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Overview of the Power System

From the Generator to the Customer
and the Effects on Metering

TESCO's Meter School

TESCOOL 

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Don Pretty, Regional Utility Account Executive
Schneider Electric

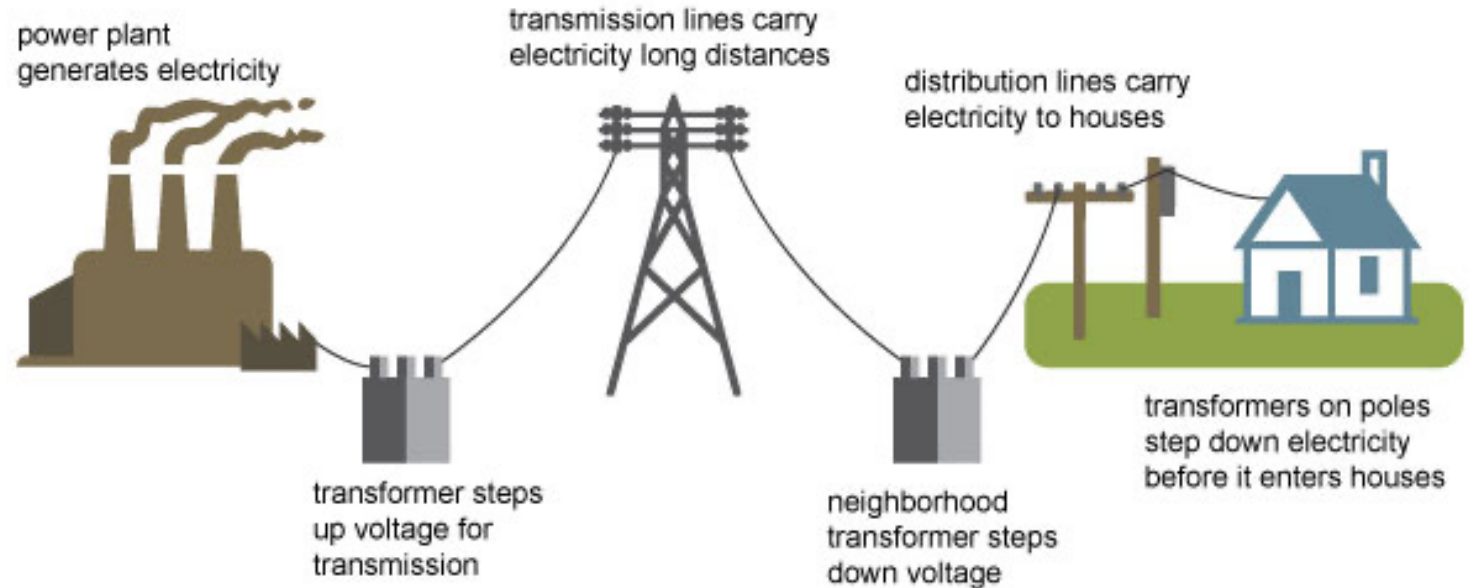
Parts of the System

Generation - process of generating electric power from sources of primary energy

Transmission – bulk movement of electrical energy from generator to substations

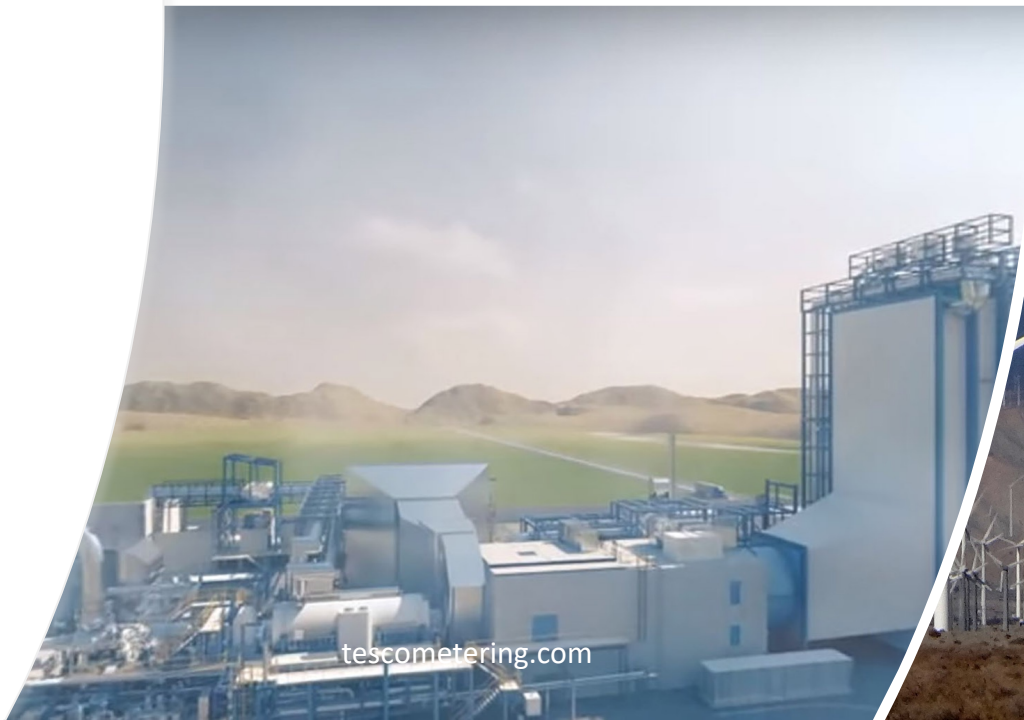
Distribution – delivery of energy to consumer

