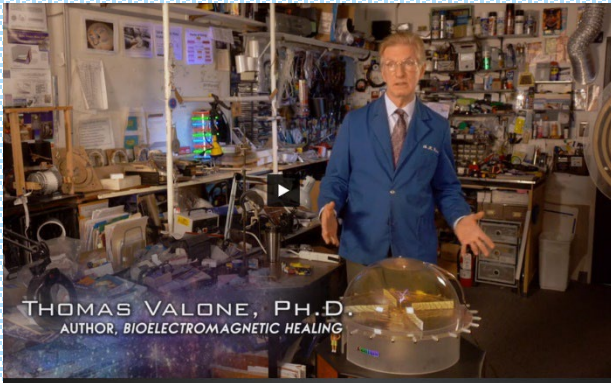




# INTEGRITY RESEARCH INSTITUTE



THOMAS VALONE, PH.D.  
AUTHOR, BIOELECTROMAGNETIC HEALING

**FUTURE ENERGY**  
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 Catalog 2024 Vol.13

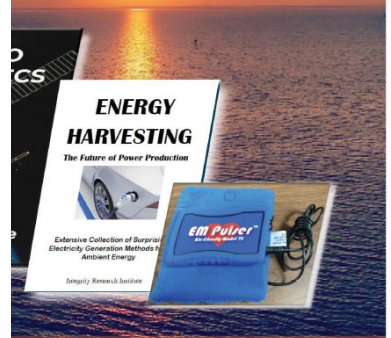


*Asian Journal of Environment & Ecology*

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ISSN: 2456-690X

## Gigatonne Carbon Dioxide Removal Can Reverse Global Heating Trend

Thomas F. Valone <sup>a\*</sup>



**ENERGY  
PROPULSION  
BIOENERGETICS**  
 Integrity-Research.org



Dr. Tom Valone

# ANNUAL REPORT 2023

## CREDITS

**Integrity Research Institute wishes to acknowledge the following for her stellar contribution to the IRI Annual Report**

*Jacqueline Panting ND*

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# Integrity Research Institute Annual 2023

Access the electronic version of this Annual Report on [IntegrityResearchInstitute.org](http://IntegrityResearchInstitute.org) and also on [Integrity-Research.org](http://Integrity-Research.org) where the web links in this report will connect and supply more information for you as you review our accomplishments for the past year.

*featuring*

## **IRI Annual Report for 2023**

Best of the Future Energy eNews of 2023

IRI Financial Report for 2023

**Thomas Valone, PhD, Editor**

## **IRI OFFICERS AND DIRECTORS - 2023**

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## PRESIDENT’S LETTER

This past year has been environmentally significant worldwide by having the hottest individual months on record. Furthermore, our planet has been witnessing an increase in fossil fuel usage which averages over 85% of its energy consumption, even though the United States for the first time is seeing its RATE of fossil fuel burning level off. As a result, we are featuring one of the most powerful climate publications that I have authored. In this case, it was published in the [\*Asian Journal of Environment & Ecology\*](#), [with open access](#) to help educate the readers on that side of the globe, at no cost to them. It also is using the metric “gigatonne” which is very close in value to the English gigaton. As noted at the end of 2023, our climate articles seem to be taking off, with more popularity worldwide than ever before. As an example, the [“Linear Global Temperature Correlation to Carbon Dioxide Level, Sea Level, and Innovative Solutions to a Projected 6°C Warming by 2100”](#) published in the *Journal of Geoscience and Environment Protection* two years ago has received 3,317 Downloads and an astounding 15,319 Views! As with most of our articles, we show a simple solution to the global warming crisis that retraces the dumping of gigatons of CO<sub>2</sub> into the atmosphere every year (up to 40 Gt this past year). Phase One is to meet or exceed the 40 Gt goal by CDR (DAC) just to neutralize our global garbage dumping to “net zero”. Then, Phase Two needs to go past 40 Gt/yr so we start DECREASING the 410 ppm currently back down to 290 ppm which is what it was when I was born. If any of our IRI Members know Senators, Congressmen, or climate professors who are open to such analysis in these articles, please send them copies and send their contact information to us.

The rest of the Annual Report is the summary of all of our best findings in the program areas of our institute: Energy, Propulsion, and Bioenergetics. In addition, we have added the Best of Future Energy eNews of 2023 for your enjoyment and edification.

Onward and Upward,

Tom Valone, PhD, PE  
President

## HIGHLIGHTS 2023

We are immensely proud of IRI's accomplishments for the past year. With our new Electronic Catalog hosted by Shopify, we are available worldwide. Our [IRI YouTube Channel](#), has grown tremendously with over 900 subscribers and many of our videos have had over 1000 views. Our *Facebook page* and *Instagram channel* have also grown with content being posted monthly. All our programs are easily accessible, filled with videos of our lab, interviews of our President Dr. Valone, videos of our products and historical information such as conferences. We also highlight all our programs, IRI publications, products, and bioenergy devices.

**Conferences and Appearances.** This year we had several in-person presentations. First Dr. Valone, did advocacy presentations during the Congressional Visit Day to Maryland Senators and Congressmen's offices sponsored by the IEEE (see photo to left). Dr Valone met with staffers from Senator Ben Cardin's office and also Senator Chris Van Hollen's to discuss IRI's mission, including the emerging energy discoveries we have researched, the climate solution articles published, and the drug free bioenergy and bioelectromagnetic inventions that IRI has developed.



“The Natural Living Expo” at the University of Maryland, Marriot Conference Centers, we had our Booth (see photo on this page) with all the literature and our latest PREMIER 4000 Tesla Energy Chair for attendees to experience. Was an excellent venue for showcasing our bioenergy products and future energy books. Dr Valone also had a workshop presentation during the Expo entitled: “**Modern Meditation at the Workplace**”.



We also had several online presentations this year, including podcasts which have become extremely popular. Dr Valone was on “Conttactour” podcast, discussing the best energy research results his latest book publications, some of the latest electrotherapy studies, published in **NASA Tech Briefs, Nature**, etc., that directly have helped IRI including how it relates to our EM Pulser 78. Dr. Valone also addressed questions about the **University Level Ufology Textbook** he's writing, and our global situation addressing the climate and energy crises, with a view toward what the

future may be like. The one-hour Instagram is popular with over 4000 views so far. Dr. Valone also did **Masterclass presentation** on great scientists, including medical inventor, physician and author, Andrija Puharich, MD, (who brought Uri Geller and Peter Hurkos to the United States for scientific investigation of their abilities) as well as Tom Bearden, Ph.D., nuclear engineer, retired Lieutenant Colonel (U.S. Army) and many others at the United States Psychotronics Association. These masterclasses are available at The USPA website [www.psychotronics.org](http://www.psychotronics.org). Dr Valone also did several podcasts on the YouTube channel "Steve's Place" throughout the year, such as the Bioelectromagnetic Healing slideshow, now on YouTube: <https://youtu.be/-opkPYxYxQ8?t=329>.

**IRI Publications and Books:** We had several journal papers, and articles published. Our Annual "Future Energy Annual 2022" was mailed free to our membership. We are also very proud that in

2023 we collected and filled a **16 GB flash drive** that we call "**The KEY**", with the first volume of a massive collection of the very BEST of IRI events, videos, interviews, photos, Proceedings, papers, and even audio recordings, in convenient MP3 and MP4 format! When evaluated at the actual individual pricing over the years, the total cost of the collection is over \$2000, along with some priceless items unavailable elsewhere! This 16 GB Flash Drive contains the entire Proceedings (slides and/or papers) of every COFE and lots of extra videos as well as many article and videos on health and wellness Includes COFE1, COFE2, COFE3, COFE4, COFE5, COFE6, COFE7, COFE8, COFE9, COFE10, COFE11 and COFE12 and many papers, videos, including segments from public appearances on TV, such as Ancient Aliens and Discovery channel. It contains 25 years of IRI Conference history, papers, videos and audios on a 16 GB flash drive.



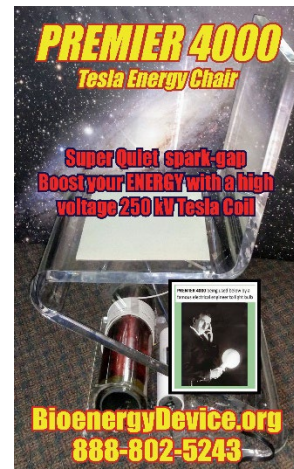
Our goal for this coming year is to publish more audio book versions of our bestselling books, including *Electrogravitics I and II* as well as *Electrostatic Motors*. We published multiple journal papers including: "Bioelectromagnetic Health and Healing" in the **European Journal of Applied Science**, and "*Gigaton Carbon Dioxide Removal can Reverse Global Heating Trend*." published in the **Asian Journal of Geology, Earth and Marine Sciences**.

**The Bioenergetics Program:** The newly designed EM Pulser MODEL78 has been a bestseller since



its inception. which now has the following attachments: PulsePad, LED , UV and Magnetic probe. Known as the combo, it is popular all over the world, including Europe and South Korea. The EM Pulser Model 78, with the earth frequency of 7.8 Hz for cardioprotection, weighs two ounces in a 1" x 2" x 5" case with a sure grip

rubber boot for extra comfort! It's portable so you can use anywhere, powered by battery. At home you can plug in any socket to save battery life. A rechargeable battery included along with the AC adapter/recharger.





