

LIGNITE:

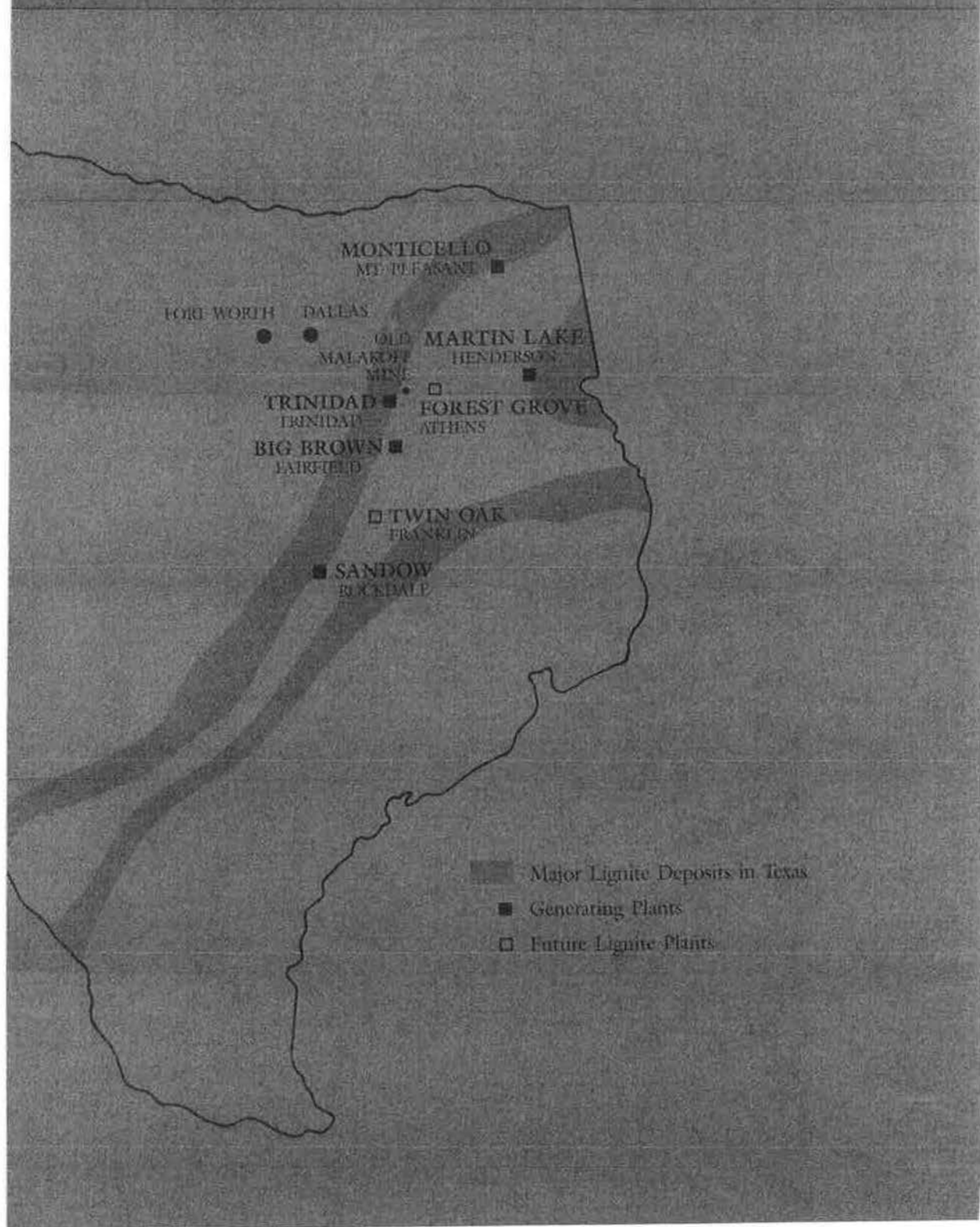
Texas Energy for Texans



A history of the development of lignite coal
by the Texas Utilities System



*On the cover:
The Monticello Steam Electric Station by night.
Monticello has two 575,000-kilowatt lignite-
fueled generating units and one 750,000-kilowatt
unit in operation. It is located near Mount
Pleasant in Titus County.*



The companies of the Texas Utilities System provide electricity in 87 counties in North Central, East and West Texas to about one-third of the state's population. The divisions making up TU Electric—Dallas Power & Light, Texas Electric Service, Texas Power & Light and the Generating Division—generate and distribute electricity to over five million people. Other subsidiaries include Texas Utilities Mining Company, which mines and delivers lignite coal to TU Electric's lignite-burning generating plants; and Texas Utilities Fuel Company, which owns and operates a natural gas pipeline system and acquires, stores and delivers natural gas and oil to TU Electric's gas/oil-fueled generating plants.

