

22AIE114 : INTRODUCTION TO ELECTRICAL AND ELECTRONICS ENGINEERING (2-0-3-3)



Unit 1, Lecture 1

Topic: Introduction

Outline

- Course Overview
- Course Objectives
- Course Syllabus
- Text and Reference Books
- Outcome of the course
- Assignments & continuous evaluation method
- Why do we need to study 22AIE114?
- Introduction to Electrical and Electronics

Course Overview

- **22AIE114 : INTRODUCTION TO ELECTRICAL AND ELECTRONICS ENGINEERING**
- **2 - 0 - 3 – 3 (L – T – P – Credits)**
- Offered to **Second Semester B. Tech. AI students**
- Lab oriented Theory course

Faculty information

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- Communicate through Email or MS Teams. (No Whatsapp message)

Course Objectives

- The course will lay down the basic concepts and techniques of electrical and electronics engineering needed for advanced topics in AI.
- It will help the students to perceive the engineering problems using the fundamental concepts in electrical and electronics engineering.
- Another goal of the course is to provide connection between the concepts of electrical and electronics engineering, mathematics, and computational thinking.

Course Syllabus

Module I:

Fundamental electrical laws-Fundamental circuit elements: charge, voltage, current – Resistance – Ohms law – Kirchhoff's voltage and current law – Energy and power – Series parallel combination of R, L, C components – Voltage divider and current divider rules – Super position theorem – Inductors and capacitors – Impedance and AC sinusoidal signals

Course Syllabus

Module II:

Semiconductor materials – PN junction diode – Diode characteristics – Diode applications: Clippers and Clampers

– Rectifiers: Half wave, Full wave, Bridge – Zener diode – Introduction to BJT – BJT characteristics and configurations – CE amplifier – Transistor as a switch – Field effect transistors: MOSFET

MODULE III:

Operational amplifiers – Inverting and non-inverting amplifier – Oscillators – Instrumentation amplifier

Text Books

1. Hughes, Edward, John Hiley, Ian McKenzie Smith, and Keith Brown. Hughes electrical and electronic technology. Pearson education, 2005.
2. David A. Bell. Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008.
3. Bhattacharya, S. K. Basic Electrical Engineering. Pearson Education India, 2011.

References Books

1. Malvino And D. J. Bates. Electronic Principles, 7th Edition, Tata McGraw - Hill, 2007.
2. Vincent Del Toro. Electrical Engineering Fundamentals, Prentice Hall of India Private Limited, 2nd Edition, 2003.
3. Michael Tooley B. A. Electronic circuits: Fundamentals and Applications, 3rd Edition, Elsevier Limited, 2006.

Course Outcomes

- CO1: Familiarise the fundamental concepts in electrical and electronics engineering.
- CO2: Implement the state-of-the-art computational techniques that can be employed to analyse the structured problems in electrical engineering.
- CO3: Realize basic electronic components and circuits using various semiconductor devices
- CO4: Implement various circuits applications in the perspective of electronics

Evaluation method

Internal:

- Mid Term exam (20%)
- Assignments (class test) - 3 Nos (15%)
- Lab experiment Report – 6 Nos (15%)
- Quiz (Lab) – 2 Nos (20%)

External:

- End Semester Exam – 1 (30%)

Why we need to study 22AIE114?

- The big question come up in your mind that why this is required for a computer or mechanical or electronics engineer...
- What are the engineering field originated initially?
- Do you know the relation between the 22AIE114 course outcome and your field of study?
- What are the application fields of 22AIE114?

Why we need to study 22AIE114?

- ✓ **The big question come up in your mind that why this is required for a computer or mechanical or electronics engineer...**
- Yes, even if I am in your place I will think that same. why I need to study electrical and electronics subjects, since I enrolled for Computer or ECE or Mechanical branch.
- The science gives invention and related application is developed by engineering.

Why we need to study 22AIE114?

- ✓ **The big question come up in your mind that why this is required for a computer or mechanical or electronics engineer..**
- ✓ **Hence, Engineer need to know how to apply theoretical knowledge obtained from Physics / Chemistry / Maths to develop a machine or controller to do some operations.**

Why we need to study 22AIE114?

- ✓ What are the engineering field originated initially?
- ✓ We have electrical, mechanical and civil are originated as engineering field to develop generators, machines, vehicles, buildings, etc.
- ✓ When the technology advanced, we started other branches to study confined to particular area.
- ✓ Even we have inter-disciplinary area of study which combines multiple domains for specific applications. (example: Aeronautics, Space science, chemical engineering).

Why we need to study 22AIE114?

- ✓ **Do you know the relation between the 22AIE114 course outcome and your field of study?**
- ✓ **The outcome of this 22AIE114 is closely related to your branch of study.**
- ✓ **You may end up with using the knowledge gained in 22AIE114 while developing applications in your branch.**

Why we need to study 22AIE114?

- ✓ For example, if you understand how the resistance in a circuit limits the current flow or
- ✓ How the magnetic circuit works or
- ✓ How the basic electronic components provide controllable output
- ✓ You may better link with your field of study and develop application in your field in combination with your knowledge.

Why we need to study 22AIE114?

- ✓ You may be knowing how to build the robots / electric vehicles and effectively control it.
- ✓ You may be knowing how the lathe speed can be controlled, how the torque is deciding the load carried.
- ✓ You may be knowing how the microcontrollers or mobile phones are working, what is the basic operations happening inside.

Why we need to study 22AIE114?

- ✓ **What are the application fields of 22AIE114?**
- ✓ **Doing mathematical operation in circuits, which is backbone of modern computers**
- ✓ **Power generation, transmission, consumption**
- ✓ **Electrical machines for doing tasks in industry**
- ✓ **Industrial automation and control**
- ✓ **Control of Electrical and electronics appliances**

Introduction to Electrical and Electronics Engineering

Introduction to Electrical Power

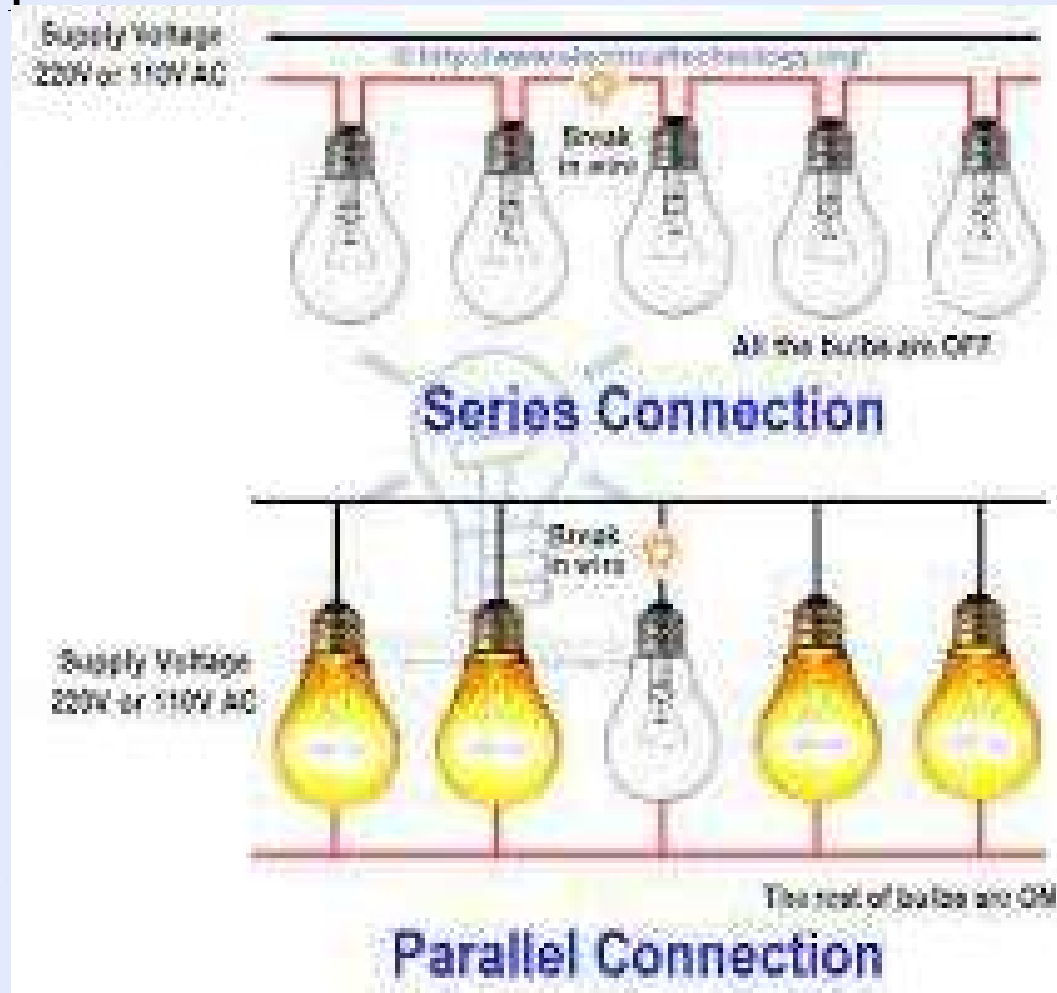
- Very first Power System constructed – DC System by **Edison in 1882**, in which steam driven DC generators are used to supply lamp loads within small area.
- The invention of transformers with long distance transmission system occupy the AC system over DC system.
- The invention of polyphase induction motors by **Nikola Tesla** led to development of AC 3 phase systems.

