HUMBOLDT STATE UNIVERSITY

ASCE Student Chapter American Society of Civil Engineers

ERE MESSENGER

Environmental Resources Engineering

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Energy Resources in ERE
The Beginning

by Peter Lehman, Ph.D., ERE Emeritus Professor
Founding Director, Schatz Energy Research Center

In the 1970s, the ERE department made a trail-blazing choice that led to a pioneering and distinctive program. The department had recently transitioned from its historic civil engineering program to environmental resources engineering, and the ERE faculty thought it important to include energy as one of the environmental resources that our students should study. The department's thinking was way ahead of its time and it continues to pay dividends through the present. To start the new program, the department advertised for an additional faculty member with energy expertise to begin work in the fall of 1979.

For me personally, it was a miraculous development. At the time, my wife Carolyn and I were teaching at Deep Springs, a tiny college in the Inyo and White Mountains of eastern California. We wanted to move to Humboldt County—where we had first met on a canoe trip on the Eel River—but the prospect of a teaching job seemed remote at best. Since I was trained as a physical chemist, I had written to the chemistry department at HSU about a job. They didn't write back.

ERE students, Schatz engineers, and Redwood National Park personnel in front of the just completed PV array at the Wolf Creek Outdoor School. The project was part of the nationwide University-National Park Energy Partnership Program.

But now there was a glimmer of hope—an energy opening in the ERE department. Though I had never taken an engineering course, I had just created two courses in Solar Energy at Deep Springs. I jumped at the opportunity and applied. I was called for an interview and during my seminar for the department, I described the solar water heater my students and I had designed and built for the school's dairy barn. I got the job! That June, my young family and I headed to Humboldt County for a tenure-track position at HSU.

Once here, I set to work designing the courses that would become part of the energy curriculum. Originally called Energy Resources Engineering I, II, and III, the courses soon evolved into the more descriptive Advanced Thermodynamics, Renewable Energy Power Systems, and Solar Thermal

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FROM THE EDITORS

Hello from the Messenger staff! We hope you enjoy this Spring 2019 edition.

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"We should not forget that the true purpose of education is to make minds, not careers."

Chris Hedges, American Journalist, The End of Literacy and the Triumph of Spectacle, 2009

Alumni Profiles

Jordan Burrows Ludtke, EIT
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Eureka, California

I grew up in Eureka and came to HSU directly after high school. I always enjoyed math and science, and have wanted to become an engineer since elementary school. I didn't know which type of engineering, but after looking into the ERE program at HSU, the courses really struck my interest. In addition, it was close to home, and my grandfather, Al Burrows, had been a professor in the program (1971 to 2003), so I decided to make the transition from Logger to Lumberjack.

I always enjoyed learning new topics, and my senior design electives didn't have much in common with one another. In addition, I graduated with minors in Oceanography and Spanish.

While in school, I worked part time and played club rugby, which both required lots of time and traveling. Rugby was an excellent release of stress and anxiety, and trained me to manage my time well. It also provided me with many friends and a large support system that is still active in my life today.

During three summers I interned with a national engineering company, TIC (The Industrial Company). This was an excellent opportunity, and I learned a lot about what I did and did not want out of my future career. It also gave me the chance to experience other states. As TIS's environmental compliance coordinator, I worked on large-scale construction projects in Kentucky, Texas, and Oklahoma. The environmental compliance duties dealt primarily with permit and regulation compliance, and the feeling of being a "cog in the wheel" of a large company was not very rewarding. I learned that I liked construction, wanted to do design work, and did not like national companies, big cities, or environmental compliance.

In my fifth year, I decided to travel abroad through the University Studies Abroad Consortium (USAC). Having waited until so far in the ERE course path, I was unable to find a program where any of the classes would count towards my major, so I decided to head to Spain and brush up on my Spanish. I decided to obtain a Spanish minor so that those classes would count for something. USAC was a great program that I would recommend to anyone who wants to travel (even if the program is not pertinent to your major it will be worth it!).

