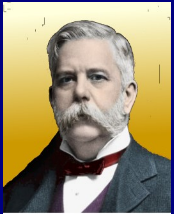
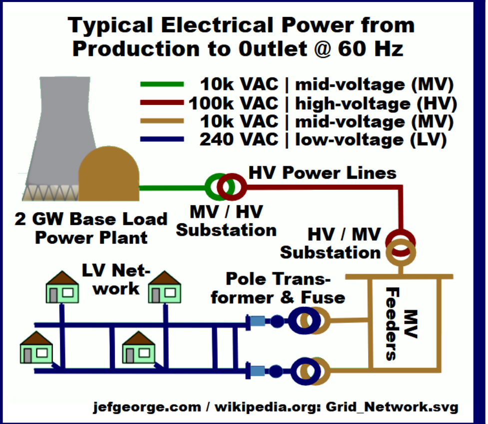
Moving Electricity Efficiently



Westinghouse
1846 – 1914

In 1896, Westing-house Electric gave power to Buffalo, New York 26 miles (42 km) from Niagara Falls. Based on Ohm’s Law, the design cut heat loss ($P_{Loss}\downarrow$) by reducing the transmission current ($I_{Tran}\downarrow$) across power line resistance ($R_{Tran}\bullet$).

$$\eta_{eff} \equiv (P_{Load}\bullet)/[(P_{Load}\bullet)+(P_{Loss}\downarrow)]$$
$$(P_{Loss}\downarrow) = (R_{Tran}\bullet)(I_{Tran}\downarrow)^2$$
$$(P_{Load}\bullet) = (V_{Tran}\uparrow)(I_{Tran}\downarrow)\ \eta_{eff}$$



For a set power ($P_{Load}\bullet$), the reduced current ($I_{Tran}\downarrow$) cut losses ($P_{Loss}\downarrow$), driving efficiency (η_{eff}) toward unity. The transmission voltage ($V_{Tran}\uparrow$) was stepped up by transformers to meet the required load ($P_{Load}\bullet$).

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