Charging a capacitor requires work. The work done is equal to the potential energy stored in the capacitor.

While charging, $V$ increases linearly with $q$:

$$V(q) = \frac{q}{C}.$$ 

Increment of potential energy:

$$dU = Vdq = \frac{q}{C}dq.$$ 

Potential energy of charged capacitor:

$$U = \int_0^Q Vdq = \frac{1}{C} \int_0^Q qdq = \frac{Q^2}{2C} = \frac{1}{2}CV^2 = \frac{1}{2}QV.$$ 

Q: where is the potential energy stored? 
A: in the electric field.