

2015 Awards Show Steady Growth of Climate Change as Market Driver

Paris and Pope Francis change the conversation

For the first time since the 2009-2010 period, when Copenhagen signaled the demise of the Kyoto Protocol and U.S. senators John Kerry, Joe Lieberman and Lindsey Graham gave up their bipartisan drive to pass climate policy, the political tides seem to have shifted decisively toward action and investment for greenhouse gas (GHG) mitigation and climate change adaptation.

Yes, Paris is a voluntary agreement, and its ultimate influence will depend “on the weight given to it by political forces and markets,” as Kyle Danish of DC law firm Van Ness Feldman wrote after COP21 (bit.ly/1SsJx42). And yes, Congressional Republicans hostile to climate policy will likely control Congress for the next few years—at least. With a Republican president, we could see the United States backing away from its Paris commitments, which are based mostly on executive actions.

But such a move would risk an intense international backlash, including possible carbon taxes on U.S. exports. It would also open a floodgate of lawsuits by the same U.S. states, local governments and NGOs that won the Supreme Court’s agreement in 2007 that GHGs are air pollutants to be regulated under the Clean Air Act. In fact, Danish posits that the next U.S. president will face “almost immediate international pressure to increase the ambition” of GHG-cutting measures such as tighter standards for power plants, vehicles and methane leaks in the oil and gas sector.

2015 Executive Review & CCBJ Awards

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Internationally, Paris will mean more work for companies and NGOs that can assist developing nations in taking low-emission development strategies (LEDS) and adapting to climate change. In the private sector, the main participants will be large firms like **Tetra Tech**, **CH2M**, **Arup**, **AECOM** and **ICF** and their sub-contractors, as well as some mid-sized firms with foreign offices.

Cheryl Karpowicz of **Ecology and Environment**, a mid-sized firm with about 300 staff in Latin America, told CCBJ that she expects Paris to lead to “new opportunities” for her firm “to support reducing emissions and building resilience to climate change impacts ... in developing countries.” (See full Q&A in this edition.) Clients for this kind of work are the aid agencies like **USAID** and **GIZ**, multilateral funders such as the **World Bank**, major foundations like **Rockefeller** and even NGOs like **WWF** and **Save the**

Children.

While a great deal must be done in rural farming regions—CCBJ award recipients **Oxfam America/World Food Program** have an exemplary business model that combines insurance and physical adaptation—the priorities for action out of Paris are the fast-growing cities of the developing world.

According to Ingrid Gabriela Hoven, director general, global issues, for the German aid agency **BMZ**, directing climate finance toward cities represents a major shift for **BMZ** and other aid agencies. “The thinking [in the past] has been that if you provide more assistance to urban areas, you might pull more people from rural areas, undermining goals such as combating hunger,” Hoven said at a COP21 side event. She noted that only about 10% of climate finance to date has gone to cities, but said the trend is toward urban initiatives.

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Indeed, green growth and LEDS must become the norm or the world has no chance of limiting global warming to 2° C. And because of their population densities, growth rates and vulnerability, cities of the developing world are increasingly the focus of resilience and adaptation initiatives. "It is these cities that will be so very important to work with, so that they learn from the mistakes of the West and can build infrastructure that is both less polluting ... and is resilient to the increasing ravages of climate change," said AECOM's Dale Sands (see full Q&A in this edition).

For smaller U.S.-based environmental consulting and engineering firms, Paris probably won't translate into new business opportunities anytime soon. But it affects a million-and-one conversations. It encourages stakeholders to urge that GHGs and climate risks be incorporated into investment decisions by public and private entities and stiffens the resolve of decision makers already concerned about climate change. In addition to the Paris effect, there's the Francis effect. As described in a recent report by the Yale Project on Climate Change Communication, Pope Francis's powerful declarations over the last year are reframing climate change as "a moral and spiritual issue."

"Americans are now hearing—often for the first time—that global warming will have severe impacts on the world's poor; that it violates divine dictates on the treatment of nature; and that it requires a concerted response from all nations in the name of social justice and God's will," states the online summary of the report (bit.ly/1QIPJMM). But even without Paris or the Pope, the market drivers chronicled by CCBJ will continue to shape demand for climate-related services because of the costs of inaction and the opportunities for action. These market drivers include:

- State and local governments that need to assess their vulnerabilities and plan for climate change;

- Federal agencies like FHWA, FEMA, EPA and NOAA that are funding broad adaptation and resilience studies, pilot projects and development of methodologies for managing climate risks;
- Water and wastewater utilities (and their research and trade groups) for whom climate change brings challenges in supply, demand and water quality;
- Military and other federal agencies under executive orders to reduce their energy use and GHGs, use more renewable power and prepare adaptation plans;
- College campuses, hospitals and other institutions that need to improve their energy management and reduce GHG emissions while planning for greater resiliency against weather disasters;
- Developers or operators of coastal projects and infrastructure who need to design for sea level rise while preserving resources, aesthetics and balance sheets;
- Regulated and non-regulated emitters who need inventories and mitigation strategies, including offsets;
- Governments and project developers that need climate change expertise incorporated into EIAs;
- Renewable energy and transmission developers who need environmental permitting expertise.
- And others that are just emerging or that escape us at this writing (feel free to email the editor with your suggestions: jhight@climatechangebusiness.com)

Many of these market drivers, as well as international projects and markets, are discussed in the Q&As that follow; and many of the firms and organizations that have won awards are building their accomplishments in these or related areas.

