Guidebook

FOR THE
BLUE VALLEY
POWER STATION

IPL
Independence Power & Light

Celebrating
100 YEARS
1901-2001

Our history

Planning Key to Power Growth

The City of Independence Power & Light Department (IPL) welcomes you to Blue Valley Power Station. Here, you will see results of a well planned, progressive expansion program that had its beginnings over 100 years ago.

Since 1901, when your city acquired ownership and operation of its electric utility, our goal has been to furnish low-cost, dependable power. New equipment and more efficient operations, such as those you see here at Blue Valley Station, are making this possible.

Initially, two Allis-Chalmers steam engine driven units, generating 250 and 450 kilowatts, were sufficient to serve all the people in the "old town" area. As demands for power increased, larger boilers and steam engines were necessary. In 1926, we purchased our first steam turbine-generator unit. The unit was housed in the original "Dodgion Street Light Plant" located east of Noland Road.

In 1948, due to annexation, the city's land area tripled. In 1948 and 1955, two 5,000 kilowatt turbine-generators were added, easing the pressure of growing power demands. These two units were located in the newer Dodgion Street Power Station, today known as "The Roger T. Sermon Center", 201 North Dodgion Street.

With yet increasing power demands, the city built the Blue Valley Power Plant in 1958. The Blue Valley Plant started operation that same year with two steam-turbine generator units producing 21,000 kilowatts on each unit. In May 1964, construction work commenced on our largest steam unit at Blue Valley which began commercial operation in July 1965. This added another 51,000 kilowatts to the City's system.

In 1981, Missouri City Power Plant, located in Missouri City, was purchased and added to the power system. This acquisition gave us an additional 38,000 kilowatts to help with power demand. Also located throughout the city are six gas or oil fired peaking turbines for a total of 107,000 kilowatts.

In September 1975, construction work started on our large gas or oil fired turbine located southwest of the Blue Valley Plant. In June 1976, this unit was put on line, in turn, adding to the already existent power system another 50,000 kilowatts. Today IPL's total capabilities for all owned units is 288,000 kilowatts.

Thank you for coming to visit your City owned Power & Light Plant.

Pictured above is the Blue Valley Power Plant located at 21500 E. Truman Rd.

Pictured above is the Missouri City Power Plant located 16 miles Northeast of the Blue Valley Power Plant.

Gas Turbine (substation J) located at the intersection of Truman Road & Noland Road

IPL Celebrating 100 YEARS 1901-2001
Independence Power & Light

Facts about electricity

In the US, 51% of electrical power is generated in steam plants like IPL's Blue Valley Generating Station. About 8% is generated in hydro-electric plants, 20% by nuclear power, 15% by gas-fired, and 3% by oil-fired.

America runs on electricity, including Industry, Agriculture, Safety and Health, Defense, and modern living in our homes. A generating plant produces electricity to instantaneously meet the electrical demand. Since AC electricity cannot be stored, it must be used when it is generated.

Investor-owned electric companies produce 73%, Federal Government power projects produce 10%, and individual towns and cities, power districts, states and cooperative organizations produce 7% of the nation's electricity. IPL is a city-owned non-profit utility. Our peak generating capacity of 288,000 kilowatts (288 Megawatts) comes from:

Blue Valley Power Plant	***93,000***
Missouri City Power Plant	***38,000***
Blue Valley Gas/Oil Turbine-Generator	***50,000***
Six Gas/Oil Peaking Turbine-Generators	***107,000***

The average household uses more than 9,000 Kilowatt-hours per year. A "kilo" watt is "1000" watts, which equates to ten 100-watt light bulbs. A Kilowatt-hour is 1000 watts of use for one continuous hour. Your electric meter reads the amount of kilowatt-hours used. At $0.08 per kilowatt hour average, the yearly electric bill would be $720.00 for 9,000 kilowatt-hours.

