

# Building Better Batteries: Moving to 3D

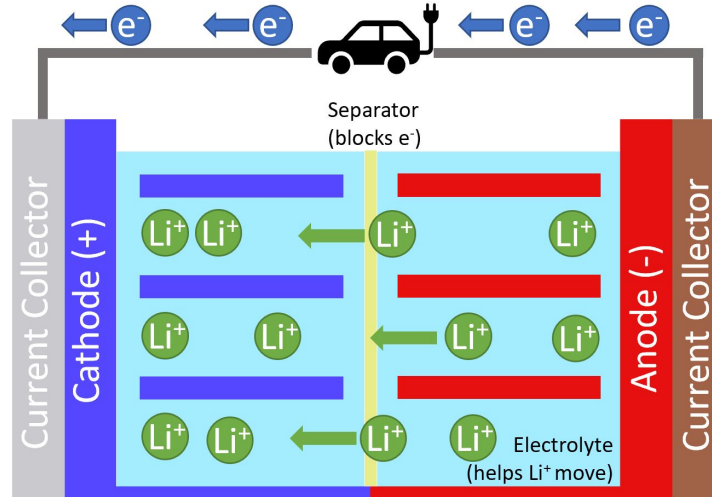
## I. What Are Batteries? How do they work?

Lithium-ion batteries power everything from cell phones to electric cars.

Electrons follow ions to create electric current that generates power.



Tries to stay together

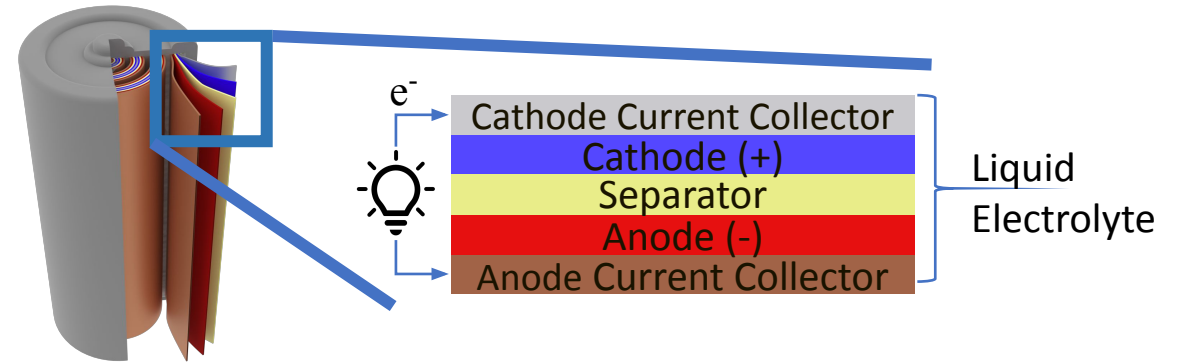


## II. Inside a Battery

**Energy:** How many ions can be stored (amount of sand)

**Power:** How fast ions move (speed of sand)

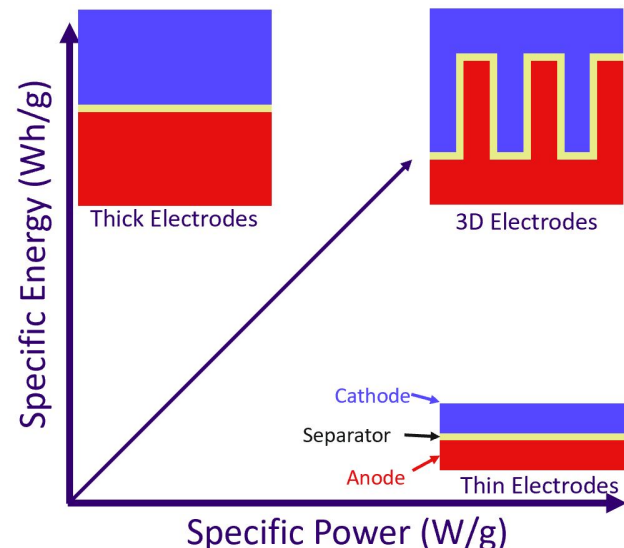
These are determined by the amount of active material (cathode & anode).



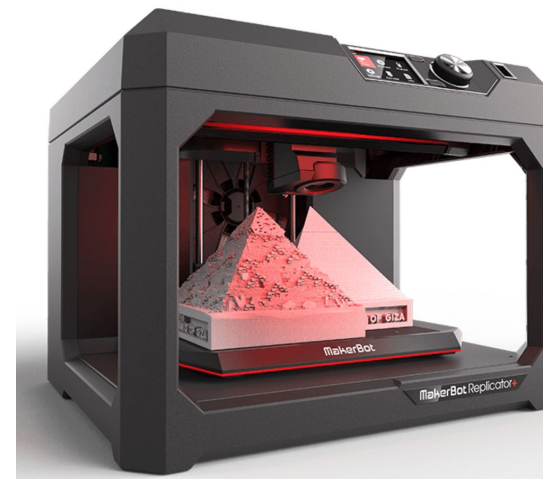
## III. Benefits of 3D Batteries

Traditional batteries give you either high energy or high power.

3D batteries can give you **both!**



## IV. 3D Batteries at CEI

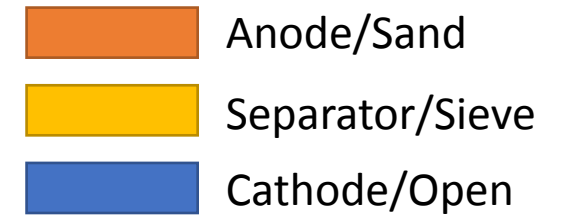


Source: [MakerBot](#)

3D batteries can't be made with current manufacturing technology.

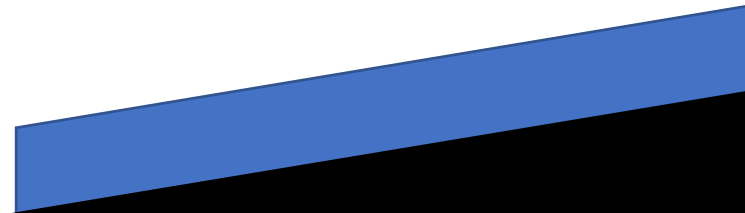
Researchers at CEI are exploring ways to make 3D batteries with additive manufacturing, or 3D printing.

# Demo Pieces



## Thin Electrode

- Sand goes quickly from orange to blue (high power density)
- Does not hold a lot of sand (low energy density)



## Thick Electrode

- Sand goes slowly from orange to blue (low power density)
- Holds a lot of sand (high energy density)

Top View



Side View

## 3D Electrode

- Sand goes quickly from orange to blue (high power density)
- Holds a lot of sand (high energy density)

