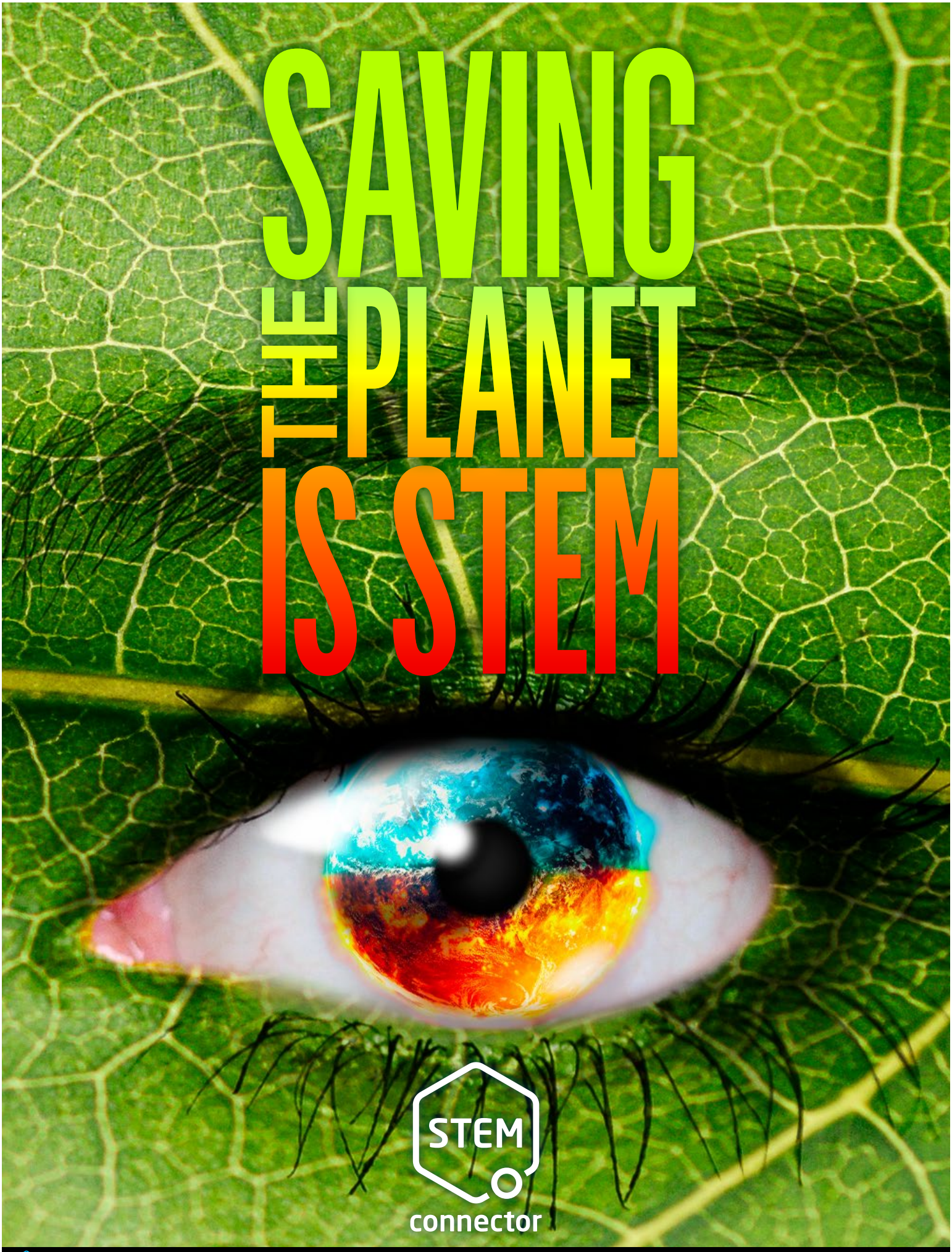
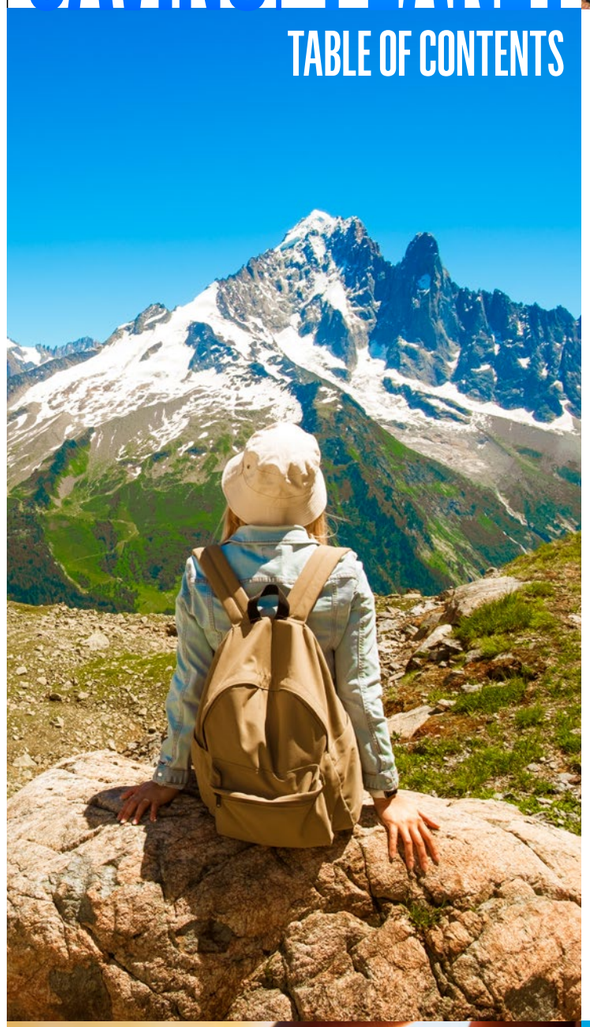
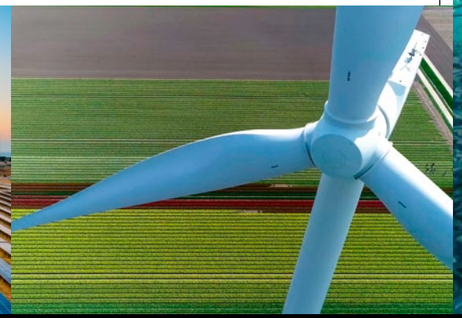


STEM connector

SAVING THE PLANET IS STEM

TABLE OF CONTENTS





THE GLOBAL STEM IMPERATIVE

> “You cannot get through a single day without having an impact on the world around you. What you do makes a difference, and you have to decide what kind of a difference you want to make.”
>
> *—Jane Goodall*

Science, Technology, Engineering and Math (STEM). The future of our planet depends on it. For saving lives and saving ecosystems. For feeding the world and addressing climate change. And yet, the shortage of STEM talent needed to address these issues is profound. How will the next generation rise to face the world’s challenges if not through STEM?

In this ebook we explore the future through the lens of STEM. The global challenges in need of attention, opportunities for innovation and the STEM pathways to making the world a better place. We created this ebook to expose, engage and inspire the next generation of STEM talent to consider the pathways and opportunities that will truly make a difference in the world. Because pathways to STEM education and careers are available to all people, and saving the planet is the responsibility of the human race.

