

A new bio-inspired solar leaf design with increased harvesting efficiency

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Concept of a PV-branch of PV-leaves. Credit: Gan Huang

New research suggests a new solar energy design, inspired by nature, may pave the way for future renewable energy technologies.

Photovoltaic solar energy is obtained by converting sunshine into [electricity](#)—and researchers from Imperial have developed a new leaf-like design with increased efficiency.

The new photovoltaic leaf (PV-leaf) technology uses low-cost materials and could inspire the next generation of renewable energy technologies.

A series of experiments has demonstrated that a PV-leaf can generate over 10% more electricity compared to conventional solar panels, which lose up to 70% of the incoming solar energy to the environment. The paper, "High-efficiency bio-inspired hybrid multi-generation photovoltaic leaf," was published in *Nature Communications*.

The new PV-leaf design developed here at Imperial could also produce over 40 billion cubic meters of freshwater annually, if it is the technology deployed to reach solar panel targets by 2050.

This design eliminates the need for pumps, fans, control units and expensive porous materials, can generate additional clean water and [thermal energy](#), and adapt to [ambient temperature](#) and solar condition variations.

Inspiration from nature

A typical plant leaf is made of different structures which enable it to move water from the plant's roots to its leaves through a process called transpiration.

Taking inspiration from plant leaves, the PV-leaf concept mimics the transpiration process, allowing water to move, distribute and evaporate. Natural fibers mimic leaf vein bundles while hydrogels simulate sponge cells, so a PV-leaf can effectively and affordably remove heat from solar PV cells.

Dr. Gan Huang, Honorary Research Fellow in the Department of Chemical Engineering, and author of the study said, "This [innovative design](#) holds tremendous potential for significantly enhancing the performance of solar panels, while also ensuring [cost-effectiveness](#) and practicality."

Professor Christos Markides, Head of Clean Energy Processes Laboratory, and author of the study, said, "Implementing this innovative leaf-like design could help expedite the global energy transition, while addressing two pressing global challenges: the need for increased energy and freshwater."

More information: Gan Huang et al, High-efficiency bio-inspired hybrid multi-generation photovoltaic leaf, *Nature Communications* (2023). [DOI: 10.1038/s41467-023-38984-7](https://doi.org/10.1038/s41467-023-38984-7)

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