

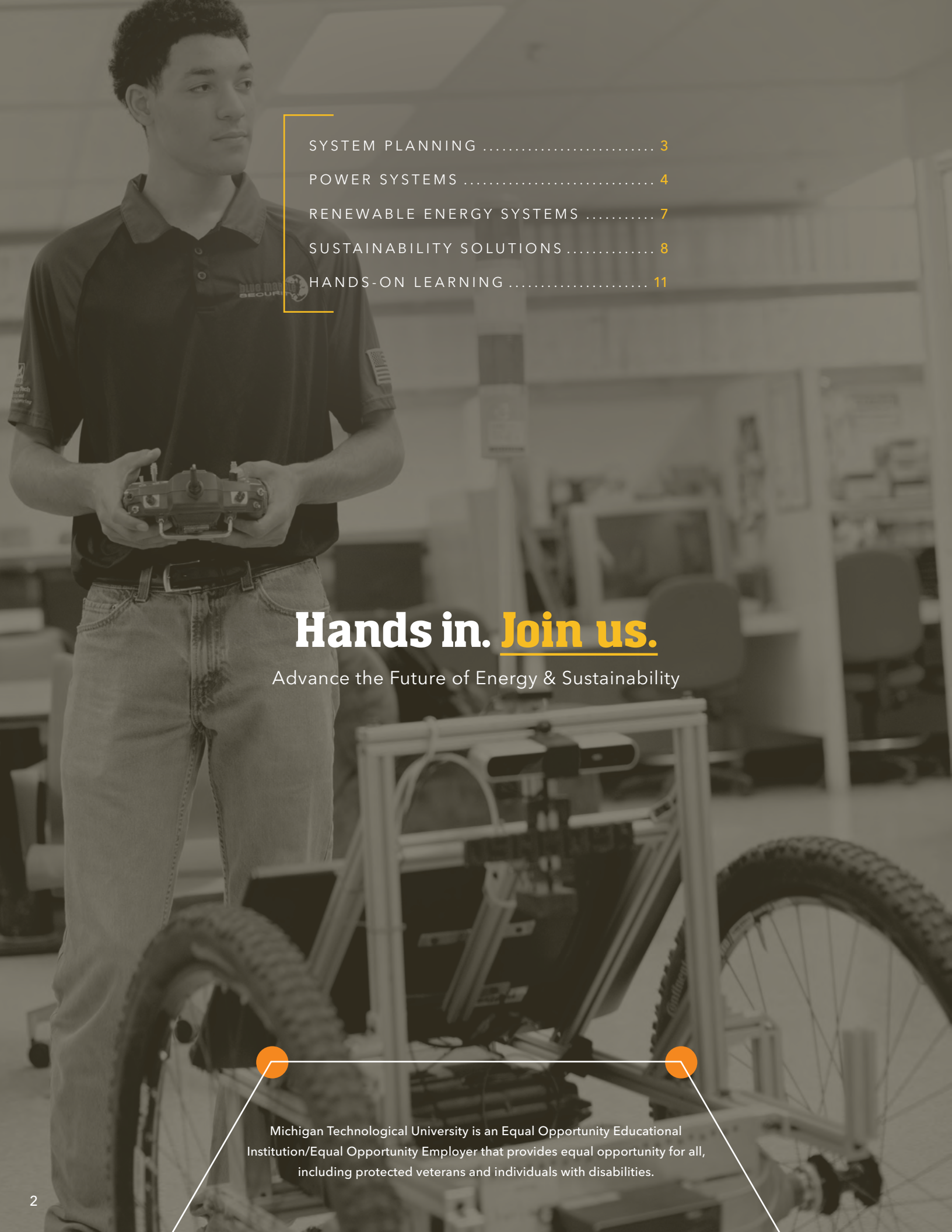


**Design.  
Generate.  
Renew.**



**Michigan  
Technological  
University**

**COLLEGE OF ENGINEERING  
ENERGY & SUSTAINABILITY  
INITIATIVES**



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# Hands in. Join us.

Advance the Future of Energy & Sustainability

Michigan Technological University is an Equal Opportunity Educational Institution/Equal Opportunity Employer that provides equal opportunity for all, including protected veterans and individuals with disabilities.



