

Los Angeles Section

Monthly: Est. 1913

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PRESIDENT'S MESSAGE

John Rogers, P.E., F.ASCE
Los Angeles Section President

VOL. LV NO. 10

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The View From New York

Home again from New York City, and back to work after experiencing the 2015 ASCE National Convention, held this year at the Marriott Marquis Hotel, just off Times Square.

As we have come to expect, the convention was superbly managed, technically challenging, and completely rewarding. Yes, it was expensive, but that is to be expected for anything in New York City. Our vote: worth every cent.



Technical topics and tours, and short courses were heavily weighted by the many significant projects currently underway in the New York area, including the replacement Tappan Zee Bridge, the new 2nd Avenue Subway, the gigantic East Side Access rail tunnel to Grand Central Terminal, and the truly remarkable High Line Park, a freight rail line repurposed into a 1-½ mile linear aerial park. A version of the classic boat tour around Manhattan Island was given an Engineer Geek spin with historic and technical details of each of the many bridges and tunnels connecting the island with New Jersey, Brooklyn, the Bronx, Queens and Westchester County. Long Island and the surrounding boroughs. Shorts courses on construction of the new tunnels, four current bridge projects, the region's response to damage caused by Hurricane Sandy, and methods of response to future disasters.

Concurrent sessions were so varied and interesting that choosing which ones to attend became difficult.

Civil Engineering History: the Brooklyn Bridge, Flood mitigation in the Netherlands and in U.S. hurricanes, Niagara Falls, 19th Century New York bridges, the Roebling family, the 1939 World's Fair,

Technical: Super-tall residential towers in Manhattan, the role of Civil Engineers in producing Boeing airliners, Flood disaster response),

Professional development: licensing, Emotional Intelligence (EQ), innovation in Civil Engineering, training interns, infrastructure report cards, and ASCE's own inspiring Jim O'Brien

The Business of Engineering: What to do before the lawyer calls, design efficiency for green infrastructure, diversity and inclusion.

Keynote speakers were thought-provoking and genuinely funny (who would expect this from Stanford-educated Electrical Engineer Don McMillan, PE, PhD. – check him out on YouTube). The introduction of the 2015 class of Distinguished Members allowed us the opportunity to meet thirteen eminent Engineers from academia and industry who were elevated this year to the highest level of recognition conferred by the Society.

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ASCE Construction Institute Sacramento Section Student Day



SACRAMENTO, California. - The ASCE Construction Institute (CI) Sacramento Section hosted its Student Day event October 17 and 18, 2016 at the Doubletree Hotel in Sacramento, California. Over 55 junior and senior civil engineering and construction management students from the regions four local universities participated in the event which featured an evening dinner on Friday and panel/breakout sessions by industry leaders.

The event was kicked off with the buffet dinner highlighted by a keynote address by the United States Army Corps of Engineers (USACE) Brigadier General Mark Toy. Brigadier General Toy delivered a nearly one hour animated and motivating presentation that focused on passion and the AURA concept that makes leaders and people successful. Having passion in what you do is the key to accomplishing whatever you want to do. Accept your position and role. Understand your duties and responsibilities. Recognize your team for their achievements. Take time to appreciate your team and yourself for the hard work put in to completing a project or winning an award.

The Saturday early morning session featured an open panel session by four industry leaders including the current ASCE CI National Director Paul Sgambati, PE, Darren Mack, GE (SAGE Engineering), Rick Reinhardt, PE (MBK Engineers) and Steven Hiatt, PE, SE (HDR, Inc.) Paul kicked off the session with his presentation titled "The Road Ahead;" which began with a capital "S;" which represented the future Leaders of the industry. Darren presented a light hearted discussion in his talk titled, "Things I Wish I Knew As a Student". He emphasized not to be afraid of doing field work and getting hands on experience, traits all engineers should have. Rick talked about his role as a flood plain manager and the everpresent challenges in his presentation, "Flood Management in the Lower Sacramento / Delta North Regional Flood Management Planning Area". Steven provided some tips for success that he has seen over his career which include getting your PE as soon as possible, remaining active in the organizations (such as ASCE), and make conscious decisions to advance your career. He also talked about getting into the business aspects of engineering, something that is outside of the box of what we typically do on the technical side of our daily work.

