SNS COLLEGE OF TECHNOLOGY

Saravanampatti, Coimbatore – 641 035

Approved by AICTE, Recognized by UGC & Affiliated to Anna University, Chennai

Department of Electronics and Communication Engineering

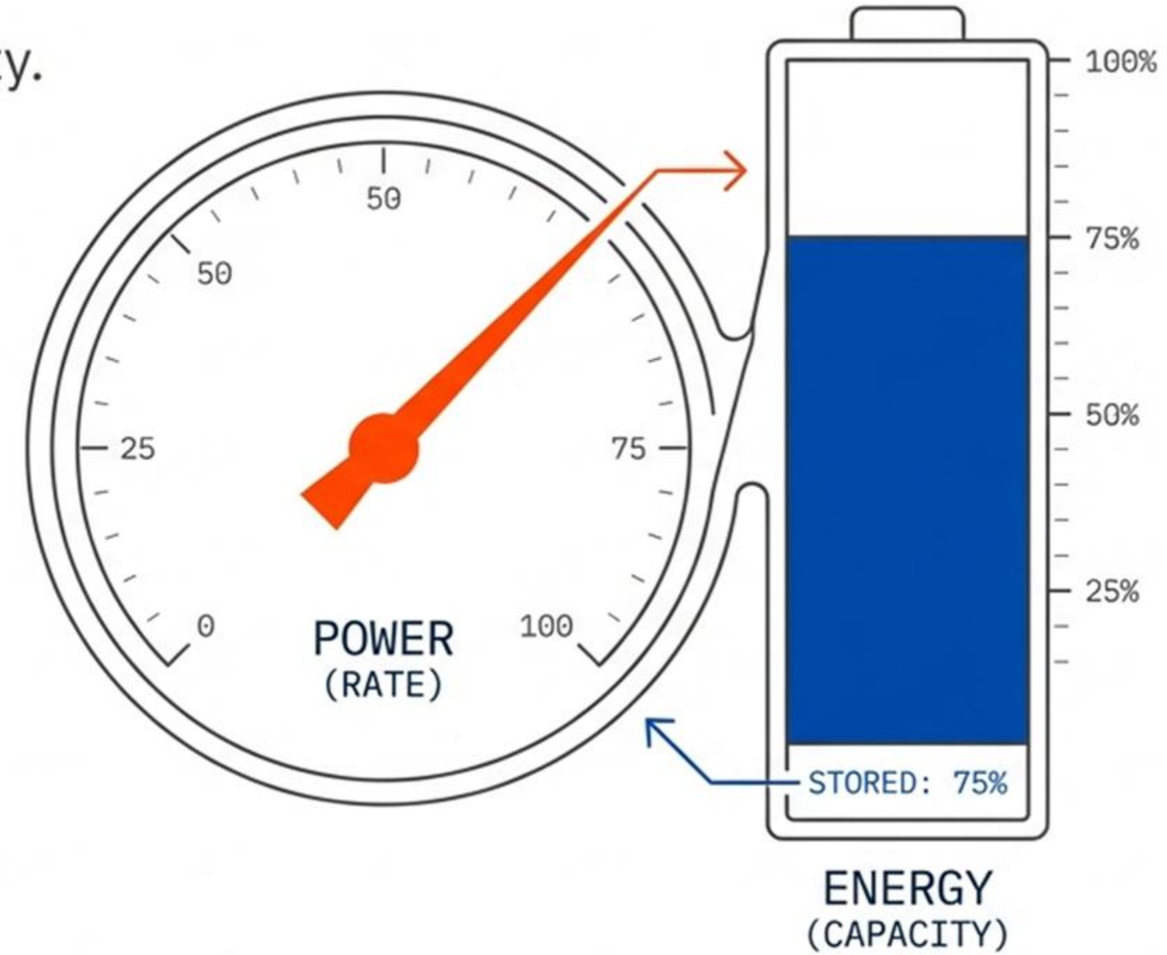
23EET103 – Electric Circuits and Electron Devices

I YEAR /II SEMESTER

UNIT -1 – Energy and Power

The Dynamics of Energy & Power

Capacity, Rate, and Reality.

