

Building a better battery – Energy Storage Solutions for Clean Energy!

Solar panels and wind turbines can't always produce energy at the time it is needed. As a result, some homeowners have banks of lithium ion batteries to store solar energy for use at night. But if you wanted to power hundreds of households with energy from a large wind turbine or solar farm you would need a much larger battery. Fortunately, there are some technologies that can store electricity for the grid.

One example of a system used for large scale energy storage is a **Pumped-Storage Plant** shown in Figure 1. These plants use electricity from solar or wind to run motors that pump the water up hill to a reservoir where the water is stored to "charge" the battery. The plant "discharges" by releasing water to flow down hill to the power turbines just like a hydroelectric dam. These plants are about 70-80% efficient at storing energy, however, they require large volumes of water to store significant energy. Currently Pumped-Storage plants account for most of the global energy storage. Unfortunately, there aren't many sites where these systems can be used.

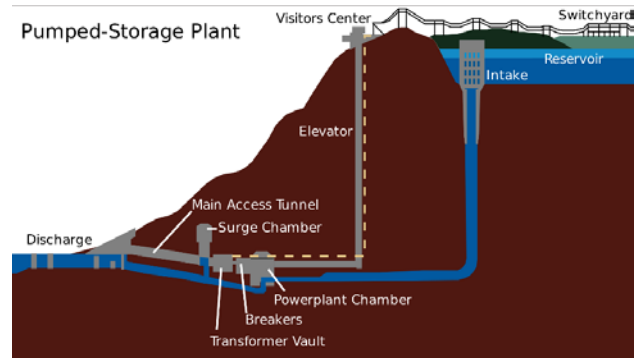


Figure 1: Pumped-Storage Plant Design

One exciting alternative for large scale storage are **Flow Batteries** which use chemical reactions to store and release energy. Large tanks of **electrolytes** are charged up when electricity is added across a **membrane**. During discharge the electrolytes are circulated and electricity is produced across the membrane. One advantage to flow cell batteries is they are much smaller and more portable than a pump-storage plant. Flow batteries are also more durable and safer than regular batteries and operate at 75-80% efficiency. Another advantage is that flow cell batteries can be easily adapted to meet the user's needs. If you need more power, the size of the membrane can be increased and to get more energy, you increase the volume of electrolytes. One type of flow battery fits inside a metal shipping container and has the capacity to store 2.2 MWh (mega-Watt hours) of energy. Since the average American household uses 28.9 kWh/day, the battery could power 76 households for 1 day on a single charge.

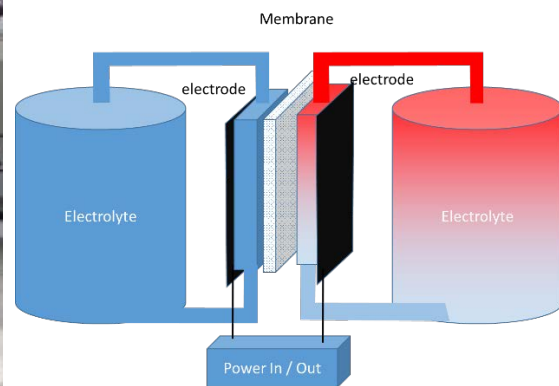


Figure 2: UniEnergy Flow Battery Source – <http://www.uetechologies.com>

Check your understanding:

Why do we need large scale electrical storage?

How do Pumped-Storage Plants work?

What form is the energy stored in a hydroelectric dam?

What limits the use of pumped storage?

What is an advantage to flow batteries?

Where is the energy stored in a flow battery?