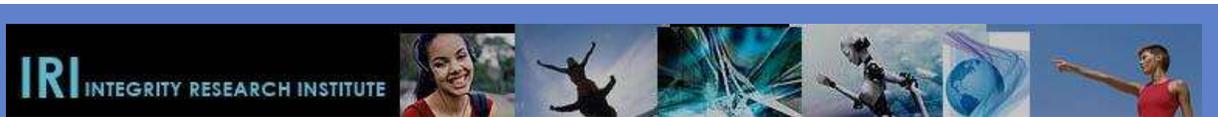

Future Energy eNews

From Integrity Research Institute <enews-integrityresearchinstitute.org@shared1.ccsend.com>

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IRI INTEGRITY RESEARCH INSTITUTE



Future Energy eNews

December 2025 Vol.26
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HAPPY NEW YEAR!

- 1. Chip-Scale Solar Thermal Electrical Power Generation**
- 2. Colour e-paper screen offers high-res video with low energy use**
- 3. First Space Solar Power Plant launches**
- 4. Hip, Knee, Joint, Back Pain Relief, with Electrotherapy book release**
- 5. New method splits water with electricity to produce hydrogen fuel**

Greetings!

We are ending the year with a hopeful note of optimism for the future with another set of breakthrough emerging energy inventions.

Story #1. To start off, we examine the international collaborative team's discovery of microfabricated thermoelectric generators (TEGs) which are ultrathin. Emphasizing that 70% of solar influx to PV is wasted as heat, a new **Molecular Solar Thermal (MOST)** power system can help recover lost solar power and turn it into electricity, in an open access journal article that continues to be cited in more recent developments. What makes this MOST system unique is its ability to "photoisomerize to a high-energy metastable photoisomer that can be stored for extended periods of time." In addition, "for an ideal liquid MOST device, up to 21% of the solar energy can be stored as chemical energy for later heat production." Of course, that is where the TEGs come in since "Thermoelectric generators (TEGs) are able to directly convert thermal energy into electrical power via the Seebeck effect." Further encouraging results are the 46,000 micro (MEMs) TEGs they packed into a 3-inch silicon wafer, sensitive to low-grade thermal energy. Therefore, to clarify the conversion process, solar energy >> MOST material >> MEMs-TEG >> electricity power output. A similar invention from 2024 is the use of solar and space energy sources with PV and TEGs in the Elsevier iScience journal <https://pmc.ncbi.nlm.nih.gov/articles/PMC11134926/>.

Story #2 was just released a month ago and possibly will create a new medium for color video displays that are disposable. With a breakthrough in tungsten-oxide nanodiscs for pixels, different spacings generate different colors so a range of colors is possible. Then with a refresh rate of 40 ms, it is fast enough to display video on a piece of paper! The number of pixels per inch is 25,000 which is outstanding. The work was done at the University of Cambridge and the journal reference is in Nature **DOI: 10.1038/s41586-025-09642-3**. Hopefully, a commercial manufacturer and distributor will be found soon.

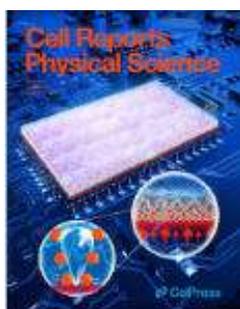
Story #3 is hot off the press, the day after Christmas, and reports on a **Caltech** experiment that successfully created a three-prong test for space solar power beaming microwaves back to earth. The system is based on their lightweight array structures, solar cells for space, and a demonstration of wireless power transmission with microwaves. While the cited article is a minimal report, the more in-depth article occurred in IEEE Spectrum <https://spectrum.ieee.org/space-based-solar-power> with an interview from the project leader, Dr. Ali Hajmiri. What is interesting to us at IRI is that the US Air Force has been pursuing the SAME invention at **Kirkland AFB** for years without much fanfare. Furthermore, IRI was fortunate to have the director Col. Eric Felt present the results and plans for their AFB work at our last **Conference on Future Energy (COFE12)** five years ago. It has been on YouTube ever since and the direct link to his amazing presentation is here https://youtu.be/n1CH9_0Fs0E?t=21220. Our guess is that the Air Force has their system already in operation by now.

