see. The diversity of the professional interests and goals among our students is impressive, reflecting the ongoing, exciting evolution of civil and environmental engineering.

A recent curricular innovation has been the formal integration of writing instruction in our undergraduate curriculum, including introduction of a new course and writing assignments in some core courses. **Andrea Francioni Rooney**, a Carnegie Mellon alumna with bachelors and masters degrees in professional writing, and our CEE Director of Undergraduate Programs, also serves as our writing instructor. Over the past several years, CEE alumna **Janel Miller** (now at the University of Wisconsin) developed the course Introduction to Professional Writing in CEE for undergraduates, as well as a course in CEE Professional Communications for graduate students. These courses are fully enrolled and much appreciated by our students. Andrea also works collaboratively with instructors of several core CEE undergraduate courses on specific writing assignments in those courses.

Another recent example of curricular innovation is the introduction this year of a three-course sequence in climate change adaptation. This educational initiative complements our department-wide research initiative in climate change adaptation for infrastructure. The three courses are a full-semester course in Climate Change Science and Adaptation (**Iris Grossmann**, EPP), and half-semester courses in Climate Change Adaptation for Infrastructure (**Costa Samaras**) and in International Climate Adaptation and Infrastructure Innovation (**Kelly Klima**, EPP). The courses, all at the first-year graduate student level, attracted many students, including undergraduates.

Our undergraduate and graduate programs are enhanced by many extracurricular activities, including numerous activities initiated by our very active student groups. In Fall 2014, for example, our ASCE student chapter organized a number of groups to begin preparing for various student competitions to be held at the Spring 2015 regional ASCE student conference in Cincinnati, our Chi Epsilon chapter launched a monthly seminar series, and our Environmental and Water Resources Institute (EWRI) student chapter held several joint events with the Pittsburgh EWRI chapter.

An upcoming milestone event for CEE is the celebration of the career of Professor **Chris Hendrickson**, who will retire and move to emeritus status in June, 2015. Chris will continue to be engaged with the department in various ways, especially in transportation-related research. The celebration will be Friday evening, April 17. If you plan to be on campus for Spring Carnival weekend and would like to attend, please let me know.

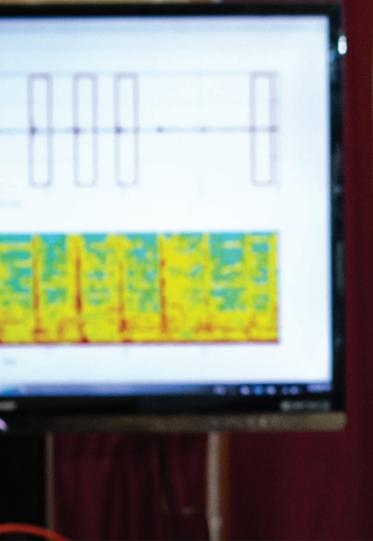
Fundraising continues for the Lawrence Cartwright Support Fund for Teaching Professors and for Dr. Elio D'Appolonia Graduate Fellowship Fund. Please consider directing your annual gift to one or both of these funds, which will help maintain the strength and vitality of our department.

The faculty, students and staff of CEE thank all of our loyal and generous alumni who support the Department in so many and much appreciated ways. We send our best wishes to all of you.

Dave Dzombak  
Hamerschlag University Professor and Department Head



DAVE DZOMBAK



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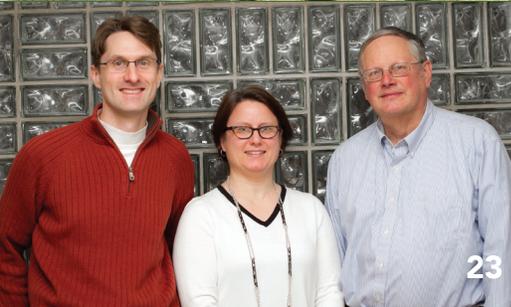
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### 2015 US News & World Report Undergraduate Rankings Announced

CEE is proud to announce that our undergraduate engineering programs have once again achieved high rankings in the U.S. News & World Report's 2015 Best Colleges report.

Our Environmental Engineering program was ranked 7th in the nation for programs of its kind, and our Civil Engineering program was ranked 12th. In addition, the College of Engineering was ranked 7th overall.

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Alumni Awards



2014 December MS & PhD Graduates



undergraduate education

# Innovations in Education

## Shaping the Next Generation of Engineers

In the early 1990s, the College of Engineering decided to introduce more flexibility in the undergraduate curriculum by reducing the number of required technical electives in each major. The flexibility was introduced in recognition of the wide range of career interests of our undergraduates. Not all of our students plan to pursue engineering as a career, but rather are using undergraduate engineering to provide a math-science-analytical background for going into law,

business, medicine, or other directions. Further, the flexibility enables students to tailor their curriculum to their own professional goals. They can go as deep or broad as they wish.

Our more flexible undergraduate curriculum in civil engineering was initiated in 1995. The core of the curriculum provides exposure of all students to four areas of civil engineering: computer-aided engineering, construction and management, environmental engineering, and structural engineering. The core curriculum also includes depth in mechanics, with required courses in statics, solid mechanics, fluid mechanics, and soil mechanics. Hands-on laboratory experience is also emphasized, with five required laboratory classes. While there have been some modifications to the curriculum over the years, the flexibility in the curriculum – with seven completely free electives – has remained intact. The department still offers a wide range of technical electives, and most students take a number of them.

Our experience with the 20 years of the more flexible curriculum is that our students have appreciated the flexibility and used it to good effect, pursuing minors and double majors, art and musical interests, or gaining depth in a particular area of civil engineering. The students are advised carefully about use of the flexibility, with faculty mentors and staff advisors working to help students identify their goals and to impress upon the students implications of their decisions.

The experiences of some current students give insight into the creative ways in which students are taking advantage of the flexibility in our undergraduate curriculum.

## Constructing a Curriculum

“The way the civil curriculum works, it’s meant to be flexible,” **Michelle Couste** (BS ’15) said of the curriculum of the Civil and Environmental Engineering Department. Although she entered the department relatively certain that she wanted to pursue construction, the project management section in the Introduction to Civil Engineering course helped to solidify her plan.

Couste took advantage of the flexible curriculum to round out her education by pursuing some courses tangentially related to her construction focus. “I decided to do the Business for Engineers minor in the business school,” Couste explained, “because a lot of their classes had to do with process engineering and operations management and things that looked like they would be really useful for construction management.”

Even with the flexibility, fitting classes from another department into her already busy schedule could be tricky. “I had to push it a little to make it work,” Couste explained, “but I’ve really enjoyed the classes I’ve been able to take. I’ve been very grateful for it, I’ve learned a lot in them.”

Figuring out which courses to take, especially in a program with such flexibility, would be a daunting task were it not for the advice from her advisor, Christiano Professor **Burcu Akinci** who helped Couste

develop goals and a strategy to meet them. “Talking to Professor Akinci, hearing her stories about projects she had worked on, and having her direct me towards good research sources taught me that construction was really interesting to me,” Couste said.

But for Couste, Akinci was more than a supportive advisor. “I picked her because I had been thinking about construction,” Couste explained, “but also I was excited to have an advisor who was a woman in the construction field because I know that’s not the most common.”

In fact, the prevalence of women in CEE was something that originally drew Couste

to the department. “I came to visit a class and when I walked around the civil department, it didn’t seem like it was all guys,” she said. The engineering discipline is “still very male-dominated, and I liked that our civil department is more balanced.”

## Sustaining Students

**Katie Bradford** (BS ’15) is pursuing a double major in CEE and EPP. In fact, she started out as an architecture major, but realized that civil engineering aligned more closely with her goals. “I’m really interested in environmental engineering and also its social and political implications,” she explained. Once someone suggested that she consider engineering and public policy, Bradford decided that a double major was the best way to pursue both areas of interest.

Her coursework in EPP helps her learn about social and political implications. “So a lot of the elective courses that I was allowed to take in my civil major were focused on that.”

Bradford was awarded a Summer Undergraduate Research Fellowship for summer 2014. She worked on a project with **Kelly Klima** in EPP, “looking at heat and vulnerability factors and determining with urban heat island effect what populations were going to be the most vulnerable.” Bradford added, “Then, using a sensitivity analysis,

I determined where you should locate cooling centers based on the demand.” The research was such a success that she is now in the process of getting it published.

She continued working on that project and then took on others. Now, she’s looking at floodplain management and considering the disaster risk for populations with limited English proficiency. While much of her work is in EPP, Bradford received help from **Andrea Francioni Rooney**, the Director of Undergraduate Programs for CEE, to figure out the details of her undergraduate research project.



Assistant Teaching Professor Jim Thompson discusses project details with students in Senior Design.

After graduating, Bradford is headed to graduate school, but she hasn’t yet decided which option she wants to pursue. So far, she has been accepted into two masters programs that each incorporate both of her degrees. Eventually, she wants to go into consulting and draw from her experiences in both of her degree programs.

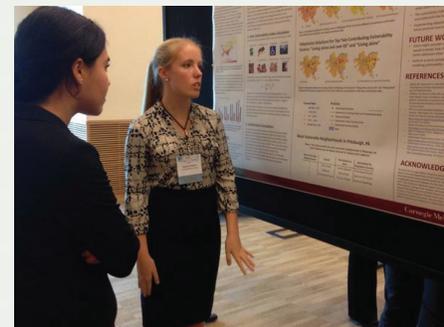
Without the flexibility in the CEE program, none of that would have been possible. “You really have a lot of freedom with what classes specifically you want to take,” she said.

## Professional Experiences

“The flexibility allowed me to take classes in many of the civil engineering disciplines, such as geotechnical, transportation, structural, environmental, construction, and computer applications,” said **Millard McElwee** (BS ’15). Without it, “I would not have found my true passion in civil engineering which is construction.”

McElwee decided early in his collegiate career that he wanted to focus on construction management and the intergration of hands-on projects have afforded him valuable experience.

One such project is in his Structural Design course, taught by Assistant Teaching Professor **Jim Thompson**. In the class, they are designing the structural layout of Scott Hall, one of the buildings currently under construction on the CMU campus. “The integration of a class project involving Scott Hall has proved challenging and rewarding,” said McElwee. “The access to the drawings and engineers allows us to



Bradford presents her research project, “A Heat Vulnerability Index and Adaptation Solutions for Pittsburgh, Pennsylvania,” at the Advancing and Redefining Communities for Emergency Management (ARC) Conference in Los Angeles, California. Turn to page 21 to read more about this project.



McElwee checks the back deck of the boat for safety hazards.

internship offer fell through, he reached out to President Emeritus and University Professor Jared Cohon, who “recommended me for an internship with Delmar Systems, which is an offshore mooring company which specializes in moving rigs in the Gulf of Mexico and abroad.” McElwee spent the summer in the Gulf of Mexico learning about safety assessments to prevent accidents and routine inspections to ensure structural integrity.

“You learn how it works,” McElwee explained of classroom experiences, “but to go out there and actually see it come to fruition, it’s really rewarding.”