Our line of PREMIER electrotherapy devices now includes two new devices: the PREMIER 4000, also known as the **Tesla Energy Chair** which has many therapeutic benefits and much public appeal. This model has a specially designed acrylic chair, so you can comfortably receive treatments while seated. It has become the favorite of health practitioner, chiropractors and integrative medicine physicians.

Our second model is the PREMIER 2000, which contains a Lakhovsky antenna that is proudly made in our lab and consists of concentric circles of gold, silver and copper. Also our OsteoPads and MaxiMat models continue to be very popular and effective for bone and cartilage regeneration. We have added now another new addition, the MiniMat, which is a medium sized Mat that is an option for those who do not want a body size Mat like the MaxiMat but wish a larger size than the OsteoPad.

**Future Energy News Program:**

Free newsletters, brochures, and reports that include the latest news on energy developments, discoveries and research given to the public. ***“Future Energy eNews”*** is sent via email,

monthly, to over 5000 recipients worldwide, free of charge through Constant Contact email service. This electronic newsletter showcases all the latest emerging eco-friendly technologies in our program areas of energy, propulsion, and bioenergetics that are being developed worldwide and published in Journals, Magazines and Newspapers.



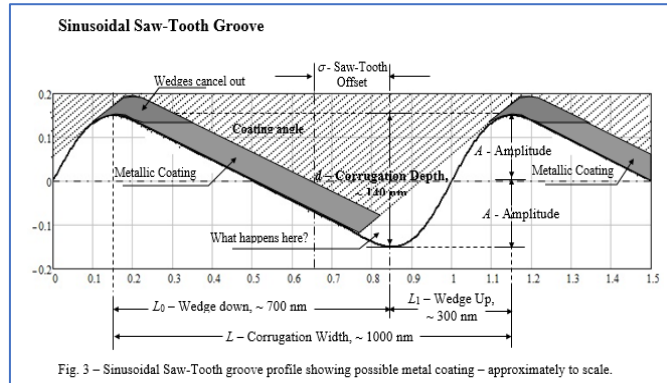
Also published in 2023, is the *Future Energy* magazine, and mailed it to all members for free. This magazine contains all the latest papers and articles relating to emerging energy technologies. Also we continue to upload to our IRI website the latest information on emerging energy technologies, climate change, and video uploads and press releases.

Regarding local advocacy for safety issues, we published a **Letter to the Editor** in the *Beltsville News* for a bike and pedestrian lane to be installed leading to our IRI office as currently it is hazardous for anyone to walk or ride a bike on Rhode island Avenue (shown in the photo), an extremely heavy traffic area, since it lacks both a sidewalk and bike lane. The appeal for a bike lane and pedestrian walkway has also been presented to the Washington DC Office of Representative Steny Hoyer who actually requested local project suggestions from us directly.





**Zero Point Energy Program.** The research continues on the possibility of tapping zero point energy through zero biased diodes. One of our many projects is the **“Quantum Fire Project”** which with Bob DiBiase in partnership with GASE of Berlin Germany. Because the Casimir forces are ultimately the result of quantum effects, If asymmetric forces are observed, it would unleash the most disruptive technology ever seen since humans first harnessed fire. The Casimir equations are very convincing. IRI received some funding this year and preliminary data and tests with suitable polymers have been produced. In Germany, Dr Ludwig along with Bob DeBiase, continue to experiment with many designs to see which is the most effective and efficient. Much research is still being done for this paper and completion is slated for 2024. Also we have some students that are researching many different possibilities with zero biased diodes to harvest ambient energy and we plan to have some papers published when more data is accumulated and reviewed.



**Propulsion Program:** The CMG Project or Control Moment Gyro Project had a milestone this year, with a successful proof of principal model that moved with powered by the scissoring gyros. We continue with more data and measurements being done. Dr Valone is the principal director along with Mike Gamble a retired aerospace engineer. For years, Inertial Propulsion has been advocated by IRI and now we have replicated a table-top model. The purpose of this experiment is to show that levitation and thrust is possible by scissoring gyros. Initial funding has been provided by our Institute and now we are pleased to say that we have a Sponsor who is providing a substantial amount on financial support to continue with our research. Regarding our SMM project, we have had much advancement. Yes, a magnetic gradient has been implemented into a permanent magnet motoring cycle. Now we have built a proper choice of a magnetic switch. This Spiral Magnetic Motor is designed to provide mechanical drive for electrical power. Peer-reviewed, online -> <https://tinyurl.com/SMMslides> or <https://tinyurl.com/SMMpaper>




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**The next section comprises article samples that IRI published during 2023 as well as samples of the BEST of *Future Energy eNews* from 2023, for your benefit and review.**

Subscribe to Future Energy eNews for FREE if you have not already. It comes out every month near the end of the month and is *emailed to thousands* of happy readers with five (5) reprinted articles signifying breakthroughs in energy, propulsion, or bioenergetics.



# Gigatonne Carbon Dioxide Removal Can Reverse Global Heating Trend

Thomas F. Valone <sup>a\*</sup>

<sup>a</sup> Integrity Research Institute, 5020 Sunnyside Ave., Suite. 209, Beltsville MD 20705, US.

**Author's contribution**

*The sole author designed, analysed, interpreted and prepared the manuscript.*

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**Review Article**

## ABSTRACT

It is a surprising realization to many that a changing temperature *tightly* correlates with the carbon dioxide (CO<sub>2</sub>) levels worldwide in a linear, lockstep manner with a reversible but very short temporal feedback loop of only a few decades. A mapping of the past 400,000 years of earth's climate history by Hansen, based on the Vostok ice core sampling, offers a glimpse into this remarkably tight relationship between CO<sub>2</sub> and global temperature levels but also the average sea level over four ice ages that are clearly delineated in his historic depiction of all three quantities. As his Table accompanying the graph is analyzed, an equation linking the three variables has now been generated, yielding a fresh view into how past decades of hundreds of gigatons of atmospheric increase will continue to affect a worldwide temperature rise, also called "global warming." The implication that is inescapable from such an analysis is that the presently stored CO<sub>2</sub> level, far surpassing by over 40% those present in 1950, is the real cause of the physics "heat-trapping effect" seen worldwide. (Note: US tons are 0.907 of metric tonnes and both are used in this article.) Research accomplished in this review point to the heat-trapping property of CO<sub>2</sub> as the major contributor to increasing heat worldwide and lead to the prediction of how much higher global temperature will rise if left unchecked, with the level of CO<sub>2</sub> over 40% higher than it has ever been in more than 400,000 years. The proposed solution offered in this review is to initiate a 40 gigatonne carbon dioxide removal (CDR) annually in order to stabilize atmospheric CO<sub>2</sub>, to be followed by an expanded CDR effort toward a goal of 100 gigatonnes/year to begin reversing and lowering global temperature.

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## Bioelectromagnetic Health and Healing

**Thomas Valone**

Integrity Research Institute, Beltsville, Maryland

**Jacqueline Panting**

Integrity Research Institute, Beltsville, Maryland

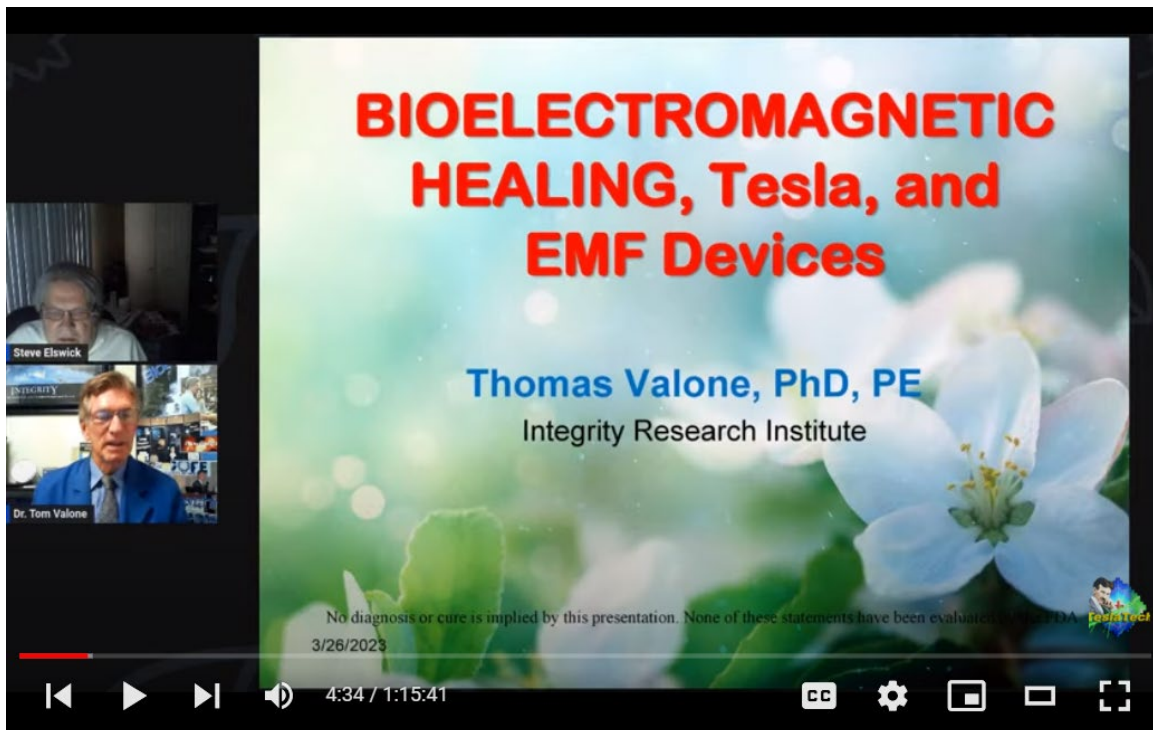
The following information is provided for educational purposes only. It is not to be construed as constituting medical advice, nor do the devices described have FDA approval though some qualify for the FDA grandfather clause which is an exemption. This article is not intended for diagnosis or treatment of disease. Persons should seek medical counsel before any investigation of these experimental devices.