During the second semester of my sixth year I interned part-time at SHN, a local engineering consulting firm. I got hired into their environmental department, but soon realized that their work focused more on environmental compliance than environmental engineering. However, their civil department actually did a lot of environmental engineering work. When I graduated that May, I accepted a permanent position and soon transferred into their civil department. My job duties have included AutoCAD design, construction management, hydraulic analyses, permitting, compaction and concrete

Alumni Profiles

testing, and cost estimating. I have worked at SHN for two years now, and I have greatly enjoyed the variety of projects I am assigned at a smaller engineering firm. I love working on both residential and public municipal projects that benefit my hometown. I also find it pretty cool to have a CEO who was taught engineering by my grandfather in the ERE program, and is a fellow HSU rugby alumni. Ω

Jacob McQuirk, PE
BS ERE 1999
Senior Engineer
Department of Water Resources
Sacramento, California

I graduated from HSU in 1998, and in 1999 accepted a position at the California Department of Water Resources' (DWR) Division of Flood Management. There I worked on flood damage reduction projects with the US Army Corps of Engineers and local agencies. I supported or managed projects including levee improvements throughout the Sacramento and San Joaquin Valley, reservoir structural and operational improvements, and planning for new projects to improve flood protection. At DWR, I learned just how difficult it is to move large civil works projects forward, and that the most difficult challenges are often social, environmental, or political.

My education at HSU helped me realize a dream. I passed all three parts of the Civil Professional Engineering exam on my first try, and became a licensed civil engineer. This brought new opportunities at DWR, eventually allowing me to become a senior engineer. After five years, I took a new job in the DWR Bay-Delta Office working on water supply planning for the State Water Project in the Sacramento San Joaquin River Delta.

While most precipitation in California falls in the North region, most urban and agricultural water demand is in the South. To resolve this issue, the federal and state governments created projects that collect and store water in the North and transport that water to the central valley and southern California. This conveyance system requires the release of enough fresh water to repel ocean salinity, so that fresh water can be pulled to the export pumps in the South Delta.

I began working on a project to construct new permanent operable gates in the South Delta. This would protect senior water rights, help salmon migration, improve operational flexibility, and allow increased water diversions. However, the required US Army Corps of Engineers permit was not approved. More studies on impacts to endangered fish from the existing temporary rock barriers were required.

In 2010, I began a project to plan, permit, and build the world's largest Bio-Acoustic Fish Fence at the divergence of Georgiana Slough from the Sacramento River. The system incorporates a proprietary multi-stimulace barrier built by Fish Guidance Systems of the UK that uses sound and light to deter juvenile salmon from entering the slough. Using acoustically tagged juvenile salmon in 2011, I worked with the US Geologic Survey to evaluate the barrier's effectiveness. The barrier worked well, and efforts are proceeding to eventually design and build an even better, permanent multi-variant machine-learning optimized barrier.

The drought of 2013-15 created a shortage of fresh water in both the Central Valley and State Water Projects. By late 2014, it was clear that without significant precipitation there would not be adequate water to repel bay salinity. Bay-Delta hydrodynamic models were used to find optimal locations for channel closures which would allow the Delta to remain fresh with fewer reservoir releases. After obtaining environmental permits to construct a series of barriers in the Delta, the project was reduced to one barrier across West False River. Modeling showed that this barrier would allow most of the Delta to remain fresh with minimal releases. With the help of an emergency proclamation from the Governor, as well as emergency federal approvals, the 700-foot rock barrier was built. It was operated in 2015 from May through November, and kept Delta salinity at levels that allowed for beneficial uses such as agriculture.

I love working with the Delta, largely because projects here require the coordinated integration of science and engineering. I have had the pleasure of being a resource speaker on the Water Education Foundation Bay Delta Tour, and I remain optimistic that sustainable solutions lie ahead.

I currently manage the South Delta Temporary Barriers Program, which installs barriers to protect senior water rights holders and anadromous fish. The temporary barriers could be improved, but permanent operable gates are still an uncertainty. What is certain, however, is the vast amount of work ahead of us to tackle all of the water challenges California faces. I strongly encourage you to consider being part of the solution. Ω

Western Weather Group

Using Weather Information To Make Operational Decisions

by Nathan Lohse (BS ERE 2010)
Chief Operating Officer, Western Weather Group, Chico, CA

While growing up in the Sacramento Valley, I became accustomed to seeing vast expanses of crop rows and orchards while on the many short "mystery trips" my brother and I took with our father. I never would have imagined that one day I would work for a company that plays a pivotal role in growing these crops.

The path to my current position started at Humboldt State University (HSU) in the ERE program. After high school, I joined the U.S. Coast Guard, and afterwards attended Sierra College to square away engineering course requirements. I started at HSU in the Fall of 2007, and quickly made my way through the ERE coursework. Along the way I developed a particular fondness for programming and electronics.

