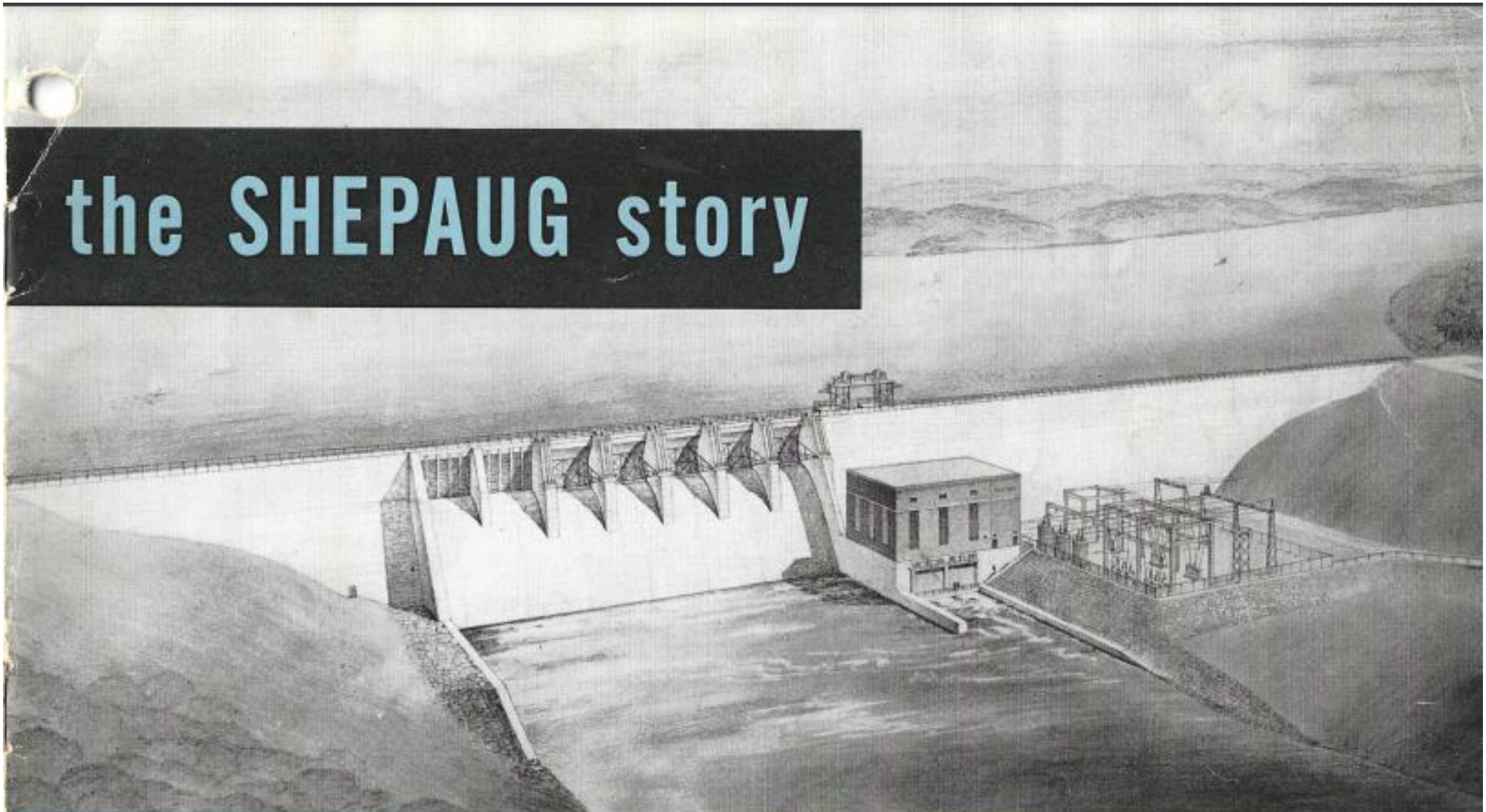
# the SHEPAUG story



## ...a new harnessing of the Housatonic

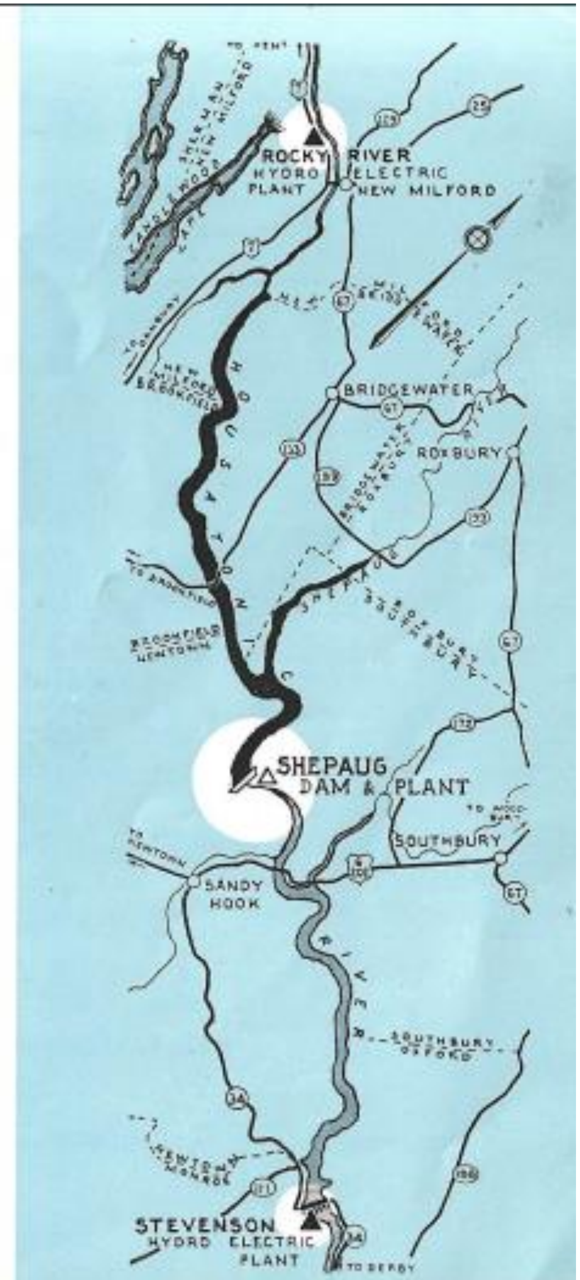
# Introduction

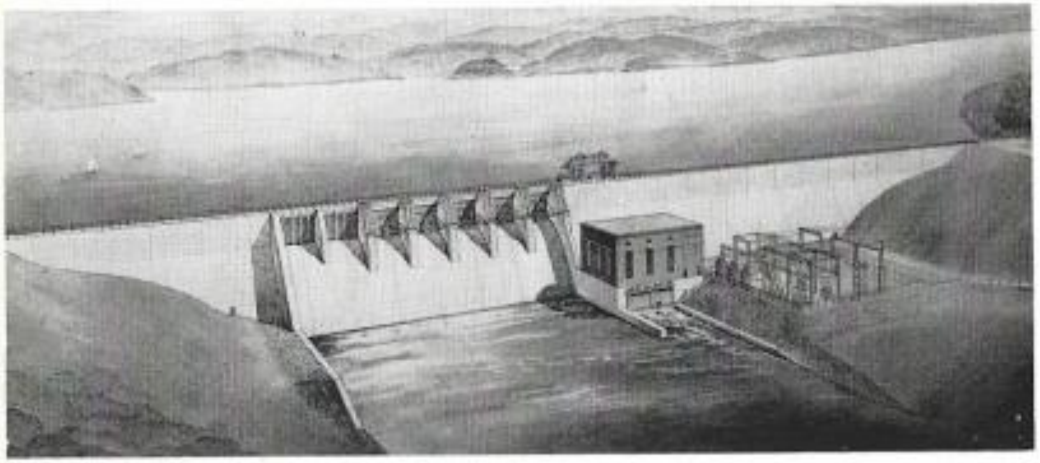
As a home owner becomes absorbed in the new home that he is building and then wants to tell all his friends about it, so are we excited about the new Shepaug dam and water power plant now under construction on the Housatonic River. Partly because of these natural feelings, and partly because it seemed worth telling on its own account, we have put this story of the building of Connecticut's largest concrete dam and water power plant in booklet form handy for all who might be interested.

# The Site

The Housatonic River which flows through the hills of western Connecticut and empties into Long Island Sound at Stratford has been well suited to water power development in this state, both because of its size and because it drops 633 feet between the Massachusetts border and sea level on the Sound. Most of the feasible fall has been developed to produce power for the benefit of the citizens of the state.

The best undeveloped water power site remaining on the Housatonic lies between Newtown and Southbury where the Shepaug dam is now being built by Electric Power, Inc., wholly-owned subsidiary of The Connecticut Light and Power Company. This is about 14 miles below the Company's Rocky River plant in New Milford, and at the head of Lake Zoar which serves our Stevenson plant about 11 miles downstream in Monroe. The Shepaug plant will utilize all the fall between these two other plants. The dam and plant take their name from the Shepaug River which enters the Housatonic about two and one quarter miles above the plant site.



