Electric Field Energy and Configuration (Potential) Energy
LIANXI MA, Blinn College — While electric field energy is the same as configuration energy in some special cases, in general they are two different concepts. Field energy stands for the energy caused by the existence of the electric field and configuration energy stands for the energy needed to assemble the system. A simple example is for a dipole the field energy is positive according to $U = \int \frac{1}{2}\varepsilon_0 E^2 dV$ while the configuration energy is negative according to $U = -k\frac{q^2}{r}$. Although the apparent conflict has been explained by Jackson, in addition to the detailed mathematical derivation to show that the self energy is involved in the first equation but not in the second, we show that the configuration energy is equal to the field energy minus self energy. The infinity of the field energy of a point charge is avoided by supposing the charge be distributed in a ball with radius R. Electron's and proton's radii are calculated in this model.

Lianxi Ma
Blinn College