If the electric field at the Earth's surface is \( +170 \) V/m, and 1000 m above the surface is \( +112 \) V/m, calculate the energy stored in the electric field in a cube 1000 m on a side with the bottom at the Earth's surface. Assume the variation in \( E \) is linear in the distance above the surface. (That is, use \( E = E_0 + ah \), and evaluate \( a \).)

\[
E = \int_0^{1000} \frac{1}{2} \varepsilon E^2 \, dh
E = \frac{\varepsilon}{2} E_0 \int_0^{1000} (E_0 + ah) \, dh
\]

\[
= \frac{\varepsilon}{2} E_0 \left( E_0 h + \frac{h^2}{2} \right) + a \frac{h^3}{3}
\]

\[
= \frac{\varepsilon}{2} \left( E_0 (1000) + \frac{(1000)^2}{2} \right) + a \frac{(1000)^3}{3}
\]

\[
= \frac{1000}{2} \left( 8.85 \times 10^{-12} \right) \left( (170)^2 + 2(170)(-0.058) \frac{(1000)^2}{2} + (0.058) \frac{(1000)^3}{3} \right)
\]

\[
\approx 89.2 \ J
\]