As useful as he found the experience with Delmar Systems, McElwee wants to get back to construction. He has an internship with Clark Construction for this summer before he heads off to graduate school in the fall. “This will be my first time getting some construction experience,” he said.

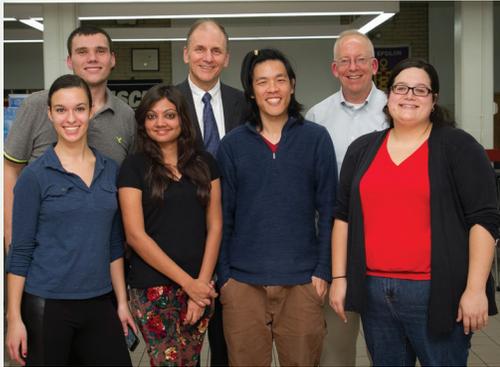
While he might have otherwise found getting back to construction daunting, McElwee found a mentor in Thompson, who supported McElwee through determining his plans for his future. “Conversations with him guided me towards graduate school,” McElwee said, “as well as how best to position myself after for the goals I wanted to achieve.”

Professor Thompson exemplifies the supportive community that first drew McElwee to CEE. “I got the chance to visit before I made my final decision,” McElwee recalled, and “I met Dean Garrett, who was then the department head. I chatted with him for maybe twenty minutes about my interests in civil. Just that conversation, the vibe I got from the CEE department. It’s a very supportive, friendly atmosphere. After that conversation, my mind was made up that I was coming here.”

question the differences between theory and application, as well as compare our design to the selected design for the project.”

McElwee has applied the skills he’s learned in courses like Structural Design in the internships he’s done. Although he came to CEE with the idea of pursuing construction management, his professional goals took a slight detour during his internships. When an

## Life @ CEE



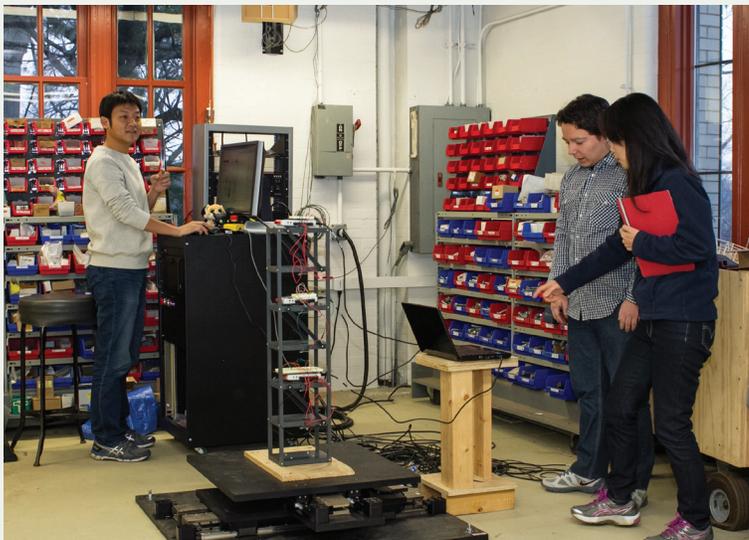
Winners and Judges at the ASCE/GSA Thanksgiving Dinner



MS Graduates play games at Dave & Busters December Graduate Farewell Dinner



Hitting the slopes at Hidden Valley! Annual CEE Ski Trip



Noh with two graduate students run shake table tests to measure the building dynamic responses to various earthquake loads as part of a structural health monitoring course project.

Dzombak in water chemistry class

## CEE Team Finds Exporting Natural Gas Will Not Increase Greenhouse Gas Emissions

CEE researchers determined that exporting natural gas to Asia or Europe will not cause increased greenhouse gas emissions (GHG). Their findings were recently published in “Environmental Science and Technology.”

Natural gas, specifically Liquid Natural Gas (LNG), has caused a major debate in the U.S. as a potentially cleaner energy source. As domestic natural gas production has increased, it has been questioned whether exporting natural gas in the form of LNG to replace gas in Europe or coal in Asia would result in increased greenhouse gas emissions.



For the most part, it doesn't, as the team, which includes CEE/EPP PhD student **Leslie Abrahams**, CEE Assistant Professor **Constantine Samaras**, EPP Associate Research Professor **Mike Griffin** and CEE/EPP **Professor H. Scott Matthews**, outlines in their paper.

“We went a step beyond just the emissions from exporting the natural gas and looked at how it might be used when it gets to its destination, such as to displace coal or other forms of natural gas,” says Abrahams, the corresponding author. In the majority of the outcomes the researchers considered, they found the most likely outcome is that U.S. energy exports would help reduce global GHG emissions.

There are social costs to the U.S.. In particular, increased LNG exports, while lowering global GHGs overall, would increase the GHGs emitted by the U.S. due to methane emissions leaked from the upstream production process. In order to further decrease GHG emissions, the U.S. would need to do everything in their power to reduce these leaks.

The paper, titled “Life Cycle Greenhouse Gas Emissions From U.S. Liquefied Natural Gas (LNG) Exports: Implications for End Uses,” has special significance for climate science because it is the first peer-reviewed paper that quantifies whether exporting U.S. LNG is good for the climate. These findings have major implications for U.S. climate and trade policy. As it stands now, the U.S. Department of Energy deems the export of liquefied natural gas to countries that fall under the Free Trade Agreement (FTA) to be in the public interest, meaning that permits for exports to these countries are approved almost automatically. The highest gas prices, however, exist in non-FTA countries, and exporting LNG to these countries is much more difficult.

“There has been some recently proposed legislation in the U.S. to expedite the approval process for permits to non-FTA countries,” Abrahams explains. “Our research focused on how allowing these exports would impact GHG emissions.”

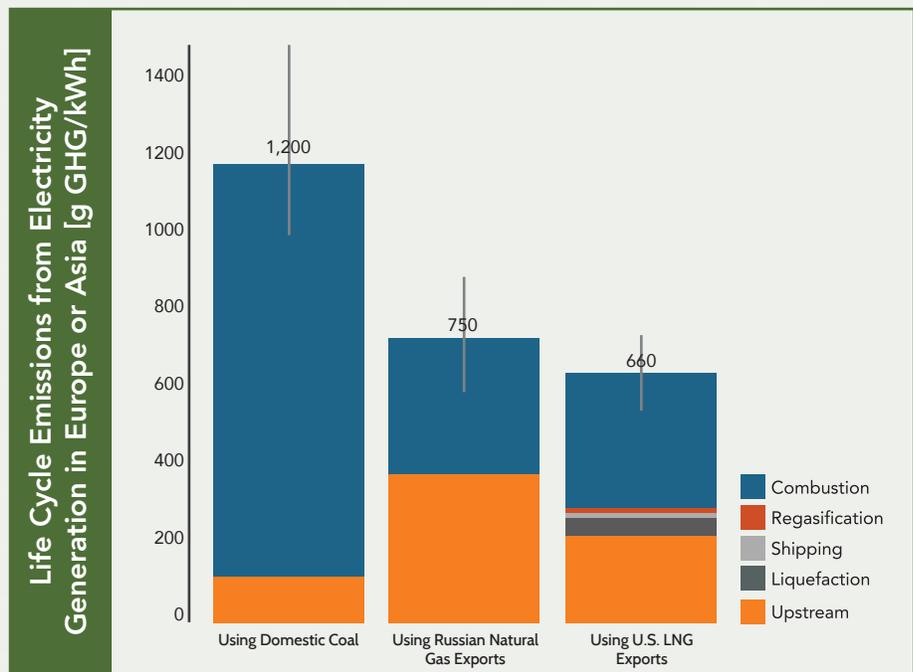
To illustrate the importance of the proposed changes, the team quantified the potential economic benefit of increased LNG exports using the Social Cost of Carbon, a metric by which the U.S. government monetizes the estimated impact of energy decision making.



Visit [bit.ly/cee-lng](http://bit.ly/cee-lng) to see CEE/EPP PhD student Leslie Abrahams discuss her LNG transportation research.

“Our best case scenario used U.S. LNG to displace coal use for electricity generation,” Abrahams says, a scenario that determined a savings of 550 g/kWh. “That equates to a social savings of \$28 per megawatt hour if you consider the net change emissions from coal to natural gas.”

Because the extraction and processing happens in the U.S., however, the carbon emissions from the U.S. specifically increase, so the cost of the increase is \$13 per megawatt hour. The paper emphasizes that the social costs, as well as the benefits, should be taken into account when determining whether increased U.S. LNG exports would be beneficial.



The graduate program in civil and environmental engineering at Carnegie Mellon has long been characterized by its innovation and interdisciplinary collaboration, in education as well as research. This is manifested in both the masters and PhD graduate programs, in different ways.

Masters-level education is aimed at gaining professional depth in a particular area. For civil and environmental engineering, this traditionally means focus in one of the subfields, such as computer-aided engineering, environmental engineering, materials engineering, structural engineering, transportation, or others.

# graduate education Innovations in Education

## Shaping the Next Generation of Engineers

In the late 1990s, in recognition of the increasing diversity of the career interests and directions of our students, CEE introduced a highly flexible masters curriculum that enabled students to assemble a set of courses and educational experiences that aligned with their individual professional goals. Many students have professional interests and goals that span several of the subfields of civil and environmental engineering, and that include topics in business, public policy,

computer science, and other fields. The masters program has requirements for a certain number of course units within the department, but at the same time allows for and encourages course units outside the department. With the flexibility comes the responsibility on the part of both the faculty and the students to ensure that students put together a coherent curriculum that is indeed aligned with a defined career objective. This requires time and careful thought for all involved, but has worked well for our students. The experiences of some current MS students illustrate how the flexibility in our masters curriculum is used by our students.

A photograph showing Assistant Professor Costa Samaras standing at the front of a classroom, holding a paper and addressing a group of students. The students are seated at desks, some looking towards the professor. The room has large windows in the background, letting in natural light.

Assistant Professor Costa Samaras leads a discussion in Climate Change Adaptation, one of the newly developed courses that helps prepare the next generation of civil and environmental engineers.

## The Science of Team Work

“With this breadth, you’ll be more prepared for industry.”



Reklaoui

**Lamya Reklaoui** (MS '15) chose CEE because it offered her an interdisciplinary approach to engineering. With her professional interests in smart infrastructure and computer-aided engineering, she needed a program that offered her a multi-faceted approach. She needed a program that not only focuses on traditional coursework, but also integrates computer applications along with civil engineering infrastructure and all the related aspects.

This interdisciplinary approach is facilitated by the flexibility of the CEE masters curriculum. Because the department requires no set of fixed courses that all students must take, Reklaoui was able to work with her advisor, **Mario Berges**, to develop a curriculum specifically tailored to her needs.

Advisors are an invaluable resource to students, and faculty support students in more ways than academic advising. Reklaoui found the Data Acquisitions course, taught by her advisor, quite valuable in developing her career goals. The course develops students’ skills in applications of design and analysis, and it definitely increased Reklaoui’s interest in computer-aided engineering.

