

Clean Energy & Technology in the State University System

August 2021

Executive Summary

Clean energy and the development of underlying technologies enabling breakthroughs in the field are essential to Florida's growing role as a leading clean technology hub. According to Enterprise Florida, more than 11,750 cleantech companies are based in Florida and specialize in various parts of the cleantech industry, including solar energy, bioplastics, and bioremediation. Florida boasts a myriad of competitive advantages for companies in the cleantech field, such as its strategic location and abundant natural resources. In 2019, the state ranked second for the highest number of solar jobs in the U.S. and ranked third in total clean energy employment. There is an irrefutable link between sustainability and long-term economic prosperity, and Floridians understand that synergy. The State University System's (SUS) degree productivity in clean energy and technology has been growing in recent years. System-wide, the number of graduates with the potential to contribute in this arena has increased by 29% over the last five years, with a significant 40% growth at the undergraduate level.

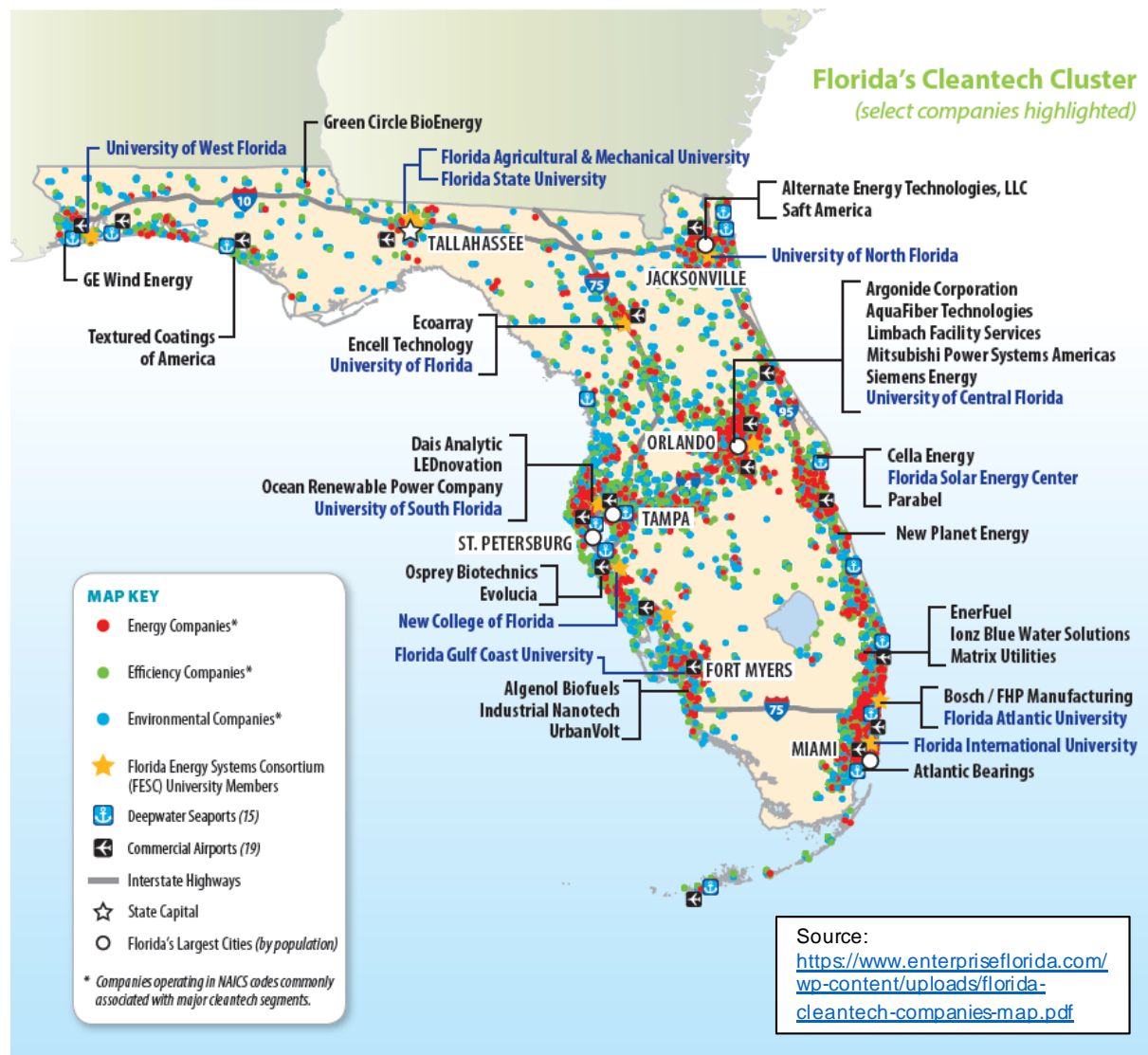
Degree programs that feed into the clean energy and technology sector are offered at all twelve SUS institutions. These include options such as environmental science, biosystems engineering, sustainability studies, a plethora of other scientific and engineering programs, and more. The SUS produced over 16,000 graduates in 2019-20 with the potential to gain employment in the clean energy and technology industry. This total included over 350 environmental science majors and nearly 4,000 civil, electrical, and mechanical engineering majors. For further and more detailed data, please reference the supplemental document titled "Degrees Awarded in Academic Programs Potentially Leading to Careers in the Clean Energy & Technology Industry." The supplemental document contains detailed graduate counts by program, institution, and degree level.

