

INTRODUCTION TO ELECTRICAL POWER DISTRIBUTION



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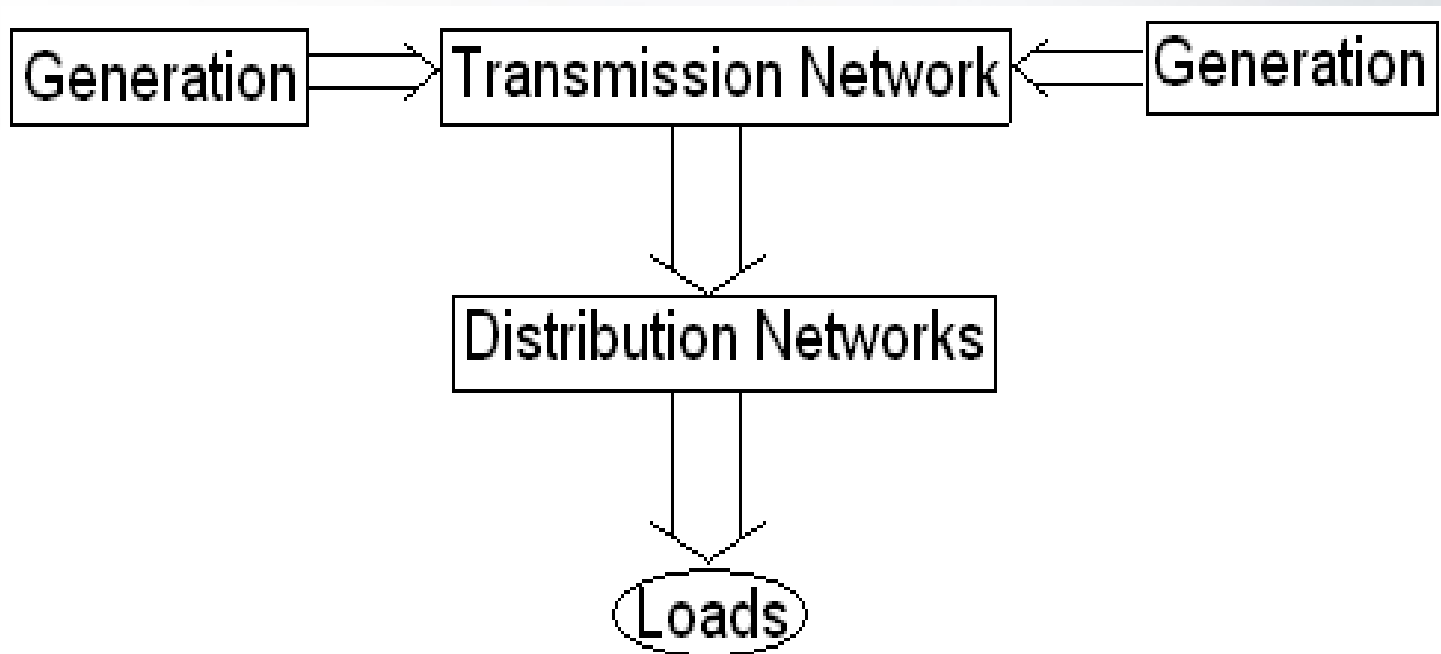