Following the early morning panel sessions, the students went to the mid morning breakout sessions which featured other industry engineering and construction leaders. The informal breakout sessions were divided into the various engineering disciplines as indicated:

- Construction Management discussion was provided by Thor Larsen, PE (HDR, Inc.) and Andy Gust, PE (Psomas)
- Transportation Engineering discussion was provided by Kevin Thompson, PE (URS Corporation)
- Interview skills and resume workshop provided by Jennifer Powers
- Geotechnical Engineering discussion was provided by Darren Mack, GE (SAGE Engineering)
- Construction and related discussion was provided by Mike Tatusko (Granite Construction)
- Water Resources Engineering discussion was provided by Rick Reinhardt, PE (MBK Engineers)

The morning sessions were followed by a field trip to the Folsom Dam Spillway and Control Structure jobsite hosted by Granite Construction and Kiewit Construction, the prime general contractors on the two massive federally funded projects. Participants met with Rob Cheeseman (the project CM) who provided an overview of the project scope and background. The students then met with Lew McIlroy (the project Safety Manager) who discussed the project safety hazards and protocols. The field trip then concluded with a visit to the dam structure and a tour of the entire jobsite. The chartered tour bus then returned to the Doubletree hotel where the conference concluded in the afternoon.

The event was 100 percent sponsored hosted by the Sacramento Section of CI. Local firms such as Magnus Pacific Corporation, Construction Testing Services, The Dutra Group, Granite Construction, Kiewit Construction, and Teichert Construction provided attendees with swag and safety gear including hard hat, safety vest, and safety glasses. In closing, the Sacramento Section CI group would like to thank the ASCE Section, the industry firms, BG Toy, and all of the individuals for their time and commitment to participating in this event as either a panel or breakout session member.



Student members attending the Convention were everywhere – a large contingent in uniform from West Point, five students from our own CSU Long Beach, and representatives from Purdue, University of Wisconsin, USC and other schools nationwide. Our own Cal Poly San Luis Obispo, represented by the current Student Chapter President, Monica Fiedler-Ross received the Robert Ridgway Student Chapter Award.

The youngest guest at the convention: Probably 6-month old Lindsey Ledbetter, daughter of Amy and Riverside-San Bernardino Branch President Steven Ledbetter.

The most rewarding benefits of attendance: the opportunity to meet Engineers from all aspects of the Civil Engineering profession, from all parts of the Country and from around the world. To meet, face-to-face, and to talk with the ASCE Presidents, National officers, and senior Staff, past, present and future. To renew old acquaintances, to learn new things, to be challenged, and to be invigorated as we go back to our day jobs.

So plan ahead to join many of your Los Angeles friends and colleagues next year, September 29 to October 3, in Portland, Oregon, chaired by past-National President (2013) Greg DiLoretto. We think his committee's efforts will result in a convention that easily equals or exceeds the efforts of their New York predecessors.

Random thoughts on New York:

The City has a truly remarkable transportation system, with easy-to-use subways and busses going to every corner of the City. Airports with multiple options for ground transportation (JFK to Times Square by AirTrain and subway, 1½ hours and \$ 7.75)

New Yorkers are friendly. Ask almost anyone on the street for directions; they will probably walk with you halfway to your destination.

Most New Yorkers appear to make their living selling stuff to other New Yorkers – and to tourists.

A significant number of working New Yorkers sell tours and tour bus tickets on the street.

New Yorkers love to eat. The entire City smells like good food. Everyplace, even in the subways. New York has taco trucks!

Views of the City from higher floors are exquisite – but unless you have an employee ID and a corner office or an upper-level apartment in one of the hundreds of tall residential towers, the views all require paid admission (e.g. The Empire State Building, Rockefeller Center, the View restaurant at the Marriott).

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State Investments and Legislative Update

by Richard Markuson, CA Region 9 Legislative Advocate



The State Legislature adjourned the regular session on September 11 but the special session called by Governor Brown to enact permanent and sustainable funding to maintain and repair the state's transportation and critical infrastructure, improve the state's key trade corridors and complement local infrastructure efforts remain – well – in limbo (as well as the special session on health care funding).

The Legislature has sent two bills, ABX1 3 (Frazier) and SBX1 4 (Beall), to conference and both houses appointed the conferees while no hearings have been scheduled at this point, leadership staff suggests an initial hearing in early October, with the likely focus on Governor Brown's September 3rd proposal and elements of the Republican recommendations. There will likely be presentations by experts such as the Legislative Analyst's office.