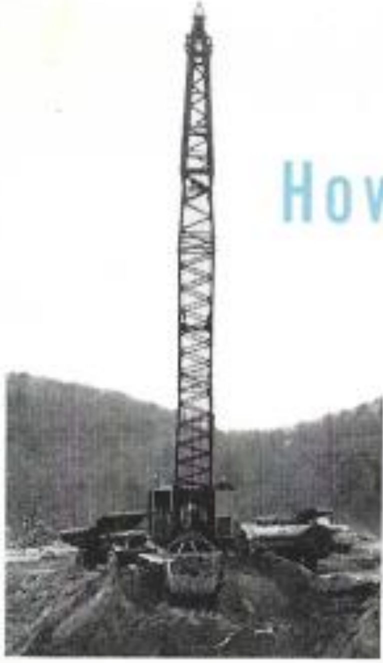


Why, you may ask, has not the site been developed earlier? The answer is due primarily to the fact that it has only been fairly recently that the Shepaug development became economically feasible.

You see, because river flow in Connecticut varies greatly from season to season, we have found that to supply dependable electric service most economically, we must maintain 80 per cent of our generating facilities in steam power plants. Hydroelectric generating capacity cannot exceed 20 per cent of our total power producing facilities.

Although the Shepaug has been under study for many years, it was only recently that forecasts of future loads indicated that the full output of the Shepaug development could be used economically, maintaining the required balance between steam and water power. In 1950 the engineering firm of Charles T. Main, Inc. of Boston was engaged to work with Company engineers in designing the project. In February 1953 the application for a construction permit was approved by the State Board of Supervision of Dams, Dikes, Reservoirs and other Similar Structures, and by March 1953 the job was underway. United Engineers and Constructors, Inc., is the contracting firm which is building the dam and power house.

# How the dam is being built



Building a large dam is a tremendous undertaking — in the area over which the work ranges, in the enormous quantities of concrete needed, and in the complexity of planning and directing the project so that the work of large groups of men is exactly coordinated, and the right amounts of material are available to them at the right spot and at the right time.

As the dam will be 1,412 feet long and about 139 feet high at its highest point, it requires a vast amount of concrete. Sand and gravel from the site area itself and from the river bed a short distance upstream are being used to make the concrete for the dam. After gravel is excavated, it is trucked to a processing plant set up on the site, which is capable of handling up to 120 tons an hour. This plant crushes much of the gravel, washes the dirt out of it, and then by a process of slanting vibrating screens, sizes it into sand, stones of up to 1½ inch diameter, stones of from 1½ to 3 inch diameter, and stones of from 3 inch to 6 inch diameter. Different parts of the dam and plant call for different types of concrete, which explains the separation of the gravel.

The screened and sized gravel falls into bins beneath the screens where it is dropped into trucks and transported to the appropriate one of four huge bins nearby where it is stockpiled. When full, these bins hold 75,000 tons of sized sand and gravel, or concrete aggregate as it is called.

The project will require 220,000 cubic yards of concrete, and to make this will require 400,000 tons of the

*Trucks pick up sand or segregated gravel from bins at the processing plant.*

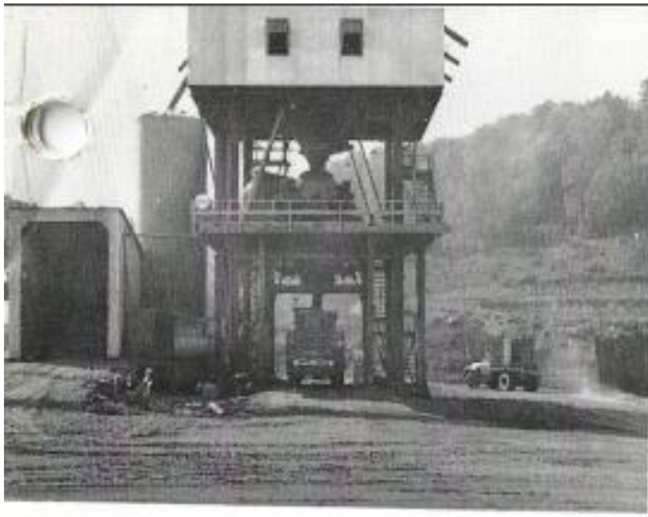
*From huge storage bins gravel is sent up conveyor belt to concrete mixing tower.*

*Operator of the concrete mixing plant sets the mix from this control panel.*

sand and gravel aggregate obtained from the site area. This means that the huge storage bins must be filled more than five times before the completion of the dam.

Gates located in the bins allow various sizes of aggregate to drop on a rubber conveyor belt which runs through a tunnel beneath the bins. The selected sand or gravel is then delivered to a second conveyor belt, which carries it to a large Johnson concrete mixing plant 350 feet away where required quantities of the various sizes of aggregate are stored separately and used as needed.

Combinations of aggregate, cement and water for 11 different types of concrete to be used in building the dam can be automatically selected by an operator at the control panel in the mixing plant. Once the short mixing operation is over, the fresh concrete falls into a hopper from which it can be dropped into a two cubic yard bucket on the platform of a waiting truck.