Florida public universities have been recognized by rankings organizations for excellence in clean energy and technology academic programs. For example, U.S. News & World Report recognized the University of Central Florida as being ranked #65 among public institutions for its environmental engineering program. UCF was also recognized for offering affordable engineering programs, both traditional and online. U.S. News recognized the University of South Florida as having a top 50 graduate program in industrial engineering and the #34 best online master's program for engineering management. More detailed rankings information can be found in the document titled "Institutional Responses Regarding Clean Energy & Technology Activity in the State University System."

Additionally, Florida universities have centers throughout the state that focus on the clean energy and technology field. For example, FIU operates the Energy, Power, and

Sustainability Group, which conducts projects funded by entities such as the National Science Foundation and is a top destination for clean energy research, education, and workforce training. Additional centers include the Southeast National Marine Renewable Energy Center at FAU, the Center of Advanced Power Systems at FSU, the Florida Solar Energy Center at UCF, and the Clean Energy Research Center at USF. These types of centers provide research opportunities for faculty and students, as well as workforce training for students.

Finally, Florida institutions partner with a vast array of native companies to research, develop, and test various clean energy technologies to provide sustainable solutions and education, training, and internship opportunities for Florida students. Thousands of leading energy companies operate in Florida, such as Duke Energy, Florida Power and Light, and General Electric. See below for a map from Enterprise Florida showing Florida's cleantech cluster with the relative locations of select companies to SUS institutions.



The following is a sampling of the numerous Clean Energy and Technology highlights provided by SUS institutions. For more detailed information, please refer to the document titled "Institutional Responses Regarding Clean Energy & Technology Activity in the State University System."

Florida Agricultural & Mechanical University

- Faculty in the FAMU-FSU College of Engineering are engaged in clean energy and technology projects across multiple program areas, including Chemical and Biomedical Engineering, Electrical Engineering, and Mechanical Engineering. Projects include battery technology and compact high-power inverters for medium-scale solar power production.
- Chemical Engineering faculty are investigating new catalysts for the production of hydrogen from water and biomass.
- The College of Science and Technology is currently working with the Lawrence Livermore National Laboratory, which focuses on the use of technology to strengthen national security, on research to increase energy production using machine learning and artificial intelligence. The research team includes four graduate students and one post-doctoral fellow who are currently in residence at the Lawrence Livermore National Laboratory.

Florida Atlantic University

- FAU houses the Southeast National Marine Renewable Energy Center (SNMREC), which focuses on ocean current energy development. The SNMREC has invested in more than 150 graduate and undergraduate research projects and partners with industries, academia, and national laboratories to conduct research in the field of clean energy and technology. The Center is currently working with municipalities and electric utilities to foster a cleantech cluster in southeast Florida.
- FAU offers an undergraduate program in Environmental Engineering, a master's program in Civil Engineering, and a Ph.D. program in Transportation and Environmental Engineering. Students can also earn a newly created Energy Resilience Certificate, which allows senior undergraduate and graduate students to further their study of technologies and tools of power and energy, energy resiliency, and renewable power generation.
- U.S. News & World Report
 - #98 Best Graduate School Engineering Specialty – Environmental Health Engineering

Florida Gulf Coast University

- The Florida Gulf Coast University campus includes hundreds of acres of conserved upland and wetland ecosystems, LEED-certified buildings, a solar energy grid, native plant landscaping, and other visible elements of its commitment to clean energy and sustainability.
- FGCU's Whitaker College of Engineering has two academic programs focused on clean energy and technology, including a bachelor's degree in environmental engineering and a master's degree in engineering with concentrations in sustainable water and renewable energy. The master's program offers concentrations in Sustainable Water and Renewable Energy.
- FGCU is home to the [Water School](#), which has programs in marine sciences, environmental sciences, and related majors and produces graduates with training in water quality, stormwater remediation, coastal ecosystem conservation, limnology, and other disciplines relevant to clean energy and technology.

