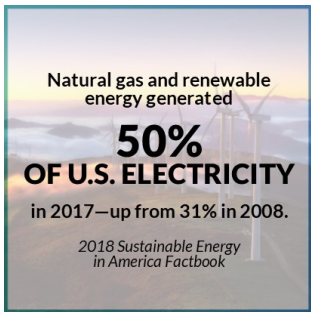
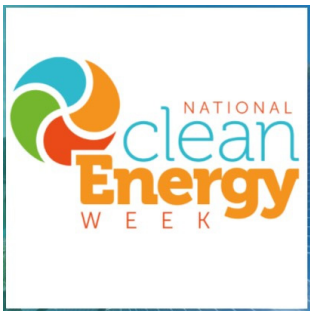




Faces Behind the Facts is a Clean Energy Business Network companion project to the *2018 Sustainable Energy in America Factbook*, which is produced for the Business Council for Sustainable Energy by Bloomberg New Energy Finance

The Facts and Faces of Sustainable Energy

In communities across the United States, the clean energy economy is creating new industries, manufacturing opportunities, and jobs every day, making the U.S. more competitive in the global economy. American entrepreneurs and researchers have been at the forefront of developing affordable, clean, reliable energy solutions. These technologies help customers save money, improve communities' resilience against natural disasters and other disruptive threats, and enhance our nation's energy independence.

The *2018 Sustainable Energy in America Factbook*, produced for the Business Council for Sustainable Energy by Bloomberg New Energy Finance, documents that clean energy industries represent the growth sectors of the energy economy:

- Over the past decade, U.S. electricity generation from renewable energy sources has grown 90%, generation from natural gas has expanded 47%, and energy productivity has soared 17%.
- These clean energy industries support the most jobs of any energy sector (3 million nationwide).
- Leading corporations are increasingly demanding more clean energy. More than 119 corporations have pledged to source 100% of their electricity from renewables and 13 have pledged to double their energy productivity.

Faces Behind the Facts tells the stories of some of the leaders making these energy transformations possible. Launched in February 2018, this series is the Clean Energy Business Network's (CEBN) new companion project to the *Factbook* released annually by the Business Council for Sustainable Energy (CEBN's parent organization) and Bloomberg New Energy Finance.

The CEBN has released new profiles throughout 2018, culminating in a compilation document prepared for National Clean Energy Week (September 24-28, 2018), a series of events and communications to generate awareness of how clean energy is driving economic growth, creating jobs, strengthening America's national security, and preserving our environment.

NATIONAL clean Energy WEEK

The leaders profiled in *Faces Behind the Facts* represent businesses working across diverse technologies, stages, sizes, and geographies, from some of the largest energy corporations in the world to some of the smallest family-owned businesses. Their stories are based on written Q&As or verbal interviews with these leaders, and are presented to inform public, policymaker, and industry audiences about the breadth and benefits of clean energy solutions available in the United States.

Support for this *Faces Behind the Facts* compilation comes from Citizens for Responsible Energy Solutions (CRES) Forum.

Visit www.bcse.org to see the facts, and www.cebn.org to see the faces.

CLEAN ENERGY BUSINESS NETWORK

The Clean Energy Business Network works to grow the clean energy economy through policy, public education, and business support for small- and medium-size energy companies. Founded in 2009 by The Pew Charitable Trusts, the CEBN is now a small business division of the Business Council for Sustainable Energy. The CEBN serves 3,000+ business leaders across all 50 U.S. states working across a broad spectrum of clean energy and transportation technologies.

Connect with the Clean Energy Business Network

Small businesses, corporations, investors, and clean energy changemakers: sign up at www.cebn.org to forge connections across the clean energy economy.

GROWING THE CLEAN ENERGY ECONOMY– ONE SMALL BUSINESS AT A TIME

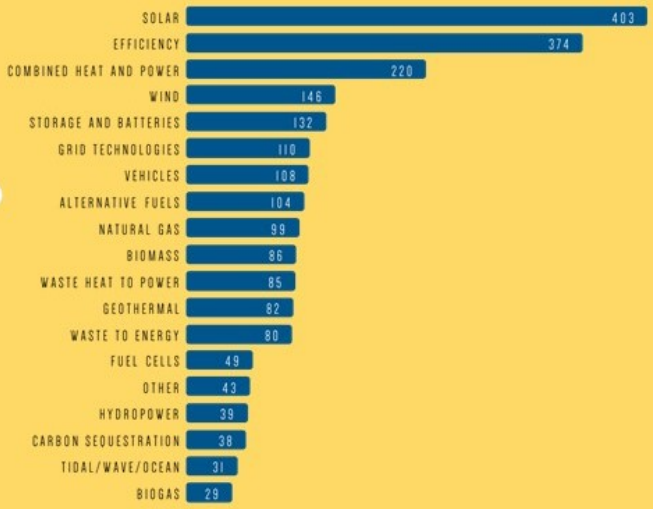
POLICY
Inform and engage clean energy business leaders in policy issues impacting the industry

EDUCATION
Communicate the benefits of the clean energy economy to the public and policymakers

BUSINESS SUPPORT FOR SMALL & MEDIUM ENERGY COMPANIES
Promote networking/industry collaboration and provide resources to help small businesses reach target markets and grow

3,000+ clean energy business leaders across 50 states and nearly 350 Congressional districts

Technology breakdown for members who have been categorized:



CLEAN ENERGY BUSINESS NETWORK

Get the facts: www.bcse.org | See the faces: www.cebn.org

Introducing the 2018 Faces

1 | JEN DERSTINE, Capstone Turbine Corporation (CA, DC) | Around the World with Microturbines

"[An exciting development in 2017 was] the development of our new PowerSync controller, which improves reliability and availability of our microturbines by eliminating any single point of communication failure for control."

3 | MATTHEW GOSS, CDM Smith (NY) | From Pit Crew to Driver's Seat in the Clean Energy Race

"The firm is distinguished by our leadership and flexibility in design-build and alternative delivery approaches for environmental and infrastructure projects."

5 | JOHN FOX, ElectraTherm (GA, NV) | From Georgia to Germany, Turning Waste Heat into a Resource

"ElectraTherm desires to push what has been done globally with waste heat to power with the same opportunities we see worldwide and push market growth in the U.S. with this reliable, proven heat and power source."

7 | LAURA THOMPSON, Flow Energy (WA) | Industry Veteran Wooed by Family Energy Efficiency Company

"Seeing the impact of precision control firsthand as a customer, I knew I had to help get the technology out to a broader market and established as a new standard for sustainability best practices."

9 | BIOJOE & BETH RENWICK, Green Energy Biofuel (SC) | Fueling Change: A Family Business Transforms Fuel Supplies and Its Community

"Our mission is to increase the availability of alternative fuels in South Carolina and create sustainable green jobs in the biofuels industry."

11 | LOY SNEARY, Gulf Coast Green Energy (TX) | Texas Rancher Reduces Gas Flaring from Oil Wells

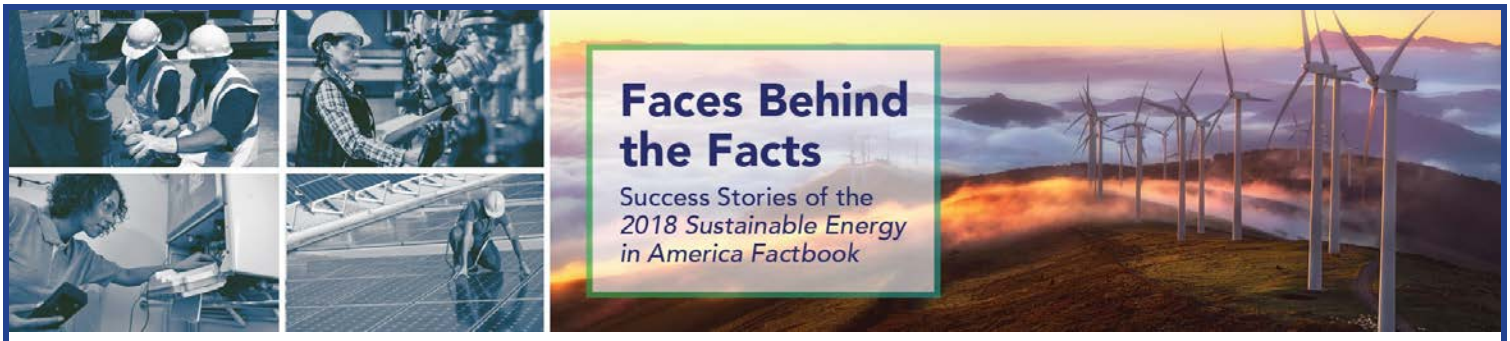
"The Gulf Coast Green Energy owners asked me to step in and take the company from start-up to being a significant and respected supplier of waste heat-to-power generation equipment."

13 | BENNIE HAYDEN, Marketing for Green (GA, MI) | Bringing Solar to Those Who Need it Most

"Long ago, I learned that everything about business starts in marketing."

15 | DEAN SEAVERS, National Grid (MA) | Steering a Utility Toward a Clean Energy Future

"My grandmother taught me about being efficient, limiting waste and practicing mindfulness, which are three values I bring to work every day."



Around the World with Microturbines

Capstone Turbine Corporation
JEN DERSTINE, Director of Strategy and Policy
Washington, DC and Van Nuys, CA
168 employees
www.capstoneturbine.com

Jen Derstine ended up in the microturbine business because her Foreign Service letter came a little too late.

When most people outside the energy industry hear the term "microturbine," they probably conjure up an image of a really tiny wind turbine. Actually, these systems are small-scale (<500 kW) combustion turbines that provide an efficient source of onsite power generation, and can be combined in parallel to serve larger loads. Microturbines are frequently used for combined heat and power—an efficiency technology that generates heat and electricity from a single fuel source, often natural gas.

Jen's story begins a few years after finishing college, when she applied to the U.S. Foreign Service, hoping to travel abroad. One day, she finally got her acceptance letter—right after she'd paid her deposit for graduate school. She went ahead with pursuing her Master's at Johns Hopkins and then successfully competed for a prestigious Presidential Management Fellowship upon graduation.

For her fellowship and beyond, Jen landed a position in the U.S. Department of Commerce (DOC), where she served as an International Trade Specialist and helped organize the first Renewable Energy and Energy Efficiency Advisory Committee to address issues impacting the growth and export opportunities for U.S. clean energy companies in international markets. On a trade mission to Saudi Arabia, she got to work closely alongside one of the companies in the group—Capstone Turbine Corporation—and was really excited about its technology.

Since 2012, Jen has worked at Capstone Turbine. She serves as the company's Director of Policy, Strategy, and Distributor Development, leading its federal and state policy priorities and working with dozens of geographically-exclusive distributors around the world to help the company develop its business plans and assess market opportunities. Whip-smart and strategic, she has an immense ground to cover—the entire global market.