From bin below mixing plant fresh concrete pours into large bucket on truck.

By the dam site crane lifts bucket from truck to the monolith under construction.

Bucket is opened and concrete pours out. Bucket is then swung back to truck for next trip.

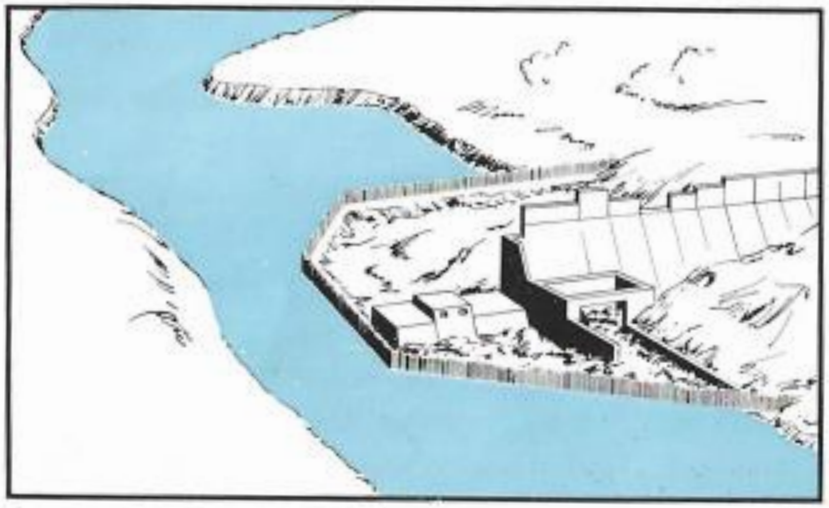
Trucks carry these buckets to the dam site nearby; cranes then lift the buckets from the trucks and swing them to the construction crews working on the particular section of the dam structure which is being built. The bottom of the bucket is then opened, the concrete pours out, the bucket is carried by the crane back to the truck and the process is repeated. To eliminate the problems and expense of artificially cooling large quantities of concrete laid on the dam, no more than five feet in depth of concrete is poured at any one time.

Before actual construction work can be started, a cofferdam must be built into the river bed from the north bank. Constructed in the form of a "U", the outer edge of the cofferdam is lined with sheet steel piling pounded down to solid rock to keep water out of the construction area while crews are working. Any water seeping through the cofferdam is gathered by a series of perforated pipes and pumped back into the river before it enters the excavation area.

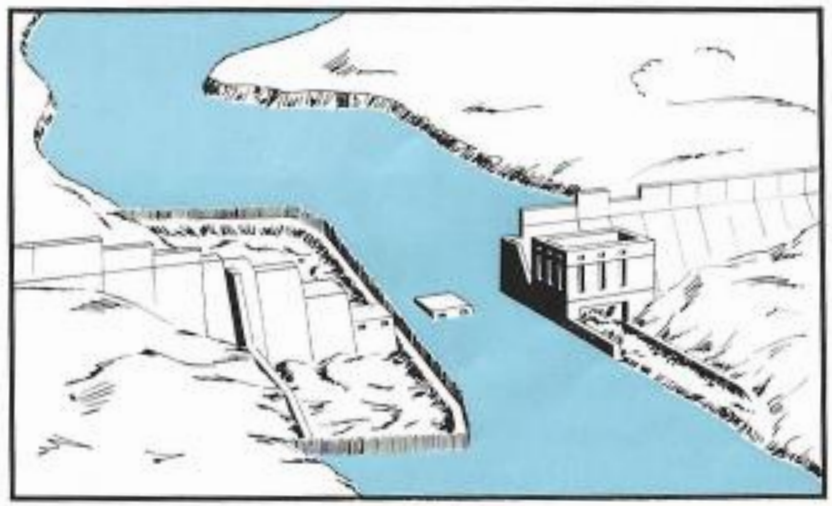
The construction of the dam proceeds in three stages. The first is the building of that part of the dam that lies north of the middle of the river. The dam is composed of huge concrete blocks known as monoliths. Three of the center monoliths in this part of the dam are left low to permit water to pass during the second phase of construction.

The second stage of dam construction consists of shifting the cofferdam to the south side of the river and putting up the remaining portion of the dam behind its protection. During the second stage the river flow normally passes over the three monoliths left low in the first stage.