Story #4 is the announcement in a Press Release of my new book, "**Hip, Knee, Joint, Back Pain, Stiffness Relief, Supplemented with Electrotherapy**," Recently, I was a guest once again on Coast to Coast AM with the focus on this topic and our connection to the NASA research aimed at bone loss of astronauts, along with their cartilage regeneration study and a patent on Tissue Repair. What IRI has discovered is that a past Conference on Future Energy introduced our mentor, a medical doctor named Glen Gordon, who invented the EMPulse, the forerunner of our modern EMPulser 78. About ten years later, we find that Dr. Gordon's circuit design, which was already based on an earlier NASA study for activating heat shock protein (HSP70), has been found to provide multiple benefits for astronauts and seniors here on earth. The circuit even *simulates* weight-bearing exercise, which is a big bonus for those who are elderly and sedentary. This book covers all of the above information and so much more, available in paperback, hardcover and Kindle ebook formats.

Story #5 is another discovery that was publicized this month. With a doubling of the hydrogen output and the lowering of costs by 40%, this new electrolysis process promises to be a real breakthrough. The new catalytic process with hydroxymethylfurfural (HMF) added to the anode chamber, as well as a modified copper catalyst, is explained in the *Chem. Eng. Journal* link <https://www.sciencedirect.com/science/article/pii/S1385894725109388?via%3Dihub> while the McGill University one-minute video is available at https://youtu.be/OQN_WJVKFnk.

We wish everyone a Happy New Year.
Tom Valone, Editor

1) Chip-scale solar thermal electrical power generation



Cell Reports Physical Science December 2025

There is an urgent need for alternative compact technologies that can derive and store energy from the sun, especially the large amount of solar heat that is not effectively used for power generation. Here, we report a combination of solution- and neat-film-based molecular solar thermal (MOST) systems, where solar energy can be stored as chemical energy and released as heat, with microfabricated thermoelectric generators to produce electricity when solar radiation is not available. The photophysical properties of two MOST couples are characterized both in liquid with a catalytic cycling setup and in a phase-interconvertible neat film. Their suitable photophysical properties let us combine them individually with a microelectromechanical ultrathin thermoelectric chip to use the stored solar energy for electrical power generation. The generator can produce, as a proof of concept, a power output of up to 0.1 nW (power output per unit volume up to 1.3 W m⁻³). Our results demonstrate that such a molecular thermal power generation system has a high potential to store and transfer solar power into electricity and is thus potentially independent of geographical restrictions.

READ MORE

2) Colour e-paper screen offers high-res video with low energy use

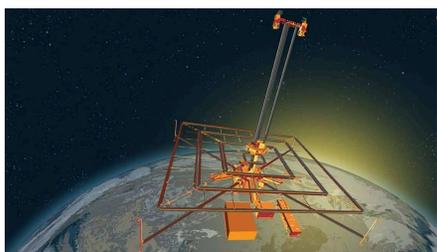
New Scientist, December 2025

A new kind of colour e-paper can present bright, high-resolution and full-colour images and video while using minimal energy, pointing to a possible future for display devices. While traditional LED screens emit red, green and blue light to produce colour, e-paper screens use tiny molecules to create images. Until recently, these devices were limited to black and white, but colour screens are now available.



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3) Humanity's first space solar power plant begins operation, launched from the US



Dairy 24 December 2025

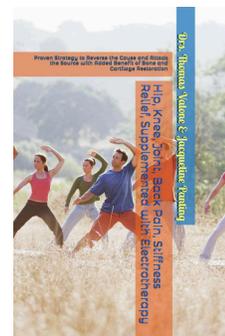
Interests in SBSP (space-based solar power plants) began as far back as 1968, when Peter Glaser, an engineer, posited that an orbital system of solar arrays in geostationary orbit could convert sunlight to microwaves and send the energy as a beam to Earth using rectennas. His research was so compelling that he received a US patent, which became the foundation of modern SBSP research.

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4) *Hip, Knee, Joint, Back Pain Relief with Electrotherapy* Book release

IRI Press Release, December 2025

In America alone, at least 50% of seniors experience osteoporosis, osteopenia, and even sarcopenia as they get older and hopefully wiser. Moreover, many of the present therapies available today only relieve pain temporarily and do not address the cause. A new book, "Hip, Knee, Joint, Back Pain, Stiffness Relief, Supplemented with Electrotherapy," gets to the source of the problems listed in the title, with a chapter devoted to each one. A handy resource book, it may become a classic in the popular field of non-invasive electromedicine. It is available as a paperback, hardcover, or Kindle ebook.



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5) New Electrochemical Process Spilts water with Electricity to produce Hydrogen Fuel

New Scientist December 2025

Scientists have developed a new technique that doubles the amount of hydrogen produced when splitting water molecules with electricity. The method works by adding a simple organic molecule and



a modified catalyst to the reactor. The adapted method lowers energy costs by up to 40% and may offer a "promising pathway for efficient and scalable hydrogen production," the researchers said in a new study published Dec. 1 in the Chemical Engineering Journal.

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