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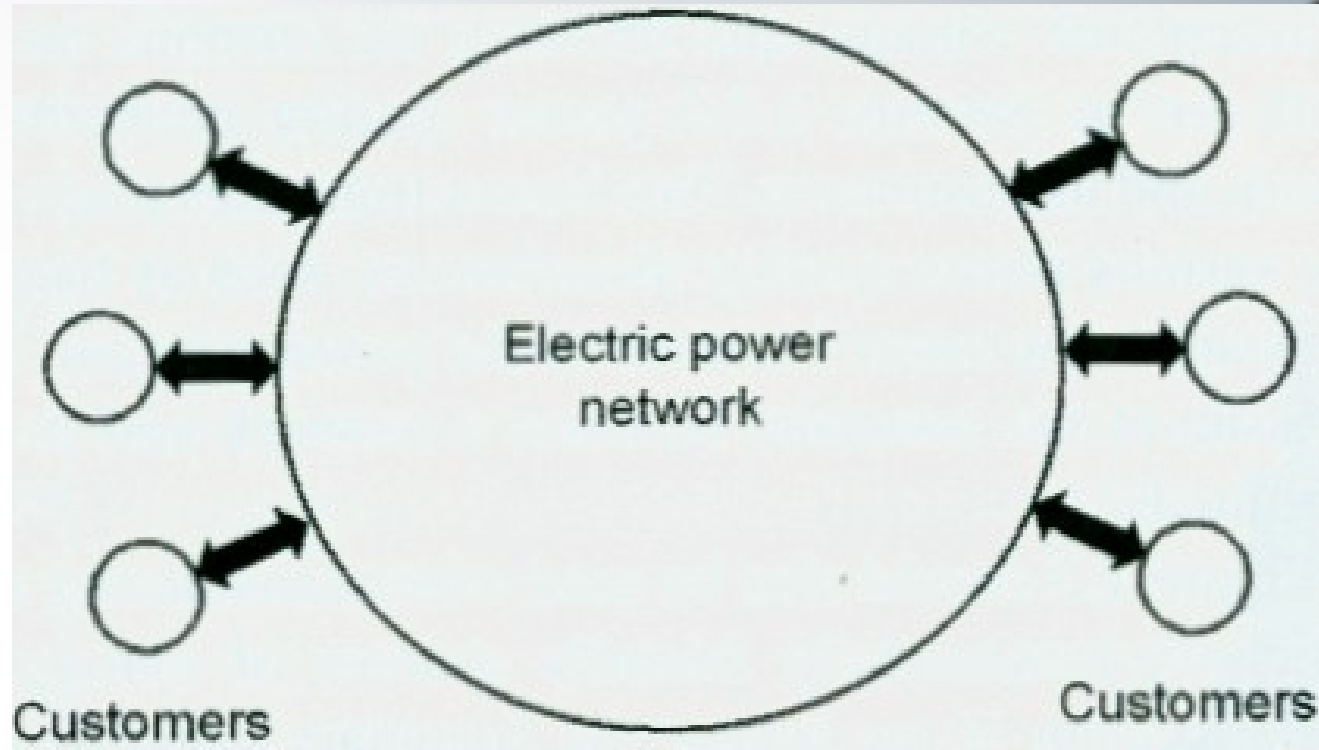
INTRODUCTION



Classical Structure of Power System



Modern View of Power System



History of Electricity



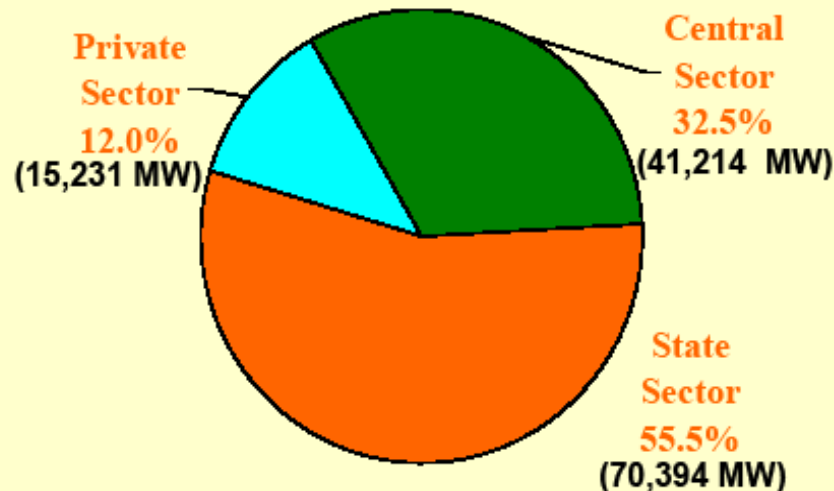
- The electric utility industry was started in **1882** when the first electric station “**Pearl Street Electric Station**” in **New York City**, went into operation.
- Now electricity is the most utilized and useful form of energy in the modern societies with out it, the present social infrastructure would not at all be feasible.
- The increasing in per capita consumption of electricity throughout the world reflects growing standard of living of the people.
- The optimum utilization by society of this form of energy can ensured by an effective distribution system.
- **Electrical Power** is the **basic Infrastructure** for **economic development** of **any developing country like INDIA**.

Present Power Scenario in INDIA



Installed Capacity of Power

Generating Capacity	Hydro	32,976 MW (26%)
	Thermal	83,772 MW (66%)
	Coal	68,989 MW
	Gas	13,582 MW
	Nuclear	3,900 MW (3%)
	Renewables	6,191 MW (5%)
	TOTAL	1,26,839 MW