As CCBJ looks back on 2015, we look forward to another year of providing the best market intelligence on climate change that we possibly can. ⚙️

2015 CCBJ Business Achievement Awards

Each year Climate Change Business Journal recognizes outstanding business performance in the climate change industry with our CCBJ Business Achievement Awards. Climate Change Business Journal is proud to announce its 8th annual business achievement awards for achievements in 2015. Congratulations to the winners, thanks to all the companies that submitted nominations, and we hope to see you in San Diego for the official awards ceremony at Environmental Industry Summit XIV on March 9, 2016 at the historic Hotel del Coronado in Coronado, California, near San Diego.

In October-December 2015, CCBJ solicited industry, government, non-profits and the broader climate change community via e-mail, social media, its website, industry events and word-of-mouth for nominations for the 2015 CCBJ Business Achievement Awards. Nominations were accepted in 200-word essays in either specific or unspecified categories. Categories may have been adjusted depending on the volume of nominations or the number of worthy recipients. Final awards were determined by a committee of CCBJ staff.

Growth: Climate Change Adaptation and Resilience

ICF International for continuing the rapid expansion of its climate impacts and adaptation practice. In 2015, ICF secured a five-year, \$30 million contract with the National Coordination Office of the U.S. Global Change Research Program, the federal agency program charged with managing climate science and communicating it to the public, as well as writing periodic National Climate Assessments. ICF will support USGCRP in four areas related to climate and the environment: science, informing decisions, assessment and communications and education.

ICF also won new climate adaptation and resilience business in 2015 from the City of Philadelphia, **Climate Central**, **USAID** and **Millennium Challenge Corporation**. With the addition of 2015 projects, ICF has now worked for over a dozen U.S. Government agencies on climate issues.

Notable ICF climate projects completed in 2015 include: States at Risk, America's Preparedness Report Card, a ranking of all 50 U.S. states on their readiness for climate change (for Climate Central); Toward a Climate-Ready Philadelphia, a report outlining how the city can address its major climate challenges, heat waves and flooding; a Vulnerability and Risk Assessment for Southeast Pennsylvania Transportation Authority's regional rail network; and a climate change and extreme weather modeling toolkit for the Airport Cooperative Research Program.

A management, technology and policy consulting firm, ICF generated \$1.05 billion in revenue in 2014, and \$851 million in revenue for the nine months ending September 30, 2015.

Growth: GHG Mitigation Practice

SCS Engineers for achieving 50% growth in GHG management and mitigation services in 2015. A long-standing leader in consulting engineering for the solid waste industry, SCS has developed a growing business helping clients in that sector comply with GHG regulations, including federal EPA inventory and reporting requirements and California's AB 32, under which solid waste operators are required to analyze—and in many cases mitigate—the GHGs associated with landfill expansions and other major projects.

In addition to preparing GHG inventories and analyses and mitigation plans for the solid waste sector, SCS verifies the emissions inventories of clients in electric power, oil and gas, food processing, ethanol production and other types

of manufacturers. SCS also verifies GHG offset projects involving ozone depleting substances, dairy manure methane, coal mine methane, rice cultivation, organic waste composting and (for project sponsors who aren't SCS consulting clients) landfill methane.

At the end of 2015, SCS Engineers' revenue from these business lines was on track to grow from \$5.2 million in 2014 to \$7.8 million in 2015, according to estimates shared with CCBJ. SCS Engineers generated total revenues of \$155 million in 2014.

Growth: Low-Carbon Energy

First Solar, the vertically integrated manufacturer, developer, builder and operator of solar PV power plants for its growth in 2015 and its robust 3.7 GW pipeline of projects in various stages of development. The Tempe, AZ, based company reported 2014 revenues of \$3.4 billion and saw its revenues for Q2 2015 grow by 43% to \$1.27 billion from 2014, driven by sales of its interest in the under-construction Desert Stateline project and higher than expected revenue from three other power plants.

While the growth story in solar PV for several years has been distributed generation, First Solar concentrates on utility-scale power plants, which are lower cost and easier to manage for grid operators. First Solar's Vision 2020 strategic plan focuses on international geographic expansion into markets it believes have a compelling need for "mass-scale PV electricity," including the Americas, Asia, the Middle East, and Africa.

Driving down the levelized cost of electricity (LCOE)—net present value of total life cycle costs of a PV solar power system divided by the energy it's expected to produce—from its PV plants is the heart of First Solar's competitive strategy. In a June 2015 speech to the Edison Electric Institute, CEO Jim Hughes said the firm regularly bids on utility power pur-

chase agreements at 5 cents and 6 cents per kWh. “We’re beginning to see 4- to 5-cent [solar] power [and] I fully believe that within 10 years we’ll be talking about low-3-cent power on a peak basis.”

One wild card in First Solar’s hand is how the extension of the 30% investment tax credit (ITC) for U.S. solar PV installations will affect its ability to compete with distributed PV. Prior to the extensions passed in December 2015, First Solar was anticipating that its cost advantages would be more prominent in a post-ITC world. Now that the ITC is in place for many more years, the firm’s cost advantage will be less significant.

Financing: Climate Change Adaptation and Resilience

Oxfam America and the World Food Program for the R4 Rural Resilience Initiative which is developing crop insurance as a climate resilience and adaptation measure for farmers in Ethiopia, Senegal, Malawi and Zambia. In rural communities where insurance was an unknown concept, these organizations and their local partners have persuaded more than 30,000 farmers in Ethiopia and Senegal to purchase—with a mix of cash and sweat equity—crop insurance.