During the past 25 years when the cost of living more than doubled, the average price of residential electric service was reduced by nearly half. Coal availability and quality in the United States remains adequate for the foreseeable future.

Power Plant 101

Generator

A generator makes electricity by using the effect a moving magnet has on a nearby coil of wire. Magnetism in motion will cause electrons to move within the metal wire; this is electricity. A magnet rotating within a coil of wire will create electricity that continuously reverses direction; this is called "alternating current", or AC.

Turbine

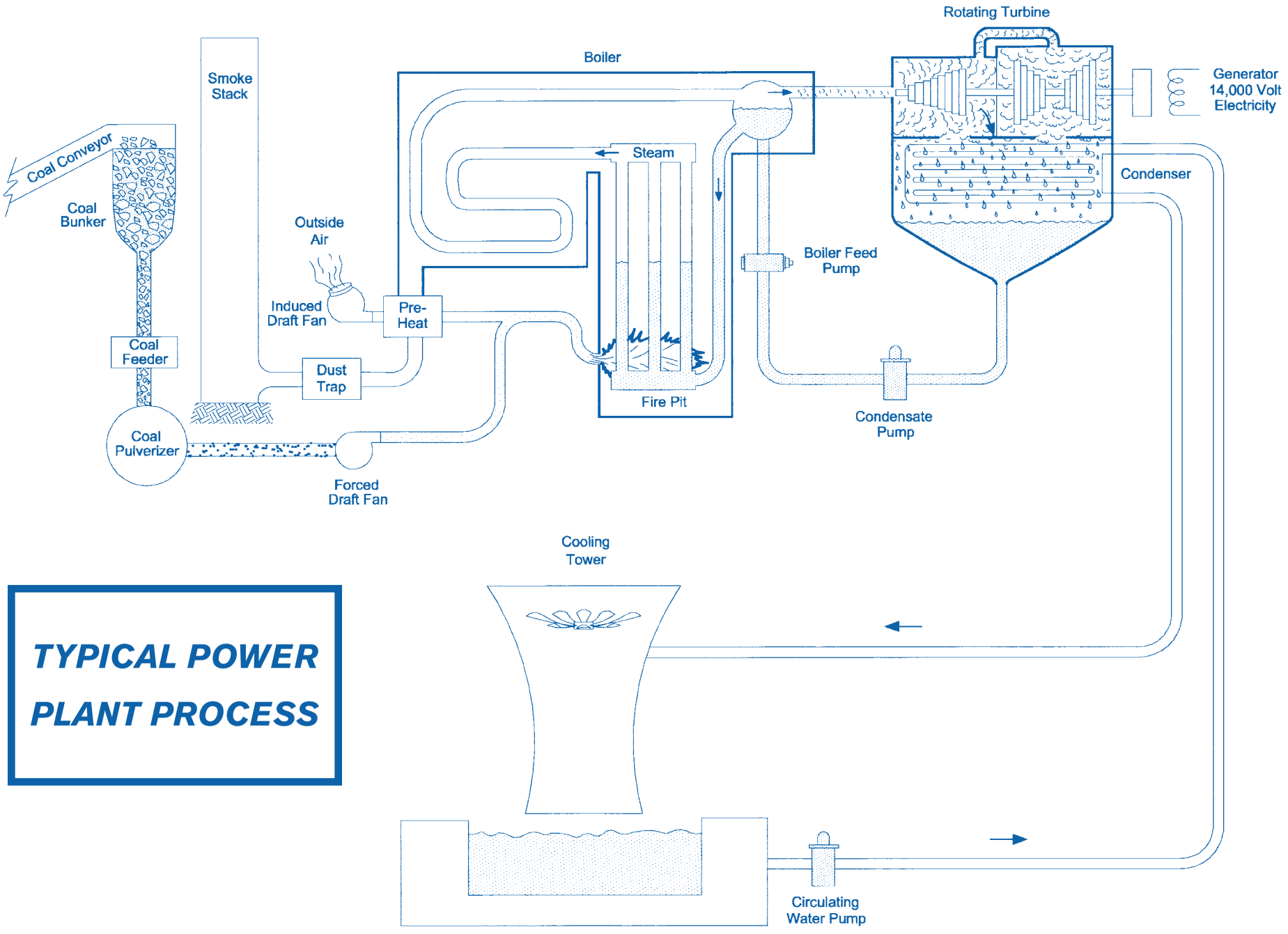
To rotate the generator, the most common method is a turbine consisting of a shaft containing many rows of curved blades. The shaft is directly connected to the generator, and when steam (or water) pushes against the turbine blades, the turbine and the generator will rotate. A simple example is when a pinwheel revolves when you blow air against it.