Electricity generation, transmission, and distribution

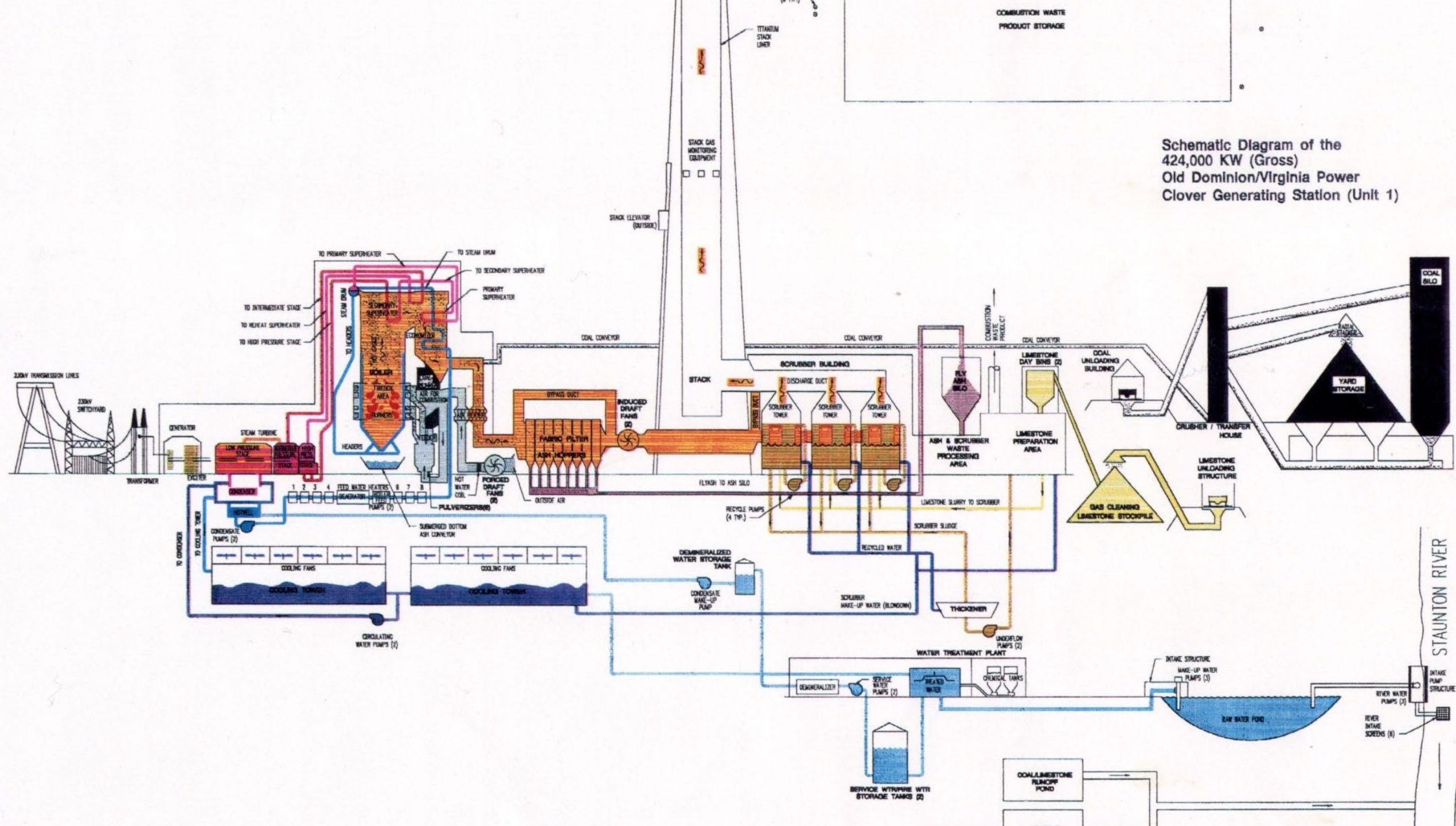


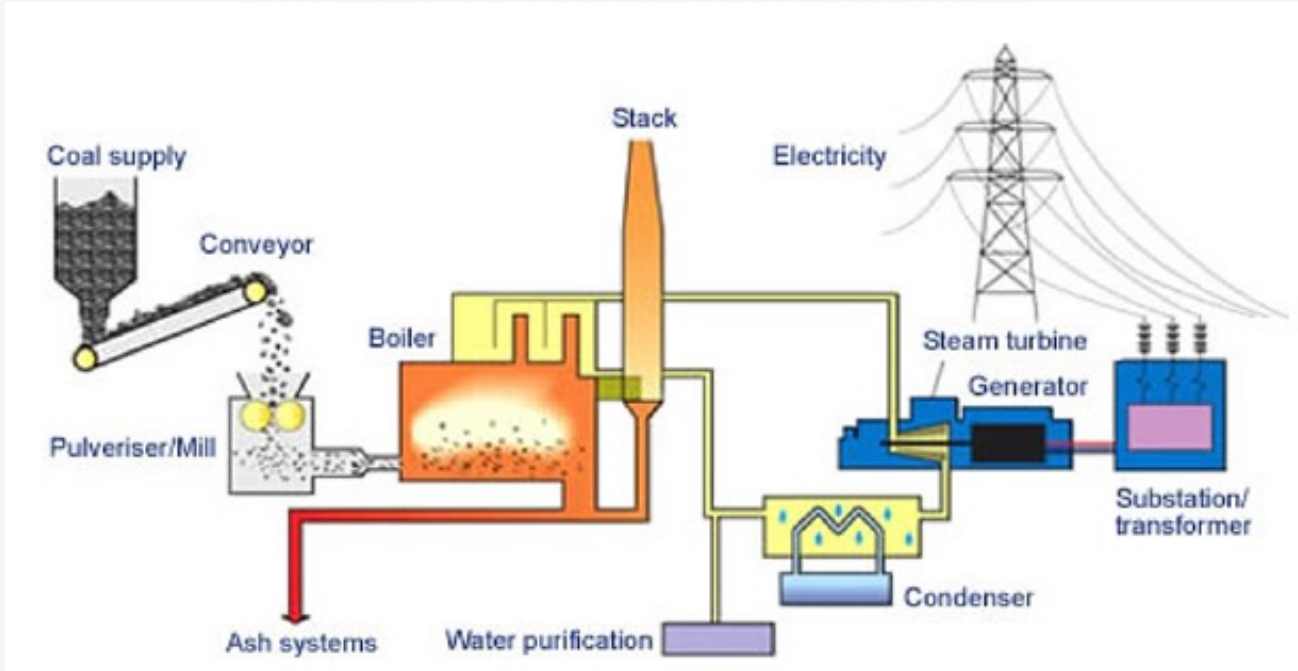
Generation

- Fossil Fuel (60.2%)
 - Coal (1880's)
 - Natural Gas (40's)
 - Oil (50's)
 - Biofuels (90's)
- Renewable (21.6%)
 - Hydro (1880's)
 - Solar (80's)
 - Wind (80's)
- Nuclear (18.2%)
 - Late 50's



