



Campus and Community-Scale Energy and Climate Challenges -Green Hydrogen-

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Research at S&T

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Research in Energy

Energy Research through CREE focuses on the development and deployment of Energy efficiencies and energy security.



Research in the Environment

Environmental Research through CREE focuses on integrating biological and physical systems involving emerging, contaminating compounds and microorganisms in natural and engineered systems.

FACILITIES AND EQUIPMENT



Solar Villages Living Laboratories



Available research equipment



MARCH 15, 2023

Readout of the White House Forum on Campus and Community-Scale Climate Change Solutions

[OSTP](#)[NEWS & UPDATES](#)[PRESS RELEASES](#)

Last week, the White House Office of Science and Technology Policy (OSTP) and the University of Washington convened a [forum](#) on leveraging the capabilities of colleges and universities to catalyze climate solutions in communities across the country. This forum was part of the Biden-Harris Administration's broader efforts to achieve net-zero greenhouse gas emissions no later than 2050, and increase community resilience to extreme weather and other climate impacts.





A World War II-era coal-fired power plant at Missouri S&T has served the campus for nearly seven decades.

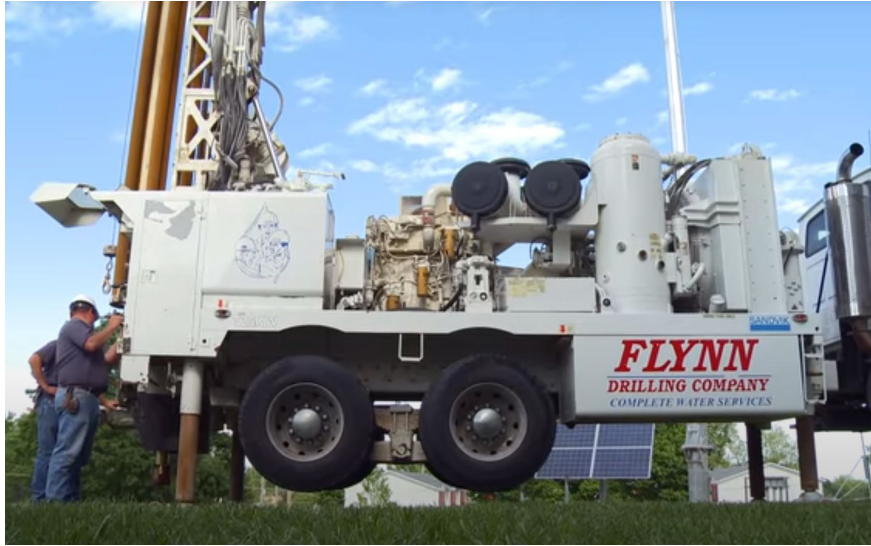






Missouri S&T Campus, Rolla





Geothermal drilling at Missouri S&T:
~800 wells

IMPACT:

Will cut annual
energy use by

50%



Actually cut
energy use by

57%

Will reduce
carbon dioxide
emissions by

25,000

tons per year



Actually reduced
carbon dioxide
emissions by

25,000

tons per year

Will cut water
usage by

10,000,000

gallons per year



Actually cut water
usage by

18,730,000

gallons per year

Missouri S&T GEOTHERMAL ENERGY SYSTEM

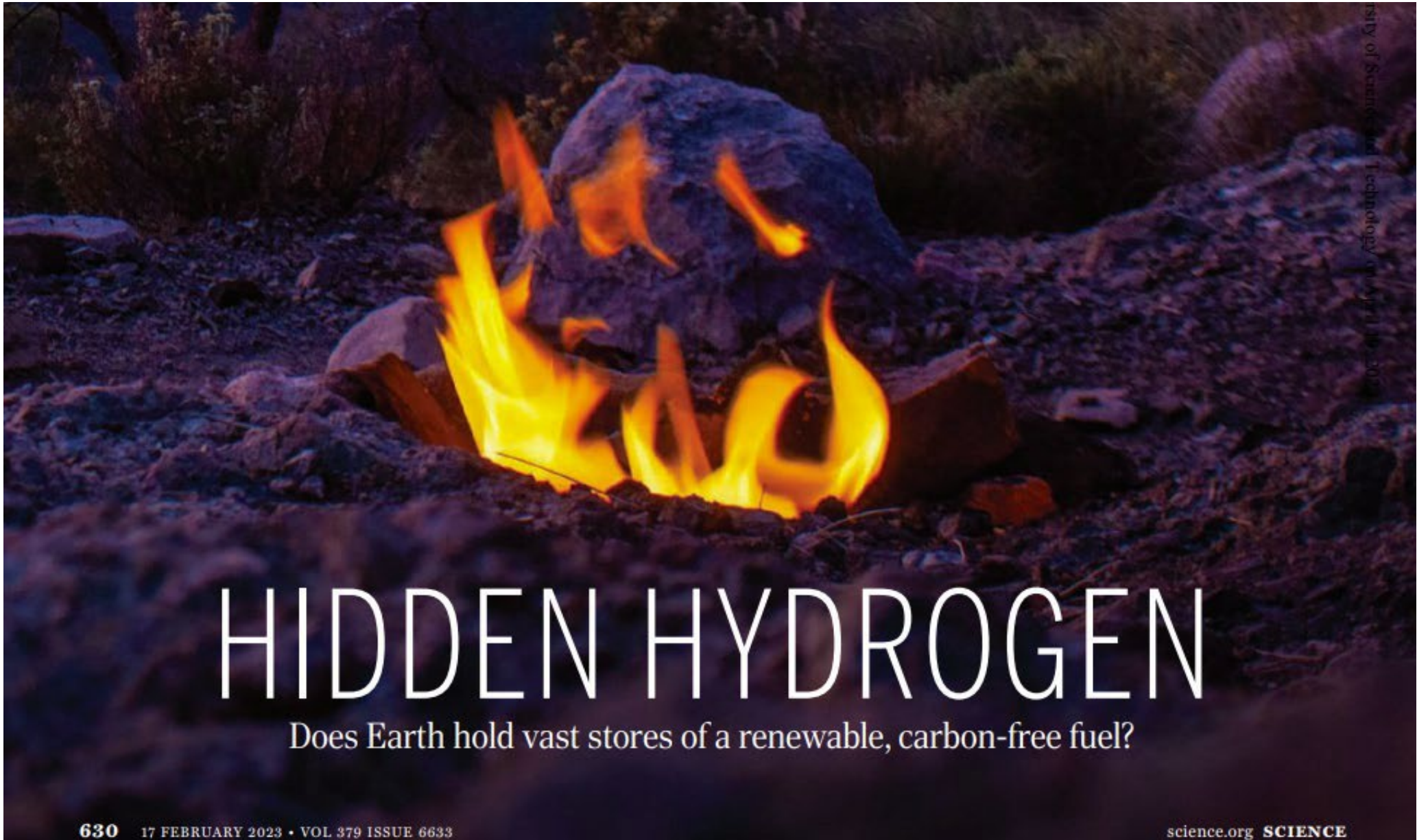
savings ~\$2.8 million
annually

Earth was a fire ball like Sun



Magma – Nuclear Reaction/Power
Nuclear Fusion –Hydrogen to Helium
Mining of Hydrogen





University of Science and Technology of China

HIDDEN HYDROGEN

Does Earth hold vast stores of a renewable, carbon-free fuel?

630 17 FEBRUARY 2023 • VOL 379 ISSUE 6633

science.org **SCIENCE**

E. Hand, Science, 24 February 2023

Hydrogen Production – Natural Hydrogen



In 2019, the startup Natural Hydrogen Energy drilled the first U.S. hydrogen well amid corn and soybean fields in Nebraska.

“We weren’t looking in the right places with the right tools.”

Geoffrey Ellis, U.S. Geological Survey

“We’ll be taking care of our generation and our children’s children’s generation.”

Denis Brière,
Chapman Petroleum Engineering

The hydrogen rainbow

Researchers use colors to distinguish between different kinds of hydrogen.

