Consider the simple series circuit should in [Electric Circuits and Interconnection Laws](#_bookmark85) [(Page 45)](#_bookmark85). In performing our calculations, we defned the current iout to fow through the positive-voltage terminals of both resistors and found it to equal



. The voltage across the resistor ***R2*** is the output voltage and we found it to equal



Consequently, calculating the power for this resistor yields



Consequently, this resistor dissipates power because ***P2*** is positive. This result should not be surprising since we showed (p. 41) that the power consumed by **any** resistor equals either of the following.



Since resistors are positive-valued, **resistors always dissipate power**. But where does a resistor's power go? By Conservation of Power, the dissipated power must be absorbed somewhere. The answer is not directly predicted by circuit theory, but is by physics. Current fowing through a resistor makes it hot; its power is dissipated by heat.

**Note:** A physical wire has a resistance and hence dissipates power (it gets warm just like a resistor in a circuit). In fact, the resistance of a wire of length L and cross-sectional area A is given by



The quantity *ρ* is known as the **resistivity** and presents the resistance of a unit-length, unit cross-sectional area material constituting the wire. Resistivity has units of ohm- meters. Most materials have a positive value for *ρ*, which means the longer the wire, the greater the resistance and thus the power dissipated. The thicker the wire, the smaller the resistance. Superconductors have zero resistivity and hence do not dissipate power. If a room-temperature superconductor could be found, electric power could be sent through power lines without loss!