

No Sun, No Battery, No Problem: IIT Indore's Device Generates Electricity Using Just Water and Evaporation

Scientists at the **Indian Institute of Technology Indore** have created a unique device that can produce electricity using only water and air. This device does not need sunlight, batteries or moving parts. It works silently by using the natural process of water evaporation to draw thermal energy from the atmosphere. This everyday phenomenon has now been turned into a clean and green power source for small electronic devices.

The invention comes from the **Sustainable Energy and Environmental Materials (SEEM) Lab at IIT Indore**, led by **Prof. Dhirendra K. Rai** and his research team member **Khushwant Singh**. They have developed a special membrane made of graphene oxide which is a layered form of carbon combined with zinc-imidazole, a stabilizing compound. When this membrane is partly dipped in water, it begins generating electricity. As the water travels upward through the membrane's special channels and evaporates, positive and negative ions get separated at opposite ends, creating a voltage. This process keeps going as long as evaporation continues, leading to constant electricity generation.

One of the most striking features of this device is that it works without any external power. A single membrane of $3 \times 2 \text{ cm}^2$ can generate up to 0.75 volts, and combining multiple membranes can give more power for bigger applications. It works not just with clean water but also with salty or muddy water from rivers or the sea and remains stable for months. This makes it very useful for areas where electricity is hard to access or where the power supply is unreliable.

This device has many possible uses from powering environmental sensors in forests and farms to emergency lighting during blackouts or even running low-power medical wearables in remote clinics. Since it does not need sunlight, it can work indoors at night or during cloudy weather, offering an edge over solar panels. It's lightweight, portable, and uses ordinary water, even unfiltered, making it ideal for challenging environments or emergencies.

"This innovation reflects IIT Indore's commitment to creating socially relevant and practical solutions through science," said **Prof. Suhas S. Joshi, Director, IIT Indore**. "Generating electricity from something as simple and natural as water evaporation opens up a world of possibilities, especially for off-grid and underserved communities. It is a shining example of how fundamental scientific curiosity can lead to impactful and sustainable technologies for the future."

Think of it as a self-charging power source, fueled by nothing more than air and water," said **Prof. Dhirendra K. Rai**. "As long as there's water to evaporate, the device keeps generating power — quietly, cleanly, and sustainably. It's a simple way to tap into nature's

energy without relying on any external source. The idea was to use materials that are both effective and affordable so that this technology could one day be used in real-world settings, especially in rural or off-grid areas.”

Looking ahead, the team plans to make the device even more cost-effective by using materials like clay-based compounds or common minerals. Its simple design, with no complex wiring or costly components, makes it easy to mass-produce in the future for homes, villages, and wearable tech. The goal is not to replace large power plants but to fill the gap by powering small devices where other sources fail. It acts like nature’s own trickle charger, drawing clean energy without pollution or waste.

Prof. Rai also sees exciting possibilities like energy-generating smart clothes or walls that power indoor sensors. This innovation is a reminder that India’s scientific research can offer practical solutions for real-world problems. Turning something as basic as evaporation into a power source reflects how curiosity and persistence can uncover powerful ideas hidden in plain sight.