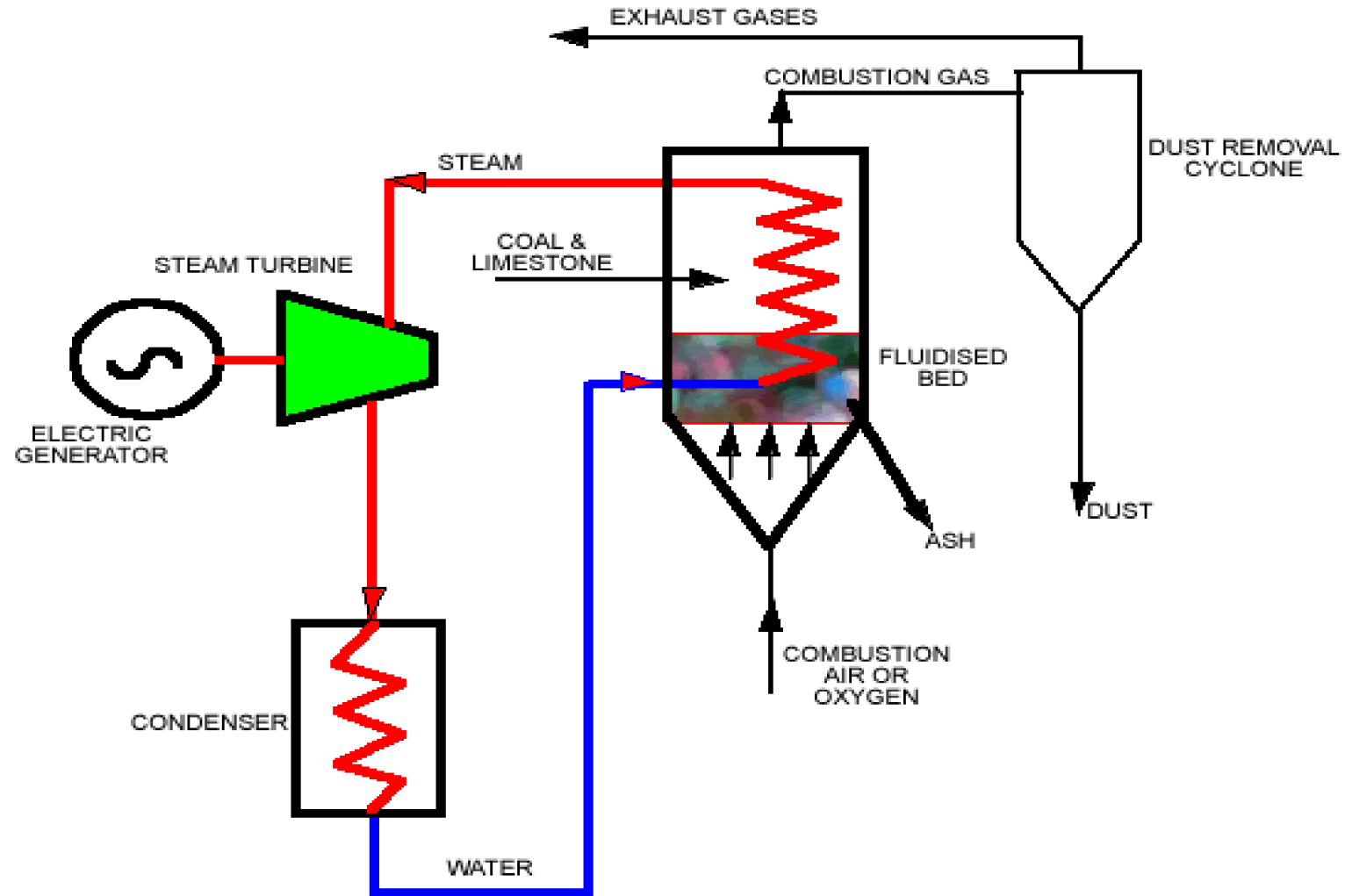
Schematic Diagram of the
424,000 KW (Gross)
Old Dominion/Virginia Power
Clover Generating Station (Unit 1)





Coal-fired Boiler Generation

- Boiler
- Generator & Turbine
- Exciter
 - Works in conjunction with the generator
- Condenser
- Plant Substation