After graduating from the ERE program in December of 2010, I was hired as an Application Engineer for Fafco, a solar thermal manufacturer based in Chico, CA. I worked there for four years, assisting clients with domestic solar hot water systems and pool heating systems. In October of 2014 I married my wife Christine, and six months later her father asked if I wanted to come and work for him in the family business. Truthfully, the thought of working for my father-in-law was daunting at first, but after further discussion with my wife we took the chance. I have since become Chief Operating Officer at Western Weather Group, and in the next several years ownership of the company will be transferred to my wife and me. I look forward to the challenge of guiding Western Weather Group into the future while maintaining the basic principles that have produced such a respected and successful company.

Western Weather Group got its start in the early 1980's with the commencement of air quality mitigation measures in the Sacramento Valley. At the time, more than 250,000 acres of rice straw was being burned each season, and these activities caused significant air quality complaints within the area. This eventually led to the adoption of the Smoke Management Plan. To address these complaints, a group of scientists from CSU Chico developed a plan for automated weather observation and forecasting systems. These systems would be used to provide information to air quality districts on when optimal burning conditions occurred. Over the next two decades the group of scientists morphed into an organization that changed hands several times. My father-in-law worked for this organization, and in 2005 the parent company made a decision to pull out of the California market. My father-in-law jumped at this opportunity to create Western Weather Group and asked the Chico office employees to join him. Over the next decade the team at Western Weather Group expanded their reach into other states and new markets. Today, Western Weather Group manages a network of more than 1,000 weather stations and provides weather forecasts to 30 different regions in California and several other states.

What makes us unique is that we provide our clients with remote automated weather monitoring stations, the collected data are used to make timely weather forecasts for a specific localized area, and these forcasts are then used by our clients to make critical operational decisions, such as mitigating risks related to weather. For example, our agricultural clients are interested primarily in frost and the associated damage to crops it can cause, but they also use data and forecasts to make decisions about irrigation, pesticide, and fertilizer application.

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Western Weather Group vineyard weather station in Paso Robles wine country in southern California.

Why Engineering?
It Was The Right Choice For Me!

by Roberto Rivera, PE
Project Manager, Calleguas Municipal Water District, Thousand Oaks, CA

The moment I decided to become an engineer, I realized I really and truly wanted to make sure I had made the right choice. Looking for inspiration, I went to the San Diego downtown library. I navigated to the reference section, and found a LIFE book about engineering. I looked through the book, hoping to somehow verify I had made the right decision. What I still remember from reading that book is that engineering is a way to give back to society by creating things that benefit mankind, things such as structures, machines, gadgets, systems, and single items. It doesn't really matter what specific kind of engineering path you choose, provided the intent is to benefit our world. This resonated within me, and I was inspired. I was sure I had made the right choice, and I decided on electrical engineering as a specialty. Much later in the course of my studies, while thinking of just how many hours I had spent in a library throughout my life, I realized how significant it was that my 'realization location' (the place where I found the answer to my BIG question) was a library.

For more than 19 years I worked in the electrical field, in areas ranging from communications systems to power generation, including energy efficiency analysis and evaluation. I also focused on solar generation system design and installation for five years. And now, my career path has brought me to work in a field I thought far removed from electricity: I now work at a public water municipality.

I am currently a project manager at the Calleguas Municipal Water District, which is located in eastern Ventura County in southern California. I'm surrounded by wonderful people, and work with a great team of engineers. The municipality comprises a well-organized team of administration, financial, engineering, maintenance, and operation departments. Our general manager and engineering manager, both women, are registered Civil Engineers. My three fellow project managers, all male, are registered Civil Engineers. I am the only registered Electrical Engineer.

Roberto Rivera is the grandfather of ERE senior Juliette Cortez

I was originally hired because the water district had been looking for a complementary engineering skill (electrical) to round out their civil engineering team. While this was good for me, I also felt a bit apprehensive due to my lack of experience specifically with water systems. However, I was confident that given the desire to learn and an intention to do the best I could, all would work out. Luckily, so far so good. The folks here have proved to be generous teachers of what I call 'all things water,' and I've gotten the needed support each time I've had a question. And, while they've shared their 'all things water' expertise with me, I've also shared electrical knowledge with them when needed. Just as my engineering manager had imagined more than three years ago, I have been able to complement the engineering team, and together we have accomplished a great deal.

One of my first projects was to replace three cathodic protection deep anode wells at the ends of their design life. My responsibility was to manage the design and installation of the three wells. I was familiar with the concept of corrosion by contact of dissimilar metals, the damage it can cause, and the basics of cathodic protection, but I needed to know more, so I attended a three-day corrosion seminar to learn more about cathodic protection. They say rust never sleeps. I discovered that corrosion damage, if untreated, can cost the economy many millions of dollars, and I found an entire industry dedicated to controlling that corrosion. I had no idea this world existed.