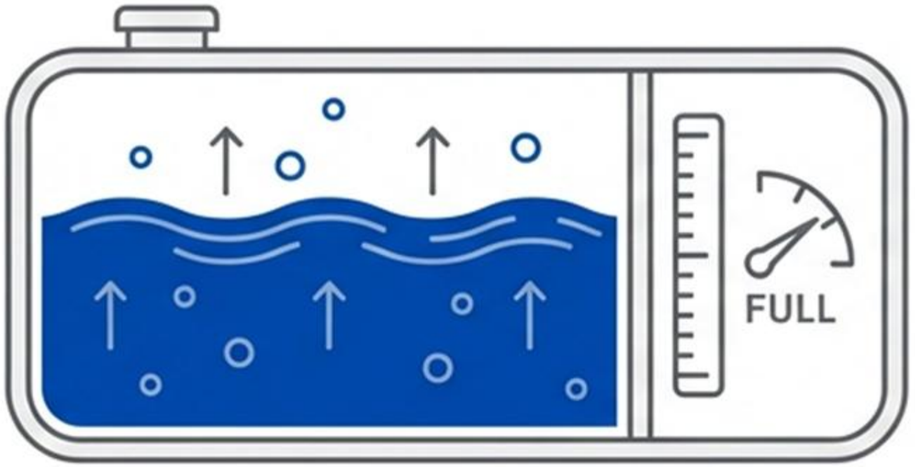


In engineering and daily life, the terms 'Energy' and 'Power' are often used interchangeably. They are not the same. Understanding the precise mathematical and physical boundary between the two is the key to master-iing everything from mechanical design to utility economics.

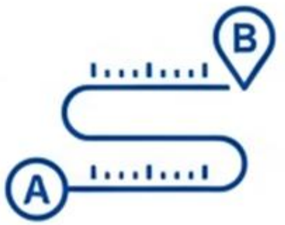
UNIT SYSTEMS: JOULES (J) VS. WATTS (W)

The Tank vs. The Burn Rate

ENERGY (E)

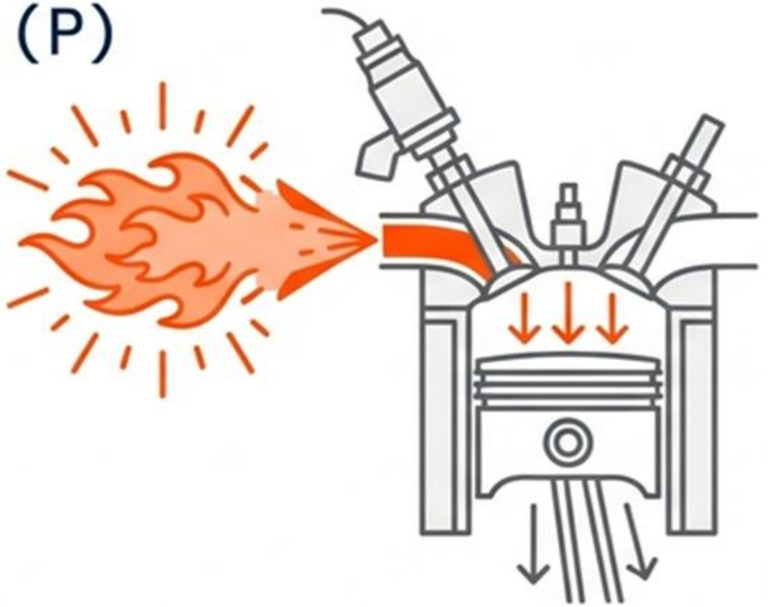


Think of Energy as the total amount of fuel in your tank. It is an inventory of potential.



Distance

POWER (P)

