

Transmission and Distribution of Electrical Power



By



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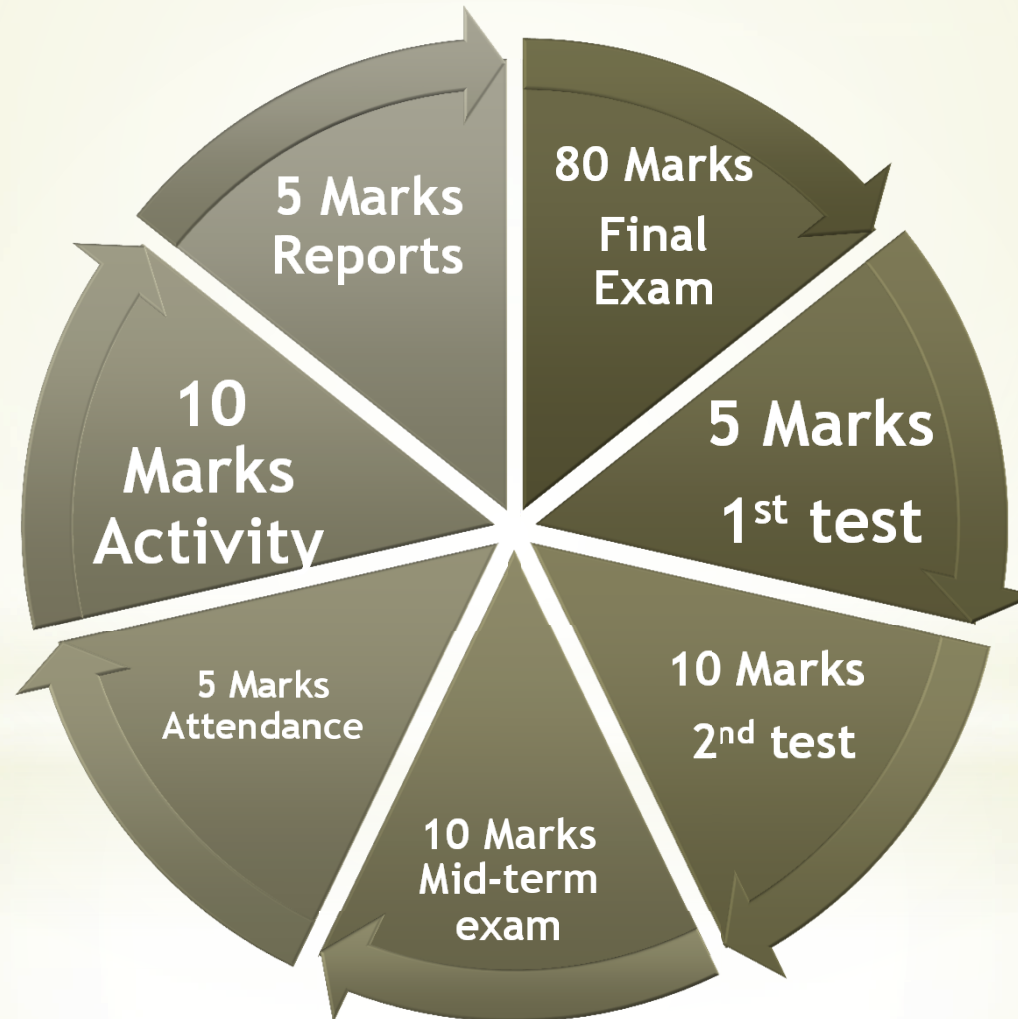
Lecture (1)



Syllabus

- 1 • Introduction.
- 2 • Fundamentals of Electrical Power Engineering.
- 3 • Transmission Line Constants Calculation.
- 4 • Transmission Line Models and Calculations.
- 5 • Mechanical Design of Overhead Transmission Line.
- 6 • D.C. Power Transmission Technology.
- 7 • Overhead Line Insulator.
- 8 • Corona
- 9 • Underground Cables
- 10 • Electrical Power Distribution

Marks Distribution Chart





Engineering Definition

What is Engineering?

Engineering is the application of math and science by which properties of matter and the sources of energy in nature are made useful.

Engineering Design Definition

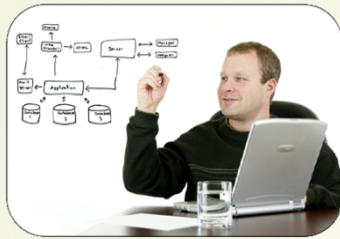
What is Design?

So, Engineering design is.....

Applications & Examples

Why Engineering Design?

Betterment of society through



Design



Manufacturing



Research & Development



Management



Continual Improvement



Logistics

Engineer Definition

Who is Engineer?

Creative

Iterative

Integrated

**Innovation is the key
Oven Story!!!!!!!!!!**

So, Engineer is.....