I had to recall my basic redox reaction theory to learn how these corrosion specialists have mastered the design and installation systems to control corrosion. Once I knew more about deep anode wells, I was able to manage the project more efficiently. The lesson? Once you have a basic set of engineering skills from one discipline, you can always expand your knowledge to do what's required for the next engineering project. So, now I know the difference between welded steel pipe and pre-stressed concrete cylinder pipe, as well as what to do to protect them from cathodic corrosion. We were able to use our engineering skills for the benefit of all and keep the water flowing through our distribution system.

Back to deep anode wells. As an engineer, of course, I understand the design process, and I know how to develop engineering drawings and specifications. I also knew about the bidding process, announcing the project, and selecting a qualified contractor. But, I had to learn the specific process used in our office. Also, I didn't know much about digging anode wells, so I waited to learn by watching the crews dig them and ask a ton of questions. It turns out that throughout your career you never stop learning something new.

I go back to the day I read that LIFE book and remember that one of the

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Western Weather Group

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ERE Professor Robert Willis (now retired) once told our class that an engineer's job description can be boiled down to determining the efficient distribution of limited resources. I am reminded of this whenever a farmer asks when the next rain event will occur and how much to expect. In this case, the farmer is trying to determine how to efficiently distribute this limited resource. I smile knowing that we are helping to facilitate those decisions.

Other clients are concerned with monitoring weather conditions for air quality impacts. We work with industrial companies across the Bay Area to provide weather information so they can meet air quality guidelines set by regulatory agencies. We also work with universities, state departments, and other agencies to provide monitoring equipment, primarily for research.

Our newest and largest market is fire weather monitoring. San Diego Gas & Electric (SDG&E) contacted us about implementing a weather monitoring network after a very large and destructive wildfire in 2008 caused by downed power lines in their service territory. The intent of the weather monitoring network is to keep the utility operators well informed about current weather conditions affecting their infrastructure. We assisted SDG&E with selecting the optimal hardware for their network, and with setting up the data collection and feeds into their operational management systems. Initially, the network consisted of a handful of stations in key areas where high winds frequently occurred. The network has since burgeoned into 175 weather stations strategically placed in locations that allow the network operators to shut down electrical power in localized areas so as to affect as few customers as possible. This type of system has also been adopted by the other two large investor-owned utilities in California, as well as by several smaller electric utilities. In addition to current weather information, the utilities are using data from the weather stations to drive fire risk and fire spread models. We work closely with modeling vendors to make sure accurate data is going into these models. Recent wildfire events in Northern California have made it clear that a significant increase in the California population living in the wildland-urban interface coupled with a changing climate will require substantial changes to how utilities provide safe electricity to their customers.

Western Weather Group looks forward to providing utilities and state agencies with critical fire weather instrumentation and information in the on-going effort to reduce the risk to these communities. Ω

Why Engineering

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greatest engineering feats it featured was the design and building of the Roman aqueducts. What impresses me most, even today, is that those architecturally beautiful and practical structures delivered water where they needed it without electricity, controls, or instrumentation. They didn't even need to worry about cathodic protection. I have realized over time that engineering is really a combination of science and art. It is used to create products that contain a certain beauty and to fulfill specific needed functions, all while ensuring that the products work as intended for a long period of time.

Every day in my workflow I have to take into account many variables in order to find and provide a solution to a particular challenge. The list of challenges seems to be never ending, which is great for job security. As I have learned by now, all of the many different engineering fields are related in many ways. The fun part is finding solutions, which requires analytical thought, creativity, and a sense of what really is the right thing to do. And, I realize that I should have studied psychology! The greatest challenge in solving many engineering problems is convincing someone else that a particular approach really is the best choice. Ω

A water district drilling crew preparing to drop an anode into a well. An inspector, in the yellow safety jacket, is on the left.

Energy Resources in ERE

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Engineering. The rationale for choosing these courses came from the energy issues of the day.

It was the early 1980s. President Ronald Reagan had just ripped the solar panels off the White House; oil was cheap again; photovoltaic (PV) panels were exorbitantly expensive; and almost all of our energy came from burning coal, oil, and natural gas. I felt that energy students should learn about traditional energy production pathways—including nuclear power—and that's what we covered in the Advanced Thermo class.

But the dangers of using fossil fuels, from air quality problems to climate change, were already clear and my goal was to focus the new program on renewable energy. The Renewable Power class covered photovoltaics, wind power, and hydropower. The Solar Thermal class covered solar water heating and electricity production from the sun using heat engines.