On September 22, leadership in each house released the names of their conferees, and breaking with tradition, named 10 members, instead of the usual 6. Each house will have 5 representatives on the Conference Committee, with 3 Democrats and 2 Republicans. Members are: Assemblymembers Jimmy Gomez, D-Los Angeles, Jim Frazier, D-Antioch, Autumn Burke, D- Inglewood, Melissa Melendez, R- Murrieta, Jay Obernolte, R – Hesperia and Senators Jim Beall, D – San Jose, Connie Leyva, D – Chino, Ben Allen, D – Redondo Beach, Ted Gaines, R – El Dorado Hills, Anthony Canella, R – Merced,

Other Bills

AB 194 (**Support**) by Assembly Member Frazier that authorizes regional transportation agencies and the California Department of Transportation (Caltrans) to develop high-occupancy toll lanes and other toll facilities without limitation was approved by both houses and is awaiting action by Brown.

AB 1171 (**Support**) by Assembly Member Linder that would authorize regional transportation agencies to use the Construction Manager/General Contractor project delivery method, as specified, to design and construct certain expressways that are not on the state highway system is also looking for a signature.

Appointments

Governor Brown has made the following appointment:

As assistant secretary for Salton Sea policy at the California Natural Resources Agency: **Bruce Wilcox**, Imperial, interim assistant executive director at the Salton Sea Authority.

Recent Reports

Jennifer L. Hernandez, et al. Holland & Knight released *In the Name of the Environment: Litigation Abuse Under CEQA (Registration Required)* The law firm Holland & Knight conducted a comprehensive study of CEQA lawsuits filed between 2010 and 2012. "Projects designed to advance California's environmental policy objectives are the most frequent targets of CEQA lawsuits: transit is the most frequently challenged type of infrastructure project, renewable energy is the most frequently challenged type of industrial/utility project, and housing (especially higher density housing) is the most frequently challenged type of private sector project." The authors also found that CEQA litigation overwhelmingly targets infill projects, rather than projects that increase sprawl.

The **U. S. Census Bureau** released *Who Drives to Work? Commuting by Automobile in the United States: 2013*. "This report focuses on patterns of commuting by private vehicle among U.S. workers in 2013. It highlights differences in rates of automobile commuting by key population characteristics such as age, race, ethnicity, and the types of communities in which workers live." The findings include the following facts: "About 86% of U.S. workers commuted to work by automobile in 2013; 3 out of 4 commuters drove alone... At 76.6% of workers, driving alone to work peaked in 2010.... The rate of carpooling has declined during each decade since 1980. About 9.0% of workers carpoled in 2013, down from 19.7% in 1980."

The **California Center for Jobs & the Economy** released *Green Goods & Services: The Distribution of Solar Panels & Energy Subsidies in California*. As California considers expanding its alternative energy programs, this report shows that the benefits to date have favored specific legislative districts, income groups and regions. "For the period 2007-2013, about half the solar panels installed in California were in the zip codes with the top 30% of median household income. The bottom 20% received only 7.8%.... The Bay Area has consistently benefited more from these programs than other regions of the state, both in absolute terms and relative to their population size.... In sharp contrast, Los Angeles region has been underrepresented in these programs, containing over 29% of the population but having only 19% of solar panel installations 2007-2013."

The **Reason Foundation** released *Truck-Friendly Tolls for 21st Century Interstates*. "This report begins with a vision of a second-generation Interstate highway system, capable of meeting the demands of the 21st century. It then reviews several possible ways to finance the replacement and modernization of existing Interstate corridors to serve future needs, especially those of the current and future trucking industry. In assessing a possible toll-financing approach, it reviews rapidly changing technology that could make 21st century tolling dramatically different from, and far more user-friendly than, cash-based 20th century tolling. It also discusses an

array of concerns that must be addressed to make this approach workable for America's trucking industry."

Next10 has released California's Manufacturing and Benefits of Energy Efficiency. It found that manufacturers "generate \$59 in state GDP for every dollar spent on electricity, compared to \$38 for the rest of the nation."

California Transportation Commission has released "Proposition 1B: Promises Made, Promises Kept," finds that the CTC's management of "more than \$12 billion" from Proposition 1B program "has resulted in additional federal, local and private investment of \$25 billion to improve transportation infrastructure around the state."

The **Legislative Analyst's Office** has released its review of the Air Resources Boards strategy for allocating proceeds from cap-and-trade auctions for the next three years, finds the investment plan "needs further development."

Little Hoover Commission has released its report, "Averting Disaster: Action Now for the Salton Sea," outlines dangers as thousands of acres of newly dried-up lake bed "become exposed to desert winds that could carry dust to populated areas and nearby world-class resort economies," recommends "immediately implementing projects to cover part of the lakebed with dust-mitigation projects and shallow ponds for wildlife habitat, and exercising an available option to sell water to boost project funding."