Engineering Process Cycle

The engineering process cycle is achieved by following 10 stages.

- 1-Identify the problem/product innovation
- 2-Define the working criteria/goals
- 3-Research and gather data
- 4-Brainstorm / generate creative ideas
- 5-Analyze potential solutions

Engineering Process Cycle

6-Develop and test models.

7-Make the decision.

8-Communication and specify.

9-Implement and commercialize.

10-Perform post-implementation review and assessment.

Stage-1: Identifying the problem/product innovation

*Engineers are problem solver: and the problems they solve are often identified as the specific needs and problems of customers

*Example:

*increased gas mileage

*Safety devices for kid, monitors, etc..

Stage-2: Define the working criteria and goals

Key questions

- 1- How much will it cost?
- 2- Will it be difficult to produce?
- 3- What will be the size, weight, strength?
- 4- What will it look like?
- 5- Will it be easy to use?
- 6- Are there legal concerns?
- 7- Will it be reliable?

Stage-2: Define the working criteria and goals

- 8- Will it meet the standard?
- 9- Is this what the customer truly wanted?
- 10- Will our customers want to purchase it?
- 11- Will customers want to purchase this version instead of a competitor's product?
- 12- Is it feasible for our customer to buy it?

Stage-3: Research and gather data

- 1- What information has been published about the problem?
- 2- Is there a solution to the problem that already may be available?
- 3- If the answer to the above is yes, who is producing it?
- 4- What are the advantages of their solution?
- 5- What are the disadvantages to their solution?

Stage-3: Research and gather data

6- What is the cost?

7- Is cost significant issue?

8- What is the ratio of time compared to overall cost?

9- Are there legal issues to consider?

10- Are there environmental concerns which must be considered?



Stage-3: Research and gather data

Information resources can be

- 1- Libraries.
- 2- Professional Society.
- 3- Journal, publications and newsletter.
- 4- Newspapers and magazines.
- 5- Market assessment surveys.



Stage-3: Research and gather data

6- Government publications

7- Patent searches and listings

8- Technical salespersons and their references catalogs

9- Professional experts including researchers, professors and other scientists

10- The competition's product (how they designed it? Disassemble their product and study it

Stage-4: Brainstorm/generate creative ideas

- * *Creative problem solving* is a major method of generating multiple ideas to a problem by a technique called *brainstorming*.
- * No preliminary judgments are made about any member's idea, and no negative comments are allowed.
- * The goal here is to list as many ideas as possible.

Stage-5: Analyze potential solutions

- 1- Computer analysis technique.
- 2- Analysis of compatibility.
- 3- Consistency of testing.
- 4- Estimation.
- 5- Economic analysis.
- 6- Common sense.
- 7- Analysis using basic engineering principles and laws.



Stage-6: Develop and test models

- 1- Mathematical models.
- 2- Computer models.
- 3- Scale model.
- 4- Diagrams or graphs.
- 5- Durability.
- 6- Ease assembly.



Stage-6: Develop and test models

7- Reliability.

8- Strength.

9- Environmental.

10- Quality consistency.

11- Safety.

Stage-7: Decision making

*Cost	Point Available	#1	#2
1- Production Difficulty	20	18	13
2- Size, weight, strength	15	10	12
3- Appearance	10	9	7
4- Convenient to use	5	3	4
5- Safety	10	8	8
6- Legal issues	5	4	3
7- Reliability/Durability	15	13	11
8- Recyclability	10	6	4
9- Customer Appeal	10	9	9



Stage-8: Communication and specify

Communicate data and design for each specific solution and get input.



Stage-9: Implement and commercialize

- 1- Implement the best solution.
- 2- Apply methods of business for profit.



Stage-10: Perform post-implementation review and assessment

*Check if the final product is giving you what you actually wanted from feasibility and if the consumer like it, etc.