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*A history of the development and
use of lignite by the
Texas Utilities System*

Coal and ice.

Humans are, of course, no newcomers to East Texas. At least a half million years ago, during what is called the Pleistocene Era—or Ice Age—humans lived off the land, and they left some remembrances behind them.

Workmen at the Henderson County gravel pit knew only that it was no ordinary chunk of rock they dug up in the year 1929. Archeologists later judged the carved stone image of a human head to be one of the oldest artifacts ever uncovered on the North American continent.

The work of some Ice Age sculptor, and one similar carving found later in the gravel pit, now rest in the Texas Memorial Museum in Austin.

They're known collectively as "Malakoff Man," named for the small town five miles east of the gravel pit.

Whoever else may have lived at the site of Malakoff through the ages, the town itself got its start in 1846 with the arrival of a Methodist preacher, the Rev. Hezekiah Mitcham, and his six sons. Texas had just become part of the United States.

The residents eventually adopted the name of a city in Russia that was much in the news because of the Crimean War. They reasoned there would be only one Malakoff in the United States.

Shortly after the turn of the century, the Melvin Dodd family opened the area's first coal mine.

The Dodds had tapped into a Texas resource that long predated even the carving of Malakoff Man—lignite coal.

Laid down when Texas was a tropical swamp some 50 million years ago, lignite lies under the earth of East Texas in long belts from Texarkana to the Gulf Coast.

It's a low-grade "soft" coal, producing less heat than the older and harder bituminous and anthracite coals of other regions. Nonetheless, it is believed to have been used for some purposes as far back as the early 1800s in Texas, primarily for home heating. More than 100 mines are known to have operated from 1900 through the mid-1930s, one of them being the Dodd mine near Malakoff.

One thing the lignite had never been used for, as of the early 1920s, was the generation of electricity.

That was due to change. In 1917, Texas Power & Light was a young company in a young industry. It was making electricity for its customers with oil and natural gas, but—in further proof that history tends to repeat itself—TP&L was having fuel problems. The price of oil was very unstable. The use of natural gas was almost prohibitive because of its production and delivery costs.

TP&L knew there seemed to be quite a bit of lignite in the parts of East Texas the company served—lignite that conceivably could be used to fuel a power plant.

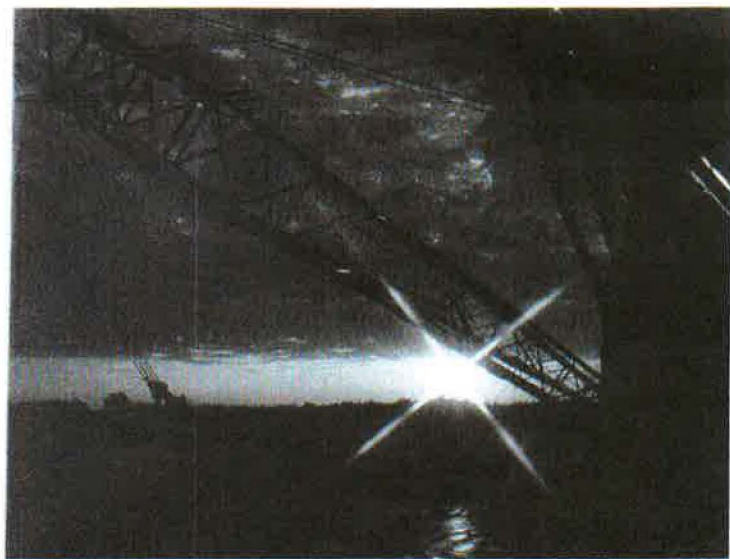




*Opposite page:
During the 1920s and '30s, lignite
mined at Malakoff was delivered by
the trainload to Texas Power &
Light's Trinidad power plant.*

*Above:
Early draglines at Trinidad uncovered
lignite much as their larger counter-
parts do today.*

*The Texas Utilities Mining Company
now ranks as the fourth-largest coal
miner in the nation and has made
Texas the nation's largest lignite-
producing state. The company mines
about 30 million tons of lignite a
year. To recover that lignite, the Min-
ing Company must move aside
almost 300 million cubic yards of
dirt, making it the nation's largest
earth handler.*



Malakoff, TP&L engineers and geologists decided, offered the best available site to mine lignite for use in a power plant. The company made a deal with the McAlester Fuel Company, an Oklahoma-based firm that had bought the Dodd mines. McAlester would mine the lignite and deliver it to a plant TP&L would build on the Trinity River at nearby Trinidad.