“My group designed a sensor-based prototype that uses temperature sensors,” Reklaoui described. “Our project was called the Smart Window Project. The goal was to save energy using this sensor-based prototype and along with this came learning how to use LabVIEW.”

In almost every course, students work on projects that require team work. This kind of experience is invaluable in preparing students for jobs in an industry that requires civil engineers to work in interdisciplinary teams. “We all come from different backgrounds and we all have different interests,” Reklaoui said, “so we all learn from each other.”

## Straddling the Boundary



Zwierlein

While the graduate focus areas can help students direct their studies, students are not limited in their choice. **Ben Zwierlein** (MS '15) focuses on structural engineering, but like Reklaoui his interests extend to related topics. He wants a broad approach to structural engineering so he won’t be limited in what he can do with it. After he graduates, he will begin a job in a relatively new firm and he will be expected to fulfill several different roles, which include

analyst, designer, and policy-writer.

“They’re looking for someone who can do a little bit of everything,” Zwierlein explained of his future employer. They need individuals with skills from structural analyzing on one side and policy writing on the other side, field engineering work and design.

In CEE’s flipped classroom, students learn theoretical topics by listening to pre-recorded lectures or videos before class while time in class with the instructor is spent solving problems and reviewing examples and applications. Assistant Professor **Matteo Pozzi** has followed Dean **James Garrett**’s example and pre-recorded lectures so he can dedicate class time to hands-on applications. The benefit of this flipped classroom is that students have more time to pose questions, interact with their instructor, and work on examples under instructor supervision. In a traditional setting, students encounter a topic in class for the first time, but in the flipped classroom, they can calibrate the learning speed as they can listen again to any part of the recorded lecture. Time spent in class is more effective, as students are already familiar with the topic that will be covered. If students have any difficulties with a topic, the time in class can be spent on clarifying these issues. In the flipped class, students get valuable experience solving problems and exploring applications.



Flipping the Classroom

Zwierlein needed a different approach. Sure, he has interests in structural engineering, but he also has professional interests that lie in the graduate focus area, Mechanics, Materials, and Computing (MMC). Fortunately, because of the flexibility in the program, he didn’t have to choose. He takes classes in both the MMC and AIS focus areas. “I liked that I didn’t have to pick one or the other,” he said. “I’ve tried to balance myself between the two.”

In addition to balancing his coursework between AIS and MMC, Zwierlein also plans to take advantage of the interdisciplinary aspect of the program. He wants to take a class in Engineering and Public Policy to get some experience in procedural writing, which will help him fulfill one of the requirements of his future job.

Like Reklaoui, Zwierlein has also benefitted from the hands-on approach in CEE classrooms. He is currently taking the Advanced Infrastructure Project course with Professor **Susan Finger**, which incorporates a client project. The client is IBM Group and the goal is to define a project suitable for them. The clients are interested in developing smart infrastructure, so Zwierlein and his team conducted over 100 interviews with faculty, students, and staff on campus to find out what they thought a smart infrastructure campus might look like.

From those interviews, Zwierlein’s team built a composite visionary scenario of the best ideas. In the scenario, they followed an undergrad student, a PhD student, and a faculty member through a day, 30 years in the future, as they used elements of the smart infrastructure. “There were no limits to the visionary scenario,” Zwierlein said. It didn’t so much matter how it happened, just that the possibilities existed.

In their scenario, Zwierlein explained that students would come into the classroom, sit down at their desks, and their chairs would automatically re-position to the students' preferences. "You just draw a square on the table," Zwierlein adds, "and it's got your computer and it uploads information from the Cloud."

From that scenario, Zwierlein and his team picked through the ideas and chose some that would be feasible to develop. "We're going to try to put together some sensors and sense temperature, humidity, lighting, CO<sub>2</sub>," Zwierlein said. "We're trying to detect patterns of usage for different rooms." Hopefully, Zwierlein explained, if they can identify patterns of usage, they can build a system based on those patterns where heating and cooling are only implemented when necessary, not constantly or simultaneously.

"I like forming a project, seeing it come together," said Zwierlein, "working together with a bunch of different people, the different parts, coordinating things."

## Designing Education



Rodrigues

**Thiago Rodrigues** (MS '15), whose passion for sustainability led him straight to CEE where he is structuring his graduate studies in preparation for a career in environmental engineering and sustainability. He intends to return

to his home in Brazil to start his own consulting firm, blending what he's learned about mechanical engineering from his undergraduate work with what he's learning about sustainability and infrastructure so he can provide better services to clients.

So far, Rodrigues has stuck to courses mostly within CEE and taken courses about civil investments and sustainable buildings, but has also branched out into the Engineering and Public Policy department to take courses on policy related to climate change and energy. "Both departments are very linked," he explained. "We have this policy linked with the technology, which makes a lot of sense."

The flexibility in the curriculum will enable Rodrigues to take business and economics courses to prepare him for the administrative side of business ownership, not to

## Tech in the Classroom - Strategic Plans

The College of Engineering is stimulating innovation and technology in the classroom across the college. CEE's Associate Professor Kelvin Gregory is a member of a college-wide committee known as Technology Enhanced Quality Education (TEQIE) that is charged with developing a strategic plan for online and technology-enhanced education, including ways to support the many and varied experiments in technology-enhanced education across the College of Engineering.

Since pulling together the committee, Dean James Garrett has committed to leveraging CMU's expertise in computing technology and education to continually improve undergraduate and graduate education through dedicating resources that enable and support faculty to bring novel technology into the classroom. This effort leverages the university-level Simon Initiative ([cmu.edu/simon](http://cmu.edu/simon)) for study of the effectiveness of different educational approaches. The College of Engineering plans to create a learner-focused database that catalogs learner experiences for various classroom technologies and establish metrics that enable the best technologies to be clearly understood and more easily adapted by the faculty.

mention learn more about the "social aspect of sustainability."

Because he plans to have a career where he will communicate directly with clients, Rodrigues appreciates the opportunity to develop his communication skills in courses

that require teamwork. "In every class, we are required to work in groups, and I think that is great actually," Rodrigues explained. "It's a very international department so you have to put ideas from different parts of the world together."



## Chi Epsilon Launches Educational Initiatives

CMU's Chi Epsilon chapter has been ramping up its commitment to education, introducing new initiatives to provide opportunities for its members to connect with the CEE community. The chapter launched a monthly research seminar series in which CEE faculty are invited to deliver talks about their current research to the student body. "The lecture series is about giving back to the community," says Chapter President **Stacie Lackler** (BS '14, MS '14). "We want to create more opportunities for students to learn about the research our professors are conducting and how they can get involved."

Chi Epsilon is also strengthening its alumni relations, so students can tap into networking and job opportunities as they approach graduation. "Developing a strong alumni system will provide a huge professional advantage for our members," says Lackler. By planning an alumni event for Carnival, she hopes to lay the groundwork for her successor to continue these important connections.

They are also collaborating with the American Society of Civil Engineering (ASCE) student chapter to institute a mentor program, in which undergraduates can benefit from the experience of upperclassmen. "Getting advice about what courses to take or how to manage your time from someone who's been there is really helpful, but it can be daunting for younger students to approach the seniors," Lackler explains. "This is helping to break a lot of those boundaries."

# Following in the Footsteps of Innovation

Today's young engineers are realizing the dreams of yesterday's science fiction. Take PhD candidate **Irem Velibeyoglu's** innovative Footstep project. Guided by her advisor, CEE Assistant Professor **Hae Young Noh**, Velibeyoglu is developing cutting edge technology that will allow a building to assess the characteristics and whereabouts of its occupants, through the vibrations made when their feet hit the floor. "Vibrations are unique to people, like your fingerprints," she explains. "It's an amazing feature."

In the future, she says this technology may be incorporated into the designs of smart structures, as an alternative to additional sensor devices. Not only will it be useful from an engineering and a security perspective, she says it could be a valuable tool in the retail business, because it allows for more advanced customer tracking.

Velibeyoglu has always had a passion for research. In June 2014, she received her BS in Civil Engineering from Middle East Technical University (METU) in Ankara, Turkey, her native country. There she became inspired by two of her instructors, **Aysegul Askan Gundogan** (PhD '06) and **Asli Akcamete Gungor** (PhD '11), both of whom earned their PhDs from CMU. "I am very eager to combine new things, and produce new technologies, using many different fields," says Velibeyoglu. "Carnegie Mellon seemed like the right place for that."

Now halfway through her first year as a PhD candidate, expresses gratitude for the funding she was awarded as a recipient of the Dr. Elio D'Appolonia Graduate Fellowship, which honors the legacy of D'Appolonia, an influential former professor in the department who helped to define the multidisciplinary, creative approach that has become the hallmark of Civil Engineering at CMU.

D'Appolonia taught engineering at CMU from 1948 to 1956 before going on to found his own geotechnical engineering firm, D'Appolonia Consulting Engineers. He became internationally renowned for his business acumen and innovative approach to solving

engineering challenges. Employees under his mentorship went to become leaders in the world of geotechnical and environmental engineering.

"Elio D'Appolonia had a tremendous impact on helping to define the field of geotechnical engineering, and on the careers and lives of many people he attracted to work with him," says CEE Department Head **Dave Dzombak**.

"The D'Appolonia Graduate Fellowship will help us extend his impact and innovative spirit to generations of new students like Irem," says Dzombak. "Her breakthrough work with Professor Noh in the Footstep project is an excellent example of how that spirit will live on."

The fund was started with a leadership gift from the Devandra and Kshama Shukla

"...he appreciates our innovative solutions to structural engineering, and I am also interested in structural health monitoring. That interest is a common theme in our work"

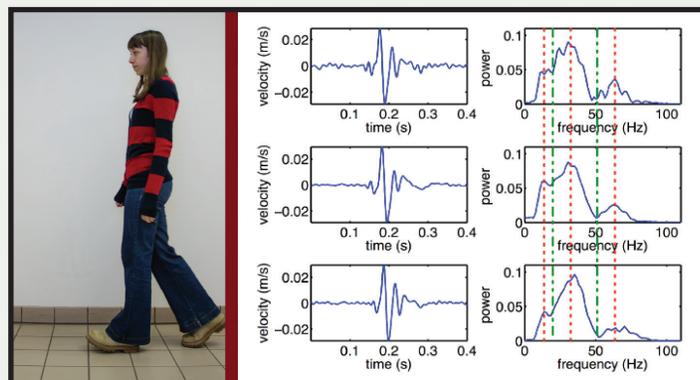


Velibeyoglu had the opportunity to meet and thank Dr. D'Appolonia and his wife, Valentina at a luncheon in December.

Last December, Velibeyoglu was able to meet with D'Appolonia. She says he was impressed by her work on Footstep. "We focus on different aspects of engineering. But he appreciates our innovative solutions to structural engineering, and I am also interested in structural health monitoring. That interest is a common theme in our work."

Throughout his career, D'Appolonia was committed to the idea that learning is an ongoing process. Now, the fund that has been created in his name is helping students like Velibeyoglu.

Foundation, and continues to build through the generosity of alumni, many of whom were D'Appolonia's students, as well as several of his friends and former colleagues. Thanks to their continued support, the CEE department plans to sustain the D'Appolonia fund indefinitely.