Introduction to Electrical Power

- Various standards are followed in the world for electrical power due to their initial development.
 - India 50 Hz, Single phase, 230 V (RMS)
 - USA 60Hz, Single phase, 110 V (RMS)
- Hence the quality of power being supplied to customer is the responsibility of utility (Electricity board at distribution level) to maintain the nominal value of frequency and voltage at all time.

Introduction to Electrical Power

- Series or parallel connection of loads?

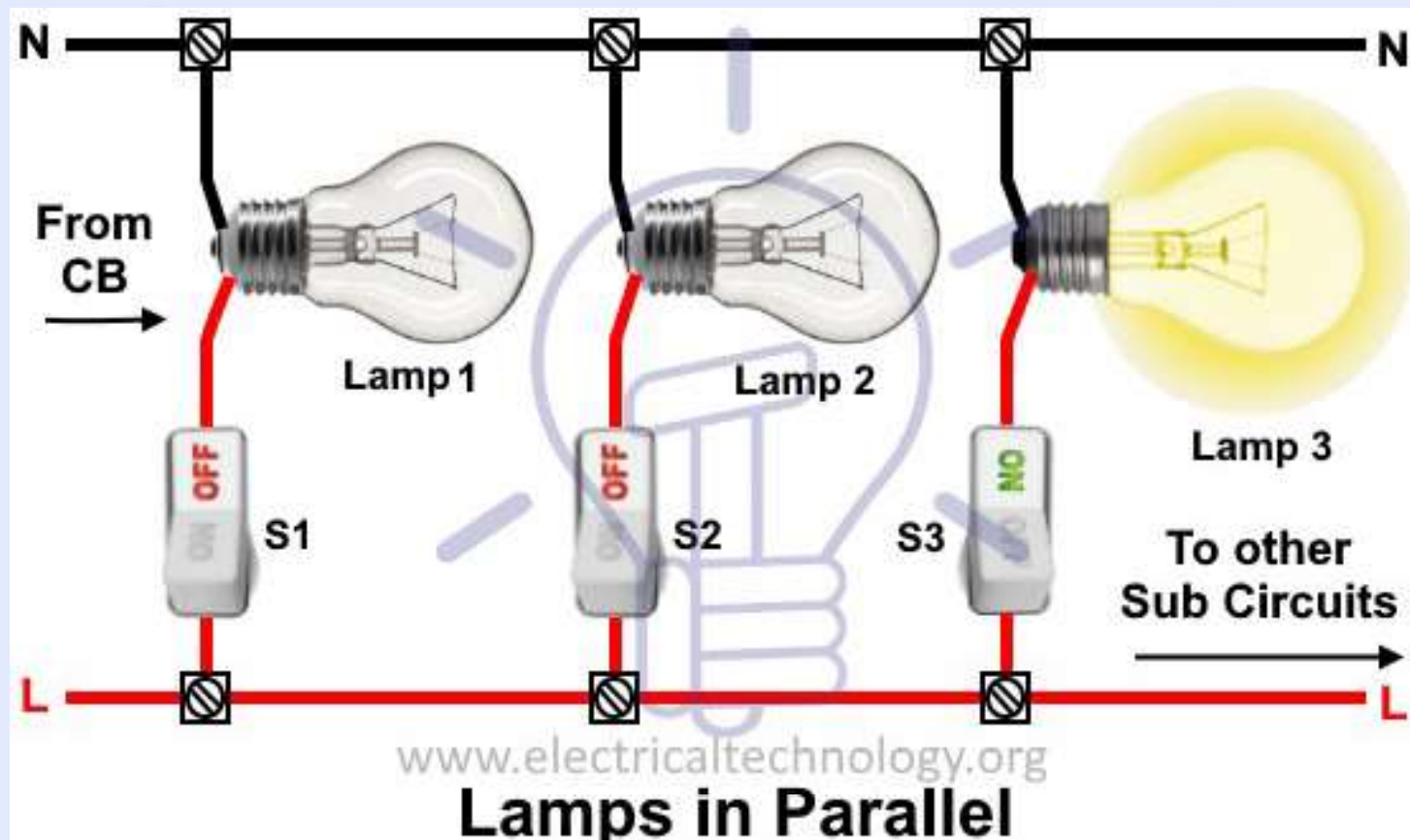


Introduction to Electrical Power

- The loads are preferred to be connected in parallel to each other to ensure that
 - The individual load can be controlled by individual switches as and when required.
 - All appliances will get same voltage level when connected in parallel, and hence depending on the resistances of individual appliances the current flowing through appliance will vary and hence power consumption also.