Peter Lehman in the new greenhouse at CCAT, January 1984.
Photo by Robert Couse-Baker.

ERE students and other volunteers installing residential solar arrays in the Blue Lake Rancheria community. These systems are designed to provide 75% of a household's electricity to replace fossil energy.
Photo by Jacob Pounds, Blue Lake Rancheria

Because of my experience as a laboratory scientist, I was eager to introduce labs to my students. In the thermo course, we visited the UltraPower biomass plant in Blue Lake, took measurements of power production and fuel usage, and brought samples of the hog fuel back to the lab to test in the bomb calorimeter. Students were surprised to learn that the plant's overall efficiency was only 18%.

In the solar classes, we repeated a famous experiment to measure the solar constant, the amount of solar energy striking the earth's atmosphere. It required taking measurements of direct beam solar radiation at a series of times during a pristine, cloudless day. Since those days are rare in Humboldt, students had to be ready to spring into action when the call went out, "It's a solar constant day."

With funds that came with our new engineering building, Science D, the department purchased a solar hot water collector. A circulation pump and a water reservoir were added, and students were able to see a solar collector in action and measure its efficiency.

Testing PV modules was not so easy. I wanted students to be able to test a variety of modules of different technologies, but because modules were so expensive (in 1979 a 40 W module might cost ~$1600), I couldn't afford to buy them. Fortunately, David Katz and Roger Herrick of Alternative Energy Engineering in Briceland (in southern Humboldt) were willing to loan me modules. It was a great symbiotic relationship. Students got to test many state-of-the-art modules and David and Roger got the results of accurate module performance data that they otherwise couldn't obtain. They built a quality reputation for their business by making decisions based on our results.

One of our more dramatic moments came when we erected a small wind turbine. Students and I chose the roof of Van Matre Hall (the department's old home) to site the turbine and carefully winched it into place on a tower secured to the roof. Soon thereafter, Arcata had a windstorm with 60 mph winds. The turbine survived the night, but didn't stay up long. Early that

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morning, I got a call from the computer center housed on the 2nd floor. "Your turbine is shaking the building. Take it down now!" From then on, we performed all the turbine experiments on small model turbines in the department's wind tunnel.

In addition to labs, we went on some wonderful field trips in those early days. We drove in students' cars and camped out. We made many trips to the Geysers Geothermal Power Plant and got an informative guided trip courtesy of PG&E. We visited Livermore National Lab and got to see the laser and magnetic hydrogen fusion experiments. They resembled a Star Wars movie in complexity and expense. We drove all the way to Barstow to see Solar One, the first solar power tower, and the Mohave Solar Project, a 280 MW solar generating plant using Luz parabolic collectors and a Rankine engine.

Our most amazing trip was to the 1200 MW Helms Pumped Storage Facility in the Sierra Nevada outside of Fresno. The plant was built to store energy for Diablo Canyon, pumping water uphill to Courtright Reservoir for storage and releasing it through three huge Francis turbines to Wishon Reservoir to regenerate electricity. We got there just before the plant opened, and got to walk through the 27-foot diameter tunnels bored into the granite mountain connecting the reservoirs, and then actually walk through the turbines—they were that big. It was a thrill!

At the same time that the energy program was getting established, the Campus Center for Appropriate Technology was getting started. Quite a number of ERE students served as co-directors at CCAT, and cut their teeth managing a complex operation and introducing technology in a real world setting. I was CCAT's first faculty advisor and continued in that role for over 20 years. It's inspiring to see CCAT still thriving and a permanent part of our campus community.

ERE Students in Professor Peter Alstone's ENGR 473 "Building Energy Analysis" laboratory conducting a thermal analysis of the SERC West Wing in Spring 2019. The image was taken with an IR (infrared) camera.

In 1989, things changed dramatically for the energy program and for me when I connected with Dr. Louis Schatz and the Schatz Energy Research Center was born. With Dr. Schatz's backing, my colleague Charles Chamberlin and I and ERE students Ron Reid, Tim Murphy, and Gian Pauletto, set out to design and build our first project, the solar hydrogen system at the HSU marine lab in Trinidad. The goal was to demonstrate the utility of hydrogen to store solar energy. In those first few years more students joined, including my colleague and current ERE professor and SERC Director Arne Jacobson. We developed and built our own fuel cell, we received two patents on fuel cell technology, and we licensed our fuel cell intellectual property to four U.S. corporations. We built the first fuel cell car licensed to drive in the U.S. and the first solar powered hydrogen fueling station. It was quite a ride!

