

Syracuse: One-Stop Shop for Business Innovation

The Clean Tech Center in Syracuse provides a centralized location, where cleantech startups are exposed to a wide entrepreneurial ecosystem that includes business leadership, economic development and R&D opportunities across New York State and beyond.

By Jodi Ackerman Frank

Inspired by a sister who worked for a humanitarian organization to provide basic needs to poor Mexican communities, Angel Francisco Martinez spent three months as a volunteer in Joaquin Amaro, a coastal village in Mexico.

Martinez, who graduated with his master's degree in civil and environmental engineering at Cornell University in 2010, initially took to the task of teaching the people of the fishermen's village how to install simple rain collectors on rooftops for a potable water source. After the first week of trying to adjust to daily life without electricity and the sea sickness from the constant rocking of the small boats on daily fishing trips, an idea dawned on him.

"I asked myself, 'What if I could reshape a linear magnet generator so that it could take advantage of the motion of the waves in a simple yet steady manner to produce electricity?'" said Martinez. "By the end of the summer, I had a few designs in mind and returned to the United States with the goal of building and testing them out."

In 2011, Martinez met Alessandro A. E. Anzani at the Cornell Venture Technology Forum, a daylong event in which Cornell-based startups have the opportunity to network and showcase their new products and technologies. Anzani is a serial entrepreneur and venture capitalist from Italy who was pursuing his MBA from Cornell University's Johnson Graduate School of Management at the time.

The two partnered to build a company, called WavElectric Inc., around Martinez's invention.

WavElectric has developed a generator by the same name that converts the motion of ocean waves to produce low-cost, sustainable electricity. The WavElectric generator can be sealed in a buoy, scaled to different sizes, and deployed as a single modular system or in arrays. The output can range from a few watts up to several megawatts to cover a number of potential applications, from powering navigational aids and marine monitoring devices to supplying electricity to entire cities.

The same year Martinez and Anzani met, in 2011, their company became a tenant in The Clean Tech Center, one of six business incubators funded by the New York State Energy Research and Development Authority (NYSERDA). The incubators assist emerging clean-energy companies through incubation, acceleration and retention, with the goal of creating new businesses and employment opportunities in the growing cleantech economy.



WavElectric founders Alessandro Anzani and Angel Francisco Martinez pose next to the sign for the Shoals Marine Laboratory, a marine field station on Appledore Island, located offshore between Maine and New Hampshire, where the startup has tested its WavElectric generator that converts the motion of ocean waves into sustainable electricity.

For its part, The Clean Tech Center provides an integrated web of support and infrastructure for early-stage companies developing renewable-energy technologies. These startups receive intensive mentoring to launch next-generation technologies in such markets as solar, wind, biofuels, energy harvesting, transmission and storage, smart buildings and the smart grid.

There are nearly two dozen companies participating in The Clean Tech Center. All told, the Center has provided technical assistance to nearly 150 companies since 2009. The Center works intensely with startups for a year and then conducts follow-up analysis for three years.

"To date, our cleantech companies have raised \$8.1 million in private funding, \$16 million in follow-on grants, and have produced products as a result," said Clean Tech Center Executive Director Seth Mulligan.

Since WavElectric became a tenant at The Clean Tech Center, Martinez, the company's chief technology officer, and Anzani, chief executive officer, have met with venture capitalists and angel investors. Mulligan also introduced them to manufacturers and other mentors.



“Seth has been invaluable in terms of connections. He has always provided incredible feedback and introduced us to the right people at the right time,” Anzani said.

“Right now, it costs thousands of dollars to send service crews just to recharge or change the batteries on offshore monitoring devices,” Anzani said. “Our goal is to manufacture a generator with an automatic charging system that can be mounted on an existing buoy to augment or replace batteries altogether.”

- Alessandro A. E. Anzani

The Clean Tech Center also provided the startup the opportunity to attend the 2012 RenewableUK Conference in Scotland, where Anzani had the chance to network with entrepreneurs and industry representatives from the wind, wave and tidal industries.