The entire south section of the dam is fully constructed in this second stage. All that remains in the third or closure stage is to build up the low monoliths to the in-

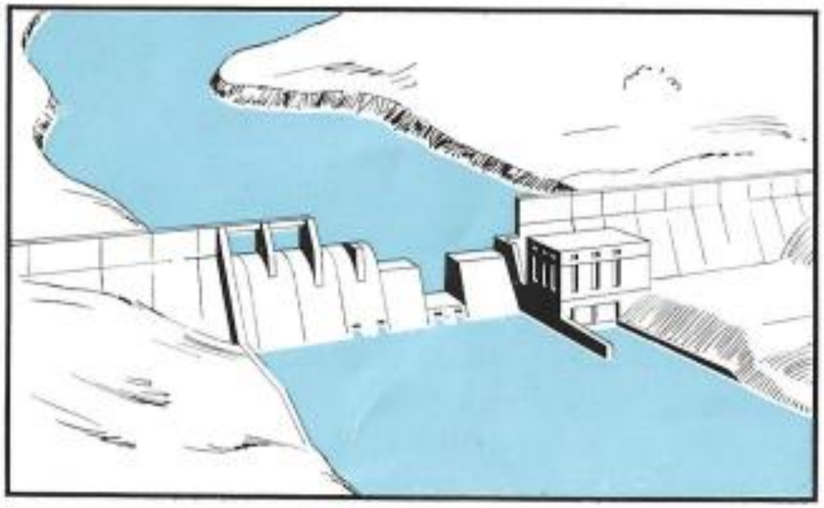


*First Stage*



*Second Stage*

tended height, and the dam is finished. Sluiceways are built at the elevation of the present river bottom, during the first and second stage, to control the water level during the final stage. The last step of the final stage is to fill these sluiceways with concrete. Construction of the power house and switching station just below the dam is carried on at the same time as the dam itself.



*Final Stage*

# Connecticut's newest lake

Water backing up behind the completed dam will form a long, narrow lake of nearly three square miles in area and with approximately 35 miles of shoreline. It will back up the Housatonic River almost to CL&P's Rocky River hydroelectric plant in New Milford, and will back up the Shepaug River to a point just below the highway bridge at Roxbury Falls. Before the water backs up, however, all the trees and brush in the area to be covered will be cut and removed.

The lake will be about one-third the size of Lake Candlewood, which is nearby and which was created some 25 years ago with the development of CL&P's Rocky River hydroelectric project. It will border on the townships of Newtown, Southbury, Bridgewater, Brookfield, New Milford and Roxbury, be surrounded for the most part by steep, wooded slopes, and be available to the state for stocking with fish. We believe that the lake, like the ones created at the Company's Lake Candlewood and Lake Zoar projects on the Housatonic, will make a notable contribution to the natural beauty of the area.

# The dam and powerhouse

As the dam is being built at a bend of the Housatonic where the river runs east, it will lie in a north-south direction rather than east-west. The power plant will be on the north, or Southbury, side of the river.

A series of huge taintor gates, each 35 feet wide and 28 feet high, and weighing 65,000 pounds, will be built into the dam as a protection against flood conditions. Raising the gates will permit excess water to pass under them and over spillways on which they rest. They will be operated by electric motors or, in an emergency, by a gasoline engine auxiliary, and can be opened to any degree desired. Each gate will be equipped with an air bubbler system to prevent ice formation, and electric heaters will be installed at the seals and bottoms of the gates to make winter operation easier.

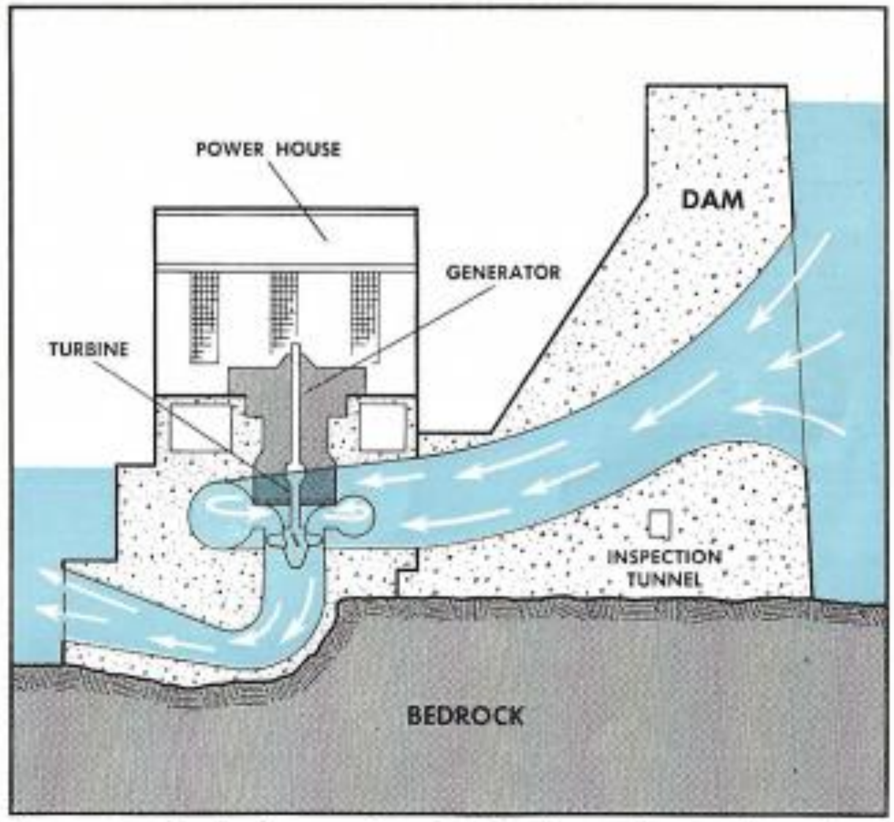
On one side of these gates will be two stanchion bays, each 35 feet by 23 feet, which can be opened in times of extremely high water and which serve as further flood protection. The bays are divided into sections seven feet wide, and can be opened by sections or as a whole. When all five gates and both stanchion bays are open, as they would be during extreme flood conditions, they can pass a flood twice as great as the 1936 flood, the most severe on record for this location.