The advent of the Schatz Center brought changes to the energy program. Much of my effort was now directed to building the Center, so I needed help teaching the energy courses. Though the department hired a couple of tenure track professors for the energy program, neither stayed for long. Fortunately, our local talent stepped up. Though he hadn't taught them before, Charles courageously took on teaching both of the Thermo courses. Chemistry professor Tom Borgers also taught Advanced Thermo and continued teaching the Building Energy class he created. Arne, then a grad student, helped by also teaching Thermo. And my SERC colleague and ERE grad Jim Zoellick taught the Renewable Energy class for several years. Along with me, this team kept the energy courses alive and thriving.

The nature of our work at SERC also affected the energy program. Hydrogen and fuel cells and energy storage in general became an important area of study. Charles used our fuel cell test station for an experiment in his Transport class and fuel cells became a topic in the advanced energy classes. The simple fuel cell experiment we developed through a grant from the Department of Energy became a regular part of our introductory ERE class. Hundreds of ERE students got hands-on experience through that experiment. It was so popular that the set-up appears on the back of one of

ERE's T-shirts; it's one of my favorites and I wear it proudly.

The energy program and the Schatz Center continue to evolve today. Liza Boyle and Peter Alstone (an ERE and Schatz Center alumnus) have joined the faculty recently and have taken over much of the teaching. Liza has brought her mechanical engineering background to both of the Thermo courses and resurrected our long dormant Air Quality class, which includes energy applications. Peter has revamped the Building Energy course and added up-to-date modeling techniques. He's also added a much-needed Grid Power course, important skills in any modern energy engineer's toolkit. They've been joined by our newest faculty members—Sintana Vergara, Ali Moradi, and Margarita Otero-Diaz—whose work is also energy related.

These new faculty members underscore how much ERE has changed. When I arrived in 1979, the faculty consisted of 9 white men; we soon added two more. The students were almost entirely white. The history I recount reflects that demographic. Now the ERE faculty has 6 women and two are Latinas. Our students are much more diverse, and though we still have more work to do, we've made substantial progress in diversifying the program.

Under Arne's adept leadership, SERC has grown by leaps and bounds. From our modest beginnings, the Center now employs 48 people (I pinch myself as I write this!). In addition to Arne, Jim, and Peter A., included are our colleagues Jerome Carman, Dave Carter, Greg Chapman, Tanya Garcia, Andy Harris, Meg Harper, Kyle Palmer, Tom Quetchenbach, Kristin Radecsky, Mark Severy, and Eli Wallach, all ERE grads. Last summer, SERC employed 15 students, mainly from ERE. We're working on important state-of-the-art projects—designing and installing local microgrids to provide renewable power and crucial resilience, providing energy access and quality assurance of solar products to developing countries in Africa and Asia, assessing the use of biomass for energy, and planning electric and hydrogen vehicle infrastructure.

Trinidad Solar Array, just after completion in Aug 1990. From left: Charles Chamberlin, Tim Murphy, Peter Lehman, Gian Pauletto, and Ron Reid.

Much of our work is right here in Humboldt County.

ERE energy grads have made important contributions to the world. Dr. Denise McKahn is an Associate Professor of Engineering at Smith College, the only all-women engineering program in the country. Dr. Rich Corsi, one of my first energy students, is Dean of Engineering and Computer Science at Portland State University. Rob Campbell, my old cycling buddy and himself a diabetic, helped invent a wearable, controllable insulin pump, improving life for diabetics worldwide. His company, Insulet, has grown to over 800 employees. Jack and Christina West invented a rackless mounting system for PV modules and revolutionized the industry by greatly shortening the time and cutting the costs for PV installations. Their company, Zep Solar, was bought by Solar City and is now part of Tesla.

And those original Schatzers? After working at SERC for over a decade and helping us develop fuel cell patents, Ron Reid moved to W.L. Gore where he designed and tested fuel cell membranes. Tim Murphy is the Communications Manager for Soltec, a large Spanish PV company. Tim wrote me, "How the hell did a Nebraska boy end up in the Spanish provinces?" And Gian Pauletto works as a power engineer for Vermont Electric Power Company.

When I look back, the most satisfying development for me over these 40 years is how renewable energy has taken off and is now providing a meaningful amount of green power for our society. Humboldt grads have played a big role in that change. When I first started here, I would hear comments like, "Why are you teaching that stuff? There are no jobs in renewable energy." Now, the world is crying out for energy engineers and our ERE program is providing leaders in the field. They are working toward our shared goal—protecting our beautiful, precious Mother Earth. Ω

Get Up! Stand Up!