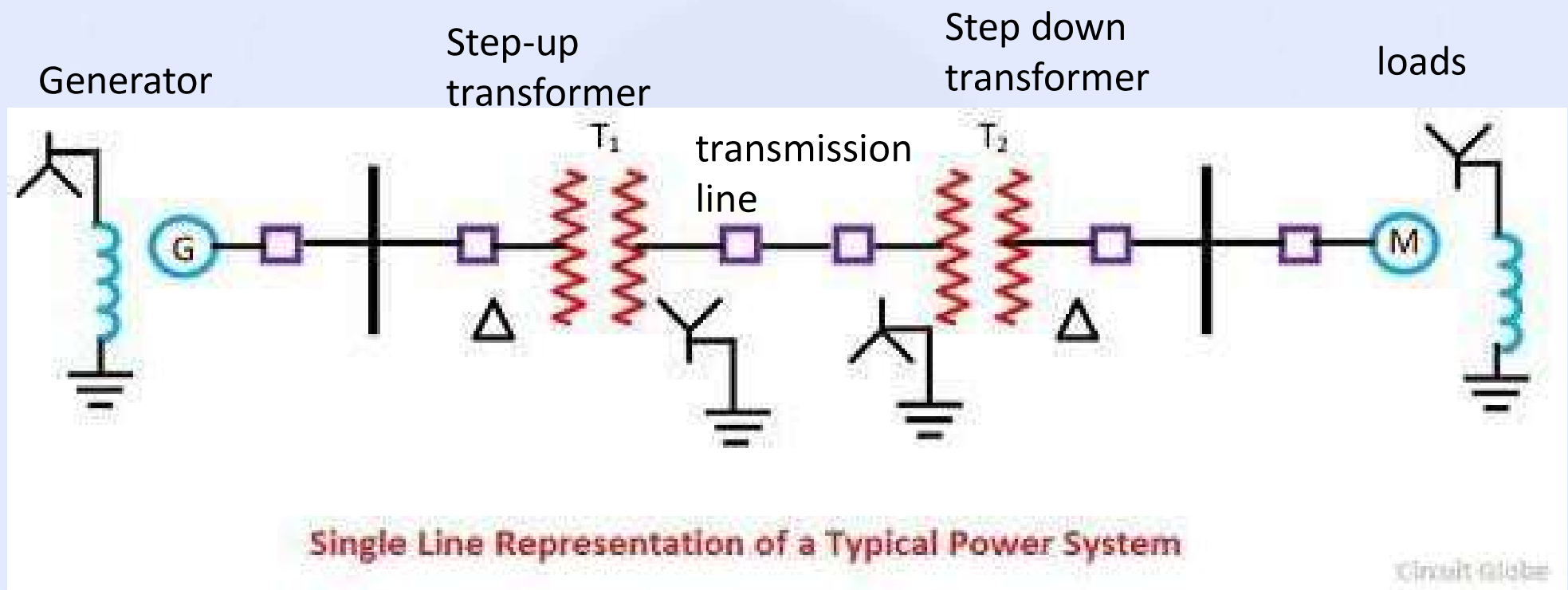
Introduction to Electrical Power

- The loads are preferred to be connected in parallel to each other to ensure that



Introduction to Electrical Power

- Single Line diagram of Power system

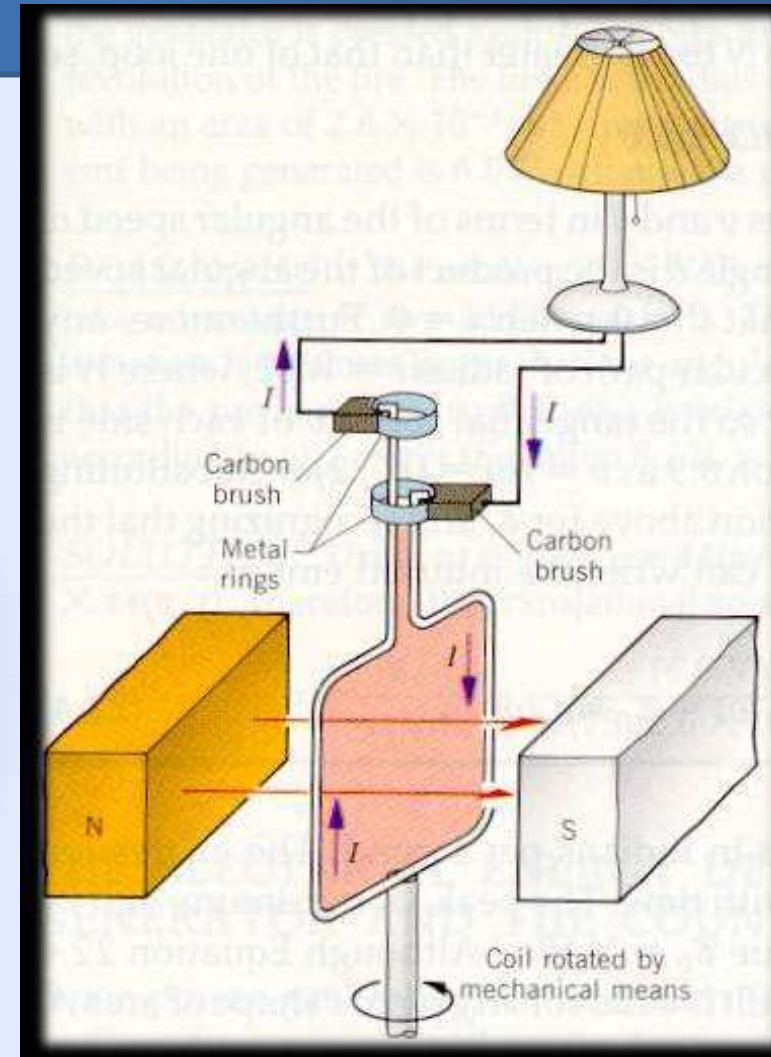


Introduction to Electrical Power

- In power system the transformers are used to step up voltage near generator end, transmitted power over long distance transmission lines, and step down to the required voltage level to consumer end.
- This reduces the losses in transmission network, reduces voltage drops, so that the efficient usage of generated power is possible.
- The consumer will receive the good quality of power without much disturbances.

Introduction to Electrical Power

- Turn a Loop of Wire in a Magnetic Field – Generates Electrical energy.
- Two conductor experiment shown, also called as one coil method.
- Induced voltage in conductor causes the current to flow through load (lamp).



Introduction to Electrical Power

Power Generation

- Boilers
- Turbines
- Generators

Transmission

- Long lines
- Substations

Distributions

- Transformers step down
- distribution lines
- Industry/commercial/residential

Introduction to Electrical Power

Power Generation



Introduction to Electrical Power

Generators:

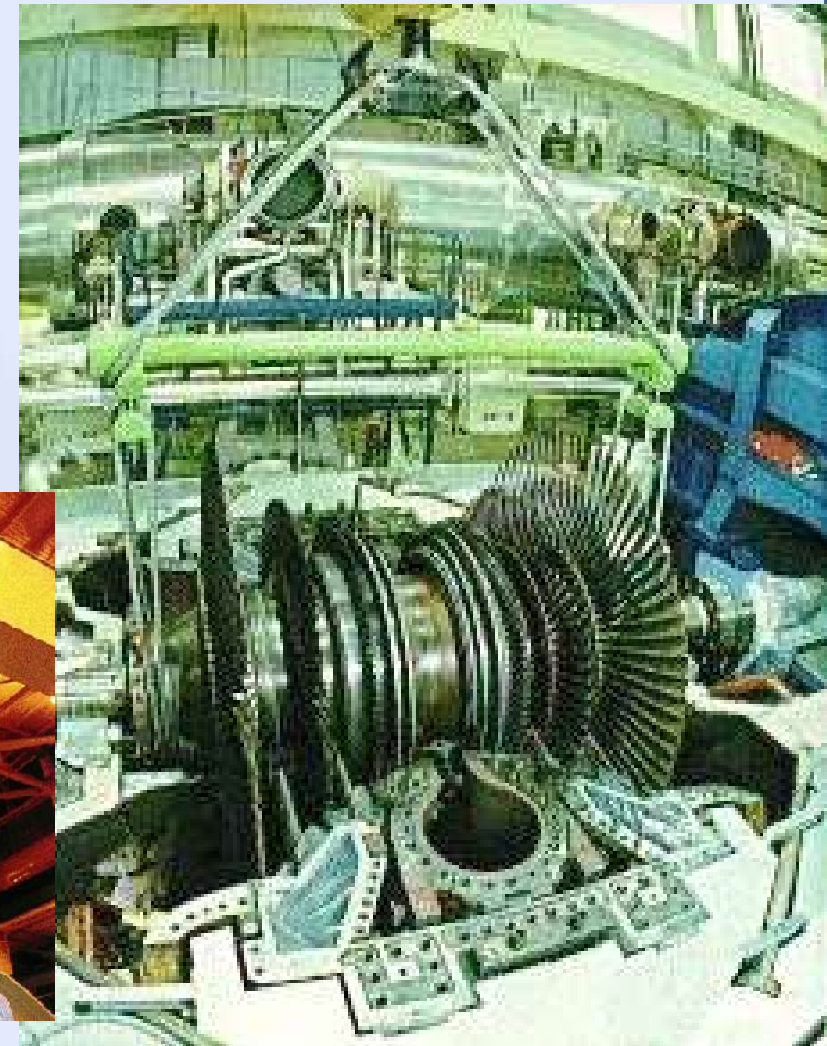
The key task of the power plant is to turn the generators to produce electrical energy.