*Electricity
Changes
Life style*

Six key questions

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

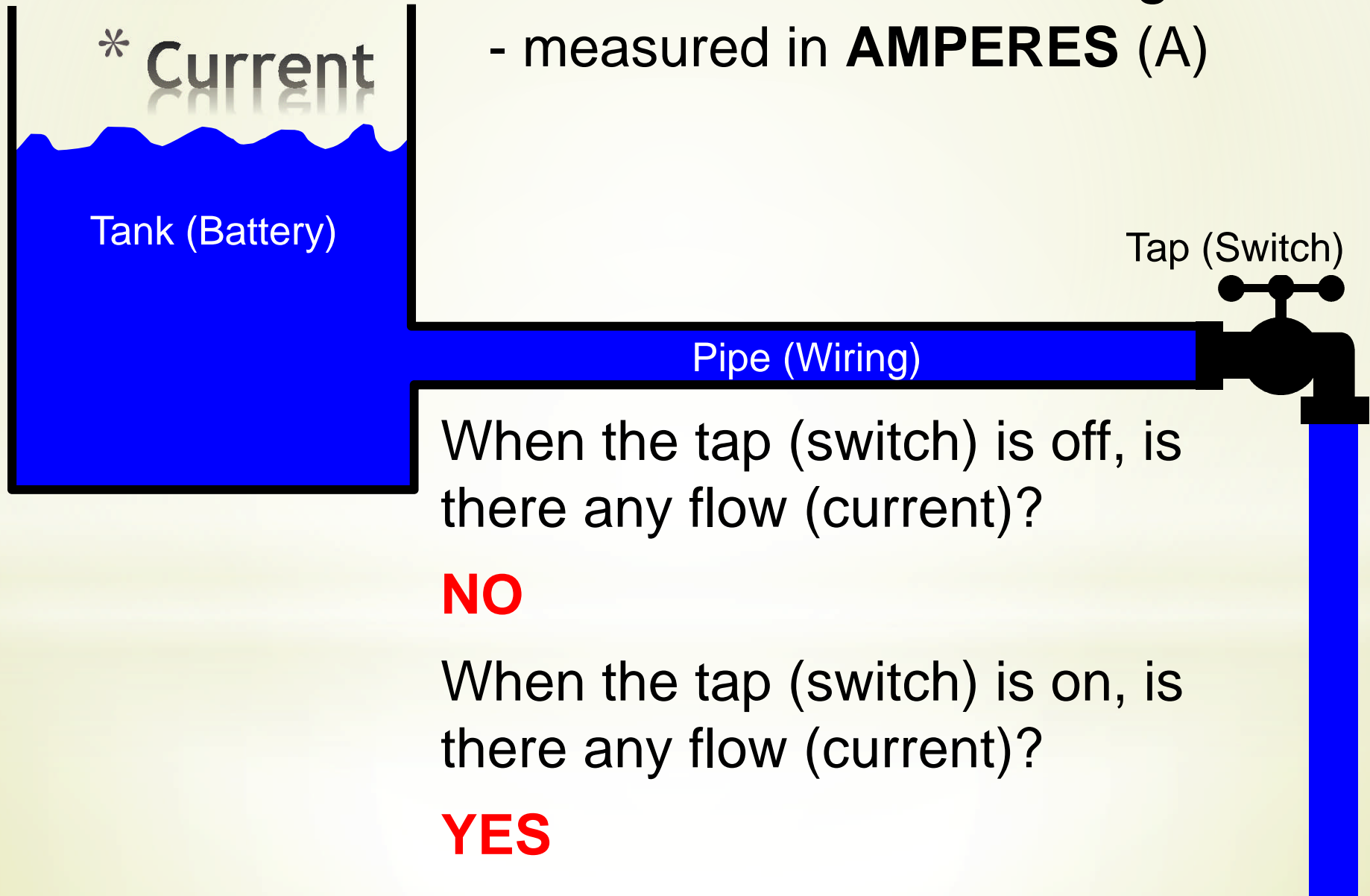
What about renewable energy resources?

What about the concept of smart grid?

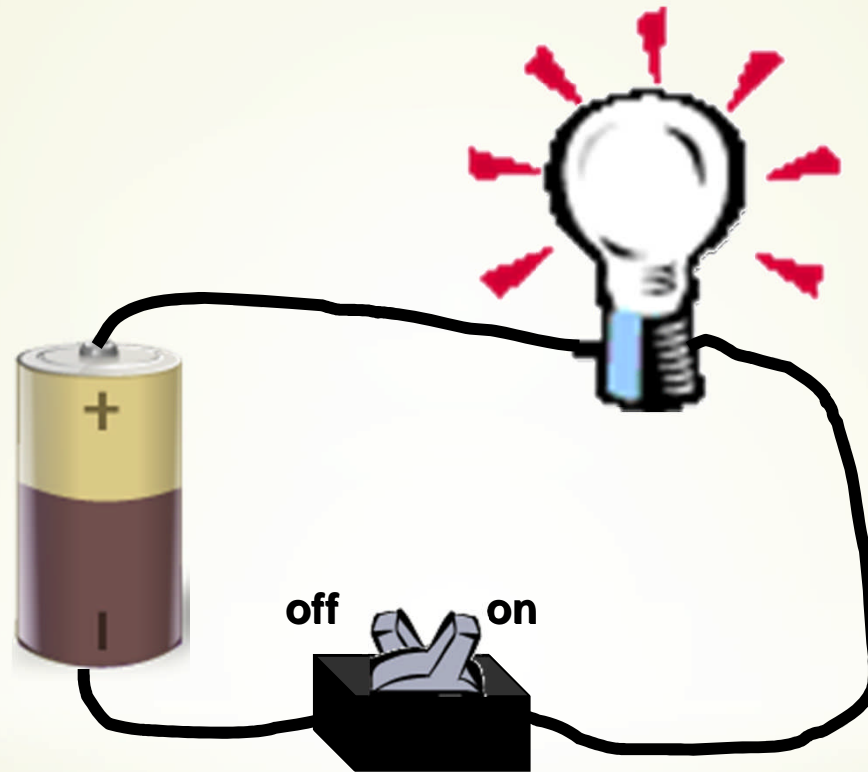
What is the electric energy?