In 1926 the Trinidad plant went on line, its two units each capable of producing 20,000 kilowatts of electricity.

Trinidad was something of an oddity—the only power plant in Texas fueled by lignite, the biggest power plant in the United States using lignite exclusively . . . and the first major power plant in the world to use pulverized lignite, a process partially developed by TP&L engineers.

With a third generating unit added in 1931, Trinidad was the backbone of the TP&L system—using Malakoff lignite to churn out electric power for a large part of Texas.

The Trinidad plant remained a pillar of the TP&L power system. But the Malakoff lignite did not.

In the late 1930s, natural gas was found in a field near Trinidad and offered to TP&L at a price of 3½ cents per thousand cubic feet. That price was well below the cost of the lignite, and TP&L began converting Trinidad to run on natural gas.

In 1942, the Malakoff mine was closed. In its time, it had produced seven million tons of lignite from surface mining and underground shafts for the Trinidad plant. But its time was gone. As far as most people were concerned, an infinite age of natural gas had arrived and there would never again be a use for lignite coal.

Or would there?

Texas was oil country. Everyone knew that. In the post-World War II boom years, Texas was literally awash with oil and natural gas.

Gas, in fact, was a drag on the market. Producers were happy—even eager—to sign 20-year contracts for it. What they couldn't unload for three to five to eight cents per thousand cubic feet was being capped off or flared in the fields.

The state's lignite was forgotten. Popular wisdom was that no one would ever need the stuff again.

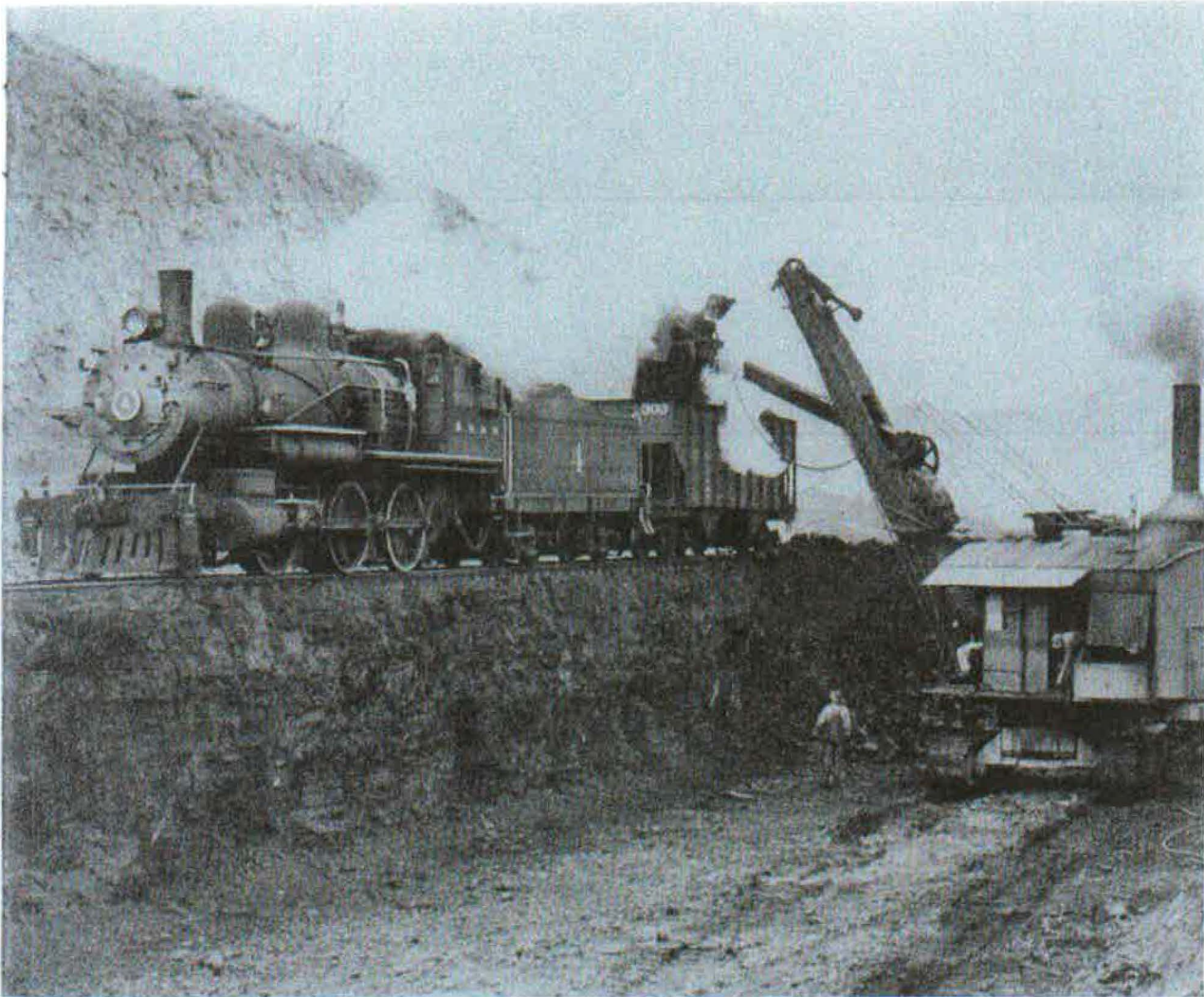
W.W. Lynch, then president and later board chairman of TP&L, didn't believe it for a minute.