The world needs STEM, and STEM needs you.

CLIMATE CHANGE
THE PLANET'S VITAL SIGNS

Earth's climate has changed over time but in the past, these changes were due to a change in earth's orbit and the amount of solar energy the earth receives. Current global warming is attributed to human activities that create greenhouse gas. Scientists are more than 95% certain that nearly all global warming is caused by increasing concentrations of greenhouse gases (GHGs) and other human-caused emissions.

GREENHOUSE GASES

A greenhouse gas is a gas that absorbs and emits radiant energy within the thermal infrared range, causing the greenhouse effect. The primary greenhouse gases in Earth's atmosphere are water vapor, carbon dioxide, methane, nitrous oxide, and ozone. The greenhouse effect is the process by which radiation from a planet's atmosphere warms the planet's surface to a temperature above what it would be without this atmosphere. Atmospheric carbon from fossil fuel burning is the main human-caused factor in escalating global warming.

WHAT CAN WE DO TO SAVE THE PLANET?

Reducing our carbon footprint is a critical step in restoring our planet. From the energy we use in our homes, to the transportation we utilize, to the food we eat - everything we do affects the amount of greenhouse gases that are emitted into the atmosphere. And we can control it.

It's going to take creative STEM minds and innovation to put our planet on a sustainable path. Many of the world's top companies have already embraced this challenge and are taking climate action. Take Google for example. Google has achieved carbon neutral status and aims to be carbon free by the year 2030. There are also companies dedicated to revolutionizing the way we build, process, distribute, reuse and recycle materials. A company in the Netherlands is making shoes out of used gum. Another is repurposing old cell phones to save the rainforest.

Whether it's seeking out renewable energy sources, restoring ecosystems to their natural state, or discovering new ways to live more sustainably, we're all part of a much larger, global initiative to take care of our planet. Read on to learn more about the fundamental challenges our planet faces, the companies, colleges and careers that are paving pathways for change.

> "Climate change requires integrated, systemic solutions that marry science, technology, economics, social science, and governance. Innovation comes from working across these areas."

STEM SPOTLIGHT

Louise Bedsworth

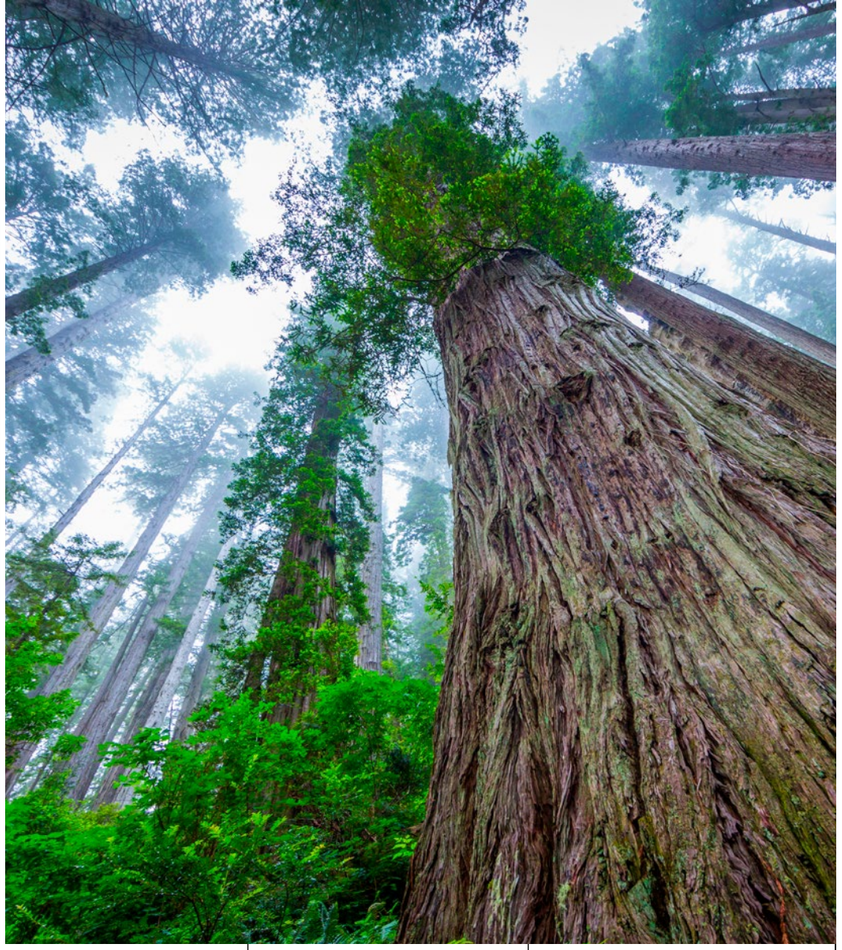
Land Use Program Director Center for Law, Energy, and the Environment at UC Berkeley School of Law

There are many pathways to STEM and saving the planet. Louise Bedsworth is proof a STEM education can lead to surprising and impactful places. Land Use Program Director at the Center for Law, Energy, and the Environment at UC Berkeley School of Law, Louise's story exemplifies the diverse and powerful applications of STEM toward saving the planet. She has spent her career working at the interface of science and policy in California to develop and implement programs and policies to address climate change.

Bedsworth has an undergraduate degree in Earth, Atmospheric, and Planetary Sciences from MIT. While at MIT, she took courses in Science, Technology, and Society and Urban Planning that provided insight into the important role that science and technology have in communities and in people's everyday lives. With that interest in mind, she pursued graduate degrees in Environmental Engineering (MS) and Energy and Resources (PhD) from UC Berkeley.

Over the course of her education and career, Bedsworth has worked in climate change research, advocacy, and, most recently, spent ten years working in leadership roles in the Offices of California Governors Brown and Newsom.

Bedsworth has had different roles over the course of her career, but each is an important piece of how we are working to save the planet. First, as an advocate, she worked to build support for aggressive climate change policies and greenhouse gas emission reduction targets in California. Then as a researcher, she has done the analysis and work needed to inform policy decisions and fill gaps in our knowledge. Finally, working in State service, she helped to design and implement programs to reduce greenhouse gas emissions and build resilience in the face of climate change.



When we asked Louise about the importance of STEM and the future of the planet, here's what she had to say:

SC What makes you the most excited when you think about the future of STEM?

LB Over the course of my work, I have learned three important lessons when it comes to addressing climate change:

- Climate change requires integrated, systemic solutions that marry science, technology, economics, social science, and governance. Innovation comes from working across these areas.
- Climate solutions require closer connections between science, research, and social systems and networks to ensure that we develop solutions that will work for all people, communities, and nature.
- Climate solutions must fully address systemic inequity, integrate local knowledge and experience, and the contexts in which they will be implemented. All communities are at a different starting point, many due to systemic racism, injustice, and disinvestment and we must acknowledge and remedy this as we address climate change.

SC What advice would you give to someone interested in pursuing your career?

