Sustainable Large Scale Stationary Energy Harvesting: Optimization and Engineering Stability

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We engineers, optimize and design a novel large-scale battery technology suitable for stationary application for harvesting the electrical energy from the natural resources (renewables), either solar or wind farms. The unsteady support of energy in these systems requires the steady storage during the time for consumption proportional to the demand.

There has been many efforts for developing different energy storage mechanisms and batteries remain the most common system as the clean source of electrical energy. In particular, the stationary aspect of energy harvesting removes the design barriers for minimization of gravimetric and volumetric energy capacity, allowing for the utilization of cost-effective electrode materials (such as zinc) as well as stable electrolytes higher conductivity (such as acidic solutions) due to establishment of more secure packaging and using flow battery systems with higher electrolyte performance will be viable.

Additionally, our multi-dimensional research aims to surpass the performance metrics of conventional metal-based batteries in terms of charge capacity and operating life-span. We engineer the integration of operative methods with chemical compositions as well as mechanical packaging of the rechargeable battery with emphasis on the membrane stability for resisting side-reaction and corrosion. Ultimately we define the space of parameters for stationary battery chemistry, mechanics and dynamics for safe and sustainable operation of the novel rechargeable battery.

The significance of our research is carrying out both experimental and computational research. Therefore not only we understand and complement our results but also we explore and verify them interchangeably. The final output of the research will be numerous publications in the energy field fabrication of a safe and high-energy density rechargeable battery with a respective calibrated smart charger, which will be patented and utilized for commercialization purpose.

In the broader context, our proposal intends tends to boost the charge-capacity of the rechargeable batteries by incorporating new electrode materials with significantly higher gravimetric and volumetric energy-density. As well, the proposal seeks to increase the longevity and health metrics of the newly-proposed rechargeable battery by proposing new chemical composition for the electrolyte and engineering a new architecture for such physically insulting, albeit ionically conductive membrane. Therefore by sustaining and stabilizing a premium rechargeable battery the recycling frequency to the environment will be reduced, leading to consumption of significantly less chemicals, polymer membranes, electrode materials as well as packaging components.