Generation and Economics of Electric Power

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Power : The Building Block of Economy

- Electricity- the most imp. Infrastructural input in the development & growth of economy.

- Consumption of electricity- imp. Index of advancement of the country & standard of living.

- Economic growth rate of 8-9% on a sustained basis is necessary for us to catch up with the rest of the world.
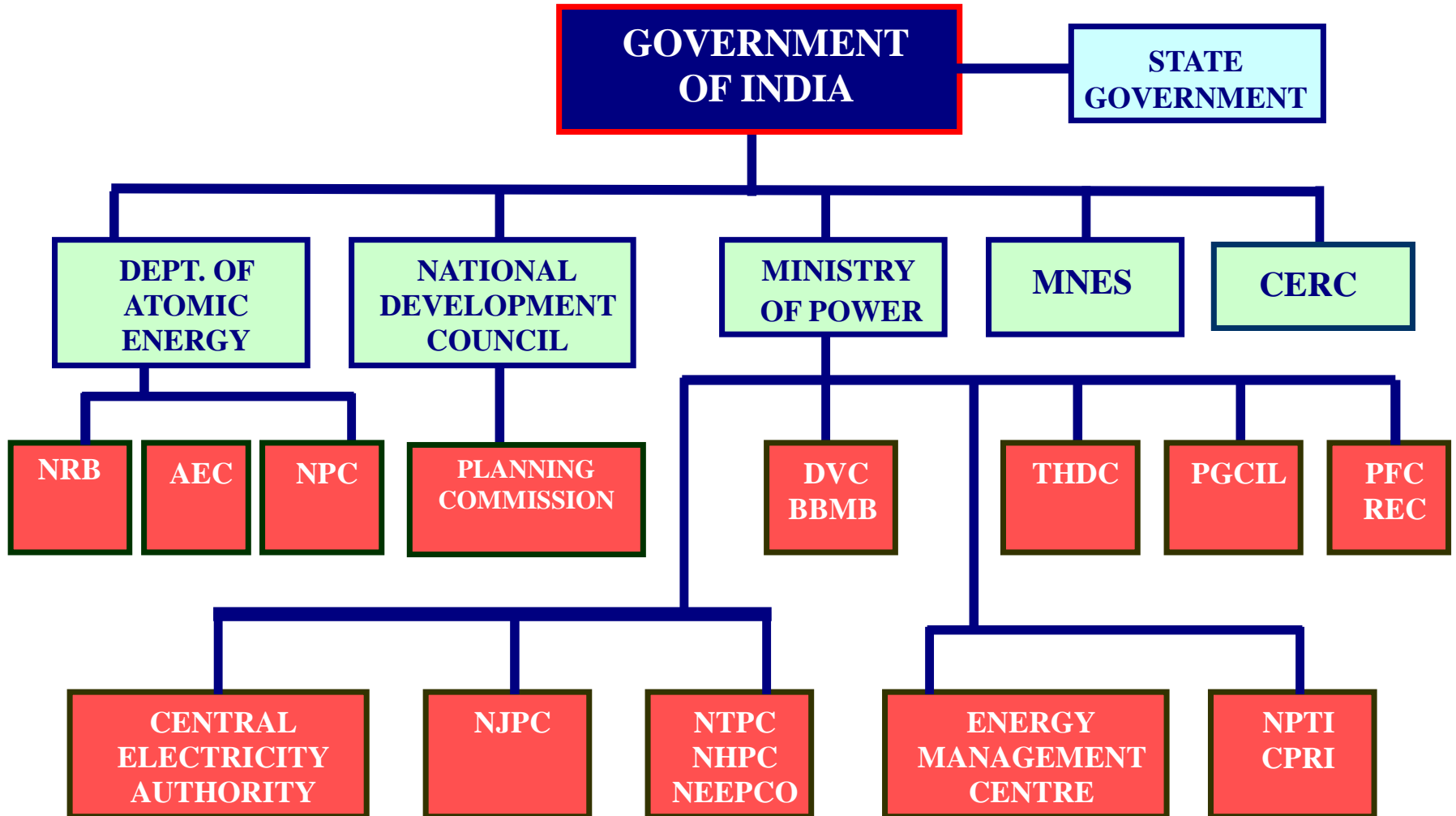
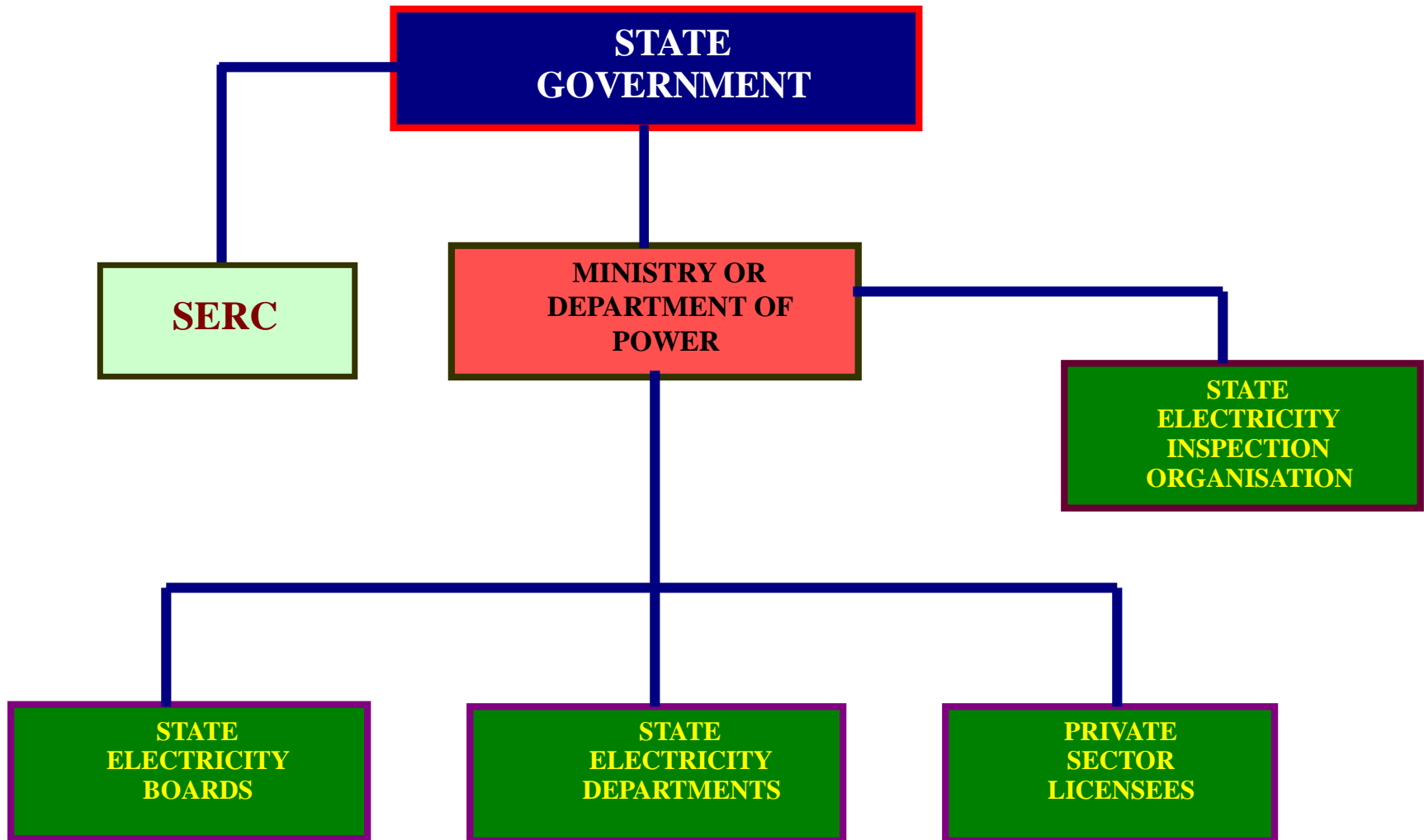# Growth of India's Power Sector