Velibeyoglu demonstrates how her footsteps are recorded and visualized by the floor sensors.



## Controlling Bacteria to Maximize the Sustainability of Fracturing

Professor Kelvin Gregory finds that reusing wastewater from hydraulic fracturing selects for extremophile bacteria

Of all the things that come to mind when you think about hydraulic fracturing—or fracking—in the state of Pennsylvania, the effect it’s having on bacteria probably isn’t one of them. But according to Professor **Kelvin Gregory**, it should be. In a recently published study, the first of its kind, Gregory has revealed that by reusing its wastewater, the fracking process is cultivating bacteria that are not only hazardous to environmental and human health, but that may also be negatively affecting the quality of gas that is being produced at the surface.

Every year in the state of Pennsylvania, fracking produces large quantities of wastewater that cannot be reincorporated into the local water supply.

Transporting this wastewater to the deep-well injection points where it is disposed of is both expensive and potentially hazardous, so instead this wastewater is often retained for use in subsequent fracks. This has the added benefit of reducing the amount of fresh water that must be sourced to enable further fracking.

Because bacteria in the frack water can degrade the walls of the fracking wells and produce malodorous chemicals, the water is treated with chemicals called biocides that are designed to eliminate bacteria. Yet, according

to Gregory, little is known about the bacteria that may be present in the wastewater, making the long-term effects of this treatment and recycling process unclear. “Up until now, there was a big question about whether the microbial community was active at all,” says Gregory, “but one of the important things that we’ve found here is an active microbial community that is changing over time, implying that it is in fact dynamic.”

By providing more information about the environmental effects of fracking on a microbial level, Gregory hopes to encourage the natural gas industry to take a more holistic approach in their strategies for production with use of fracking. “Instead of just

thinking about what’s going to optimize gas production, we need to think about designing hydraulic fracturing fluids with an end point microbial community in mind.” According to Gregory, ideal strategies for water management would encourage the survival of those microbial communities that might have a beneficial effect in the produced water over time, while minimizing harmful bacteria.

The bacteria that Gregory discovered are “extremophile,” meaning that they have evolved to withstand extreme conditions: high temperatures, high pressures, and high

concentrations of salt. They may also be developing resistance to the biocides that are used to kill them. These tough bacteria appear to have evolved genes for producing sulfide, a toxic and corrosive compound. When sulfide enters the gas stream during drilling, that gas becomes “sour” and must be removed, meaning significantly higher treatment costs for the industry. So reusing the treated wastewater is helping to select for bacteria that not only produce sulfides, but have developed a resistance to biocides—and according to Gregory, these bacteria are going to be harder to treat in the next well, and even more expensive.

Gregory says he isn’t surprised to find that the bacteria are able to withstand treatment with biocides. “Mother nature finds a way to win every time,” he says. “Whenever we as engineers and scientists think that we can beat her, she always seems to prove us wrong.” He says that by gaining a better understanding of these bacteria, we will be better able to identify problems that could result from bringing them into the next well through the recycled water. Gregory’s goal in pursuing this line of research is to assist the industry in designing better tactics for frack water management. “We need to identify strategies for controlling the microbes, and for managing the water, that enhance the economic sustainability of oil and gas recovery, while also reducing its environmental footprint,” he says.

**“Instead of just thinking about what’s going to optimize gas production, we need to think about designing hydraulic fracturing fluids with an end point microbial community in mind.”**



# Senior Design

Students in CEE Senior Design – Fall 2014 were “hired” by Kristoff, the iceman, to design and build a portable bridge that would aid Queen Elsa of Arendelle; her younger sister, Princess Anna; Olaf, the snowman; Kristoff; and his trusty reindeer, Sven in their ascent of the North Mountain.

The ten teams designed bridges that needed to be three feet in length and made in one piece using only ice and steel reinforcing wire.



## Hendrickson Elected to National Academy of Construction

Hammerslag University Professor **Chris Hendrickson** was recently inducted into the National Academy of Construction (NAC) at their annual meeting in Austin, Texas. Hendrickson was one of 28 new inductees and joined 187 members who share this distinction.

The National Academy of Construction, established in 1999, is an organization of industry leaders who have made outstanding contributions to the engineering and construction industry. It is composed of a wide variety of industry representatives, including construction users, designers, constructors, consultants, attorneys, sureties, and academics. In addition to being a personal honor, election to the Academy allows members to volunteer their expertise to a variety of organizations, governmental and nongovernmental, for the betterment of the industry as a whole.

Hendrickson was selected for the NAC in part because of his outstanding systems-oriented research and his leadership in construction project management, transportation, and green design. He is the Director of the Traffic 21 Institute and editor-in-chief of the American Society of Civil Engineers (ASCE) Journal of Transportation Engineering. His research contributions range from computer-aided engineering to transportation systems to project management and environmental systems. Hendrickson developed a travel distance formula as part of his doctoral work in 1978 for random stops that is still in use today for home service planning.

Hendrickson and others at the former CMU Engineering Design Research Center pioneered an experimental building design system that spanned initial concept through construction scheduling and animation. He is the co-author of five books and numerous articles in professional literature. For the past 20 years, he has focused on green design and the environmental life-cycle consequences of alternative product and process designs.

The recipient of many teaching awards and several recognitions and honors from industry groups, Hendrickson is a member of the National Academy of Engineering, a Fellow of the American Association for the Advancement of Science, a Distinguished Member of ASCE, and an emeritus member of the Transportation Research Board.



Chris Hendrickson (right) with NAC President MG Joseph Ahearn (left) at the induction ceremony.

## ASCE Names Dean Garrett Civil Engineer of the Year

Dean of Engineering and Thomas Lord Professor of Civil and Environmental Engineering **Jim Garrett** was recently named Civil Engineer of the Year by the Pittsburgh Section of ASCE. Dean Garrett was recognized for his meritorious achievements and improvements in the practice, and applications benefiting the field of civil engineering.

Throughout his career, Garrett's research and teaching have been focused on bringing advanced computing and information technologies to bear on civil engineering problems. His research interests have included applications of sensors and sensor systems to civil infrastructure condition assessment; mobile hardware/software systems for field applications; representations and processing strategies to support the usage of engineering codes, standards, and specifications; and knowledge-based decision support systems. Garrett holds two patents, is the author of more than 250 technical publications, and is very active professionally, especially with ASCE and IABSE.

Garrett's research has had significant impact and is recognized nationally and internationally. He has received numerous awards, including the Alexander von Humboldt Research Prize in 2012; the CIT-ICES Steven J. Fenves Award for Systems Research in 2007; the ASCE Computing in Civil Engineering Award in 2006; the ASCE Journal of Computing in Civil Engineering Best Paper Award in 2002; the Alexander von Humboldt Research Fellowship in 1994; the ASCE Wellington Prize in 1993; the IABSE Prize from the International Association of Bridge and Structural Engineers in 1992; the Moisseiff Award from the ASCE Journal of Structural Engineering in 1990. For his professional accomplishments, his research contributions to civil engineering, and his professional service to ASCE, Garrett was elected as a Fellow of ASCE in 2009.

Since becoming Dean of the College of Engineering in 2013, Garrett has led in the creation of a new strategic plan, and launched a number of new initiatives in research (e.g., advanced manufacturing, soft robotics, smart infrastructure), communications, faculty development and educational programs for innovation and entrepreneurship.



William Gross (right) presents James Garrett with the ASCE Civil Engineer of the year award.

## VanBriesen Receives Two Prestigious Awards



Duquesne Light Company Professor **Jeanne VanBriesen** has received two prestigious awards in recognition of not only her technical and environmentally focused research, but also her leadership and commitment to mentoring women pursuing careers in engineering.

ASCE named VanBriesen the 2015 recipient of the Margaret S. Petersen Award. The award is named for Petersen, a pioneer in hydraulics and water resources engineering. “Margaret

Petersen was a prominent figure in water resources engineering, and a powerful force for mentoring,” says VanBriesen. “What touches me most about this award is being linked with her.”

This ASCE award, in its second year, aims to recognize women who make an impact by guiding the next generation of women engineers and who also, like Petersen, make significant contributions to the area of water resources engineering.

VanBriesen will accept the Margaret S. Petersen Award at the annual World Environmental and Water Resources Congress in Austin, Texas this May, where she will give a keynote presentation. Many of her current and former students will be in attendance.

The Carnegie Science Center awarded the 2015 Carnegie Science Environmental Award to VanBriesen in recognition for her water quality research. She was one of five CMU faculty members who were honored at the award announcement ceremony in February. The Carnegie Science Awards recognize and promote outstanding science and technology achievements in western Pennsylvania. She will be presented with her award in May at a their annual banquet.

VanBriesen’s research is in biological processes in the environment, with an emphasis on engineered water systems. For the past 15 years, VanBriesen has focused on combined sewer overflows, drinking water quality, and the impacts of resource extraction. Her research on the treatment and discharge of drilling wastewater was instrumental in developing Pennsylvania state policy. VanBriesen currently serves on the U.S. EPA Science Advisory Board.



VanBriesen Research Group

## Professor Small Honored as ASCE Professor of the Year

Heinz Professor Mitchell Small was honored with the ASCE Pittsburgh Section Professor of the Year award in recognition of his achievements and dedication as an engineering educator and researcher. He is jointly appointed in the Departments of Civil and Environmental Engineering and Engineering and Public Policy.



Small joined the department in 1982 and has consistently received high marks from his students for his teaching. A hallmark of Small’s style is that he shows students, in an engaging way, how quantitative analysis can bring deep insight and predictive ability in analysis of engineering problems, design, and policy formulation and analysis. He equips students with quantitative tools in statistical modeling and process modeling that enable them to excel in practice, academia, and government.

In 2005, Professor Small completed a textbook with two of his former PhD students, Anu Ramaswami (MS ‘89, PhD ‘94) and Jana Milford (MS ‘85, PhD ‘88). The book, entitled “Integrated Environmental Modeling: Pollutant Transport, Fate and Risk in the Environment,” has been adopted by instructors in environmental engineering and science programs across the U.S.. It defines the discipline of multimedia environmental modeling with a bridge to human exposure assessment, health effects, and regulatory decision support.

He has made numerous contributions to advancing knowledge in civil and environmental engineering, and related areas of public health and public policy. He is widely recognized as a national leader in the development of integrated assessment for civil environmental engineering decision making. His path breaking research has focused on building and applying models that link contaminant fate and transport, human behavior, exposure, and risk to inform engineering decisions as well as policy and regulation formation. Small’s work has significantly advanced stochastic approaches in environmental engineering modeling, where the need is great because of the variability in the natural and engineered systems of interest. Furthermore, he has linked the results of stochastic modeling directly to civil environmental engineering decision making.

## Akinci Patents a Revolutionary New Approach to Data-Fusion



When it comes to engineering, the more information you have the better. Knowing as much as possible about a given environment can help project engineers better assess potential risks and account for any factors that may affect construction. Today, the prevalence of sensor technologies allow engineers access to more information than ever before. But from different sources exists in different formats, it is difficult to combine.