### INTRODUCTION TO ELECTROMEDICINE AND ELECTROTHERAPEUTICS

In 1898, Tesla published a paper that he read at the eighth annual meeting of the American Electro-Therapeutic Association in Buffalo, NY entitled, "High Frequency Oscillators for Electro-Therapeutic and Other Purposes." He states that "One of the early observed and remarkable features of the high frequency currents, and one which was chiefly of interest to the physician, was their apparent harmlessness which made it possible to pass relatively great amounts of electrical energy through the body of a person without causing pain or serious discomfort."<sup>1</sup> Tesla also concluded correctly that bodily "tissues are condensers" in the 1898 paper, which today is estimated to be about 100-300 pF. It is also the basic component (dielectric) for an equivalent circuit only recently developed for the human body. In fact, the relative permittivity for tissue at any frequency from ELF (10 Hz-100 Hz) through RF (10 kHz-100 MHz) exceeds most commercially available dielectrics on the market. This unique property of the human body indicates an inherent adaptation and innate compatibility toward the presence of high voltage electric fields, probably due to the high transmembrane potential (TMP) gradient in healthy individuals, present across cellular membrane tissue. This surprisingly intense electric field, which averages 100 kV/cm or equivalently 10 MV/m as noted in our first figure, is extraordinary because it demonstrates the body's ability to withstand high electric field energy, like storing a lightning bolt in each cell. It is also one of the *only two ways that the human body stores energy* (electrical gradients or chemical gradients). We have found that debilitated people, with or without disease, will respond to a five-minute exposure of a high voltage therapy device and report an increase in their liveliness and vitality almost immediately.

For example, a client of ours named Susan R. wrote to us to place an order for our portable Tesla-coil- styled Premier Junior stating, "About an hour after I tried the device for the 2nd time on the last day of the conference I had so much energy I packed up and drove 7 hours to get home. After I got home, I still had energy to burn! I cannot wait to have more of that on a regular basis!" This seems to be related to the "charging" of the body's condensers (capacitors) which are the cell's membranes. Another reason is that electrons are the active ingredient in antioxidants and have the ability to quench free radical damage faster than any pill or capsule

## IRI President on "Steve's Place YouTube" March 26, 2023 at 9 pm EDT



Steve's Place Live!



### “Bioelectromagnetic Healing, Tesla, and Effective EMF Devices”

Archived on <https://integrityresearchinstitute.org/videos.html>

There are many electromagnetic field (EMF) instruments and devices now emerging that bring beneficial changes to human organisms, especially those that pulsate the fields (PEMFs). Electromedicine or electromagnetic healing are the terms applied to such developments in the ELF, RF, IR, visible or UV band, which when properly used, represent the ideal, noninvasive therapy of the future. The roots of this science can be traced to 1898 when Nikola Tesla presented his findings of therapeutic uses for his newly invented high frequency Tesla coil oscillator to the eighth annual meeting of the American ElectroTherapeutic Association. Thirty years later, on September 6, 1932, Dr. Gustave Kolisher announced to the American Congress of Physical Therapy that "Tesla's high-frequency electrical currents are bringing about highly beneficial results in dealing with cancer, surpassing anything that could be accomplished with ordinary surgery." With the subsequent onset of extraordinarily aggressive suppression by the AMA and FDA, most doctors today are unaware of the scientific wealth of techniques for healing with electrotherapy. Recent studies however, have continued to demonstrate incontrovertible evidence for the benefits of bioelectromagnetic healing devices, for a wide variety of illnesses, with a surprising lack of harmful side effects. Just the discovery that electrons are antioxidants, for example, could change the way we fight free radicals in the future. An overview of these findings, along with a biophysical explanation based on the science of bioelectromagnetics, is presented.

# Best of IRI Future Energy eNews of 2023



[Home](#) / [Chemistry](#) / [Biochemistry](#)  
[Home](#) / [Chemistry](#) / [Analytical Chemistry](#)

🕒 MARCH 8, 2023

✓ Editors' notes

## Newly discovered enzyme that turns air into electricity, providing a new clean source of energy

by Monash University

Australian scientists have discovered an enzyme that converts air into energy. The finding, published today in the journal *Nature*, reveals that this enzyme uses the low amounts of the hydrogen in the atmosphere to create an electrical current. This finding opens the way to create devices that literally make energy from thin air.

The research team, led by Dr. Rhys Grinter, Ph.D. student Ashleigh Kropp, and Professor Chris Greening from the Monash University Biomedicine Discovery Institute in Melbourne, Australia, produced and analyzed a hydrogen-consuming enzyme from a common soil bacterium. Recent work by the team has shown that many bacteria use hydrogen from the atmosphere as an energy source in nutrient-poor environments. "We've known for some time that bacteria can use the trace hydrogen in the air as a source of energy to help them grow and survive, including in Antarctic soils, volcanic craters, and the deep ocean" Professor Greening said. "But we didn't know how they did this, until now." In this *Nature* paper, the researchers extracted the enzyme responsible for using atmospheric hydrogen from a bacterium called *Mycobacterium smegmatis*. They showed that this enzyme, called Huc, turns hydrogen gas into an electrical current. Dr. Grinter notes, "Huc is extraordinarily efficient. Unlike all other known enzymes and chemical catalysts, it even consumes hydrogen below atmospheric levels—as little as 0.00005% of the air we breathe."

The researchers used several cutting-edge methods to reveal the molecular blueprint of atmospheric hydrogen oxidation. They used advanced microscopy (cryo-EM) to determine its atomic structure and electrical pathways, pushing boundaries to produce the most resolved enzyme structure reported by this method to date. They also used a technique called electrochemistry to demonstrate the purified enzyme creates electricity at minute hydrogen concentrations. Laboratory work performed by Kropp shows that it is possible to store purified Huc for long periods. "It is astonishingly stable. It is possible to freeze the enzyme or heat it to 80 degrees Celsius, and it retains its power to generate energy," Kropp said. "This reflects that this enzyme helps bacteria to survive in the most extreme environments."

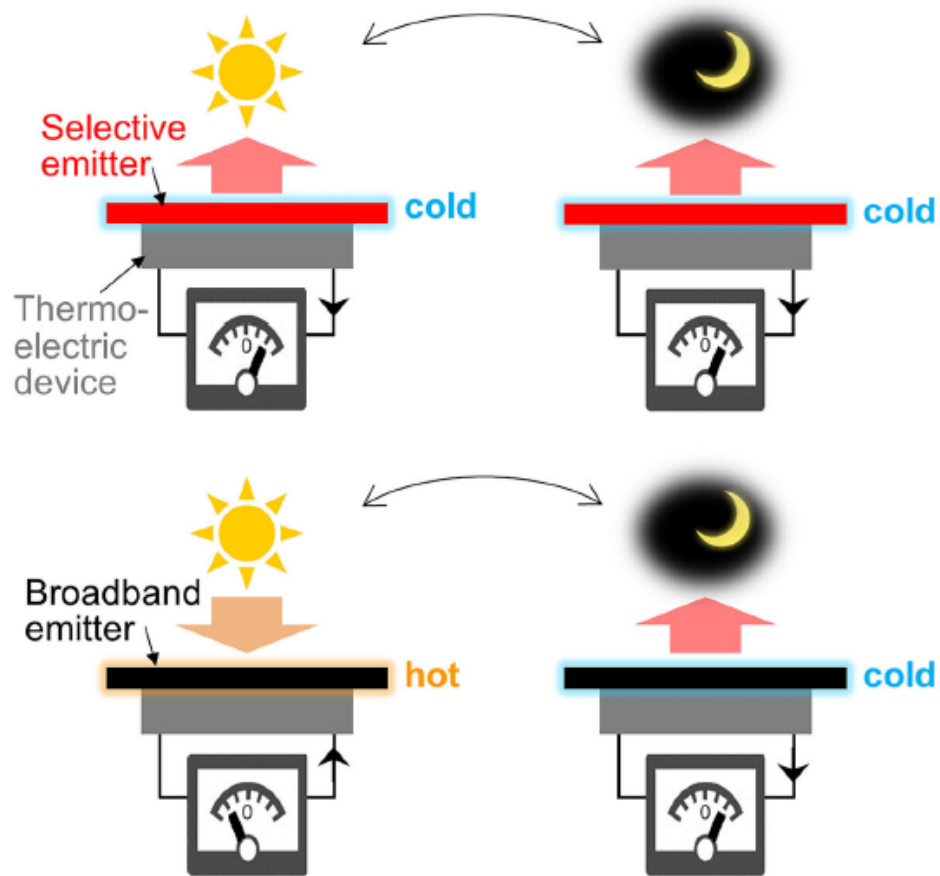
Huc is a "natural battery" that produces a sustained electrical current from air or added hydrogen. While this research is at an early stage, the discovery of Huc has considerable potential to develop small air-powered devices, for example as an alternative to solar-powered devices. The bacteria that produce enzymes like Huc are common and can be grown in large quantities, meaning we have access to a sustainable source of the enzyme. Dr. Grinter says that a key objective for future work is to scale up Huc production. "Once we produce Huc in sufficient quantities, the sky is quite literally the limit for using it to produce clean energy."