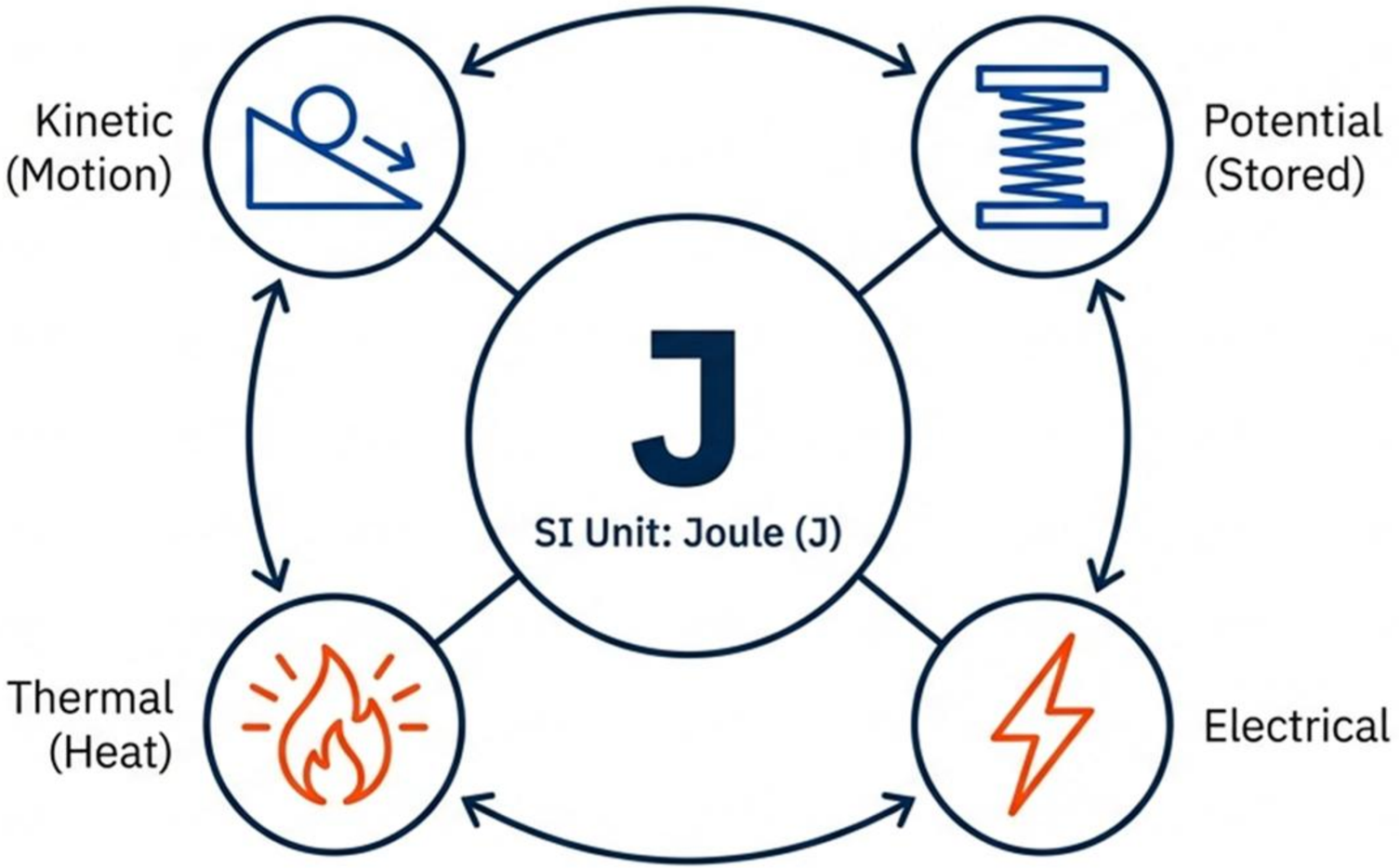


Think of Power as how fast you're burning that fuel. It is a measure of intensity.

Speed

Energy is the Capacity to Do Work

Energy is defined strictly as the capacity to do work. It is never “used up” or disappeared; it simply changes form (The Law of Conservation of Energy).



Work Transforms Energy into Action

When a system does work, it is transferring energy from one state to another (e.g., chemical fuel to kinetic motion).

Work: The transfer of energy (Joules).