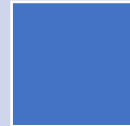
ATMOSPHERIC FLUIDISED BED COMBUSTOR (AFBC) DIAGRAM



Metering in the Generation Plant



Control House



Plant

Why transformation of electrical energy is necessary

High Voltage

- 69kv
- 115kv
- 138kv
- 220kv
- 500kv
- 756kv

Med Voltage

- 23kv
- 34.5kv
- 43kv





Substations Overview

To reduce voltages for distribution throughout the system and to provide points of protection/isolation to prevent problems in one part of the system from affecting another

Substations Infrastructure

- High side bus
 - HV Fuses
 - HV Breakers
- Transformer
 - Step down





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Substations Infrastructure

- Low side bus
 - Protective devices
 - LV Breakers
 - LV Fuses
 - Reclosers
 - Control devices
 - Relays
 - Meters





Metering in the Substation

- kWh
- kVARh/kQh
- V^2h
- I
- V

Distribution System Overview

To distribute electricity at voltages $> 2400\text{V}$ and to step those voltages down to usable levels for the consumer





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Distribution System Parts

- Poles
 - Wires
 - Primary
 - Secondary
- Transformers
- Meters



Metering Throughout System



Used all throughout system to measure energy



Electric watt-hour meters are most accurate commercial measurement devices used today



Metering applications vary based on:

Physical location

- E.g. in plant, pole top, control cabinet

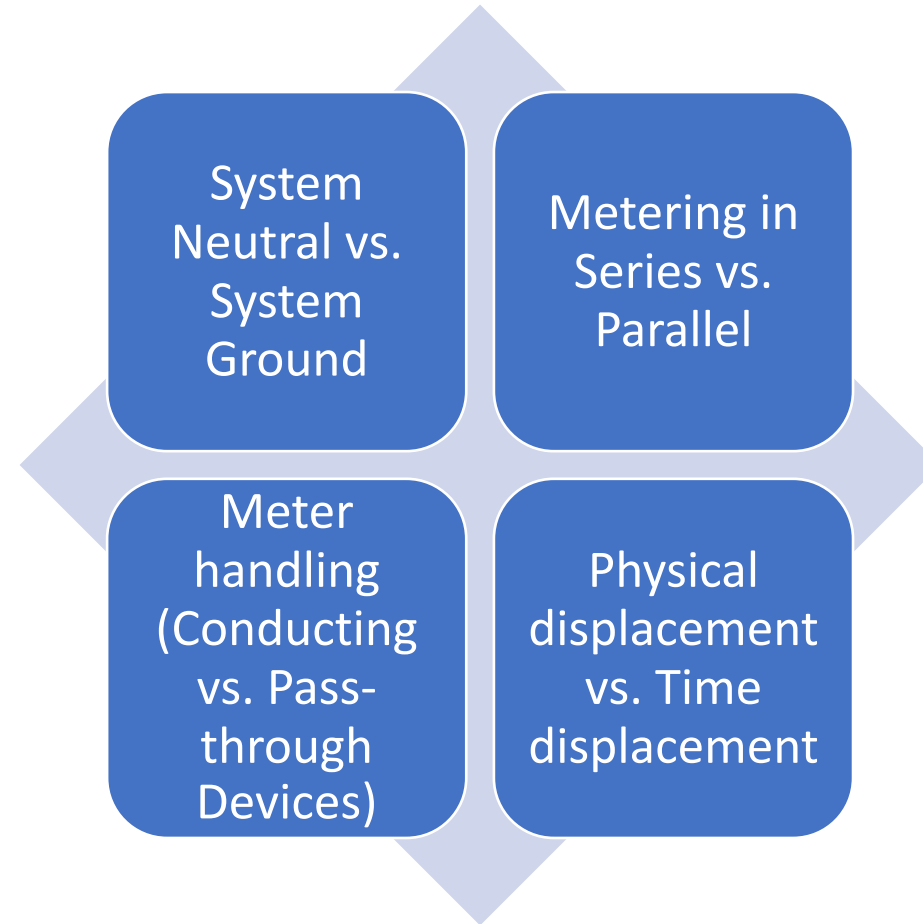
Monitoring point

- E.g. transformer (3 Wire or 4 Wire)

What information

- E.g. 2-Channel vs. 4-Channel, revenue grade

Metering Considerations





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Questions?

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Internal