Capstone Turbine is headquartered in Van Nuys, CA. According to Jen, the company works to "provide microturbine energy solutions to help customers improve business operations by reducing operational expenses, ensuring high power availability and helping to preserve the environment with a near-zero emissions profile."

The company works with a broad variety of clients, from the oil and gas industry to hospitality to data centers to manufacturers. Capstone's microturbines even power the Ronald Reagan Presidential Library.

Capstone's microturbines are particularly getting attention right now for their reliability benefits due to their "microgrid" capability, which means the ability to disconnect from the electric grid and provide onsite power when there is a disruption to local power supplies. Capstone Turbine's clients include the only hotel in the U.S. Virgin Islands to retain power and water during Hurricane Irma, along with a fast-food store in Puerto Rico that kept the lights on during Hurricane Maria.

Jen says, "All Capstone Turbine dual mode microturbines can be considered microgrids, and all of our microturbines are microgrid-ready due to our DC output potential."

According to Jen, the company is continuing to expand its microgrid capabilities. An exciting development for Capstone Turbine in 2017 was "the development of our new PowerSync controller, which improves reliability and availability of our microturbines by eliminating any single point of communication failure for control. It also can be easily integrated with external control or monitoring equipment using industry standard communications protocols. This new controller enhances commissioning and troubleshooting capabilities through transient operation and event information and improved field service connectivity."

A U.S. energy trend that interests Jen is the growing market potential for small-scale CHP systems. She says, "All of Capstone's individual turbines are <500 kW, and we offer pre-packaged systems of up to 1 MW, which can then be interconnected to provide larger solutions as required. We have offered a packaged C65 CHP system for many years and introduced our packaged CHP system for our 200kW-1MW products in 2015 and 2016. Having done the work to size the heat recovery module to the microturbine makes it easier for the customer to design and engineer the final project."

Jen's Favorite Fact

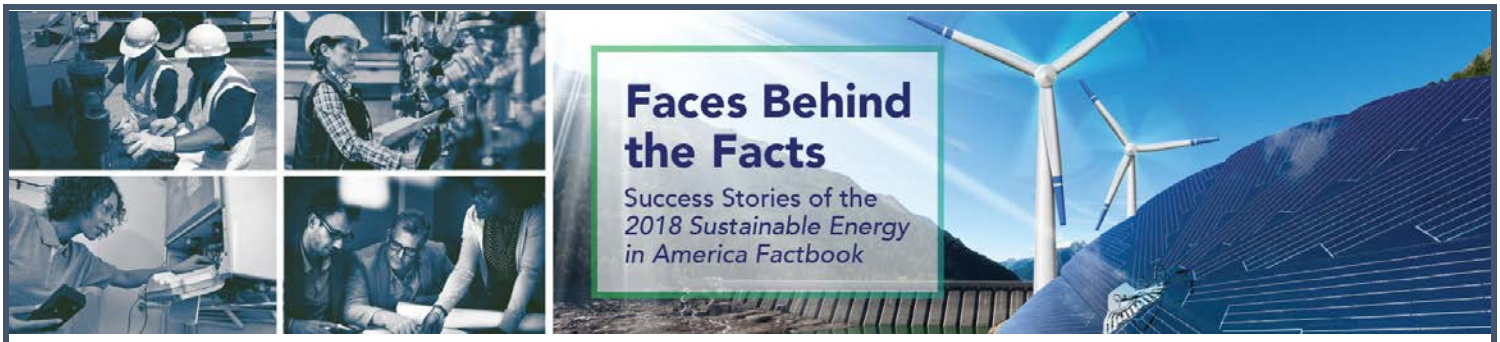
"In 2016, the U.S. added 76 large-scale CHP projects (500kW or greater) and 97 small- to medium-sized projects (1-500kW). This represents a growth in installations over 2015 levels, when the U.S. added 73 large-scale facilities and 91 small- to medium-size projects."

- 2018 Sustainable Energy in America Factbook

Despite being the world's leading technology manufacturer of microturbine systems, Capstone Turbine is still a relatively modest size company, with less than 200 employees. And that's one thing Jen likes about it. She says, "There's not a lot of bureaucracy, so everyone in the company can have an impact, make suggestions, and be included in the company direction."

#

Hear more from Capstone Turbine Corporation in *Powering through the Storm*, an episode of the CEBN's podcast featuring clean and efficient energy technologies that can keep the lights on during natural disasters.



From Pit Crew to Driver's Seat in the Clean Energy Race

CDM Smith

MATTHEW GOSS, VP/Technical Strategy Leader—Infrastructure & Energy

Latham, NY and locations across the U.S.
4,674 employees
www.cdmsmith.com

There are only so many people who know what a racing flywheel is, much less how to install one. Matthew Goss is one of those select few. As a college student, Matthew spent a summer working at an automotive racing school, where he helped out as a car mechanic and pit crew member. He still works on automobiles, but now most of his time is spent coming up with engineering solutions. On a day off, you might find Matthew spending time with family, especially since he and his wife recently became the proud parents of twins—a boy and a girl.

When Matthew was a college student, he did not even have consulting engineering on his radar. But having graduated during a recession and finding a hiring freeze in his industry of choice, Matthew bounced down an unpredictable path.

"It was an unfortunate turn of events at the time, but it worked out better than I could have ever imagined."

Today, Matthew is a Vice President and the Technical Strategy Leader for Infrastructure and Energy at CDM Smith, a firm that "provides lasting and integrated solutions in water, environment, transportation, energy and facilities to public and private clients worldwide." The company provides both construction and engineering services, as well as consulting in both fields.

CDM Smith recently developed a campus-wide utility delivery system and 9 MW cogeneration plant for Harvard University's Allston campus.

The system delivers everything from heat to telecommunications, with a smaller carbon footprint than the previous infrastructure.The firm's client base generally focuses on government and industry stakeholders seeking solutions on environmental and infrastructure projects.

"The firm is distinguished by our leadership and flexibility in design-build and alternative delivery approaches for environmental and infrastructure projects."

Matthew's Favorite Fact

"In 2016, the U.S. added 76 large-scale CHP projects (500kW or greater) and 97 small- to medium-sized projects (1-500kW). This represents a growth in installations over 2015 levels, when the U.S. added 73 large-scale facilities and 91 small- to medium-size projects."

- 2018 Sustainable Energy in America Factbook

Before CDM Smith can make those ideas reality, however, the firm first has to visualize these concepts and convey them to the client. That's where Matthew gets really excited. CDM Smith uses Microsoft's Hololens, which is Augmented Reality technology that portrays a three-dimensional, virtual model of blueprints. Matthew credits this development with helping both clients and team members stay on the same page and complete projects more efficiently and effectively. Indeed, it is not hard to imagine that a scaled, interactive projection of plans might make it easier to present the layout to prospective clients.

"This technology allows our employees and clients to experience and explore virtual 3D components at scale in the real world around us and improves teamwork and communication between project members because of this shared first-person perspective."

But it's not all about the virtual for Matthew. He still gets a rush from the very real experience of motorsport racing. His time in that field gave him a first-hand appreciation of the sport from a new point of view, and showed him that people can express a true passion and dedication to the work they enjoy. And while Matthew is now exhibiting that passion and dedication in consulting engineering at CDM Smith, he reminds us that he has "always been a car person, and will continue to be one."

Expect two future speed demons from those twins of his!

#

From Georgia to Germany, Turning Waste Heat into a Resource

ElectraTherm
JOHN FOX, Managing Director
Flowery Branch, GA and Reno, NV
www.electratherm.com

In 2010, John Fox quit his job at United Technologies, packed up his family of four, and left Connecticut. They were headed to Nevada.

After 19 years, John was leaving his stable, successful job to run a fledgling startup company.

"It was a wild (and great) ride," says John. "Without the support of my wife and family, I would never have made the career changing trek across the country."

He laughs when he talks about it, remembering how his wife reacted when she first saw the CEO job description. "She knew it was over when I showed her the skiing available near Reno in the Sierras," he says. The family had great experiences out west and supported John through eight years of constant business travel and another move back east.

ElectraTherm's Power+ generator

John's new role in 2010 was at the helm of ElectraTherm, a manufacturer of waste heat-to-power (WHP) technology.WHP is a highly underutilized technology in the United States but much more common abroad. There are several different approaches and suitable temperature ranges, but WHP turns wasted heat from industrial processes (e.g., at a manufacturing plant) and uses it to generate electricity. Hot water is essentially the fuel.

Specifically, ElectraTherm's Power+ generator produces fuel-free, emission-free power from low temperature waste heat using Organic Rankine Cycle and patented technology. As he took on leadership at the company, John oversaw a complete design turn of the beta product line, launched commercial production, and navigated the business through many challenges and successes.

His efforts paid off. In 2017, BITZER—based in Germany and serving as the world's largest private manufacturer of refrigeration and compression

technologies—acquired ElectraTherm. While ElectraTherm remains headquartered in the USA, taking on BITZER as its parent company has opened the door to state-of-the-art manufacturing facilities and expanded export opportunities abroad.

"2017 has been an amazing chapter in our growth: we moved ElectraTherm from Reno, NV to Flowery Branch, GA and built a brand-new production facility and enhanced test cell supported by BITZER," says John.

It's hard work selling WHP systems in the United States. There are very limited positive policy signals driving the market as compared to Europe. Customers here are often unfamiliar with the technology, have much more strict payback criteria and are less sustainability focused. A large driver for that is they pay so little for electricity that they don't have much incentive to conserve it. ElectraTherm has been very successful deploying its technology overseas, including in 11 countries.

John's Favorite Fact
"Global investment in clean energy hit $333.5 billion in 2017, the second highest after the $360 billion invested in 2015. This represented a 3% increase from 2016 investment levels."
- 2018 Sustainable Energy in America Factbook

But John is still encouraged in the U.S. by "the ever-increasing focus on energy efficiency and clean energy, and the growing smart and proven use of readily available waste heat sources to generate additional power on engines/CHPs, boilers, flare elimination, geothermal and more."

"ElectraTherm desires to push what has been done globally with waste heat to power with the same opportunities we see worldwide and push market growth in the U.S. with this reliable, proven heat and power source," he says.

ElectraTherm has been making more inroads into U.S. markets, and has particularly been a leader in innovating new uses of WHP technology. For example, the company is currently working with the Office of Naval Research and U.S. Naval Academy in Annapolis, MD to demonstrate gas turbine waste heat recovery onboard ships. ElectraTherm also worked with a Texas developer, Gulf Coast Green Energy, on a unique demo project to reduce gas flaring in oil wells. (To learn more, see the CEBN's profile of Loy Sneary, another leader featured in our *Faces Behind the Facts* series.)