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come to understand as human-centered design, a process of skilled empathetic interviews that provide the groundwork of the design research. In my experience, meeting people's needs is the primary success criteria even if the goals of a project are to design an environmental outcome. Every day, I use my Master's Degree training in both my non-profit work and political role.

Recently, an issue related to natural resource impacts was addressed by five local agencies. The owners of a gravel mining operation proposed to locate a cannabis processing facility on the floodplain of the Mad River. Mad River is very close to our region's drinking water intake as well as to a public park. Our services district receives drinking water from the Municipal Water District and distributes it to our customers, and as a District Director, I received several statements urging the District to oppose the zoning and/or application for the new facility. These statements cited the potential impacts to the adjacent public park, to the river, and to our drinking water. The Board had limited time to communicate and gather information, yet we were able to place this issue on our agenda for discussion and a vote. Public concerns were heard and we (the Board) voted to write a letter in opposition to the proposal.

A basic and often overlooked fact in politics is that politicians are *people* who make decisions, and the position of one elected or appointed representative may not be enough to affect change. A Board majority is needed for an action to be taken in most local political settings. Due to the Brown Act, no more than two elected or appointed representatives can discuss a topic in their purview (scope of influence) outside a public meeting. The public and other groups can choose to influence representatives and support logical and scientific findings, or to allow people in powerful positions to act without the benefit of the public's perspective.

I urge you to share your perspective with your representatives, while keeping the following points in mind:

- elected and appointed officials have limited capacity to do research and you may know more than they do;
- share your thoughts with several representatives of the same Board or Committee in person, via email or a phone call, so that your perspective is known to the decision-making body prior to the public meeting where it may be voted on;
- use a 3-minute time allocation at the start of a public meeting for items not related to the agenda to raise awareness about a topic that is within the government body's purview;
- use the 3-minute time allocation during each agenda item to share your perspective on the topic, even if you agree with what you've already heard. It is nice to hear from others during the decision-making process.

The Bridge Builder

Will Allen Dromgoole

An old man, going a lone highway,
Came at the evening cold and gray
To a chasm vast and deep and wide
Through which was flowing a sullen tide.
The old man crossed in the twilight dim;
The rapids held no fears for him.
But he turned when safe on the other side
And built a bridge to span the tide.

"Old man," cried a fellow pilgrim near,
"You're wasting your time in building here.
Your journey will end with the closing day;
You never again will pass this way.
You have crossed the chasm deep and wide;
Why build you this bridge at even-tide?"

The builder lifted his old gray head.
"Good friend, in the path I have come," he said,
"There follows after me today
A youth whose feet must pass this way.
This stream, which has been as naught to me,
To that fair youth may a pitfall be.
He too must cross in the twilight dim
Good friend, I am building this bridge for him."

Funding, say, a cure for disease, or for restoration of ecological processes, or improving regulations on CO_2 emissions all involve political decisions, and they also involve science. We must work together to elect people who make political decisions based on science. Scientific inquiry and debate are how we define and refine scientific truths, and they inform how we define the problems we face. People in positions of power make decisions that affect our lives, and when they reject scientific truths, they may delay or even negate actions on critical problems.

We all need one another. I believe there are more things that bring us together than pull us apart. Take a moment and feel your presence here on Earth. If you are willing, close your eyes, listen to the sounds around you, take a deep breath, and feel the sun, the breeze, and perhaps the fog on your skin. Make the choice to live, teach, and act in peace. I urge you to be involved in your community, and to create a truly sustainable and inclusive world for all.

Leadership takes many forms, and I urge you to be a leader in some form in your own community. Become knowledgeable about topics that are being discussed in local government, formulate a way to think through issues, and take the time to make your voice heard. In the words of the great Bob Marley, "Get up, stand up, stand up for your rights; Get up, stand up, don't give up the fight." Ω

