Impact of Dielectric (1)

What happens when a dielectric is placed into a capacitor with the **charge on the capacitor** kept constant?

	vacuum	dielectric
charge	Q_0	$Q = Q_0$
electric field	E_0	$E = \frac{E_0}{\kappa} < E_0$
voltage	V_0	$V = \frac{V_0}{\kappa} < V_0$
capacitance	$C_0 = \frac{Q_0}{V_0}$	$C = \frac{Q}{V} = \kappa C_0 > C_0$
potential energy	$U_0 = \frac{Q_0^2}{2C_0}$	$U = \frac{Q^2}{2C} = \frac{U_0}{\kappa} < U_0$
energy density	$u_E^{(0)} = \frac{1}{2}\epsilon_0 E_0^2$	$u_E = \frac{u_E^{(0)}}{\kappa} = \frac{1}{2}\kappa\epsilon_0 E^2 < u_E^{(0)}$

Impact of Dielectric (2)

What happens when a dielectric is placed into a capacitor with the **voltage across the capacitor** kept constant?

	vacuum	dielectric
charge	Q_0	$Q = \kappa Q_0$
electric field	E_0	$E = E_0$
voltage	V_0	$V = V_0$
capacitance	$C_0 = \frac{Q_0}{V_0}$	$C = \frac{Q}{V} = \kappa C_0 > C_0$
potential energy	$U_0 = \frac{1}{2} C_0 V_0^2$	$U = \frac{1}{2} C V^2 = \kappa U_0 > U_0$
energy density	$u_E^{(0)} = \frac{1}{2} \epsilon_0 E_0^2$	$u_E = \kappa u_E^{(0)} = \frac{1}{2} \kappa \epsilon_0 E^2 > u_E^{(0)}$