Georgia Institute of Technology

Linear Circuits

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An introduction to linear electric circuit elements and a study of circuits containing such devices.

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Power and Energy

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- *Calculate power and energy*
- *Describe the difference between power and energy*
- *Use conservation of energy to find unknown energy*
- *Use power to calculate current or voltage*

Previous Class

- Voltage – electrical potential
- Battery charging and discharging

Module 1: Background

- Charge
- Current
- Voltage
- Power
- Energy
- Circuit Introduction

Lesson Objectives

- Calculate power from energy function
- Calculate energy from a power function
- Use conservation of energy to find power of an unknown device
- Calculate power from voltage and current
- Find a voltage or a current for a device with a known power

Power

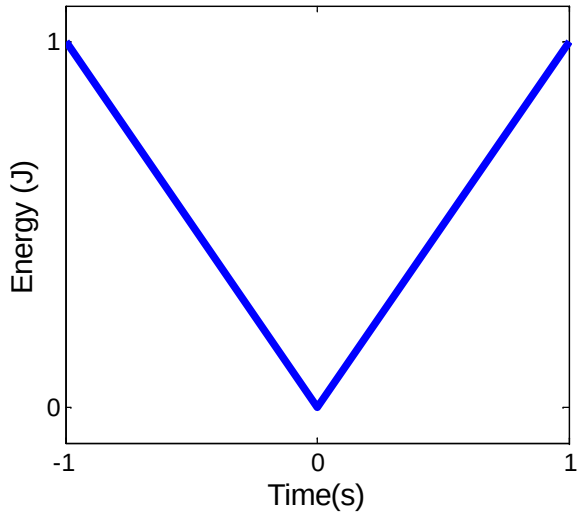
$$p = \frac{dw}{dt} = \frac{dw}{dq}\frac{dq}{dt} = vi$$

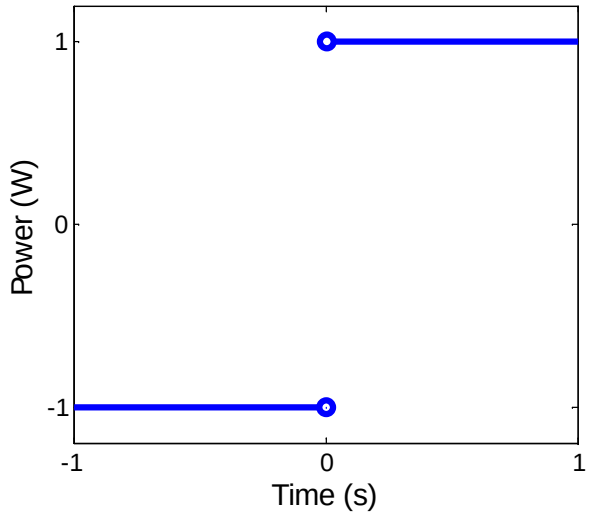
$$w = \int_{t_0}^{t} p(\tau)d\tau + w(t_0)$$

Energy	
Units	joule (J)
Variable	w

Power	
Units	watt (W=$\frac{\text{J}}{\text{s}}$)
Variable	p

Instantaneous Change





$$p = \frac{dw}{dt} = \frac{dw}{dq}\frac{dq}{dt} = vi$$

$$w = \int_{t_0}^{t} p(\tau)d\tau + w(t_0)$$

Charging for Power

You run a power company. Do you charge customers for power or energy? Why?

Pause

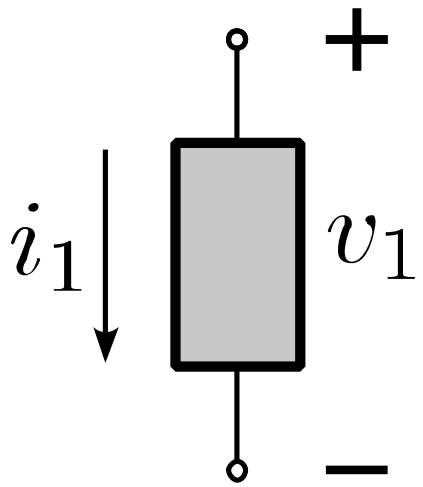
Conservation of Energy

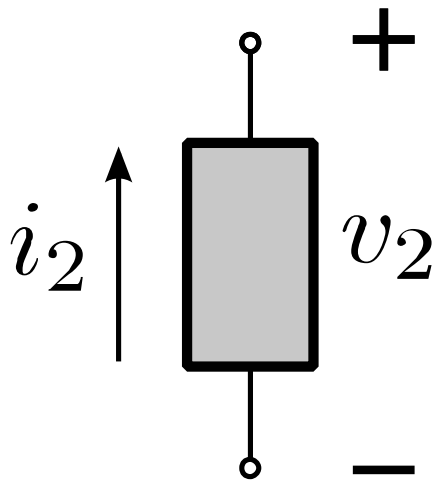
$$\sum_{i=1}^{N} w_i = K$$

$$\frac{d}{dt}\sum_{i=1}^{N} w_i = \frac{d}{dt}K = 0$$

$$\sum_{i=1}^{N} \frac{dw_i}{dt} = \sum_{i=1}^{N} p_i = 0$$

Reference Direction

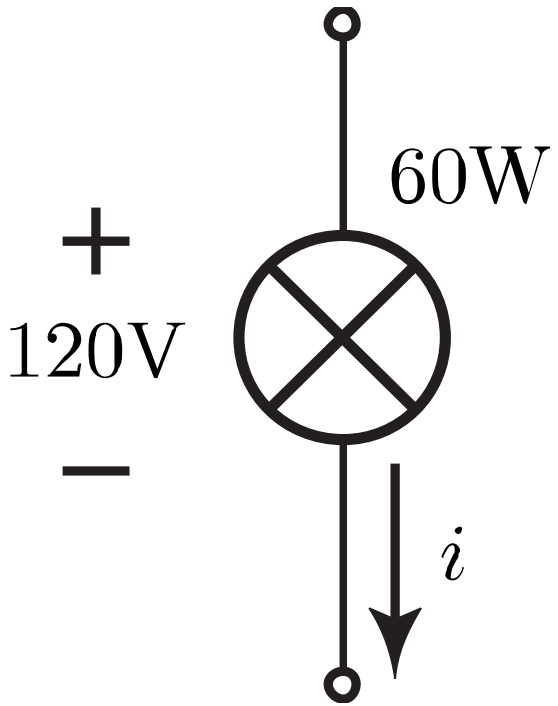




$$p = iv$$

$$p = -iv$$

Using Power for Analysis



Pause

Summary

- Described the relationship between power and energy and how to calculate them
- Described how voltage and current relate to power
- Presented a derivation for conservation of power and how this property is used in analysis
- Solved first simple analysis problem

Next Lesson

- Introduce circuit diagrams