**More information:** Chris Greening, Structural basis for bacterial energy extraction from atmospheric hydrogen, *Nature* (2023). DOI: 10.1038/s41586-023-05781-7. [www.nature.com/articles/s41586-023-05781-7](http://www.nature.com/articles/s41586-023-05781-7)  
**Journal information:** Nature



## Cooling mechanism increases solar energy harvesting for self-powered outdoor sensors

July 7 2020



An illustration of thermoelectric devices using a wavelength-selective emitter and a broadband emitter. The device using a broadband emitter experiences a

voltage drop due to environmental temperature changes, while the device with a selective emitter remains constant thanks to daytime radiative cooling. Credit: Satoshi Ishii

Sensors placed in the environment spend long periods of time outdoors through all weather conditions, and they must continuously power themselves in order to collect data. Many, like photovoltaic cells, use the sun to produce electricity, but powering outdoor sensors at night is a challenge.

Thermoelectric devices, which use the [temperature](#) difference between the top and bottom of the device to generate power, offer some promise for harnessing naturally occurring energy. But, despite being more efficient than photovoltaics, many [thermoelectric devices](#) flip the sign of their voltage, meaning the [electrical current](#) changes the direction of its flow, when environmental temperatures change, so the voltage drops to zero at least twice a day.

"The sign of the thermoelectric device depends on the temperature difference between the top and bottom of the device," author Satoshi Ishii said. "Cooling can be used to create a temperature difference compared to the [ambient temperature](#), and if there is a temperature difference, thermoelectric generation is possible."

In a study published this week in *Applied Physics Letters*, the authors tested a thermoelectric device made up of a wavelength-selective emitter that constantly cools the device during the day using radiative cooling, the dispersion of thermal energy from the device into the air. As a result, the top of the device is cooler than the bottom, causing a temperature difference that creates constant voltage through day and night and various [weather conditions](#).

The authors compared a broadband emitter with a selective emitter, showing the selective emitter avoids the problem of the voltage dropping to zero during [environmental changes](#) in temperature.

"For the selective emitter, it is best to have emissivity close to unity in the atmospheric window, approximately 8 to 13 micrometers, where the atmospheric transmittance is high and thermal emission can effectively radiate into space, which in turn cools the device," Ishii said.

The device they tested is comprised of a 100-nanometer-thick aluminum film on the bottom of a glass substrate. The authors discovered that other sources of heat, such as the roof where a sensor might be mounted, can augment its ability to generate voltage.

"A large temperature difference results in a large thermoelectric voltage," Ishii said. "Using the heat on the backside of the device makes the temperature difference between the bottom and top larger, so heat from behind the [device](#) is beneficial for thermoelectric generation."

**More information:** "Radiative cooling for continuous thermoelectric power generation in day and night," *Applied Physics Letters* (2020). [aip.scitation.org/doi/10.1063/5.0010190](https://aip.scitation.org/doi/10.1063/5.0010190)

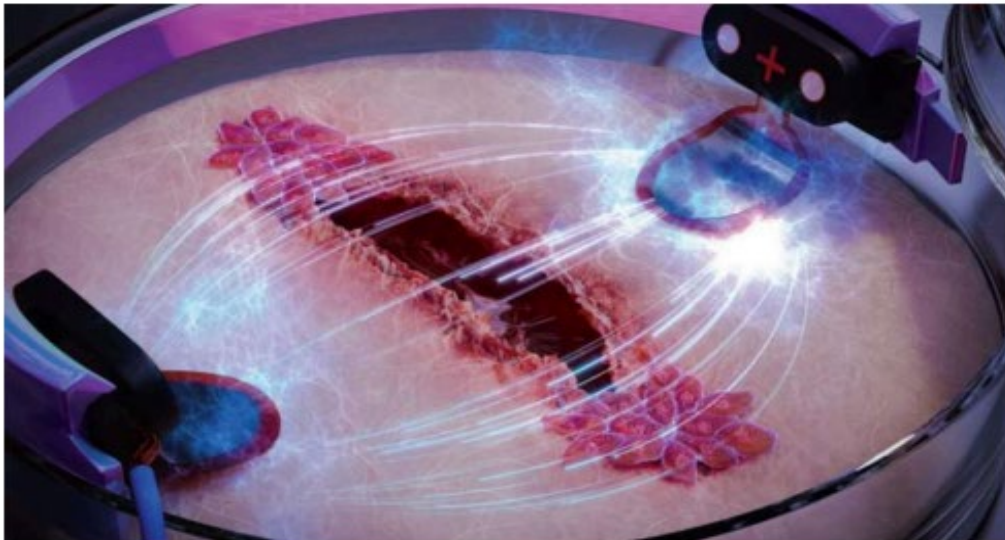
Provided by American Institute of Physics

Citation: Cooling mechanism increases solar energy harvesting for self-powered outdoor sensors (2020, July 7) retrieved 20 May 2024 from <https://phys.org/news/2020-07-cooling-mechanism-solar-energy-harvesting.html>



## How electricity can heal wounds three times faster

by Chalmers University of Technology



New research from Chalmers University of Technology, Sweden, and the University of Freiburg, Germany, shows that wounds on cultured skin cells heal three times faster when stimulated with electric current. The project was recently granted more funding so the research can get one step closer to the market and the benefit of patients. Credit: Science Brush, Hassan A. Tahini

Chronic wounds are a major health problem for diabetic patients and the elderly—in extreme cases they can even lead to amputation. Using electric stimulation, researchers in a project at Chalmers University of Technology, Sweden, and the University of Freiburg, Germany, have developed a method that speeds up the healing process, making wounds heal three times faster.

There is an old Swedish saying that one should never neglect a small wound or a friend in need. For most people, a small wound does not lead to any serious complications, but many common diagnoses make wound healing far more difficult. People with diabetes, spinal injuries or poor blood

based on the individual wound. We are convinced that this is the key to effectively helping individuals with slow-healing wounds in the future,” Asplund says.

**More information:** Sebastian Shaner et al, Bioelectronic microfluidic wound healing: a platform for investigating direct current stimulation of injured cell collectives, *Lab on a Chip* (2023). DOI: [10.1039/D2LC01045C](https://doi.org/10.1039/D2LC01045C)

**Journal information:** [Lab on a Chip](#)

Provided by [Chalmers University of Technology](#)

**Citation:** How electricity can heal wounds three times faster (2023, April 18) retrieved 20 May 2024 from <https://medicalxpress.com/news/2023-04-electricity-wounds-faster.html>

# Solar-Powered Vehicle Market will Growing at a CAGR of 37% by 2030 | SNS Insider

Solar-Powered Vehicle Market Segmentation by Electric Vehicle Type, by Battery Type (Lithium-ion battery, Lead-acid battery, Lead-carbon battery, Others), by Solar Panel (Monocrystalline, Polycrystalline), by Regions and Global Market Forecast 2023-2030

February 22, 2023 10:00 | Source: [SNS Insider pvt](#)

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Pune, Feb. 22, 2023 (GLOBE NEWSWIRE) -- According to SNS Insider "**[Solar-Powered Vehicle Market](#) Size was valued at USD 431.86 million in 2022 and is expected to reach USD 5359 million by 2030 and grow at a CAGR of 37% over the forecast period 2023-2030.**" Electric vehicles that use sun energy as a form of fuel for propulsion are known as solar powered vehicles. Photovoltaic cells, which are mounted on solar panels and are in charge of converting solar energy into electrical energy and storing it directly in the vehicle's battery, are a feature of solar vehicles. The material which is used to create these solar panels in the vehicles-silicon, absorbs heat and transforms it into electrical energy. The demand for solar vehicles has expanded as a result of the growing adoption of cutting-edge automotive technology, which is fueling the expansion of the solar vehicle market globally.

[Science](#) > [Energy](#)

# A Large-Scale Power Plant Has Turned Solar Power Into Hydrogen Fuel

The reactor is ready for the big time.