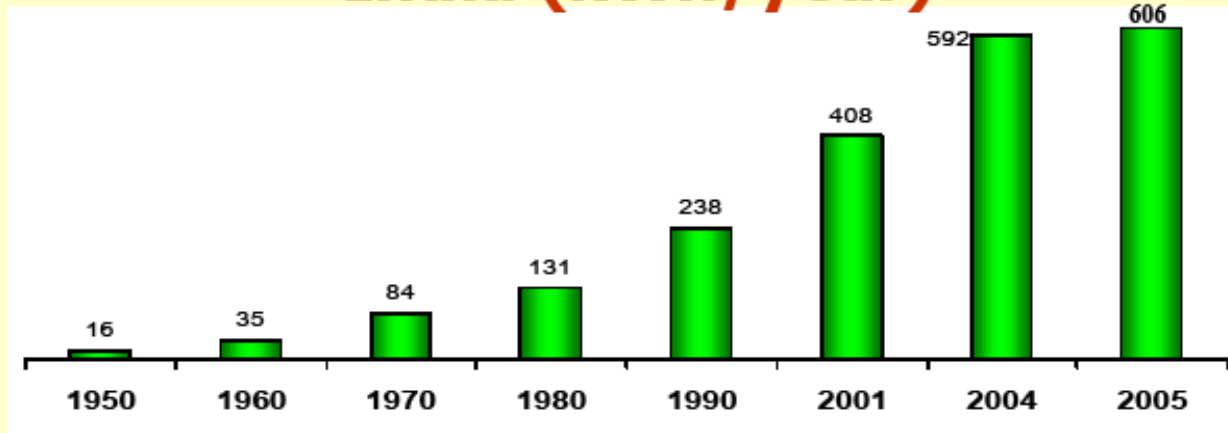


In addition captive generation capacity of appx. 41,000 MW.



➤ In **INDIA**, phenomenal expansion has taken place in the in the area of power systems since last **FIVE DECADES**.

Per Capita Consumption of Electricity in India (kWh/year)



In 1950 Electricity consumption per capita was 15 kwh
In 2012 it is projected at 1000 kwh.

Brazil	:	1900
China	:	1400
Thailand	:	1800
Malaysia	:	3000



- **For example generation capacity has grown at an average rate of 12% and reached a level of more than 1,57,000MW(Approx) as on today.**
- **Similarly the development of transmission network followed the growth, starting with a meager Tr.network, with 132KV as the highest Tr. Voltage at the time of Independence, today beside HVDE lines, we have 765KV as the highest Tr.voltage.**
- **And five regional grids under operation and formation of a National Grid inter connecting all the regional grids in under progress (like National Highways)**
- **In our country out of total 5,87,258 villages as per 1991 survey more than 86% villages have been electrified, 13 states are 100% electrified.**

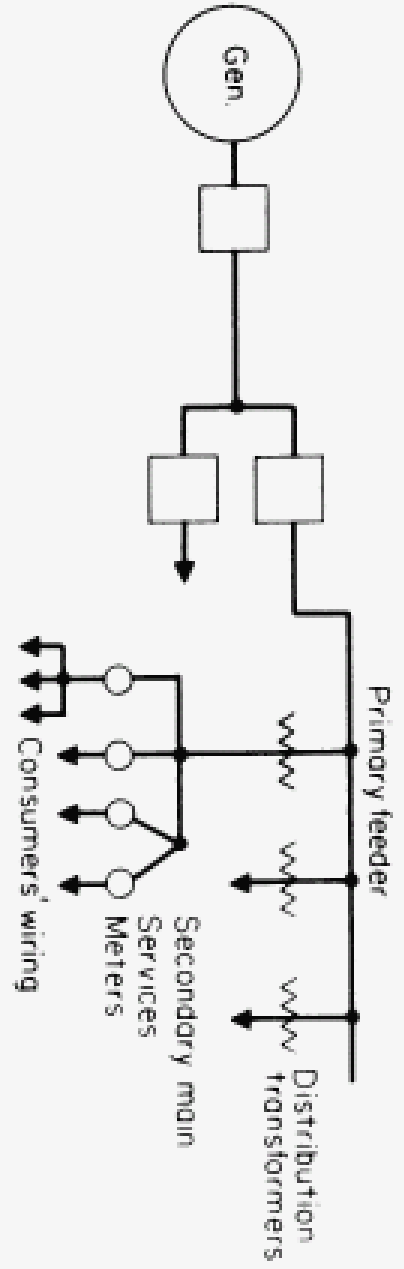
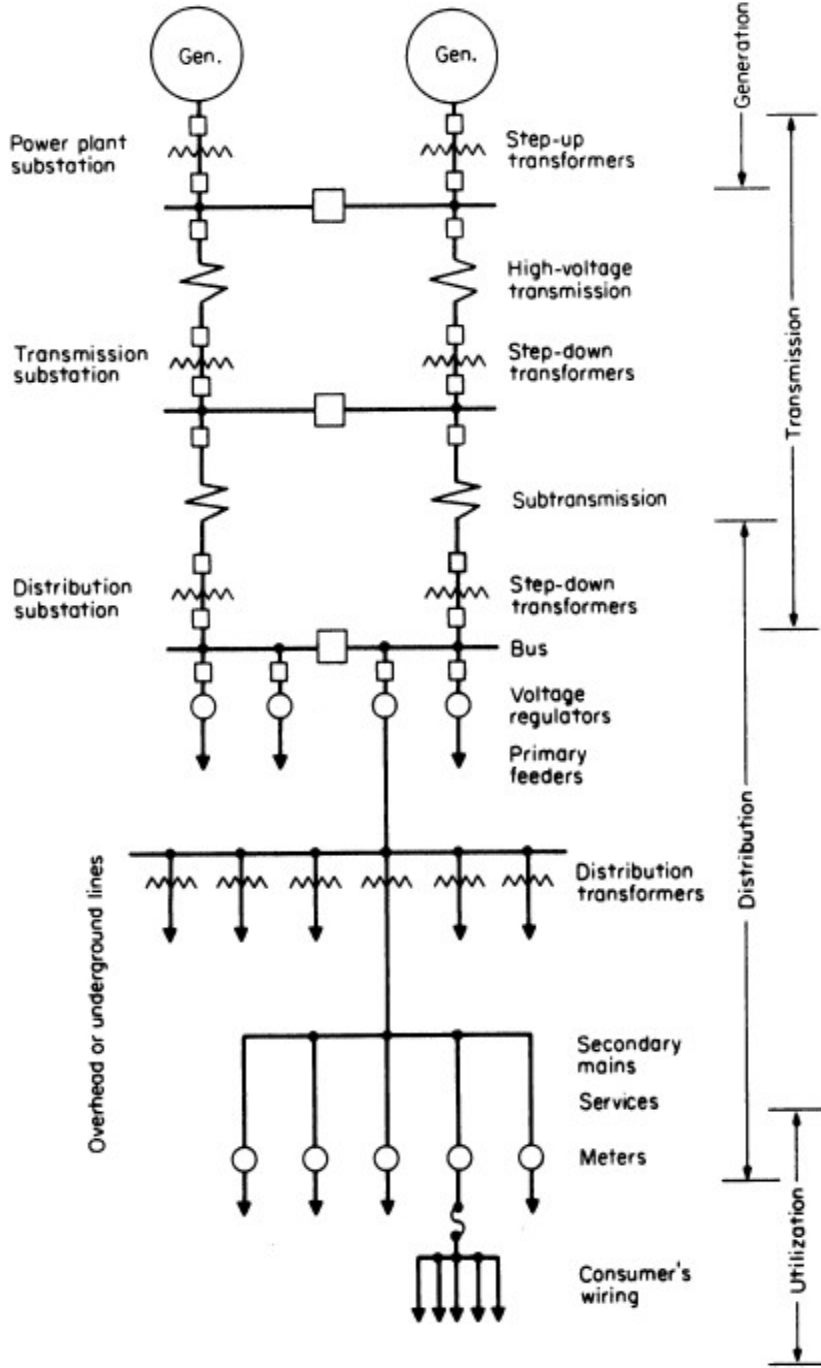
Distribution System