Boiler

To generate high pressure steam to turn the turbine, a large boiler is used to heat chemically-pure water enclosed in metal tubes into steam by burning a fossil fuel (coal, oil, or natural gas). Coal is pulverized into a powder and blown into the furnace for efficient burning.

Condenser

A condenser will cause steam (water vapor) to condense back into water by supplying a cooling effect. The condenser changes the used steam back into water so it can be reused in the boiler in a closed system. Cool water from the cooling towers flows in metal tubes inside the condenser. The cool tubes contact the steam as it exits the turbine and condenses it back to water for reuse in the boiler.

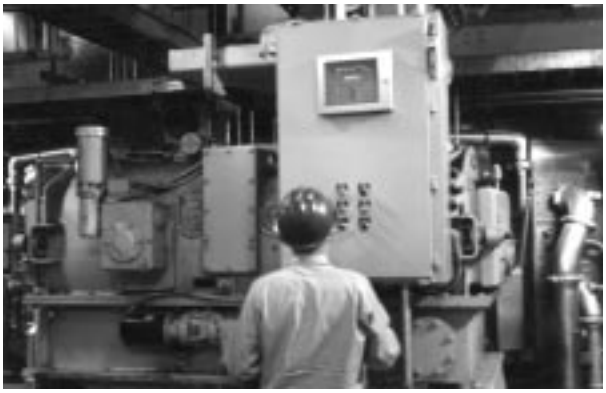


TYPICAL POWER PLANT PROCESS

Where it's made

Coal Pile

Coal is the primary fuel used for the generation of electricity at the Blue Valley Plant. Our main source of coal comes from a coal mine near Butler, Missouri. A stock pile of coal for unexpected emergencies is maintained at Blue Valley. A 90-day supply of coal consists of 45,000 tons of coal.



Coal Feeders

Feeding coal from the bunkers to the pulverizers is the purpose of the coal feeders. The pulverizers grind the coal into a fine powder which is then blown to each corner of the boiler. Each coal feeder is able to deliver up to 15.1 tons of coal per hour. Each coal feeder weighs the coal so we are able to know exactly how much coal is used for each kilowatt of power generated.