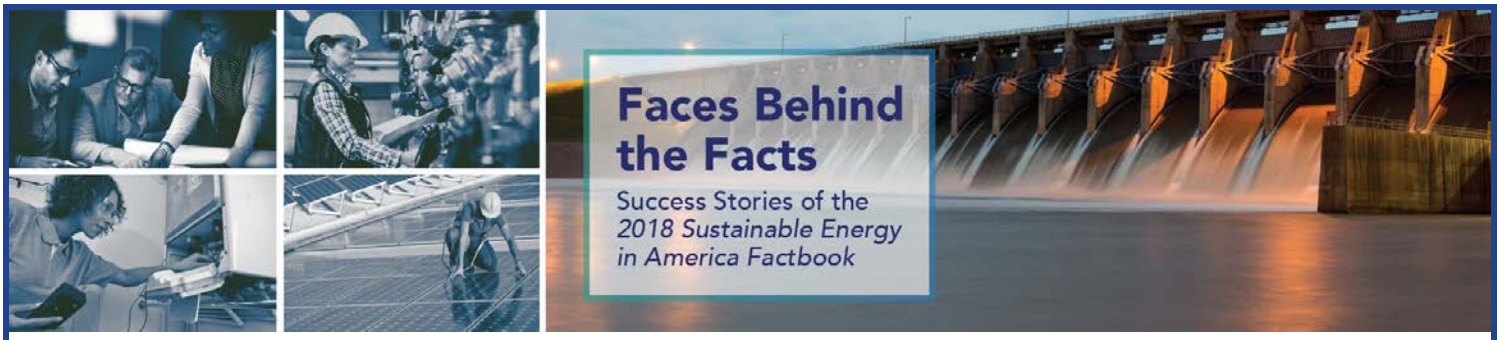
You see, John isn't one to back down from a challenge. He's a direct, straight shooter and has given a piece of his mind (politely) to more than one Member of Congress. But he's also down-to-earth, funny, and remarkably humble for someone who recently closed such a large M&A. He tells a story of an experience at his old job at United Technologies—14 years of which were at the corporation's jet engine manufacturing operation, Pratt and Whitney.

"One of my jobs was to build and test new jet engine designs and validate their robustness for the FAA. That included ice and bird ingestion tests and blade-outs. There is amazing technology that goes into the design of a jet engine, and the modeling of what is about to happen, such as when you shoot a large pheasant into an operating engine and the results versus predictions afterwards. I am glad we went to extremes and made very robust engines; I was on a flight that ingested a bird that caused a diversion to a nearby airport and dumped the majority of our fuel, landing with fire trucks chasing us down the runway."

His story, and the easy-going way in which he frames it, strikes at the heart of John's success. He keeps on pushing, unfazed, through any challenge—even matters of life and death, pheasants and fires.

#

To learn more about waste heat to power, see these resources and video from the Heat is Power Association.



Industry Veteran Wooed by Family Energy Efficiency Company

FlowEnergy
LAURA THOMPSON, Vice President

Woodinville (Seattle), WA
Other office locations: Overland Park, KS
22 employees
www.flowenergy.com

How does a small, family-owned energy business snag a senior executive from one of the largest engineering firms in the nation? By wowing her with efficiency improvements like nothing she's ever seen.

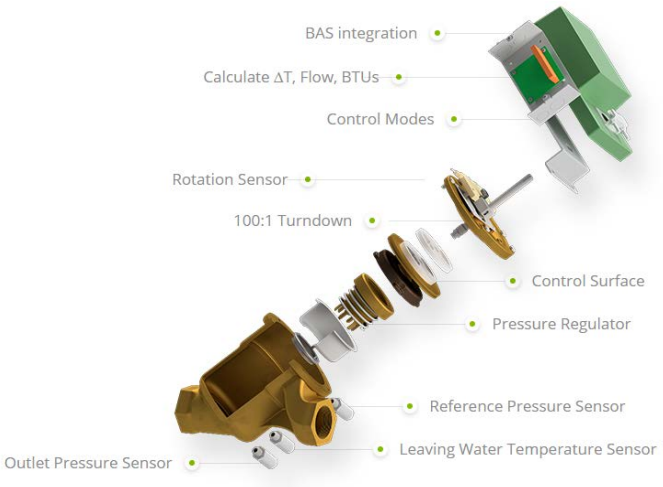
Laura Thompson is an engineer, MBA, and 30-year veteran of the energy industry. The Kansas native has worked at some of the leading energy services providers in the U.S., including Chevron Energy Solutions (which later became OpTerra and then ENGIE Services) and Burns & McDonnell.

In 2009, when Laura was at Burns & McDonnell, her firm had just completed a new chiller plant and chilled water distribution system to supply air conditioning at a university, with a guaranteed return on investment for the client. The problem? The system and plant were not achieving the expected efficiency.

Looking for solutions, Laura came across FlowEnergy, a company outside Seattle with a new SmartValve technology.

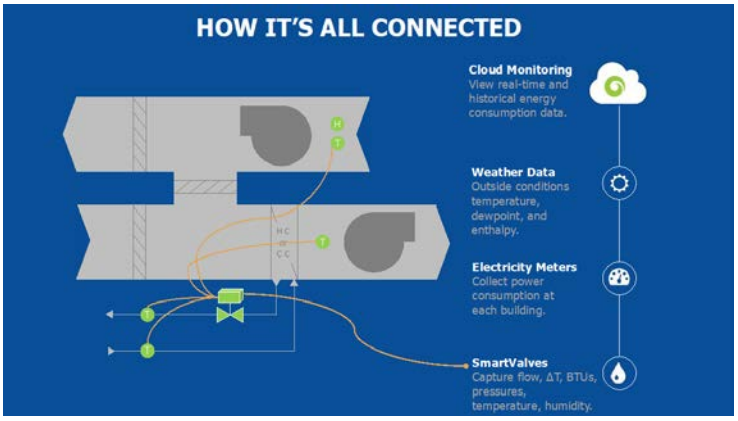
The CEO & Founder of FlowEnergy, Paul Skoglund, started out as a contractor in Alaska for the oil and gas industry, where he innovated precision valves to deliver lubricants for production and exploration. Seeing the potential applications for energy, he optimized the valves for use on hydronic HVAC systems (i.e., those that use water to transfer heat—a fairly common approach).

With imprecise flows, many HVAC systems waste significant amounts of energy because they need to under- and over-shoot flow and temperature control setpoints to arrive at the desired value for comfort. FlowEnergy sought to change that. Paul's daughter, Tami Hansen, joined at the helm as President, and the company built out an integrated approach using SmartValves, software, and modeling/optimization services to achieve unprecedented stability.



FlowEnergy's SmartValve hardware

When Laura Thompson's firm implemented FlowEnergy's SmartValves for its university client, she says the technology "uncovered 20% more savings and system capacity than we had achieved with a $20M investment in energy efficiency measures and facility upgrades. FlowEnergy's precision controls brought a stability to the cooling system which all of our and our controls contractors' efforts could not achieve, uncovering hidden costs that we never knew could be avoided."



Laura worked with FlowEnergy on several more projects and saw the results replicated. The valves and controls "solve the root cause of poor system performance in heating, ventilation and air conditioning systems in buildings," she says. "Coil leaving air temperature for building environmental control is maintained to within one tenth of a degree of setpoint, 15 times the current energy standard for control. Data Intelligence including energy insights, deep equipment monitoring down to the end use, fault detection software and dashboards with data in context for continuous optimization and reliability to assure performance is sustained for the life of the system."

Laura was so impressed with FlowEnergy's approach that in 2016, she went from customer to employee. "Seeing the impact of precision control firsthand as a customer, I knew I had to help get the technology out to a broader market and established as a new standard for sustainability best practices."

Laura is helping FlowEnergy expand to new markets and explore more opportunities with performance contracts. In 2017, FlowEnergy was selected for the New York City Innovative Demonstrations for Energy Adaptability (IDEA) Program to demonstrate Clean Technologies for HVAC in municipal buildings. The company is currently working on a project at the Manhattan Courthouse.

One trend that interests Laura from the *2018 Sustainable Energy in America Factbook* is the enormous reduction in energy use by HVAC equipment over the past four decades. Yet, FlowEnergy's innovations indicate that there is still room for improvement.

Laura's Favorite Fact
"Today, air conditioning equipment uses 20-40% less electricity to provide the same amount of cooling as when [federal] standards were first introduced."
- 2018 Sustainable Energy in America Factbook

Laura says, "The conventional wisdom widely accepted by the industry for control of heating, ventilation and air conditioning systems is that performance gaps in the amount of energy that is transferred from the energy generation systems to the end use for building environmental control (typically indicated by Delta T) cannot be corrected, they can only be managed. Technological advances in control valves and data intelligence mean that these performance gaps, additional energy use, and costs no longer have to be accepted."

#

For case studies of FlowEnergy's projects, visit http://flowenergy.com/customers.html.

Fueling Change: A Family Business Transforms Fuel Supplies and Its Community

Green Energy Biofuel
BIOJOE & BETH RENWICK, Founder and President

Columbia, South Carolina
32 Employees
https://gebiofuel.com/

In 2007, as gas prices were passing $4 a gallon, Joe and Beth Renwick were looking to cut costs in their family budget. They decided to experiment with making their own fuel in their garage, working with bio-based products. What they found was that everyone else's trash was their treasure. Waste vegetable oils that schools and restaurants often discard could be cleaned and recycled into biodiesel fuel, which could then be used to heat a building or run a car engine. Soon, the Renwicks found themselves launching a biofuel business that would extend the economic benefits of biofuel from their family, to their local community, and on to the greater Southeast region.

Founded in 2008 as Midlands Energy, the company quickly spread its reach beyond South Carolina into multiple states in the region. In 2017, the Renwicks renamed their firm Green Energy Biofuel to reflect both its commitment to providing clean energy and the geographic expansion of the company. The firm has secured major corporate customers with a high volume of product, and as a result, has invested in significant plant modifications to increase the efficiency of processing the oil received from customers.

The "fearless leader" of Green Energy Biofuel is Joe Renwick, who goes by the moniker “BioJoe” and harkens his leadership skills to lessons learned in The Citadel, one of the toughest military academies in the U.S.

“The fuel produced is not only biodegradable, but non-hazardous," says BioJoe. "Our mission is to increase the availability of alternative fuels in South Carolina and create sustainable green jobs in the biofuels industry.”

Green Energy Biofuel provides two key services to food industry establishments: cooking oil collection and grease trap pumping. The company maintains a fleet of trucks that criss-crosses the Southeast to collect waste cooking oil that is loaded into tanks. However, not every establishment has the best infrastructure to facilitate grease collection, so Green Energy Biofuel also installs grease traps in these kitchens. One advantage for the restaurants is that the grease traps pay for themselves, as restaurant owners sell waste oil to Green Energy Biofuel for $0.50 per gallon.

On the receiving end of the finished biofuel, the company works to make its product as accessible as possible to any vehicle. Green Energy Biofuel no longer makes its own biodiesel; however, the firm sells its purified biofuel to a large biodiesel manufacturer, which then produces the fuel on a much larger scale. BioJoe and Beth's trucks run on South Carolina biodiesel, but most engines would require modification to accept 100% biofuel. Instead, many engines can accept a mixture of 20% biodiesel and 80% regular diesel as a drop-in fuel. This mixture burns more efficiently than petroleum diesel, lubricates the engine, cleans out engine particulates, and emits less pollutants than petroleum diesel. Not to be overlooked, the exhaust also smells like french fries, which is a nice improvement from the odor of petroleum diesel.