The power plant will be constructed of brick, with limestone trim and glass block windows. It will contain the generating unit, composed of a turbine or water wheel, and generator, which produces power from the falling water.

Electric power will be produced at the plant by raising a headgate 18 feet wide and 32 feet high, the top of which is about 60 feet below the water level on the lake side of the dam. This permits water to flow down a huge penstock, or inclined pipe, and against the blades of the turbine wheel, causing it to rotate. The vertical shaft of the turbine is directly connected to the shaft of an electric generator, causing it to revolve at the same speed, and thus producing electricity. After hitting the blades the water enters a draft tube which leads it back into the river. The turbine's blades will be automatically adjusted to the angle which will produce maximum power from the varying amounts of water being used. A heavy iron screen before the headgate prevents logs or other large floating objects from entering the turbine.

The turbine wheel at Shepaug, which is a variable pitch Kaplan type, is believed to be the first in the country of this type developed for a fall as high as 97 feet. Under best efficiency at this fall, which means using 4,970 cubic feet of water per second, the turbine will produce 50,000 horsepower which will drive a generator with a rated capacity of 37,250 kilowatts. However, for short periods of time, when the flow in the river is above normal, the unit can be operated using 5,700 cubic feet of water per second, which will produce 57,000 horsepower and generate 42,800 kilowatts.

Annual power generation at the Shepaug plant in a year of average flow along the Housatonic is estimated at about 117,000,000 kilowatthours of electricity, or almost equivalent to the annual electric requirements of a city such as Bristol, Connecticut. The Shepaug plant will be connected to the present 69,000 volt Norwalk-Rocky River transmission line, and power from the plant will flow along this line to adjoining parts of CL&P's widespread transmission system.




*A cross sectional diagram showing the dam and power house from the side. When the gate is open, water flows down the wide pipe in the center of the dam, through a scroll case, or circular pipe gradually diminishing in diameter, and then through wicket gates down onto the propeller type turbine. After hitting the blades, water flows out through tail race and back to the bed of the river.*