BY [TIM NEWCOMB](#) PUBLISHED: APR 20, 2023 12:15 PM EDT

**Researchers at the Swiss Federal Institute of Technology broke through the 1-kilowatt ceiling of green hydrogen generation using solar energy.**

**The system turns solar power into hydrogen, oxygen, and heat.**

The lab wants to find new ways to use solar to create useful energy sources.

Researchers in Switzerland took a promising lab experiment and scaled it into a real-world example of how we could use solar energy to produce green hydrogen. Their system broke the coveted 1-kilowatt ceiling for green hydrogen production, and offers a new commercialization opportunity.

This efficient convertor of solar energy to fuel functions as an efficient artificial photosynthesis system, according to a new study by the Swiss Federal Institute of Technology (EPFL) **published in *Nature Energy***.<sup>\*</sup> It also produces useful byproducts of oxygen and heat.

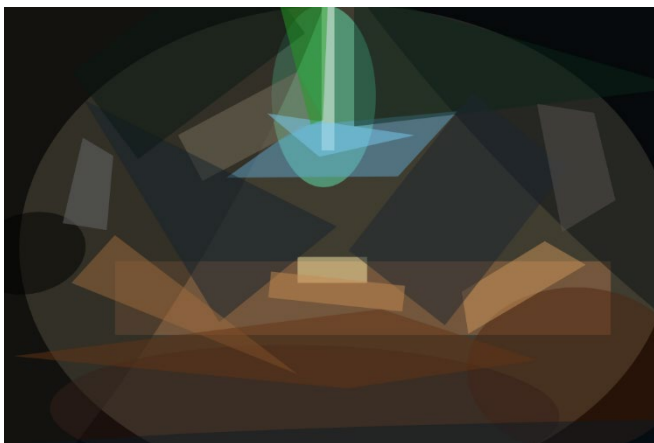
“This is the first system-level demonstration of solar hydrogen generation,” Sophia Haussener, head of the Laboratory of Renewable Energy Science and Engineering in the School of Engineering at EPFL, says in a news release. “Unlike typical lab-scale demonstrations, it includes all auxiliary devices and components, so it gives us a better idea of the energy efficiency you can expect once you consider the complete system, and not just the device itself.”

- Holmes-Gentle, I., Tembhurne, S., Suter, C. *et al.* Kilowatt-scale solar hydrogen production system using a concentrated integrated photoelectrochemical device. *Nat Energy* **8**, 586–596 (2023). <https://doi.org/10.1038/s41560-023-01247-2>

## Copper Catalyst Converts Carbon Dioxide into Liquid Fuels

The research could help in turning CO<sub>2</sub> into new, renewable solar fuels through artificial photosynthesis.

NASA Tech Briefs, Lawrence Berkeley National Laboratory, Berkeley, CA, May 1, 2023



Now, a research team led by Lawrence Berkeley National Laboratory (Berkeley Lab) has gained new insight by capturing real-time movies of copper nanoparticles (copper particles engineered at the scale of a billionth of a meter) as they convert CO<sub>2</sub> and water into renewable fuels and chemicals: ethylene, ethanol, and propanol, among others.

“This is very exciting. After decades of work, we’re finally able to show — with undeniable proof — how copper electrocatalysts excel in CO<sub>2</sub> reduction,” said Peidong Yang, a Senior Faculty Scientist in Berkeley Lab’s Materials Sciences and Chemical Sciences Divisions who led the study. Yang is also a Professor of chemistry and materials science and engineering at UC Berkeley. “Knowing how copper is such an excellent electrocatalyst brings us steps closer to turning CO<sub>2</sub> into new, renewable solar fuels through artificial photosynthesis.”

The work was made possible by combining a new imaging technique called operando 4D electrochemical liquid-cell STEM (scanning transmission electron microscopy) with a soft X-ray probe to investigate the same sample environment: copper nanoparticles in liquid. First author Yao Yang, a UC Berkeley Miller Postdoctoral Fellow, conceived the groundbreaking approach under the guidance of Peidong Yang while working toward his Ph.D. in chemistry at Cornell University.

Scientists who study artificial photosynthesis materials and reactions have wanted to combine the power of an electron probe with X-rays, but the two techniques typically can’t be performed by the same instrument.

<https://www.techbriefs.com/component/content/article/48112-copper-catalyst-converts-carbon-dioxide-into-liquid-fuels>

For more information, contact Theresa Duque at [tnduque@lbl.gov](mailto:tnduque@lbl.gov); 510-495-2418.

# Scientists manage to harvest energy from ripples in graphene

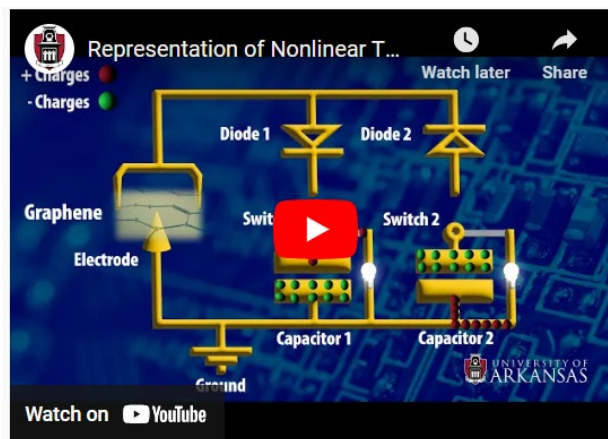
This innovative approach relies on out-of-the-box thinking resulting in a unique circuit design.

**Published:** Aug 21, 2023 06:06 AM EST, Tejasri Gururaj, Interesting Engineering

Obtaining useful energy from random fluctuations in systems at thermal equilibrium has been a long-standing challenge. When a system is in thermal equilibrium, the particles of the system are constantly in motion due to their thermal energy. These particles move randomly, colliding with each other and exchanging energy, but the overall energy distribution remains stable.

The challenge to harness energy from this disordered motion lies in channeling this inherent energy randomness into a controlled and usable outcome. Now, a team of scientists led by Paul Thibado from the University of Arkansas has found a way to harness energy from thermal fluctuations in graphene. The team achieved this by connecting a unique circuit to freestanding [graphene](#), a one-atom-thick graphite sheet.

The circuit design was chosen to overcome the condition set by the second law of thermodynamics, which says that useful energy can't be collected when both the circuit and the ripples are in thermal equilibrium, even if we use a diode. Using the unique setup with two diodes, the team found that they could slow down the process. As the circuit interacts with the particles in Brownian motion, it temporarily breaks equilibrium, allowing current to flow between the diodes and the charging of storage capacitors. This entire process occurs while adhering to thermodynamics' first and second laws.



<https://youtu.be/GYzsB55mfjE>

# Using the Oceans to Help Capture Carbon

## How can the deep blue seas fight climate change best?

PRACHI PATEL

15 AUG 2023, *IEEE SPECTRUM* [HTTPS://SPECTRUM.IEEE.ORG/DIRECT-OCEAN-CARBON-CAPTURE](https://spectrum.ieee.org/direct-ocean-carbon-capture)

Off a dock in the Port of Los Angeles, a 100-foot blue barge carrying large metal cages and tanks, electronic equipment, and a jumble of pipes and wires has been floating since mid-April. The dock belongs to the ocean research institute [AltaSea](#) and the barge to [Equatic](#), which is testing a daring new idea to remove carbon dioxide from the atmosphere—by sucking it out of the seas.

The oceans are a vast carbon sponge, absorbing a quarter of global CO<sub>2</sub> emissions. Removing the gas makes room for them to soak up more. Equatic's L.A. facility and another similar one in Singapore remove 100 kilograms of CO<sub>2</sub> from seawater daily. The company plans to have a 10-tonne-per-day unit running by 2025 in Singapore, and by 2028, expects to remove millions of tonnes of CO<sub>2</sub> annually.



Equatic's pilot won't be alone for long. By early fall, startup [Captura](#) will start operating a 100-tonne-per-year land-based plant also at AltaSea. Captura has been testing a smaller 1-tonne-per-year system in Newport Beach, Calif., since August 2022, and was one of [15 milestone winners](#) announced last spring by the XPrize Carbon Removal competition, one of only three

with ocean-based carbon-removal platforms.

The process consumes about 2.2 megawatt-hours of energy per tonne of removed CO<sub>2</sub>. But about half that energy cost is offset by the 35 kilograms of hydrogen produced per tonne of CO<sub>2</sub>. Boeing [signed a deal](#) in June to purchase 2,100 metric tons of green hydrogen from Equatic for sustainable aviation fuel.

Scaling beyond 100,000 tonnes per year will depend on increasing electrolyzer manufacturing capability, Sanders says. Electrolyzers are usually made for pure water, and saltwater electrolysis is relatively new, he says. Equatic makes proprietary electroplated anodes that are durable in that environment.

“We retain the chemistry of the ocean water as it comes out of the plant,” says Oldham. “You will see a slight increase in pH level because we took CO<sub>2</sub> out of ocean that creates a slightly higher alkalinity, but that is rapidly diffused in the wider ocean. We expect that within tens of meters from the outflow of the plant all ocean water will be back to its natural chemistry. We do not expect any negative environmental consequences on outflow. We have an oceanographer on staff and we are an open book.”

