4. An electric heater supplies heat to a system at a rate of 100W. If system performs work at a rate of 75 Joules per second. At what rate is the internal energy increasing?

Sol. Heat is supplied to the system at a rate of 100 W.

$\therefore$ Heat supplied, Q = 100 J/s

The system performs at a rate of 75 J/s.

$\therefore$ Work done, W = 75 J/s

From the first law of thermodynamics, we have:

Q = U + W

Where,

U = Internal energy

$\therefore$ U = Q - W

= 100 - 75

= 25 J/s

= 25 W

Therefore, the internal energy of the given electric heater increases at a rate of 25 W.