# Unusual method of operation of the plant

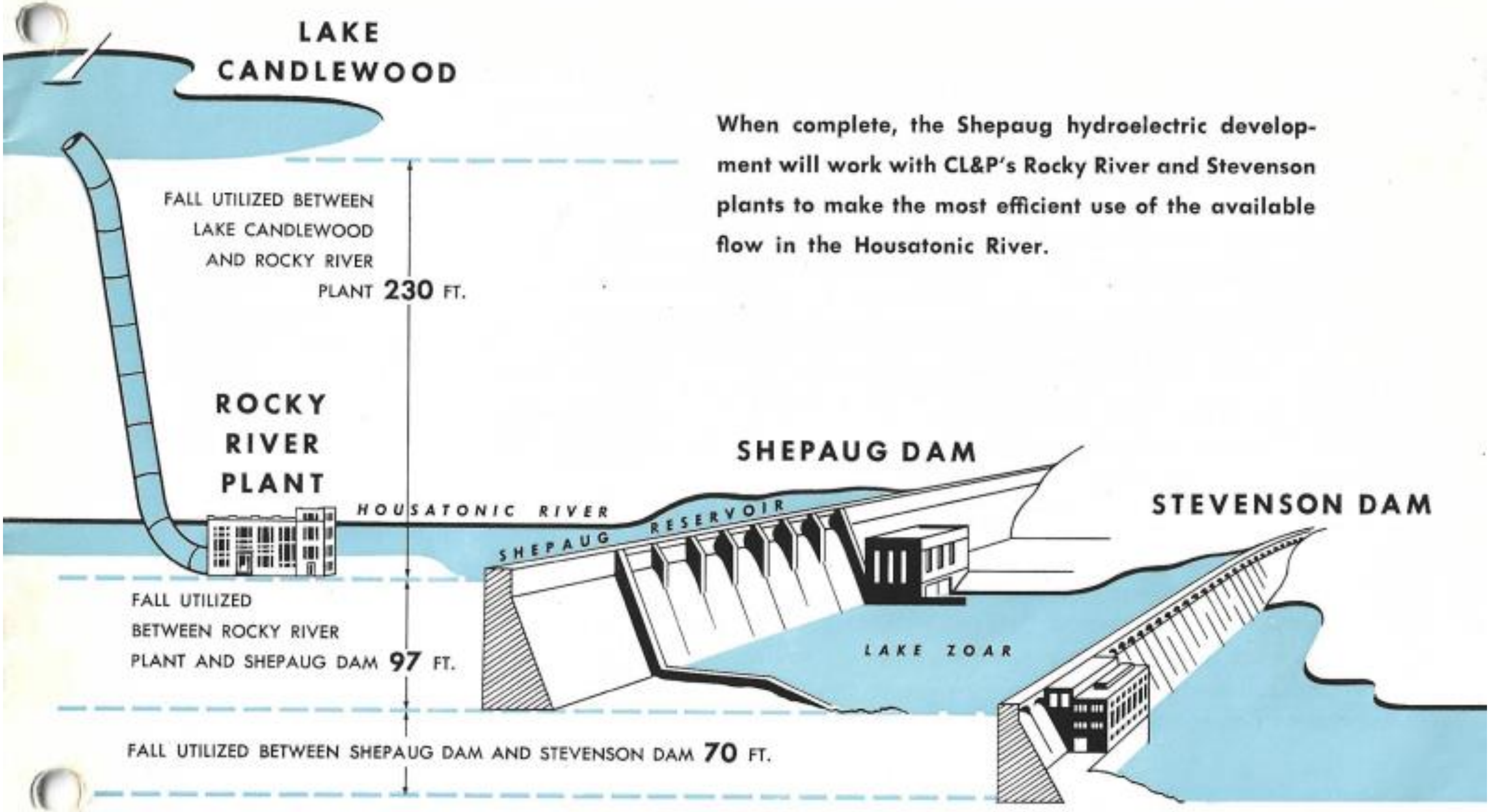
The Shepaug plant has been designed to operate at the same rate of river flow as CL&P's Stevenson water power plant about 11 miles down the Housatonic at Monroe. Both of these plants will have the benefit, as Stevenson does now, of the pumped water storage provided by Lake Candlewood and the Company's Rocky River plant 14 miles up the river. The large single generating unit which will be installed at the Shepaug plant can simultaneously use the same amount of water at full normal operation as do the four smaller generating units at the Stevenson plant down the river. Thus the rate at which water can be utilized at Shepaug is the same as it is at Stevenson, which eliminates the possibility of water being wasted in overflow at the lower plant. Though Shepaug will use the same amount of water as Stevenson, its output of electricity will be greater because the distance the water drops at the Shepaug plant is 97 feet, while the fall at the Stevenson development is only 70 feet.

To understand the function of the Rocky River development it should be realized that at the plant, water is pumped from the river up through a penstock into Lake Candlewood during periods of high river water, when the water otherwise would be lost for power production. By allowing the water to flow back down through the penstock, electricity is generated. In terms of units of electrical energy of this pumped water, the value of the three plants — Rocky River, Shepaug, and Stevenson — may be explained as follows: For every 1,000 kilowatthours of electricity that is expended to pump water up into Lake Candlewood, 627 can be recovered at Rocky River, 300 at Shepaug and 209 at Stevenson, or a total of 1136 kilowatthours, a net gain of 136 kilowatthours or 13.6 per cent.

Besides their normal available output of electricity, one of the great values of these hydroelectric plants to CL&P is the substantial amount of electric power they can produce on a few minutes' notice, helping steam power plants meet daily "peaks," or extremely high demands for electricity which last only a short time.

Steam generating units cannot be used to produce large amounts of power on short notice unless boilers and turbines are kept warmed-up and ready for operation, involving considerable fuel expense.

When complete, the Shepaug hydroelectric development will work with CL&P's Rocky River and Stevenson plants to make the most efficient use of the available flow in the Housatonic River.



# Cost and financing

Estimated cost of the Shepaug dam and plant is approximately 10 million dollars. The cost of the dam is perhaps worth mentioning because an investor-owned power company, like CL&P, must obtain the money it needs to build its plant from the *voluntary* investments of thousands of people, made both individually and collectively, in a free market, with the expectation of earning a reasonable return on the money they invest.

