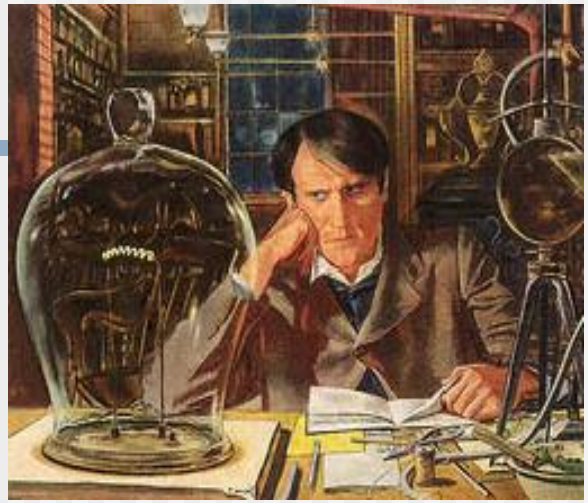
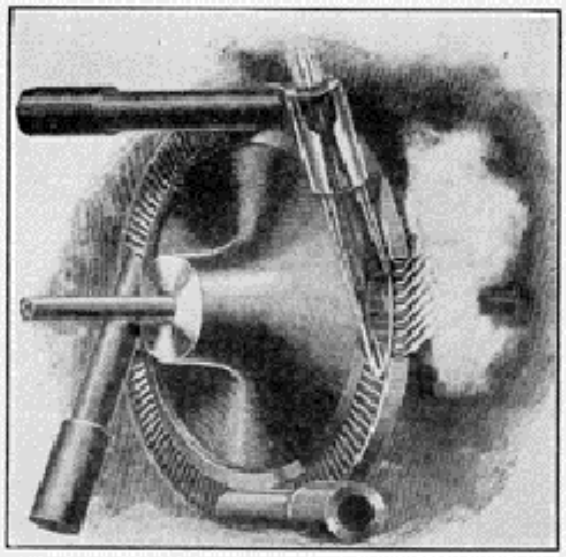
HISTORY OF POWER GENERATION

- ***1878*** **- Joseph Swan** and **Thomas Edison** independently invented the carbon filament that produced light from electricity – incandescent lamp.
- ***1879*** **- Thomas Edison** founded the electric company, his greatest achievement **-** "Edison Electric Light Station".
- ***1882*** – **Carl de Laval** invented steam turbine that drove electric generators more efficiently than earlier reciprocating steam engines. Coal then oil was used.





HISTORY OF POWER GENERATION (2)

- ***1884* - Charles Parsons** constructs the first practical steam turbine electric generator to be driven by fuel-burning power plants in the electric power industry.
- ***1895* - Niagara Falls -** world's first large-scale central generating station transmitts power 20 miles away to Buffalo and it employed 2-phase AC techniques of Nikola Tesla.
- ***1905* - Albert Einstein** publishes his "Theory of Relativity" and the equation $E = m c^2$, foundation of nuclear power.
- ***1907* -** a new material called *tungsten* was used to replace carbon strips of bamboo as filament in the incandescent lamps
- ***Other inventions that used electricity* -** electric trams and railways for urban transport, telephone and telegraph, phonograph, radio and television, incandescent and fluorescent lighting, electric motors and electric heating, refrigeration and air conditioning, computers and electronics - accelerated the need for larger and reliable generating plants.

HISTORY OF POWER GENERATION (3)

- ***1946*** – **John Eckert** and **John Mauchly** construct first electronic computer (ENIAC) using 18,000 vacuum tubes.
- ***1948*** - **John Bardeen, et al -** invent solid-state transitor, revolutionizes the computer and electronics industries leading to smaller, faster and reliable machines.
- ***1953*** - **Jay Wright Forrester** develops random-access memory (RAM) using magnetic techniques for computers.
- ***1954*** - **Bell Telephone Lab** develops photovoltaic cells that convert light energy to electrical energy without any fuel.
- ***1954*** - **George Teal** develops silicon transistor.
- ***1954*** - **Obninsk, Moscow, USSR** - first nuclear power plant goes into operation (5 MW).
- ***1958*** - **Jack Kilby** develops integrated circuit (IC) that leads to 3rd generation computers - smaller, faster.

HISTORY OF POWER GENERATION (4)

- ***1966*** **- Bay of Rance, Brittany, France -** first modulated single-basin tidal power plant with peak power of 240 MW.
- ***1972*** **- Hideki Shirakawa** discovers electrically conductive plastics by accident when he adds 1000 times too much catalyst while making polymer polyacetylene. In 1977, adding iodine vastly improved the plastic's conductivity.
- ***1988*** **- AT&T** develops the mono-electronic transistor which can switch a circuit with the passage of a single electron.
- ***1992*** **- Camelfor, Cornwall, UK -** first commercial wind farm to generate electricity for the grid.
- ***1995*** **- Clyde River, Scotland -** first electric generator harnessing the energy of ocean waves.
- ***1996*** **- General Motors -** begins marketing first mass-produced electric car **-** *Saturn EV1*.