Florida International University

- FIU has identified Environmental Resilience as a program of distinction under the Board of Governors Universities of Distinction initiative. FIU faculty are engaged in a variety of research initiatives aimed at developing energy solutions. These research activities have resulted in the development of curricular offerings to students in areas such as energy cyber security, climate change, and energy efficient and safe transportation.
- FIU provides multiple opportunities for graduate students to engage in clean energy and technology research projects. For example, the new Energy Cyber Security degree program allows graduate students to participate in research and partnerships with private sector and federal research entities.
- FIU houses the Energy, Power, and Sustainability Group, which conducts projects funded by entities such as the National Science Foundation, and is a top destination for clean energy research, education, and workforce training. Over 50 engineering students have been hired by Florida Power and Light/Next Era Energy, as well as national labs, federal agencies, and other leading institutions.
- A team of FIU researchers in the College of Engineering and Computing are developing a new battery that will result in doubling the range of electric vehicles.

Florida Polytechnic University

- Florida Poly offers multiple undergraduate degree programs with clean energy and technology curricula embedded to provide students with opportunities to study the field more in-depth with specific coursework or concentration options. These programs include Electrical Engineering, Computer Engineering, Mechanical Engineering, Cybersecurity Engineering, Engineering in Physics, and Environmental Engineering.
- Florida Poly's year-long senior capstone design sequence provides students of all majors opportunities to collaborate on industry-sponsored projects. For the 2020-21 school year, students partnered with Duke Energy on a project which included work on solar energy collection and distribution and refined electric grid technology capable of sustaining commercial and residential electric vehicle charging stations.
- Florida Poly partners with clean energy companies, such as CED Greentech and Duke Energy to provide internship and career opportunities to students.

Florida State University

- FSU's Environmental Science Program and FAMU-FSU's Environmental and Civil Engineering Programs partner with multiple solid waste energy corporations to solve problems on a variety of clean energy issues, such as quantifying methane emissions and methane oxidation, increasing the use of climate change data to support Florida's decision making in water resource management, and locating oil seepage.
- FSU is developing an interdisciplinary program to assess the resource potential of rare earth elements (used in advanced electronics, electric vehicle motors, wind turbines, etc.) in Florida. This effort will result in FSU students in Environmental Sciences being trained in a nexus of government-industry-academia to become leaders in restoring Florida's environment, while securing an indigenous supply of rare earth elements for a forthcoming boom in renewable energy and electric vehicles.
- Researchers received more than \$250 million in grants from federal, state, and private resources in 2020 including \$20 million for projects at the Center of Advanced Power Systems (CAPS), an electrical engineering research center; \$14.6 million of which was from the U.S. Navy's Office of Naval Research for the Electric Ship Research and Development Consortium.
- U.S. News & World Report - FAMU-FSU College of Engineering
 - #98 Engineering Graduate Schools
 - #69 Doctoral-granting Engineering institutions

New College of Florida

- NCF boasts a student-developed patent-pending invention in the area of clean energy transportation that was one of only ten projects chosen to receive an OZY Genius Award.

University of Central Florida

- UCF administers the Florida Solar Energy Center which serves as a partner in energy research that benefits the state. This statewide research center allows personnel throughout the SUS to participate in research and development activities. The Center promotes engagement from K-12 STEAM students and teachers via forums and professional development, which serves as a bridge between the K-12 system and post-secondary education. The Center also partners with local, national, and international entities involved in clean energy.
- UCF offers a newly developed Smart Cities master's program, the first engineering degree of its kind in the nation. The program prepares students on emerging technologies in urban settings to address issues such as transportation, water availability, and sustainability.
- Clean energy and technology related curriculum and research are embedded in major degree programs throughout the university, including Chemistry; Civil, Environmental, and Construction Engineering; Electrical and Computer Engineering, Interdisciplinary Studies; Materials Sciences and Engineering; Mechanical and Aerospace Engineering; Optics and Photonics; Physics, and Public Administration.
- U.S. News & World Report
 - #65 Best Environmental Engineering Program