The parametric insurance policies pay farmers for estimated losses when seasonal rainfall totals fall below a certain threshold. In R4’s Q2 2015 report, premiums of \$306,000 had been collected in Ethiopia and Senegal on insured value of \$1.5 million. Payouts have totaled \$36,000 so far.

R4 also promotes physical adaptation measures, such as stone bunds (retaining walls) and ponds to retain rainfall, as well as disaster risk reduction training and programs that encourage savings.

While adaptation is usually associated with engineering solutions, insurance has become increasingly viewed as an important strategy to mitigate the damage from extreme weather and climate change in

the developing world. In June 2015, the G7 member nations agreed to provide insurance against climate-related hazards for 400 million vulnerable people.

One of the 17 members of the international Oxfam confederation, Oxfam America works to right the wrongs of poverty, hunger, and injustice in more than 90 countries. The World Food Program is the food assistance branch of the UN.

Financing: GHG Mitigation

Renovate America for surpassing \$1 billion in financing for residential energy efficiency, water conservation and distributed solar PV improvements through its four-year-old Home Energy Renovation Opportunity (HERO) Program. HERO is far and away the leading administrator of residential Property Assessed Clean Energy (PACE) programs in the nation, having made home energy and water upgrades affordable to more than 45,000 homeowners. HERO is made available through a public-private partnership with over 360 communities representing nearly 80% of California.

According to PACENow.org, a total of \$1.184 billion in home improvements have been financed through PACE programs nationwide, making HERO the leader with almost 90% of national market share. Over the useful lifetime of the installed products and systems, the \$1 billion in improvements and distributed PV financed through HERO are projected to save homeowners \$2 billion on energy bills, conserve 6.7 billion kWh of electricity, reduce emissions by 1.8 million tons and save more than 2.1 billion gallons of water. According to Renovate America, HERO also has created more than 8,400 jobs and generated aggregate economic impact of more than \$1.7 billion in the state of California, with planned expansion into other states in 2016.

Consulting & Engineering: Climate Change Adaptation and Resilience

CH2M for completing research on future rainfall intensity in the UK and the implications for sewer and stormwater system design. With damaging floods wreaking havoc in late 2015, UK media quoted climate scientists saying that December’s high temperatures and precipitation levels fell outside the range of natural variability and were partly due to climate change.

According to CH2M’s client, UK Water Industry Research, the report has produced estimates of rainfall intensity change using a combination of climate analogue data and a high-resolution (1.5 km) climate model developed by the UK Met Office. “The resultant rainfall intensity change estimates are, in general, higher than existing UK guidance suggests. Sewer flooding frequency and volume, and frequency of pollution events are also investigated for five locations; indicating that these are also likely to increase in the future.”

According to CH2M, the project provided fresh insight into how urban drainage systems should be adapted to accommodate climate change with combinations of increased capacity and the use of stormwater green infrastructure to reduce demand and manage flow pathways on the surface.

An employee-controlled professional engineering services firm, CH2M (formerly CH2M Hill) produced \$3.95 billion in revenues during the first three quarters of 2015.

Dewberry for providing decision support on climate stressors to infrastructure and assets for federal, state, local and private clients in 2015. Building on its history in hazard risk management and engineering, Dewberry has taken on some of the largest and most critical sea level rise (SLR) projects, providing analysis and

guidance for FEMA, the US Army Corps of Engineers (USACE), EPA and Transportation Research Board (TRB), as well as vulnerable state and local governments such as New York, Florida and the City of Virginia Beach.

In 2015, Dewberry delivered SLR floodplain mapping for lower New York State to the New York State Energy Research and Development Authority, and was awarded follow-on work to support development of an Internet viewer. Dewberry also received new awards from NYSERDA for a community coastal erosion study and a collaborative effort with the New York State Department of Transportation to research bridge and culvert vulnerability.

Dewberry was awarded a contract by the Florida Department of Economic Opportunity to lead a pilot program for sea level rise vulnerability assessments and adaptation pilot studies. And in May 2015, it was named by the New Jersey Department of Environmental Protection as one of the key consultants on the Rebuild by Design Hudson River Project.

At the federal level, Dewberry's summary report for climate change risk assessment and adaptation guidance for airports was published by TRB's Airport Cooperative Research Program. Also in 2015, Dewberry completed a climate change analysis for the National Flood Insurance Program's Environmental Impact Study, undertook a vulnerability analysis for EPA's Oceans and Coastal Protection Division, and reviewed USACE tools for detecting non-stationarity at river gage stations across the country.

Headquartered in Fairfax, Va., Dewberry has approximately 2,000 employees and generated \$380 million in revenue in 2014.

Hazen and Sawyer for its leadership role in evaluating climate change assessment and adaptation planning for water

and wastewater utilities. In 2013, the firm partnered with CH2M on the post-Sandy NYC Wastewater Resiliency Plan, and more recently it has performed studies on water and climate change for the American Water Works Association, Water Research Foundation, Water Environment Research Foundation, Water Services Association of Australia and other industry groups.

The firm has special expertise in evaluating how climate change will affect water quality and water demand. On the water quality side, Hazen and Sawyer executives published papers and spoke at industry conferences in 2015 about how climate change can increase risks of disinfection by-products and harmful algal blooms. Individual water utility clients appreciate the firm's work in modeling demand changes over time, factoring climate change, population growth and other factors into the models that utilities use for their long term asset and resource planning.

A water-focused engineering and technical services firm, Hazen and Sawyer had 2014 revenues at \$165 million.