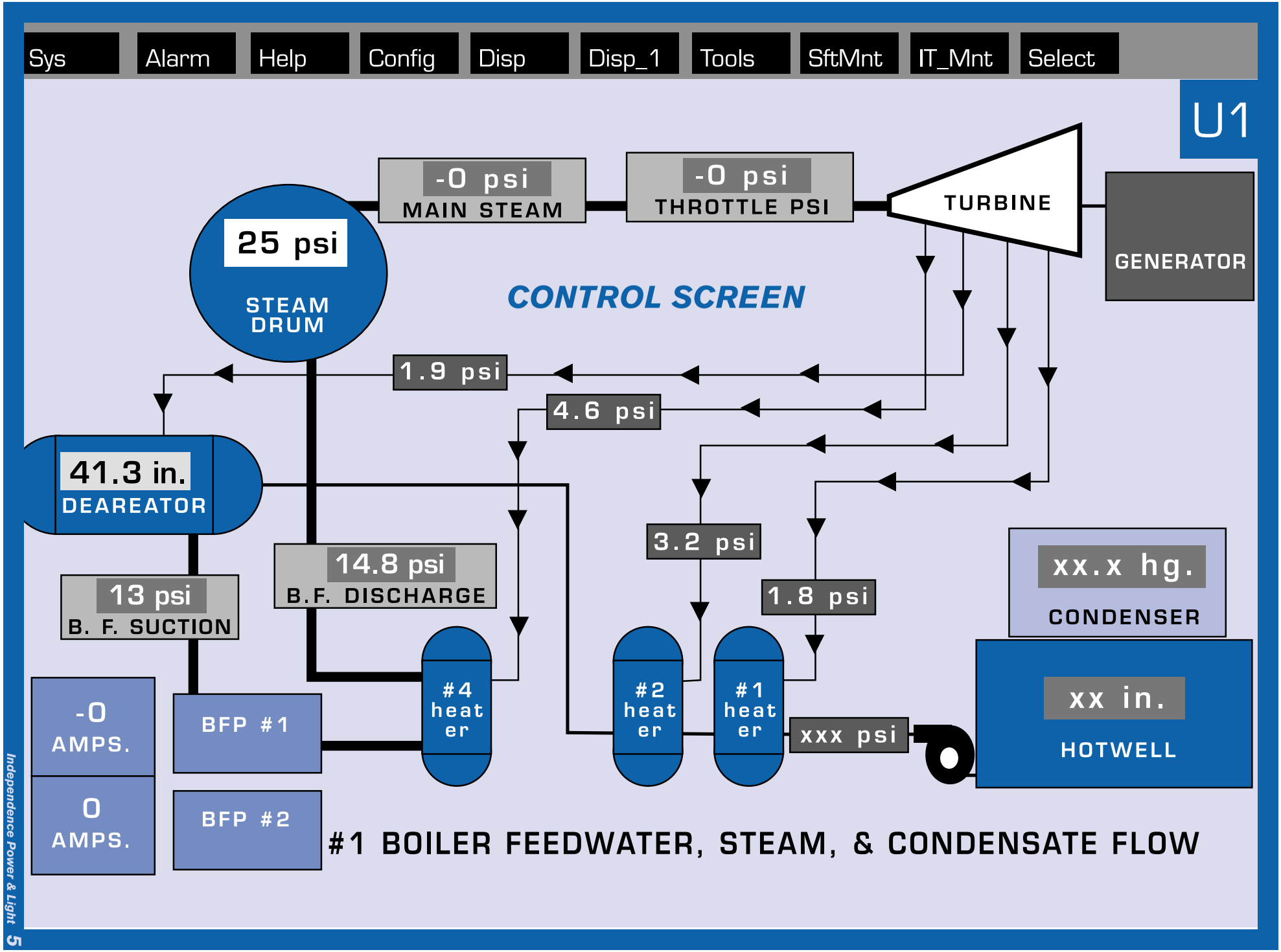
Steam Boilers

Here is where the steam is produced to operate the steam generator. Water, passing through miles of tubes in this boiler, is converted to steam at the rate of 220,000 pounds per hour. A boiler is more than 80 feet tall and has a main steam drum (for collecting steam) that weighs 32 tons. Each furnace burns approximately 12.4 tons of coal each hour. The boilers are capable of burning gas or oil.

Control Room

The Blue Valley Control Room reflects the latest state of the art in control operations. From here, the boiler fire, generator functions, and all auxiliary equipment are controlled and monitored. Critical data is monitored by the Computer Control System to warn operators of any potential equipment problems.

The picture on the opposite page shows a touch-screen, which can be selected at the control room computer. This screen monitors the Water-Steam Cycle rotating the turbine. Heated water converted to steam collects in the "steam drum." Steam pressure is monitored and controlled by valves to spin the turbine. Vacuum occurs as the used steam changes back to water. Vacuum pressure/water level are also monitored. Alarms can notify operators to take corrective action if needed.


