The NEC Supercap from Arbor Scientific has a rating of 1 Farad.

How do they do it?

The capacitance increases accordingly.

The capacitance of a capacitor is given by the formula: 

\[ C = \frac{Q}{V} \]

where: 
- \( C \) is the capacitance in Farads (F) 
- \( Q \) is the charge in Coulombs (C) 
- \( V \) is the voltage in Volts (V)

The capacitance of a capacitor increases when the area of the plates increases and the distance between the plates decreases.

Two ways of increasing capacitance:

1. Increasing the area of the plates
2. Decreasing the distance between the plates

DC motors or other circuit users for the bulbs.

The experiment may be repeated adding another bulb in series to double the resistance. Additional applications could substitute small discharge.

The bulb will glow as long as the capacitor discharges.

When the capacitor is fully charged the bulb will cease to glow.

The bulb will glow while the capacitor charges; this may take some time because the Supercap has a large capacitance.

Two plates separated by an insulating dielectric, called the dielectric. A capacitor is a device which has the ability to store an electric background.
It is believed that at every interface there exists an array of oriented dipoles (atoms or molecules with their ends oppositely charged). When an electric field is applied across this array, it orients these dipoles in such a way as to cause this layer to act as a dielectric (a very thin dielectric on the order of one or two molecules thick).

The two materials serving as interface media in the NEC Supercap are activated carbon and sulfuric acid. Activated carbon is ground to a powder and mixed with sulfuric acid to form a paste. The surface area of the activated carbon is approximately 1,000 meters\(^2\) per gram. The combination of this very large surface area with the very small distance between the capacitor "plates" results in a capacitance of about 200 to 400 Farads per gram of activated carbon.

One problem with these materials is that if more than 1.2 volts is applied to this junction, the aqueous sulfuric acid solution breaks down. To remedy this, the Supercap incorporates a number of small cells, each consisting of a "sandwich" of the paste separated by a porous material. Each cell is encompassed by an impermeable gasket (to hold everything together) squeezed between two electrically conductive ends. The whole system is pressurized.

**General Information**

Your NEC Supercap has a capacitance of 1.0 Farads at a rated voltage of five volts DC. It will hold a charge for about 200 hours at 20 degrees Celsius. Its leakage current is roughly 10 microamps at room temperature.

Because of the way it is constructed, the Supercap will not present a hazard if a voltage higher than that recommended is applied. At voltages above 1.2 V, the individual cells become non-conductive as water in the sulfuric acid solution vaporizes. The Supercap will not explode like standard electrolytic capacitors; it will simply cease to work.

**Applications**

The primary industrial application of these capacitors is in the protection of memory circuits during temporary power losses. The educational applications of this amazing technology, however, are many.

One simple experiment demonstrates the ability of capacitors to serve as timing devices. It may be presented as a demonstration or lab (we recommend the latter for its hands-on involvement).

Individual cells are stacked in series (end to end) and squeezed into a metal outer cover. By stacking them in series, the effective voltage of each cell is multiplied to useful proportions.

Set up the circuit illustrated with a 6 volt lantern battery (6.3V @ 150 mA), and the capacitor. Use jumper wires to make the necessary connections.