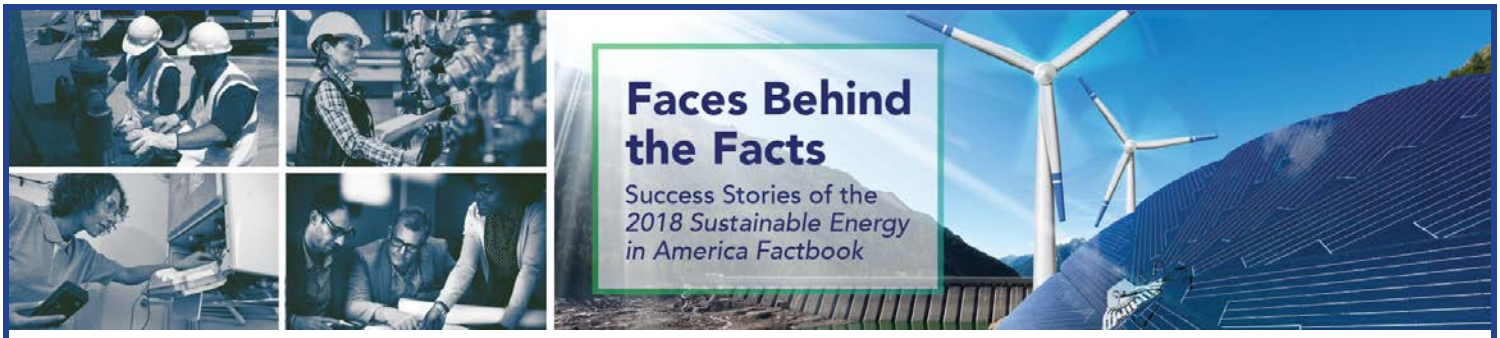
BioJoe and Beth's Favorite Fact
According to data from the *Factbook*, biodiesel production in the U.S. is on an upward trend having grown 25% from 2015 to 2017 and reaching peak production in 2016 of two billion gallons.
- 2018 Sustainable Energy in America Factbook

Another tangible benefit of Green Energy Biofuel, BioJoe and Beth pay their success forward by giving schools, colleges, and small businesses back a percentage of profits from collections. They also provide opportunities for children to tour the production facility and learn how biofuels are made.

"As long as we are 'Making Fuel Baby,' we will always be a proud supporter of education," says BioJoe.

Green Energy Biofuel, which showcases business materials alongside quirky photos of the staff and family events on its website, isn't just producing biofuel. In addition to fueling trucks in the Southeast from its collection stream, Green Energy Biofuel is producing sustainable jobs, bolstering business bottomlines, and enhancing local communities—all this from a restaurant grease trap.

#



Texas Rancher Reduces Gas Flaring from Oil Wells

Gulf Coast Green Energy
LOY SNEARY, President/CEO
Bay City, TX
www.gulfcoastgreenenergy.com

Loy Sneary's face lights up when he talks about his grandkids coming to visit. He says he puts them through "Cowboy Camp"—waking them up at dawn and keeping them out on the ranch 'til dusk, herding cattle and exploring the outdoors. No television, no iPads—and by the end of the week, they don't want to leave.

In person, Loy commands a presence. He's the embodiment of Texan class and charm. Tall and trim with a thick head of salt-and-pepper hair, Loy offers a firm handshake and a gentle smile to everyone he meets. He's pounded the pavement on Capitol Hill quite a few times, and the heels in his cowboy boots set off the metal detectors every time.

He's also the owner of a small waste heat-to-power business southwest of Houston that's working on some pretty innovative projects.

Gulf Coast Green Energy specializes in selling and installing ElectraTherm Power+ waste heat-to-power generators for commercial geothermal, oil and gas, solar thermal and internal combustion engine industrial applications. These fuel and emissions free Power+ Generators add efficiency and emissions reductions from wasted heat that would otherwise be vented to the atmosphere. (For more background on ElectraTherm, see the CEBN's profile on John Fox, another business leader in our *Faces Behind the Facts* series.)

Before starting at Gulf Coast Green Energy, Loy spent years working at the nexus of industry and government—including as a county judge and community leader on sustainable development, land management, and ranching practices. He also did a tour in the Navy years ago, where he learned and began developing leadership skills.

Loy's always had an interest in innovative, cost-saving technologies. And in 2007, he says, "The Gulf Coast Green Energy owners asked me to step in and take the company from start-up to being a significant and respected supplier of waste heat-to-power generation equipment."

One of the most exciting applications of Loy's work is in the oil and gas industry. Gulf Coast Green Energy and ElectraTherm worked on an innovative project with Hess Corp., the Houston Advanced Research Center and Texas A&M to capture flare gas off the Bakken oil field in North Dakota. They used the flare gas to fire a boiler, which delivered the hot water needed for

the ElectraTherm Power+ generator to make power from the gas that would have otherwise been flared. This approach could be a new model for reducing flaring in oil fields, landfills, and wastewater treatment plants. Instead of wasting the natural gas, it could be used to reduce emissions and create an efficient source of electricity to power onsite operations or export to the grid.

Flare reduction demonstration project in North Dakota

In 2017, a new report from Texas A&M verified the emissions reductions from this flare reduction demo project, finding that it cut CO by 89%, NOx by 48% and VOC's by 93% compared to just flaring the gas. The State of North Dakota has also qualified the Power+ generator as an approved technology to make a beneficial use of gas that would otherwise be flared.

According to Loy, one finding of the *2018 Sustainable Energy in America Factbook* that resonates with him is "the increase in renewable energy generating capacity and the trend toward energy efficiency. We have also been impressed that certain sectors of the economy, particularly O&G, are taking serious actions to reduce Methane and other VOC emissions."

Loy's Favorite Fact

"GDP growth in the U.S. continued apace in 2017, even as primary energy consumption shrank. This decoupling between economic growth and energy use is reflected in improvements to energy productivity. Within the past decade, energy productivity ticked up 18%, as GDP jumped 15% while primary energy consumption shrank 2%."

- 2018 Sustainable Energy in America Factbook

Loy's line of work is not always easy. "Waste heat-to-power" is certainly not a household name, and it takes a lot of work to get customers up to speed on the technology's benefits. Despite that, Loy says, "we've been in the business of waste heat-to-power for over 12 years…and we're still here!"

While smoothing out the bumps in the road over these years, Loy has also enjoyed starting an all-volunteer non-profit to promote and encourage healthy lifestyles in his area of Texas. "Because our area is above national averages of all chronic diseases," he says, "this has been a rewarding volunteer endeavor. After 15 years of raising, begging for and borrowing money and applying for grants we have successfully built a $7 million Wellness and Rehabilitation Center which serves our community and the surrounding area. It's been very cool to be a part of bringing the community and area industry and businesses together for a common healthy life style goal." Loy's next volunteer project is to build a $13 million aquatics center for aquatherapy, student and adult athletes and recreational swimming.

Loy approaches everything in his life—from his business, to his volunteer work, to ranching, to his family—with such heart. It's not clear how he manages it all, but hopefully he'll find time to add just one more thing to his plate: a Cowboy daycare.

#

Watch this video about the flare reduction project demonstrated by Gulf Coast Green Energy and ElectraTherm.

Hear more from Loy in *Powering through the Storm*, an episode of the CEBN's podcast featuring clean and efficient energy technologies that can keep the lights on during natural disasters.

Bringing Solar To Those Who Need It Most

Marketing for Green
BENNIE HAYDEN, Founder
Atlanta, GA & Detroit, MI
www.marketingforgreen.org

Bennie Hayden's mother often said, "In times of crisis, there are also opportunities for those who choose to look for them." Bennie experienced this firsthand in 2010, during the recession. He had built a successful 30-year career in marketing, starting with Xerox as a Senior Marketing Representative, and most recently with Texas Student Loan Guarantee Corporation (TG), as a Regional Account Executive. And then, like many Americans, he was laid off from his job, in his case due to legislation eliminating the Federal Family Education Loan Program (FFELP).

At a late stage in his career, Bennie suddenly had to start over again. He had a family to support, with two teenagers in school. But Bennie isn't the kind of person to be deterred easily. He radiates positivity and optimism—finding joy in Motown and jazz, jogging and the outdoors. Like his mother taught him, Bennie decided to view the layoff as an opportunity to reinvent himself and find a new application for his skillset.

After exploring potential markets, Bennie decided that focusing on sustainability could be a viable new career path while allowing him to contribute to his community. He founded Marketing for Green with the goal of effecting "positive change environmentally and socially, helping to create a sustainable society." And he's doing this the best way he knows how: marketing.

"Long ago, I learned that everything about business starts in marketing," he says.

Bennie earned a Professional Certification in Business Sustainability from the University of Vermont and pounded the pavement at networking events. He works with businesses of all sizes to take a holistic approach to sustainability. Examining everything from the design of a product to its distribution, Marketing for Green finds ways that the business can improve efficiency and reduce their footprint on the planet.

Marketing for Green is now an advisor to teams competing in the Department of Energy's Solar in Your Community Challenge, a competition with a $5 million grand prize for solutions to improve access to solar for low- and moderate-income households; state, local, and tribal governments; and nonprofit organizations. Bennie is coaching teams in Memphis, Baltimore, and Florida to help them reach their goals. Bennie says, "Where possible, I also collaborate with fellow coaches where we work together to identify potential funding sources for workforce development in underserved communities, ideally to create jobs and closed loop economic activities."

The Challenge has been helpful personally and professionally to Bennie. While helping more communities access solar, Bennie has also worked to grow a niche market for his business. He says, ""One of my favorite quotes is 'Chase passion, not money' (although making money is nice)."

Source: Department of Energy's SunShot Price: Solar in Your Community Challenge

Bennie says, "At the end of the 18-month Challenge, my goal is to use this experience and expertise to develop solar energy projects, particularly for underserved communities."

One trend highlighted in the *Sustainable Energy in America Factbook* that Bennie finds encouraging is the growth of energy storage.