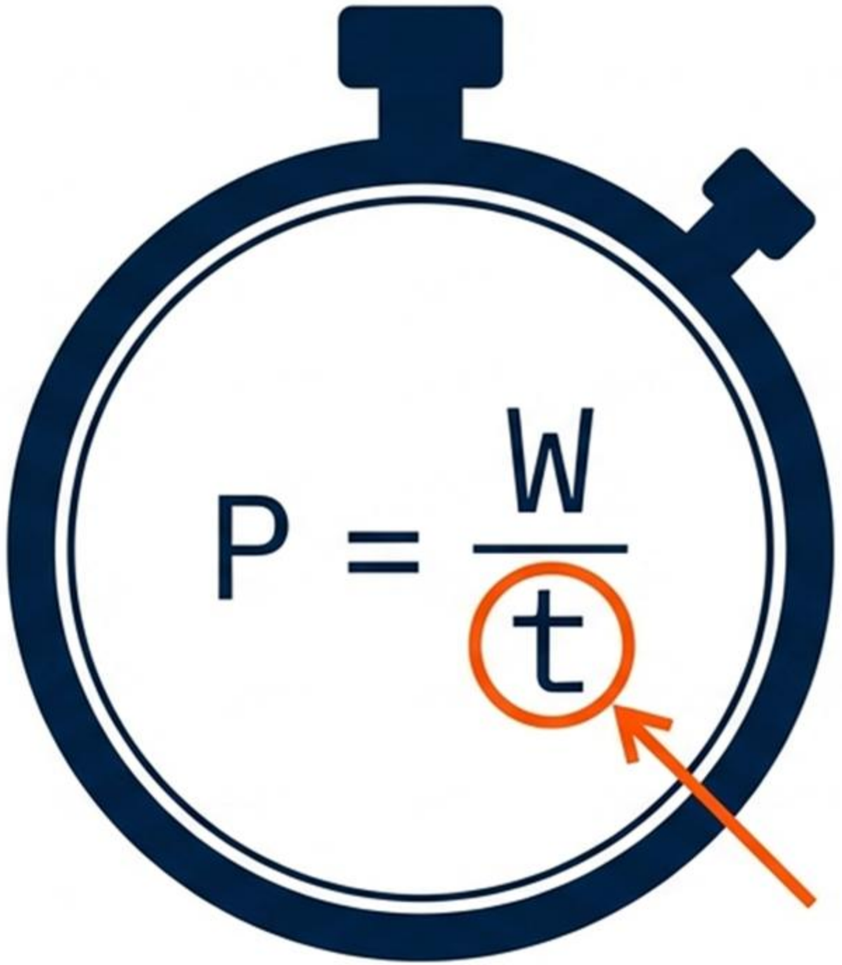
$$W = \Delta E$$

The **Change in Energy State.**

Is **equal to**

Power is the Rate of Execution

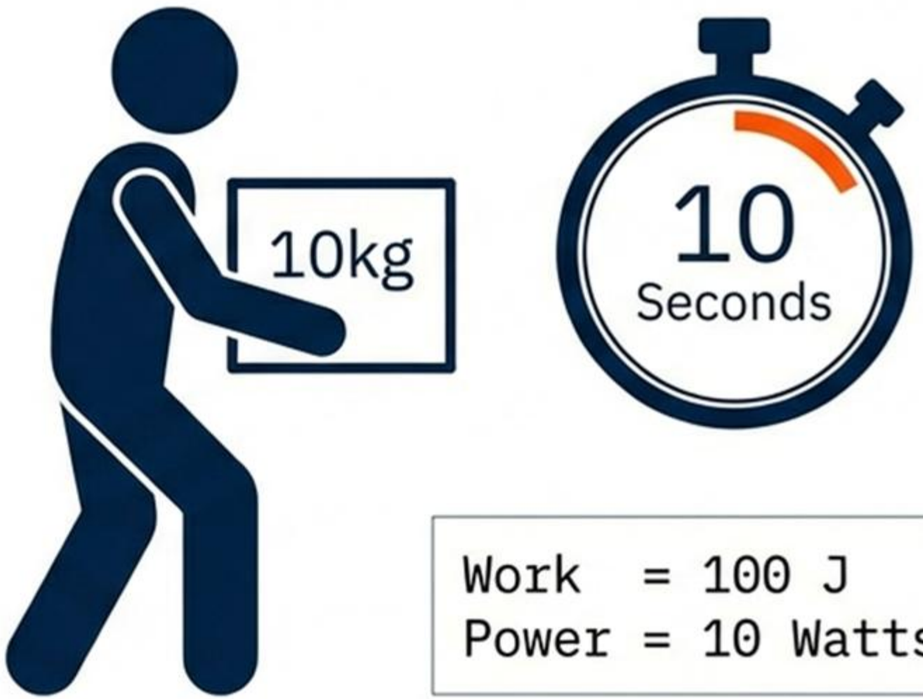
Power is the rate at which work is done or energy is transferred.
It answers the question: “How fast?”