“The Clean Tech Center covered the expenses for this conference, and that’s how we got in touch with some major offshore monitoring device producers,” Anzani said. “Scotland is the world’s leader in the development and commercialization of wave and tidal energy, so this was a very important conference for us to attend.”

In 2013, WavElectric Inc. was awarded a Commercialization Assistance Program (CAP) grant of \$50,000. Established by SyracuseCoE in partnership with Empire State Development (ESD) and the CenterState Corporation for Economic Opportunity (CenterState CEO), a 12-county business leadership and economic development organization, the grant program provides funding for scaling up product production.



As a result of the grant, Anzani guided a team of 17 researchers to test WavElectric’s technology in the ocean in conjunction with Shoals Marine Lab, a marine field station on Appledore Island, located offshore between Maine and New Hampshire. The lab is operated and maintained by Cornell and the University of New Hampshire. The total value of the six-month project has been more than \$280,000, mostly sponsored through in-kind contributions by Cornell and Shoals Marine Lab.

A prototype generator was built and tested in ocean depths of between 40 and 70 feet. A supply chain and cost analysis also was completed. WavElectric has received four letters of interest to adopt and/or jointly develop its first product: an onboard generator to power more than 50,000 deployed offshore monitoring devices on platform buoys.

“Right now, it costs thousands of dollars to send service crews just to recharge or change the batteries on offshore monitoring devices,” Anzani said. “Our goal is to manufacture a generator with an automatic charging system that can be mounted on an existing buoy to augment or replace batteries altogether. In addition, sampling and transmitting frequency can be enhanced using our technology as an onboard renewable power source because power is not weakened by a low-battery charge.”

Among its many recognitions, WavElectric Inc.’s technology was named the “2011 Sustainable Technology” by the NASA Tech Briefs, a publication that highlights new, commercially significant technologies.

Broad Network for Startup Support

The Clean Tech Center is managed through The Tech Garden, a 33,000-square-foot technology business incubator in downtown Syracuse. The Tech Garden is home to the suite of programs established by CenterStateCEO, which has more than 2,000 members located along a central-northern corridor of the State that extends from Tompkins to St. Lawrence counties.

What this means is that through The Tech Garden, The Clean Tech Center is supported by a network of collaborators across New York State and beyond that includes academic and industry leaders, angel and venture capital investors, financial institutions, service providers, utilities, industry associations, government agencies, and even health insurance providers.

“What makes The Clean Tech Center unique is that it is not tied to a single research university,” Mulligan said. “Rather, it is able to take advantage of a consortium model. All of these interregional resources and assets help our client startups become successful companies that can continue to grow within the Central New York region.”

This wide-encompassing economic development model from which The Clean Tech Center draws not only regional, but also national and international resources, has proved a successful strategy.

“The Clean Tech Center at Syracuse-based The Tech Garden and the Syracuse Center of Excellence are at the forefront of the green innovation movement.”

- Shawn Lesser

In 2010, only a year after it was established, the Center was recognized as one of the top 10 cleantech cluster organizations in the world by Shawn Lesser, founder of Watershed Capital Group. The international consulting firm advises companies in the pursuit of advancing a sustainable economy.

In Lesser's publication of rankings, titled "Top 10 Cleantech Cluster Organizations" and released by the Cleantech Group in California, The Clean Tech Center ranked second in the U.S., ahead of similar organizations in San Francisco and San Jose, and sixth worldwide.

The Cleantech Group, a market advisory firm focused on green technologies and innovation, defines a cleantech cluster organization as "an economic development organization aimed at growing jobs in a specific geographic region. Among a cleantech cluster's main goals are to promote innovation and investment."

"You've heard of the big apple. The green apple is Central Upstate New York," Lesser said in his summary of rankings. "With 38 colleges and universities, 138,000 college students, \$2 billion in annually funded R&D, and a green landscape that supports clean-energy production, New York's 'green core' is launching and growing cleantech enterprises. The Clean Tech Center at Syracuse-

based The Tech Garden and the Syracuse Center of Excellence are at the forefront of the green innovation movement."