Dept. of Water Resources released statistics on the 2014/15 water year (10/1/14 through 9/30/15), data includes: average low temperature for the Sierra Nevada region last winter was 32.1 degrees, "first time this value was above water's freezing point in 120 years of record-keeping;" storage in state's reservoirs will end this water year at 54 percent of historic average; according to current surface temperature of Eastern Pacific Ocean there's a 95% chance of a strong El Nino year, "six strong El Nino events since 1950 produced wet conditions in Southern California, but only the strongest ones in water years 1983 and 1998 brought significant precipitation throughout the state;" note that fifth year of drought is possibility, "California has experienced two six-year droughts in the past nine decades, 1929-34 and 1987-92."

California Natural Resources Agency released its report, "Challenges Facing the Sacramento-San Joaquin Delta," urges "more than 230 agencies, institutions and stakeholders" with interests in the Delta "to become more nimble and better coordinated and to act incrementally with the understanding that any management action 'typically leads to new complexities.'"



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Bi-Monthly Board Meetings



Day:
First Thursday of every other month

Location:
OCTA
550 S. Main St.
Santa Ana, 92868

Time:
6:00 pm

Everyone is welcome

ASCE Region 9 Accomplishments Over the Past Year

by Jay H Higgins, P.E., F.ASCE, Region 9 Director



September 30th marks the end of the Region 9 fiscal year, and it is at our September Face-to-Face meeting, that the Board of Governors looks back over past year and plans for the future year. One of the important sessions of that meeting is hearing from the Governors on what they feel Region 9 has accomplished over the 2014-2015 year.

Listed below is a summary of the results of that discussion, which highlights the major accomplishments of Region 9 and its organizational entities toward implementing

Society's three top strategic initiative; Infrastructure Advocacy, Sustainability, and Raise the Bar:

- **Sustainability Committee Formation** – One of the three top strategic initiatives of the Society is sustainability. To support this initiative, Region 9 implemented a Sustainability Committee, Chaired by Mark Norton. The Committee is up and running with representatives from all four Sections participating in conference calls and activities. They are coordinating their activities with the Society's Committee on Sustainability. Look for more integration of sustainability topics in Region 9 activities, such as the Infrastructure Symposium. The Committee is also encouraging all Region 9 members to obtain the Envision® Sustainability Professional (ENV SP) credential. For more information concerning this credential, go to: www.sustainableinfrastructure.org/rating/.

- **Raise the Bar Committee Formation** – Another of the three top strategic initiatives of the Society, is Raise the Bar (RTB) which has a goal to advance the profession and the public welfare by actively supporting the National movement to raise the educational requirements for licensure of future professional engineers. To support this initiative, Region 9 started a RTB Committee, Chaired by Kwame Agyare. The Committee is up and running with several representatives from the Sections and Branches participating in conference calls and activities. They are coordinating their activities with Society's RTB Committee and have made presentations to members, which has provided valuable feedback. The Region 9 Committee is available for presentations to your Branch or Section. If interested, contact Kwame at agyare.kwame@gmail.com. For more information on the Raise the Bar, initiative go to: www.asce.org/raise_the_bar/.

- **Region 9 Legislative Day Fly-In to Sacramento and Legislation Support** – This year the Region started an introduction to the legislative process. The first half of the day was a training session to introduce members who are new to the legislative process to the work done by our Region 9 infrastructure advocacy initiative and how they can participate in the advocacy process. The second half of the day was spent visiting State Legislators to discuss pending legislation related to infrastructure and offer ASCE support and provide contacts for future civil engineering bills and issues. We plan on holding this activity each year in the spring. The Region 9 Committees of Transportation, Water, and Government Relations regularly reviewed legislation which resulted in a significant number of "support" letters to California State Legislators and the Governor.

- **California Infrastructure Symposium and Region 9 Awards** – Another activity is the annual Region 9 Infrastructure Symposium and Awards Dinner. This year, Region 9 partnered with the San Diego Section, which was also celebrating their 100th Year Anniversary. The day-long Infrastructure Symposium addressed the major issues in transportation

and water. Region 9 greatly appreciates all of the efforts of the San Diego Section members that worked so hard to make this event a success. There were a number of other accomplishments throughout the year. Below are just some of the many other achievements of the Region 9 Governors, Committee Chairs, Sections, and Branches:

- **Region 9 Awards Online Awards System** – This year the Region 9 awards submission process became fully automated. This new system, which is also being implemented at the Section and Branch levels, will provide a process for individual and project award recipients to be submitted from the Branch to the Section to the Region automatically. Thanks to the Region Awards Committee Chair, Kwame Agyare, for his work on this new efficient process;
- **Governors Serve on Society Committees** – Part of the responsibility of a Region 9 Governor is to serve on a Society Committee. For example, last year I served on the Society's Member Communities Committee, which is focused on providing value to our members. The Member Communities Committee is responsible for member support, engagement, and communication. The Member Communities Committee provides support and oversight to the Society's Geographic Units. Examples of other committees that Governors provide service to include Critical Infrastructure, Public Policy, and State Government Relations to name just a few. If you have a concern or question about your Society, contact your Section's Governor, and they can steer your inquiry so that it can be addressed by the proper committee and, if necessary, brought to the attention of the Board of Direction;
- **Efforts to revitalize two inactive Branches moved forward;**
- **Efforts continued to create a new Monterey Branch within the San Francisco Section;**
- **Region 9 members participated in judging at the Mid-PAC Student Conference Competition and the Pacific Southwest Student Conference National Student Steel Bridge Student Competition;**
- **Disaster Preparedness Committee Chair, Doug Taylor, focused on stepping up the efforts to train members to receive California Safety Assessment Program (SAP) certification;**
- **In conjunction with San Diego Centennial Celebration, San Diego published two books; 1) a San Diego Section Life Members Memoirs; and 2) History of San Diego. They also added a chapter to San Diego Historical Journal; and**
- **Sacramento Section's activities toward Scholarship fundraising, which raised a significant amount of funding.**

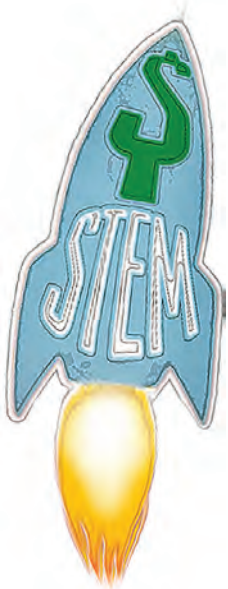
These accomplishments could not have happened without the leadership and dedication of Governors, Section Presidents, Committee Chairs, and active members who give so much of their time to support Region 9 activities. To them I would like to express my sincere appreciation and look forward to working with our members over the next year to continue to provide quality activities throughout the Region.

I would also like to take this time to thank Mark Norton and Larry Pierce, the two outgoing Governors, for their service over the past three years. Mark served as a Governor-at-Large, Region 9 Vice Chair, and Chair of the Water Committee. We are fortunate that he is willing to continue on his involvement with Region 9 as Chair of the Sustainability Committee. Larry served as Governor of the San Diego Section, Internal Secretary, and Chaired the San Diego Infrastructure Report Card, a major undertaking. Their dedication and service has contributed greatly to the successes of Region 9 over the past year.

If you have any questions about Region 9 or your Society, please feel free to contact me at jayhiggins896@gmail.com

Research Finds Good Jobs Are Indeed Growing

by Kevin Wilcox



The report reveals that “good jobs,” defined as those that pay more than \$53,000 and that generally offer health care and retirement benefits, have grown 44 percent.

Researchers at Georgetown University's Center on Education and the Workforce have found that during the protracted recovery from the Great Recession, the U.S. economy created more high-quality jobs than headlines over that period—which emphasized the addition of only lower-paying jobs—might have indicated.

“Those low-wage stories ran counter to what we know about cyclical patterns and long-term economic trends,” says Tamara Jayasundera, Ph.D., a research professor at the center and one of the authors of the recent report “Good Jobs Are Back: College Graduates Are First In Line.” The report defines “good jobs” as those that pay more than \$53,000, which is 26 percent above the median for full-time workers in the United States.

Jayasundera notes that these good jobs tend to be the first added during an economic recovery as employers fill professional and managerial positions in advance of an expected expansion. Additionally, “over the long term, employers have been hiring more educated, highly skilled workers,” she says. “And the college wage premium...has been growing since the 1980s. We truly wanted to

figure out what is going on.”

To examine the discrepancy between what was commonly reported about new low-wage jobs and the nature of the jobs that were actually added, the team used data from the Current Population Survey, a joint effort by the U.S. Census Bureau and the U.S. Bureau of Labor Statistics, which includes employment information about U.S. workers, compiled monthly. That data was complemented with a more detailed annual supplement collected by Census Bureau each March. The researchers found that the common misperceptions were often based on research that grouped jobs by the industries creating them rather than the actual types of jobs that were being created. For instance, the hospitality and leisure industry has a high percentage of low-paying jobs, and thus a lower average salary for the industry, and so more jobs in that category were often reported as more low-wage jobs. Yet that field also provides many high-paying jobs—for example, managerial and financial professionals.

