

# *Electrical Power Engineering*



By



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# Lecture (2)



*Electricity  
Changes  
Life style*

## Six key questions



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graph TD; A[Six key questions] --- B[What is the electrical energy?]; A --- C[How do we produce electric energy?]; A --- D[Why do we think the electrical energy is important?]; A --- E[What are the resources of electrical energy?]; A --- F[What about renewable energy resources?]; A --- G[What about the concept of smart grid?];
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**What is the electrical energy?**

**How do we produce electric energy?**

**Why do we think the electrical energy is important?**

**What are the resources of electrical energy?**

**What about renewable energy resources?**

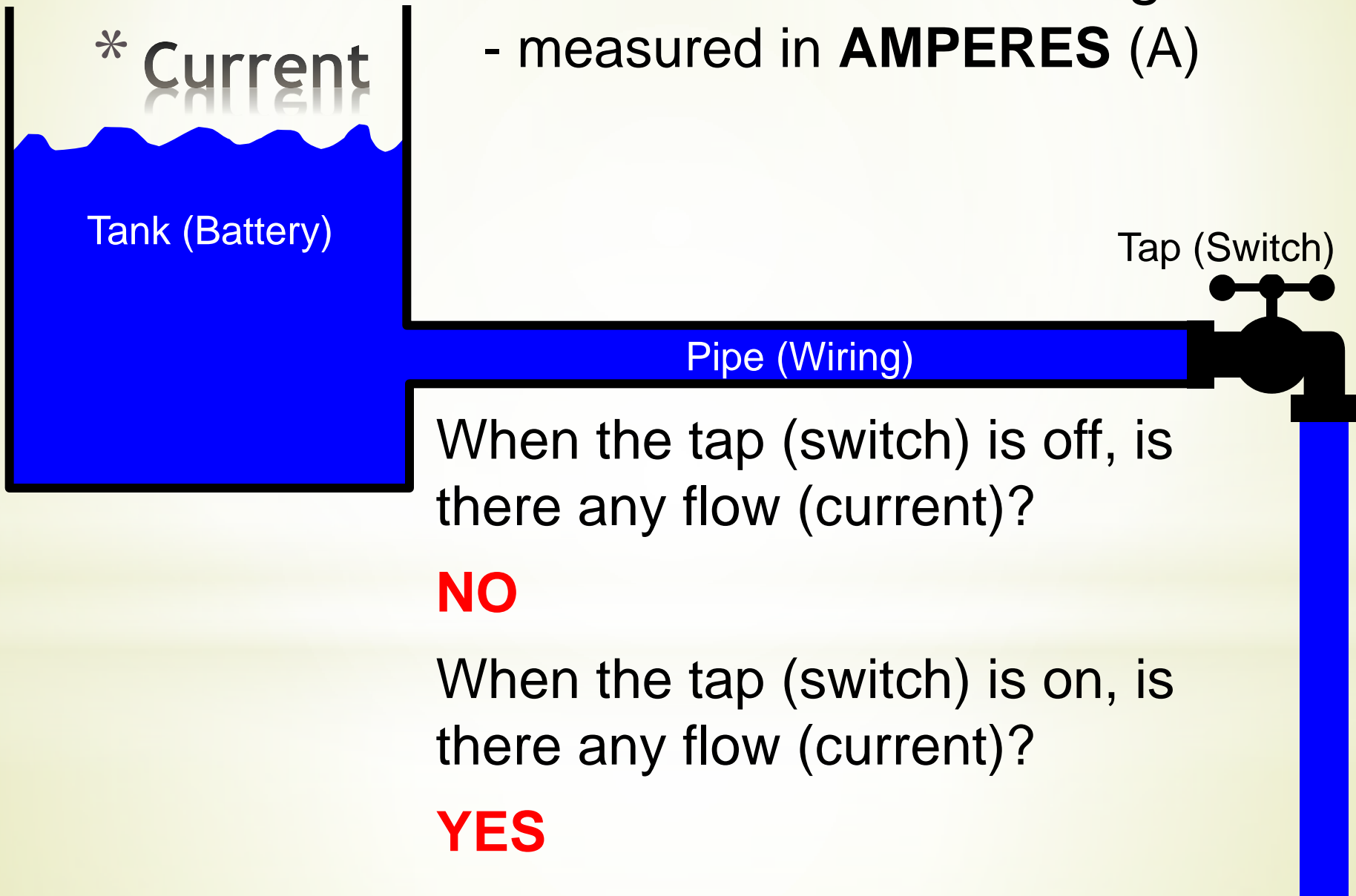
**What about the concept of smart grid?**

# What is the electric energy?

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- \* It is one of the most important energy forms*
- \* Energy cannot be created or destroyed.*
- \* In all devices and machines, including electric circuits, energy is transferred from one type to another.*