In order to get the most out of the information that exists, Paul Christiano Professor **Burcu Akinci** and former PhD student **Anu Raj Pradhan** (PhD '09) have devised a cutting edge approach to data-fusion. The federal government has just issued them a patent for the algorithm, which makes it possible to extract information from multiple data sources, bring it to the same level, and integrate it for the purposes of answering a specific query.

“From a data science perspective, it offers a new approach,” Akinci explains. “When someone has a query, we fuse the necessary information to answer only that query, but the original data source remains as is. So you don’t have a big bulky database to deal with, and you don’t have to worry about storing and maintaining all that information, because data is integrated on demand to answer a specific query.”

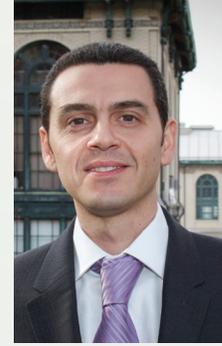
Akinci has already been recognized for her contributions to the world of engineering. In 2011 she was named Professor of the Year by the American Society of Civil Engineers (ASCE) Pittsburgh Section for her exceptional teaching ability and significant contributions toward improving professional aspects of Civil Engineering education. She also serves as a co-director of the Smarter Infrastructure Incubator (SII), an interdisciplinary research lab at CMU.

Her research is focused on creating technologies that will help cities, government, and industries streamline processes to support construction and operation of smarter infrastructures, through integrating data that is collected from a variety of sensors with semantically rich information models. Akinci plans to use data to enhance information models and a variety of sensors to streamline the way construction and infrastructure projects are managed, and sees this new data-fusion method as contributing to that goal.

“This approach would be useful I would say not just for construction but for integration of any kinds of data sources that are heterogeneous,” she says. “We are moving into a big data world, and we have to learn to take advantage of the data that is available. Given the nature of where we’re going, I see this approach being used in different phases of a facility life cycle.”



Berges



Karamalidis



Pozzi

## Berges Awarded Dean’s Early Career Fellowship

Assistant Professor **Mario Berges** was recently awarded a Dean’s Early Career Fellowship from the College of Engineering. The award was established to recognize deserving untenured faculty members.

Berges’ research group, INFERLab, focuses on researching and developing technologies to improve the operational efficiency, resilience, adaptiveness, and autonomy of built environments.

## Karamalidis and Pozzi Awarded Berkman Faculty Development Grants

Associate Research Professor **Athanasios Karamalidis** is one of the awardees of the CMU Berkman Faculty Development Grant. Karamalidis’ project focuses on developing an absorbent technology for separating rare earth elements from selected aqueous media. As part of this study, Karamalidis will look at how to develop an example selective sorbent and incorporate it into a polymer backbone to increase capacity.

Assistant Professor **Matteo Pozzi** was also awarded a CMU Berkman Faculty Development Grant. Pozzi’s proposal, “Sensing Networks for Urban Systems,” will investigate how sensing networks extended to a whole urban area can improve the safety and efficiency of infrastructure systems. As part of this study, Pozzi will look at how a network of sensors can be placed and deployed for infrastructure monitoring so as to collect meaningful data in an efficient manner.

## CEE Welcomes Meagan Mauter



Assistant Professor **Meagan Mauter** was welcomed as the newest member of CEE. Mauter has been working closely with many of the CEE faculty since she joined the CMU faculty in 2012 with a joint appointment in the Departments of Chemical Engineering (ChemE) and Engineering and Public Policy (EPP). She will now have a joint appointment in CEE and EPP and is looking forward to joining the department.

“It is a great pleasure to be joining CMU’s esteemed CEE faculty,” she says. “My formal move into the department will allow us to strengthen our interdisciplinary work on materials and processes for aqueous separations and water treatment.”

As an educator, Mauter has long been committed to interdisciplinary collaboration. She received her PhD

## Acharya in High Demand

It's going to be a busy year for CEE professor **Amit Acharya**. He has been awarded a total of three prestigious visiting professorships at universities in Europe and Asia, thanks to his internationally recognized expertise in mechanics, materials, and computing.



In April 2015, Acharya will go to SISSA, The International School for Advanced Studies, in Trieste, Italy, where he has been invited to deliver a series of lectures on the subject of continuum mechanical modeling of the dynamics of dislocations. SISSA is an international, state supported, post graduate teaching and research institute in Italy with a special statute, aiming to promote science and knowledge, particularly in the areas of Mathematics, Physics, and Neuroscience.

Acharya will then head to England from September to November, 2015, where he will hold a Leverhulme Visiting Professorship at the University of Bath, awarded by the Leverhulme Trust, U.K.. In Bath, he will work in the Dept. of Mathematics, collaborating with researchers there and from Nottingham and Edinburgh. He will deliver the Leverhulme Lectures on defect mechanics and one aimed at a general audience in the Mathematical Landscapes series. During this time he will also be visiting Oxford, Cardiff, and various other universities throughout the United Kingdom.

Following this appointment, Acharya will head to Israel for two months, where he has been awarded the Rosi and Max Varon Visiting Professorship at the Weizmann Institute of Science, which is a top research institute in Israel. He will be based in the Department of Mathematics and Computer Science collaborating to advance his research on coarse-graining nonlinear evolution equations.

## Plotting a Course for the Future: Susan Finger Completes NSF Service

When Professor **Susan Finger** was named a Program Director for the National Science Foundation (NSF), she was given a unique opportunity to influence engineering education on a national scale. Working in the Division of Undergraduate Education (DUE), she relied on her 30+ years of teaching experience to make recommendations about which proposals would best use the three million dollars the NSF distributes each year to Science, Technology, Engineering, and Mathematics (STEM) education.

Susan was selected through the Intergovernmental Personnel Act to serve as one of the foundation's rotators, who make up roughly half of its scientific staff. Through its rotator system, the NSF calls upon the expertise of professionals across the STEM disciplines to guide its decision making. "The idea is you keep bringing in new people and you keep the ideas fresh," she explains. "You have new people in with new ways of looking at things. It keeps the ideas lively."

One of the things she enjoyed the most working at the DUE was the opportunity to collaborate with this diverse group of educators, who were selected from the STEM disciplines for their excellence in education to promote progress through education research. Susan and her fellow rotators each lent their unique perspectives about what constitutes effective teaching methods. "It's a very collegial atmosphere," she remembers. "You can talk to someone who's an expert in biology education and someone who's interested in math education while you're talking to someone who works in engineering education. So you get really interesting conversations."

In addition to this interdisciplinary collaboration, her work put her in direct communication with engineering faculty in the earliest stages of the research process. Susan says she enjoyed this exclusive glimpse into burgeoning research. "It's the same thing that's fun about graduate students," she reflects. "You talk to them about what their educational goals are, and you ask them, is what you're doing based on what we know about how people learn? And when you do it in your classroom, how are you going to know what your students are learning?"

In her four years at the NSF, Susan worked on over 250 education projects, although she reviewed hundreds more. "There are between 8-10 proposals for every one that gets funded," she explains. "Over four years, I had something to do with each one of them."

Throughout that time, she remained dedicated to her own work as an educator. She was awarded an Independent Research Grant that allowed her to make the round-trip from Washington D.C. to Pittsburgh nearly every weekend, in order to meet with her graduate students. Now back at CMU, she says she's looking forward to engaging with the newest crop of engineering students. "When I was ready to come back I told my colleagues at NSF that I missed teaching. But then once I got back I realized that what I really missed was interacting with students."



Susan Finger (center) pictured above with Janis Terpenney and Mary Lee Ledbetter, who also served as NSF Program Directors.



in Chemical and Environmental Engineering at Yale University, after completing undergraduate degrees in Civil and Environmental Engineering and History at Rice University. Her present research focuses on the intersection of water and energy. She applies novel materials, advanced treatment processes, and innovation analysis to the pressing challenge of resource efficiency.



Left to right: Jim Thompson, Paige Sieffert, Miriam Hegglin, and Dave Dzombak

## CEE Undergrads Recognized at ASCE Student Awards

Three CEE students: Miriam Hegglin, Paige Sieffert, and Millard McElwee were recognized at this year's ASCE Pittsburgh Annual Awards Banquet as emerging leaders in civil engineering. These students were celebrated for their distinguished academic achievements as well as their successes outside of the classroom.

### American Bridge Leadership Award

**Miriam Hegglin** (BS '15) has an impressive academic record in addition to numerous leadership roles in several student organizations. She has served as project leader with Engineers Without Borders (EWB) and as ASCE chapter president, social chair, and sophomore representative.

### American Bridge Achievement Awards

**Paige Sieffert** (BS '16) has expanded her leadership roles within the ASCE chapter to include her service as ASCE chapter secretary this year and captain of the Steel Bridge team. She is also an active member of Chi Epsilon and a member of the varsity swim team.

**Millard McElwee** (BS '15) has demonstrated a remarkable level of leadership on campus as CMU ASCE chapter's vice-president, as a member of both the National Society of Black Engineers and the CMU President's Multicultural Student Advisory Council.

## Recent PhD Theses

**ELFATHI AHMED** - *Structural Design and Economic Analysis of Suspension Bridges Constructed Using FRP Deck* - Advisors: Garrett and Sobrino

**RACHEL HOESLY** - *Implications of Mobility, Population Shifts, and Growth for Metropolitan Energy and GHG Emissions Planning* - Advisors: Matthews and Hendrickson

**EMRE CAN KARA** - *Data-Driven Approaches to Demand Response: Studies on Thermostatically Controlled Loads and Electric Vehicles* - Advisor: Berges

**CHANG LIU** - *Singular Value Decomposition Applied to Damage Diagnosis for Ultrasonic Guided Wave Structural Health Monitoring* - Advisor: Oppenheim

**JASON MARSHALL** - *Atomistic Multiscale Modeling with Long-Range Electrostatic Interactions* - Advisor: Dayal

**HARIPRASAD PARTHASARATHY** - *Arsenic Dissolution from Sedimentary Formations Under Geologic Carbon Dioxide Storage Conditions* - Advisors: Karamalidis and Dzombak

**GWEN DI PIERTO** - *Economic Value, Resiliency and Efficiency of Inland Waterway Freight Transport in the Ohio River Basin* - Advisors: Hendrickson and Matthews

**MOHAMMAD HOSEIN POURMATIN** - *Computational Multiscale Methods for Defects: 1. Line Defects in Liquid Crystals; 2. Electron Scattering in Defected Crystals* - Advisor: Dayal

**AKANKSHA VISHNOI** - *Homogeneous Dislocation Nucleation* - Advisors: Maloney and Acharya

**HUI WANG** - *Scenario-Based Prediction of U.S. Water Withdrawal and Consumptive Water Use* - Advisors: Dzombak and Small

**YUXIN WANG** - *Source Water Quality Assessment and Source Water Characterization for Drinking Water Protection* - Advisor: VanBriesen

**XUE YANG** - *A Formal Approach to Provide Information Support for Troubleshooting of HVAC Related Problems* - Advisor: Ergan



Davis



Roscoe

## More Great Student Experiences Online:

### CLEARED FOR TAKEOFF: CEE Senior Spends Summer at NASA

CEE Senior **Kiera Davis** launches her construction career through second summer internship with Hensel Phelps. [ [bit.ly/davis-internship](http://bit.ly/davis-internship) ]

### Creating Economic Opportunities in Thailand

CEE and E&TIM masters student **Tessa Roscoe** travelled to Thailand this summer to explore alternative business options for an impoverished village in Chiang Rai where she learned the value of appreciating the needs of the customer over the technical feasibility of the product. [ [bit.ly/roscoe-internship](http://bit.ly/roscoe-internship) ]

# Student Awards

## Andrew Carnegie Society Scholars



**Miriam Hegglin (BS '15)** has served in ASCE leadership roles including president of the chapter. She spent the summer in Germany studying the social dimensions of sustainability as the recipient of a competitive international research experience offered by the German Academic Exchange Service. She also received recognition in the Undergraduate Environmental Research Award category at the Meeting of the Minds in May.



