Energy Storage & Transmission

By

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Lecture (4)

Differences between Electrical Loads & Power Systems Loads

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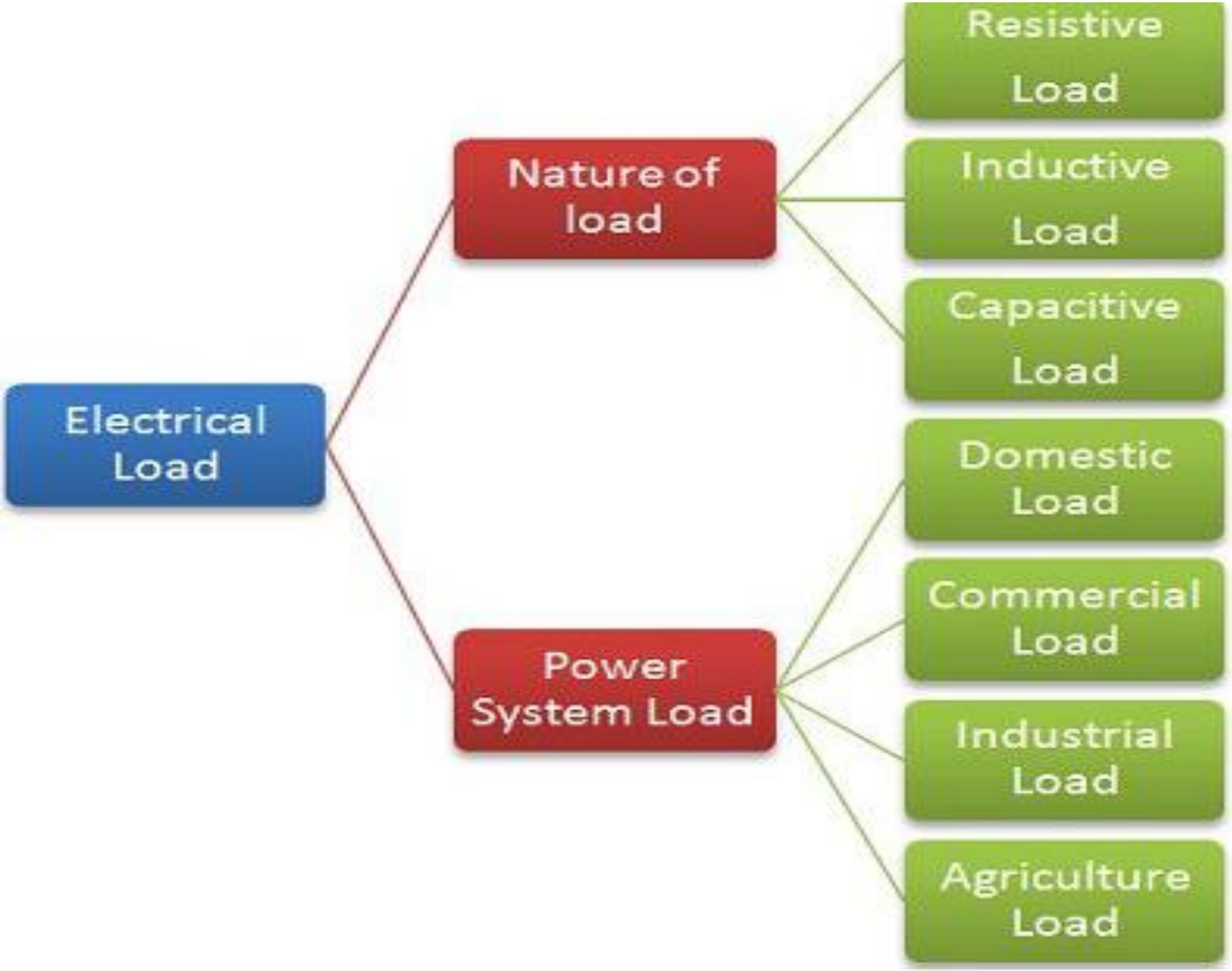

Electrical Load
Nature of load
Power System Load
Resistive Load
Inductive Load
Capacitive Load
Domestic Load
Commercial Load
Industrial Load
Agriculture Load

Types of Electrical Loads

- An **electrical load** is a device or an electrical component that consumes electrical energy and convert it into another form of energy.