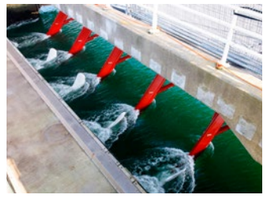
LB First, follow your passion and interests. For me, this led to connections, relationships, and opportunities that I never would have predicted. These have led to an incredibly fulfilling and exciting career that keeps me engaged every day. Second, be a lifelong learner. Do not be scared or intimidated by new things but dig in and embrace new topics and ideas. This continual learning opens doors and helps you stay creative and innovative - two traits we need in everyone tackling complex global issues!

POWER TO THE PLANET

Renewable energy sources or "clean" energy sources, come from natural sources that are constantly replenished, like water, wind and sun. Renewable energy is needed to replace "dirty" fossil fuels like oil, gas and coal that produce carbon that contribute to greenhouse gas.

HYDROELECTRIC POWER

Hydro energy uses the power of water in motion to generate electricity. To harness this power, a dam or barrier can be built in a body of water creating a reservoir. When the water is allowed to flow out of the reservoir, it drives a turbine and power is generated. Because the water can be stored in reservoirs and the flow of water leaving the reservoirs can be throttled, hydro power is one of the most reliable forms of renewable energy because energy can be stored for when it is needed.



TIDAL ENERGY

Tidal energy is a form of hydro energy that harnesses the power of the ocean's surging tide as it rises and falls, to generate electricity with underwater turbines. The tidal force of a rising and falling tide is not constant, however it is relatively predictable making this form of energy production efficient and reliable. The job outlook for tidal energy into the future looks very positive as scientists continue to uncover new coastal territories where tidal energy can flourish.

WIND ENERGY

Wind energy is harnessed using giant propellers called turbines that spin as the wind pushes against their blades causing them to rotate. The rotating motion of the turbine drives a generator converting the wind into usable electricity. With turbine placement and quantity being vital to the success of wind energy efforts, a large quantity of turbines will be placed together in "wind farms" to keep up with demand.

GOOGLE First major company to be carbon neutral. First company to achieve 100% renewable energy. First major company to operate carbon free by 2030.

SOLAR ENERGY

The future looks bright for solar energy. In one hour, the amount of solar energy that reaches the earth's surface is enough to meet the global population's total energy demands for an entire year. Solar panels use an inverter to convert solar energy, caught by the panels, into usable energy, consumers can use. Solar energy is vital for creating a sustainable renewable energy future.

GEOTHERMAL ENERGY

As heat travels to the surface in the form of water or steam, it can be harnessed to generate clean electricity. The United States is the leading producer of geothermal energy and generates around 16.7 billion kilowatt hours (kWh) annually with some of the country's biggest companies pitching in to keep innovation moving forward.

THE FUTURE GETS BRIGHTER WITH RENEWABLE ENERGY

TESLA is an electric vehicle and clean energy company. Tesla's current products include electric cars, battery energy storage from home to grid-scale, solar panels and solar roof tiles.

The Center for Energy Workforce Development (CEWD) is a non-profit group of energy companies, contractors, associations, unions, educators, and business partners working together to ensure there is enough skilled, diverse workforce talent to meet future industry needs.

CEWD is at the forefront of forecasting the demand for workers, communicating the skills and knowledge for current and future workers, and partnering with educators across the country to create scalable career pathways for energy jobs.

CEWD CENTER FOR ENERGY WORKFORCE DEVELOPMENT

STEMconnector talked with the Center for Energy Workforce Development, and this is what they had to say about the importance of STEM in the energy industry and the global impact of developing new energy resources.

Q How important is STEM to the energy industry?

A More than 6 million people work in innovative, rewarding, and dynamic energy careers. Not only do these careers offer opportunities to make a difference in the world around you, but they give students a chance to put their STEM skills to good use. Energy analysts use trends in data from consumers' energy use to predict how much energy we will need in the short-term and long-term future. Technicians solve problems, such as those from power outages, by analyzing the data presented to them by their tools, and then following a logical progression to identify issues and use the more effective method to fix them. Meter technicians take careful measurements from devices that measure every aspect of the power grid. They then collect, analyze, and respond to the data to ensure that every aspect of the grid is working effectively. Industry engineers and innovative technicians continue to explore new ways to harness power.

Q How can the energy industry help save the planet?

A The energy industry is critical to the transition to a clean energy economy by promoting the responsible development of renewable energy. In the past the focus on renewable energy has been on solar and wind. Supportive federal actions will progress timelines for further expansion and new technologies, including advanced batteries, offshore wind, and green hydrogen technology. As these new technologies, especially green hydrogen production and storage, move toward commercialization, we may see more power-to-x projects to store, convert, and reconvert surplus solar and wind power into carbon-neutral fuels and chemicals.

Q What is power-to-X?

A Power-to-X describes a method for converting electrical energy into liquid or gaseous chemical energy sources through electrolysis and further synthesis processes. Through this CO_2 emission free process, Hydrogen can be easily stored for future use, allowing surplus electric power to be used for other things like transportation.

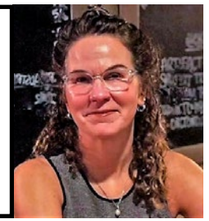
GLOBAL ESTIMATE

7.7

MILLION JOBS IN RENEWABLE ENERGY

International Renewable Energy Agency, 2015

> "The energy industry needs students who know how to solve real-world math and science problems, who understand how things work, are critical thinkers, and who can use technology to communicate and perform their jobs efficiently.
>
> *—Julie Strzempko, Education Consultant, CEWD*



COMPANY SPOTLIGHT

ALLIANT ENERGY

Alliant Energy is the third largest utility owner-operator of regulated wind in the United States. They rely on STEM-related expertise every day as they pursue innovations in wind, solar energy and energy storage. Through its utility subsidiaries Interstate Power and Light Company and Wisconsin Power and Light Company, Alliant Energy provides electric and natural gas service to approximately 975,000 electric and 420,000 natural gas customers in the Midwest. These vital services would not be possible without the work of STEM-educated specialists, who are uniquely suited to maintain and innovate the energy generation and distribution systems. Alliant Energy's STEM-trained workforce support the communities they serve by pursuing emerging technologies and safe, sustainable methods of energy production.

INVESTING IN THE NEXT GENERATION OF STEM

Growing and maintaining a STEM talent workforce is critical to Alliant Energy to achieve net-zero carbon dioxide (CO2) emissions from the electricity generated by 2050 and eliminate all coal from their generation fleet by 2040. Hiring STEM-trained talent in engineering, technology, HR, marketing, customer support, accounting and generation careers ensures they are putting the best minds to work to achieve these goals.

CLEAN ENERGY BLUEPRINT

Alliant Energy's Clean Energy Blueprint is a roadmap to accelerate a transition to renewable energy – something that has become especially important to sustain the economic and environmental health of the communities they serve in Wisconsin and Iowa. By 2023, nearly 50 percent of Alliant Energy's Iowa generation portfolio will be from renewables.

ADVANCING WOMEN IN STEM

Alliant Energy's Foundation and Community Affairs team partner with and support STEM programs across Iowa and Wisconsin to increase the availability of STEM opportunities available to underrepresented female students.