Kleinfelder for its resiliency work with local governments and infrastructure managers, primarily on the East Coast. Kleinfelder's large clients include **Massport**, operator of airports and ports in Massachusetts, and Washington D.C.'s Department of Energy and Environment, but the firm has also worked for many smaller communities.

For Massport, Kleinfelder performed a Disaster and Infrastructure Resiliency Planning study commissioned after Irene, Sandy and other storms flooded terminals, caused other damage and "demonstrated the link between climate hazards and the resiliency of the built environment," according to MassPort. Drafted in 2014, the DIRP was updated in 2015 to include the best available coastal flood risk modeling data. Kleinfelder also helped MassPort in

2015 to develop flood response plans for Logan International Airport and guided its evaluation of more than 20 flood protection products before eventually selecting AquaFence, which received a \$1 million order (see Aquafence profile in CCBJ's Q4 2015 issue).

In June 2015, Kleinfelder's first report on Climate Projections and Scenario Development for Washington, D.C. was published (collaborators include Perkins + Will, Atmos Research and Consulting and the universities of New Hampshire and Massachusetts at Boston). Kleinfelder has also helped towns and cities in Massachusetts with climate risk assessment and adaptation planning, often performing pro bono work to help potential clients obtain funding for studies from the state's Coastal Zone Management program.

A design firm with complimentary engineering and environmental capabilities, Kleinfelder has close to 2,000 employees in the United States, Canada and Australia and 2014 revenues of \$380 million.

Moffatt & Nichol for integrating sea level rise and other climate change impacts into the design and engineering of some of the United States' most vulnerable communities and facilities. Some of the firm's recent projects include the Shoreline Protection Feasibility Project for **San Francisco International Airport** (performed with another engineering firm, AGS), a shoreline protection system for the 400-acre Treasure Island Development Project in San Francisco Bay and protection measures for Santa Barbara's iconic Cabrillo Pavillion.

In August 2015, the firm and partners **West 8** and **Louisiana State University Coastal Sustainability Studio** won a design competition run by EDF to develop a 100-year framework to sustain the Lower Mississippi River Delta. The Giving Delta framework was built on principles including "empower[ing] the River to nourish

the human, economic, and ecological systems that depend on the River as a shared resource” and “build[ing] and sustain[ing] wetlands to mitigate the effects of climate change and subsidence and to slow the inevitable marine transgression of the Delta.” A global infrastructure advisor specializing in coastal projects and freight, Moffatt & Nichol employs more than 600 staff and had \$134 million in 2014 revenue.

Business Model Innovation: Climate Change Adaptation and Resilience

Entergy Corporation for its support of pilot projects and methodologies to make wetlands enhancement and restoration a viable source of carbon offsets, thus spurring private investment in wetlands projects which have value for climate change adaptation and resilience as well as GHG mitigation.

Entergy supported the development of the first wetland carbon methodology that introduced wetland restoration to emissions trading markets and the first wetland carbon pilot project in the nation. In 2015 a two-year assessment, supported by Entergy’s Environmental Initiatives Fund, and prepared in partnership by **Tierra Resources** and **The Climate Trust**, determined carbon finance revenue can provide up to \$1.6 billion in critical funding to assist with wetland restoration over the next 50 years.

Study findings also showed that restoration in Louisiana has the potential to produce over 1.8 million metric tons of offsets per year; almost 92 million tonnes over 50 years. Entergy’s commitment to the study stems from the company’s mission to create sustainable value for all its stakeholders. Wetlands play a crucial role in storm protection for many Entergy communities, helping preserve industries, businesses, homes, and livelihoods along with Entergy’s own facilities and assets.

Operating electric utilities in Texas, Arkansas, Louisiana and Mississippi and

a wholesale energy commodities business, Entergy has annual revenues of more than \$12 billion and approximately 13,000 employees.

The Nature Conservancy for leveraging its expertise, reputation, fundraising abilities and political skills to catalyze investment and action for climate change resilience and adaptation. Over the last decade, TNC has connected its core mission—“protecting nature, preserving life”—with climate change adaptation and resilience by supporting and developing green and hybrid gray-green infrastructure solutions.

In the United States, TNC has partnered with **CH2M**, **AECOM** and **Environmental Science Associates** around green infrastructure and worked with local governments and smaller consulting firms on a wide range of climate resilience projects. Through its outreach and education to members and others, TNC is raising awareness that natural systems and natural infrastructure help protect people and property.

TNC is building on its success with innovative transaction-based financing structures—such as fishing quota acquisition, debt swaps and water funds—to create new resources for conservation and climate change adaptation through its NatureVest unit. A landmark debt swap project that closed in December 2015 will benefit the Seychelles, a small island state that faces severe climate change risks and is burdened with a high level of distressed sovereign debt.

The Nature Conservancy raised \$23 million in impact capital loans and \$5 million in grants to buy back \$29.6 million of Seychelles debt at a 5.4% discount. The cash flow from the restructured debt is payable to and managed by the new **Seychelles Conservation and Climate Adaptation Trust (SeyCCAT)**, and it will support improved management of coasts,

reefs and mangroves; repayment of the impact investors; and capitalization of SeyCCAT’s endowment.

One of the largest global conservation organizations, TNC employs about 3,200 people worldwide. The nonprofit has more than 1 million members and its revenues for the year ending June 30, 2015 were \$957 million.

Business Model Innovation: Energy and Carbon Management

ChargePoint, the world’s largest electric vehicle (EV) charging network with more than 25,000 charging points in the United States, for leading the transformation to electrified personal transport by providing networked charging stations and mobile apps that allow EV drivers to plan their travel and refuel with greater freedom and security.