- **Examples of electrical loads** Electric lamps, air conditioners, motors, resistors etc.

- They can be classified according to their nature as **Resistive, Capacitive, Inductive, and combinations of these.**

1. Resistive Loads

- Two common examples of resistive loads are **incandescent lamps** and **electric heaters**.

- Resistive loads consume electrical power in such a manner that the current wave remains in phase with the voltage wave. That means, **power factor** for a resistive load is unity.

2. Capacitive Loads

- A capacitive load causes the current wave to lead the voltage wave. Thus, power factor of a capacitive load is leading.

- **Examples** of capacitive loads are: capacitor banks, buried cables, capacitors used in various circuits such as motor starters.

3. Inductive Loads

- An inductive load causes the current wave to lag the voltage wave. Thus, power factor of an inductive load is lagging.

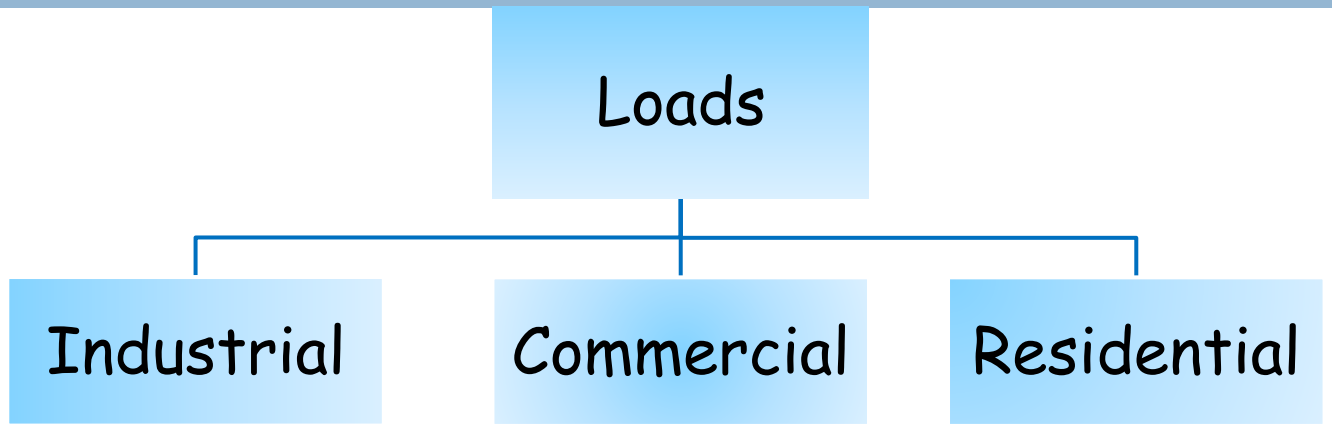
- Examples of inductive load include transformers, motors, and coils.

4. Combination Loads

- Most of the loads are not purely resistive or purely capacitive or purely inductive. Many practical loads make use of various combinations of resistors, capacitors and inductors. Power factor of such loads is less than unity and either lagging or leading.

- **Examples:** Single phase motors often use capacitors to aid the motor during starting and running, tuning circuits or filter circuits.

Types of loads in power system



1. Very large industrial loads may be served from the transmission system.
2. Large industrial loads are served directly from the sub transmission network.
3. Small industrial loads are served from the primary distribution network.

Cont.

- **Commercial and residential loads** consist largely of lighting, heating, and cooling. These loads are independent of frequency and consume negligibly small reactive power.

- **The industrial loads** are composite loads, and induction motors form a high proportion of these load. These composite loads are functions of voltage and frequency and form a major part of the system load.

Cont.

- The magnitude of load varies throughout the day, and power must be available to consumers on demand.