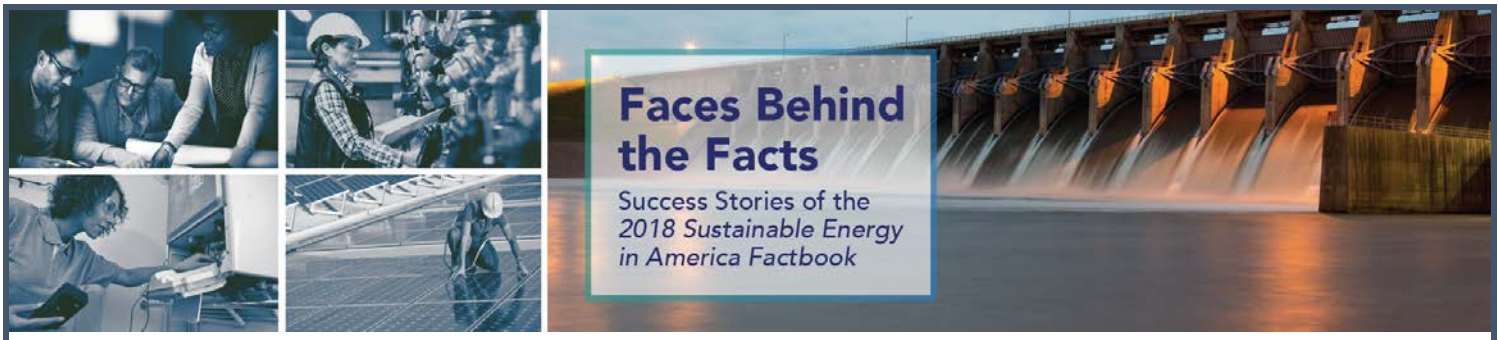
Bennie says, "The advances made in energy storage technology will play an increasingly important role in solar deployment in 2018. For our first responders, this technology can provide more resiliency in the event of power outages by enabling their ability to respond to emergencies/disasters."

Bennie's Favorite Fact
"Solar…added almost 74,000 jobs from 2015 to 2016, marking a 25% growth year-on-year and again taking top place out of all electricity generation sectors."
- 2018 Sustainable Energy in America Factbook

Sustainability is an increasingly fundamental component of doing business in the 21st century. Bennie is ensuring that the economy of the future will be accessible to all.

#

Learn more about the Solar in Your Community Challenge.



Steering a Utility Toward a Clean Energy Future

National Grid
DEAN SEAVERS, President

Waltham, MA
(Other office locations throughout MA, NY, RI)
16,000+ employees
https://www.nationalgridus.com

Dean Seavers' grandmother impressed upon him the importance of not being wasteful. She expected her grandson to turn out the lights upon leaving a room. She expected him to close doors quickly to keep the heat from escaping during those cold winters in Sandusky, Ohio.

Utilities and other bills were meaningful expenses for her, and she understood, out of necessity, the connection between daily behaviors and the bills that came at the end of each month. These lessons have stayed with Dean today and this appreciation for conserving resources has influenced how he approaches his work.

"My grandmother taught me about being efficient, limiting waste and practicing mindfulness, which are three values I bring to work every day," he says.

These values are especially important to Dean's role as President of United States operations for National Grid, a British-based multinational electricity, natural gas and clean energy delivery company serving 20 million customers in New York, Massachusetts, and Rhode Island.

Dean didn't initially seek to work in the energy industry. He began his career at Ford Motor Company, then moved to Tyco International Ltd., and landed a role leading General Electric and United Technologies Corporation. The former CEO of National Grid personally recruited Dean to take over the helm in the U.S. company, where he now works every day to assist customers in moving towards a clean energy future. His enthusiasm for the role is palpable, for which he credits National Grid and its value-creation mindset.

"Finding ways to create value for our customers, our shareholders, and our employees is what gets me out of bed every day."

Dean believes in balancing growth and sustainability while creating value for customers and employees alike. In the last year, National Grid has added over 70,000 new customers while winning multiple awards for energy efficiency. The utility has

received a host of honors for its efforts to ensure a diverse and inclusive workplace for employees of all ethnicities, genders, and abilities, as well as a 100% rating on the 2017 Corporate Equality Index by the Human Rights Campaign.

"We believe that [our diversity initiatives] will also attract new, diverse talent, as the demographics of the next generation of the workforce changes quite dramatically."

One project Dean is particularly proud of over the past year is the rollout of National Grid's Northeast 80 x 50 Pathway. This blueprint aims to reduce greenhouse gas emissions in New York and New England by 80% below 1990 levels by the year 2050, while supporting economic growth and improving public health. Dean remarks that "the approach combines several strategies that provide a clear pathway to significant emissions reductions, and signal a shift in the way we relate to energy."

The three pillars for achieving these emission reductions are heat, power, and transportation. To this latter point, National Grid is working to promote customer adoption of electric and other alternative-fuel vehicles. In addition to promoting clean energy adoption by customers, the company also offers rebates to employees, funded by shareholders, through the Electric Vehicle and Smart Home Adoption Program for purchases of electric and hybrid vehicles, solar panels, and energy efficient home technologies.

Dean's Favorite Fact
"Sales of electric vehicles – a category that includes battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV) – increased 23% to over 194,000 units in 2017, from 158,000 units in 2016."
- 2018 Sustainable Energy in America Factbook

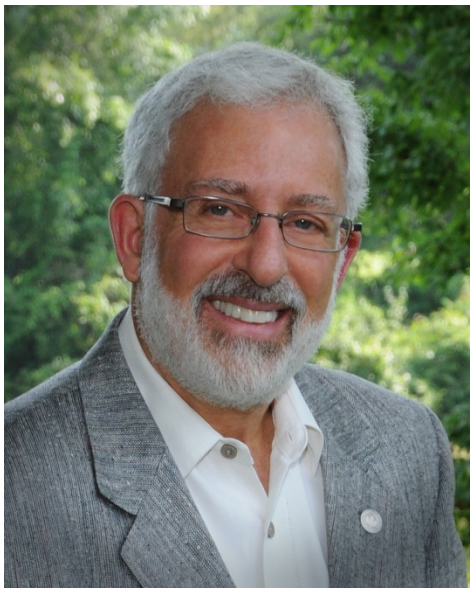
"We support our states' goals of reducing greenhouse gas emissions by 80% by 2050. Implementing programs like these allow our employees to reduce their carbon footprint and will help us get there."

As Dean plans for the future of National Grid and his own family, he does so with an eye to the past.

"My grandmother was the original efficiency expert in my life, so it's fitting that I have found myself in the energy industry. Now, as I look at my grandson, I feel a responsibility to carry on that efficiency torch and work towards a clean energy future."

#

Making the Old New Again



Newman Consulting Group, LLC
JIM NEWMAN, Founder and Managing Partner
Farmington Hills, MI
www.newmanconsultinggroup.us

What does it take to earn the title “Dean of Green”?

Jim Newman has earned this moniker through more than four decades of energy efficiency retrofits and his ongoing efforts to share that expertise with others. One example of his work includes upgrading an 1894 mansion that had been converted to a fine-dining restaurant to the tune of $2 million in energy savings over the next 20 years. Projects like these help building owners be green and sustainable while saving a lot of green.

Jim says, “For my last birthday, I received a birthday card from my wife that said, ‘It’s not how old you are, but the number of years you’ve made the world a better place.’ This is what keeps me going.”

Jim’s interest in efficiency traces back to the oil embargo of 1973. A mechanical engineer working as a technical consultant to owners, architects and design engineers at the time, he noticed architects were designing tighter building envelopes to reduce air leaks and cut down on energy use due to high prices. At the same time, engineers were designing HVAC systems that used less outside air. These changes led to air stagnation in buildings and a potential health issue for occupants called "sick building syndrome.” At the convergence of these two trends, he realized there was a huge opportunity for growth as the concept of sustainable development was just beginning.

“This led to my interest in the then ‘new’ concept of green and sustainable buildings, and how to help buildings use less energy while still making people healthier and more productive where they live, learn, work and play."

Today, Jim is Managing Partner at Newman Consulting Group (NCG) which works to help commercial, industrial, and multi-family property owners implement energy efficient solutions. The firm improves building envelopes and HVAC systems and lighting, implements building information systems, installs solar and wind assets, and eliminates waste. Some of this work is supported through tax credits and utility rebates and/or an innovative financing model known as Commercial Property Assessed Clean Energy (C-PACE). This financing model is currently available in more than 30 states and the District of Columbia, and it allows a building owner to finance the upfront costs of energy upgrades and pay the costs back over time through payments added on to an owner's property tax bill.

C-PACE funding has proved to be especially valuable to Jim's business, as Newman Consulting Group was the first firm to use the model to finance projects in two large Southeast Michigan counties and the City of Detroit. One of the firm's notable projects in 2017 was the renovation of the Whitney Restaurant.

"A 124-year-old, 21,000 S.F. historic home turned fine-dining establishment, the Whitney building is a three-story, National Historic Landmark in the heart of Detroit," Jim explains. Built by a lumber baron in downtown Detroit, the Whitney was converted from private use to a restaurant in 1986.

Retrofitting the building required maintaining its historic aspects while replacing outdated energy-intensive systems with efficient solutions and making the establishment more comfortable for workers and patrons. Upgrades included replacing 214 windows, exchanging overhead fluorescent and 1,600 chandelier light bulbs with LED lighting while maintaining the quaint restaurant atmosphere, and installing energy efficient heating and cooling systems with networked building controls. These improvements are expected to reduce energy costs by 25% for the building, eliminate high maintenance costs and make the atmosphere more comfortable for patrons and workers.

In the future, Jim is excited by the growing IoT, or "Internet of Things"—i.e., intercommunication between systems, such as the networked building controls used in The Whitney Restaurant. Interconnected systems are making new innovations in efficiency possible. For example, an air-conditioning system that knows the weather forecast for tomorrow will be able to cool a building more efficiently, and appliances within a building that "talk" to each other can form a more efficient system as a whole.

Jim's Favorite Fact

"Smart thermostat costs continue to decline with all the leading brands now offering products for $170 or less, down from $250 only a year ago. Coupled with utility incentives that further reduce the sticker price, BNEF estimates that over 14 million households had a smart thermostat in 2017."

- 2018 Sustainable Energy in America Factbook

Jim says, "The Internet of Things is bringing everything together in one place to make operations and maintenance more efficient, easier and less costly. Improved results are not only in lighting and HVAC equipment but also in the overall operation of buildings."

Jim has shared his enthusiasm and expertise in efficiency with communities around the world. He's given presentations on energy efficiency across 24 states, 7 countries, and 4 continents, including serving as Distinguished Lecturer for ASHRAE—the organization that develops the basis for building codes in most states.

As Jim's experience demonstrates, incorporating energy efficiency solutions in the existing built environment can have multiple benefits. An office building can be upgraded to use less energy and provide a more comfortable workspace with fresher air. A restaurant can preserve its historic details while boosting energy efficiency and slashing costs. The old can be made new again—without losing its charm.

#

Learn more about the Whitney Restaurant project.
View a list of Newman Consulting case studies.

A Game-Changer for Natural Gas Vehicle Fueling

Onboard Dynamics
RITA HANSEN, CEO
Bend, OR
9 employees
www.onboarddynamics.com

When Rita Hansen was introduced to a local researcher at Oregon State University in 2013, she could immediately see the promise of his natural gas compression technology—along with the challenges in turning it into a mature product.

That researcher was Dr. Chris Hagan, an Assistant Professor at Oregon State University who had been working on a concept for integrating natural gas compression into an automotive engine. The Advanced Research Projects Agency – Energy (ARPA-E), a federal program that helps support early-stage technology development, had given Chris a $1 million award to prove the technology.

