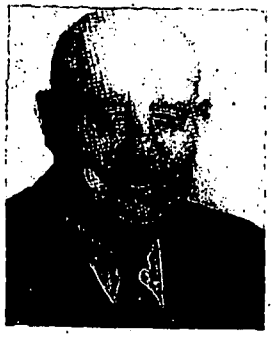


PRESIDENT of SRVWUA's board of governors, Lin B Orme assisted in organizing the association back in 1917

GENERAL MANAGER of the project, O L Norman succeeds H J Lawson, who directed its operation for many years

SUPERINTENDENT of the Cross Cut plants, Clyde Williams is responsible for many unusual features of design

than the well water, and this system of treatment, scale problems have been largely eliminated and boiler internal surfaces are virtually as clean as when the boilers were installed.

As now arranged, scavenging air for the diesels is drawn in through washers and oil-impingement filters and supplied to the engines at required pressure by two scavenging blowers, each driven by a 400-hp motor. Engine exhaust passes through waste-heat boilers to generate steam for general plant use. Mr Williams now proposes to replace the waste-heat boilers by exhaust economizers, which will replace the last-stage of feedwater heating by bled steam. Estimates indicate that this will increase turbine output by about 1500 kw at a cost of about $40,000, thus making added capacity available at less than $30 per kw.

Boiler Plant. The three integral-furnace boilers, each rated at 100,000 lb per hr at 450 psi and 750 F, are oil and gas fired, with air heaters but no economizers. Originally installed for full outdoor operation, experience during heavy rain storms indicated need for some protection, largely for the benefit of the operating crew. So a light corrugated-steel roof and partial side housing has been installed on the boilers proper. Forced- and induced-draft fans, air heaters and stacks are still fully exposed.

Fuel oil for the boilers is stored in two tanks (40,000 and 26,000 bbl), equipped with suction heaters, and supplied by tank car. The fuel pumps discharge through steam heaters to the burners, which are steam-atomizing for the lower part of the load range, and mechanical-atomizing for the upper part. A centralized boiler control board mounts the fully automatic combustion-control equipment and boiler gages and meters. There are three large boiler-feed pumps, one turbine driven and two motor driven, with a smaller motor-driven pump for light loads. A separate tank stores diesel fuel (40% bunker C and 60% diesel oil) which is heated and filtered before entering the engine system.

A limited supply of natural gas is also available to the plant. The boilers have all been fitted for burning gas, and experimental work is now under way to establish the feasibility of making the diesels gas burning under the low-pressure-admission or dual-fuel system. This work is being done on a single cylinder of No. 1 engine, which has been isolated for the purpose, and when development is completed it is expected that both engines will be adapted to burning gas, if and when gas is available.

Turbine Plant. The three turbines are identical 14-stage machines, with three bleed points. At present, the lowest-stage bleed supplies tubular heaters, the middle-stage deaerating heaters, and the highest-stage tubular heaters. Makeup from the evaporators enters the deaerating heaters. Condensate is pumped first through the steam-jet air-ejector condensers and then through the 13th stage heater to the deaerator. A booster pumps condensate from the deaerator to a hotwell from which the boiler-feed pumps take their suction, discharging through the 4th stage heater to the boilers. The 4th-stage heater condensate is trapped back to the deaerator and the 13th stage heater condensate is trapped back to the condenser.

Electric System. The main bus structure and transformer banks are outside the steam plant. Into this bus connect the ties with Parker Dam, Central Arizona Light and Power, Inspiration Copper Co; as well as ties with the other Salt River plants. Power generated at Cross Cut is controlled by two switchboards: One in the hydro building handles both 60- and 25-cycle hydro generation, the frequency changer, and the 25-cycle power from the diesels. The other, in the turbine-room of the steam plant, handles the 25-cycle output of that plant.

Operating problems faced by this system are unusually severe; water is relatively scarce, air is dust-laden, and temperatures are high. A variety of load conditions must be supplied over an extensive transmission system exposed to severe mountain electrical storms, at two different frequencies generated by hydro units dependent in the last analysis on rainfall conditions and by firm-power units made inadequate by heavy load growth. To a great extent the purely mechanical problems of water, air and temperature have been solved; the system-operation problems created by dual frequency and rapid load growth are most pressing now and must be resolved in the near future.