- **The load factor** is the ratio of average load over designated period of time to the peak load occurring in that period.

$$\text{Daily L.F.} = \frac{\text{average load}}{\text{peak load}}$$

residential loads

Coffee maker	900-1200 watts
Microwave	750-1100 watts
Toaster	800-1400 watts
Dishwasher	1200-2400 watts
Washer	350-500 watts
Dryer	1800-5000 watts
Iron	100-1800 watts
Ceiling fan	65-175 watts
Space heater (40gal)	4500-5500 watts
Hair dryer	1200-1875 watts
Laptop	50 watts
Computer monitor	150 watts
Computer tower	120 watts
Television 19"-36"	65-133 watts
Television 53"-61"	170 watts

Example (1)

The daily load on a power system varies as shown in Table 1.2. Use the **barcycle** function to obtain a plot of the daily load curve. Using the given data compute the average load and the daily load factor (Figure 1.2).

Table 1.2 Daily System Load

Interval, hr			Load, MW
12 A.M.	–	2 A.M.	6
2	–	6	5
6	–	9	10
9	–	12	15
12 P.M.	–	2 P.M.	12
2	–	4	14
4	–	6	16
6	–	8	18
8	–	10	16
10	–	11	12
11	–	12 A.M.	6

Solution (1)

- The following data:

Interval, hr		Loads, MW
0	2	6
2	6	5
6	9	10
9	12	15
12	14	12
14	16	14
16	18	16
18	20	18
20	22	16
22	23	12
23	24	6

Sum (Dt) =

(2-0)+(6-2)+(9-6)+(12-9)+(14-12)+(16-14)+(18-16)+(20-16)+(22-20)+(23-22)+(24-23)=24

W = P * Dt=

6*(2-0)+5*(6-2)+10*(9-6)+15*(12-9)+12*(14-12)+14*(16-14)+16*(18-16)+18*(20-16)+16*(22-20)+12*(23-22)+6*(24-23)=277

P_{avg}= W / Sum(Dt)=

277/24=11.5417

P_{peak}= 18

Load Factor=P_{avg}/P_{peak}= (11.5417/ 18)=64.12

Prices of electricity slots

الاستهلاك (ك.و.س/شهر)	٢٠١٨/٢٠١٩ (جنيه/مشترك-شهر)
جهد فائق، عالي ومتوسط	٣٥,٠
أخري جهد منخفض	٤,٠
استخدمات أخرى جهد منخفض	٢٥,٠
الاستخدامات المنزلية	
الاستهلاك (ك.و.س/شهر)	
٥٠٠-٠	١,٠
١٠٠٠-٥٠١	٢,٠
٢٠٠٠-١٠٠١	٦,٠
٣٥٠٠-٢٠٠١	١١,٠
٦٥٠٠-٣٥٠١	١٥,٠
١٠٠٠٠-٦٥٠١	٢٥,٠
أكثر من ١٠٠٠٠	٤٠,٠
المقروء بصفر	٩,٠
المحلات التجارية	
الاستهلاك (ك.و.س/شهر)	
١٠٠٠-٠	٥,٠
٢٥٠٠-١٠٠١	١٥,٠
٦٠٠٠-٢٥٠١	٢٠,٠
١٠٠٠٠-٦٠٠١	٢٥,٠
أكثر من ١٠٠٠٠	٤٠,٠
المقروء بصفر	٩,٠

How to Calculate Your Electric Bill ?

- To calculate your electric bill, you'll need to figure the energy usage of each of the appliances and electronic devices in your home.
- **calculate the cost of use with this formula:**

1. Multiply the device's wattage by the number of hours that the appliance is used per day.
2. Divide by 1000.
3. Multiply by your kWh rate.

Example (2)

- *Suppose, a consumer consumes 1000 watts load per hour daily for one month. Calculate the total energy bill of the consumer if the unit rate is 9.*

Solution (2)

- 1unit = 1kWh.
- So Total kWh = 1000 Watts x 24 Hrs x 30 Days = 720000 watts hour.
- We want to convert it into units, where is 1unit = 1kWh. So total consumed units. 720000/1000…… (k=kilo=1000).
  Total units = 720.
  Cost per unit is 9.
- So total cost or electricity bill= 720 x 9 = 6480