UNIT BREAKDOWN
SI Unit: Watt (W)
Conversion: 1 W = 1 Joule per second (J/s)

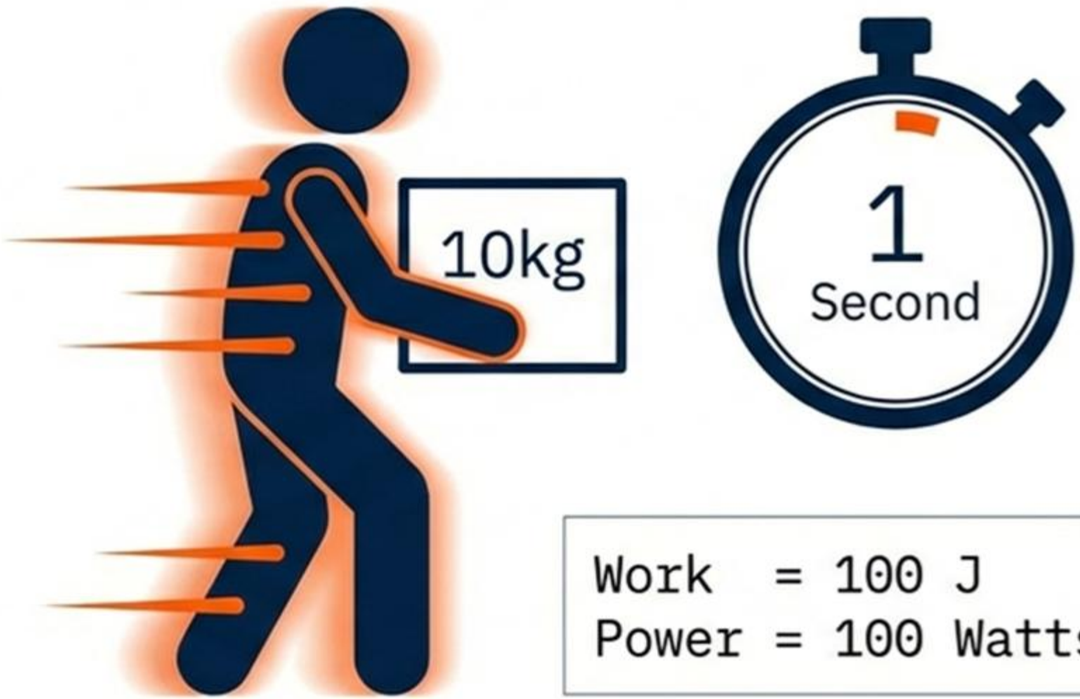
The Physics of the Lift

Scenario A: Low Power



Work = 100 J
Power = 10 Watts

Scenario B: High Power



Work = 100 J
Power = 100 Watts

Same Work (Energy Transferred). 10x Difference in Power.

The Reference Dashboard

ENERGY	POWER
Capacity to do work	Rate of doing work
Distance traveled	Current Speed
How much?	How fast?
Joule (J)	Watt (W)

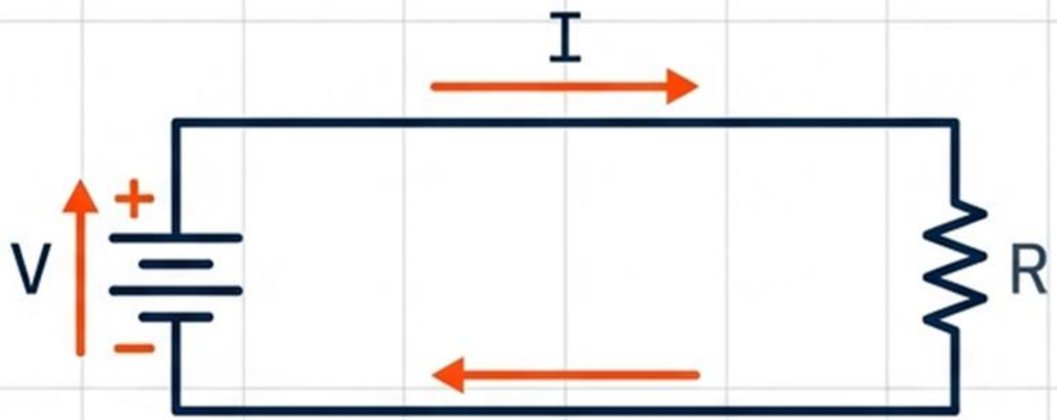
Power in Electrical Circuits

Power (Watts)