The *flow* of electric charge  
- measured in **AMPERES (A)**



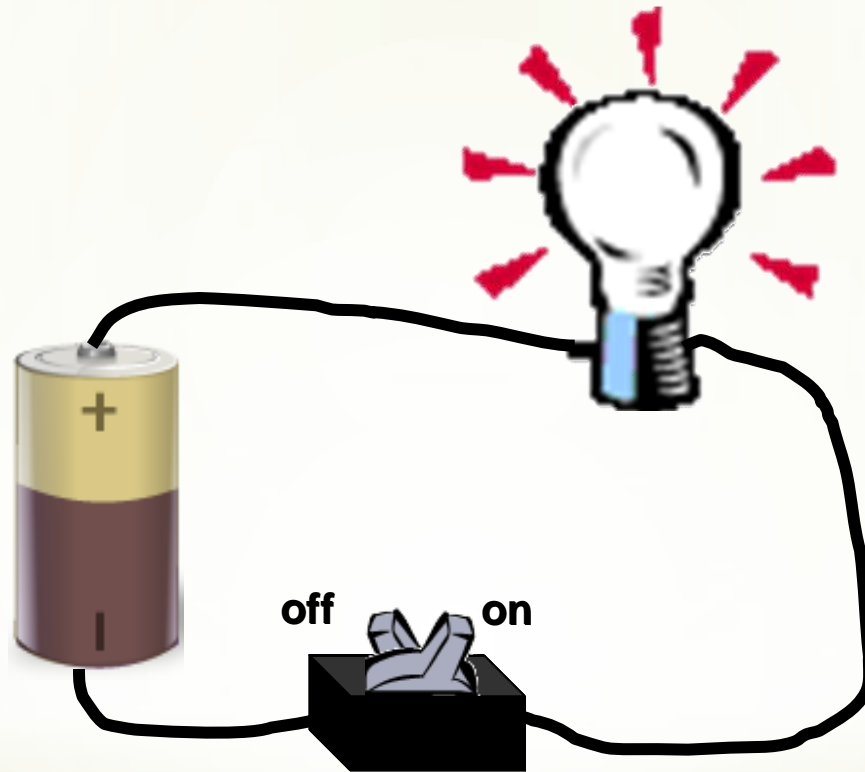
When the tap (switch) is off, is there any flow (current)?

**NO**

When the tap (switch) is on, is there any flow (current)?

**YES**

# Current in a Circuit



When the switch is off, there is no current.

When the switch is on, there is current.





# How do we produce electric energy?

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**Magnetic field + movable conductor = electricity**

## \*Edison and Swan



Nearly 40 years went by before a really practical DC (Direct Current) generator was built by Thomas Edison. In 1878 Joseph Swan, a British scientist, invented the incandescent filament lamp and within twelve months Edison made a similar discovery in America.

# \*Edison and Swan...continued

Swan and Edison later set up a joint company to produce the first practical filament lamp. Prior to this, electric lighting had been crude arc lamps.

Edison used his DC generator to provide electricity to light his laboratory and later to illuminate the first New York street to be lit by electric lamps, in September 1882. Edison's successes were not without controversy, however - although he was convinced of the merits of DC for generating electricity, other scientists in Europe and America recognized that DC brought major disadvantages.