When the team examined the data by grouping the jobs by occupation, they found that the jobs being created were actually those with higher wages and good benefits, such as those in the managerial, professional, and technical fields.

“When you look at occupation, [which] is categorized by the skills you need and the work you do on the job—[and] is very closely tied to the wages you earn—44 percent of job growth was happening among good jobs,” Jayasundera says. “There is growth at every level—and

low-wage jobs are also growing. However, low-paying jobs are not the overwhelming majority.”

Of the 6.6 million jobs added during the recovery, 2.9 million were these good jobs, compared to 1.8 million low-wage jobs, and 1.9 million middle-wage jobs. The growth of good jobs accelerated from 2011 through 2012 and continued adding more jobs through 2014. The research found that 86 percent of the good jobs are full time, 68 percent offer health insurance, and 61 percent include retirement benefits.

The research reinforces the value of a college education—2.8 million out of the 2.9 million good jobs were filled by college graduates. Fewer workers holding a high school diploma held good jobs by the end of 2014 than did in 2010. “Throughout, what we see is workers with a high school diploma or less are getting pushed out,” Jayasundera says. “If you don’t have anything beyond a high school education you’re going to be struggling really hard to get into today’s labor market.”

Nearly all of the good jobs as defined in this report require at least some college education, Jayasundera says. “But even when you come to the low-wage jobs, you needed some post-secondary education,” she points out. “Sixty-one percent of the low-wage jobs were taken by workers with some college education or an associate degree.”

And the research reaffirms that a college education in science, technology, engineering, and math (STEM) continues to be a wise choice: STEM fields added 881,000 new good jobs between 2010 and 2014, second only to the 1.78 million added in the managerial and professional occupations. And other recent research indicates that students who earn a bachelor’s degree in STEM fields earn more over their lifetimes than those who hold other bachelor’s degrees. (Read “New Study Shows STEM Education Pays Off over A Lifetime” on Civil Engineering online.)

The center’s research revealed that 445,000 good jobs were added in health care occupations, which rates second-highest after STEM fields, and 124,000 were added in sales and office support. But the blue-collar and education fields both lost good jobs over the same period.

“Job growth is being driven by the fastest-growing industries: consulting, business services, and healthcare,” Jayasundera says. “Those are the industries that hire large numbers of managers and professional workers as well as STEM workers.”

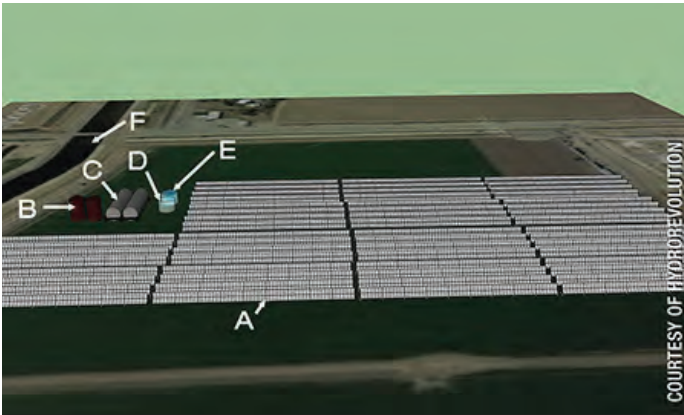
Jayasundera says that the overall sluggish recovery in the construction and manufacturing sectors is holding down the growth of middle-wage jobs, but both are beginning to show improvement.

She says that the center will undertake research to learn more about the college graduates who have filled these good jobs during the recovery and also to research wage stagnation during the recovery to determine how severe it is and why it is happening. “The stories that we hear is that wages have not been growing,” Jayasundera says. “There is employment growth happening, but the wages have been stagnant.

“There are small signs of improvement, but it is not anywhere near what we want to see,” she says. “I want to look into that wage growth a little bit more.”

Can Solar-Powered Desalination Aid California?

by Catherine A. Cardno, Ph.D.