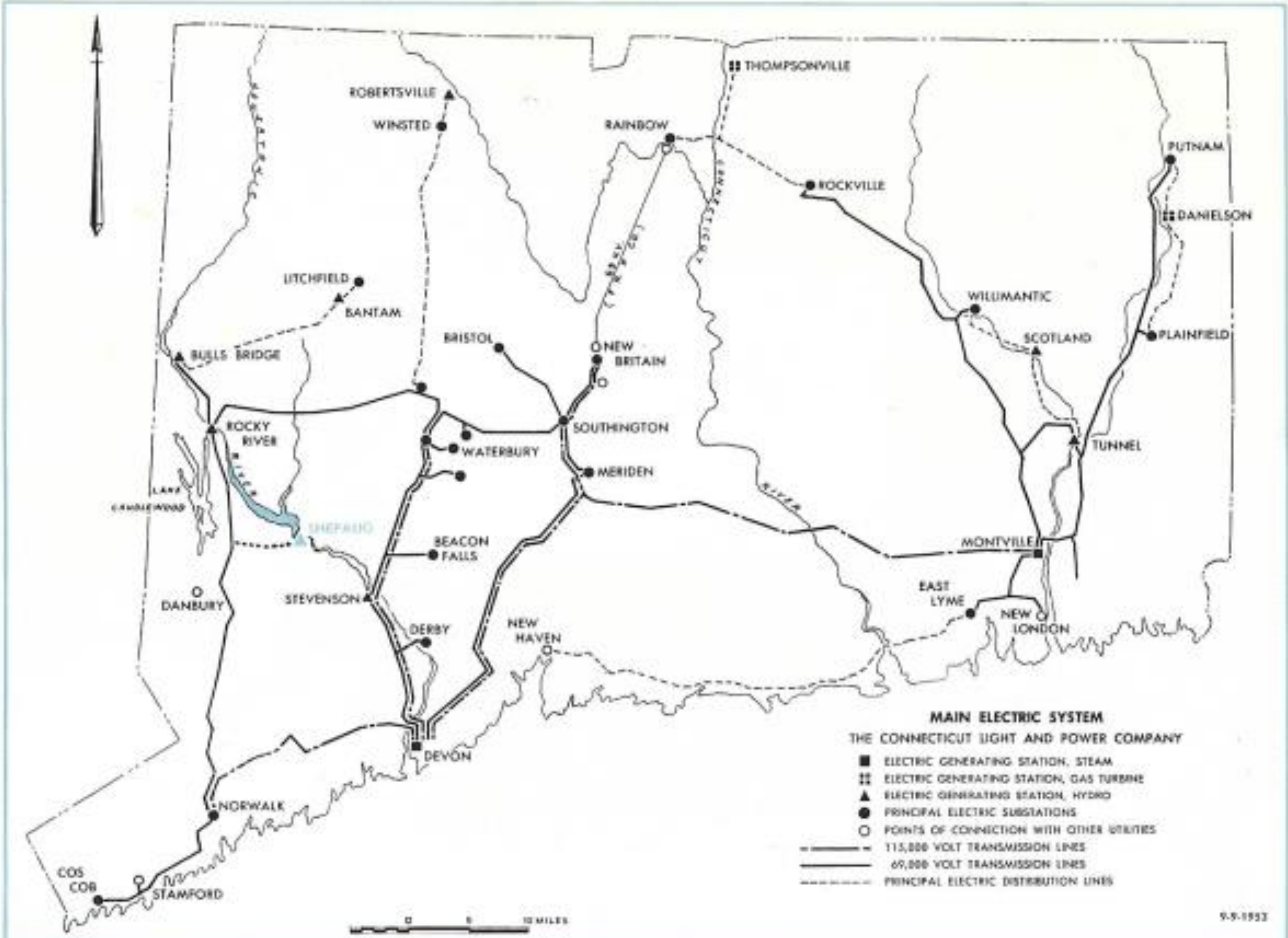
This is a very different matter from the way in which federal power projects are financed in which the cost ultimately falls upon the general taxpayer without his ever having a choice as to whether or not he would want to put his money into it. In addition, of course, federal power projects do not pay any federal income taxes, nor do they pay their fair share of local and state taxes. Not only will the Shepaug plant pay its full share of local, state, and federal taxes, but not a penny of its cost will be imposed upon the nation's taxpayers.

# The Housatonic . . .

## one of America's hardest working rivers

Though a relatively short river, the Housatonic, when the Shepaug project is completed in 1955, will have an extremely high degree of development of its water power. Compared, for example, with the Tennessee River, whose development by the government is well known, and in proportion to their respective drainage areas, rainfalls, and river falls, the Housatonic in 1955 will be developed 61 per cent more than the Tennessee River at the same date.

By utilizing most of the fall and flow of the river, without changing or harming the water used in any way, hydroelectric developments like the Shepaug have provided new scenic beauty and recreational opportunities for the people of our state. At the same time, they are hard-working sources of vital electric energy contributing substantially to the efficiency and prosperity of Connecticut and its citizens.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