ERE Clubs Information Board

Compiled by Steven Hopper, ERE Senior

Organization	Spring 2019 Activities	Fall 2019 Planned Activities
ERE Student Association (ERESA) **Email:** *eresa@humboldt.edu* **Webpage (temporary):** *http://tinyurl.com/HSUERESA*	• Crab Feed • ASCE Workshop for Student Chapter Leaders (WSCL) in Honolulu, HI • Pizza with Professionals • ASCE Leadership Conference • ASCE Wastewater Treatment Comp • Ice Cream Social / ERE Awards Banquet • Mock Interviews • ASCE Order of the Engineer • ERE graduation reception	• Klamath Connection Welcome • Locker Raffle • Strawberry Rock Hike • Welcome Back Pizza • Pizza with Professionals • Tentative YMG collaborative events • Fall Follies • ERESA elections • Tentative ASCE Report Card
Engineers Without Borders (EWB) **Email:** *humboldtewb@gmail.com* **Webpage:** *URL coming soon*	• AHHA domestic sanitation design proj • Demonstration ram-pump • Tish Tang CG water resource design • New int'l project coord with NCPC • Project coordination with CCAT • NCPC Homebrew Festival fundraiser • Sponsored project presentations • Joint meeting with SWE	• AHHA domestic sanitation design proj • Tish Tang Campground water resource design • New Int'l project coord with NCPC • Project coordination with CCAT • Ram-pump and rope-pump improve • Sponsored project presentations • I-Block party tabling
Renewable Energy Student Union (RESU) **Email:** *resu@humboldt.edu* **Webpage:** *https://www.facebook.com/HsuRenewableEnergyStudentUnion/*	• Local residential solar installations with GRID Alternatives • Solar Radiation Monitoring Station (SoRMS) • Sustainable Future Speaker Series • 2019 California Solar Regatta	• Local residential solar installations with GRID Alternatives • Solar Radiation Monitoring Station (SoRMS) • Sustainable Future Speaker Series • Samoa biomass plant tour • Geysers geothermal plant tour • Shasta Dam tour
Society of Women Engineers (SWE) **Email:** *swe@humboldt.edu* **Webpage:** *http://hsu.swe.org*	• SWE Social • Mentor Meet-up • Rita's fundraiser • Girl Scout Day • WELocal Conf in Belleview, WA	• Engineering Day • SWEshi • Attend professional meetings • Fall Follies • All Clubs Day • Resume Workshop • Other prof development activities
Society of Hispanic Professional Engineers (SHPE) **Email:** *shpe@humboldt.edu* **Webpage:** *https://www.facebook.com/shpe.hsu/*	• Tostada Bar • Summer Experience application workshop • Civil Engineering AutoCad workshop • Celebracion Latin@ – Cesar Chavez & Dolores Huerta • SHPE Regional Conference • End of the semester potluck • ERE Graduation Party	• Tostada Bar • Time management workshop • Fiesta Patrias • Networking workshop • Bay Area Graduate Pathway to STEM • SHPE National Conference • Summer Experience Panel • Architecture AutoCad workshop • 5-Year course planning • End of the semester potluck

Get Up! Stand Up!

And Seek Elected Public Office

by Mary Burke (MS ES-IDT 2011)
Program Manager, California Trout (CalTrout), N Coast Region, Arcata, CA
Board Member, McKinleyville Community Services District, McKinleyville, CA

As an elected official, I am motivated to inspire people to engage in political action. Having worked alongside ERE students at HSU while earning my Master's Degree in Environmental Systems (ES), I know that your training and skills are exceptionally valuable in the public sector. Working as an engineer requires hard work and dedication, and people's lives depend upon engineered decisions. Similarly, the decisions of political bodies also affect lives. Imagine combining your training as an engineer with the ability to affect change within an institutional body. Politicians with this combination of skills are in high demand.

The ERE program requires collaborative teamwork and training in communication and relationship development, all just as important as knowing the right formulas and assumptions. Combined, these skills make you ideally suited to take on a leadership role in your community. This is confirmed by the fact that seven ERE and ES graduates are currently serving as elected or appointed officials in Humboldt County. We serve on the Arcata City Council; Humboldt Bay Harbor, Recreation, and Conservation District; County Board of Supervisors; County Planning Commission; North Coast Unified Air Quality Management District; Redwood Coast Energy Authority Board, and McKinleyville Community Services District. In addition, our District and others contract with ERE graduates working for local firms to help us tackle water and wastewater infrastructure improvements and natural resource enhancement projects.

Mary Burke in her hometown of McKinleyville, California.

Three years ago, I did not imagine my future held a political election and public service in addition to an already rewarding career in natural resources conservation. However, the pivotal moments that started me on this path were witnessing massive songbird die-offs and salmon fish kill events. How could these tragic ecological events be happening? I was motivated to become engaged in the decision-making process by pursuing a graduate degree and improving my skills in critical thinking and communication.

I moved to Arcata in 2005 and enrolled in the International Development Technology (IDT) program of the Environmental Systems Master's degree program at HSU. IDT was a unique program option designed by ERE Professor Robert Gearheart, who became one of my mentors. The coursework involved politics, economics, and appropriate technology geared to produce effective international development projects. In my research, I was introduced to assessment tools that I have

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