In 2015, ChargePoint teamed up with **Green Charge Networks** to start deploying battery storage systems at charging points. This feature may be critical for charging station operators to avoid economically crippling demand charges from local electric utilities. It will also be important to maintaining grid stability as electric vehicles gain larger shares of vehicle markets. According to GreentechMedia.com, by Q3 2015, the two firms had already backed up five EV charging stations in Redwood City, Calif. They saw a reduction in annual demand charges (based on peak demand at any point over a year) by \$7,000.

Two of ChargePoint’s latest innovations are a multi-family service in which drivers can get EV charging in their assigned parking spot and a networked residential charger that works with the Nest smart thermostat and is managed with the ChargePoint mobile app.

Business Model Innovation: Smart Grid and Energy Management

Green Mountain Power for offering its customers Tesla Powerwall 7 kWh batteries for onsite storage of power generated with solar PV or off-peak grid power. During an outage, the battery is “able to power essential parts of the home like lights, a refrigerator, and heat pump” or oil or gas heating system, according to Green Mountain Power.

While the backup power will certainly appeal to many in the cold Vermont winters, green energy advocates are excited about the innovative business model: an investor-owned utility selling its customers an onsite storage option that can make them more independent and let them use more self-generated PV power. This is the kind of distributed residential electricity storage system that will be needed to accommodate large growth of distributed PV power.

Green Mountain Power has ordered 500 Powerwalls and expects to start installation in February 2016. The utility is selling the Powerwalls for \$6500 with an option to receive a \$32/month bill credit in exchange for giving the utility “shared access” to use the battery to meet local electricity demand. Leasing is available for \$1.25 per day.

Green Mountain Power is the investor-owned utility for Vermont, with \$506 million in annual revenue through Q2 2015. It is a certified B corporation, committed to “using the power of business to alleviate poverty, address climate changes, and build strong local communities and great places to work.”

Advancing Best Practices: Climate Change Adaptation and Resilience

EcoAdapt for providing valuable support, training and assistance to local adaptation practitioners in the public and private sectors. EcoAdapt manages the Climate Adaptation Knowledge Exchange

(CAKE) and was the primary sponsor of the May 2015 National Adaptation Forum attended by about 800 people.

EcoAdapt’s State of Adaptation initiative produces case studies and synthesizes lessons learned through interviews with and surveys of adaptation practitioners. In 2015, these surveys included assessing adaptation efforts in the Southeast and U.S. Caribbean water resources and U.S. marine fisheries management. Studies and reports developed from these projects will be released in 2016 after undergoing external peer review.

Also in 2015, EcoAdapt worked with **SeaPlan**, the City of Boston and **The Boston Harbor Association** to develop an adaptation indicators framework to track and evaluate climate-related progress within the city. Finally, EcoAdapt’s Available Science Assessment Project aims to apply scientific knowledge to increase the effectiveness of adaptation actions, with its first test case examining the role of fire treatments in Northwest national forests and communities.

Nonprofit EcoAdapt has a staff of 10 and is funded primarily by grants and sponsorships. Its support and revenue in 2014 was \$2 million.

Environmental Science Associates for its work and research on using nature-based approaches—sometimes known as “green infrastructure”—to stabilize shorelines and mitigate erosion of vulnerable coastal communities and ecosystems. The firm has worked with Monterey Bay groups to evaluate and model how “soft” engineering solutions would perform vs. hard engineered structures like revetments. And for San Francisco Bay communities facing sea level rise and requirements to upgrade wastewater treatment facilities, ESA developed green infrastructure approaches that use marshes to address contaminant issues and provide defenses against sea level rise.

ESA is one of three environmental consulting and engineering firms to collaborate with **The Nature Conservancy** on green infrastructure in the Gulf of Mexico, also partners with the State of California and TNC’s Coastal Resilience Program to map future coastal hazards.

Wetland carbon, also known as blue carbon, for GHG mitigation and adaptation to sea level rise is a particular strength of ESA’s. In a report for **Restore America’s Estuaries**, ESA quantified carbon sequestration and coastal protection benefits of wetlands restoration activities, using Washington’s Snohomish River estuary in Puget Sound as a case study.

In August 2015, ESA, its clients and partners celebrated the culmination of many years of work on the Qwuloolt Estuary near the mouth of the Snohomish River as tidal waters flowed into 350 acres of restored, formerly diked wetlands. In October 2015, ESA and partners **Research Planning Inc.** and **Industrial Economics** were selected by the U.S. Department of the Treasury to perform scientific and technical reviews of Gulf Coast Restoration projects.

Environmental science and planning firm ESA has more than 350 people working in 13 offices across the West and in Florida.

Southeast Florida Regional Climate Change Compact for advancing the understanding of climate change impacts and supporting cooperative solutions in a region of the United States that is highly vulnerable to rising sea levels and higher storm surges.

A coalition of Broward, Miami-Dade, Monroe and Palm Beach counties, the Compact set out in 2009 to create “a new form of regional climate governance” and to support their mutual efforts—and those of the jurisdictions within their borders—to plan for and adapt to climate change. The Compact produced a Regional

Climate Action Plan in 2012, followed by a series of implementation guidelines and workshops such as the 2014 guidance for stormwater management.

To ensure that major infrastructure projects and planning efforts throughout the region incorporate a consistent regional sea level rise projection in design and develop risk-informed adaptation strategies for the region, the Compact issued its first Unified Sea Level Rise Projection in 2011.