Lynch figured it was just a matter of common sense. Nothing good lasts forever. Someday—maybe not for a while—but someday, that oil and gas was going to get hard to come by. And someday, that lignite was going to start looking good again—really good.

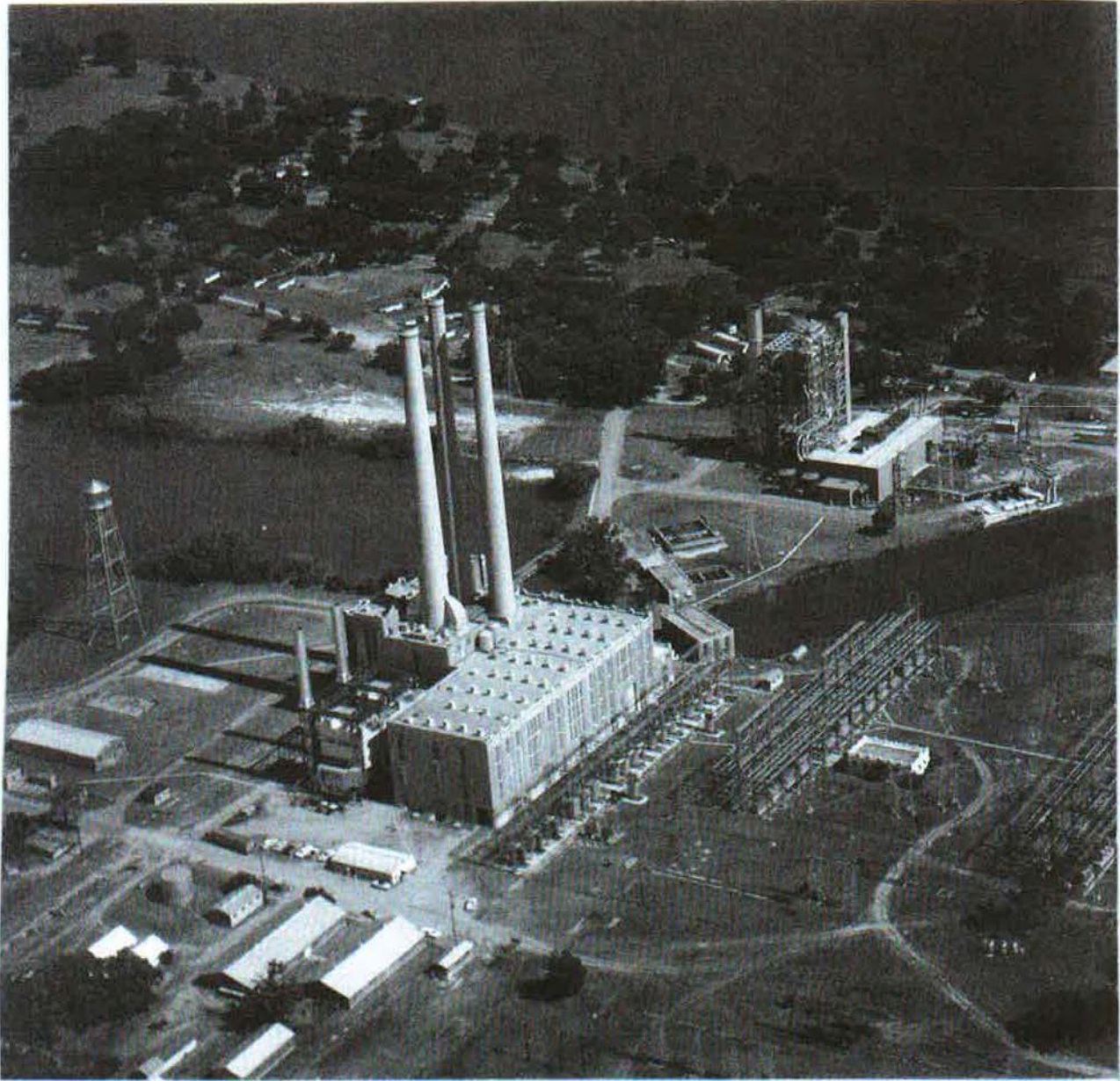
Meanwhile, being as there was no demand for it, the lignite was up for grabs. Lynch and the man who was then his boss, the late Board Chairman John W. Carpenter, made a decision: go after it.