serious growth after the 60s
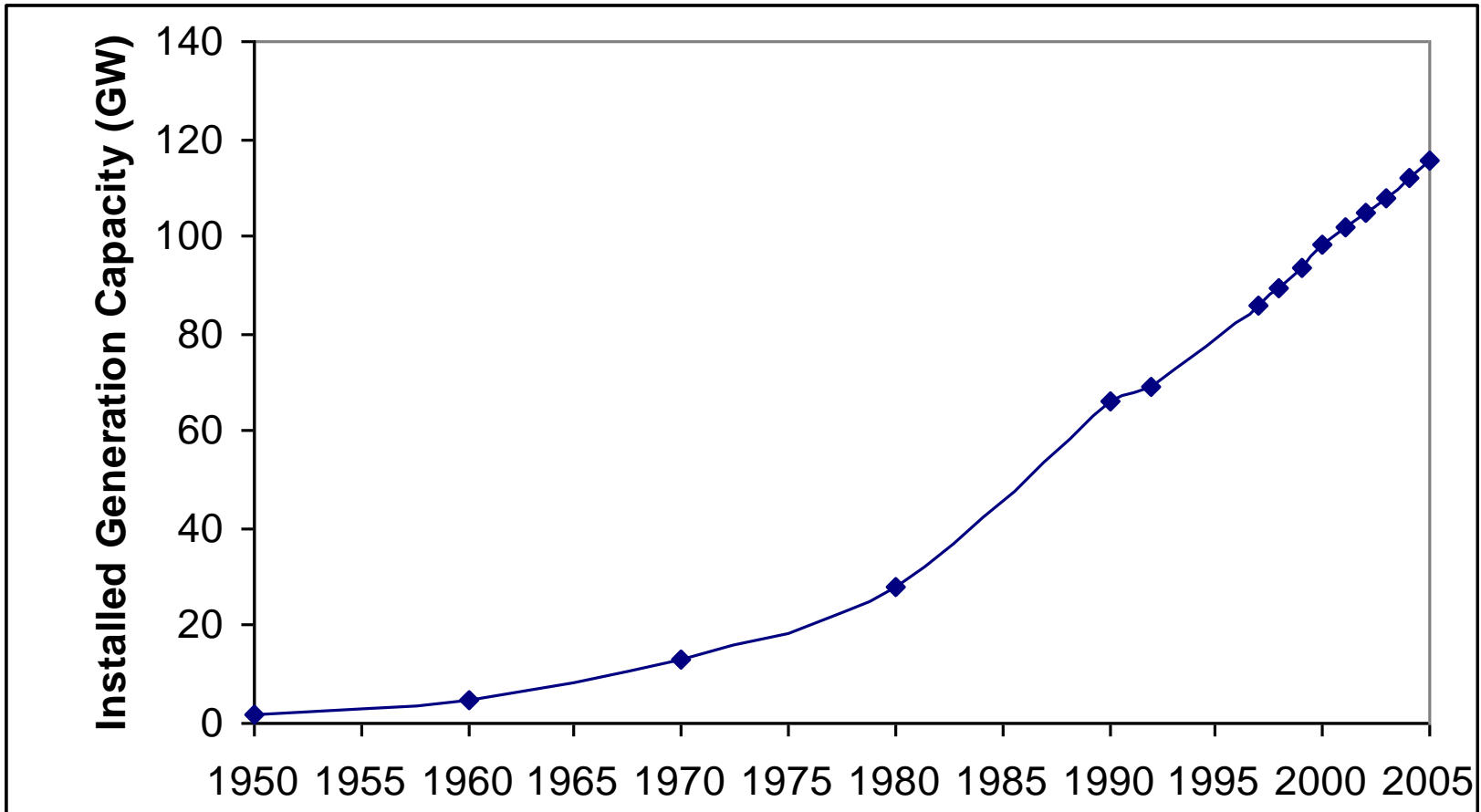
Institutional Framework
# Central Power Organization