The Clean Tech Center was also selected by Partners for Livable Communities and the Institute for Sustainable Development as the winner of the Green Plus Chamber of the Year in 2010. Partners for Livable Communities, based in Washington, D.C., also featured The Clean Tech Center in its report, The Dollars and Sense of Green Business. The publication explores the innovation and leadership by chambers of commerce from around the country.

"Thanks to the entrepreneurial efforts taking place at The Clean Tech Center and the other NYSERDA incubators, New York continues to lead in providing opportunities that allow start-up clean-energy companies in the State to grow and prosper," said John B. Rhodes, President and CEO, NYSERDA. "NYSERDA's incubator programs continue to support Governor Andrew Cuomo's

Ephesus A Spotlight on Success

Over the last 18 months, Syracuse-based Ephesus Lighting has taken the spotlight in pioneering the brightest and most rugged LED lamps for arenas, stadiums and other commercial and industrial spaces, tapping into a broad market that few cleantech companies have ventured into.

"The reason we're able to make the brightest and most rugged light fixtures that outperform other lighting products is because we have engineers who are capable of developing completely new lighting systems," said Ephesus CEO Amy Casper. "Using the best LEDs on the market, we know how to manage the heat issues more efficiently as well as develop better optics and circuitry."

That's little wonder. Amy, her husband Joe Casper and five other former Lockheed Martin employees, who make up their company's core team and about half of their company's staff, have a plethora of experience in electrical, mechanical and systems engineering.

Ephesus, established in 2010, is a tenant company in The Clean Tech Center, one of six clean-energy business incubators around the State funded by the New York State Energy Research and Development Authority (NYSERDA). The startup plans to expand into a new facility in nearby Baldwinsville.

With support from NYSERDA and other state and business development organizations, Ephesus has developed and sold its lighting systems to arenas and warehouse-size facilities around the country.

Last year, its Visium™ LED luminaire light series was installed on the 65-foot-tall ceiling of the War Memorial Arena, located in the Oncenter conference facility in downtown Syracuse. The 34,500-square-foot arena, which has seating for 7,000, is a popular venue for sporting events, concerts and the like. Not only do the lamps provide better quality lighting, but they will also save Onondaga County more than 85% in annual energy costs.

"This is the first single fixture, 1000-watt equivalent LED light installation in a major sports complex anywhere in the country," said Joe Casper, company president.

Ephesus LED lighting fixtures are built in New York State, using LED chips produced in the United States. The final lighting products are produced by Ansen Corporation, an electronics contract manufacturer in Ogdensburg, N.Y.

The company's first project, under a \$200,000 NYSERDA grant, was for the development of an LED street light. In December 2011, 15 streetlights in Baldwinsville were retrofitted with Ephesus lighting fixtures, which are engineered to last 50 percent longer and glow 20 percent brighter while using 20 percent less power. The fixtures are 20 percent cheaper than similar LED products.

Ephesus Lighting is also developing its own patented LED chip, using gallium nitride on diamond. The technology is moving forward under the company's subsidiary, Ephesus Technologies.

Meanwhile, the company is pushing its current LED fixture products outfitted with patent-pending lens designs into other venue markets. The company was recently awarded a \$300,000 NYSERDA grant to build upon its previous LED streetlight product for a new light fixture for baseball parks and other outdoor stadiums.

"With the support of NYSERDA as well as a host of other R&D and manufacturing resources and partnerships, we've been very successful in developing the brightest, most efficient and most cost-effective LED lighting solutions for commercial and industrial applications that will stand the test of time," Joe Casper said.

efforts to promote the commercialization of promising clean energy and energy-efficient technologies, adding jobs as well as leveraging investment opportunities from the private sector.”