EARTH SCIENCE WOMEN'S NETWORK'S ANNUAL SCIENCE-A-THON.

Alliant Energy is a sponsor of the Earth Science Women's Network's annual Science-A-Thon. The goal of Science-A-Thon is to increase visibility of science and the important role it plays in the world. Anyone who advances scientific knowledge or applies science to solve problems is welcome to participate – from mathematicians and engineers to doctors and industry researchers and developers.

10%

OF ENERGY IN THE U.S. IS SOLAR OR WIND POWERED

> "We are putting the best minds at work to help us think critically and overcome barriers to our goal of achieving net-zero carbon dioxide (CO2) emissions from the electricity we generate by 2050 and to eliminate all coal from our generation fleet by 2040 – 10 years faster than previously planned."
>
> *—Alliant Energy*

STEM SPOTLIGHT

Sarah Martz

Manager of Distribution Engineering, Alliant Energy Cedar Rapids, Iowa

Q Can you tell us about your role at Alliant Energy?

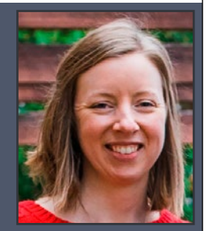
A As the Manager of Distribution Engineering, I manage a team of engineers who handle distribution system improvements, maintenance issues and questions. My team also actively identifies opportunities to improve performance of the distribution system each year. The work engineers are doing to advance renewable energy is exciting. There are a lot of complicated questions that still need to be answered and I really enjoy having the opportunity to dig in and be a part of the solution.

Q What was your pathway to Alliant Energy?

A I was interested in energy in high school and have followed that path throughout my education and career. I attended Iowa State University and pursued a degree in mechanical engineering. I had the opportunity to intern for three energy-related companies: General Electric, Caterpillar and Alliant Energy. After graduation, I went on to get a master's degree in mechanical engineering with a focus on advanced energy generation systems, including fuel cells, combined heat and power systems, and hydrogen power. I joined Alliant Energy as a thermal performance engineer which focuses on energy generation and worked my way over to energy delivery in my current role.

Q What advice would you give to someone interested in pursuing a career in energy?

A Take courses you are passionate about and pursue as many internships and real-life learning opportunities as possible. Internships allow you to ask questions and be curious and those experiences can lead you down a path you might not have been aware of otherwise.



> "There are many technical barriers to getting to zero carbon emissions and fully renewable, but the exciting thing about my role is solving those issues, such as how to maintain a reliable grid while making the transition to renewable energy"
>
> ***—Sarah Martz,***
>
> *Manager of Distribution Engineering, Alliant Energy*

REGENERATION

SOIL & PLANTS

STEM resources are needed to renew and restore our natural resources, habitats and ecosystems. Restoration of the earth's degraded landscapes which include forests, agriculture, rangelands, wetlands, oceans, and coastal areas is a proven solution to slow global warming and combat climate change.

SOIL DEGRADATION

Industrial agriculture contributes to greenhouse gas, degrades soil, and reduces the soil's natural ability to absorb atmospheric carbon and convert it to soil carbon. Many modern farming methods poison, expose, and exhaust the soil, depleting its ability to balance the atmosphere.

DEFORESTATION

Forests cover about 30% of the planet. The ecosystems forests support are essential for life on earth. At the current rate of deforestation, it is estimated the earth's rainforests will completely disappear in about 100 years. Deforestation contributes to 17% of the earth's greenhouse gas emissions. When trees are cut, they release the carbon inside of them. Conversely, when trees are alive, they play a critical role in absorbing greenhouse gas emissions.

> "Look deep into nature & you will understand everything better"
>
> *— Albert Einstein*

REFORESTATION

Reforestation helps to restore damage to natural ecosystems because of deforestation. Reforestation increases the number of plants allowing more carbon dioxide to be absorbed and improving air quality. Reforestation also prevents soil erosion and works to prevent water pollution.

REGENERATIVE AGRICULTURE

Regenerative agriculture is organic agriculture that focuses on creating and maintaining healthy soils that absorb and store carbon. Instead of contributing to greenhouse gases, this approach to farming removes gases from the air.

SUSTAINABLE FARMING

The goal of sustainable agriculture is to meet the food needs of the present without compromising the ability of future generations to meet their own needs. There are many practices used by people working in sustainable agriculture and sustainable food systems including promoting soil health, minimizing water use, and lowering pollution levels.

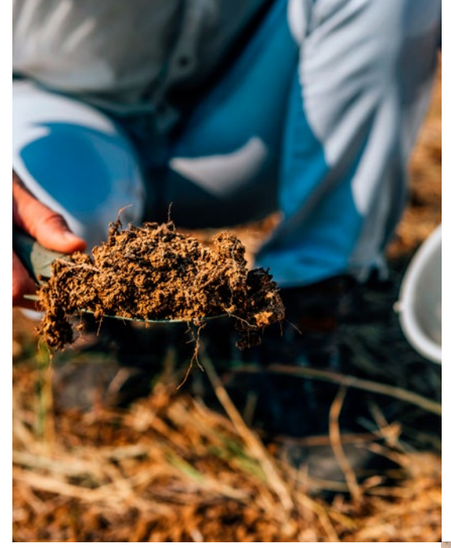
SOIL SCIENCE

Soil science is the study of soil as a natural resource on the surface of the earth including soil formation, classification and mapping; physical, chemical, biological, and fertility properties of soils; and these properties in relation to the use and management of soils.

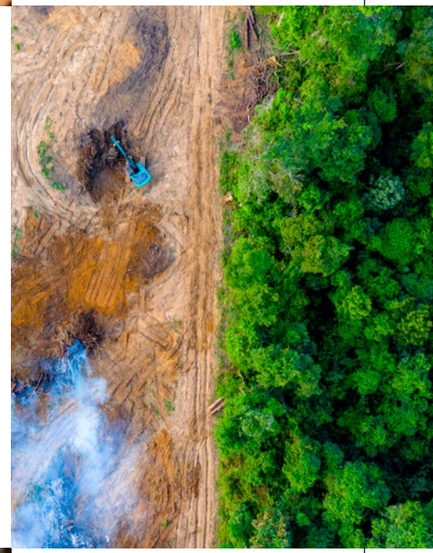
HOW CELL PHONES ARE SAVING THE RAINFOREST

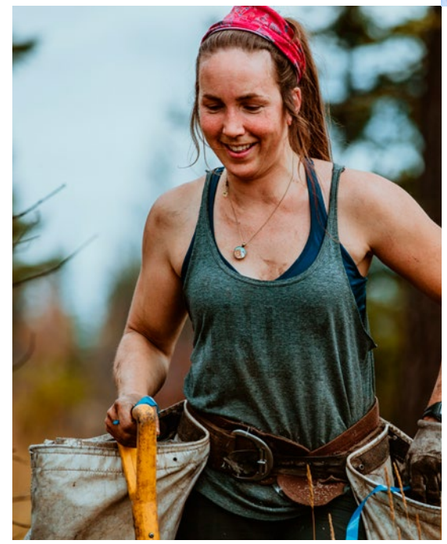
Topher White is an engineer and founder of San Francisco non-profit, Rainforest Connection. He has developed a system in which a cell phone charged by solar cells, with an extra microphone, can listen to the sounds of the forest 24/7. The device can detect the sounds of chainsaws nearly a mile away. Leveraging data analysis, the cell phone's computers can distinguish a chainsaw's sound from others in the forest. This real time sound detection is helping put an end to illegal deforestation in real time and providing an upcycling opportunity for old cell phones.