$$P = V \times I$$

Voltage (Volts) - The Pressure

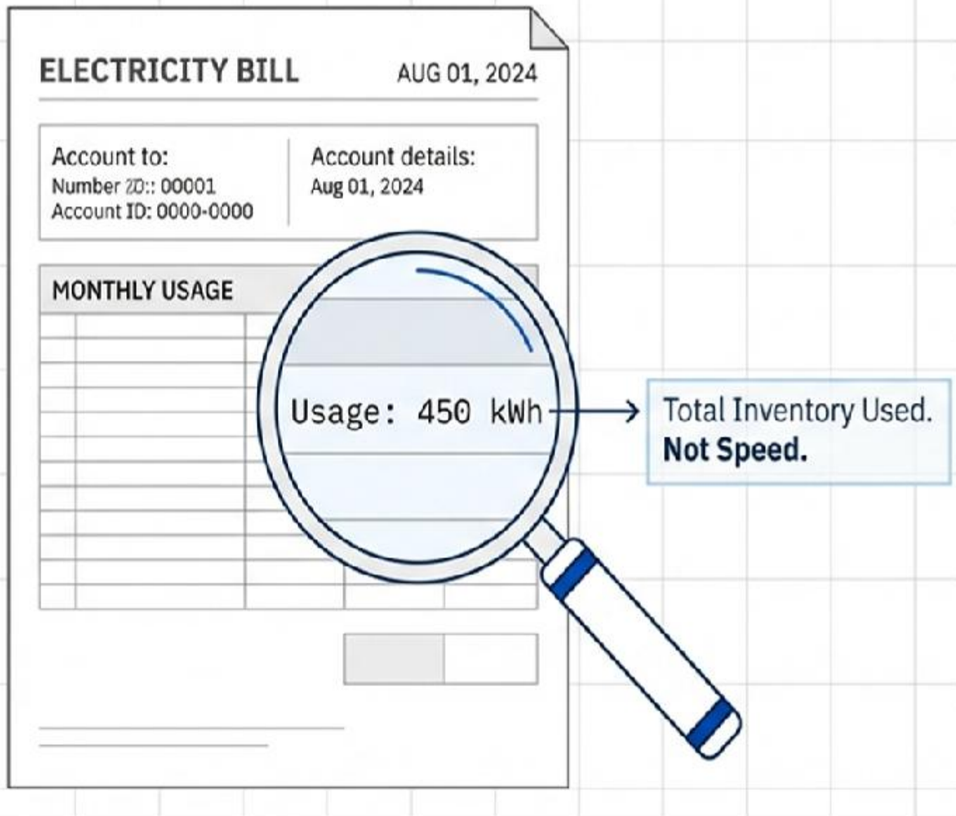
Current (Amps) - The Flow



In electronics, we adapt the physics formulas to account for the flow of electrons. Voltage pushes the current to create Power.