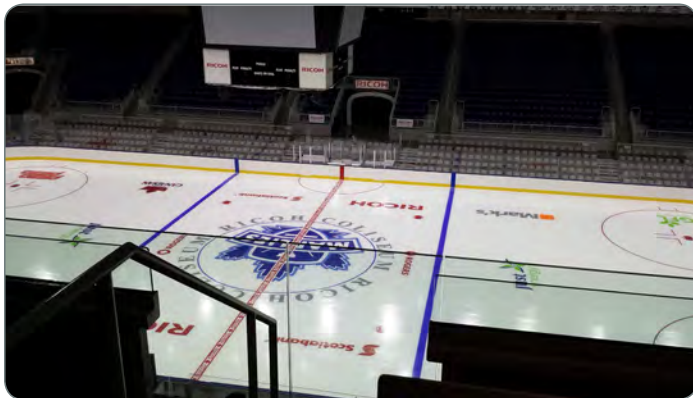
Opening Doors

Few people are more aware than Amy and Joe Casper of all the resources — from R&D institutions to business development opportunities — that the State of New York has to offer.

Four years ago, the Caspers, a husband-and-wife team, were looking for a place to launch their company, Ephesus Lighting. After they were granted office and lab space at The Clean Tech Center, Linda Dickerson Hartsock, former executive director of The Clean Tech Center, became a significant mentor, assisting the company in reaching out to organizations and finding networking opportunities across the State.

“Linda’s guidance and our company being physically located in The Tech Garden were important elements in our growth,” said Ephesus Lighting CEO Amy Casper. “Helping us with connections and the opportunities to meet people who come through The Tech Garden has opened so many doors and allowed us to move forward quicker than we would have been able to do if we were on our own and isolated from this business incubator community.”

“The Clean Tech Center program is performing exactly as we envisioned,” said Hartsock, who now serves as the director of economic development and community engagement at Syracuse University. “A large part of what makes the program successful is that we have built long-term relationships with these companies. We want them to succeed, and The Clean Tech Center uses all the resources and tools at its disposal to help them do just that.”



Ricoh Coliseum after Ephesus Lighting install..

Ephesus Lighting designs and engineers LED lighting products used primarily for commercial and industrial spaces, such as arenas, warehouses, manufacturing facilities, parking lots and stadiums. The company’s first large project was upgrading the lighting at the War Memorial Arena, home of the Syracuse Crunch hockey team and housed in the Oncenter in downtown Syracuse. The LED installation, which replaced the typical metal halide arena fixtures, not only improved the arena’s brightness, but is expected to save Onondaga County more than 85 percent in the arena’s annual energy costs. The \$590,370 project was completed in 2012. (See company sidebar for a more comprehensive profile of Ephesus Lighting.)

Since then, Ephesus’ LED lighting systems have been installed in arenas in New York’s Broome County as well as Chicago, Connecticut, Rhode Island and Toronto. In addition to these arenas, Ephesus has installed lighting systems at numerous other sports and recreation facilities across North America.

SyracuseCoE was one of many connections that Ephesus made through The Clean Tech Center. The company was able to accelerate its market development through the SyracuseCoE–Clean Tech Center’s NYE-RIC Bridge to Markets event in New York City in 2013.

SyracuseCoE is one of six centers of excellence, each stationed at a university and overseen by the Empire State Development’s (ESD) Division of Science, Technology and Innovation (NYSTAR). The centers were established to encourage rapid commercialization of scientific breakthroughs and support high-technology ventures. NYE-RIC, which stands for New York Energy Regional Innovation Cluster, is a consortium of scientists, architects and engineers, industries, small businesses, state agencies, economic development and workforce training experts among others from Upstate and Downstate New York. The consortium’s goal is to accelerate and promote New York State firms that have developed advanced energy-efficient products for buildings.

The Clean Tech Center helped the Caspers prepare a business presentation for the NYE-RIC Bridge to Markets event. After their presentation, the Caspers were encouraged to apply for a \$50,000 CAP grant. In addition to obtaining the grant, Ephesus also received \$1 million in tax incentives from ESD.

Tapping into New York State’s Vast R&D Assets

Even before becoming a Clean Tech Center tenant, the Caspers and their team dug deep into their extensive relationships with multiple universities and research centers throughout the State to jumpstart Ephesus.