Chris was having tremendous success accomplishing the technology development milestones for the ARPA-E award but was challenged with meeting the tech to market milestones. This is not a unique situation for innovators of new energy technologies.

As Rita explains, “It’s not just the science and technology, but also will someone buy it at the end of the day.”

Chris knew he had to pull in the right business team. He reached out to Economic Development for Central Oregon, a local economic development agency. EDCO put him in touch with Rita. She had an engineering background and more than thirty years’ experience in major energy and technology companies—so she understood the technological promise but also brought to the table deep expertise in business development, commercialization, and angel investment.

Rita and a team of local entrepreneurs rallied behind Chris to develop a commercialization pathway. They established the company in October 2013, with Rita at the helm as CEO. The team successfully pitched ARPA-E for a follow-on investment to take the proof of concept Chris had developed to the next stage of product development. Along the way, Rita and her team pulled together other local finance and commercialization partners—including cleantech incubator Oregon BEST and the Oregon Nanoscience and Microtechnologies Institute (ONAMI).

Even with a strong team in place, it wasn’t always smooth sailing. The original concept was to integrate the compression technology into a vehicle. “Halfway through the process,” Rita says, “in response to the market feedback we were getting, we adapted the product from Onboard Vehicle to a mobile compressor.”

Essentially, prospective clients kept telling Onboard that they already had the vehicles, but needed a better way to fuel them. So Onboard instead focused on making the compressor portable.

By the end of 2017, Onboard Dynamics completed its ARPA-E award, secured a major manufacturing partner—Linamar Corporation—and officially launched commercial production of its first product, the GoFlo™ CNG80. The GoFlo™ is a mobile natural gas compressor that can turn pipeline or renewable natural gas into fuel for NG vehicles.

And as for Rita's question, "Will someone buy it?"—the answer is a resounding yes. Onboard has secured its first field demonstration project to begin deploying the GoFlo™ at a customer site with Southern California Gas Company (Sempra), a large natural gas utility.

The GoFlo™ could be a game-changer in how natural gas fleets are fueled. "We work to lower fuel costs and carbon emissions by removing infrastructure barriers to driving natural gas-powered vehicles," says Rita. "Our product line integrates natural gas compression into automotive engines, thereby allowing fleets to refuel economically from any low-pressure natural gas supply line or renewable source without the need for electricity."

Because Onboard's unit is so portable and doesn't require electricity, it's also useful in disaster response along with everyday fleet refueling.

One trend that interests Rita from the *2018 Sustainable Energy in America Factbook* is the growing use of natural gas as a transportation fuel. She says, "We believe that this trend will continue to increase, especially with the deployment of new renewable natural gas projects coming on line in the next few years. The environmental benefits of using R-CNG as a transportation fuel are a real game-changer in the transportation industry."

Rita's Favorite Fact

"Natural gas use in vehicles has grown steadily since 2013. In 2017, the amount of natural gas used for this purpose rose 4% year-on-year to 43.4Bcf. This represents a 44.5% increase over 2013 levels, and a 5.9% compounded annual growth rate over the last decade (since 2008)."

- 2018 Sustainable Energy in America Factbook

Rita elaborates on these environmental benefits, quoting Marianne Mintz of Argonne National Laboratory's Energy System Division, who says "R-CNG can achieve the greatest GHG reductions of any transportation fuel today—70 percent or more as compared to gasoline or diesel."

Rita elaborates, "And, in 2016, over 60% of all natural gas consumed in California as a transportation fuel came from a renewable source. The National Petroleum Council estimates that 35 billion gallon gasoline equivalents nationwide is possible—which is the equivalent of 1.2 times total diesel consumed by freight trucks."

Onboard Dynamics' story demonstrates how important it is for entrepreneurs to be adaptable. From the first seeds of the technological idea, to pulling together the right business team and financial package, to rethinking the product design, the Onboard team has been willing to listen to new perspectives and make changes to suit the market. Rita says that all of Onboard's strategic partners "have helped us get up to the point where today we're now standing on our own two feet."

#

To hear more from Rita, listen to a CEBN webinar on ARPA-E funding opportunities and advice from prior grant recipients.

Clean Energy Champion in Coal Country

Schneider Electric
JOHN HOEKSTRA, Global Vice President of Sustainability and Cleantech Services

Louisville, KY
1,800 employees
www.schneider-electric.com/ess

John Hoekstra is proof that clean energy knows no borders.

He serves as Global Vice President of Sustainability and Cleantech Services at Schneider Electric, a French-based multinational energy corporation with a commitment to efficiency and renewable energy.

He says, "When people ask where I do global sustainability work, it's sometimes a comical surprise to learn that our Energy & Sustainability Services division headquarters are in Louisville, Kentucky–an area that is well-known for coal. It makes for a good laugh, but also a great opportunity to welcome new conversations and share my passion."

Founded in 1836, Schneider Electric is one of the leading global providers of electric products and services. If you look around carefully, you'll come across the company's logo nearly everywhere you go. Its light switches, electrical sockets, thermostats, circuit breakers, power control systems, air conditioners, and other products are ubiquitous in homes and offices around the world. But unless you work in energy, you may be less familiar with Schneider Electric's work in energy management and sustainability services.

Specifically, John's division, Energy and Sustainability Services (ESS), specializes

in helping organizations buy clean energy more strategically, use energy more efficiently, and become more sustainable in how they manage resources across the globe.

John grew up in Kentucky, in a family that valued sustainability, and this deeply-instilled ethic has resonated throughout his career. He completed his bachelor's in chemical engineering at the University of Kentucky and after several early positions, landed a job at Summit Energy (later acquired by Schneider Electric) managing energy supplies in Europe. When the European Union Trading Emissions Scheme launched in 2005, he and his colleagues began focusing on how to help their customers manage their carbon emissions more effectively.

That mission drove him to the work he does today with Schneider Electric's clients. John's responsibilities include managing the New Energy Opportunities (NEO) Network, a growing global community of forward-thinking corporations and cleantech solution providers who enjoy exclusive access to transaction-accelerating intelligence. Launched in North America in 2016, Schneider expanded the NEO Network to Europe and Australia over the past two years.

An exciting development for Schneider Electric in 2017 was the acquisition of Renewable Choice Energy, a pioneering leader in corporate renewable energy procurement and carbon offsetting.

"This acquisition furthered our existing position in the rapidly growing commercial & industrial (C&I) renewables market, bolstered our ability to provide advisory services for power purchase agreements (PPAs), and enhanced support to our clients in the implementation of other innovative cleantech solutions."

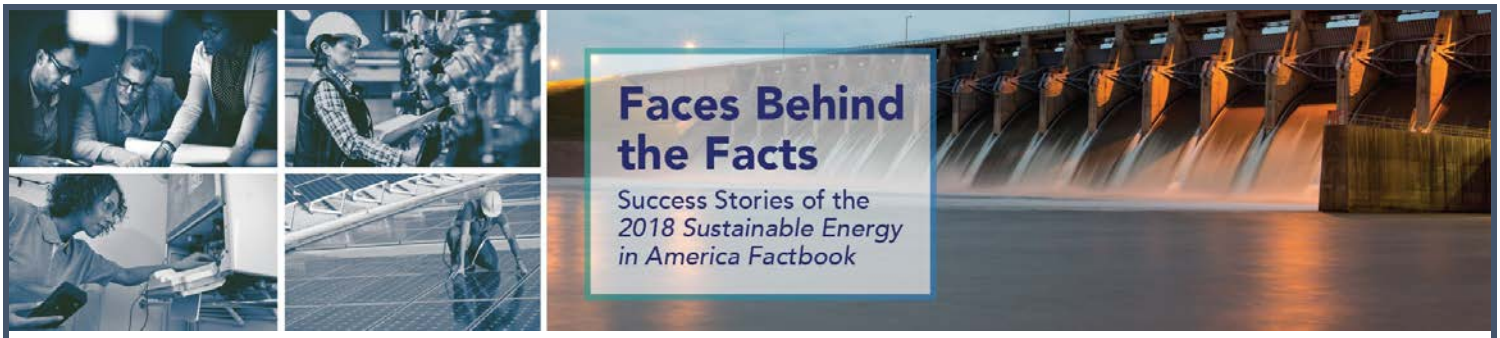
John is excited by the growing corporate role in building momentum for renewable energy. His division is finding growing demand from companies across the world seeking to navigate global energy markets and maximize their financial and social impact.

"I love supporting our clients in their cleantech and sustainability journeys."

John's Favorite Fact
"With 18.4 GW of new additions, 2017 marked another boom year for renewables build, second only to 2016's record of 22.7 GW."
- 2018 Sustainable Energy in America Factbook

John's own journey—across the Atlantic and back home in Kentucky—demonstrates that clean energy can be good for planet and profit alike.

#



A Solar Pioneer is Made at the World's Fair

TerraShares
JOHN ATKINS, President
Morristown, TN
TerraShares.com

John Atkins fell in love with solar at the 1982 World's Fair in Knoxville.

He says, "The Fair's theme was energy and I became enamored of the numerous solar energy displays, returning many times to talk with the exhibitors."

At the time, John was working in diesel engine sales. But the nascent solar industry kept calling to him. Four years later, he founded TerraShares and began developing solar systems, most of which at the time were thermal solar. The "alternative energy" industry was still young and struggling to get off the ground.

John has been a pioneer in the clean energy industry in many ways. Not only did he get into the solar business when the industry was fairly new, but he also pioneered commercial scale solar and third-party funding in 28 K-12th grade schools in Tennessee.

This was harder to accomplish than it might sound. In Tennessee, school districts have strict limits on their ability to take on debt, and the state doesn't allow third parties to own solar projects and sell the power

Students at the Rogersville Middle School in Hawkins County learn about a 50-kW solar energy system installed by TerraShares

back to the end user—so John had to explore some very unique and creative financing options to help schools pay for the projects.

Now, John is exploring new ways of coupling solar with other sources of clean energy, such as combined heat and power and waste heat to power (CHP/WHP), highly-efficient technologies that harness heat that is usually lost during conventional power generation.

"We are seeing that our educational, corporate and non-profit clients are seeking even greater energy independence and control over a range of energy challenges than solar alone can address. To assist them, TerraShares is expanding our network of resources to include additional proven clean energy technologies like CHP/WHP and related capabilities in energy analysis/strategy, engineering, installation and financing."

John has a philosophical view of sustainability combined with a professorial depth of knowledge about energy and finance. He's a true believer in renewables, but knows that the real driver of transformation in energy markets is achieving cost reductions for customers.

One trend in the *2018 Sustainable Energy in America Factbook* that interests John is the growing corporate demand for clean energy. This development doesn't surprise him at all. John feels that when states and utilities don't respond to corporate demand, businesses are more aggressive about generating their own clean energy.

John's Favorite Fact

"Corporations are playing a stronger role in the energy transformation, increasingly demanding cleaner energy and seeking to capture gains from energy efficiency."