Next year a 2 million gal/day solar-powered desalination plant will be constructed in California's Central Valley. At the facility, large solar thermal parabolic collectors, A, will maximize the collection of solar energy. Excess heat will be stored in thermal storage tanks, B, filled with a solid, highly conductive material. The desalination process will use the collected heat in a distillation system, C, where the mineral salts will be separated from the freshwater. Salts will be stored in a tank, D, before being sold as a useful byproduct, and freshwater will be stored in a tank, E, before being discharged into a canal, F. Courtesy of HydroRevolution

It is not breaking news that the state of California is suffering from a debilitating drought that led Governor Edmund G. Brown, Jr., to issue the first-ever state-wide mandatory water restrictions earlier this year (read "Engineering for Every Drop" by Robert L. Reid in the forthcoming November issue of *Civil Engineering*). These restrictions have resulted in residents letting their lawns brown, or go "California Gold," as it's been called; at least one city required for a period of time that restaurants serve food with disposable plates and utensils to conserve water; and farmers are letting what would otherwise be lucrative fields lie fallow. The state's snow pack is almost nonexistent in the Sierra Mountains, reportedly hitting a 500-year low, and the entire state is collectively holding its breath for the promised wetter-than-usual winter that is predicted by some to arrive with this year's El Niño.

But what if a cost-efficient desalination system was already in the works, with the potential to help Californians with their water supply regardless of drought conditions? A successful 25,000 gal/day prototype built in the state's Central Valley—long known for its fertile fields and successful crops—has proven that a grid-independent, solar-powered desalination plant can operate successfully. With its success come plans to begin construction of a full-size, 2 million gal/day facility next year in the rural community of Panoche. Design of the facility is currently under way.

The Central Valley is one of the best places for solar thermal energy, according to Brian Fojtasek, a chemical engineer, a senior process engineer, and the president of Amherst, New York-based ATSI, the

full-service engineering and consulting firm that helped develop the solar-powered desalination technology for commercial use. ATSI, which has also been involved in early commercialization of such renewable technologies as waste-to-energy systems, partnered with the Cambridge, Massachusetts, and Healdsburg, California-based water production company WaterFX to develop the solar desalination technology. The team created the new facility, dubbed HydroRevolution, to be both its own company and a test project, based in Firebaugh, California.

The system uses agricultural runoff that is not absorbed by plants or soils during irrigation. In the Central Valley, this agricultural runoff typically includes concentrations of 1.5 to 3 percent of salts, and those salts contain boron and selenium, which can contaminate any bodies of water into which they are discharged. "The project was initially intended to treat the agricultural runoff water to prevent contamination of the nearby rivers," Fojtasek explains.

Despite the drought that has afflicted the state, "this runoff treatment remains one of the primary goals for the Panoche site [of the] HydroRevolution project," Fojtasek notes. "In fact, whenever 'normal' rains return to California, there will be even more runoff water to treat, making the project continually viable regardless of whether drought conditions exist."

With the process that has been developed to treat the water in Panoche, the salty runoff is collected and sent through the desalination process so that the mineral salts can be separated from the freshwater. The freshwater is then directed to a canal so that it can be reused in the fields, while the mineral salts are collected as solids that can be sold as a useable by-product to either consumers or businesses. "Specific minerals such as boron [as borate] can be extracted for use in agriculture fertilization, or salt compounds such as gypsum [calcium sulfate] can be used for industrial materials," explains Fojtasek.

What makes this system so unusual, however, is its high efficiency compared to existing systems, which enables it to operate in remote locations and to be powered by renewable energy. "A solar still is a device for capturing solar energy and using that energy to evaporate and condense pure freshwater," Fojtasek explains. Unlike typical stills, however, the HydroRevolution technology—which is called Aqua4—dramatically increases the efficiency of the process. "While stills have been around for a very long time, the basic solar still will only produce 9 cubic meters of water per day per acre of solar collection area," Fojtasek says. "Aqua4 incorporates state-of-the-art technology for using solar energy as efficiently as possible to produce over 275 cubic meters of freshwater per acre, every day. This is a thirtyfold increase in the productivity of solar distillation and results in greater water production in a smaller footprint."

The system provides a 100 percent recovery rate of freshwater from

the source water, according to Fojtasek.

At the Panoche facility, large solar thermal parabolic collectors will maximize the collection of solar energy. The array's mirrors will direct the sun's energy to a mineral oil-based heat-transfer fluid located in glass-insulated piping, heating it to greater than 400 degrees F. The fluid will then carry the heat to an absorption heat pump that optimizes the system's efficiency and heat utilization, according to Fojtasek. Excess heat will be stored in thermal storage tanks filled with a solid, highly conductive material that can be drawn upon to reheat the transfer fluid for 24-hour-a-day operation and during cloudy spells. A natural gas backup will also be built on-site in Panoche, in case it proves necessary for full operations to continue in the typically cloudy periods of January and February.