# System Planning

INFORMING THE DESIGN PROCESS

Sustainability is our focus.

We embrace renewable energy—ranging from solar to wind to water—while keeping power generation and grid management as a cornerstone. And we design for a global circular economy—defining both a product’s intended use and its recycled application. Our students research, lead, and direct these concepts, hands-on.

Sustainability is always a primary goal, whether we’re out in the field, in the classroom, or in the lab. It’s actively woven into projects for senior design, undergraduate research, Enterprise, and more.

We need support to install instrumentation and energy-efficient applications to be on display in buildings and labs. If we can help our students visualize, analyze, and conceptualize sustainable needs on campus today—they will be better prepared to solve global challenges tomorrow.



# Power Systems

## PLANNING FOR GRID MANAGEMENT

Facing an aging power ecosystem, we teach about strengthening our nation's current power systems, along with new ways of powering the future.

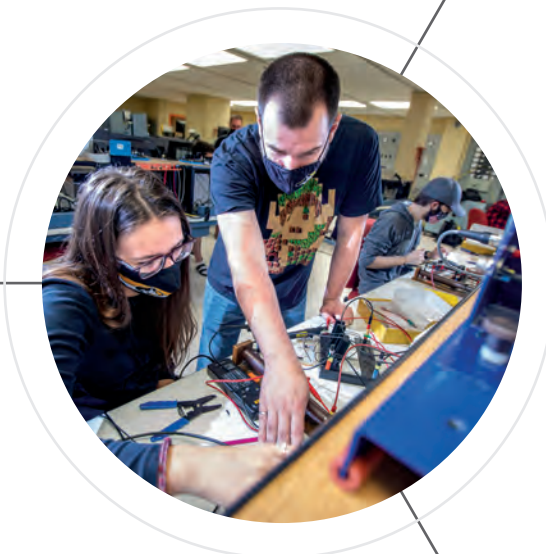
One example: sags in power lines, caused by thermal expansion. Replacing the aluminum core with a composite material reduces the sag and resulting power outages.

We also use sensors to monitor electricity, water, and gas flow on campus, then display the information real-time to help inform and reduce energy consumption.

With malware-initiated attacks occurring on critical national energy infrastructure, companies across the globe must upgrade and invest in their transmission systems. They need graduates ready to deliver.

At Michigan Tech we build in an understanding of compliance and baseline protection for stronger, integrated utility and transmission generation systems—while preparing our students to develop and use new malware and ransomware verification frameworks.

Along with power generation comes disaster mitigation. As more predictive models become available on upcoming weather patterns and trajectories, we explore the likelihood of which nodes in the power network may be impacted—to better improve resilience and strengthen infrastructure.



# Innovation Lab

Ensuring our students can work directly with the infrastructure of today—while also being prepared for the infrastructure of tomorrow—requires technology both present and future. We need support to strengthen hands-on learning across all our lab facilities, as well as funding for additional sensors to monitor and reduce our energy consumption.



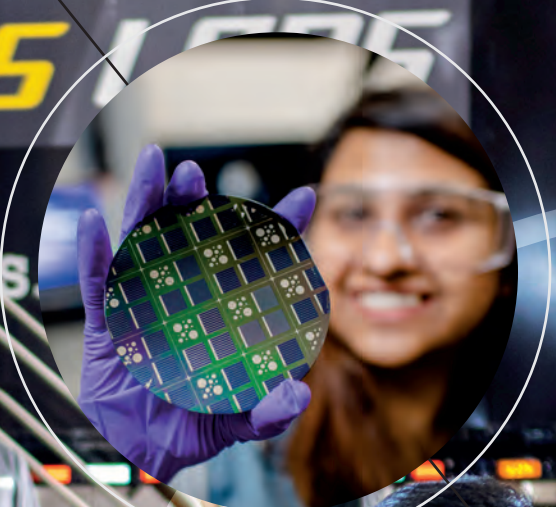


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APS LABS

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NATIONAL  
INSTRUMENTS



# Renewable Energy Systems

POWERING TOMORROW

Looking to the future, we explore alternative energy sources, including wind, water, solar—even waste.