Water Treatment. Taking first the water problem, makeup for the Cross Cut plant came originally from two separate groups of wells. This water was high in scale-forming mineral salts. Sulphuric acid proved effective in the cooling towers but makeup for the steam boilers and waste-heat boilers required zeolite softening ahead of the evaporators. These treatment methods proved effective but although costs were in line with other plants under similar conditions, they were high at best, with heavy blowdown. Experiment and test indicated that canal water from the hydro plant averaged much lower in temperature than the cooling-tower water in summer months, and was much lower in scale-forming salts than the well water. By installing ordinary sand filters for the canal water ahead of the zeolite softeners and by putting the evaporators in series, boiler blowdown has been reduced to virtually zero, for a substantial cost saving. Use of canal water also means cleaner surfaces in the diesel jackets which means better heat transfer and lower maintenance. Use of the cooler canal water in both steam and diesel plants permits carrying full load at best economy during hot summer months, increasing capacity when it is most needed.

Air Washing. The air in the desert country is hot, dry and contains considerable abrasive dust. Diesel liner and ring wear were materially reduced by installing air washers ahead of the filters on the scavenging blowers. Air filters have been installed throughout the plant to keep out dust as far as possible.

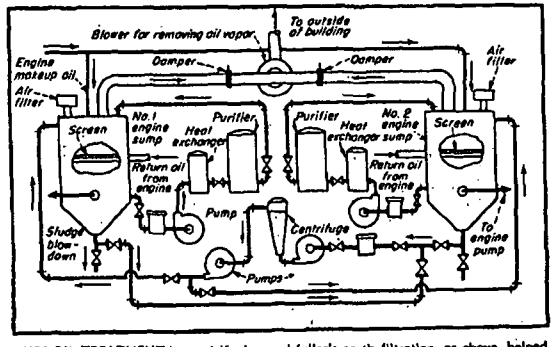
Lubrication of the diesel engines presented certain problems which have been solved by redesign of the lubrication system with provision for oil purification (diagram right). Early bearing troubles seemed to result from excessive foreign matter in the crankcase oil, consisting of siliceous material, carbon, and finely ground metallic particles.

DATA ON SALT RIVER VALLEY PROJECT DAMS AND HYDROELECTRIC POWER PLANTS

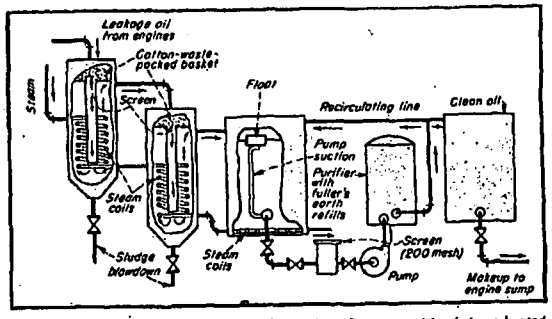
Dam	Built	Coping elev, ft	Spillway crest elev, ft	Length, ft	Height, ft	Drainage area, sq mi	Lake cap, acre-ft	Head on turb, ft	Gen cap, hp
Roosevelt.....	1905–11	2146	2120.25	723	280	5830	1,400,000	112–222	24,000
Horse Mesa.....	1924–27	1920	1869.5–1891	660	300	5940	245,000	253.5	43,000
Mormon Flat...	1923–25	1671	1610.5	380	224	6100	57,800	131.5	10,000
Stewart Mt.....	1928–30	1535	1506	1260	207	6200	70,000	116.0	17,500
Bartlett.....	1936–39	1803	1748	800	283	5500	182,600	.....	.....

NOTES: Bartlett Dam is on Verde River; all others on Salt River. Length is for dam proper; height is bedrock to deck or roadway. Total area of watershed is 13,000 sq mi. There are nine dams: five for storage, three for diversion (not listed above) and one for flood control (not listed above).

In addition to the four power plants listed above, there are four in the valley using about 300 ft total head in the canal system: Cross Cut Plant described in the text is one of these. Total capacity of river plants is 94,500 hp; canal plants add 11,000 hp for a total hydro capacity of 105,500 hp.



LUBE-OIL TREATMENT by centrifuging and fuller's earth filtration, as above, helped solve early bearing troubles. One centrifuge serves both engines but each has its own filters. Blower removes oil vapors from the engine sumps, which have air filters



RECLAIMING CYLINDER OIL affects further savings. System consists of steam-heated filtering units with sludge blowdowns, storage tank, screen, and fuller's earth purifier