It was not a decision that was met, at the time, with universal applause. Even some of Lynch's and Carpenter's counterparts, while supportive, were dubious. The late C.A. Tatum, at that time president of Dallas Power & Light and later board chairman of Texas Utilities Company, said, "I didn't fully appreciate the value of it. I respected their judgment on it, although at the time it wasn't apparent that the System would need it and benefit by it."

People were skeptical when the search for lignite deposits started in 1948, especially when there was an abundance of natural gas.



The Malakoff lignite mine, about 1930. Shovels at that time loaded the lignite directly into the rail cars. Those early shovels held 1½ cubic yards of lignite, or about two tons. Today's will hold up to 16 cubic yards, or about 21 tons.



Texas Power & Light's Trinidad power plant in Henderson County went into operation in 1926, the first power plant in Texas to be fueled by lignite. The plant still operates today, although it was converted to use natural gas in 1940.

The search started out with one core drilling truck and some dusty records of places lignite once had been mined.

The lignite exploration team was small, but it got around. A second drilling rig was added, and in just the first six years of the program, the team covered 41 East Texas counties. It drilled almost 317,000 feet—the equivalent of 60 miles—to core test lignite deposits, and the company leased those that were promising.

The exploration program was long and tedious, continuing through the 1950s and into the '70s.

Bill Lynch might have been a determined man, but still there was skepticism about the worth of the program he insisted on.

Even some of those who had devoted years to the exploration program had moments of nagging doubt.

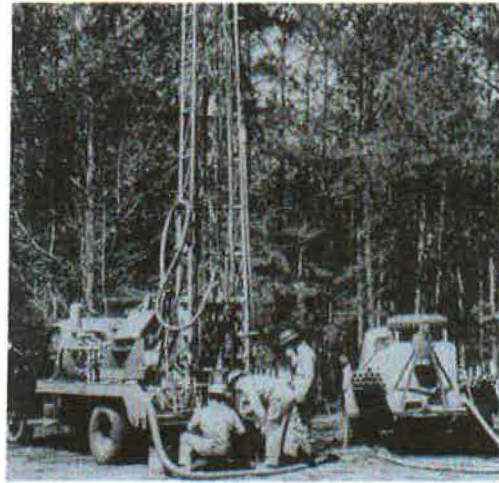
"Time began to drag," remembers Dan Taylor, who joined the exploration group in 1955. "By the time we got to the '60s, I've got to admit I had some thoughts—and some other people in the program also—that there was a possibility we would never use lignite."

For one thing, supplies of natural gas didn't seem to be dwindling, said Taylor, retired manager of geotechnical services for Texas Utilities Mining Company.

"I don't suppose it was really going begging, but there was no question in anybody's mind that I knew of but what you could go to a commercial supplier and buy all the natural gas you wanted—forever."

Taylor said the feeling the System might, after all, never use the lignite was reinforced by another fact: TP&L was virtually all alone. Very few other people were even slightly interested in the lignite.

"The thought crosses your mind—if we're the only ones interested in it, well, you really wonder if it has any value."



TP&L's lignite exploration teams and their drilling rigs began core testing for East Texas lignite reserves in the late 1940s.

The beginning of the end.

To most Texans, natural gas still seemed the wave of a cheap, abundant energy present, and future.

But a few people in some power departments, executive offices and board rooms in Dallas and Fort Worth were seeing something take place that eventually would change—in the largest sense—the course of world history.

The price of natural gas was going up, edging its way toward 20 cents per million Btu.