- 2018 Sustainable Energy in America Factbook

"A key concept, for business, is that sustainability means doing more with less—less material, less cost, less pollution, less waste, and lots of other 'lesses.' Businesses invest every day in measures to that reduce their cost; it's what they must do to remain competitive."

John points out that investing in energy conservation measures is one of the few things a company can do to substantively impact its bottom line, generating savings that can be reinvested in its workforce, productivity, or research and development.

He cites a study that the consulting firm A.T. Kearney conducted in 2009, when clean energy was just starting to gain widespread traction and technology costs were still much higher. Even back then, John says, "What Kearney found was that those companies that had actually gone green averaged 15% greater profitability than non-green competitors in their same industry." John argues that beyond simply saving on energy costs, the reinvestment of those savings into other corporate activities further compounds a company's competitive advantage.

"Taken together the benefits of adopting sustainable practices can be a competitive game-changer," he says. "And the competitive advantage it creates is permanent."

#

Rethinking HVAC from the Outside In

ThermoLift
PAUL SCHWARTZ, CEO

Stony Brook, NY and Ann Arbor, MI
15 employees
www.tm-lift.com

It turned out to be the most memorable bar mitzvah Paul Schwartz ever attended.

It wasn't the canapes or cocktails that changed his life, but rather a chance professional encounter at the Garden City, Long Island celebration.

"I was standing at the bar and this guy—an attorney—struck up a conversation about ThermoLift's technology with me," Paul explains. "Turns out he knows Bob Catell, former chairman of National Grid and the American Gas Association. After an introduction and a few meetings, both became the first investors in ThermoLift!"

Advanced Energy Research and Technology Center (AERTC) at Stony Brook University

The AERTC completed construction in late 2011 and then started a Clean Energy Business Incubator Program (CEBIP) with support from the New York State Energy Research and Development Authority (NYSERDA), which helps clean energy companies commercialize their technologies. Shortly after the bar mitzvah Paul successfully pitched his company, ThermoLift, and joined the companies housed at the incubator. The incubator opened a world of doors—to local investors, mentors, and physical space for the company's growing team.

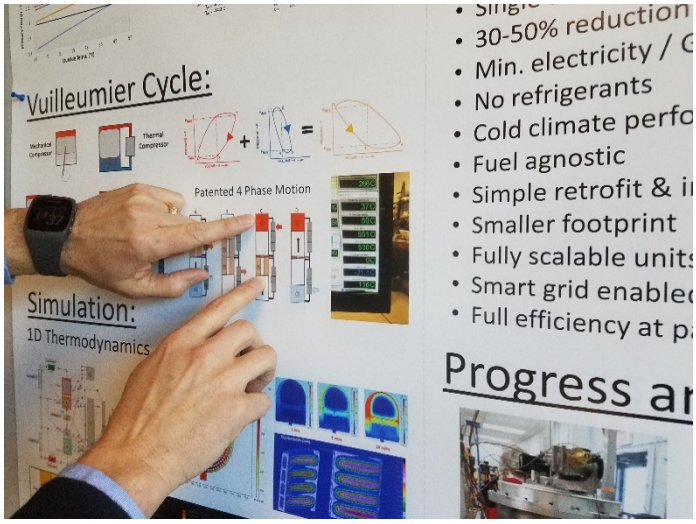
"A gas-fired heat pump which can provide heating and cooling is the holy grail for the utility industry," says Bob Catell, Chairman of the AERTC.

Paul and his business partner, Dr. Peter Hofbauer, founded ThermoLift in 2012 out of Paul's garage on Long Island. Peter, who works at ThermoLift's lab in Ann Arbor, MI, is the engineering brain behind the operation. Paul is the finance expert with a history of raising money for startups. Their TC-Cycle™ Thermal Energy System uses natural gas

as its primary fuel to provide heating, air-conditioning, and hot water in a single appliance for homes and commercial buildings that is vastly more efficient than other HVAC systems on the market.

Imagine using the outdoor air to heat your home in the winter or cool your home in the summer. Sound impossible? It's not—the TC-Cycle™ incorporates unique innovations to the well-established Vuilleumier cycle heat pump design.

For non-engineers, let's dust off some basic thermodynamic principles from high school physics class. If you have a constant volume of gas and add heat, the pressure increases. (And vice versa, if you remove heat pressure decreases.) This principle, the Ideal Gas Law, allows the Vuillemier cycle to use changes in temperature to create changes in pressure. Controlling this process is the key to ThermoLift's patented Thermal Compressor (TC-Cycle™) which replaces the mechanical compressor in traditional heat pumps, creating the Ultimate Heat Pump.



Schematic of how the TC-Cycle™ device uses changes in temperature and pressure draw heat out of the air.

ThermoLift's design can utilize renewable heat, resulting in a 30-50% reduction in energy use which amounts to nearly $1,000 in annual operational cost savings when compared to state-of-the-art HVAC systems. The TC-Cycle™ appliance also offers many unique features including efficient cold-climate (<0°F) operation even at partial loads, smart grid/demand response and fuel-agnostic capabilities, and ultra-low NOx emissions all without the use of harmful refrigerants.

In addition to the consumer benefits, the unit will help electric and gas utility companies by balancing loads during peak summer demand for A/C, increasing resiliency for the grid.

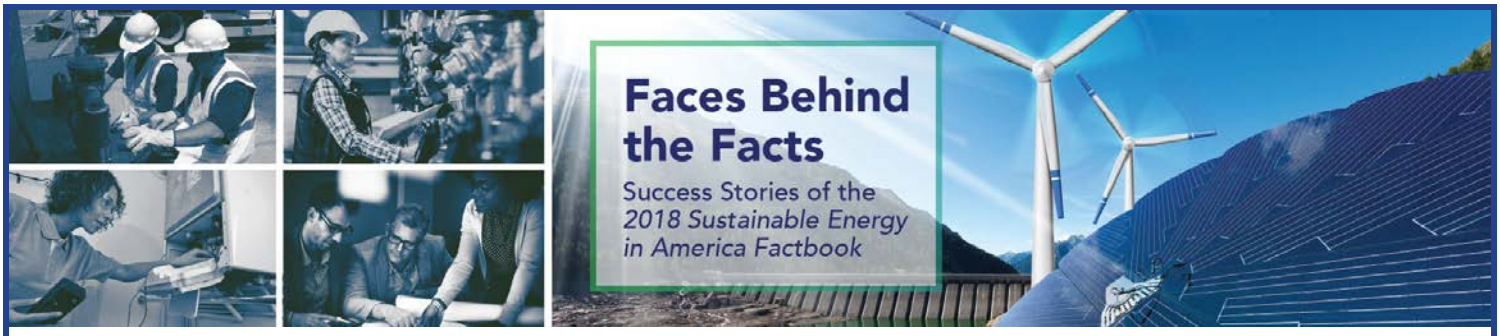
Paul's Favorite Fact:
"Natural gas has become increasingly affordable for consumers. Retail prices for the commercial sector averaged just $8/mcf in 2017, down 42% over the past decade and near the recent trough observed in 2016. Gas prices for the industrial sector have followed a similar trajectory but continue to undercut commercial rates, averaging just over $4/mcf in 2017."
- 2018 Sustainable Energy in America Factbook

"Since our founding, ThemoLift has tried to recruit partners and experts to help develop and commercialize our technology," says Paul. "We have been able to build a strong network of supporters including the US Department of Energy, NYSERDA, Wells Fargo, Oak Ridge National Laboratory and the National Renewable Energy Laboratory, the Gas Technology Institute, and domestic and international utilities including National Grid, ConEdison, SoCal Gas, DTE Energy and the European Heat Pump Association among others."

ThermoLift has raised over $16 million in funding, through Series A and Series B rounds, and through grants from the Department of Energy, NYSERDA, and Wells Fargo IN2 Incubator Program, to develop multiple generations of the TC-Cycle™ prototype for testing. The company is working on further enhancing performance and reducing costs and intends to begin commercial production in 2-3 years.

Seems like a 'Mazel tov!' is in order.

#



A Winning Hand with CHP

UGI HVAC Enterprises
GARY FECHTER, General Manager of Performance Solutions and Engineering Services

Wyomissing, PA
Multiple field offices across Eastern PA
300 employees
www.ugihvacenterprises.com
www.ugiperformance.com

Meeting in a boardroom with Gary Fechter feels like kicking back at the poker table over a couple of beers. He runs a successful, midsize company that's drawing in 8-digit revenues. He's worked on five continents and at several major energy companies, served in the Army, and even taught physics at West Point. But he's a regular guy at heart—down-to-earth, disarming, and quick with a joke and a smile.

Gary runs the design-build team on the unregulated side of a company that is primarily a gas utility. UGI Performance Solutions (UGIPS) is a leading provider of combined heat and power (CHP), developing and executing CHP projects for UGI HVAC. From conceptualization, to design, to construction, all the way through operation, UGIPS works with clients to provide integrated solutions to their unique energy needs.

Gary took over the helm at UGIPS in 2014. At the time, he has just sold his consulting firm and was planning to retire. He would play more golf with his buddies, drive around in his C70 convertible, and travel with Joyce—his wife and high school sweetheart. He would have more time to devote to one of his passions—organizing fundraisers for the SGC Foundation, which supports children's hospitals around the nation.

But you know what they say about the best-laid plans.

"After selling my consulting firm and completing a transition period with the new owner," Gary says, "I was asked by several clients to work with them directly. During this time, I was introduced to the team at UGI HVAC and after a year and a half as a consultant I was asked to consider a full-time role and joined the team at Performance Solutions."

UGIPS is a big player when it comes to encouraging CHP deployment in Pennsylvania. For background, CHP systems generate both heat and electricity from a single fuel source—often natural gas. By harnessing the heat that is lost during

conventional powering generation, CHP can nearly double efficiency. These systems can also provide a reliable, onsite source of electricity to keep manufacturing plants, hotels, apartment buildings, hospitals, military bases, and college campuses powered up in the event of a grid disruption. Due to Pennsylvania's strong manufacturing base and variety of suitable sites, the state ranks 12th in the nation for CHP deployment (2.9 GW) and still has more than 7.7 GW of untapped technical potential.

In describing examples of UGIPS' work, Gary notes, "An exciting development for my company in 2017 was completion of a combined heat and power project for the casino at Mohegan Sun Pocono Downs."

A CHP plant UGIPS designed for Mohegan Sun Pocono Downs reduces operating costs and provides more reliable power

Why would a casino want CHP? It's all about the money.

Gary says, "This 828 KW internal combustion engine with integrated heat recovery provides approximately 30% of the electric requirements for the casino. The project also involved restructuring the electrical infrastructure and adding uninterruptable power supplies for the slot machine busses. This allowed the casino to save significant operating costs on reduced maintenance to the slot machines due to their sensitivity to power interruptions and disturbances."

Sounds like a great place for a site tour—and maybe that poker game with Gary.