Introduction to Electrical Power

Turbines:

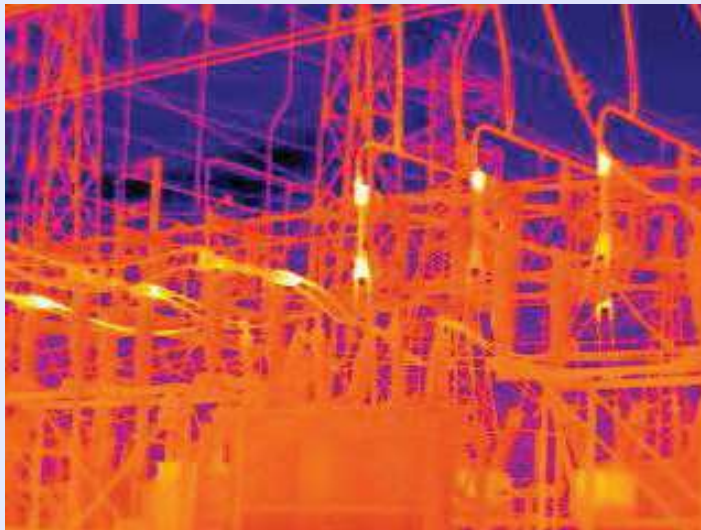
- Provide mechanical energy to rotate shaft,
- Difficult to replace



Introduction to Electrical Power

Bus Bars:

- Uninsulated electrical conductors
- large cross-section = low resistance
- No voltage drop
- must be far from ground and other components to avoid arcing



Introduction to Electrical Power

Switches and Switchyards:



Introduction to Electrical Power

Transformers:

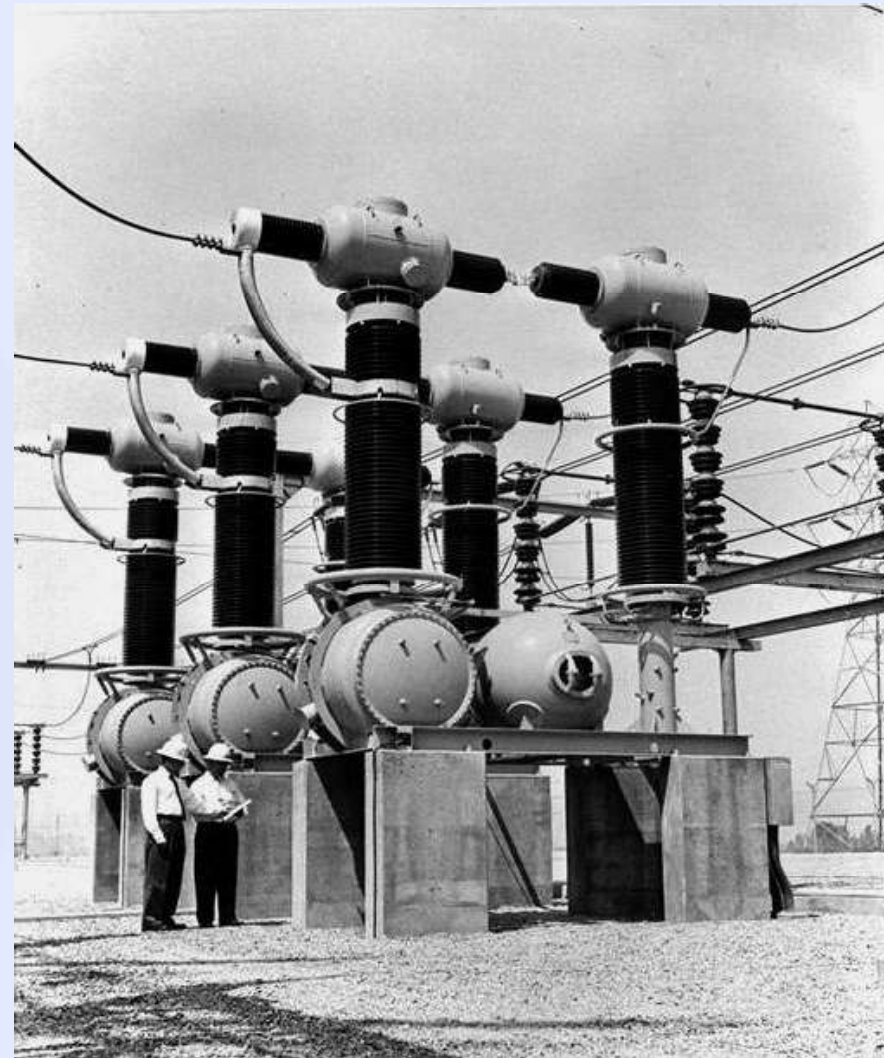
- Purpose: to change the voltage => “step-up” or “step-down”
- Often run hot, must be cooled, prone to explode



Introduction to Electrical Power

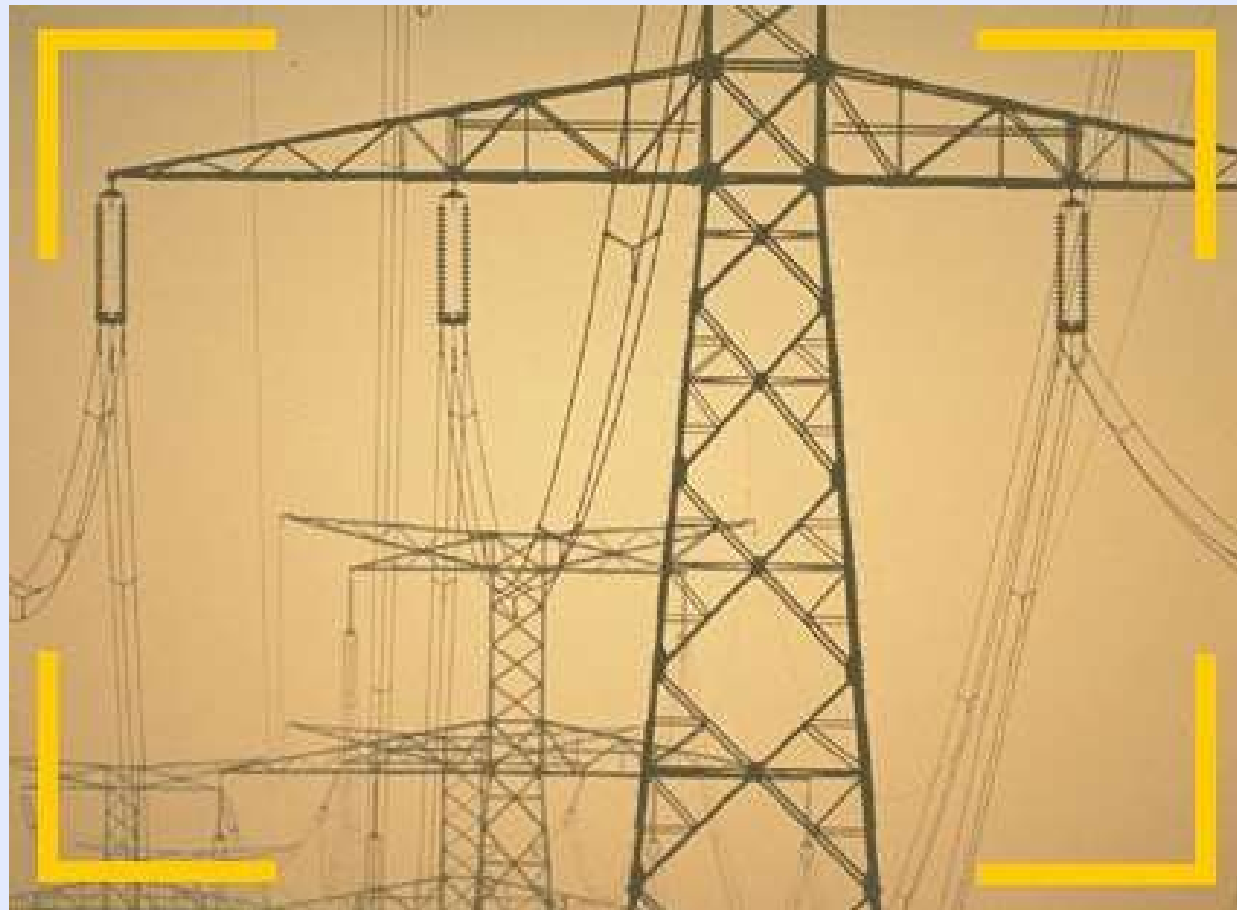
Circuit Breakers:

- purpose: De-energize the power circuit during the fault or excess demand to avoid the damage of power components.