In October 2015, its Sea Level Rise Work Group—17 scientists and engineers from governments and universities in the region—updated the projections to reflect the latest scientific research; to follow federal guidance using 1992 as a base year; and to extend projections from 2060 to 2100. The work group also added an upper boundary curve (based on NOAA projections) for high risk critical infrastructure projects expected to be in use after 2060 (for more, see bit.ly/1VezFK5).

While the report highlights the extraordinary long-term risks for Southeast Florida—where high tides already push sea water up into stormwater systems, even on rain-free sunny days—at least with the Compact, governments, property owners and residents have the benefit of robust information and a cooperative framework in which to plan for adaptation.

Swiss RE for quantifying the economic value of adaptation and resilience measures. Long active in climate change, the global reinsurance company was a founder of the ClimateWise Alliance and an early supporter of the R4 Rural Resilience Initiative which is selling crop insurance for climate resilience and adaptation in Ethiopia, Senegal, Malawi and Zambia.

Swiss Re made climate change a “priority issue 20 years ago,” according to its 2014 financial report. It created a climate change strategy focused on: advancing

understanding of climate risks in order to quantify and integrate them into underwriting; developing products and services to mitigate GHGs and adapt to climate change; raising awareness and public advocacy; and tackling its own carbon footprint.

Through the Economics of Climate Adaptation (ECA) studies, Swiss Re and its collaborators have estimated the total climate risks facing more than 20 vulnerable regions and cities and identified the most cost-effective measures to address the risks.

In a December 2015 presentation at COP21, Swiss Re’s David Bresch discussed ECA studies for Bangladesh’s Barisal province and for San Salvador’s Acelhuate River region. The analyses estimated the long-term cost-benefit ratios of more than a dozen adaptation measures appropriate for each geography, ranging from deepening drainage canals to resettling slum dwellers. For each measure, the upfront costs are weighed against the likely avoided damages by 2040, allowing local governments and aid agencies to invest in the measures with the best ROI. Swiss Re’s partners in the ECA work group include the Global Environment Facility, McKinsey, the Rockefeller and ClimateWorks foundations, the European Commission and Standard Chartered Bank.

Swiss Re is the world’s second largest reinsurance firm (after Munich Re) with \$3.5 billion in 2014 revenues.

Advancing Best Practices: Wind/Solar Integration

Advanced Energy Economy Institute and The Brattle Group for their June 2015 case study, Integrating Renewable Energy into the Electricity Grid, which explores how Electric Reliability Council of Texas (ERCOT) and Xcel Energy Colorado are integrating variable renewable energy (primarily wind power) into their regional grids.

ERCOT and Xcel Energy Colorado already manage large volumes of wind power while matching generation with demand in real time—an ironclad physical law of electricity grids. To allow continued growth of renewable power as envisioned under the federal Clean Power Plan and state renewable power mandates, other grid operators will have to contend with the same challenges that these two grid operators are facing successfully.

At 12.5 GW of wind turbine capacity, ERCOT is the biggest user of wind energy in North America; and Xcel Energy Colorado meets close to 20% of its average load with wind energy and experiences periods when wind energy is meeting more than half of demand, according to the report.

The two grid operators are managing the variability of wind power with “well-established and widely available methods and technologies,” including: Ancillary services provided by flexible gas turbines, demand response and storage; the evolving reliability capabilities of renewable generators; and expansion of transmission infrastructure.

While ERCOT and Xcel Energy Colorado demonstrate what’s possible with existing methods, authors Jürgen Weiss and Bruce Tsuchida aver that for renewable power to keep growing, “continued significant planning and effort, as well as investment [will be needed] in transmission infrastructure to bring electricity from renewable resource rich locations to load centers, and in distribution infrastructure.”

“Bringing additional renewable resources to market will thus likely be an important additional driver of planning and building a 21st century grid, which is also driven by changes on the demand side ... (including distributed generation, but also new sources of demand and options for demand-side flexibility), changing population densities, the desire to

further increase inter-regional interconnections, cybersecurity concerns, the aging of existing transmission and distribution infrastructure, etc.”

AEEI is the nonprofit educational division of clean energy trade group, Advanced Energy Economy. Brattle is a research and consulting firm specializing in electric power, oil and gas, healthcare, financial services, telecom and transportation.

Technology Merit: Climate Change Risk Modeling and Assessment

CH2M for providing program management for the Miami-Dade County Water and Sewer Department’s \$3.3 billion Ocean Outfall Legislation Program. The 11-year program with 28 capital projects is the culmination of a regulatory mandate by the Florida Legislature to stop all wastewater discharge to the ocean by 2025.

This task included assessment of projected changes for key climate variables (sea level rise, precipitation, and wind); modeling the extent of inundation due to sea level rise, storm surge, and extreme rainfall for a range of scenarios based on the service life of wastewater facilities; evaluating risks to those facilities from the different climate change scenarios; and estimating the associated costs of protecting facilities.

Using its analyses of costs versus risk, CH2M facilitated a series of workshops with Miami WAsD staff and design consultants to select design criteria that specifies flood control elevations and facility hardening options. These were documented in a Design Guide for Hardening Wastewater Facilities against Flooding from Surge, Sea Level Rise, and Extreme Rainfall. These measures are now being used by all of WAsD’s consultants, and they will undergo revision and enhancement as lessons are learned from each design effort.

