Flow batteries freetown

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While you may be familiar with traditional battery types such as lead-acid, Ni-Cd and lithium-ion, flow batteries are a lesser-known but increasingly important technology in the energy storage sector.

Actually, the development of flow batteries can be traced back to the 1970s when Lawrence Thaller at NASA created the first prototype of this battery type. Now flow batteries haev evolved into a promising technology for certain solar energy storage applications.

A flow battery"s cell stack (CS) consists of electrodes and a membrane. It is where electrochemical reactions occur between two electrolytes, converting chemical energy into electrical energy.

Unlike traditional rechargeable batteries, the electrolytes in a flow battery are not stored in the cell stack around the electrodes; rather, they are stored in exterior tanks separately.

Apart from the tanks for storing electrolytes, other auxiliary parts of a flow battery generally include pipes and valves for electrolyte flow control, pumps for circulating electrolytes, sensors for monitoring temperature, pressure and flow rate, and a control system.

Specifically, each tank of a flow battery contains one of the electrolyte solutions. The electrolytes are pumped through a cell stack, where they flow past electrodes immersed in the solutions. These electrodes are separated by a membrane that allows the passage of ions but prevents the mixing of the electrolytes.

During charging, an external power source such as solar power drives the oxidation-reduction reactions (one electrolyte loses electrons while the other gains electrons), storing energy in the electrolytes. During discharging, the reverse reactions occur, releasing the stored energy as electricity.

As a newer battery energy storage technology, flow batteries hold some distinct strengths over traditional batteries. But without question, there are some downsides that hinder their wide-scale commercial applications.

Flow batteries exhibit superior discharge capability compared to traditional batteries, as they can be almost fully discharged without causing damage to the battery or reducing its lifespan. Traditional batteries like lead-acid and lithium-ion ones, on the other hand, can experience a decreased lifespan and reduced performance if they are frequently deeply discharged.

Talking about lifespan from a chemical standpoint, flow batteries store energy in electrolytes and involve reversible chemical reactions, allowing for decoupling of power and energy capacity--being charged and discharged repeatedly without significant degradation.

In contrast, most prevalent lithium-ion batteries are known to suffer from degradation mechanisms such as lithium plating, growth of passivated surface film layers on electrodes, and loss of recyclable lithium ions and electrode material, all of which adversely affect their longevity.

Additionally, certain amount of heat will be generated during the operation of lithium-ion batteries and the capacity of them decreases during cycling, leading to a reduction in their overall lifespan.

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