Introduction to Electrical Power

Transmission Lines:

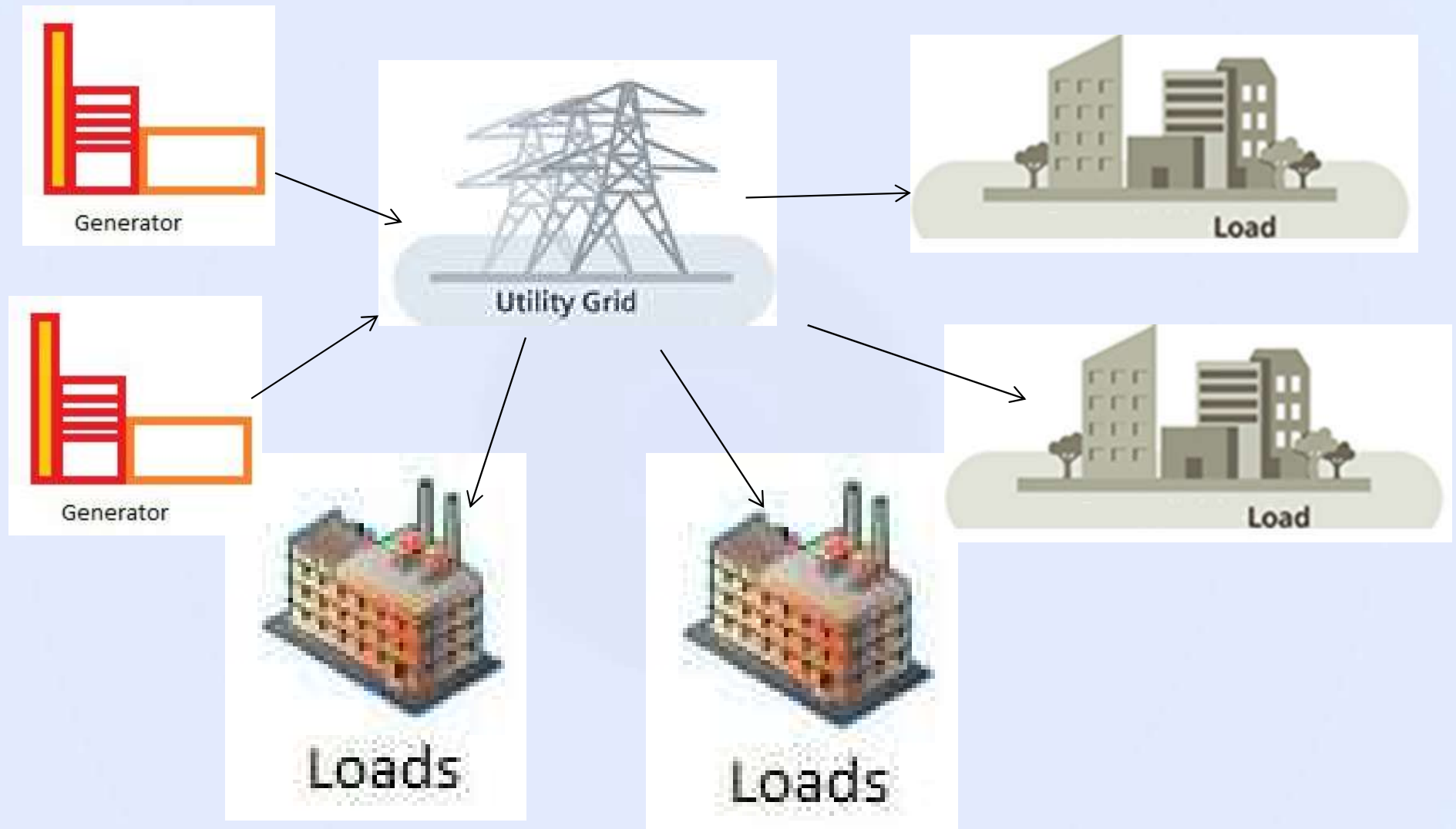


Introduction to Electrical Power

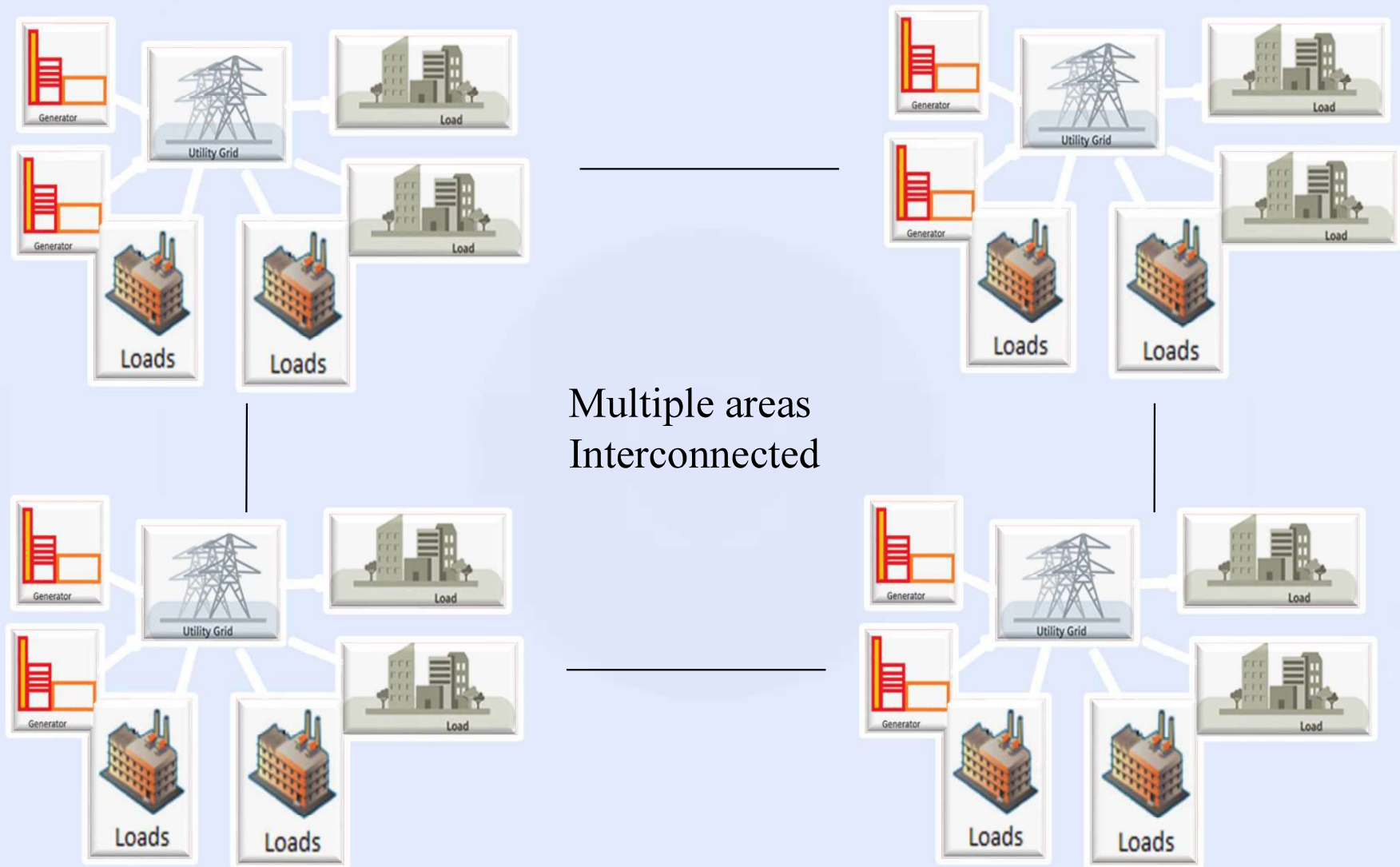
Distribution transformers and Lines:
smaller transformers to reduce the voltage further to the 240V delivered to individual homes



