Energy Density Within Solenoid

Energy is stored in the magnetic field inside the solenoid.

- Inductance: $L = \mu_0 n^2 A\ell$
- Magnetic field: $B = \mu_0 n I$
- Potential energy: $U = \frac{1}{2} L I^2 = \frac{1}{2\mu_0} B^2 (A\ell)$
- Volume of solenoid interior: $A\ell$
- Energy density of magnetic field: $u_B = \frac{U}{A\ell} = \frac{1}{2\mu_0} B^2$