While the parabolic array is being designed to minimize its structural mass, its overall 115 m by 6 m size will nevertheless result in a significant potential for impacts from wind-based forces, according to Fojtasek. So the array's collectors will require robust foundations, and these will need to address the poor soil conditions on-site. Designs for micropilings, screw pilings, spread footings, and other foundations are currently being evaluated so that the most economical and suitable foundation can be selected, Fojtasek says.

In addition, wind fences will be installed on two sides of the array to protect it from prevailing winds, and the winds will be continually monitored so that the system can be put into a "storage" mode during unusually strong wind events.

The desalination process, which is separate from the solar energy-collection system, works by feeding the collected heat into a distillation system. "The steam generated by the thermal energy drives a multieffect distillation process that 'multiplies' the energy by reducing pressure in multiple distillation stages," Fojtasek explains. "That means that the energy used to generate steam from one stage, or 'effect,' is used in subsequent effects at lower pressure to generate more steam.

"Instead of condensing the last effect-generated steam and effectively throwing away that energy, WaterFX's technology recycles and recovers that steam in a proprietary heat-pump system," he continues. "That recycled energy is then applied to the first effect, thereby reducing the amount of outside energy required for distillation."

In all, the amount of energy required to operate the system will thus be reduced by between 40 and 60 percent versus typical thermal desalination systems, according to Fojtasek. This reduction—which also equates to significant cost savings—has been documented in a peer-reviewed paper published in the journal *Desalination* (Elsevier, 2015), he notes.

The lower energy requirements make the system a good candidate for the use of renewable energy production. "By demonstrating the ability to use renewable thermal energy, it makes the project and technology viable for energy-stranded regions," Fojtasek notes, such

as island nations or developing countries in which extensive energy infrastructure is lacking. "Any thermal source is sufficient for running the unit, but solar is 100 percent renewable and readily available in the Valley," he points out. Such sources as geothermal, biomass, or waste heat from other industrial sites could also be used to run the system.

"One of the most valuable innovations of the WaterFX technology is the ability to recycle thermal energy in our process," Fojtasek says. And this is a system that can be implemented in traditional coastal desalination systems that draw on seawater, as well—lowering their energy consumption by similar percentages, he notes. By retrofitting existing thermal systems, this processing capability reduces the direct cost and carbon footprint of existing desalination facilities because it can upgrade the systems without adding suction and discharge lines to the ocean, according to Fojtasek.

In addition, "the WaterFX technology allows for the efficient and cost-effective 100 percent recovery of the seawater, thereby eliminating the need for brine reject to the ocean and doubling the recovery of water from the intake," Fojtasek says. "The resulting sea-salt is a marketable product for commercial and industrial markets."

The technology solves numerous water problems, according to Fojtasek: it generates a new water supply, because it creates freshwater from previously unusable water; it reduces farmers' reliance on federal water supplies by recycling agricultural runoff; and it draws little to no energy from the grid, reducing the environmental impact of the plant. The technology can also be used to treat the contaminated water that is a by-product of the oil extraction.

And what does the future hold? According to Fojtasek, the idea is to develop fully renewable, municipal-scale projects that can convert municipal solid waste—trash—into low-cost electrical and thermal energy that, in turn, could be used to create low-cost freshwater from currently unusable water sources. "ATSI has helped develop these technologies with different partners, and these combined-renewable-product projects serve communities' mandates of reducing landfill [use], generating low-cost renewable power, and providing a low-cost, stable source of 'new' water," he says.



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Publisher

ASCE LA Section
Gayle Stewart
1405 Warner Ave., Suite B
Tustin, CA 92780
Phone (714) 258-8306
Fax (714) 258-8391
E-mail: GStewart@associationplanet.com

Editor

Dr. Cris B. Liban, P.E.
LACMTA
One Gateway Plaza
Mail Stop 99-17-2
Los Angeles, CA 90012
Phone (213) 922-2471
FAX (213) 922-6875
E-mail: cliban@alumni.ucla.edu
Typesetting, Layout & Printing: Apollo Printing & Graphics



Please send all copy to the Editor by
the first of the month preceding publication.

Identification Statement

ASCE Newsletter, (ISSN 0273-6233)
is published monthly by ASCE,
Los Angeles Section, 1405 Warner Ave.
Tustin, California 92780. Subscription price
included in Section dues of \$45.

Circulation

Circulated monthly (except for a joint
July/August issue) to the 5,000 subscribing
members of the Los Angeles Section, ASCE.

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