State Power Organization

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              ┌─────│  STATE              │
              │     │  GOVERNMENT         │
              │     └─────────┬───────────┘
     ┌────────┴──────┐        │
     │               │        │
┌────┴─────┐   ┌──────┴────────────────┐
│  SERC    │   │  MINISTRY OR          ├──────────────┐
│          │   │  DEPARTMENT OF        │              │
│          │   │  POWER                │        ┌─────┴──────────┐
└──────────┘   └──────────┬────────────┘        │  STATE         │
                          │                     │  ELECTRICITY   │
                          │                     │  INSPECTION    │
                          │                     │  ORGANISATION  │
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STATE GOVERNMENT

SERC

MINISTRY OR DEPARTMENT OF POWER

STATE ELECTRICITY INSPECTION ORGANISATION

STATE ELECTRICITY BOARDS

STATE ELECTRICITY DEPARTMENTS

PRIVATE SECTOR LICENSEES

Load and Load Curves

**Load Curve**

Load curve or chronological curve is the graphical epresentation of load (in kW or MW) in proper time sequence and the time in hours.

Practical Load Curve
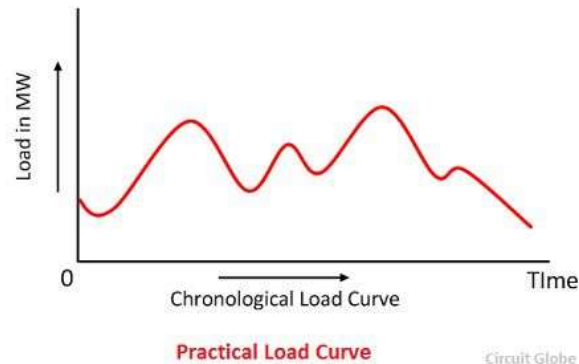
Mass Curve

A mass diagram is the plot of accumulated inflow (i.e. supply) or outflow (i.e. demand) versus time. The mass curve of supply (i.e. supply line) is, therefore, first drawn and is superimposed by the demand curve.