- **The distribution system is particularly important to an electrical utility for two reasons**
 - 1. it's close proximity to the customers**
 - 2. it's high cost of investment**

- **Mainly distribution systems are two types**
 - 1. Primary Distribution (33KV/11KV)**
 - 2. Secondary Distribution (11KV/440V)**

- **Household electricity is alternating current (AC)**
- **Household voltages are typically 120V or 240V**



Distribution System Considerations



- In determining the design of distribution systems, three broad classifications of choices need to be considered:
 1. The type of electric system: dc or ac, and if ac, single- phase or poly phase.
 2. The type of delivery system: radial, loop, or network. Radial systems include duplicate and throwover systems.
 3. The type of construction: overhead or underground.
- **DESIRED FEATURES**
 1. **Safety**
 2. **Smooth and Even Flow of Power**
 3. **Economy**

Types of Electric Systems



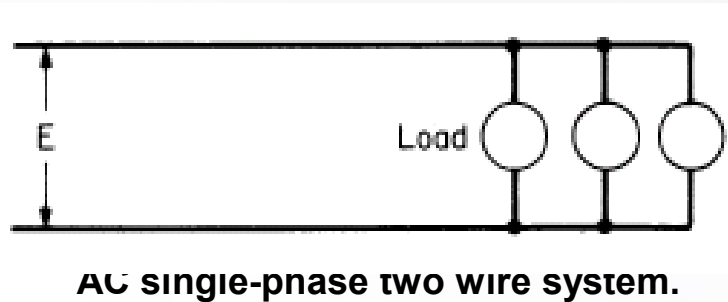
- **Direct Current Systems**
- **Alternating Current Single-Phase Systems**
 1. *Two-wire Systems*
 2. *Three-wire Systems*
 3. *Series system*
- **Alternating Current Two-phase Systems**
 1. *Four-wire Systems*
 2. *Three-wire Systems*
 3. *Five-wire Systems*
- **Alternating Current Three-phase Systems**
 1. *Four-wire Systems*
 2. *Three-wire Systems*
- **Alternating Current Six-phase Systems**
 1. *Six-wire Systems*
 2. *Seven-wire Systems*



➤ Direct Current Systems

➤ Alternating Current Single-Phase Systems

1. Two-wire Systems



2. Three-wire Systems

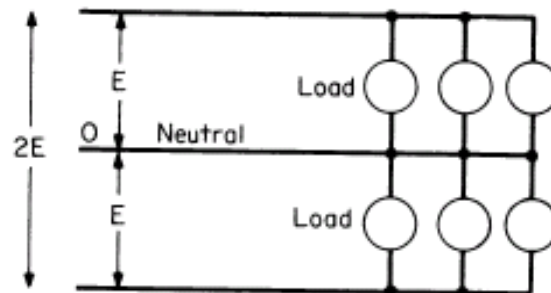


Figure 2-2. AC single-phase three-wire system.