- **Gray hydrogen** Made from fossil fuels, which release carbon dioxide and add to global warming.
- **Blue hydrogen** Same as gray hydrogen, but the carbon is captured and sequestered.
- **Green hydrogen** Made without carbon emissions by using renewable electricity to split water.
- **Gold hydrogen** Tapped from natural subsurface accumulations.
- **Orange hydrogen** Stimulated by pumping water into deep source rocks.



Regional Clean Hydrogen Hubs

The Regional Clean Hydrogen Hubs program—or H2Hubs—includes up to \$7 billion to establish six to 10 regional clean hydrogen hubs across America. As part of a larger \$8 billion hydrogen hub program funded through the Bipartisan Infrastructure Law, the H2Hubs will be a central driver in helping communities across the country benefit from clean energy investments, good-paying jobs and improved energy security.

Clean hydrogen hubs will create networks of hydrogen producers, consumers, and local connective infrastructure to accelerate the use of hydrogen as a clean energy carrier that can deliver or store tremendous amounts of energy.

Welcome to the Midwest Alliance for Clean Hydrogen

MachH2: An alliance committed to growing the Midwest regional hydrogen value chain to deliver positive climate and community impact.

Made up of more than 60 public and private entities

Iowa, Nebraska, Missouri Partner for Application to Create Clean Hydrogen Hub

Governor Mike Parson said:

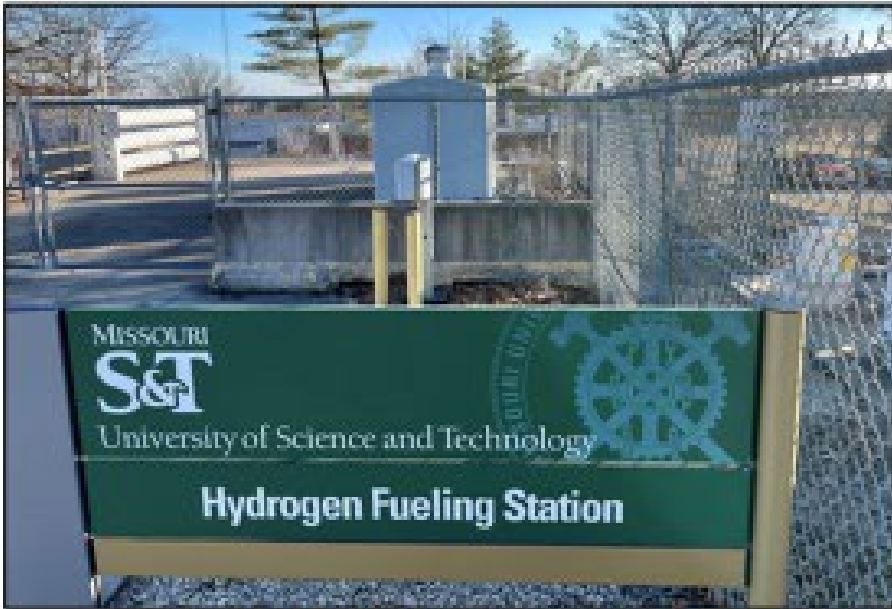
” Missouri and the Midwest enjoy a diverse energy portfolio that will only be strengthened by this clean hydrogen hub partnership.

“This partnership looks to the future and the collective strength of our economies by bolstering reliable renewable energy sources and promoting energy security all while supporting opportunities for Missouri farmers and ranchers, business investment, and good-paying jobs across the region.”

Iowa, Nebraska, Missouri Partner for Application to Create Clean Hydrogen Hub

The partnership includes to do the following:

- **Drive economic growth and development for each of the participating states and the region.**
- **Incorporate the latest science, research, and technology for the cost-effective production, transportation, storage, and use of clean hydrogen.**
- **Develop a pathway for workforce development and training.**
- **Address pipeline safety, leak minimization, and pathways for new pipeline construction.**
- **Address the air quality impacts of hydrogen production, transportation, storage, use, and combustion, including emissions of nitrogen oxides.**
- **Respect the unique needs and policy approaches of each participating State.**



Hydrogen Fueling Station

State's first hydrogen fueling station in 2008 at Missouri S&T.

The station currently needs rescoped to be operational.

Midwest Alliance for Clean Hydrogen (DOE H2Hub)

An alliance committed to growing the Midwest regional hydrogen value chain to deliver positive climate and community impact.