HISTORY OF POWER GENERATION (5)

- ***Early 1900s*** **-** Hydropower entered the generation mix, but much of the key work on water turbines was carried out in the second half of the 19th century.
- ***Beginning of 20th century*** – Both spark and compression ignition engines were developed for transport and power.
- ***1950s*** – Birth of nuclear power as modern source of energy for modern age – believed to be cheap, clean and technically exciting.
- ***Early 1970s*** **-** Widespread concern for environment; measures to reduce emissions from fossil fired plants.
- ***End of 1970s*** **-** Nuclear bubble burst; progress slowed dramatically.
- ***1973*** – Arab-Israeli war caused a dramatic increase in world oil prices and interest in renewable energy sources (wind, solar, geothermal, ocean waves, tidal, ethanol) began.

HISTORY OF POWER GENERATION (6)

- ***1980s*** – Gas turbine began as peaking units; soon graduated to large base-load power plants using gas turbines and steam turbines in combined cycle.

  - Pulverized coal began replacing traditional coal firing. Biomass and waste-to-energy systems were being developed to clean the environment and mitigate global warming.

  - Atmospheric and pressurized fluidized bed combustion technologies began to emerge to reduce NO_X and SO_2 emissions, attain fuel flexibility and raise efficiency.

  - Combined heat & power (CHP) and fuel cell technologies began to emerge for power, heating/cooling and water.

- ***1990s*** – Use of combined cycle gas turbines multiplied; decade of the gas turbine.
- ***Late 1990s*** – Need for cleaner fuels lead to development of gasification processes on coal to remove most of its pollutants for use in combined cycle gas turbines.

