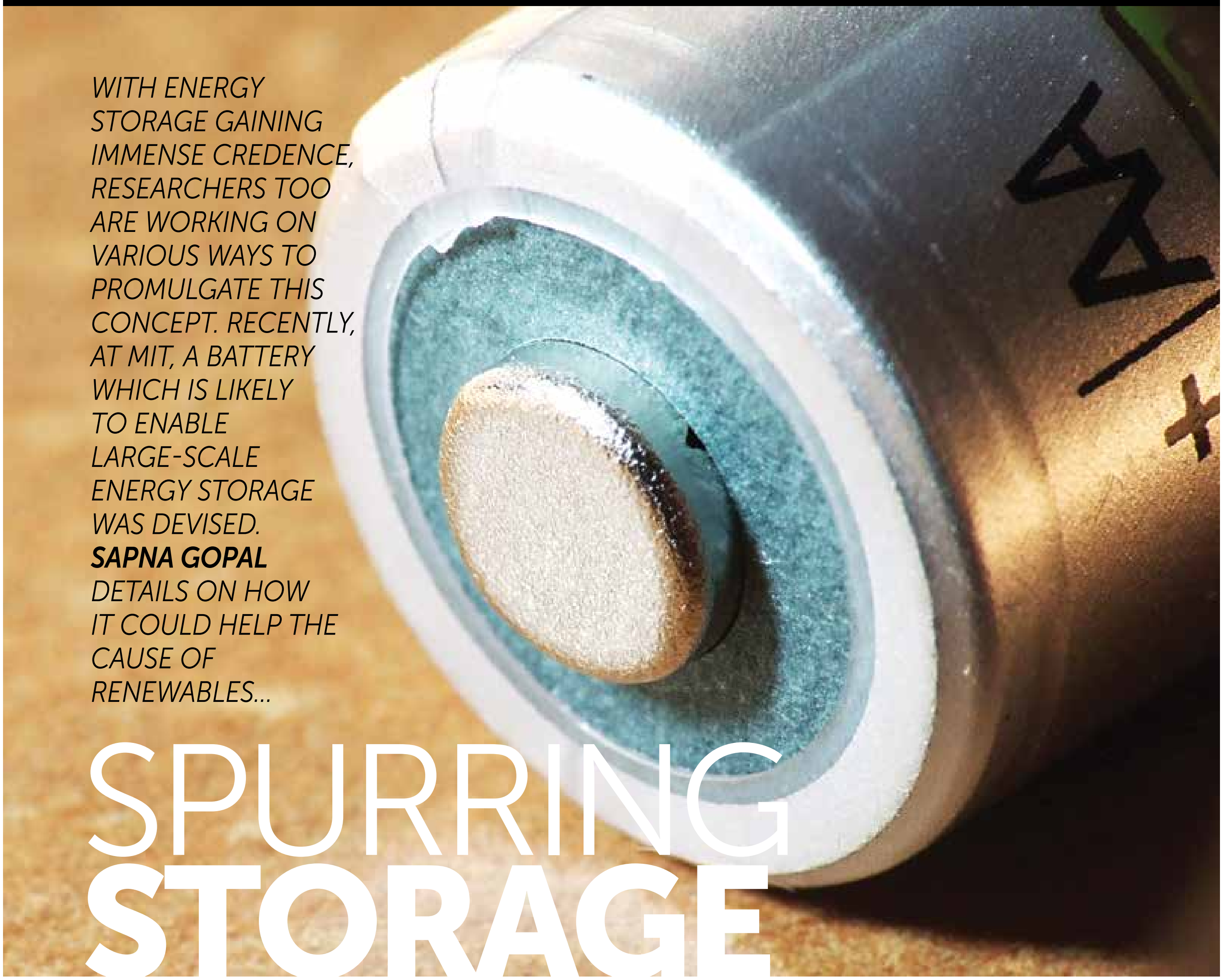


WITH ENERGY STORAGE GAINING IMMENSE CREDENCE, RESEARCHERS TOO ARE WORKING ON VARIOUS WAYS TO PROMULGATE THIS CONCEPT. RECENTLY, AT MIT, A BATTERY WHICH IS LIKELY TO ENABLE LARGE-SCALE ENERGY STORAGE WAS DEVISED. ***SAPNA GOPAL*** *DETAILS ON HOW IT COULD HELP THE CAUSE OF RENEWABLES...*

SPURRING **STORAGE**

A new rechargeable flow battery engineered by researchers at MIT, doesn't rely on expensive membranes to generate and store electricity. In times to come, it is likely to enable cheaper, large-scale energy storage. Explaining how it will work, William Braff, a graduate student in mechanical engineering, states: "The battery we have developed has three key traits that give it an advantage in providing low cost energy storage. The first is that as a flow battery; it stores its reactants outside the electrochemical cell itself, which allows for storage of large quantities of energy in low-cost tanks. Secondly, it uses abundant, low-cost reactants, further reducing the cost of energy storage. The third important trait of the battery is that the cell is able to generate very high power densities. This ensures that the electrochemical cell can be as small and low cost as possible."