The Kilowatt-Hour Trap

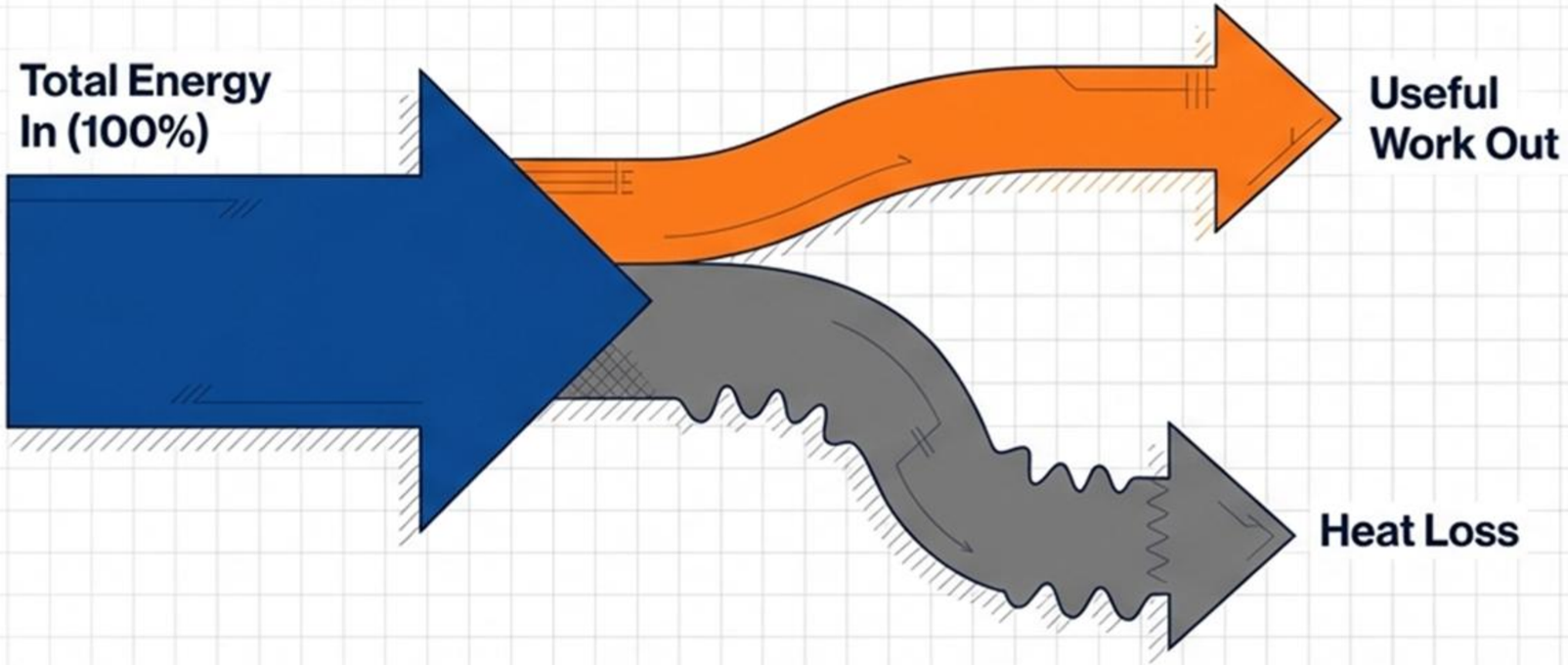
Why your bill measures Energy, not Power.



$$\text{Energy (kWh)} = \text{Power (kW)} \times \text{Time (h)}$$

Despite having "Watt" in the name, the Kilowatt-Hour is a unit of Energy. It measures the total amount of fuel you pulled from the grid, not just how fast you pulled it.

The Efficiency Tax



PRO-TIP

When calculating power requirements, you must account for this loss.

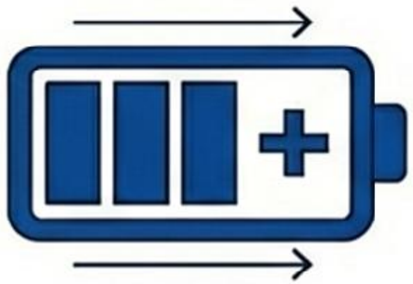
A motor outputting 100W of work might draw 120W of electrical power due to heat loss.

$$\text{Efficiency} = \frac{\text{Useful Energy Out}}{\text{Total Energy In}} \times 100\%$$

The Three Dimensions of Work

ENERGY

The Inventory



What you have.
Measured in **Joules**.

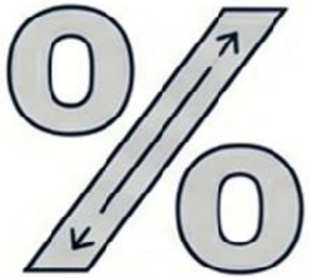
POWER

The Throughput

How fast you spend it.
Measured in **Watts**.

EFFICIENCY

The Reality



The tax on conversion.
Measured in %.

Understanding the distinction between what you have and how fast you spend it is the foundation of efficient engineering.

REFERENCES

- https://www.electrical4u.com
- https://www.allaboutcircuits.com
- https://nptel.ac.in/courses/108106172

THANK YOU