Project Merit: Climate Change Adaptation and Resilience

Four Twenty Seven for helping healthcare institutions understand and plan for climate change. While most work around climate adaptation and resilience has focused on infrastructure and the built environment, healthcare services will also have to respond to increasing health risks from heat waves, shifting insect populations and other impacts of climate changes.

In 2015, Four Twenty Seven executed two healthcare projects: A web-based Heat Vulnerability application that lets health professionals explore how climate change and heat vulnerability will affect every U.S. county; and the Resilient Hospital Dashboard that allows hospital administrators to assess risks to their facilities and the patients most exposed to climate change.

The Heat Vulnerability Index (427mt.com/heat-vulnerability/) ranks every U.S. county’s heat risk based on heat & humidity, social vulnerability, medical access and the physical environment. Four Twenty Seven developed the application as part of its commitment to the White House Climate Data Initiative.

For the Resilient Hospital Dashboard, Four Twenty Seven worked with healthcare networks and **Healthcare Without Harm**, a nonproft that promotes environmentally responsible health care. The private dashboard enables healthcare networks to identify hotspots, key drivers of risk and climate impacts faced by their hospitals. It combines local climate projections with analytics to help hospitals understand how climate change impacts will affect their populations.

Four Twenty Seven is a boutique climate change consultancy focused on adaptation and resilience.

AECOM for using the Disaster Resilience Scorecard it developed with IBM to

lead an assessment of the disaster resilience planning process with Bandung, the capital city of Indonesia’s West Java province. The city of over 2.5 million people faces environmental climate change risks from flooding and severe storms as well as fire and earthquakes.

AECOM facilitated a workshop with over 60 government representatives and used the scorecard to formulate and develop disaster risk reduction plans. The analysis revealed that major water and sanitation infrastructure systems were at risk and that a local disaster management agency is needed. Additionally, the resilience of surrounding farmland areas must be considered for food security in disasters.

The results of the scorecard and disaster planning were presented by Bandung Mayor Ridwan Kamal at the 2015 Summit for Better Cities in New York. As a next step, the scorecard is now being adopted by six other cities in West Java to conduct disaster risk assessments.

Global planning, consulting, design and engineering firm AECOM had revenue of \$18 billion in its fiscal year ending September 30, 2015.

ConocoPhillips and **Tierra Resources** for the success of a three-year pilot project to plant mangroves to protect against wetland erosion and hurricane surge in coastal Louisiana where the firm owns approximately 636,000 acres of wetlands. These wetlands, which face some of the fastest rates of wetland loss in the world, protect coastal communities as well as seafood, maritime trade and oil and gas industries.

Due to increasing temperatures, black mangroves had already started to expand northward over several decades into coastal salt marshes of Louisiana, where they are expected to decrease wetland erosion and provide better storm surge protection. However, the dispersal of mangrove seeds,

referred to as propagules, has been limited to wetlands bordering coastal waters, leaving internal marshes largely unpopulated by mangroves.

The mangrove planting pilot project succeeded in using a crop-duster airplane to distribute propagules and establish mangroves on three one-acre sites in Lafourche and Terrebonne parishes. According to Tierra Resources, this is first successful test of air seeding mangroves, a method that is much more cost- and labor-efficient than manual planting and can be replicated in other areas of the world.

The world's largest independent exploration and production company, ConocoPhillips had \$55.5 billion in 2014 revenues. Founded in 2007, Tierra Resources LLC (New Orleans) is a small firm focused on researching, developing and monetizing the "blue carbon" in coastal wetland ecosystems.

Project Merit: Low-Carbon Energy

Stanford University for its Stanford Energy Systems Innovations (SESI) project which replaces the university's gas-fired combined heat and power central plant—once considered the best option for campus electricity and heating—with a \$485 million district energy system that uses hot water instead of steam. In a deal with **SunPower**, the campus will also deploy over 70 MW of solar PV capacity, 68 MW off campus. Under construction since 2013, SESI is expected to be complete in 2016.

SESI will capture waste heat from evaporative cooling towers using three 2,500-ton heat recovery chillers and use three 60,000 pound gas-fired hot water generators to meet winter peak heating loads. Also included: 10 million gallons of chilled water tanks and 2 million gallons of hot water tanks providing thermal energy storage, which Stanford will use—along with controls and predictive analytics software co-developed with

Johnson Controls—to operate in California wholesale electricity markets.

In addition to Johnson Controls, SESI was developed with help from consulting firms **Affiliated Engineers**, **COWI** (Denmark) and **FVB** (Sweden). **Jacobs Carter Burgess**, **Enginomix**, **Black & Veatch** and **Navigant** provided peer reviews.

Project Merit: GHG Mitigation

Tetra Tech for completing the five-year, \$41.5 million **USAID** project Indonesia Forestry and Climate Support (IFACS) program. Through IFACS, Tetra Tech developed a scalable framework to serve as a model to significantly reduce Indonesia's GHG emissions through conservation of carbon-rich forests and peatlands.

Tetra Tech worked with all levels of Indonesia's government and private sector to empower Indonesians to engage in managing their natural resources. Tetra Tech conducted rigorous site selection exercises, GIS mapping and vulnerability assessments to identify solutions to reduce GHG emissions and conserve Indonesia's forests, biodiversity and ecosystems. Over the life of the project, IFACS contributed to the sequestration of more than 5 million tons of carbon dioxide, supported the sustainable management of 1.5 million hectares of forest, conserved 230,000 hectares of mangroves and helped 12,000 farmers convert to higher-value crops. The successful implementation of this program helped Tetra Tech win the \$47-million follow-on project known as LESTARI.