Proposed Missouri S&T/GTI Energy Collaborative:
\$5 million (1:1 cost share)

POC: Fatih Dogan, Interim Director of the Center for Research in Energy and Environment
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- **Hydrogen in Steel and Cement Production**
- **Decarbonization of Manufacturing**

Missouri S&T researcher earns \$4 million grant for energy-efficient steelmaking

Posted by Peter Ehrhard
On August 19, 2020



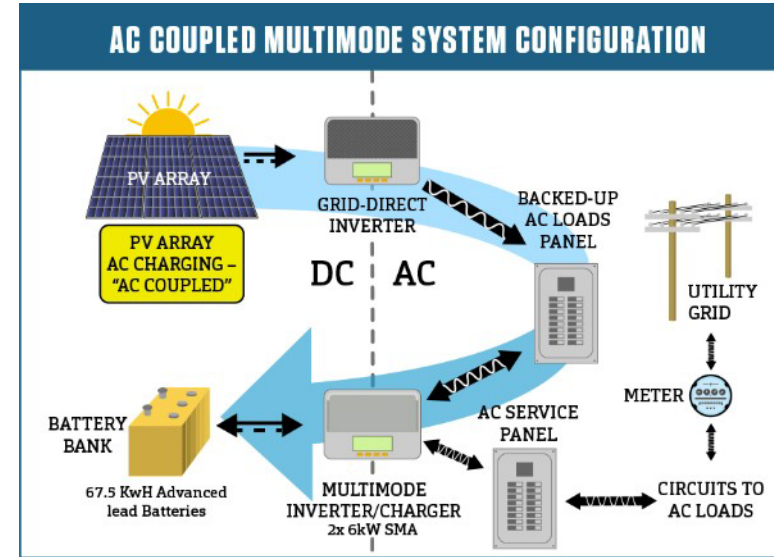
A steel pour in the Foundry Laboratory of McNutt Hall. Photo by Sam O'Keefe, Missouri S&T.

Steelmaking is among the most energy- and carbon-dioxide-intensive process in manufacturing. U.S. steel producers are challenged by narrow profit margins due to the cost of raw materials and associated energy costs. But researchers at Missouri S&T could soon help the steel industry overcome those challenges.

With a \$4 million grant from the U.S. Department of Energy (DOE), researcher Dr. Ronald O'Malley is working to prove the economic viability of increased renewable energy usage in steel production.

The project would create a steel production system that combines a hydrogen-reduction reactor for ironmaking (H2DR) with electric furnace melting for steelmaking. This combination is then integrated into a flexible electrical grid with energy storage and hydrogen generation by balancing hydrogen and natural gas usage in the H2DR process.

MISSOURI S&T SOLAR VILLAGE & MICROGRID



Smart Living Laboratories-Solar Villages and Microgrids

Industry Partnerships and Research Opportunities

- Photovoltaic Renewable Generation
- Energy Storage
- Intelligent Switchgear
- Advanced and Secure Communications
- Human and Technology Interaction
- Collaboration with Industry Partners
- Intelligent and Sustainable Architecture
- Privacy and Technology
- Load Shading
- Energy Monitoring and Controlling



S&T student Solar Workshop

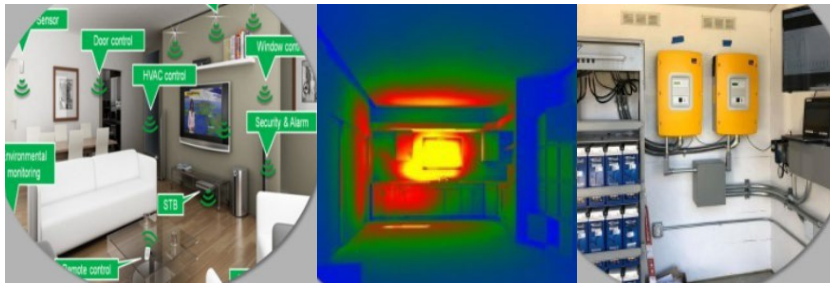


S&T students Class tour

Community Outreach



MISSOURI
S&T



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