Energy in an Inductor

When a electric current is flowing in an inductor, there is energy stored in the magnetic field. Considering a pure inductor L, the instantaneous power which must be supplied to initiate the current in the inductor is

$$P = iv = Li\frac{di}{dt}$$

so the energy input to build to a final current i is given by the integral

$$\text{Energy stored} \ = \ \int_0^I P dt = \int_0^I Li'di' = \frac{1}{2}LI^2$$

Using the example of a solenoid, an expression for the energy density can be obtained.