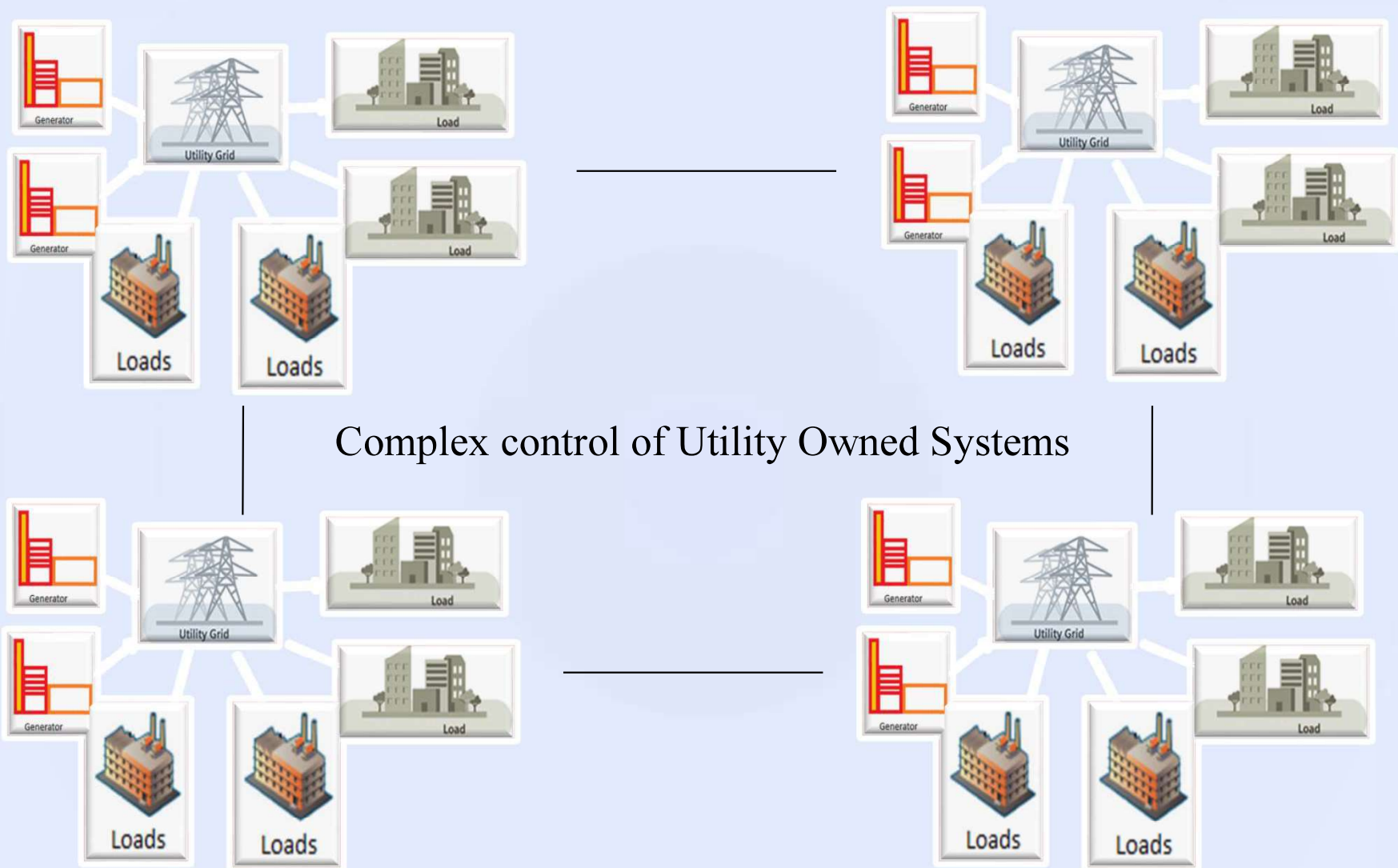
Introduction to Power Grid and its Evolution



Introduction to Power Grid and its Evolution



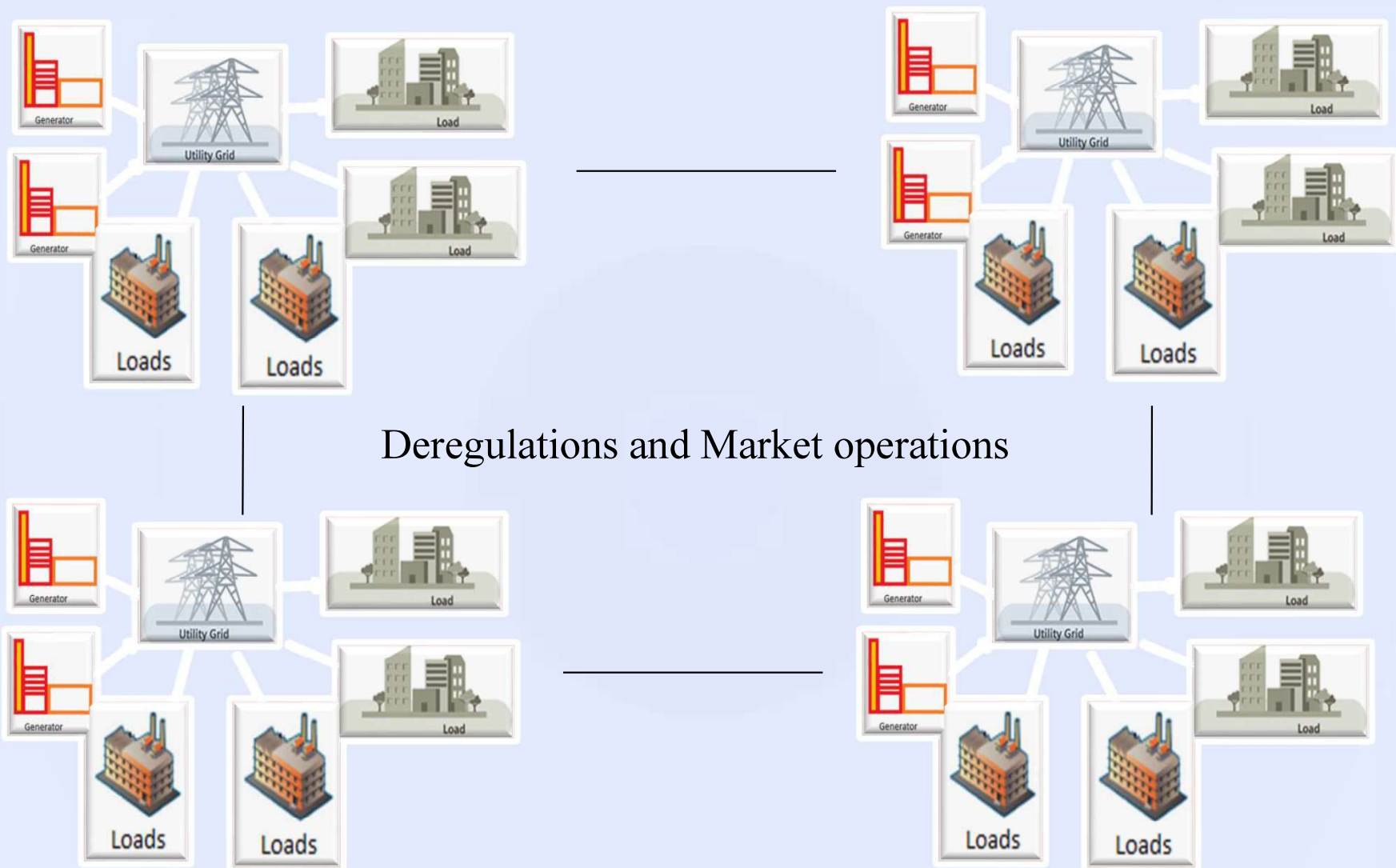
Introduction to Power Grid and its Evolution



