# Singapore researchers convert rainwater into electricity with breakthrough plug flow technology



Researchers at the National University of Singapore have developed a novel technology that converts the energy from falling raindrops into electricity, marking a significant advancement in renewable energy generation. The innovation employs a phenomenon called plug flow, whereby water flows in segmented slugs through a vertical tube, enhancing electrical charge separation and enabling the conversion of over 10 per cent of the rainwater’s energy into usable electricity. This efficiency surpasses traditional methods by a remarkable five orders of magnitude.

The system operates by allowing raindrops to fall into slender vertical polymer tubes where the water forms short bursts or plugs separated by air pockets. As these plugs descend, they generate electrical charges along the conductive inner surface of the tube. Wires placed at both ends of the tube capture the generated electricity. According to Siowling Soh, PhD, a member of the research team, “Water that falls through a vertical tube generates a substantial amount of electricity by using a specific pattern of water flow: plug flow.” While previous techniques only produced charge along the water’s surface, this segmented flow significantly boosts charge separation, resulting in greater energy capture.

Initial experiments utilised slower droplet speeds than those naturally occurring in rainfall, yet the researchers anticipate higher electricity yields under natural conditions. Further tests demonstrated that using two tubes simultaneously or sequentially doubled the energy output. Subsequently, the team expanded the system to four tubes, successfully powering 12 LED lights continuously for 20 seconds, illustrating the practical potential of the technology.

The implications of this development are particularly noteworthy for urban centres, where traditional hydroelectric power is often unfeasible due to a lack of suitable water bodies. The simplicity and efficiency of the design mean that rooftops and other urban surfaces could be converted into mini power stations that harness rainwater for clean energy production. Furthermore, this technology offers promising possibilities for remote or energy-poor regions that struggle to access conventional electricity sources.

By tapping into the natural abundance of rainfall, this approach contributes to ongoing efforts to diversify and decentralise renewable energy sources amidst growing concerns over climate change and energy security. The research highlights the unexplored potential of everyday natural phenomena to address global energy challenges.

Looking ahead, the research team intends to refine and optimise the system for enhanced power generation from smaller volumes of water. Integrating this technology with existing infrastructure could transform urban energy landscapes and facilitate a shift towards more sustainable and locally sourced forms of electricity.

The Rude Baguette is reporting on this pioneering work, underscoring its significance in expanding the toolkit of sustainable energy technologies that harness natural resources beyond conventional means.

Source: [Noah Wire Services](https://www.noahwire.com)

## References

* <https://www.euronews.com/green/2025/04/17/clean-energy-from-rain-scientists-generate-electricity-from-falling-droplets> - This article confirms that researchers at the National University of Singapore have generated electricity from raindrops falling through vertical tubes, lighting up 12 LEDs, and explains the use of plug flow to enhance charge separation and electricity generation efficiency.
* <https://thebrewnews.com/science-technology/raindrop-electricity-generation/> - This source supports the claim that the novel technology converts over 10% of rainwater’s energy into electricity using plug flow, showing the scalability of the system with multiple tubes and practical demonstrations such as powering 12 LEDs for 20 seconds.
* <https://www.sciencedaily.com/releases/2025/04/250416135601.htm> - ScienceDaily reports on the NUS team's discovery that water falling through a vertical tube generates substantial electricity through the plug flow pattern, reinforcing the scientific basis of the energy conversion method.
* <https://scitechdaily.com/shocking-simplicity-scientists-turn-falling-rain-into-renewable-energy/> - This article highlights the simplicity and effectiveness of the new system to convert falling rain into electricity, emphasizing the potential for urban and remote usage where traditional hydroelectric power is impractical.
* <https://www.zmescience.com/science/news-science/scientists-found-a-way-to-turn-falling-rainwater-into-electricity-using-a-simple-plastic-tube/> - ZME Science explains the plug flow phenomenon and the experimental success of using narrow plastic tubes to convert falling rainwater into electricity, including the ability to power small bulbs, confirming the practical application of the technology.