Chapter 33 Problem 57 [†]

Given
$P = 10^9\ W$
$m = 1\ g$

Solution
Find the time city could be powered.

From the rest mass energy we have

$$E = mc^2$$

Power is just the energy used per time

$$P = E/t$$

Solving for time gives

$$t = \frac{E}{P} = \frac{mc^2}{P}$$

Substituting in the provided values gives

$$t = \frac{(1.0 \times 10^{-3}\ kg)(3.0 \times 10^8\ m/s)^2}{10^9\ W} = 9.0 \times 10^4\ s$$

The city could be powered for 25 hours.

[†]Problem from Essential University Physics, Wolfson