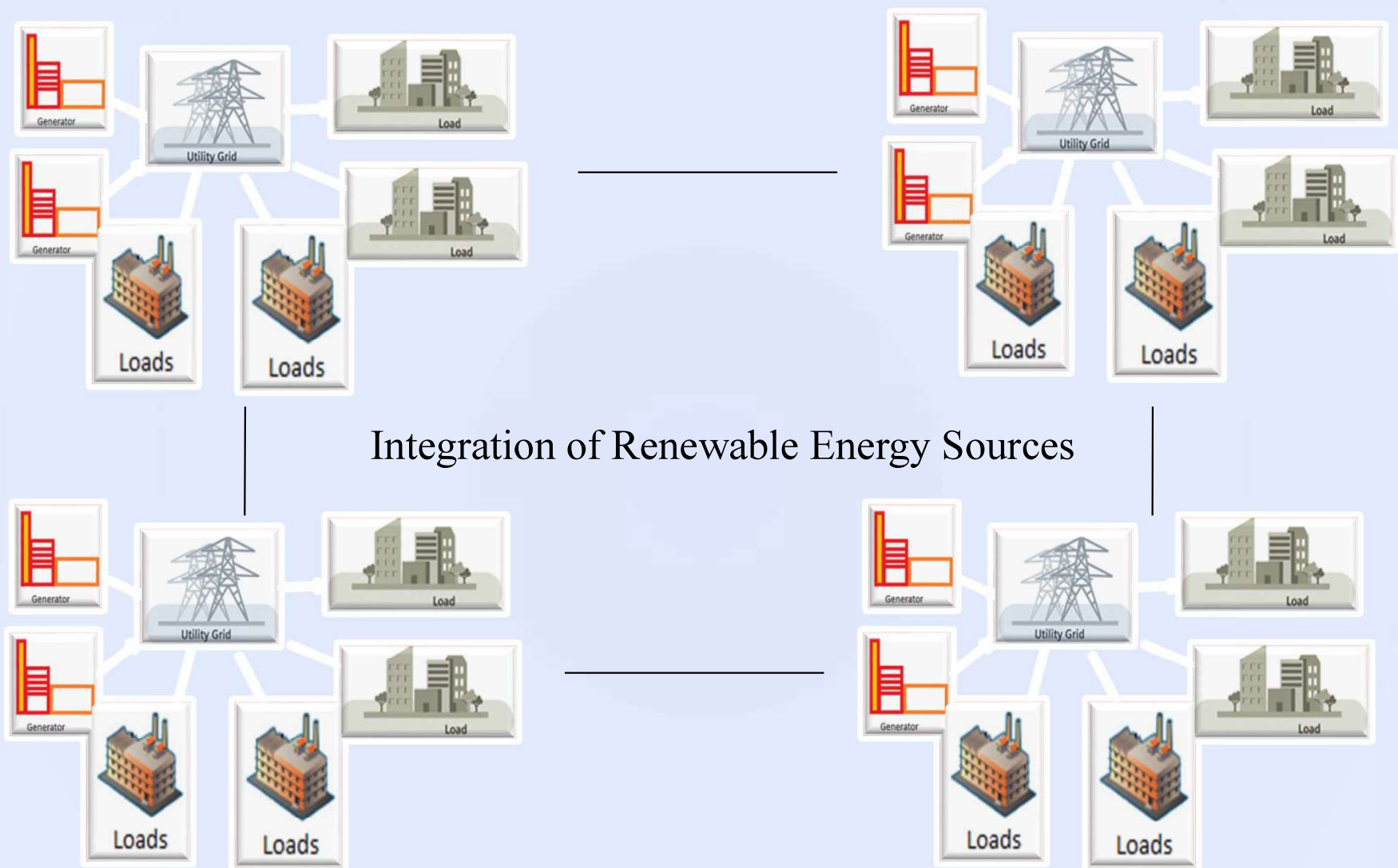
Introduction to Power Grid and its Evolution

- Grid **frequency** and **voltage standardisation** demanded for interconnection of such small areas. (60Hz / 50 Hz)
- The **technological development** (modified transformer design, power flow controllers, FACTS, numerical relays, advanced circuit breakers, etc,) happens continuously to utilize the electrical energy more effectively.
- The high **power electronic converters** supported the operation of AC transmission system to bring flexibility with high efficiency.

Introduction to Power Grid and its Evolution



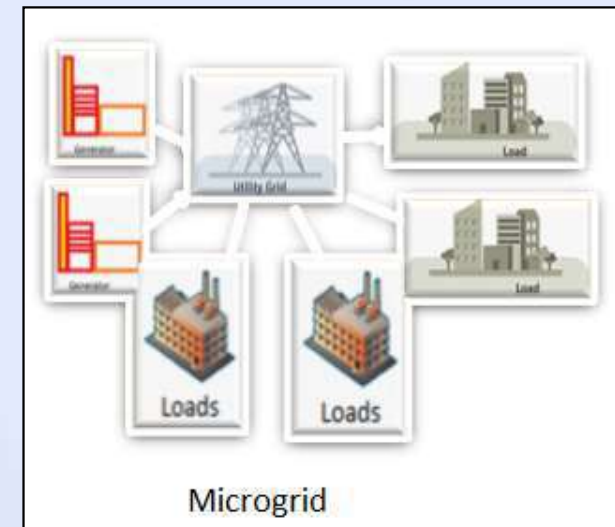
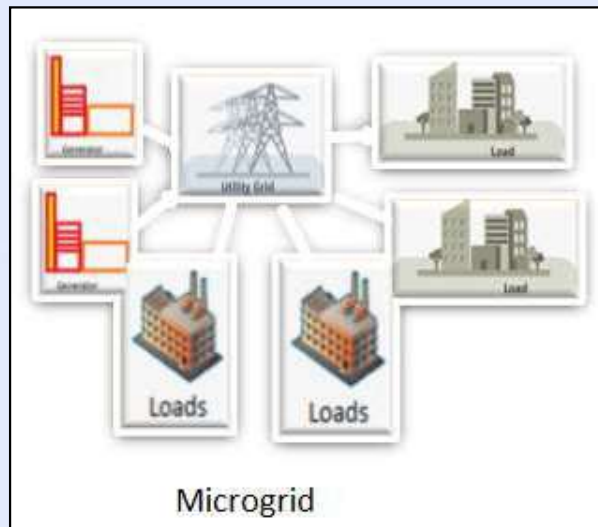
Introduction to Power Grid and its Evolution



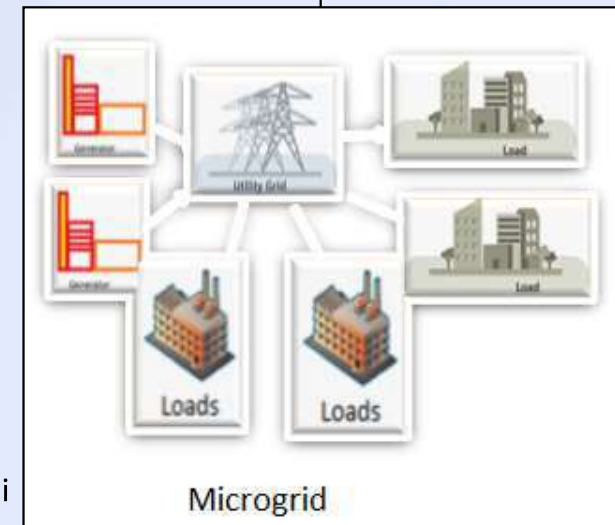
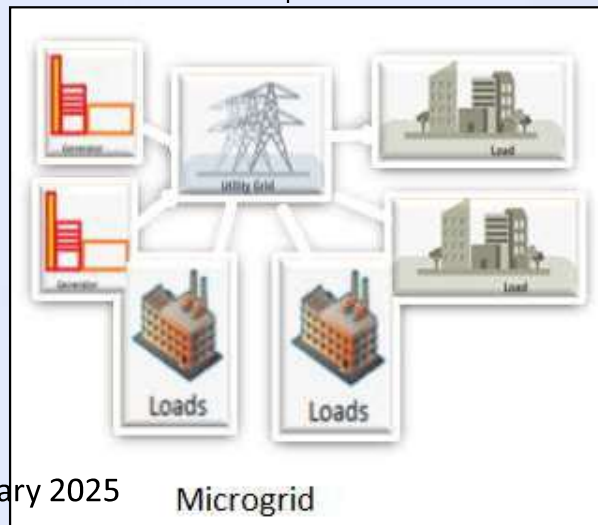
Introduction to Power Grid and its Evolution

- Power system becomes **large and complex to control**, which is very difficult to manage by single utility.
- Rapid growth in the **demand** of electricity
- The **environmental concerns** necessitates the use of alternative energy options, which make many countries to go for major policy changes.