The Caspers, who both grew up and married in the Syracuse metropolitan area, worked for a number of high-tech firms in Washington state and Texas before starting WaferTech. The startup, sold to Taiwan Semiconductor Manufacturing Company in 2006, is the largest integrated circuit semiconductor foundry in the United States.

After the sale of WaferTech, the Caspers returned to Syracuse to work for Lockheed Martin. While Amy oversaw logistics and sustainment functions at the Syracuse radar facility, Joe ran Lockheed’s strategic research and development group in which he worked with universities across the State, including Rensselaer Polytechnic Institute (RPI); Clarkson, Cornell and Binghamton universities; and the College of Nanoscale Science and Engineering (CNSE) at the University at Albany.

“When we came back to Syracuse 23 years later, we didn’t expect to find anything new and exciting,” said Joe Casper. “But we were very surprised to see the investment New York State had made to advance new technologies through NYSTAR, the centers of excellence and the university system.”

During that time, he formed various R&D teams to develop an LED chip based on gallium nitride on diamond. The technology, which is more efficient in removing heat, was being tested on amplifiers for radar systems. The new LED chip didn't fit Lockheed's research goals. Still, the Caspers continued to work with the universities to develop the chip. Eventually, they marketed it under Ephesus. The Caspers are still amazed at all the resources at their disposal in developing their technology and building their company.

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- Joe Casper

“The technology was developed at the Lighting Research Center at RPI, the prototype was built and produced at the CNSE, and it was through Clarkson University that we found a manufacturer,” Joe Casper said.

In addition, much of the product testing and packaging was conducted at Binghamton University. The Caspers then turned to Syracuse University and The Clean Tech Center for help in writing a comprehensive business plan.

“We worked with nine lawyers at Syracuse University to help us take our product to market,” Amy Casper said. “We eventually hired two interns from the university's law department to join Ephesus.”

“All of these assets at the universities were instrumental in our launch,” Joe Casper added. “In fact, we currently employ several graduate students from Cornell, Clarkson, RPI and Syracuse.”

It's All Right Here — In New York State

The Clean Tech Center has also attracted out-of-state startups. MicroGen Systems (MicroGen), one of the first startups accepted in The Clean Tech Center, was founded by Robert Andosca in 2007 as a spinoff company out of the University of Vermont (UVM).

MicroGen has developed the BOLT™ Power Chip, a family of renewable-energy devices that harnesses vibrational energy at a certain frequency to produce electricity. The chip, based on piezoelectric microelectromechanical systems (piezo-MEMS), extends battery life in wireless sensor network (WSN) systems. At some point, these devices could eliminate the need for batteries altogether.

MicroGen's micropower generator has been transferred for production at the Germany-based X-FAB Silicon Foundries AG, one of the world's largest MEMS foundries. The overall BOLT micropower electronics module's assembly, packaging and testing will be conducted in New York State.

Andosca, who was born in Boston and grew up in New Hampshire, completed his doctoral degree in materials science at UVM. He relocated to New York State in 2008 to take advantage of Statewide funding opportunities and state-of-the-art research facilities to further develop the energy-harvesting technology.

Andosca initially received a \$619,000 NYSERDA contract, including \$319,000 in matching funds from various sources such as UVM, to conduct further research at the Smart System Technology & Commercialization Center (STC, which was previously called the Infotonics Technology Center) in Canandaigua. This work was also supported by an Army Research Laboratory grant through the STC, which houses 26,000 square feet of cleanroom space and an 8,000-square-foot MEMS and optoelectronic packaging facility.

To refine the technology further, in late 2009, Andosca turned to the Cornell Nanoscale Science & Technology Facility (CNF), with an eye on the facility's large and diverse set of microfabrication equipment in addition to the research expertise of faculty and doctoral students. The CNF, a member of the National Nanotechnology Infrastructure Network, is a facility used by researchers around the country that supports a broad range of nanoscale science and technology projects by providing state-of-the-art resources coupled with expert staff support.