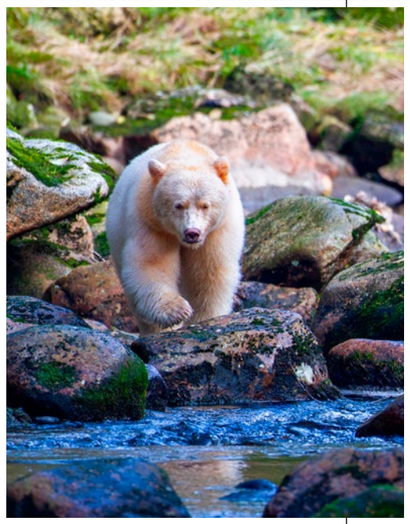
90%
OF DEFORESTATION IS ILLEGAL



> "A covered planet is a healthy planet. We can fix a lot of our climate issues if we bring the CO2 down into a living plant and put it back into the soil where it belongs."
>
> -Ray Archuleta,
> Conservation Agronomist, NRCS







COMPANY SPOTLIGHT

CORTEVA AGRISCIENCE

Sustainable farming, soil health and water conservation are key fundamentals to restoring earth's lands and increasing the resiliency of our global food supply. STEMconnector ebook contributor, Ronda Hamm knows this all too well. Ronda is the Global Academic Relations Leader for Corteva Agriscience, a major agriscience company completely dedicated to agriculture. Here's what she had to say about STEM and the role of agriculture in addressing climate change.

CORTEVA™ agriscience

CORTEVA AGRISCIENCE

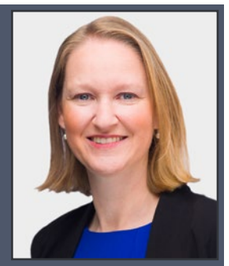
Ronda Hamm Ph.D.
Global Academic Relations Leader

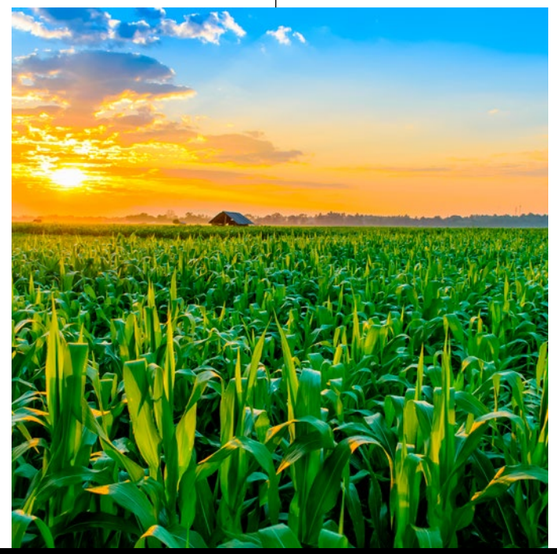
Q How does STEM connect your company to the world?

A STEM is at the heart of everything we do at Corteva Agriscience. Our company's purpose is to enrich the lives of those who produce and those who consume, ensuring progress for generations to come. We accomplish that by developing products and technologies that can help farmers around the world produce more food in more sustainable ways. We believe that farmers are a key part of the solution to climate change and other challenges facing our world, and our scientists, engineers, agronomists and more are focused every day to improve the seeds, crop protection products and digital tools that will help them farm more efficiently and sustainably than ever before.

With operations in more than 140 countries, we also know that the challenges and opportunities are unique to each farmer, and we are working to tailor solutions in each market we serve.

> "We believe that farmers are a key part of the solution to climate change and other challenges facing our world, and our scientists, engineers, agronomists and more are focused every day to improve the seeds, crop protection products and digital tools that will help them farm more efficiently and sustainably than ever before."
>
> *—Ronda Hamm Ph.D.,*
> *Global Academic Relations Leader, Corteva Agriscience*





Q What is Corteva Agriscience doing to address climate change and meet the food needs of the global population?

A Corteva Agriscience has announced a set of sustainability goals to achieve by 2030 to increase the resilience of our global food system. These goals are designed to benefit farmers, the land, our communities, and our operations, and include focused targets such as aiming to enable farmers to sustainably increase crop yields by 20 percent while also reducing greenhouse gas (GHG) emissions by 20 percent and working to provide training to 25 million farmers on soil health, nutrient and water stewardship, and productivity best practices. We're also working to improve our own operations by establishing sustainability criteria for all new products, managing our GHG emissions, and using only reusable and recyclable packaging for our products. Our teams around the world have embraced these goals and are developing internal plans and collaborating with partners to achieve them and make a positive impact on our food supply and planet.

Q How important is biodiversity in agriculture and what is Corteva Agriscience doing to promote it?

A Biodiversity is the foundation of agriculture and our food system. It enhances soil health, habitats, biological pest control, erosion resistance, and the prevention of runoff into waterways. One example of how Corteva Agriscience is working to maintain biodiversity is the Corteva Grows Pollinator Habitat initiative. This initiative supports monarch butterfly and pollinator habitat at Corteva Agriscience locations throughout the United States. Through this program, Corteva Agriscience engages 4-H youth to help increase pollinator habitats and populations, supporting biodiversity. The program also strengthens pollinator education efforts through Pheasants Forever's Youth Pollinator Habitat Program. In addition to providing seasonal food supplies and a home to pollinators, the sites will be used to educate students on the benefits of pollinators and their habitats and grow youth with the awareness, passion and skills to be responsible stewards of our planet for generations to come.

We're also developing advanced technologies for land management, and establishing partnerships around the world that develop, document and communicate how proven management practices positively impact biodiversity. We recently announced a collaboration with the National Fish and Wildlife Foundation in the US that will enhance biodiversity and improve critical wildlife habitats on grazing lands—a unique and immensely important ecosystem—in Texas and Colorado.

> "We're collaborating with National Fish and Wildlife Foundation to join areas of expertise and scale measurable impact beyond our own reach. This partnership brings science-based measurement and local agronomic and biodiversity expertise together to develop, document, and communicate how proven management practices and our advanced technology can positively impact biodiversity."
>
> - Morgan Gray
> Global Sustainability Partnerships Manager, Corteva Agriscience

REUSE – RECYCLE – RESTORE

WATER & WASTE

Although water covers 71% of our planet, most of the world's water (97%) is salt water and unsuitable for drinking or growing crops. There is a limited amount of fresh water and over 40% of the world's population live in a region where the demand for water exceeds supply.

New technology is being used to recycle or reuse water as well as desalinate ocean water to make it safe for people and agriculture. The bottom line is there is not enough water supply to support the existing population. Climate change will likely contribute to increasing water shortage as rising temperatures lead to more unpredictable weather, including floods and droughts.