Consulting and engineering firm Tetra Tech generated \$3 billion in revenues for the year ending September 27, 2015.

Industry Leadership

AECOM for its extensive global practice in climate change adaptation and resilience. In 2015, AECOM delivered 35 climate adaptation and resilience projects in 20 countries, chaired sessions at global

forums, participated in panels at COP21 in Paris and worked alongside UN agencies, **World Bank**, **Rockefeller Foundation** and other influential entities on global programs and initiatives. AECOM also completed an update of the UN's Ten Essentials of Disaster Risk Reduction.

The year saw AECOM publish its *Becoming Climate Resilient* guide for private sector companies and the new book *What's Next In Making Cities Resilient*, as well as contributing to the NIST Community Resilience Planning Guide. AECOM and partner **IBM** received the 2015 Notre Dame Global Adaptation Index (ND-GAIN) Corporate Adaptation Prize for their UNISDR Disaster Resilience Scorecard, which has been adapted for small businesses and is piloting in New Orleans.

One of AECOM's most notable climate adaptation resilience projects is its work to help Miami Beach protect its built environment from rising sea levels and flooding. In international projects, AECOM completed the International Climate Change Adaptation Framework for Road Infrastructure for the World Road Association's (PIARC). The framework helps road infrastructure managers identify assets and networks vulnerable to climate change, prioritize the risks, develop adaptation responses and integrate those into decision-making.

Additionally, AECOM developed new climate adaptation technologies, including an economic framework for analyzing adaptation options and predictive modeling for sea-level rise, coastal erosion and riverine flooding. After acquiring **URS** and **Hunt Construction Group** in 2014, AECOM's annual revenues for the year ending September 30, 2015 were \$18 billion.

PwC for integrating GHG mitigation and climate change adaptation and resilience into its client services, growth

strategy and thought leadership. One of the largest global professional services companies, PwC provides consulting and advisory services to large clients around climate and disaster resilience, carbon markets, low-carbon energy, climate-smart agriculture, sustainable development and other topics. The firm's international sustainability and climate change practice includes over 700 specialists. In its 2015 Global Annual Review, PwC highlighted "Climate Change and Resource Scarcity" as one of five megatrends "shaping and disrupting the global economic landscape and society."

PwC is driving the global conversation about climate risk in business and public policy, and it works with financial services and insurance clients demonstrating how and why climate risk should be more integrated into investment and insurance portfolios. In 2015, PwC was engaged again as the independent reviewer for **ClimateWise**, for whom it analyzed the climate risk management performance of participating insurance companies. And PwC executives spoke at the New York Climate Summit in support of the 1-in-100 initiative that would "provide new and robust climate related information for investors, corporates, governments, rating agencies, and dare I say it, regulators," according to PwC's Malcolm Preston.

Also in 2015, PwC published its seventh Low Carbon Economy Index, evaluating the emissions reductions trajectories embodied in the national commitments that ultimately became part of the Paris agreement. PwC's analysis indicates that the aggregate national commitments will achieve less than half of the annual emissions reductions needed to limit global average temperature increases to 2° C. It also estimated that China and the EU alone will invest \$700 billion a year to achieve their decarbonisation goals.

Multinational professional services firm PwC reported global revenues of

\$35.4 billion for its financial year ending 30 June 2015.

NGO Award

Georgetown Climate Center for its support of local government efforts to plan for and adapt to climate change impacts including increased flooding, drought and extreme heat. One of GCC's focus areas is green infrastructure to manage stormwater in the face of changing precipitation patterns, and it works with city and federal officials and NGOs to develop strategies to implement these approaches.

GCC has produced case studies of adaptation initiatives in transportation infrastructure and cities, including a comparison of the efforts of three U.S. and three Chinese jurisdictions. In August 2015, the center published *Reimagining New Orleans after Katrina*, describing how the city adapted the design and function of public schools and water systems to create a more resilient city.

GCC aided state and local governments in applying for HUD's \$1 billion National Disaster Resilience Competition. The organization also hosts the Adaptation Clearinghouse in partnership with the **American Society of Adaptation Professionals**, the **Urban Sustainability Directors Network** and EPA. The clearinghouse was recently upgraded to let users monitor states' progress in adaptation planning and will soon boast new functionality to support adaptation practitioners in local governments and water utilities.

GCC partners with many other NGOs and research outfits, including the **National Center for Atmospheric Research**, **Rutgers Climate Institute** and **Old Dominion University**. Its major funders include the **Kresge**, **MacArthur** and **Rockefeller** foundations and the **Federal Highway Administration**.

The Notre Dame Global Adaptation

Index (ND-GAIN) for achieving a higher profile for its analyses of the relative climate-readiness of nations, and for increasing its support for public and private sector leaders to prioritize adaptation and resilience investments. Covered in the UK newspaper *The Independent*, *Business Insider*, *HuffingtonPost* and other media prior to COP21, ND-GAIN's November 2015 country index release included new visualization tools covering 20 years of data across 180 countries.

In 2015, ND-GAIN also began pilot Urban Adaptation Assessments in Baltimore, Los Angeles, Memphis, Seattle and Davenport, Iowa, and it hosted global adaptation webinars in Spanish and Mandarin. In conjunction with **Four Twenty Seven** and **Business for Social Responsibility**, ND-GAIN published a study of corporate adaptation that identified water scarcity as the top concern of corporations surveyed.

ND-GAIN's major funders include the **Natural Gas Partners Foundation**, **Kresge Foundation**, **Templeton Foundation** and the **International Initiative for Impact Evaluation**. ⚙