The conversion of 1 kg/hour would supply 1.5 times the world power production (for 2011).
A 15-gallon tank of gasoline could power the world for 2 1/2 days.

But: when U-235 undergoes fission, only about 0.09% of mass is converted to energy.
\[ \rho = \frac{u}{c^2}, \]  

where \( \rho \) = mass density, \( u \) = energy density.

The photon has zero rest mass:

\[ |\vec{p}|^2 - \frac{E^2}{c^2} = 0, \quad \text{or} \quad E = c|\vec{p}|. \]

Redshift:

\[ n_\gamma \propto \frac{1}{a^3(t)}, \quad E_\gamma \propto \frac{1}{a(t)} \quad \Rightarrow \quad \rho_\gamma = \frac{u_\gamma}{c^2} \propto \frac{1}{a^4(t)}. \]

Radiation-Dominated Era:

\[ u_r = 7.01 \times 10^{-14} \text{ J/m}^3 \quad \Rightarrow \quad \frac{\rho_{r,0}}{\rho_{m,0}} \approx 3.1 \times 10^{-4}. \]

Assuming that \( a(t) \propto t^{2/3} \) from \( t_{eq} \) until \( t_0 \) (crude approximation), find \( t_{eq} = (3.1 \times 10^{-4})^{3/2} t_0 \approx 75,000 \) yr, for \( t_0 = 13.8 \) Gyr.

\[ \frac{\rho_{r}(t)}{\rho_{m}(t)} = \frac{a(t_0)}{a(t)} \times 3.1 \times 10^{-4}, \]

\[ \frac{\rho_{r}(t_{eq})}{\rho_{m}(t_{eq})} = 1 \quad \Rightarrow \quad \frac{a(t_0)}{a(t_{eq})} = \frac{1}{3.1 \times 10^{-4}} \approx 3200. \]
Friedmann equations:

\[
\left( \frac{\dot{a}}{a} \right)^2 = \frac{8\pi}{3} G \rho - \frac{k c^2}{a^2} \quad \text{ (matter-dominated universe)}
\]

\[\ddot{a} = -4\pi G a \rho,\]

\[\dot{\rho} = -3 \frac{\dot{a}}{a} \rho\]

Becomes inconsistent if

\[\dot{\rho} = -3 \frac{\dot{a}}{a} (\rho + \frac{p}{c^2})\]

Solution:

\[\ddot{a} = \frac{4\pi}{3} G \left( \rho + \frac{3p}{c^2} \right) a\]