97% OF THE EARTH'S WATER IS FOUND IN OCEANS

WATER REUSE

Water reuse or reclamation is the process of converting municipal wastewater (sewage) or industrial wastewater into water that can be reused for a variety of purposes, including industrial, agricultural, and even drinking water.

GROUND WATER REPLENISHMENT SYSTEM

The GWRS in Orange County, CA is the world's largest water purification system for indirect potable reuse. The system takes highly treated wastewater that would have previously been discharged into the Pacific Ocean and purifies it using a three-step advanced treatment process consisting of microfiltration, reverse osmosis and ultraviolet light with hydrogen peroxide. The process produces high-quality water that meets or exceeds all state and federal drinking water standards.

Its leadership in water purification, turning recycled water into drinking water, has been recognized worldwide and has influenced the creation of water recycling projects around the globe.

WATER DESALINIZATION

There are two types of water desalination: thermal and reverse osmosis. Both processes come at a cost which include the high amounts of energy needed to fuel the process and the output of the process which is the salty brine residue. Typically the salty brine is returned to the ocean which can have negative environmental impacts.

> "Our game-changing technology provides limitless supplies of fresh water in a carbon-neutral, marine friendly, cost-effective manner, using the concentrating power of sunlight. This means that desalination no longer has to be costly, polluting and unsustainable."
>
> *— David Reavley*
> *CEO, Solar Water, Plc*

SOLAR WATER: THE FUTURE OF DESALINIZATION?

Solar Water Plc is revolutionizing the water desalination process, helping solve one of the world's most pressing problems – sustainable and affordable access to fresh water.

The company has created a technology that provides limitless supplies of fresh water in a carbon neutral, marine friendly, cost effective manner, using the concentrating power of sunlight.

THE OCEAN CLEANUP RECYCLED PLASTIC REMOVED FROM THE GREAT PACIFIC GARBAGE PATCH AND TURNED IT INTO SUNGLASSES. 100% OF THE PROCEEDS GO TOWARD CONTINUING CLEANUP EFFORTS.

MARINE ECOSYSTEMS

The ocean covers over 70% of the earth's surface and is home to over 230 distinct species and numerous complex ecosystems. The ocean is critical for life on earth. It regulates climate, absorbs CO2 and provides food for over a billion people. The ocean absorbs over 90 percent of the planets heat trapped in the atmosphere.

Coral reefs play a major part within the marine ecosystem. They provide habitats and shelter for thousands of marine organisms, help with nutrient recycling, assist in carbon and nitrogen-fixing, water filtration, and provide nitrogen and essential nutrients for the diverse array of life that exists within the marine food chain.

GREAT PACIFIC GARBAGE PATCH

In addition to increasing water temperatures, the rate at which we are polluting the ocean poses a real threat to all marine life. Trash accumulates in five ocean garbage patches, the largest one being the Great Pacific Garbage Patch, located between Hawaii and California. If left to circulate, the plastic will impact our ecosystems, health, and economies. The Great Pacific Garbage Patch is around 1.6 million square kilometers, that is bigger than the state of Texas.

LET'S TALK TRASH

Over 2 million tons of waste are produced around the world every year. The U.S. produces the most trash at around 1,600 pounds per person per year. Recycling is one of the leading waste management solutions and new technologies to recycle and reuse waste are being created every day. Recycling material reduces pollution, energy use and greenhouse gas emissions. Reusing or repurposing food waste can be the equivalent of removing millions of cars from the road to reduce greenhouse gas emissions.

NON-PROFIT SPOTLIGHT: THE OCEAN CLEANUP

Every year, millions of tons of plastic enter the oceans, of which the majority spills out from rivers. A portion of this plastic travels to ocean garbage patches, getting caught in a vortex of circulating currents. If no action is taken, the plastic will increasingly impact our ecosystems, health, and economies.

The Ocean Cleanup is a non-profit organization developing advanced technologies to rid the oceans of plastic. The Ocean Cleanup is developing a passive cleanup method, which uses the natural oceanic forces to rapidly and cost-effectively clean up the plastic already in the oceans. With a full fleet of cleanup systems in the Great Pacific Garbage Patch, they aim to clean up 50% of its plastic every five years. After fleets of systems are deployed into every ocean gyre, combined with source reduction, The Ocean Cleanup aims to remove 90% of ocean plastic by 2040.

> STEM is the key to the careers of the future, and it needs many more participants. In an increasingly global society, it's critical that we create and expand opportunities for all students to access the kind of education that will enable them to navigate and lead the 21st-century world they'll inherit."
>
> — *Melody Graveen*
> *Ed.D., Dean of Instruction, Career & Tech Ed*
> *Moreno Valley College*

CONNECTING THE PLANET WITH STEM

MORENO VALLEY COLLEGE

STEM is vital for non-STEM jobs too. Every job includes a financial aspect – math education can help in this. STEM is vital to understanding the basics of the environment. In an increasingly global society, it's critical that we create and expand opportunities for all students to access the kind of education that will enable them to navigate and lead the 21st-century world they'll inherit.

Moreno Valley College is building a STEM community that connects STEM leaders and practitioners across the global network, enabling them to share insights and innovations, best practices, and sustainable solutions.

IMPROVING WATER QUALITY

Water conservation and quality is a pressing issue. To help combat this issue the Career and Technical Education Center (CTE) and iMAKE Innovation Center team at Moreno Valley College partnered with IREX (an international group that embraces a people focused approach to development that invests in human potential and the conditions that help people thrive) in a five-week virtual exchange to address this global challenge. The program connected over 300 community college and university students from the U.S. with students from Jordan and Iraq to discuss a variety of global challenges.

Moreno Valley College focused on discovering different options of providing a clean source of water. With the help of Dr. Kasey Nguyen and other faculty members of MVC, students produced 3D printed water filters and water quality monitoring systems using Arduinos to discover different low-cost options to provide clean water to all. The project began during the Spring semester of 2021 and provided international connections while addressing global issues.

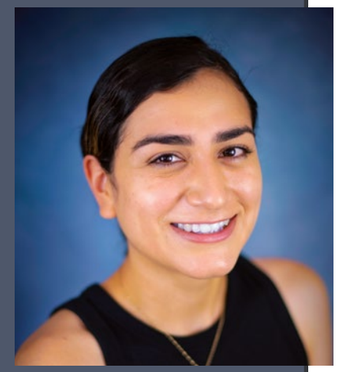
THE FUTURE IS STEM

Statistics tell us that there are more than a million STEM job vacancies in the STEM industry while at the same time only about 16% of college students graduate in the STEM fields or subjects. Demand for STEM jobs increased dramatically over the past 20 years. STEM is the key to the careers of the future, and it needs many more participants.

67%
OF U.S. JOBS ARE STEM RELATED

> Math in itself will not save the planet. It can, however, lay the foundation for other fields to do so."

STEM SPOTLIGHT



Gabriela Florido
Assistant Professor of Mathematics, Moreno Valley College

Gabriela Florido is an Assistant Professor of Mathematics who designs classes that are active, modern and innovative. She brings high impact projects to her classes to provide career defining opportunities and expose students to technology.