**Maddie Gioffre (BS '15)** has served as ASCE treasurer and is a past president of Engineers Without Borders (EWB). She spent part of her summer in Ecuador installing thatch roofing made from recycled plastic bottles. She has been instrumental in EWB's growth at Carnegie Mellon. In her sophomore year, she spent a summer in India as part of the iStep program, developing technology to assist visually impaired children.

## CEE Alumni Fellowship



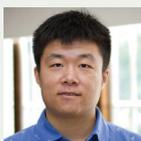
**Chelsea Kolb (EESS PhD)** is focusing her research on climate change adaptation for water and wastewater infrastructure systems, as part of the new Climate Change Adaptation Initiative launched in the Department. This new research initiative hopes to explore climate adaptation strategies for infrastructure systems, helping to make our built environment more resilient in the face of climate change. (Advisors: VanBriesen and Pozzi)

## Jared and Maureen Cohon Graduate Fellowship



**Kenneth Sears (EESS PhD)** was awarded this fellowship to help support his research which focuses on how excess water vapor from thermoelectric plants can be captured, condensed and reused. The potential capturing of excess water vapor in power plants will assist in necessary measures for climate change adaptation and provision of future accessible surface water. (Advisors: Lowry and Samaras)

## Julia and Michael Ellegood Doctoral Fellowship



**Xuechen Lei (AIS PhD)** was awarded the Ellegood Fellowship to help support his work which looks at integrating Building Information Modeling (BIM) and sensor technology for use in larger infrastructures. (Advisors: Akinici and Berges)

## Northrop Grumman Fellowship and Bradford and Diane Smith Fellowship



**Lauren Strahs (EESS PhD)** was awarded two fellowships to help support her research which looks to characterize, predict, and mitigate organic fouling that occurs with membrane treatment for desalination. (Advisor: VanBriesen)

## John and Claire Bertucci Fellowship



**Vaibhav Agrawal (MMC PhD)** models dynamic structural phase transformations, which is usually seen in certain metal alloys. These materials are useful for making small-scale sensors and actuators and have diverse applications in aerospace, automotive and biomedical sectors. (Advisor: Dayal)



**Hanqi Chen (EESS PhD)** is focused on developing statistical methods and modeling tools to aid in the assessment of the occurrence and magnitude of fugitive emissions at shale gas drilling sites. (Advisor: Small)



**Eric McGivney (EESS PhD)** will use his fellowship support to continue his research on the effects of nanoparticles on cell-to-cell signaling. (Advisors: VanBriesen and Gregory)



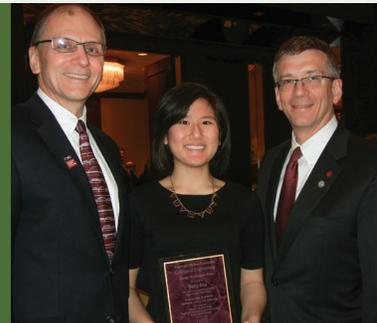
**Argha Namhata (EESS PhD)** is modeling subsurface environment of a carbon dioxide (CO<sub>2</sub>) geologic storage site. One of the goals of Namhata's research is to predict the fate of the injected carbon dioxide in the subsurface environment and to ensure that it remains in the storage reservoir in perpetuity. (Advisors: Karamalidis and Nakles)

## CEE Senior Wins George Washington Prize

CEE Senior Dolly Hsu (BS '15) was awarded the George Washington Prize at the Annual Engineering Awards Banquet of the Engineers' Society of Western Pennsylvania.

Hsu was recognized for her strength in academics, service, and leadership throughout her studies at Carnegie Mellon. She ranks consistently among the top students in Civil and Environmental Engineering and looks for opportunities for intellectual growth outside of the classroom. Hsu has been a member of the CMU ASCE Steel Bridge Team for three years, serving most recently as Team Captain – one of the few female team captains in the competition.

In addition to distinguishing herself with these accomplishments, Dolly also serves as the current president of Chi Epsilon and has been heavily involved with the Society of Women Engineers, working on campus relations for the Technical Opportunities Conference, and chairing SWE's mentoring program and social events. She organized the civil engineering-related outreach activity for SWE's High School Day last fall, and will be the Co-Chair for SWE's Middle School Day this year. She is dedicated to outreach to young, prospective engineering students.



## CEE Senior Studies Renewable Energy Options

CEE/EPP senior **Yang You** (CEE '15) spent her summer in Switzerland at the École Polytechnique Fédérale De Lausanne (EPFL) researching the logistics of a biorefinery plant to be built in South Africa.

**How did you spend your summer?**

I worked with the head of the Bioenergy and Energy Planning Resource Lab. The project that I was looking at specifically was setting up this biorefinery in South Africa, all the logistics, the cost, what it takes to move the biomass that's produced in the field and transport it to the biorefinery itself.

The feedstock we were looking at was sugar cane. The sugar is harvested away from the field and what's left in the field is the biomass of the plant. There's a lot of energy that can be harvested from it, so we were looking at transporting that. There are a lot of factors that go into it.

**What else was involved in the project?**

We did some chemical lab tests on some samples of this biomass. Another project that I worked on was testing the physical properties of it. I took the biomass and compacted it, used different compacting pressures. By varying that, I was able to see what the durability was and what the content was. Compacting it like that makes it easier to transport.

**How did you get involved in this project?**

CMU has a partnership with EPFL. They came in the fall when I was a junior to give a presentation on this program - what they're expecting, how to apply. You go online and see what lab or professor you would be interested in working with and you can state a preference for three of them. They started this internship program last year, so I was in the first batch of students to go there.

**What CEE classes or faculty helped prepare you for this project?**

Environmental Engineering gave me the chemistry background to understand it. It took me a while to understand how the different inputs and outputs go through. There are a lot of outputs or co-products that are produced. They walked me through it; the chemistry behind it gets very complicated.

**How do you think this experience has influenced your career goals?**

I realized that research isn't necessarily the path for me. You don't really get to see the results of what you do immediately. I want to explore something in industry or consulting, where it's fast-paced and I can see the direct results of my work.

**What skills did you pick up or develop while working on this project?**

I would say designing an experiment. You need to set your variables and your constraints, what you can or can't do, and then expect any type of results. Things can be very unexpected in research in the real world.

**What did you find to be the most surprising or interesting part of this project?**

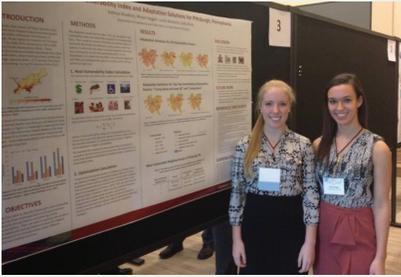
I really enjoyed the topic itself. I didn't fully understand the logistics behind it and how the co-products were created from the biomass, but I asked my professor and he sat down and explained the chemistry behind it. Some of these co-products are fuels that can be used to fuel the biorefinery itself, so in a sense, you can see it as net-zero. It's a very sustainable process where you can use what it produces as input to power it.

*(Pictured: Yang You hiking in Zermatt with other interns with the Matterhorn in the background.)*



## Collaborating to Combat Climate Change

Making Pittsburgh more resilient to the threat of global warming



Bradford (left) and Hegglin present their research at the ARC meeting in Los Angeles

CEE/EPP seniors, **Kathryn Bradford** (BS '15) and **Miriam Hegglin** (BS '15) want to make sure that everyone in Pittsburgh is prepared for the effects of global warming. The research project, "A Heat Vulnerability Index and Adaptation Solutions for Pittsburgh, Pennsylvania," is the culmination of months of research towards finding ways to protect Pittsburgh's citizens from the heat.

The team presented their project in December at the Advancing and Redefining Communities for Emergency Management (ARC) Conference in Los Angeles, California. The goal of this year's conference was to encourage diverse industries to work together to make communities more resilient against threats of natural disasters and climate change.

Bradford and Hegglin's team focused on how Pittsburgh will respond to extreme heat events, which are expected to become increasingly frequent due to climate change. Using an index that considered socioeconomic factors, as well as age, disability, and living conditions, they mapped the heat vulnerability in each of Pittsburgh's census tracts, naming Glen Hazel, East Liberty, and Squirrel Hill South its most vulnerable neighborhoods. In each of these areas, a large portion of the population is elderly and/or disabled, making it difficult for them to evacuate their homes in the event of an emergency, the team said.

Having identified Pittsburgh's most at-risk areas, they then began looking for ways to help. Using the same index, they mapped potential cooling center locations for the most vulnerable areas. The team proposed using pre-existing public spaces such as libraries, senior centers, and schools as an inexpensive solution for protecting susceptible populations against extreme heat events by providing them places to take shelter.

Bradford and Hegglin began this research as a component of their Engineering and Public Policy capstone class, "Climate Adaptation for Pittsburgh," which they took in Spring 2014. Bradford was able to continue the team's research over the summer thanks to the funding she received from the Summer Undergraduate Research Fellowship (SURF) grant.

The team is currently looking to publish their work in the Oxford Journal of Public Health. In the meantime, Hegglin says that the ARC conference was an excellent opportunity to develop their presentation skills, gain feedback on their research, and talk to leaders in the government, engineering, and healthcare sectors. Bradford and Hegglin were able to attend the conference thanks to support from the CEE department.

"I want to thank CEE department head **David Dzombak**, (EPP) instructor **Kelly Klima**, (CEE/EPP) PhD student **Leslie Abrahams**, and my teammates, especially Miriam Hegglin," said Bradford. "CEE is such a nurturing environment that is supportive of assisting students in reaching their goals. They have been encouraging through the entire process of the ARC Conference and for our entire time as undergraduates in the CEE department."



**LOVE  
A DONOR**  
Carnegie Mellon University

The Carnegie Mellon Chi Epsilon chapter sponsored a CEE Love a Donor event in conjunction with the university's Love a Donor Week. CEE undergraduates and graduate students gathered to write personalized thank you notes to supporters of the CEE department.



## You're Hired! : CEE Connects Students to Careers



The student scurries for the door, but **Ashley Patton**, the CEE Director of Career Services nabs him before he gets there. His collar is ruffled and his tie askew. She carefully and efficiently folds everything into place, then sends him on his way. His destination: the CEE Career Fair.