# Inside the Global Race to Tap Potent Offshore Wind

Here's why we need wind turbines that float

**PETER FAIRLEY**, 23 SEP 2023, IEEE SPECTRUM

IN A HANGAR AT THE UNIVERSITY OF EDINBURGH, A TRIANGULAR STEEL CONTRAPTION SITS BESIDE A GIANT TANK OF WATER. INSIDE THE TANK, A TECHNICIAN IN A YELLOW DINGHY ADJUSTS EQUIPMENT SO THAT THE TRIANGLED STRUCTURE CAN BE HOISTED INTO THE WATER TO SEE HOW IT DEALS WITH SIMULATED WAVES AND CURRENTS. ONE DAY SOON, A PLATFORM 50 TIMES AS LARGE MAY FLOAT IN THE DEEP WATERS OF THE NORTH SEA, BUOYING UP A MASSIVE WIND TURBINE TO HARVEST THE STEADY, STRONG BREEZES THERE. ABOUT AN HOUR'S RIDE UP THE COAST, FULL-SCALE 3,000-TONNE BEHEMOTHS ALREADY FLOAT IN ABERDEEN BAY, CAPTURING ENOUGH WIND ENERGY TO ELECTRIFY NEARLY 35,000 SCOTTISH HOUSEHOLDS.

THE PROTOTYPE AT THE FLOWAVE FACILITY—ONE OF 10 NEW FLOATING WIND-POWER DESIGNS TESTED HERE—IS PROGRESSING FAST, SAYS TOM DAVEY, WHO OVERSEES TESTING. “EVERYTHING YOU SEE HERE HAS BEEN MANUFACTURED AND PUT IN THE WATER IN THE LAST COUPLE MONTHS.”

THERE'S GOOD REASON FOR THIS HUSTLE: THE UNITED KINGDOM WANTS TO ADD 34 GIGAWATTS OF OFFSHORE WIND POWER BY 2030, EN ROUTE TO DECARBONIZING ITS GRID BY 2035. BUT THE SHALLOW WATERS EAST OF LONDON ARE ALREADY PACKED WITH WIND TURBINES. SCOTLAND'S DEEPER WATERS ARE THEREFORE THE U.K.'S NEXT FRONTIER. AUCTIONS HAVE SET ASIDE PARCELS FOR 27 FLOATING WIND FARMS, WITH A COMBINED CAPACITY EXCEEDING 24 GW.

[HTTPS://YOUTU.BE/6BGMCCOgcng](https://youtu.be/6BGMCCOgcng)



ON THE INNOVATION END ARE PEOPLE LIKE DAVEY AND THE FLOWAVE TEAM, WHO'VE ALREADY ADVANCED SEVERAL FLOATING WIND DEVICES TO SEA TRIALS. ONE FLOWAVE-TESTED PLATFORM, ENGINEERED BY COPENHAGEN-BASED STIESDAL OFFSHORE, WAS RECENTLY SELECTED FOR A 100-MEGAWATT WIND FARM TO BE BUILT OFF SCOTLAND'S NORTHERN TIP IN 2025.

TO FULLY UNDERSTAND WHAT DEVELOPERS ARE UP AGAINST, IT HELPS TO KNOW HOW HARD IT IS TO DEPLOY ANY KIND OF WIND POWER AT SEA. THE 15-MW TURBINES BEING ORDERED TODAY FOR TOMORROW'S OFFSHORE WIND FARMS WEIGH ROUGHLY 1,000 TONNES. THE FOUNDATIONS OF TRADITIONAL OFFSHORE WIND TURBINES ARE ALSO MASSIVE STEEL OR CONCRETE STRUCTURES THAT HAVE TO BE EMBEDDED IN THE OCEAN FLOOR. AND INSTALLING A TURBINE ATOP A TOWER THAT'S TWICE AS TALL AS THE STATUE OF LIBERTY REQUIRES DEDICATED AND COSTLY VESSELS, WHICH ARE IN SHORT SUPPLY WORLDWIDE.

YOU CAN DO WITHOUT SUCH VESSELS BY USING A FLOATING PLATFORM. THE EQUIPMENT CAN BE FULLY ASSEMBLED ON SHORE AND THEN TOWED TO THE SITE. BUT HAVING A PLATFORM THAT FLOATS COMPOUNDS THE CHALLENGE OF SUPPORTING THE TOWERING TURBINE.

# Plastic Waste Becomes Clean Hydrogen Goldmine

By [Haley Zaremba](#) - Oct 26, 2023, 3:00 PM CDT, [OilPrice.com](#)

- A technique called flash joule heating at Rice University can convert plastic waste, even unsorted and unwashed, into clean hydrogen and valuable graphene.
- If sold at just 5% of its market value, the graphene produced could make the hydrogen essentially free, provided the process is powered by renewable energies.
- While green hydrogen offers significant potential for decarbonization, especially in high-heat industrial applications, its production requires vast amounts of clean energy, necessitating a balanced approach to its adoption.



A study focused on turning waste plastics into high-value graphene just unlocked a new way of producing hydrogen that could transform the nascent industry and, on a grander scale, positively alter projected decarbonization pathways. The breakthrough could be a win-win for the environment, recycling plastic waste – of which the world has approximately 6.3 billion tons – while providing high-yield hydrogen gas which can be used as clean fuel, all while producing graphene as an end product which makes the whole process economically viable. The breakthrough is detailed in a new paper in *Advanced Materials*, <https://onlinelibrary.wiley.com/doi/10.1002/adma.202306763>. Until now, the relatively pricey process of creating green hydrogen (as compared to combustible fossil fuels) has been a major barrier for bringing the industry up to a commercial scale. While plenty of hydrogen is already being produced and used in industrial applications, all but a slim fraction of this is gray hydrogen, or hydrogen produced from fossil fuels including coal and gas. Green hydrogen is produced from clean energies and represents just a sliver of the current hydrogen market.

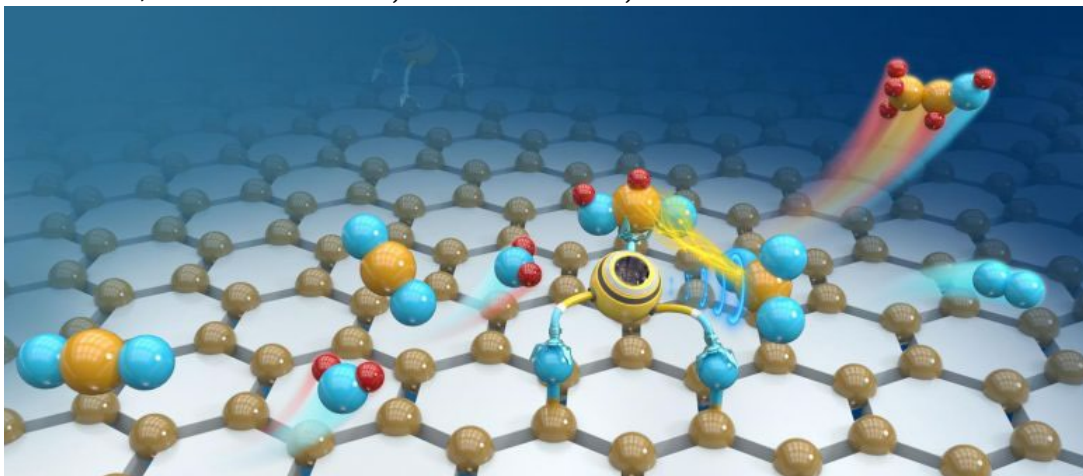
But if green hydrogen is being produced as a by-product of graphene production, the clean fuel pays for itself – and still yields a considerable profit. “We converted waste plastics—including mixed waste plastics that don’t have to be sorted by type or washed—into high-yield hydrogen gas and high-value graphene,” Kevin Wyss, who led the groundbreaking research at Rice, said in a press release. “If the produced graphene is sold at only 5 percent of current market value—a 95 percent off sale—clean hydrogen could be produced for free.” Of course, the process would still need to be powered with renewable energies for the hydrogen produced to be ‘green.’

The process involves a technique called flash joule heating, developed at Rice. “It involves grinding plastic into confetti-size pieces, mixing it with a conductive material, placing it in a tube, and then passing a very high voltage through it,” Singularity Hub recently reported. “This heats the mixture to around 5,000 degrees Fahrenheit in just 4 seconds, causing the carbon atoms in the plastic to fuse together into graphene and releasing a mix of volatile gases.” Of these gases, there was a significant amount of extremely pure hydrogen. Moreover, since all of the gases’ carbon is converted into graphene, the process does not release any carbon dioxide. **Bloomberg Green** wrote last year in report titled “Why Hydrogen Is the Hottest Thing in Green Energy. However, while it seems that converting all of these heavy industries to green hydrogen as soon as possible would be an obvious win for the environment, the reality is not quite so simple. Production of green hydrogen requires enormous amounts of clean energy which may be better used in other applications. A 2022 report by the **International Renewable Energy Agency (IRENA)** warns against the “indiscriminate use of hydrogen,” cautioning policy-makers to consider that overuse of green hydrogen “may not be in line with the requirements of a decarbonised world.” As such, diverting too much green energy toward hydrogen production could actually slow down the decarbonization movement as a whole.