3. Series system

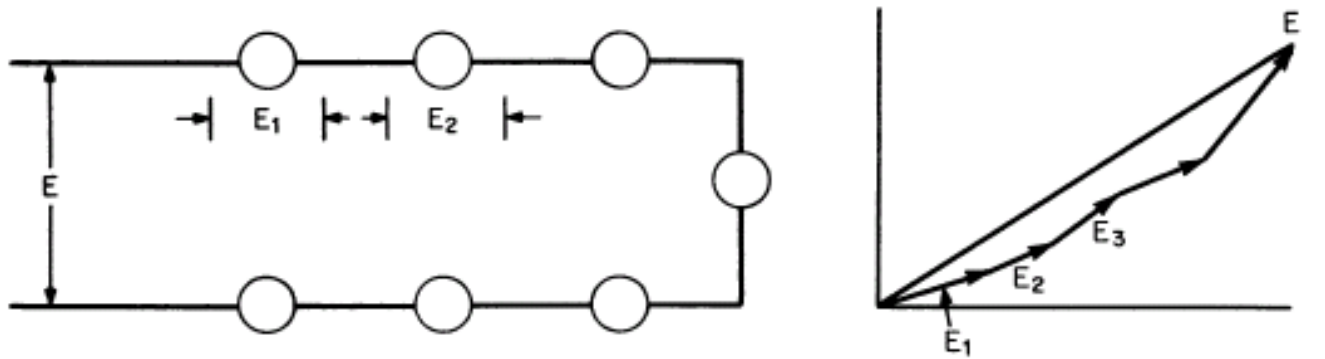


Figure 2-4. AC single-phase series system and voltage vector diagram.

➤ Alternating Current Two-phase Systems

1. Four-wire Systems

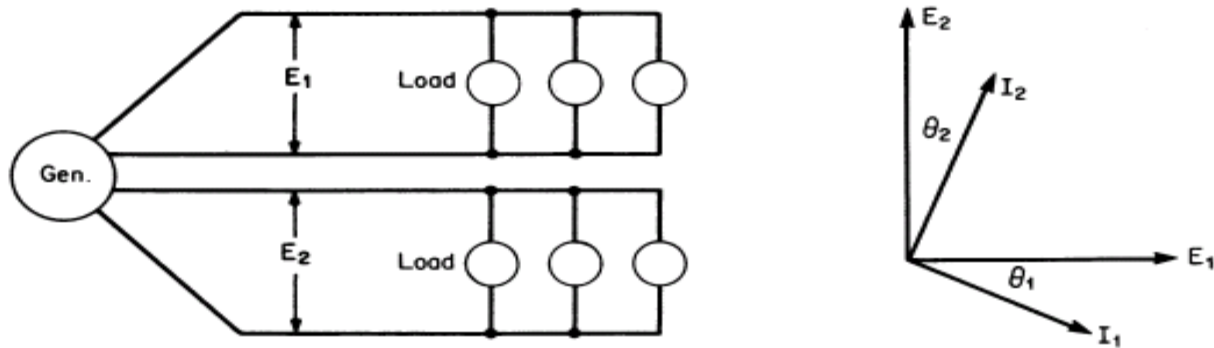


Figure 2-5. AC two-phase four-wire system and vector diagram.