Mass curve
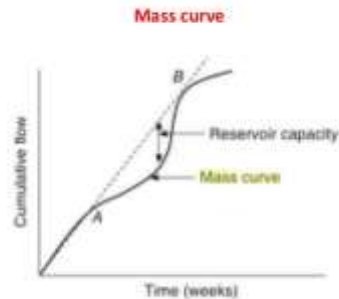
Definitions

- Types of loads and effect of load
- Maximum demand
- LF,UF,GDF,PDF,CF
- Base load plant
- Peak load plant
- Load forecasting

Costs of plants

- Capital Cost includes

  Preliminary cost, cost of land cost of design and planning ,cost of building equipment ,transprtation ,erection and installation etc.

- Annual fixed Cost includes

  Interest, taxes, insurance, depreciation, managerial cost and rate of return

- Operating cost

  Fuel, maintenance Cost and supplies

And effect of load factor on energy cost.

Depreciation

- Depreciation: Depreciation is treated as a revenue loss which is recorded when expired utility fixed assets such as plant and machinery, building and equipments.

Straight Line method

Sinking fund Method

Fixed percentage method

A power plant has initial cost of Rs 2*108. Assuming a salvage value of 15 % and useful life of 25 years , (a) find rate of depreciation by fixed percentage method (b) Also find accumulation depreciation at the end of 10th year.

Tariffs

- Objective of tariff making
- Types of tariffs
- (i) Domestic
- (ii) Commercial
- (iii) Agricultural
- (iv) industrial

Power factor improvement

- Causes of low power factor

- Need for power factror improvement

- Using capacitors

- Determination of economic power factor :

A load of 500 kW at 0.8 pf lagging is takes by industry concern. The tariff is rs 400 per kVA of maximum demand per year + 100 paisa per kWh. The cost of installation of capacitor bank is rs 600 per year and the interest and depreciation is 11 % . Find (a) the most economic power facotor (b) rating of capacitor bank to improve the power factor to this value.

Power plants Selection

- Selection of plant (plant location, plant Size, number and size of unit)
- Economic Comparative Analysis based on
(i)   Annual Cost
(ii) Rate of return
(iii) Present worth
(iv) Capatilised Cost

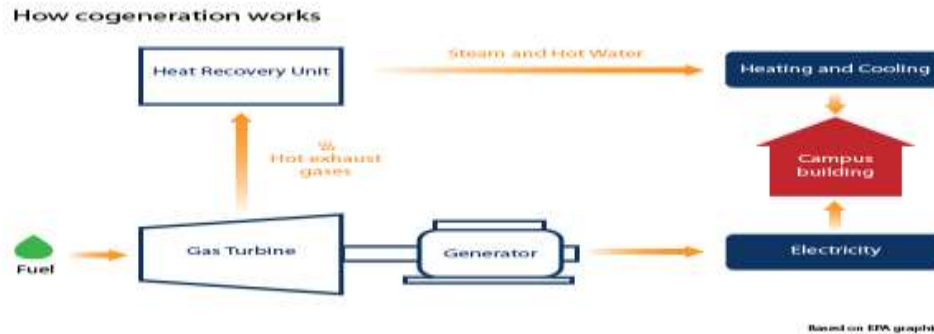# Economic operation of Steam plants

- Input-output Curve

- Heat rate

- Incremental Cost

- Lagrangian multiplier

- Iterative procedure to solve coordination equations

Hydrothermal Coordination

- Run-off river plant
- Long term operational aspects
- Scehdulling methods

Cogenration

- **Cogeneration**. **Cogeneration** is the process of producing electricity from steam (or other hot gases) and using the waste heat as steam in chemical processes. In contrast, a stand-alone power-producing plant typically converts less than 40% of the heat energy of fuel (coal, natural gas, nuclear, etc.)

- Topping and Bottoming Cycles

- Different technologies(Steam turbine, gas turbine and combined Cycle)

References

- https://circuitglobe.com/load-curve.html
- https://www.google.com/search?q=cogeneration&tbm=isch&source=
- B.R. Gupta, " generation of electrical energy" , S. chand 2017