University of Florida

- Over 100 UF faculty members are engaged in research ranging from energy efficiency, power generation, distribution, security to nuclear energy.
- UF administers the [Florida Energy Systems Consortium](#), which promotes collaboration among energy experts at state university system institutions and performs research and development on innovative energy systems leading to alternative energy strategies, improved energy efficiencies, and expanded economic development for the state.
- UF has multiple centers and programs focused on integrating energy efficient technologies into building construction and manufacturing. These include the following.
 - The [Industrial Assessment Center](#) assesses energy, productivity, and waste of small- to medium-sized industries.
 - The [Powell Center for Construction and Environment](#) fosters sustainability principals into the creation of the built environment internationally.
 - The [Program for Resource Efficient Communities](#) applies UF's educational and analytical assets towards the adoption of best design, construction, and management practices that reduce energy and water consumption and environmental degradation in new residential communities.
- UF houses multiple centers to study diversified power source and delivery, including biomass/algae energy technologies, solar energy, solar fuel/hydrogen, and nuclear energy. Faculty at these centers have received millions of dollars in research grants from a variety of partners. Research and education opportunities for students at these centers include the following.
 - The UF Energy Research and Education Park developed a module for contemporary materials challenges to increase the social literacy of engineers and technical literacy of non-engineers. The course materials are available for free to other universities. The Park also provides the Energy Sustainability, Technology, and Resiliency Testing Hub and Certificate Program to provide training and research opportunities in advanced energy generation, storage, and grid resiliency technologies.
 - The Nuclear Training Reactor is one of the 25 reactors used for education, training, research, and testing in the U.S., which provides training to students in nuclear and environmental engineering, chemistry, physics, and geology.

University of North Florida

- UNF faculty in the School of Engineering are actively engaged in clean energy research and development, including power systems and smart grid controls, sensing, and energy management; advanced simulation and testing for improving roadway infrastructure. Research in tidal and wave energy conversion systems has resulted in multiple patents.
- UNF coastal engineering faculty and students created a spinoff start-up company, Sea's the Future LLC, that is actively commercializing ocean energy harvesting systems. The company was a finalist for the 2019 Cade Prize, which rewards inventors and entrepreneurs who demonstrate a creative approach to addressing problems in their field of expertise resulting in an innovative invention.
- For two years in a row, UNF undergraduate students participated in the U.S. Department of Energy's "Marine Energy Collegiate Competition: Powering the Blue Economy." In 2020, the UNF team was recognized with the MacGyver Award for exceptional innovation and creativity.

University of South Florida

- USF offers various programs through their College of Engineering, College of Marine Science, and Patel College of Global Sustainability to prepare students to address clean energy challenges. These colleges partner to deliver a Master of Science degree program with a concentration in sustainable energy that contributes to workforce development.
- The Clean Energy Research Center is recognized globally as one of the top ten energy researchers by the Global Energy Association. In addition to conducting scientific research, the Center supports regional economic development and serves as a source of information for new and environmentally clean energy systems, such as solar energy. Faculty and staff of the Center have led ten technology start-ups, resulting in jobs, investments, and positive economic impact.
- A new undergraduate program in Environmental Engineering allows students to work with faculty that have expertise in studying different clean energy approaches and energy requirements to provide safe water as well as storm and wastewater management.
- The Industrial and Management Systems Department partners with industry, such as TECO and Duke Energy, to prepare students in the field of clean energy technologies through courses, certificate programs, and graduate research.
- U.S. News & World Report
 - Among the top 50 graduate programs in Industrial Engineering
 - #34 Best Online Master's program (Master of Science in Engineering Management)

University of West Florida

- The UWF Mechanical Engineering Department is sponsoring a solar car project team that plans to compete in the 2022 American Solar Challenge.
- UWF maintains industry partnerships with entities focused on clean energy and technology. These include the following.
 - The Construction Management program's partnership with NASA in conducting research that evaluates used plastics and other types of curbside recycling materials to produce construction materials that can be used instead of concrete.
 - The Earth and Environmental Sciences program's partnership with the Pensacola and Perdido Bay Estuary Program and the North Port St. Joe Project Area Coalition.
 - The Electrical and Computer Engineering program's partnership with General Electric focused on a wind turbine hub platform.