2. Three-wire Systems

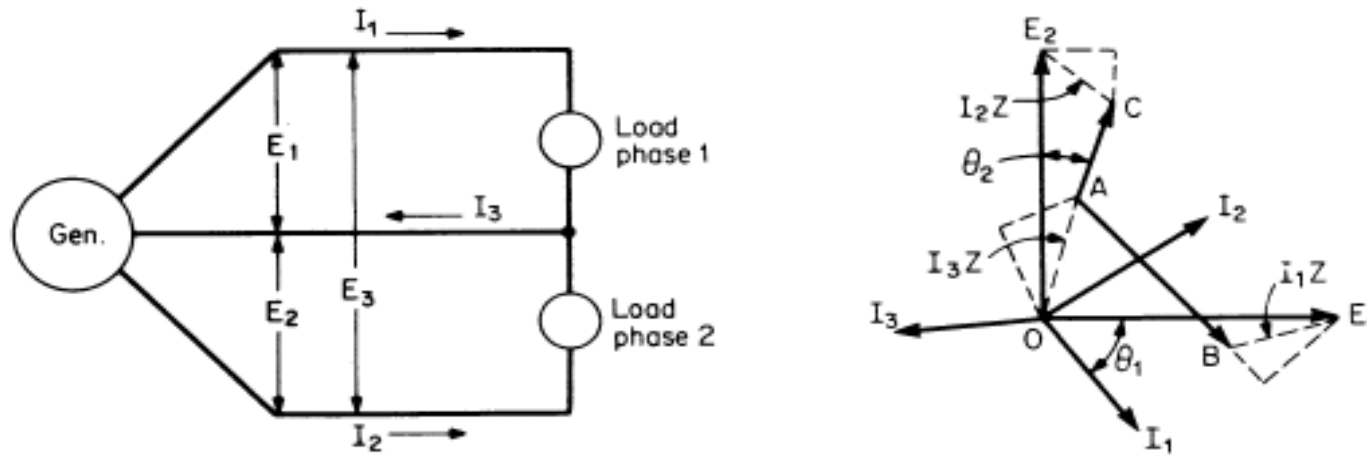


Figure 2-6. AC two-phase three-wire system and vector diagram.

3. Five-wire Systems

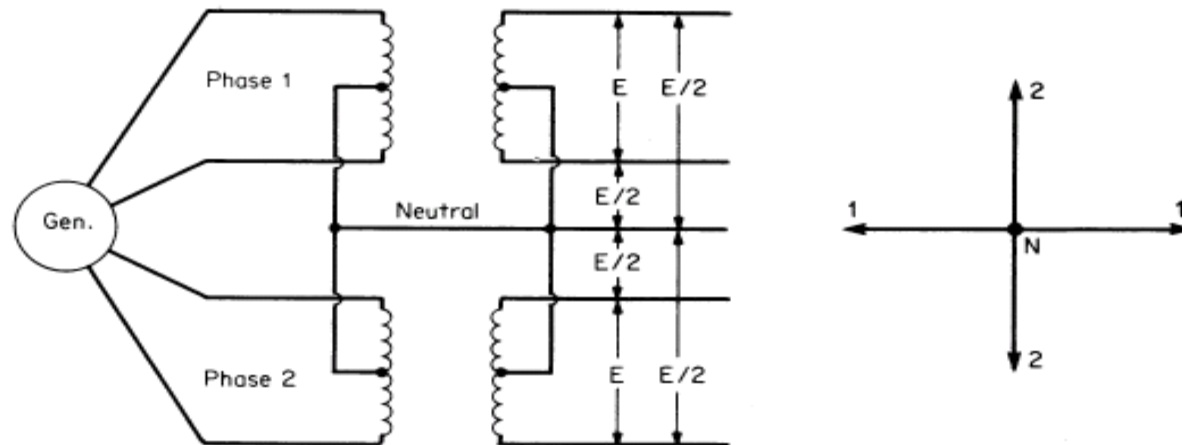
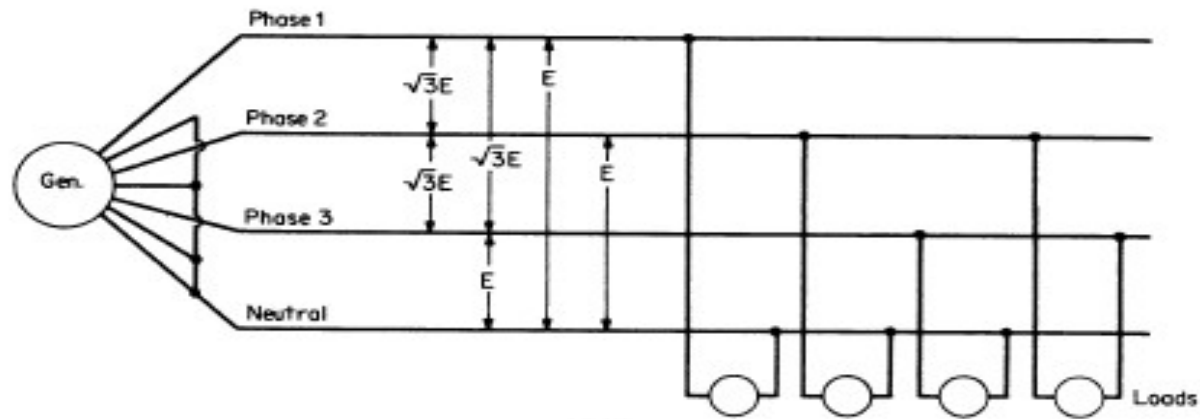