During college, Florido decided to change her major from interior design to mathematics after working as a math tutor. She went on to receive her masters and worked as a Graduate Teaching Assistant where she gained experience in teaching practice and leadership. Florido completed her thesis, which led to her involvement in other research projects later on. After finishing her masters, she continued teaching and went on to pursue her current role at Moreno Valley College.

Q What makes you the most excited when you think about the future of STEM?

A MVC is currently working on bringing VR technology to help STEM students. This project has an emphasis on Hispanic students, and I believe it will increase inclusivity within the STEM field... The ability to have concepts that were entirely theoretical, now be something that you can physically hold in your hand is just amazing.

Q What advice would you give to someone interested in pursuing your career?

A There is a perception that if you find math "easy" that you are "good" at it. You will likely fail a class or two when you reach this point in your academic career and that is okay. Create study groups, make sacrifices, and don't let imposter syndrome win.

INSTITUTE OF ENVIRONMENT

FLORIDA INTERNATIONAL UNIVERSITY

FIU

Florida International University is a minority-serving public research institution in Miami, Florida. FIU uplifts learner success, fosters high social mobility, and accelerates innovative solutions in research areas such as the environment, population health, and forensics. The university serves a diverse student body of over 58,000 with 260,000 alumni. Among other rankings, in 2021 FIU was the top performing public university in the State of Florida, its international business is ranked number 2 by US News and World Report, and it is among the top 20 universities contributing to the public good, according to Washington Monthly Magazine.

> “Some of the world’s largest economic hubs are faced with the inevitable reality of higher seas. We must train a new generation of experts to develop sustainable solutions to climate change impacts.”
>
> — *Florida International University*

FIU INSTITUTE OF ENVIRONMENT

In collaboration with local and international partners, FIU efforts have led to expanded protections for endangered species; improved sanitation and access to clean water; increased community resilience across the globe; and adaptive management of terrestrial, freshwater, coastal and marine resources. FIU is addressing both current and unprecedented future threats of environmental change, providing data-driven solutions to society’s greatest and most urgent challenges. FIU conducts research across many environmental topics and disciplines, all related to saving our planet and its species.

A key player in global environmental research, FIU has engaged in investigations and collaborations in more than 60 countries. The UNESCO Chair for Sustainable Water Security works to address risks to water resources, the overlap of gender and water equity issues, as well as developing new technologies for improving access and availability of water worldwide.

MEDINA AQUARIUS PROGRAM

FIU’s Medina Aquarius Program is dedicated to the study and preservation of marine ecosystems with the world’s only undersea research laboratory, Aquarius Reef Base. Scientists are at the cutting edge of research on coral reefs, ocean acidification, climate change, fisheries and overall ocean health.

The only facility of its kind, Aquarius Reef Base offers maximum efficiency and access for the study and exploration of a region particularly susceptible to global environmental threats. It also offers extensive educational outreach programming to give access to a unique marine ecosystem, share the latest science and inspire countless minds.

FIU SEA LEVEL SOLUTIONS CENTER (SLSC)

The FIU Sea Level Solutions Center in the Institute of Environment works with local partners including city and county staff, elected leaders and leaders of community-based organizations to develop and apply interdisciplinary science and co-create solutions that reduce the causes and consequences of climate change.

The Sea Level Solutions Center provides a toolkit for everyone - scientists, educators, city planners, businesses, citizens - looking for the latest information on sea level rise and how it will impact our communities. The SLSC brings knowledge and expertise together from a wide range of disciplines to provide information and education to diverse audiences, in a way that is accessible, relevant, and applicable.

The Sea Level Solutions Center, part of the Institute of Environment’s Coastlines and Oceans Division, was created to address the emerging need for an organizational mechanism to develop useful and sustained sea level and other climate change-related responses for both the human and natural environments. We coordinate and engage in local to global solutions-oriented research, education, strategic thinking, communications, and outreach by organizing top scientists, educators, students, municipal leaders, and policymakers to produce an accurate understanding of impacts of sea level rise and climate change.

Learn more about FIU’s Institute of Environment and Sea Level Solution Center at https://environment.fiu.edu

STEM SPOTLIGHT

Dr. Tiffany Troxler

Associate Professor, Department of Earth and Environment Director of Science, Sea Level Solutions Center in the Institute of Environment, FIU

Dr. Troxler is an ecologist whose work cuts across science, policy and management of natural and urban environments. In the field, she and her students examine the effects of saltwater inundation on Everglades coastal wetlands, monitor how Everglade’s ecosystems respond to efforts to restore the Everglades, and advance interdisciplinary nature-based solutions in urban environments.

In college, Dr. Troxler studied Anthropology and Ecology and later went on to receive her masters and PhD in Biology. She held several postdoctoral research positions where she received research grants that developed into a research program. Dr. Troxler worked on national-level greenhouse gas inventory and later found her current position at Florida International University.

DR. TROXLER’S ADVICE

> “Try an internship in a research lab, government office or NGO. Your university will have information about opportunities available. Even if it is an unpaid position, if you perform well, this can be a foot in the door to a new opportunity. When you face setbacks, don’t give up.”

STEM FOR GOOD

YOUTH ORGANIZATIONS AND OPPORTUNITIES

There are many ways to get involved with STEM and saving the planet. Check out local organizations that educate on climate change or online resources such as NASA Climate Kids, or Our Climate Our Future a project from Alliance for Climate Education. Many companies offer summer hands-on experiences as well as internships for high school and college students. The Department of Energy has an extensive list of opportunities including the Minority Educational Institution Student Partnership Program. Additionally, The National Wildlife Federation has programs for all ages. Below you will find additional resources for planet-friendly STEM pathways.

SCIENCE OLYMPIAD

Science Olympiad is a program that engages millions of students in science exploration and excellence. Science Olympiad's twin programs of Elementary Science Olympiad (grades K-6) and Science Olympiad (grades 6-12) offer non-competitive and competitive science events and activities that help students connect to science through hands-on, team-based learning that is not only fun, it's life-changing.

Students who are on Science Olympiad teams compete in contests that test their building skills, knowledge and application skills in a variety of STEM subjects like epidemiology, weather, engineering and biology.

Science Olympiad prepares students with the skills they need to pursue STEM education and careers beyond high school. Their alumni work as science teachers, researchers, engineers, doctors and STEM advocates all over the country. They have taken the passion they found for STEM in Science Olympiad into the larger world to make it a better place.

Additionally, Science Olympiad partners with many employers and STEM advocates, like NASA, NOAA, Hikma, Corteva and IEEE that have a vested interest in building the next generation of scientists. Their support helps the program to design challenges that are related to current challenges and opportunities that participants need to prepare for now.

UNICEF: YOUTH FOR CLIMATE ACTION

One of the most important ways in which UNICEF helps young people participate in climate action is by giving them the opportunity to engage with leaders at events like the 2019 United Nations Youth Climate Summit in New York City.

YOUTH CLIMATE LEADERS

Youth Climate Leaders creates a global network for kids interested in sustainability efforts and climate change. The organization also seeks to help kids find mentors and real workers in their field of interest.