“The hard part is replicating our chips millions of times in a reliable way, and the CNF was a logical choice to figure out exactly how to do that, said Andosca, who noted the BOLT chip is made the same way computer chips typically are fabricated — in silicon wafer form within state-of-the-art cleanrooms on the same or very similar equipment as their counterpart computer chips.

In 2010, MicroGen was admitted into The Clean Tech Center. The same year, the company placed second in the Rochester Regional Business Plan contest, winning cash, services and office space at High Tech Rochester.

Over the next couple of years, as the company developed a close working relationship with The Clean Tech Center, it earned a number of recognitions and additional grants. At the end of 2011, MicroGen won a NYSERDA technology commercialization contract worth \$1.2 million in which the company received \$700,000 from NYSERDA. The company's \$500,000 cost-share came from other sources, including angel investors in New York State.

In 2012, MicroGen was awarded \$200,000 as the grand prize winner of CenterState CEO's Center Core Emerging Business Competition. The company also was included on the 2012 Silicon 60 list, published by EE Times, which recognizes the top 60 emerging technology startups to watch worldwide.

MicroGen, with corporate offices at High Tech Rochester and an office at The Clean Tech Center, also took part in NYSERDA's Entrepreneur-In-Residence Program. The NEIR Program provides a broad range of high-level strategic advice and assistance to early-stage companies through a network of participating entrepreneurs in residence.

Growing Cleantech Companies

Seth Mulligan knows what it's like to be an entrepreneur with an emerging clean-energy technology. In 2008, he formed GoVo Biofuels, which converted used frying oil from restaurants into heating oil and diesel fuel. GoVo Biofuels was a client in The Clean Tech Center before Mulligan assumed his current role in 2012. Mulligan scaled down company operations last year. His focus as executive director of The Clean Tech Center and as director of Venture Development for CenterState CEO is to show startups the real deal about starting a business and to help entrepreneurs grow their companies.

"If I could give some kudos to Seth Mulligan, he's been great for us. He has been a stalwart advocate for our startup," said Steve McMahon, founder and CEO of Cortland Research. "He has introduced us to other established businesses, which has allowed us to learn from them and possibly work with them. He's also reviewed my business plan many, many times."

Cortland Research, an engineering firm in Homer, N.Y., has developed the Point of Use Network Controlled Electrical (POUNCE®) System, which controls and monitors energy use in real time through wall switches and outlets. The system features smart outlets and switches, each one containing a radio with an integrated antenna, on/off control and microsensors for temperature, occupancy, and power.

POUNCE® includes a system-control unit, which is a web server and database that integrates and communicates with POUNCE® switches and outlets. The control unit accesses, measures, analyzes and reports energy efficiency data in a variety of formats (charts and graphs, for example) to residential, commercial and industrial consumers, allowing end users to compare energy consumption and efficiency in relation to the occupancy of their building spaces.

"Our system takes the guess-work out of energy analysis," said McMahon, whose company is an energy solutions partner with National Grid.

"Cortland is a great company," Mulligan said. "We have supported the startup for a solid two years in finding manufacturers, refining its business plan, as well as securing sales opportunities."

Cortland Research works with three manufacturers to produce the POUNCE® system. The company has installed two systems at the BOCES administrative campus in Syracuse as well as at the Furnace Brook Retreat Center at Onondaga Community College (OCC). Cortland employees have served as guest lecturers at OCC, teaching technology students how to install and configure the POUNCE system as a way to learn about energy conservation.

The company consists of seven staff members, including McMahon. "We intend to hire as many people as we can. We want to grow, and we want to give back to the community," he said. "That's why it is important for us to keep the manufacturing in the U.S., and in New York State in particular."



Showcased here is the POUNCE® system, developed by Cortland Research. The system includes a control unit, which is a web server and database that integrates and communicates with POUNCE® switches and outlets.

NYSERDA Business Development Efforts

Visit nyserdera.ny.gov/Business-Development to learn about how New York State and NYSERDA are helping inventors, innovators, and investors bring clean energy technology to market. To receive Clean Energy technology information from NYSERDA, sign up for our Clean Energy ListServ. nyserdera.ny.gov/clean-energy-listserv