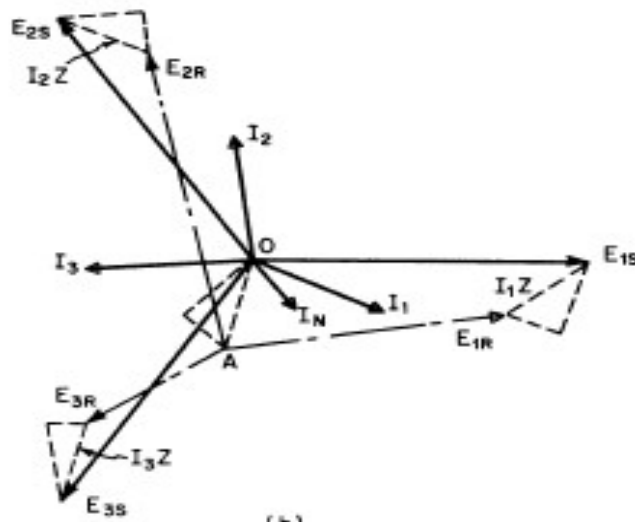
Figure 2-7. AC two-phase five-wire system and vector diagram.

➤ Alternating Current Three-phase Systems

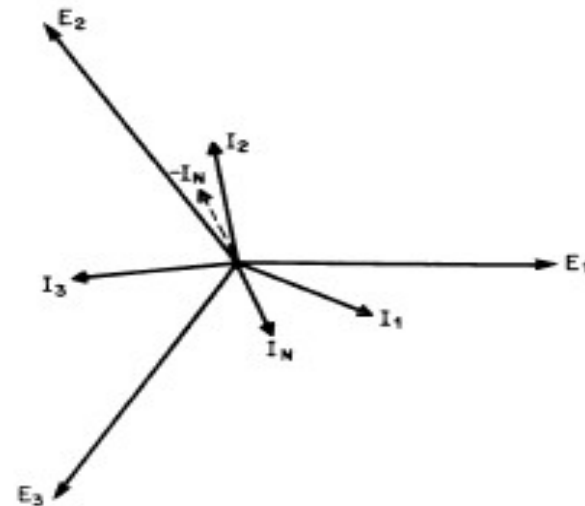
1. Four-wire Systems



(a)



(b)



(c)

Figure 2-8. (a) AC three-phase four-wire system; (b) voltage and current vector diagram; (c) current vector diagram.

2. Three-wire Systems

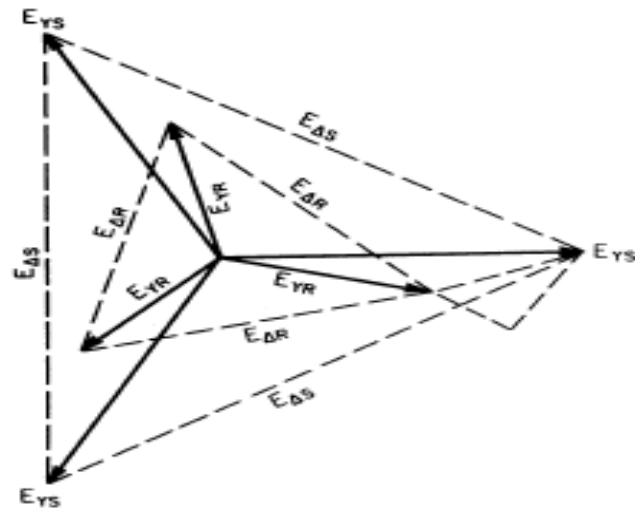
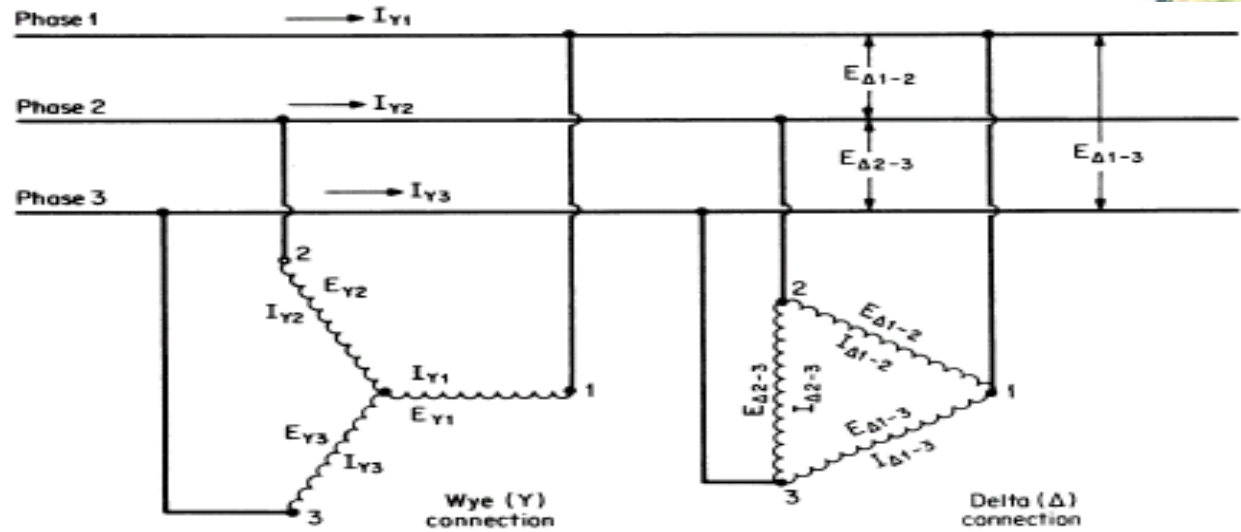
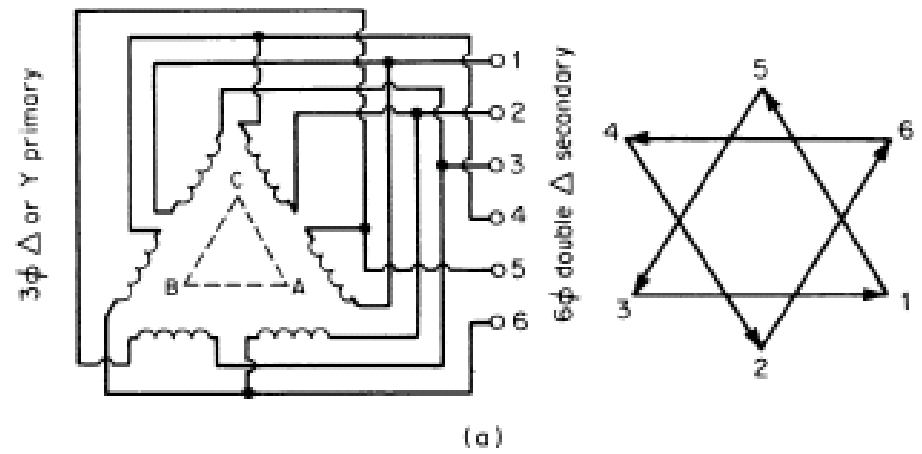