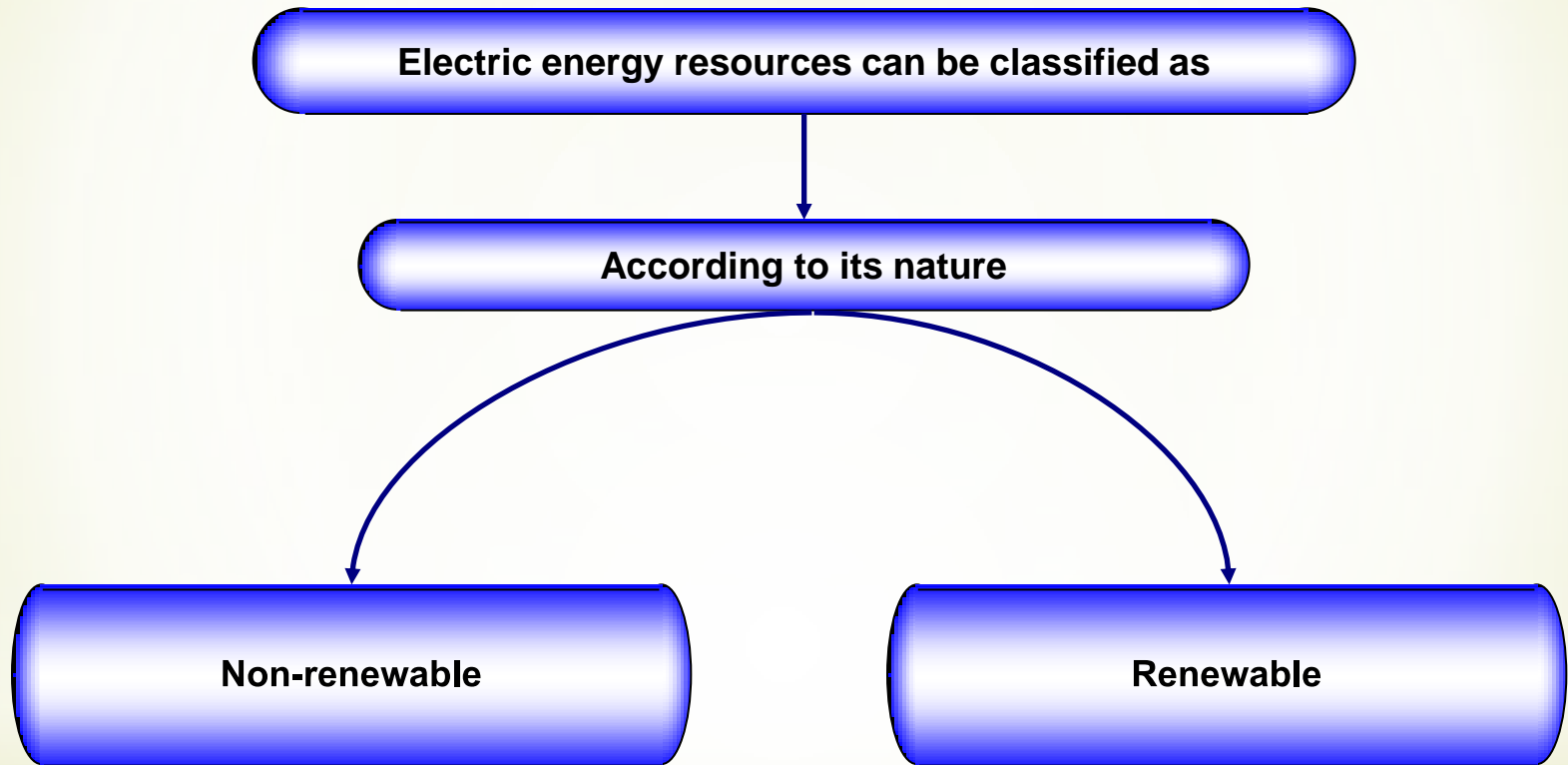
# Electric energy changes the life style

*\* We can say that the electric energy is the source of life*

*\* Imagine life without electricity!!!!!!!!!!!!*



# Classification of electrical energy resources



**Most of our electricity comes from the burning of the fossil fuels coal and gas.**



# Example: Energy Dilemma

**The fact**  
**X 2**  
**Energy demand**

**VS.**

**The need**  
**÷ 2**  
**Co2 emissions**

**Result**

**Frequent power outages**

**Rising energy prices**

**Climate change**

**Conflicts for resource access & control**

# Proposed Solution

**The fact  
New and  
Renewable  
Energy  
Production**

**with**

**The need  
Energy  
Control**

**Result**

**Result**

**Productive  
& Green**

**Reliable**

**Efficient**

**Safe**

## *Classifications of main drivers behind the focus on renewable energy*

### **Environmental drivers**

- ❖ *Limiting green house gas (GHG) emissions*
- ❖ *Avoidance of the construction of new transmission circuits and large generating plants*

### **Commercial drivers**

- ❖ *General uncertainty in electricity markets favours small generation schemes*
- ❖ *DG is a cost effective route to improved power quality and reliability*

### **National/regulatory drivers**

- ❖ *Diversification of energy sources to enhance energy security*
- ❖ *Support for competition policy*

# Problem Definition

- ➔ 1- Renewable energy resource is a highly variable power source, and there are several methods of characterizing this variability.
  - A. The most common method is the power duration curve.
  - B. Another method is to use a statistical representation.
- ➔ 2- In the power system the objective is to generate and deliver power as **economically** and **reliable** as possible while maintaining the voltage and frequency within permissible limits



# What about the concept of smart grid?

## THE SMART GRID



Source: European Technology Platform SmartGrids

# Smart Grid Definition

- \* A smart grid is a modern electric system.
- \* It uses communications, sensors, automation and computers to improve the flexibility, security, reliability, efficiency, and safety of the electricity system.
- \* It offers consumers increased choice by facilitating opportunities to control their electricity use and respond to electricity price changes by adjusting their consumption.

# What can Edison say about the electricity today?



**Thank You**  
**For Your Attention**



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