energy dissipated = same

\[ P = I^2 R = (I_0 e^{-t/\tau})^2 R \]

Energy = \[ \int_0^\infty P \, dt = \frac{I_0^2 R \cdot \tau}{2} = \frac{I_0^2 L}{2} \]
Energy Storage

Power Company Storage Unit

e.g. want 100 kW for 8 hours

\[ \text{energy} = 10^5 \text{W} \times 30,000 \text{ s} = 3 \times 10^9 \text{ J} \]

suppose \( I = 1000 \text{ A} \), \( L = ? \)

compare: 1 barrel oil \( \sim 10^{10} \text{ J} \)
1 stick dynamite \( \sim 10^6 \text{ J} \)