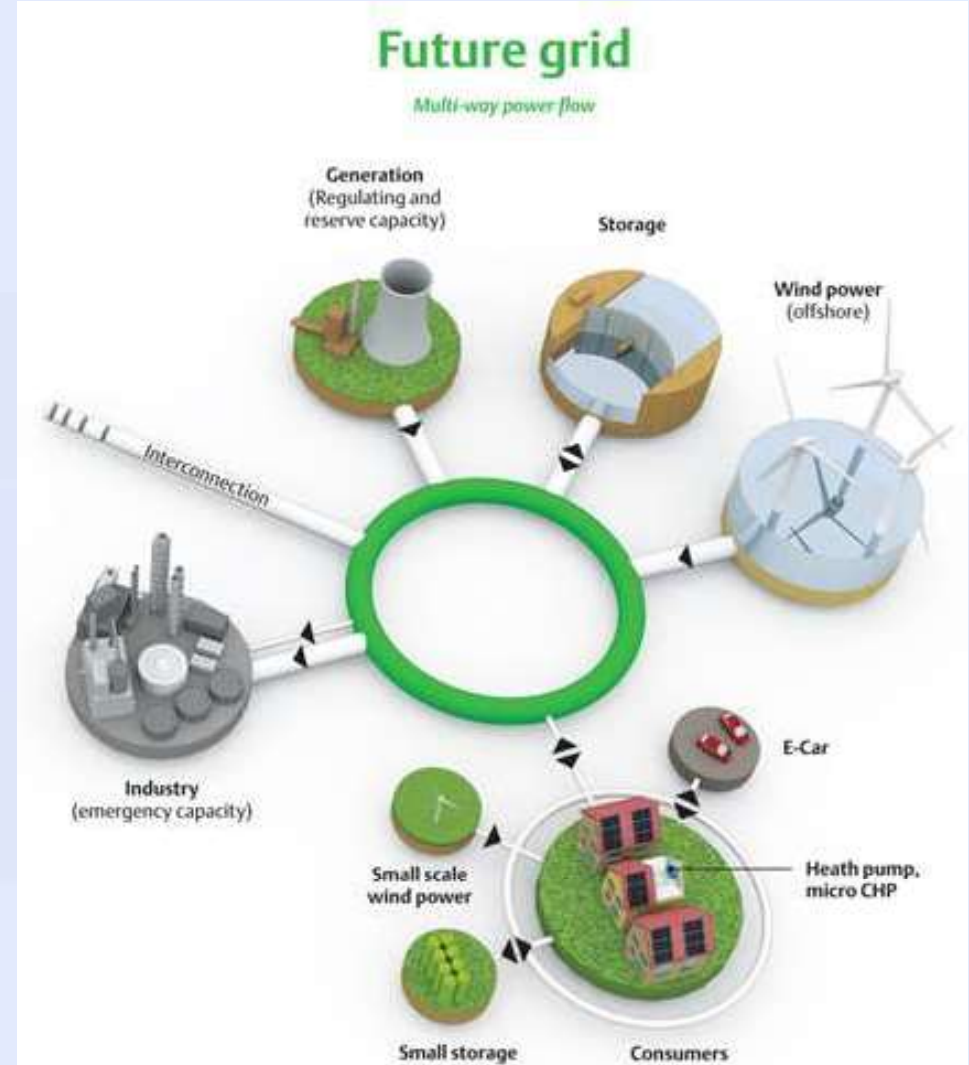
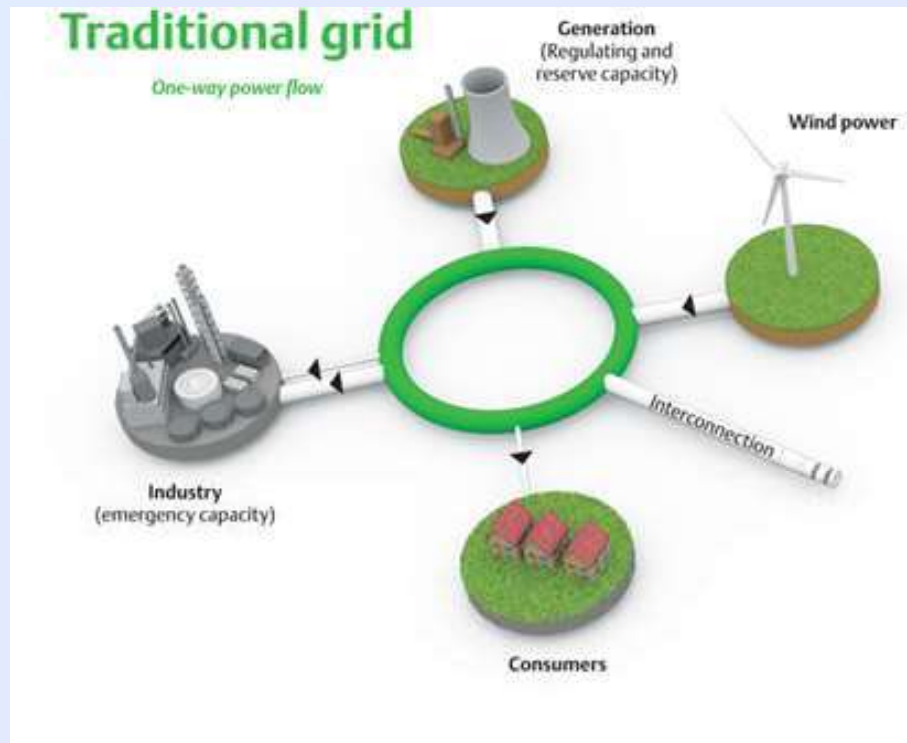
Introduction to Power Grid and its Evolution



Micro Grid formation



Evolution of Modern Power Grid



Evolution of Modern Power Grid

- **In classical power system:** Maximal demand drives generation – Power consumption Peaks since customer decides how much they want to consume.
- **In modern power system:** Generation drives demand – Utilize the available power generation effectively.

Question - 1

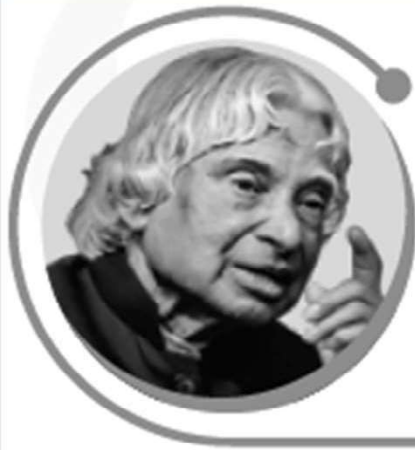
The electrical Power generation has

- a) Boiler
- b) Generator
- c) Turbine
- d) all of the above

Question - 2

The electrical transformer has step-up operation

- a) Near Load end
- b) At distribution centre
- c) At generating station
- d) all of the above



“ Amrita Vishwa Vidyapeetham has a major role to play in transforming our society into a knowledge society through its unique value-added education system.

Dr. A.P.J. Abdul Kalam
Former President of India

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THANK YOU