

The JETS Challenge

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Challenge 81 – The Shower Challenge

Problem:

A typical shower lasts about 10 minutes and uses a flow rate of 5 gallons of water per minute (gpm). Assume water enters the water heater at 50°F and flows to the shower at a nominal temperature of 105°F. The equation for calculating the rate that energy must be added in the water heater is given by

$$Q = 500 * \text{gpm} (T_{\text{out}} - T_{\text{in}})\Delta t$$

Where Q = the annual energy usage in BTU
gpm = the flow rate of water in gpm
 T_{out} = temperature leaving the water heater
 T_{in} = temperature entering the water heater
 Δt = number of hours of operation required annually

How much energy does a typical family of four use in a year if everyone takes one shower per day?

Solution:

4 showers per day

365.4 = 1,460 showers per year

14,600 minutes

= 243. $\bar{3}$ hrs. per year = Δt

$Q = 500.5 (105-50) \cdot 243.\bar{3}$

$Q = 33,453,750 = 33.46 \times 10^6$ BTU/yr.

$$\text{Gpm} = 5$$

$$T_{\text{out}} = 105^\circ$$

$$T_{\text{in}} = 50^\circ$$