In fact, this palm-sized prototype generates three times as much power per square centimeter as other membraneless systems — a power density that is an order of magnitude higher than many lithium-ion batteries and other commercial and experimental energy-storage systems. Elaborating on how it will help, Braff adds, "One of the biggest hurdles in the development of low cost flow batteries for energy storage is that the electrochemical cell is expensive to manufacture. Even without the requirement of a membrane, the cell accounts for a very significant portion of the total cost of the system. Increasing the power density of the system means that for a given application, a smaller, less expensive cell can be used, minimising the overall cost of the system."

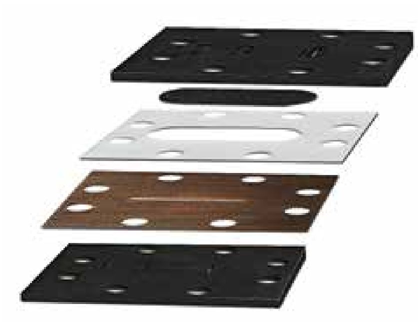
Also, this innovation stores and releases energy in a device that relies on a phenomenon called laminar flow. Laminar flow is a type of fluid flow in which the liquid moves in smooth, parallel layers. These layers serve as an effective barrier between the two electrodes in the cell. Two liquids are pumped through a channel, undergoing electrochemical reactions between two electrodes to store or release energy. Under the right conditions, the solutions stream through in parallel, with very little mixing. The flow naturally separates the liquids, without requiring a costly membrane. Braff explains that if the fluid were to move about a thousand times faster than it currently does in the cell, laminar flow would be disrupted by turbulence.

Impact on renewables

With the market demand for energy storage over the next decade expected to grow to hundreds of billions of dollars, assuming that certain critical cost targets are met, this device could also help renewable sources of power such as wind and solar since low-cost energy storage has the potential to foster their widespread use.

Cullen Buie, an assistant professor of mechanical engineering at MIT, believes that storage is an enabling technology for renewable energy technologies such as photovoltaic panels and wind turbines. "Our group is still in the early stages of developing this technology, but if we can play a role in reducing the cost of energy storage, the consequences could be very significant."

"The nature of the sun and the wind is that the output of solar and wind plants can't be controlled to match demand. As a result, they can only make up a small fraction of the power generation on the grid without disastrous consequences. Low cost energy storage could solve this problem by storing excess energy when it is available, and then releasing that energy when it is most needed," adds Buie.

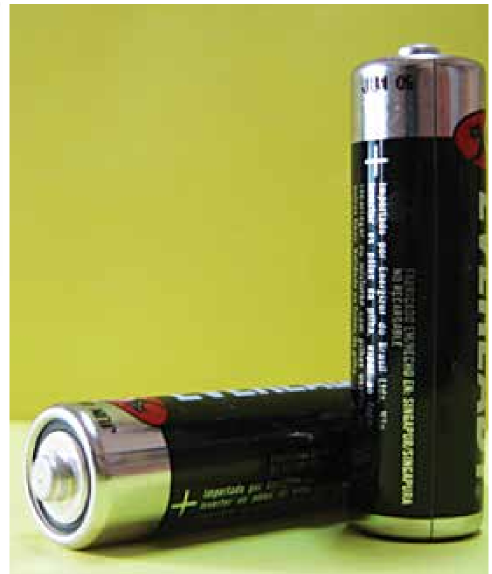


By designing a flow battery without a membrane, the group was able to remove two large barriers to energy storage; cost and performance. Membranes are often the most costly component of a battery and the most unreliable

As of now, it is estimated that the membraneless flow battery may produce energy costing as little as $100 per kilowatt-hour. Martin Bazant, a professor of chemical engineering, MIT, adds, "The technology we have developed is still in the early stages, but based on the performance advantages we have observed so far and the cost of existing systems, we think that $100 per kilowatt hour of storage is reasonable."

While there is a long way to go, Bazant is hopeful of this innovation helping the energy sector. "One of the real strengths of our new battery is the extent to which builds on existing technologies, many of which have been around for a long time. Like any new technology, there are technical risks involved, but we believe that the concept is very feasible. Were it to be successful, it could play a key role in allowing renewable energy generation to continue to advance, and in providing a cleaner, more robust electrical grid."

Photo: Felice Frankel



For countries such as India, grappling with energy storage, this could be of immense value. Bazant is of the opinion that if energy storage were to be deployed on to the electrical grid in a substantial way, the peak loads that typically produce energy shortages could be 'levelled', reducing strain on the grid and minimising energy shortages. "Additionally, a little over 12 per cent of energy produced in India is using renewable resources, making it the fifth largest renewable generator in the world. Low cost energy storage could help India establish its position as a leader in clean energy technologies."