Clad in full professional attire and clutching portfolios stocked with resumes and samples, CEE students crowd around tables and prepare to give elevator pitches to the assembled prospective employers. CEE hosts this career fair twice a year and several companies send multiple representatives to recruit CEE students for internships or full time positions.

Patton, coordinator of the event, brings in companies who are searching specifically for civil and environmental engineers. "It's a very direct match between some of the jobs the Navy is looking for and what the students are studying in this department," explained Petty Officer Robin

Kittell of the United States Navy. "As soon as we saw the information about the event, we definitely wanted to attend."

Employers eagerly return to CMU to recruit on-campus because they have had such good experiences with CEE engineers in the past. As Barbara Pomeroy of NMP Engineering explained, "We have a couple of employees who graduated from here and they really do an outstanding job."

Rizzo Associates, whose founder **Paul Rizzo** is a CEE alumnus, continues to send representatives to the career fair year after year. "When we found out, we were definitely signing up," said Rizzo representative David Bellone. "We have a lot of CMU grads," Bellone continued with a smile. "They're a big part of our company."

A distinct advantage of Patton's event is that employers can spend more time with each candidate. That extra time

allows the students to move beyond their elevator pitch and establish a better connection with a potential employer. While the elevator pitch quickly breaks the ice, the employers clearly value the opportunity to get to know the candidates better through longer conversation.

**Craig Boman** (BS '16) felt the opportunity to talk more in depth with employers gave him a better idea of the company and whether he would fit in. "They're huge companies and that's awesome to get them to come here," he explained, but "the local offices are extremely different everywhere you go."

CEE offers many resources to students to prepare for interviews, career fairs, and other employment opportunities. The students can get advice on anything, from how to build their resume to how to dress appropriately for the event. Several students had their resumes reviewed by Patton, who took the time to help even as she coordinated the event.

Employers could tell that students had practiced their interviewing skills because it made the employers' jobs easier and led to more meaningful conversations. This spring was the first career fair for some companies, but based on their experience, they will begin attending regularly.

"We're looking for highly intelligent people," said Bellone, "which are easy to find here."

*If your company would like to participate in our next CEE Career Fair, please contact Ashley Patton, Director of Career Services and Alumni Relations for details.*

## STAFF NEWS

### Francioni Rooney Receives Burritt Education Award

Director of Undergraduate Programs Andrea Francioni Rooney was awarded the Timothy J. Burritt Education Award at the 2014 College of Engineering Staff Recognition Awards.

Andrea joined the Department of Civil and Environmental Engineering in 2007. In 2011 Andrea was promoted to Director of Undergraduate Programs, a role in which she is the academic advisor of all of our undergraduate students, and in which she leads our CEE professional communications program.

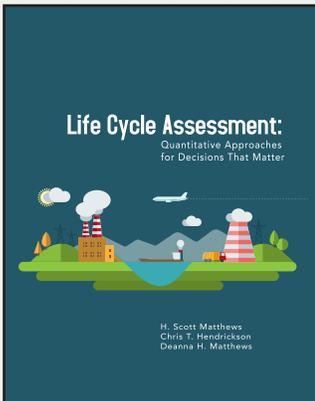
Andrea has a BA from Carnegie Mellon in Creative Writing and she earned a MA in Professional Writing studying as a part-time student over the past several years while maintaining full-time employment, graduating in May 2014.

The Timothy J. Burritt Education Award was established in memory of Tim Burritt, former undergraduate advisor for the College of Engineering, who worked diligently at completing his bachelor's degree at Duquesne University while excelling at his work duties. The criteria for the Burritt Education Award include maintenance of a balance of work and education, perseverance in the quest for education, and enthusiasm for the value of continuing education.



## Digital Mindshare

“As an economist, I know it sounds crazy... I agreed to get half my salary for a year, to then give away a book? But for me, mindshare is better than a few thousand dollars. I would rather know that there were students out there actually using our book, and learning from it. That would beat packaging and selling, no contest.”



LCA textbook is available for free download at [www.lcatextbook.com](http://www.lcatextbook.com)

CEE/EPP Professor **Scott Matthews** is referring to their recently published Life Cycle Assessment (LCA) textbook, which he spent the past year on sabbatical writing, with the help of his wife, EPP Professor and Associate Department Head for Undergraduate Affairs **Deanna Matthews**, and Hamerschlag University Professor **Chris Hendrickson**. The text, which reflects the team's combined fifty years' experience in LCA teaching and research, is the centerpiece of a comprehensive collection of unique learning resources—all of which are available online, for free, to anyone in the world.

Life Cycle Assessment (LCA), is a method for examining the environmental ramifications of a product or structure “from

cradle to grave,” and encourages a more holistic approach to building and manufacturing. Ten years ago, CMU became one of the first universities to offer a full course in the subject, which is now rapidly gaining popularity in schools across the country. Though Matthews and his colleagues had compiled and created ample LCA course materials in their combined thirty years teaching the subject, they sensed a growing demand for a core resource. Because no such text existed, Matthews took it upon himself to create one.

“I knew that unless someone decided to jump headfirst and say, we're going to do this massive undertaking, it would take something like 20 years of part-time effort to get anything resembling a textbook,” he explains. And so at the end of the Fall semester in 2012, he suggested to Deanna that they get the ball rolling on a text of their own. Working over winter break, they were able to finish the first three chapters before the start of the next semester; another chapter soon followed. Encouraged by their progress, and feedback from the professors at CMU and Pitt who test-drove the first chapters in their own courses in the Spring semester, Matthews decided to go on sabbatical the following year to complete the project.

The resulting text reflects the rigorous, quantitative approach to LCA that Matthews and his colleagues have pioneered in the past decade the course has been offered. But it isn't just for students on the CMU campus. The team is already working with CEE graduate students from China and Thailand who are translating the book into their native languages. “For



Left to right: Scott Matthews, Deanna Matthews, and Chris Hendrickson

developing countries across Asia, who are facing serious environmental problems, LCA has become enormously popular,” Matthews explains. “Making this textbook available to those communities has been a huge focus of the project.” The first edition is now

as just one of many authors, that would be incredible.”

Ultimately, Matthews' goal in writing this book was to cultivate a deeper understanding of how LCA really works. He and his co-authors were concerned that,

**“I encourage anyone who would like to improve on what we've done,” he says. “If in five years I'm listed as just one of many authors, that would be incredible.”**

complete and available for download. But for Matthews, this is only the beginning. “Now that we've taken the first initial step, hopefully the LCA community will continue to build around it,” he says. When asked why he elected to forgo the traditional print publication route, Matthews says it was an easy decision. Because he and his co-authors don't have to worry about submitting manuscripts for publication in fixed form, the digital format will facilitate ongoing collaboration. “I encourage anyone who would like to improve on what we've done,” he says. “If in five years I'm listed

without a comprehensive guide to the subject, people would depend on software tools to perform assessments, without understanding how the results were achieved. Instead, he says the book will help people understand how to do LCA on their own, without relying on expensive software tools. In the future, he plans to market the text outside the world of engineering, so that, whether in an academic or a corporate setting, anyone interested in doing an LCA model can use this resource to guide them.

# ALUMNI NEWS

## Alumni Honored at 2014 CEE Alumni Awards Luncheon



The CEE department recognized the achievements of a number of its alumni at the 2014 CEE Annual Alumni Awards Luncheon, which was held at the Pittsburgh Athletic Club. CEE alumni, students, current faculty, and staff attended the event.





Pictured with CEE Department Head Dave Dzombak and Professor Emeritus Larry Cartwright (left to right) Dr. Rodney Clifton, Lt. Col. Ross Monta, Stephen Hinson, and Dr. Corinne Scown.

### Distinguished Alumnus Award

Dr. **Rodney J. Clifton** (MS '61, PhD '64) was recognized with the Distinguished Alumnus Award. The award recognizes CEE alumni who have achieved major accomplishments in the field of professional engineering that have helped to improve the work of fellow engineers or helped to improve people's lives.

Dr. Clifton, Professor Emeritus of Engineering and former Dean at Brown University, has had a profound impact upon many different subjects, including dynamic plasticity, experimental mechanics, adiabatic shear localization, dynamic and hydraulic fracture mechanics, stress wave propagation, time dependent rheology and friction, and the micro-mechanics of deformation and flow in engineering materials. A pioneer in his field, Clifton has provided foundational contributions for the understanding of numerous scientific and technological problems, and his work has frequently offered essential insight which formed the basis for eventual developments in the field for many years following.

Dr. Clifton said he was "truly honored by this high award," and modest as well as distinguished, he added, "I appreciate the chance to be here and see other people being recognized." Reflecting on his graduate years, Clifton said, "The background I got at Carnegie Mellon, the friends I made here, have truly contributed to a wonderful life."

### Lt. Col. Christopher K. Raible Distinguished Public Service Award

**Ross A. Monta** (BS '95) received this award which was created to honor the memory of Lt. Col. Christopher K. Raible, killed in action in Afghanistan in 2012. The award honors CEE alumni who have made significant contributions in service of the public, such as distinguished military service.

Lt. Col. Monta has had a distinguished career in the U.S. Marine Corps. He was selected in February 2014 by the Assistant Secretary of the Navy, Research, Development and Acquisitions for participation in the Secretary of Defense Corporate Fellowship Program. He was assigned to collaborate with Hewlett-Packard to explore ways to find successful IT acquisition strategies for the Department of Defense and industry. Included in his personal awards are the Meritorious Service Medal, the Navy and Marine Corps Commendation Medal with Combat V, the Navy and Marine Corps Achievement Medal, and the Combat Action Ribbon. "I am very humbled and honored to receive this award," Lt. Col. Monta said. He concluded by saying, "Thank you for setting this award up to honor my friend, Lt. Col. Chris Raible."

### Outstanding Alumnus Service Award

**Stephen Hinson** (BS '97) was honored with the Outstanding Alumnus Service Award. This award recognizes CEE alumni who have provided sustained and outstanding service to the engineering profession.

Hinson comes from a long tradition of offering help to those less fortunate than him. He fondly remembers the family meetings during his childhood when he and his siblings were encouraged to take an active role in deciding where the family's donations would go. This tradition has remained with him, leading him to be a dedicated member of the CEE Alumni Advisory Council and an integral part of the department's efforts to establish the Cartwright Support Fund for Teaching Professors. Hinson graciously accepted his award, fulfilling his goal to be "better at receiving, better at showing thanks."

### Recent Alumni Achievement Award

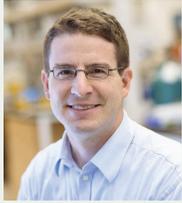
Alumna **Corinne D. Scown** (BS '06) received the Recent Alumni Achievement Award, which recognizes CEE alumni who have made noteworthy achievements within ten years of earning their highest degree from CEE. The recipient of this award must be a role model for students and demonstrate exemplary leadership in the public or private sector.

Scown earned her PhD in 2010 from UC-Berkeley and is with the Sustainable Energy Group at Lawrence Berkeley National Lab. Her research interests include life-cycle assessment, the environmental impacts of energy production, economic input-output models, air quality, and the interaction between science and policy/decision-making.