# Eco-Friendly Breakthrough: Single Atom Catalyst Transforms CO<sub>2</sub> Into Ethanol

**TOPICS:** [Catalysts](#), [Chinese Academy Of Sciences](#), [Energy](#), [Ethanol](#), [Green Energy](#)  
By DALIAN INSTITUTE OF CHEMICAL PHYSICS, CHINESE ACADEMY SCIENCES, **SCITECHDAILY**, NOVEMBER 21, 2023



Tandem single atom electrocatalyst realizes reduction of CO<sub>2</sub> to ethanol. Credit: DICP

**A recent breakthrough in CO<sub>2</sub> reduction research involves a newly developed Sn-based catalyst that efficiently produces ethanol, representing a significant step forward in renewable energy technology.**

The electrochemical CO<sub>2</sub> reduction reaction (CO<sub>2</sub>RR) into carbon-based fuels provides a promising strategy to mitigate CO<sub>2</sub> emission and promotes the utilization of renewable energy.

## Challenges in CO<sub>2</sub> Reduction

C<sub>n</sub> (n≥2) liquid products are desirable because of their high energy densities and ease of storage. However, manipulation of C-C coupling pathway remains a challenge due to the limited mechanistic understanding.

## Breakthrough Research

Recently, a research group led by Profs. Tao Zhang and Yanqiang Huang from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS) has developed a Sn-based tandem electrocatalyst ( $\text{SnS}_2@\text{Sn}_1\text{-O}_3\text{G}$ ), which could reproducibly yield ethanol with a Faradaic efficiency of up to 82.5% at  $-0.9 \text{ V}_{\text{RHE}}$  and a geometric current density of  $17.8 \text{ mA/cm}^2$ .

The study was published recently in the scientific journal *Nature Energy*.

### Catalyst Development

The researchers fabricated the  $\text{SnS}_2@\text{Sn}_1\text{-O}_3\text{G}$  through a solvothermal reaction of  $\text{SnBr}_2$  and thiourea on a three-dimensional carbon foam. The electrocatalyst comprised  $\text{SnS}_2$  nanosheets and atomically dispersed Sn atoms ( $\text{Sn}_1\text{-O}_3\text{G}$ ).

### Mechanistic Insights

A mechanistic study showed that this  $\text{Sn}_1\text{-O}_3\text{G}$  could respectively adsorb  $^*\text{CHO}$  and  $^*\text{CO}(\text{OH})$  intermediates, therefore promoting C-C bond formation through an unprecedented formyl-bicarbonate coupling pathway.

Moreover, by using isotopically labeled reactants, the researchers traced the pathway of C atoms in the final  $\text{C}_2$  product formed over the catalyst of  $\text{Sn}_1\text{-O}_3\text{G}$ . This analysis suggested that the methyl C in the product comes from formic acid whereas the methylene C was from  $\text{CO}_2$ .

### Conclusion

“Our study provides an alternative platform for C–C bond formation for ethanol synthesis and offers a strategy for manipulating  $\text{CO}_2$  reduction pathways towards desired products,” said Prof. Huang.

Reference: “A tin-based tandem electrocatalyst for  $\text{CO}_2$  reduction to ethanol with 80% selectivity” by Jie Ding, Hong Bin Yang, Xue-Lu Ma, Song Liu, Wei Liu, Qing Mao, Yanqiang Huang, Jun Li, Tao Zhang and Bin Liu, 30 October 2023, *Nature Energy*.

[DOI: 10.1038/s41560-023-01389-3](https://doi.org/10.1038/s41560-023-01389-3)

# Company invents first-of-its-kind station for powering electric cars

**"Using more wind, solar and hydroelectric power is the key to survival."**

By Jeremiah Budin, TheCoolDown.com, December 28, 2023



Although electric vehicles are vastly more environmentally friendly than gas-powered cars, there are still environmental drawbacks to their usage, including the fact that much of the electricity we rely on comes from non-renewable, dirty energy sources such as gas and coal. To address this problem and allow people to power their EVs with clean energy from renewable sources, one company has developed what it is calling "the world's only hybrid generating system powered by both wind and sun."

The aptly named Wind & Solar Tower — which harvests energy from the wind and sun to power EVs — has been in development since 2007, initially as an energy source for farms. But its inventor, Jim Bardia, later pivoted to make it into a "self-powered high-capacity electric vehicle charging system that operates without adding to grid load."

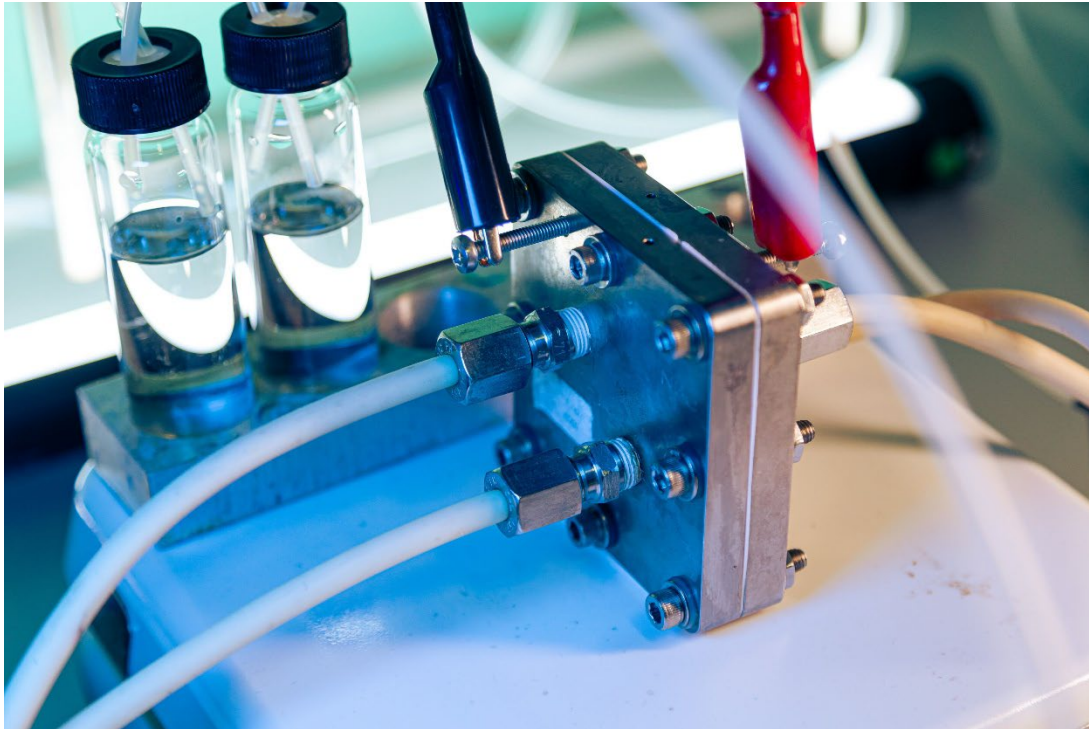
"Having a Wind and Solar Tower is like having a gas station with your own oil well," Bardia told EV Pulse. "It gives you a lot of flexibility when you don't have to buy the electricity." According to the product's website, the Wind & Solar Tower generates 234,154 kilowatt hours of electricity per year, which is enough to power an EV for 810,000 miles. The benefits of harvesting clean, renewable energy to power EVs practically go without saying, as the solution could save users money in the long run while also significantly decreasing pollution.

"We can't spend billions of dollars to build additional power plants that will increase pollution by burning more fossil fuels. Using more wind, solar and hydroelectric power is the key to survival of our grid and the continuation of the comfortable lives we've come to enjoy," Bardia told Times Live.

As for when it will appear on the market, EV owners hoping to generate their own electricity to power their cars will have to wait a bit yet — the Wind & Solar Tower recently debuted at the Detroit Auto Show, and Bardia is currently "actively negotiating the financing for a worldwide buildout of this practical, pollution-free EV charging system."

# A new system for producing green hydrogen cheaply and efficiently

Italian Institute of Technology, **Tech Xplore**, DECEMBER 13, 2023



What does it take to produce green hydrogen more efficiently and cheaply? Apparently, small **ruthenium particles** and a solar-powered system for water electrolysis. This is the solution proposed by a joint team involving the Istituto Italiano di Tecnologia (Italian Institute of Technology, IIT) of Genoa, and BeDimensional S.p.A. (an IIT spin-off). The technology, developed in the context of the Joint-lab's activities and recently published in *Nature Communications* and the *Journal of the American Chemical Society*, is based on a new family of electrocatalysts that could reduce the costs of green hydrogen production on an industrial scale.

