RL Circuit: Energy Transfer During Current Buildup

Loop rule: $IR + L\dfrac{dI}{dt} = \mathcal{E} \quad (I > 0,\ \dfrac{dI}{dt} > 0)$

- $I\mathcal{E}$: rate at which EMF source delivers energy
- $IV_R = I^2R$: rate at which energy is dissipated in resistor
- $IV_L = LI\dfrac{dI}{dt}$: rate at which energy is stored in inductor

Balance of energy transfer: $I^2R + LI\dfrac{dI}{dt} = I\mathcal{E}$