- * 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)**



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?

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.

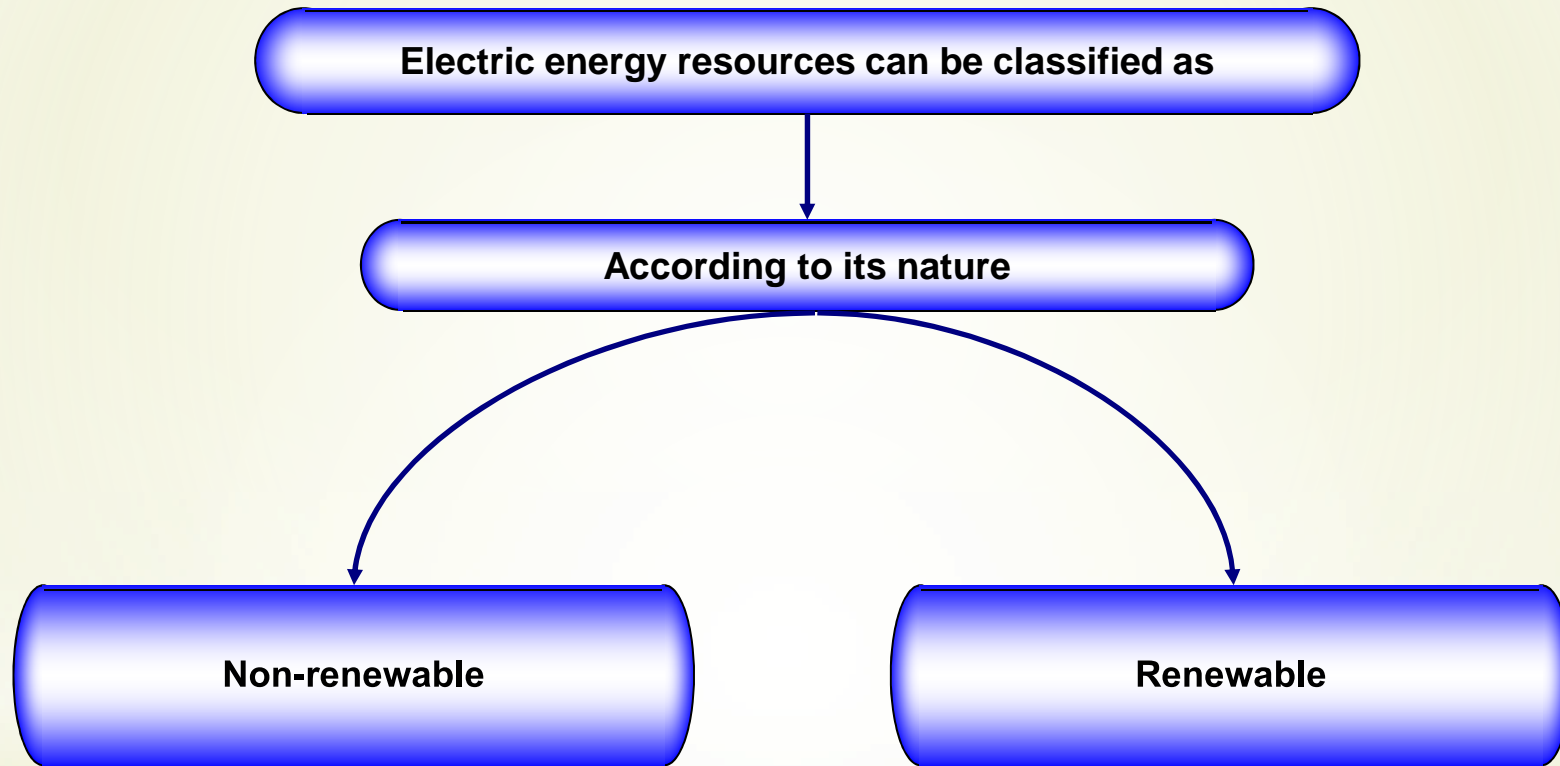
Edison used his DC generator to provide electricity to light his laboratory and later to illuminate the first New York street to be lit by electric lamps, in September 1882. Edison's successes were not without controversy, however - although he was convinced of the merits of DC for generating electricity,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



*Mohamed Ahmed
Ebrahim*