Figure 2-9. AC three-phase three-wire system and voltage vector diagrams (current vector now shown).

❖ Alternating Current Six-phase Systems



1. Six-wire Systems



2. Seven-wire Systems

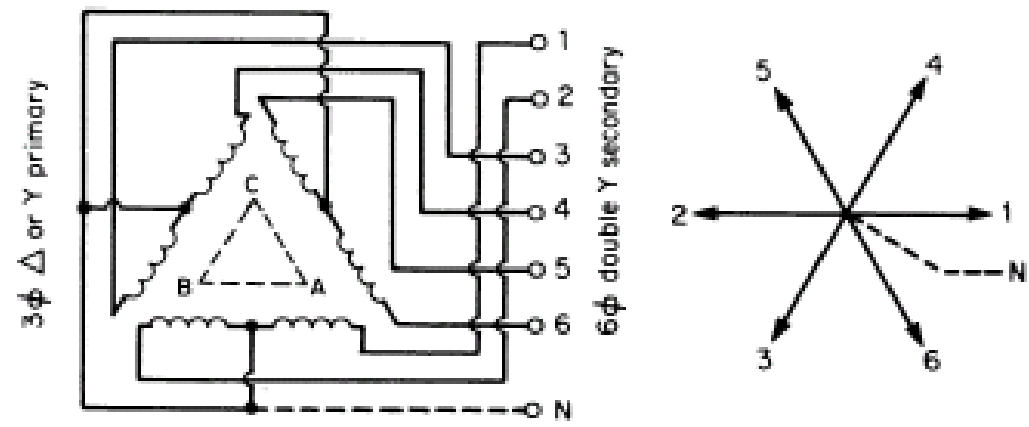




Table 2-1. Comparative efficiencies of AC systems.

<i>Type of ac system</i>		<i>Amount of conductor</i>	<i>Power loss</i>	<i>Voltage drop (approximate)</i>
Single-phase	2-wire	1.0	1.00	1.00
	3-wire	1.5	0.25	0.25
Two-phase	3-wire	1.5	0.50	0.50
	4-wire	2.0	0.25	0.25
	5-wire	2.5	0.25	0.25
Three-phase	3-wire*	1.5	0.167	0.167
	3-wire**	1.5	0.50	0.50
	4-wire*	2.0	0.167	0.167
Six-phase	6-wire	3.0	0.042	0.042
	7-wire	3.5	0.042	0.042

*Wye (Y) voltage same as single-phase.

**Delta (Δ) voltage same as single-phase.



- **Types of Delivery Systems:**

1. **Primary distribution**, which carries the load at higher than utilization voltages from the substation (or other source) to the point where the voltage is stepped down to the value at which the energy is utilized by the consumer.

- **Primary distribution systems include three basic types:**

- 1. Radial systems, including duplicate and throwover systems
- 2. Loop systems, including both open and closed loops
- 3. Primary network systems

2. **Secondary distribution**, which includes that part of the system operating at utilization voltages, up to the meter at the consumer's premises.

THANK YOU!!!