Sys
Alarm
Help
Config
Disp
Disp_1
Tools
SftMnt
IT_Mnt
Select
U1
-0 psi
MAIN STEAM
-0 psi
THROTTLE PSI
TURBINE
GENERATOR
25 psi
STEAM DRUM
CONTROL SCREEN
1.9 psi
4.6 psi
41.3 in.
DEAREATOR
3.2 psi
1.8 psi
xx.x hg.
CONDENSER
14.8 psi
B.F. DISCHARGE
13 psi
B. F. SUCTION
#4 heat er
#2 heat er
#1 heat er
xxx psi
xx in.
HOTWELL
-0 AMPS.
BFP #1
0 AMPS.
BFP #2
#1 BOILER FEEDWATER, STEAM, & CONDENSATE FLOW

Steam Turbine-Generators

Two Allis-Chalmers 21,000 kilowatt turbines and one General Electric 51,000 kilowatt turbine-generator units are the heart of your power plant. Here is where heat energy of the steam is converted to mechanical energy by the turbine which, in turn, spins the generator rotor. The action of the rotors magnetic field moving past coils of wire in the generator stator produces electrical energy for Independence homes and businesses. Total capabilities for our three turbine-generator units is 93,000 kilowatts. Three generators running at full load would light 930,000 one-hundred watt bulbs.

Boiler Feed Pumps

The purpose of the boiler feed pump is to keep a constant supply of water to the boilers. These pumps return the condenser water to the boiler. It will be reheated several hundred degrees in the feed-water cycle. The 600 h.p. motors turning the pumps return the condensate at a rate of 34,000 gallons per hour, boosting feedwater pressure to 1450 pounds per square inch in the process.

Condensers

Changing exhausted steam from the turbine into condensate is the purpose of the condenser. This is accomplished by steam passing over some 3831 tubes. The latent heat is removed by circulating water through its contact with the tubes, thus steam is condensed, and the condensate falls to the bottom of the condenser. With this process the condensate is circulated back and is used over again as boiler feed water.

Circulating Water Pumps and Cooling Towers

These 400 h.p. motors drive pumps that deliver as much as 22,000 gallons of cooling water to the condensers every minute. In the condensers, the heat from steam is transferred to this water, in turn circulating to the cooling towers, located behind the pump motors. In the cooling tower, heat picked up by the cooling water in the condenser releases to the atmosphere. The circulating water is cooled 10 to 12 degrees in the process and is then ready to be pumped again through the condenser.

Daily operations

Modern Technology

Pictured here are some of the operations of the Blue Valley Power Station. Improved fire safety systems give added protection to costly equipment. Accurate measurements and improved control logic reduce operating costs and increase savings to you, our customers. Up-to-date training systems further enhance the efficiency and reliability of the Blue Valley Station.

Control Room

Boiler Water Treatment

Governor Control #3 Turbine

Maintenance and Machine Shop

Cooling Towers

Operators and Technicians Training Area

How electricity is delivered

Transmission and Distribution

Electricity is transmitted over long distances at high voltage and distributed with the following equipment:

Transformer

The output voltage of the power plant generator is 14,000 volts; efficient transmission of electric energy over small diameter power lines requires higher voltage. A transformer has an input winding and a separate output winding; the ratio of the number of turns of these windings will determine the ratio of the input and output voltages. The step-up transformer will boost the transmission voltage from 14,000 volts to 161,000 volts.

Circuit Breaker

Circuit breakers are used to protect against unacceptable circuit conditions, such as overcurrents and imbalances. The generating plant output circuit breaker protects the generator and step-up transformer; it can instantly disconnect the plant equipment from the transmission grid circuit.