Scown has also participated in several outreach programs relating to sustainability and female-focused engineering. Two such programs are the SEED Educational Program, which is an after-school program designed to teach junior high students about energy and climate change, and Engineering Your Future, which introduces basic engineering concepts with demonstrations to high school girls in Pittsburgh.

Currently, Scown is working on projects to optimize the production of advanced biofuels, to model impacts at the county level of electric vehicle adoption on greenhouse gas and human health, and to manage lithium-ion automotive batteries end-of-life.

## Giammar (BS '96) Named Browne Professor at Washington University



Professor Daniel Giammar (BS '96) has been named the Walter E. Browne Professor in Environmental Engineering at Washington University in St. Louis. Giammar has been on the faculty in the Department of Energy,

Environmental & Chemical Engineering in the School of Engineering & Applied Science since 2002. His research focuses on chemical reactions that affect the fate and transport of heavy metals and radionuclides in natural and engineered aquatic systems. His recent work investigated biogeochemical processes for remediation of uranium-contaminated environments, water treatment processes for chromium and arsenic removal, control of lead corrosion and geologic carbon sequestration.

## CEE Alumni Honored at 2014 CMU Alumni Awards

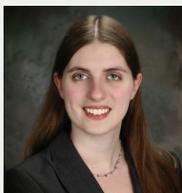
### Alumni Distinguished Service Award



**Joseph F. DiMario** (BS '54, MS TPR '60) is currently the Director of Planned Giving for the Diocese of Greensburg in Greensburg, PA. His professional career has included being a partner in an international accounting firm, the

CFO of a publicly-traded company, the CEO/Vice Chairman of a major manufacturing company in the auto and heavy equipment industry, an Executive Vice President of one of the top ten banks in the country, the head of his own business consulting firm, and a Senior Vice President of a multi-billion dollar regional bank. DiMario has been involved with a variety of non-profit/profit entities as Executive Director and Director. He also served as board chair of non-profit foundations, a regional liberal arts college and chair of the planning commission, as well as the school board in his local community.

### Recent Alumni Award



**Linda Kaplan, P.E.** (BS '07) is a bridge engineer working in the Pittsburgh office of Gannett Fleming. She holds a BS in civil engineering from CMU and a MS in structural engineering from Lehigh University. She

has been involved with many bridge and tunnel projects including work on the Squirrel Hill Tunnel Reconstruction, the Hulton Bridge Replacement, and multiple structures as part of the Maryland Transit Authority Purple Line Project.



Noh and her team demonstrate their vibration monitoring system

## Positive Impact: Creative Engineering at Innovation Palooza

CEE faculty and staff showcased their creative approach to problem solving in the College of Engineering's first annual Innovation Palooza. The event featured faculty and student demos in fields ranging from facial recognition technology to kitchen chemistry, and a series of lightning talks by industry leaders, highlighting recent innovations in their current fields.

CEE Associate Professor **Hae Young Noh**, with members of her research team, CEE PhD candidates **Mike Lam**, **Mostafa Mirshekari**, **Shijia Pan**, **Ningning Wang**, and **Irem Velibeyoglu**, demonstrated her innovative new occupation estimation system. Their program, as part of a collaboration with CMU-SV professor **Pei Zhang**, uses vibration monitoring systems to localize and assess the occupants of an indoor space. Not only is the technology able to determine someone's location but also their height, weight, and shoe size, and it can tell whether or not they seem lost, dizzy or nervous, based on changes in their gait pattern.

To demonstrate this technology in action, Noh's team had their sensors linked to a video monitor, allowing them to capture and display movement across the floor in real time. Event attendees walked, stomped, and tip-toed past the booth repeatedly, mesmerized by the system's ability to capture their movement on screen. The sensors were even able to detect the percussive vibrations generated by Pittsburgh-based chamber ensemble Cello Fury's performance at the other end of the ballroom.



Left to right: CEE Seniors Hannelie Mostart, Michelle Krynock, Dolly Hsu, and Chris Kim

CEE students exhibited their entries in the Impact-A-Thon contest, where teams were challenged to devise a solution to a real-world social problem, specifically, the shortage of homeless shelters during winter months. Seniors **Dolly Hsu**, **Chris Kim**, **Michelle Krynock**, **Hannelie Mostart**, and **Yang You** had five days and \$250 to build their prototype.

Using wood, bricks, and insulation foam board, they created a prototype system of interlocking units.

These individual units could be employed as needed in order to increase an existing homeless shelter's maximum capacity. The use of bricks, heated in ovens throughout the day, would provide an efficient and affordable source of heat for these temporary shelters.

CEE senior **Alejandro Gonzalez** teamed up with electrical and chemical engineering students to build a shelter that, in addition to providing an economical solution, would specifically accommodate individuals with handicaps. Their prototype featured a combination of cots and hammocks that could accommodate up to fifteen people per shelter. This eco-friendly model used cork as its low-cost insulating material, and would tap into the city's public lighting system to satisfy its minimal energy requirements.

Event co-director and Director for Innovation and Entrepreneurship **Jon Cagan** said he devised the Impact-A-Thon contest to enhance the students' learning experience by engaging them in creative, purposeful problem-solving. "We wanted students to recognize that they are capable of solving hard social problems" he explained, "and emphasize that they can change the world in a positive and meaningful way."



Floating vetiver grass for uptake of petroleum hydrocarbons from contaminated water

## Nanotechnology to the Rescue

CEE alumnus Dr. **Tanapon Phenrat** (PhD '08), a professor at the Naresuan University in Thailand, has just been named 2014's Best Entrepreneur by Thailand's Environmental Restoration Initiative (TERI). The award recognizes his innovative application of various techniques including nanotechnology to bring about remediation, the process of cleaning up sites that have been contaminated with hazardous substances. Due to the Thailand's lack of pollution regulations, illegal dumping of toxins by large factories has rendered the ground water undrinkable in many areas, and several communities have banned cultivating rice due to high levels of cadmium in their soil—a sanction that makes it very difficult for villagers in these areas to sustain themselves economically.

magnets to remove them. We got a very good result in the lab, around 98% removal. Professor Lowry and I are now working on a book about this new method, which we hope to finish this year.

### Why did you decide to come to CMU to study remediation?

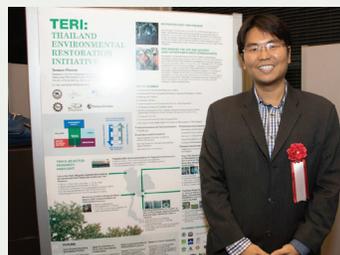
I'm so lucky I was able to do my PhD at CMU. When I was given a scholarship to study environmental nanotechnology in the U.S., I began reaching out to professors in the field. Professor Lowry had already started his research in nanotechnology, and was able to give me a very clear idea of what his work was about. I thought it could be a very useful means of remediation, so I decided to come to CMU and start working with him.



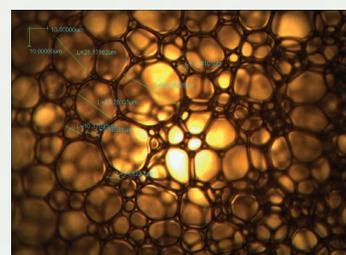
Dr. Phenrat is presented with the 2014 Best Entrepreneur award



School children line up for safe drinking water after treatment by Phenrat's ozone generator.



Dr. Phenrat at TERI



Reactive nano iron foam for subsurface remediation. (I don't really understand what that means.)

In the past four years Phenrat has been working closely with local communities to address these problems. He has participated in 15 remediation projects, and succeeded in restoring four of Thailand's ten most contaminated areas. Below, he discusses his award, what drives his work, and how nanotechnology can be used to solve some of Thailand's most pressing environmental issues.

Now, I am one of only three people in Thailand who have a PhD in remediation, and I am so grateful that I was able to work with Greg, and to take courses with Professor **Dave Dzombak**. I was very lucky to have these professionals as my supervisors, and to have the opportunity to do such innovative work in the lab.

### How are you using nanotechnology to help people living with pollution?

To help villagers who do not have drinkable water, I developed an ozone generator that uses  $O_3$  gas as an oxidant, to degrade toxic compounds out of water very quickly. The Thai government granted me the funding to develop 40 of these ozone generators, to install in the homes of the villagers whose water has been contaminated with Phenol. We then worked with these villagers to help them be comfortable using the technology. I believe this project shows the real impact of lab work in the field and in the lives of real people.

### What do you see as the future of remediation in Thailand?

We want to approach the problem of remediation and pollution from the top down, to influence pollution regulation at the policy level. I see opportunity for that, because there's a lot we can share. Right now, I'm developing a database that can help shape Thailand's public policy about pollution. I've built a website about it so that government agencies can use it as a guideline as they move forward.

Another project I am very excited about is one I have been working on with CEE Professor **Greg Lowry**, to help villagers whose paddy field soil has been contaminated with cadmium. I mixed reactive iron nanoparticles with this contaminated soil. The contaminants are attracted to these nanoparticles, which are magnetic, so then I use

### How does winning this award affect your future work?

It makes me very happy to know that my work is valued. During my presentation, the judges asked me what I want to do: have a company to make money, or be an NGO, to help people? I told them I want to be just what I am now—a faculty member. Because we can do both. We can work for businesses, and we can serve the public. This is the message that I want to send to my colleagues and to other students: as academics, we are in a position to be flexible. We are unique in this sense.

# Carnegie Mellon University Civil and Environmental Engineering

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## To our alumni: Thank You!

You support us in our mission in so many ways, and we're very grateful for the generosity you show. We're proud of what you've accomplished after you graduated, and we hope you're equally proud to call us your alma mater.

We'd love to keep in touch with you, and it's easy to update your information with the department. It takes less than 5 minutes to fill out our contact survey: [bit.ly/cee-alum-update](http://bit.ly/cee-alum-update).

Questions about this survey, or just want to know more about how you can get involved with the department? Please contact Ashley Patton at [awpatton@andrew.cmu.edu](mailto:awpatton@andrew.cmu.edu).



Ashley Patton  
Director of Alumni Relations

## Join CEE During Carnival!



### Chris Hendrickson Emeritus Reception

Friday, April 17  
6:00pm – 9:00pm  
Singleton Room  
Roberts Hall of Engineering

Please join CEE for a celebration of the career of Chris Hendrickson, Hamerschlag University Professor, during his time at CMU.

Chris has had an immeasurable impact on many, and we'd like to invite you to participate in an evening celebrating his career and the difference he's made in the lives of his colleagues, students, and friends.

RSVP: [bit.ly/hendricksonreception](http://bit.ly/hendricksonreception)



### CEE Alumni Breakfast

Saturday, April 18  
8:30am – 10:00am  
Tung Au Lab  
Porter Hall

CEE alumni are invited to drop by the department for donuts and coffee. Feel free to stay and chat with faculty, students, and friends or grab your coffee to go on your way to the Buggy finals!

Registration: [bit.ly/CEEBreakfast2015](http://bit.ly/CEEBreakfast2015)