At Michigan Tech we explore waste conversion to useful fuels, and waste recycling into building materials, furniture, roadways, and more. In one lab, rubber from ground-up tires and even brewery waste are analyzed and mixed into asphalt, and used as aggregate in concrete.

We optimize wind turbine blades and enhance materials for higher efficiency, lower-cost wind farm development. We model how thermoelectric power plants adapt to temperature and water stress.

Our large wave tank on campus, along with nearby Lake Superior, provide optimal environments to test wave energy converters and understand the energy ecosystem impacts of global climate change. We model renewable marine energy in the Great Lakes by monitoring solar climates, and explore the electrification of freshwater marine vessels.

Our solar panel system tests photovoltaic performance in high-latitude regions. This coincides with our research on how solar panels are beneficial for utility companies and consumers alike.

We explore opportunities for clean, safe energy storage in old mines. Water can be pumped from lower to upper tunnels to store excess power generated from solar and wind. Then, when electricity is needed, water from the upper tunnels can run down to the lower tunnels through a turbine to generate energy.

We develop sustainable energy from hydrogen fuel cells to electrification through battery optimization. And we seek improved efficiencies from drying clothes to cooling large data and computing centers.

To support advancements in renewable energy, we seek support to purchase the needed sensors, modeling computational infrastructure, and equipment for wind, solar, water, and waste conversion testing.



# Sustainability Solutions

## ENVIRONMENTAL PROTECTION

Focused on circular and blue economies, we are dedicated to protecting our environment.

Early on, we teach our students sustainable design and life cycle assessment. Sustainability plays a significant role in engineering design. Ensuring a product is designed well for its initial application, so it can be recycled or reused, is what enables a circular economy.

We explore and conduct remediation efforts in streams, lakes, and drainage areas to reduce ground, water, and air pollutants. We track toxins, such as PFAS, PCBs, mercury, and DDT to determine best ways to remove them.

To deal with the treatment of contaminants in wastewater and groundwater, we develop advanced water treatment processes, capable of breaking down difficult contaminants using photochemistry. We pair life cycle analysis with water reuse infrastructure to improve biosolids treatment sustainability.

In developing sustainable solutions for low-impact mining, we conduct mine stabilization work using microbes that cement particles together, minimizing dust.

Essential to monitor and understand the current state of the environment around us is proper measurement. These measurements are our baseline—to track what is happening, changing, and where we are going.





We need funding for a van or movable trailer equipped with samplers and analytical instrumentation to analyze air masses, as well as highly sensitive ICPMs and GCMs.





# Hands-on Learning

## PROGRAMS & PROJECTS

Our engineering activities, organizations, and degree programs embrace hands-on experience, partnering with industry or community. We've got numerous new initiatives in the works.

At Michigan Tech we're shaping a new doctoral program, one that combines environmental engineering with policy, ethics, and culture. Students will collaborate with communities to increase sustainability and resilience, spending time out in the field during semester-long internships with advocacy and policy groups and national labs. The goal: heighten mutual understanding of effective engagement.

Our undergraduates must now integrate environmental regulation requirements into their work to ensure they think through those as part of their engineering initiatives.

A senior design team recently developed a portable potable water source for catastrophic weather events.

Less than pristine water can be collected in shipping containers, filtered, and processed into clean drinking water, and driven on a truck to where it is needed.

Our student teams and groups each focus on building energy efficient, sustainable solutions to solve today's problems for a better, cleaner future.

Thriving at Michigan Tech: SENSE, Built World Enterprise, Engineers without Borders, Blue Marble, Alternative Energy Enterprise, Robotics Systems Enterprise, Innovative Global Solutions, the Sustainability Demonstration House, Green Campus Enterprise, and more.

We now offer graduate study and certificates in the world of cyber-physical security to prevent power system hacking and failures.

We want to expand the length of our senior design program from one semester to one full year. It would greatly benefit our students to have the extra time. We need community and industry partnerships to help provide our students with real-world engagement throughout the planning, designing, and prototyping processes. We also seek funding for material and equipment purchases.





# Hands on. Hands in.

The sustainable, clean, and energy-efficient solutions  
we all need rest on the education of our engineers.

**Tomorrow needs Michigan Tech. Tomorrow needs you.**



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Technological**  
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