YOUTH SUSTAINABILITY LEADERSHIP PROGRAM

The Youth Sustainability Leadership Program, started by Sustainable Cleveland, allows selected youth to attend summits and get access to information about how to help their communities. Members develop sustainability projects throughout the year and are encouraged to include their peers to spread information.

COMPANIES TAKING CLIMATE ACTION

BEYOND MEAT

A study from the University of Michigan assessed the Beyond Burger's environmental impact compared to a standard quarter pounder. The study determined that the Beyond Burger uses 99% less water, 93% less land, 46% less energy, and produced 90% fewer greenhouse gas emissions compared to its beef counterpart.

MICROSOFT

2031: Carbon negative. Microsoft has been carbon neutral across the world since 2012 and aims to be carbon negative by 2031

HEWLETT PACKARD

2025: aim to reach carbon neutrality and zero waste in HP operations and 100% renewable electricity in global operations

JOHNSON & JOHNSON

2039: Net zero emissions from all products from sourcing to point of sale

UNILEVER

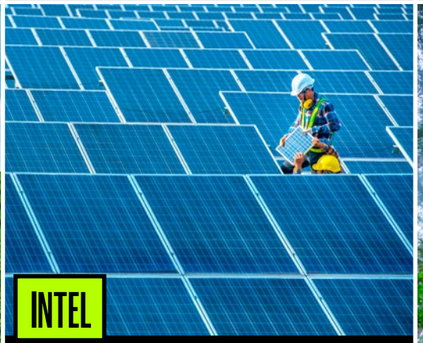
2039: Net zero emissions from all products from sourcing to point of sale

APPLE

2030: Carbon neutral across entire footprint.

MICRON

2030: 95% reuse, recycling and recovery, and zero hazardous waste to landfill



INTEL

100% of Intel's US and EU electricity supply and more than 70% of our global electricity use is either directly purchased as renewable energy or through Renewable Energy Credits (RECs) or generated from on-site alternative energy installations.

NIKE

2020: 100% renewable energy in U.S. and Canada for our owned and operated sites

EDUCATION AND CAREER PATHWAYS

ENVIRONMENT & SUSTAINABILITY

Florida International University
- Environmental Studies and Geosciences

UC Davis
- Agricultural and Environmental Education

Rochester Institute of Technology
- Environmental Sustainability

Harvard University
- Harvard University Center for the Environment

University of Washington
- College of the Environment

Oregon State University
- College of Earth, Ocean, and Atmospheric Sciences

California Institute of Technology (Caltech)
- Climate Dynamics Group

University of California, San Diego
- Green Labs Program
- Green Office Program
- Scripps Institution of Oceanography

Arizona State University
- Global Institute of Sustainability and Innovation
- College of Global Futures
  - School for the Future of Innovation in Society
  - School of Sustainability
  - School of Complex Adaptive Systems

Texas A&M University
- The College of Geosciences

University of Illinois, Urbana-Champaign
- College of Agricultural, Consumer and Environmental Sciences

Pennsylvania State University
- College of Earth and Mineral Sciences

Cornell University
- Cornell Atkinson Center for Sustainability

Stonybrook University
- School of Marine and Atmospheric Sciences: Ecosystems and Human Impact

Career Pathways

Climate/Environmental Scientist
Environmental Lawyer
Environmental Engineer
Geoscientist
Renewable Energy Scientist
Renewable Energy Technician
Clean Car Engineer
Sustainability Consultant
Climatologist
Conservation Scientist

WATER & MARINE CONSERVATION

Brown University
- Department of Ecology, Evolution and Organismal Biology

University of California, Los Angeles
- Institute of Environment & Sustainability - Marine Center

Northeastern University
- Marine Science Center

Boston University
- Marine Program

University of Miami
- Rosenstiel School of Marine and Atmospheric Science

Texas A&M University
- Department of Marine Biology

University of California, Santa Barbara
- Marine Science Institute

University of Washington
- The School of Oceanography

University of California, San Diego
- Department of Environmental and Ocean Sciences

University of Delaware
- Marine Science

Career Pathways

Ocean Engineering
Marine Biology
Marine Mammal Trainer
Marine Archaeology
Marine Researcher
Marine Environment Educator / Oceanography
Aquatic Veterinarian
Scuba Diving Instructor and Underwater Filmmaker
Marine Scientist
Marine Environment Economist
Civil Engineer
Environmental Engineer
Hydrologist
Environmental Scientist/Specialist
Conservation Scientist

RENEWABLE ENERGY

Penn State World Campus
- Renewable Energy and Sustainability Systems

University of California, Berkeley
- Energy, Climate & Environment

Massachusetts Institute of Technology
- MIT Energy Initiative

Stanford University
- Energy Innovation and Emerging Technologies Program

University of Maryland
- Maryland Energy Innovation Institute

Career Pathways

Contractor / Electrician
Green Engineering
Sustainable Farming
Environmental Consultant
Mechanic
Architecture and Design
Renewable Energy Scientist
Renewable Energy Technician

RECYCLING

American University
- Zero Waste

Valencia College
- RecycleMania Competition

College of the Atlantic
- Waste Minimization and Recycling

University of California, Davis
- Zero Waste

Kalamazoo College
- Sustainability at K

SOIL SCIENCE AND AGRONOMY

Michigan State University
- Department of Plant, Soil and Microbial Sciences

University of Florida
- Soil and Water Sciences Department

University of Wisconsin - Madison
- Department of Soil Science

North Dakota State University
- Soil Science

Purdue University
- Soil and Water Sciences

RESOURCES & CONTRIBUTORS

RESOURCES

- Best Colleges
- Bureau of Reclamation
- CompareCamp
- Condor Ferries
- Global Forest Watch
- Green America
- Job One for Humanity
- Kiss the Ground [Documentary]
- LeafScore
- NASA
- National Geographic
- National Marine Sanctuary Foundation
- National Resources Defense Council
- Ocean Conservancy
- Rainforest Connection
- Ray Archuleta | Soil Health Academy
- SolarWater Plc
- The Ocean Cleanup
- U.S. Environmental Protection Agency
- World Meteorological Organization

CONTRIBUTORS

ALLIANT ENERGY
Sarah Martz
Manager of Distribution Engineering, Alliant Energy

CENTER FOR ENERGY WORKFORCE DEVELOPMENT
Julie Strzempko
Education Consultant, CEWD

CORTEVA AGRISCIENCE
Ronda Hamm, Ph.D.
Global Academic Relations Leader, Corteva Agriscience

FLORIDA INTERNATIONAL UNIVERSITY
Dr. Tiffany Troxler
Associate Professor, Department of Earth and Environment, Director of Science, Sea Level Solutions Center in the Institute of Environment, FIU

MORENO VALLEY COLLEGE
Gabriela Florido
Assistant Professor of Mathematics, Moreno Valley College

MORENO VALLEY COLLEGE
Melody Graveen, Ed.D.
Dean of Instruction, Career & Tech Ed

UC BERKELEY SCHOOL OF LAW
Louise Bedsworth, Ph.D.
Land Use Program Director at Center for Law, Energy & the Environment, UC Berkeley School of Law