Hydrogen is considered a sustainable energy vector, an alternative to fossil fuels. But not all hydrogen is the same when it comes to environmental impact. Indeed, the main way hydrogen is produced nowadays is through methane steam reforming, a fossil fuel-based process that releases carbon dioxide (CO<sub>2</sub>) as a by-product. The hydrogen produced by this process is classified as "gray" (when CO<sub>2</sub> is released into the atmosphere) or "blue" (when CO<sub>2</sub> undergoes capture and geological storage). To significantly reduce emissions to zero by 2050, these processes must be replaced with more environmentally sustainable ones that deliver "green" (i.e., net-zero emissions) hydrogen. The cost of "green" hydrogen critically depends on the energy efficiency of the setup (the electrolyzer) that splits water molecules into hydrogen and oxygen.

The researchers from the joint team of this discovery have developed a new method that guarantees greater efficiency than currently known methods in the conversion of electrical energy (the energy bias exploited to split water molecules) into the chemical energy stored in the

hydrogen molecules that are produced. The team has developed a concept of a catalyst and has used renewable energy sources, such as the electrical energy produced by a solar panel.

"In our study, we have shown how it is possible to maximize the efficiency of a robust, well-developed technology despite an initial investment that is slightly greater than what would be needed for a standard electrolyzer. This is because we are using a precious metal such as ruthenium," said Yong Zuo and Michele Ferri from the Nanochemistry Group at IIT in Genoa.

The researchers used nanoparticles of ruthenium, a noble metal that is similar to platinum in its chemical behavior but far cheaper. Ruthenium nanoparticles serve as the active phase of the electrolyzer's cathode, leading to an increased efficiency of the overall electrolyzer

"We have run electrochemical analyses and tests under industrially significant conditions that have enabled us to assess the catalytic activity of our materials. Additionally, theoretical simulations allowed us to understand the catalytic behavior of ruthenium nanoparticles at the molecular level; in other words, the mechanism of water splitting on their surfaces," explained Sebastiano Bellani and Marilena Zappia from BeDimensional, who were involved in the discovery. "Combining the data from our experiments with additional process parameters, we have carried out a techno-economic analysis that demonstrated the competitiveness of this technology when compared to state-of-the-art electrolyzers."

Ruthenium is a precious metal that is obtained in small quantities as a by-product of platinum extraction (30 tons per year, as compared to the annual production of 200 tons of platinum) but at a lower cost (18.5 dollars per gram as opposed to 30 dollars for platinum). The new technology involves the use of just 40 mg of ruthenium per kilowatt, in stark contrast with the extensive use of platinum (up to 1 gram per kilowatt) and iridium (between 1 and 2.5 grams per kilowatt, with iridium price being around 150 dollars per gram) that characterize proton-exchange membrane electrolyzers.

By using ruthenium, the researchers at IIT and BeDimensional have improved the efficiency of alkaline electrolyzers, a technology that has been used for decades due to its robustness and durability.

For example, this technology was on board of the Apollo 11 capsule that brought humanity to the moon in 1969. The new family of ruthenium-based cathodes for alkaline electrolyzers that has been developed is very efficient and has a long operating life, being therefore capable of reducing the production costs of green hydrogen.

"In the future, we plan to apply this and other technologies, such as nanostructured catalysts based on sustainable two-dimensional materials, in up-scaled electrolyzers powered by electrical energy from renewable sources, including electricity produced by photovoltaic panels," concluded the researchers.

**More information:** Yong Zuo et al, Ru–Cu Nanoheterostructures for Efficient Hydrogen Evolution Reaction in Alkaline Water Electrolyzers, *Journal of the American Chemical Society* (2023). [DOI: 10.1021/jacs.3c06726](https://doi.org/10.1021/jacs.3c06726)

Yong Zuo et al, High-performance alkaline water electrolyzers based on Ru-perturbed Cu nanoplatelets cathode, *Nature Communications* (2023). [DOI: 10.1038/s41467-023-40319-5](https://doi.org/10.1038/s41467-023-40319-5), **Journal information:** *Journal of the American Chemical Society* , *Nature Communications*

# "The KEY" New 16 GB Flash Drive: Twelve Conference Proceedings

Integrity Research Institute

PRESS RELEASE

December, 2023



For the first time, an accomplishment taking months of effort succeeded in placing all of the papers, select videos, and photos of twelve International **Conferences on Future Energy (COFE 1 – 12)** spanning twenty-five years into one compact flash drive. After years of work, the storage of the individual **Proceedings of COFE 1-12**, from conference host Integrity Research Institute, along with many selected videos (MP4 format), photos, and reviews, has been successfully archived in a stylish, durable, menu-driven key-shaped flash drive, suitable for a key ring, called **"The KEY. Vol. 1."** It literally contains the reports, Proceedings, videos, papers, and unavailable material all totaling more than \$1000 when sold individually over the past two decades.

As a sample of the contents, the initial COFE 1 was a historic event with fourteen scientists, including one cold fusion speaker and lots of media coverage, followed by a stellar group of scientists at every COFE afterwards. COFE 1 focused on emerging energy science, which in 1999 was so outside the box of narrow-minded power brokers that just investigating a government venue for it caused the organizer Thomas Valone to be dismissed from his position as Patent Examiner at the USPTO only a few months later, which was regained through arbitration. Historical details of that event, including news articles, audio recordings, and papers from the conference are all included in the KEY drive.

The KEY 16 gigabyte USB drive contents was recently summarized in its entirety with a 75-minute slideshow presentation on the internet show, **"Steve's Place," on December 10, 2023**. The KEY slideshow has been preserved with explanations and posted on [YouTube](#) with a video version of the 84 slides showing every pop-up menu and some samples for each of the twelve conferences (COFE 1-12) in only eight (8) minutes with Aether musical accompaniment! → <https://tinyurl.com/TheKEYcontents>

The description is automatically generated. The KEY shown here offers all of the major links to submenus, which are highlighted in the slideshow.

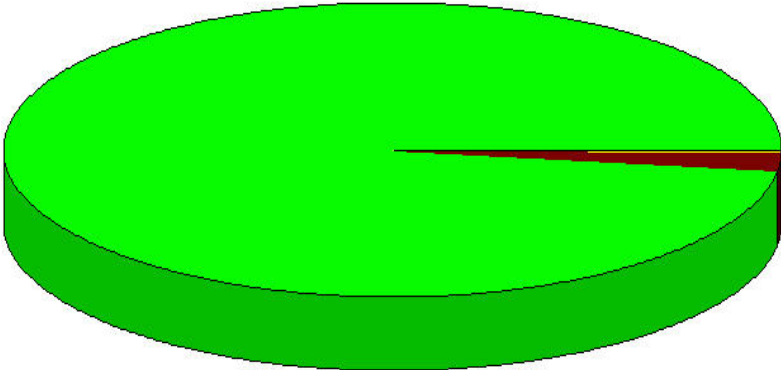
The KEY offers such a wide range of the COFE 1-12 collection from Integrity Research Institute that it can provide a valuable library archive of scientific and future-oriented discoveries to help students as well as teachers and professionals looking for future energy innovations, along with propulsion discoveries with Slides, Papers, and Videos, that do not burn fossil fuels to provide force, and bioenergetics drug-free electrotherapy inventions that do not have side effects.

With pharmaceutical companies and oil companies controlling much of our viewing media, it is a welcome relief to see honest breakthroughs in all areas of energy, propulsion, and bioenergetics which will help our future become more sustainable and healthy. Visit [TinyURL.com/KeyFlashDrive](https://TinyURL.com/KeyFlashDrive) to see more information and to **order The KEY** → <https://tinyurl.com/KEYflashdrive> for only \$45 or on Amazon for only **\$39**

# IRI FINANCIAL REPORT 2023

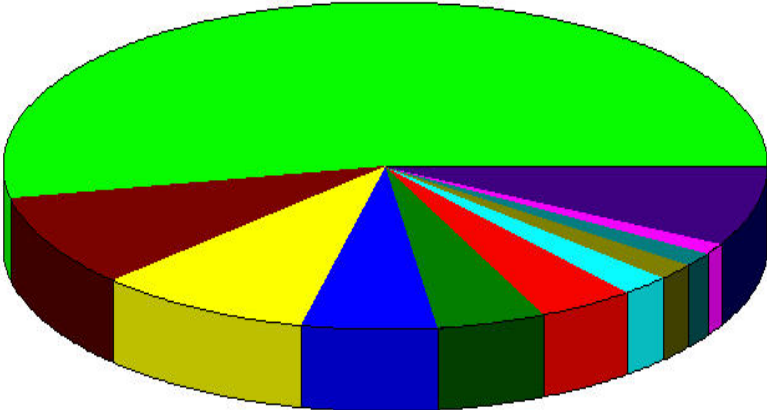
Income Summary  
January through December 2023

Sales	97.79%
Direct Public Support	2.13
Program Income	0.08
<b>Total</b>	<b>\$186,708.31</b>



Expense Summary  
January through December 2023

Parts for products	53.21%
Facilities and Equipment	9.36
Shipping costs	9.22
Telephone, Telecommunications	5.83
Books printed	4.68
Travel and Meetings	4.25
Supplies	2.11
Other Types of Expenses	1.67
Memberships and Dues	1.57
Software	1.21
Other	6.88
<b>Total</b>	<b>\$175,392.21</b>





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