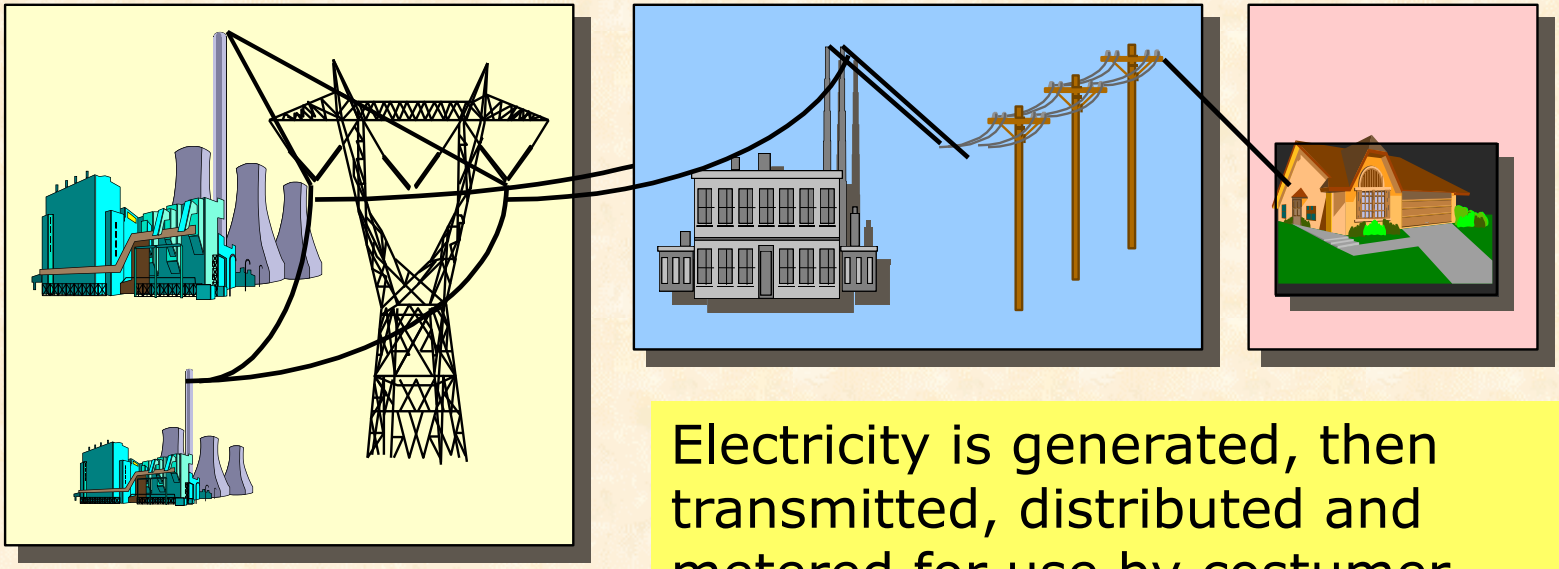
DESCRIPTION OF ELECTRIC POWER SYSTEM

GENERATION
- NPC
- NPC IPPs
- Meralco IPPs

TRANSMISSION
- Transco

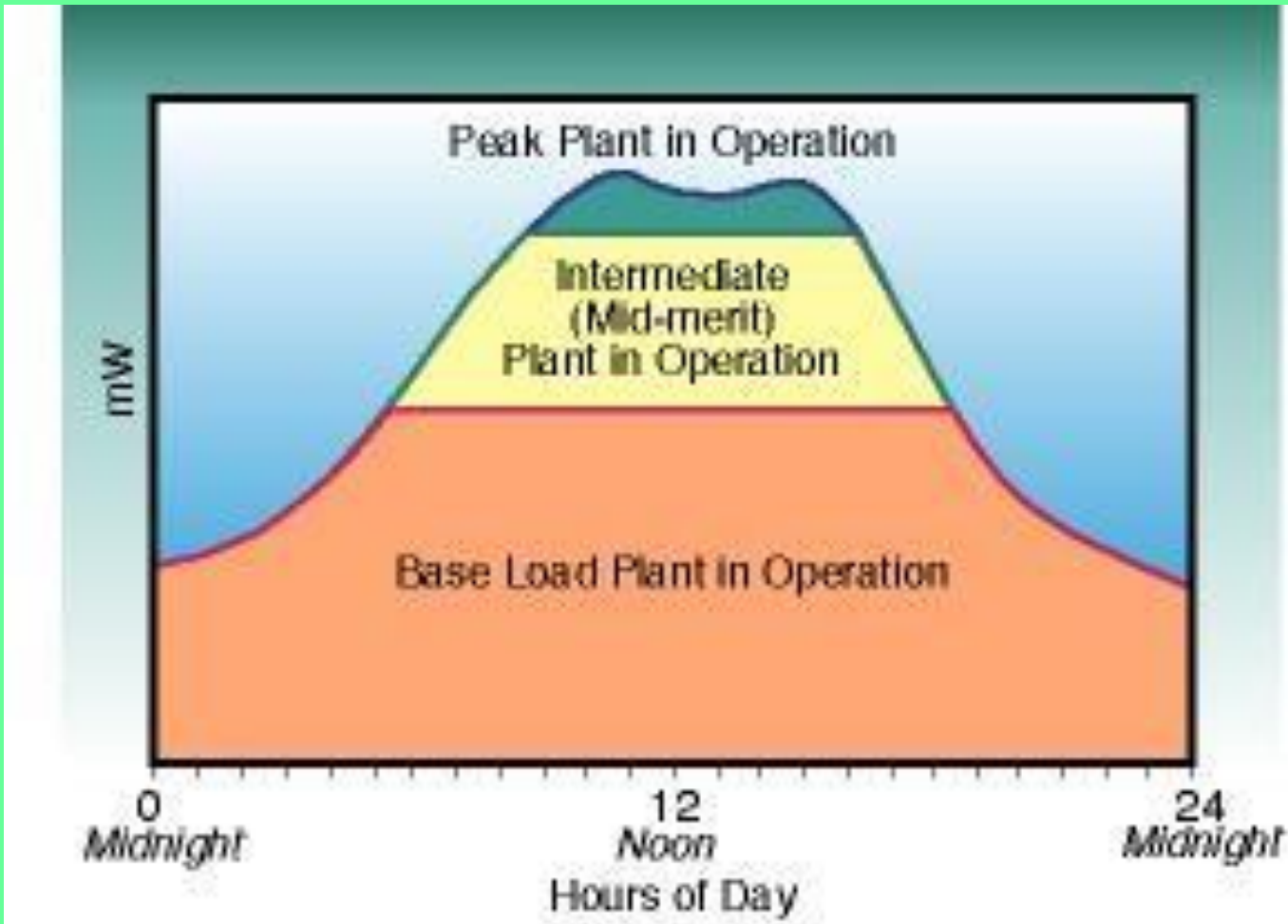
DISTRIBUTION:
- Meralco
- Cepalco
- Veco
- Davao Light
- Cooperatives

UTILIZATION
- Residential
- Commercial
- Industrial
- Transport



Electricity is generated, then transmitted, distributed and metered for use by costumer. The voltage changes as it flows thru the system.

Base Load, Intermediate Load and Peak Load



Resource Stack versus Loads over a 24-hour Period

Hourly Variation of System Load:
Base Load
Intermediate Load
Peaking Load