One trend in U.S. energy markets that interests Gary is "the changing role of distributed generation in the electric market. The expanded use of onsite generation assets has forced changes on the infrastructure of the grid and how the regulated utilities deal with inside the fence generation. As the quantity of these facilities change and as they decrease in size I am interested to see the changes in regulatory and utility rules. These can make this transition significantly easier or may block the process completely. What the long-term grid looks like should be a concern of all energy users."

Gary's Favorite Fact
"CHP units produced an estimated 341TWh in 2017, or 8.5% of total U.S. generation."

- 2018 Sustainable Energy in America Factbook

Gary brings up a heavy issue—changing utility models are a complicated challenge undergoing debate all around the country right now. But Gary doesn't shy away from complexity. He engineers CHP systems, after all. He sees things simply and breaks down complicated problems to their roots.

"Having over 30 years' experience in the independent power business has allowed me to see great growth but also a lot of reinventing of the wheel. We all need to remember it rolls best when round."

#

See videos explaining UGI Performance Service's approach and projects.
To learn more about CHP and see examples of other projects, visit the websites for the Alliance for Industrial Efficiency and CHP Association.

Taking on the Toughest Solar Projects

Wolfe Energy
DORI WOLFE, Founder
Houston, TX and Strafford, VT
https://www.wolfeenergy.com

In 1793, two men were tapping sugar maple trees on the back hills of Strafford, Vermont when one of them noticed rust in the snow. It turned out to be a copper iron sulfide deposit.

The site would eventually become the Elizabeth Mine, and would produce nearly 50,000 tons of copper before closing in 1958. What was once an economic boon for the area later earned EPA superfund designation, as the abandoned mine generated toxic waste runoff that made its way to local waterways.

Since the fall of 2017, however, the Elizabeth Mine site has been generating something else: 5 MW of electricity, enough to power 1,500 homes in the area. It is the largest solar array in Vermont. This transformation from a stagnant brownfield to a community solar farm would not have been possible without Dori Wolfe.

Dori is a self-described renewable energy and energy efficiency advocate and sustainability proponent. From Vermont to Texas, she, through her company Wolfe Energy, has been a catalyst for change in the communities she has called home. Dori was intimately involved in the planning of the Elizabeth Mine community solar project, relying on her technical background as a mechanical engineer and her connections in the solar industry. Building the project required bringing together regulatory experts, capital partners, and the local utility.

At the September 2017 ribbon cutting ceremony, Wolfe told the crowd gathered, "It takes a whole community, a state, to build a solar field on a Superfund site."

She continued, "This mine over the years has given so much to Strafford and Thetford and the state, and now (it will bring) a new tax base to the communities and state in a clean, renewable way." Indeed, the project is generating more than just electricity, contributing $10,000 to $30,000 annually in tax revenue to Strafford and the

Photo reprinted courtesy of Valley News (Oct. 8, 2017)

neighboring town of Thetford, and $20,000 annually to the state.

Dori now lives in Texas, where she is also working on a similarly complex solar project at a local landfill in Houston.

"I do complicated projects," she laughs.

Dori's home in Houston is a microcosm of the clean energy solutions her firm offers to clients. On top of her roof sits a 9-kW solar system that offsets the vast majority of her family's energy use. She's added LED lightbulbs and insulation throughout the house and low-watering landscaping outdoors, reducing electricity and water demand. Even when the Texas sun is at its strongest in July and August, the family home uses less energy than it produces. Dori's local utility, Green Mountain Energy, credits her account with the energy exported to the grid, bringing down her bills to net-zero on average. Dori enjoys tracking her home's energy production and use, watching the red curve that shows her net electricity use behind the meter.

"It can be addictive—always finding ways to live within our solar production," she says.

In her garage, a wall-mounted battery pack stores energy during the day and discharges it if needed during an outage to power lights and appliances. The solar array also powers the family's fleet of two all-electric vehicles and electric lawn mower. To be truly carbon-neutral, Dori hopes to soon replace her gas hot water heater with high efficiency electric heater. The addition of solar pays for itself in less than a decade, and generates positive cash flow perpetually after that.

Dori's Favorite Fact
"Solar… added almost 74,000 jobs from 2015 to 2016, marking a 25% growth year-on-year and again taking top place out of all electricity generation sectors."
- 2018 Sustainable Energy in America Factbook

Dori's experience in renewable energy runs deep. She and her husband started groSolar in 1998 out of a spare bedroom in their Vermont home. The company grew from an initial base of five residential solar projects in its first year, to serving corporate, government, utility, and other large customers across the Northeast, to having offices across the continent. EDF Renewables purchased groSolar in 2012, and as of 2016, the firm boasted a portfolio of over 2,000 projects representing 150 MW of installed capacity.

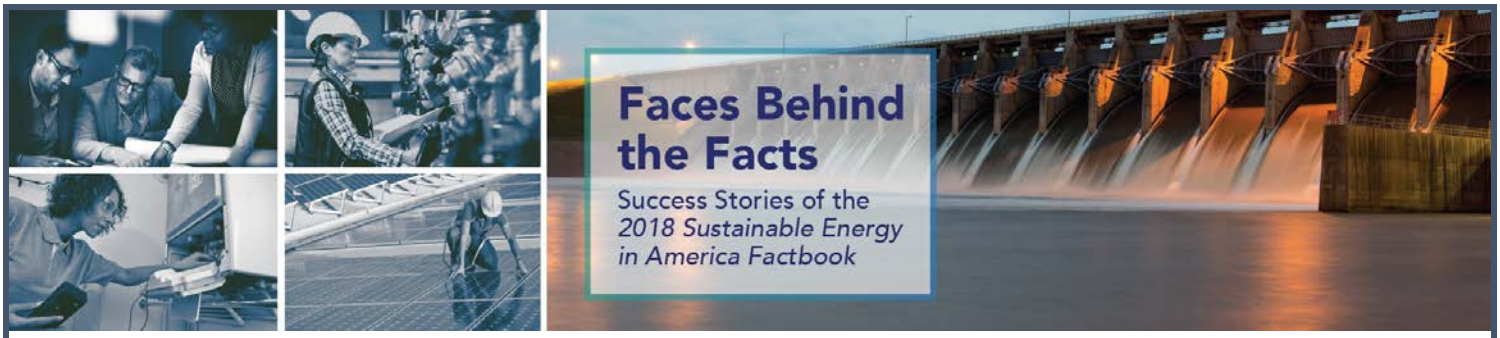
Dori hopes to replicate this kind of success in Texas, where she sees tremendous untapped opportunity to harness the state's ample renewable resources. These days, Dori is occupied not only by managing Wolfe Energy but also by lending her expertise to Solarize Houston, a local non-profit that works to accelerate solar in the area. The grassroots, all volunteer operation works by engaging homeowners in the local community who are interested in going solar, and leveraging bulk purchasing power to negotiate lower rates for solar installation projects.

In 2016 Solarize Houston installed 13 projects in the area representing 100 kW. In 2017 the project hit 200 kW of installed solar capacity across 21 different projects. In 2018 and beyond, Dori is pushing to help install even more solar in her community.

"As Solarize volunteers, we do events at homes and businesses to talk about the opportunity for solar. My dream of having a rotating Solarize program for the surrounding communities is coming true as we are about to launch Solarize Katy this fall," she says.

Barriers to solar deployment in Houston include low electricity prices, a complex distribution market, and customers' lack of familiarity. But if there is any doubt to Dori's ability to execute her vision, you need only look down into the valley below Whitcomb Hill in Vermont, where you'd see 20,000 photovoltaic panels glimmering in the sun.

#



Developing the Business Case for Sustainability

WSP USA
JULIAN GONSALVES, Consultant

Washington, DC with multiple other locations
7,000 employees
www.wsp.com

Working for Habitat for Humanity often gives people a greater appreciation of what they have but, for Julian Gonsalves, it gave him an appreciation for sustainable development. Now, Julian is applying that interest as a team member at WSP USA, a large infrastructure consulting firm headquartered in Washington, D.C.

Julian grew up in Mumbai, a city in west India. He had always been interested in the built environment, so he decided to pursue a bachelor's in civil engineering at the National Institute of Technology Karnataka in Mangalore. Unsure of what his next step would be, Julian took some time to work as a civil engineering associate with Habitat for Humanity, where he participated in the implementation of sustainable housing solutions from a triple bottom line (social, environmental and economic) perspective.

This experience inspired Julian to move halfway around the world to California, where he earned a master's in Sustainable Design and Construction at Stanford University.

"I realized that I wanted to work on developing successful business cases for implementing projects based on sustainable solutions," he says.

After graduating, Julian found the perfect pathway for his interests at WSP USA, which provides engineering and professional services in the energy, water, environment, buildings, and transportation sectors. The firm's team consists of engineers, planners, technical experts, project managers, and strategic advisors, enabling an integrated approach to project management. Julian's role is to provide public-private partnership advisory services and investor due diligence. He helps public and private sector clients make informed procurement and investment decisions and work together on collaborative projects.

"In a way, I'm like a facilitator," he says. "While I focus on the financial and procurement feasibility of projects, given my background in engineering, I am also able to understand the technical aspects."

With Julian's expertise in these areas, he was thrilled about a recent exciting development for WSP USA in 2017. The Maryland Department of Transportation's (MDOT) selected WSP as technical advisor on the Maryland Electric Vehicle Infrastructure Council (EVIC).

The state of Maryland passed a package of bills in 2011 to promote electric vehicle deployment, including legislation establishing the Electric Vehicle Infrastructure Council (EVIC). The EVIC was charged with evaluating incentives for the ownership of EVs and the purchase of EV charging equipment; developing recommendations for a statewide infrastructure plan; and exploring other potential policies to promote the successful integration of EVs into Maryland's communities and transportation systems. WSP has carried out a number of tasks in support of MDOT's EVIC efforts, including: providing staff for meeting support at monthly EVIC and working group meetings; preparing proposal documents on behalf of the state to secure EV infrastructure funding; generating GIS maps of EVs, infrastructure, and demographic information; developing the EVIC's Annual Report; developing operational procedures; coordinating the redevelopment of Maryland's Electric Vehicle website; and conducting public outreach at multiple events across the state.

In addition to the work done in Maryland, WSP USA built on its 2016 technology study for the City of Albuquerque, NY to perform detailed transit facility infrastructure engineering designs in 2017 to support the city's roll out of its first phase of Battery Electric Buses.

Julian's Favorite Fact

"Corporations continued to turn their attention to sustainability in 2017. The "EP100", an initiative launched in 2016 through which companies promise to double their energy efficiency, has gained 13 pledgees. On the renewables front, 119 companies globally had pledged by end-2017 to source 100% of their energy from renewables under the "RE100" initiative."

- 2018 Sustainable Energy in America Factbook

Julian is excited to see an increasing appreciation of sustainability among corporations and the public sector alike, an important trend documented in the *2018 Sustainable Energy in America Factbook*.

"The growing demand for corporate sustainability has only solidified my conviction in a triple bottom line approach to tackling infrastructure challenges," Julian says.

#