High Voltage Transmission Line

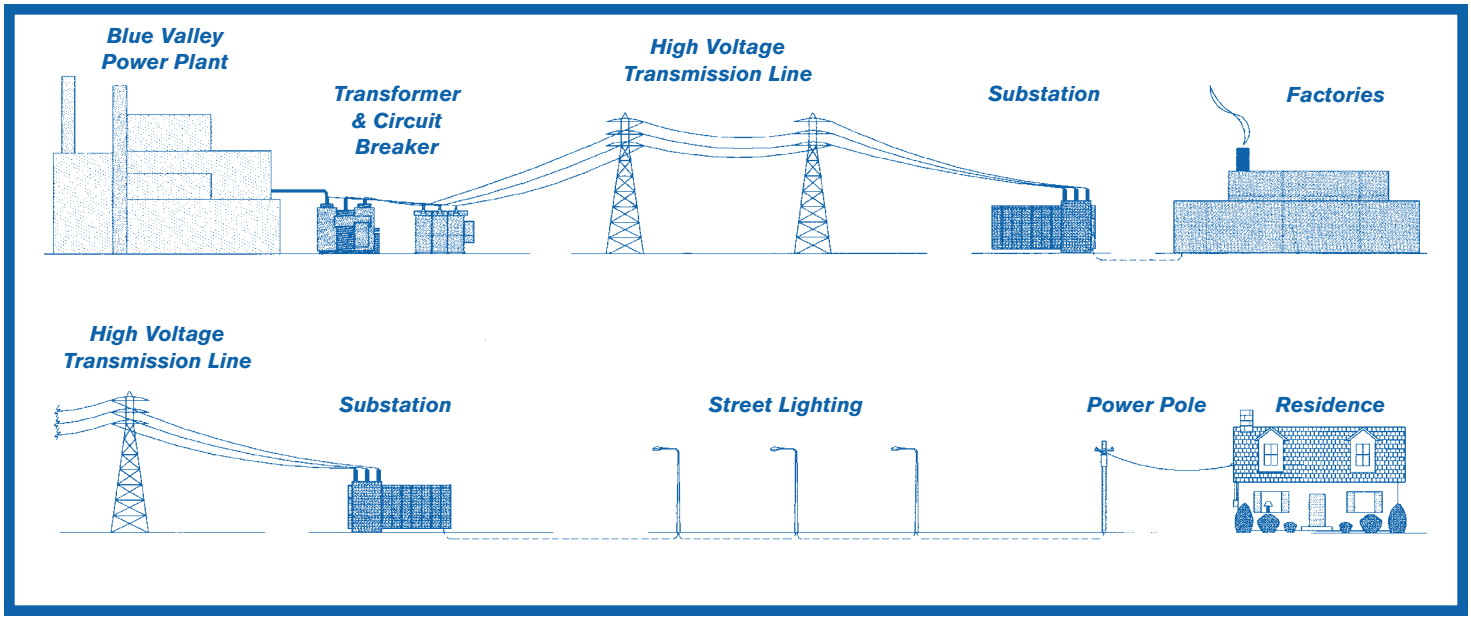
Energy sent down the wire is measured in “watts” which is a product of the voltage and current (V times I); the same energy can be “high voltage with low current” or “low voltage with high current”. Using high voltage with low current allows the wire to be smaller diameter, thus less expensive and easier to work. Lower current also reduces energy losses along the transmission line.

Substation

Users cannot use high voltage from the transmission line, so it must be stepped down to a usable voltage. The substations located throughout the city will transform the voltage to what is required; manufacturers sometimes need 4000 volts for large industrial machines.

Power Pole

Power poles are located throughout the city for distribution. The circular transformer located on a pole near a house, or the ground-level block transformer located in neighborhoods having underground cables to each residence, will step-down the voltage to the 120-volt/240-volt electric service required for house appliances.



We're linked to you

Dispatch Center

We appreciate the opportunity to inform you about how your city-owned Power & Light plant operates. We continue to provide dependable low-cost electricity to our 50,000-plus residential and commercial customers, and to work for you and the City of Independence.