And producers were no longer happy, eager or even willing to sign 20- and 30-year supply contracts.

Dallas Power & Light, Texas Electric Service Company and Texas Power & Light—allied as the electric utility operating companies of the Texas Utilities System—saw trouble coming.



Big Brown in Freestone County, with its two 575,000-kilowatt generating units, was the TU System's first modern lignite-fueled power plant. It, like the System's other two lignite plants, includes a cooling lake and adjacent parkland. At the three locations, the System has made more than 9,000 acres of lake surface and almost 1,900 acres of land available to the public for recreational purposes.

By the early 1960s, the late C. A. Tatum said, the three companies had become seriously concerned about where they'd find fuel for their power plants in the next 20 to 30 years.

Trouble becomes apparent, he said, "when you go to the prospective gas suppliers and try to make contracts for 20 to 30 years at a firm price, and they won't give it to you. It's apparent when you can't make a contract with them."

That lignite, so stubbornly and painstakingly leased for so many years, looked better all the time.

A matter of timing.

As the 1960s progressed, it became a question of when—not if—the lignite reserves would be needed.

Burl Hulsey, then president of Texas Electric Service Company, said it was a matter of "when lignite would become economical compared to natural gas, but more particularly, when it would be required because of the need for alternate fuels.

"All of us felt that lignite was the way to go. But the concern was, is now the time? Is it now competitive with natural gas? When is natural gas going to undergo a rapid increase in price? Is gas going to just simply become unavailable to us as a boiler fuel?"

By the middle of the decade, said retired TU Board Chairman Louis Austin, the numbers told the story: by the time a lignite-fueled power plant could be built, it would be cheaper to produce electricity with lignite—even though the plants would be much more expensive to build and operate than plants fueled by natural gas.

It also became apparent that the most economical use of the lignite would be through the System companies working together in a joint effort to build the generating units. New lignite reserves could be

acquired on behalf of all three companies. Existing reserves could be allocated among the companies in proportion to their ownership of the units, with DP&L and TESCO buying their shares at cost from TP&L.

There were technical problems to consider.

Lignite, again, is a low-grade coal. Because it doesn't contain as much heat per pound as harder coals, it would take much more lignite to produce a kilowatt-hour of electricity.

Producing the number of kilowatt-hours needed by the three companies on an economical basis would require a bigger boiler than ever built before in the United States.

The question to be answered was, could it be done? The companies would be venturing onto untried ground, developing new technologies.



At the Monticello plant, lignite is transported by train from near the mining site to the generating units. The rail cars—and the haul trucks that bring the lignite out of the mining pit—can carry up to 100 tons of lignite each.

The size of the power plant was only one of "a world of big problems" that had to be overcome, recalls George MacGregor, then president of the Texas Utilities Company.

"You have to have equipment that's big enough to dig the amount of coal we were talking about. You have to have transportation to move it. You have to handle the ashes, the flue gases and all the things attendant to it."

More research was done—much more. Research, though, can't make human decisions, and finally a very few men—the heads of DP&L, TESCO, TP&L and TU—had to say yes or no.

They decided to build the Big Brown plant in Freestone County.

Big Brown proved it would work. After experience with that plant, the companies went ahead with plans to build other lignite generating units, which eventually would provide much of their baseload capacity.

The class of '53.

It's not strictly true that absolutely no one was interested in lignite during its dormant years.

It takes a huge amount of electricity to manufacture aluminum. In the early 1950s, TP&L President Bill Lynch contacted a number of aluminum companies asking if they'd be interested in using lignite to produce their electricity.

The result was construction of a new Alcoa smelting plant near Rockdale in Milam County, as well as a new power plant, Sandow, built by Alcoa to provide the smelting plant with electricity. TU

formed a subsidiary, the Industrial Generating Company (IGC), to mine lignite and operate the Sandow plant.

The people who hired on in 1953 to work the Rockdale mine, and those who went on the payroll in later years, were to give the Texas Utilities System a priceless head start in using lignite almost 20 years later.

At the time, they didn't know what they were getting into.

Leonard A. "Speedy" Sales was the first person to go on the IGC payroll. At the time, he didn't know much about mining lignite. He only knew the job conditions sounded like the best he'd ever heard of.

Sales stayed on to run the draglines at the Rockdale mine, and later at the TU System's Monticello lignite plant, for almost 23 years.

"I started out as an operator, and I turned down promotions because I just love machinery. The bigger it is, the better it is . . . the easier it is to run," he said.

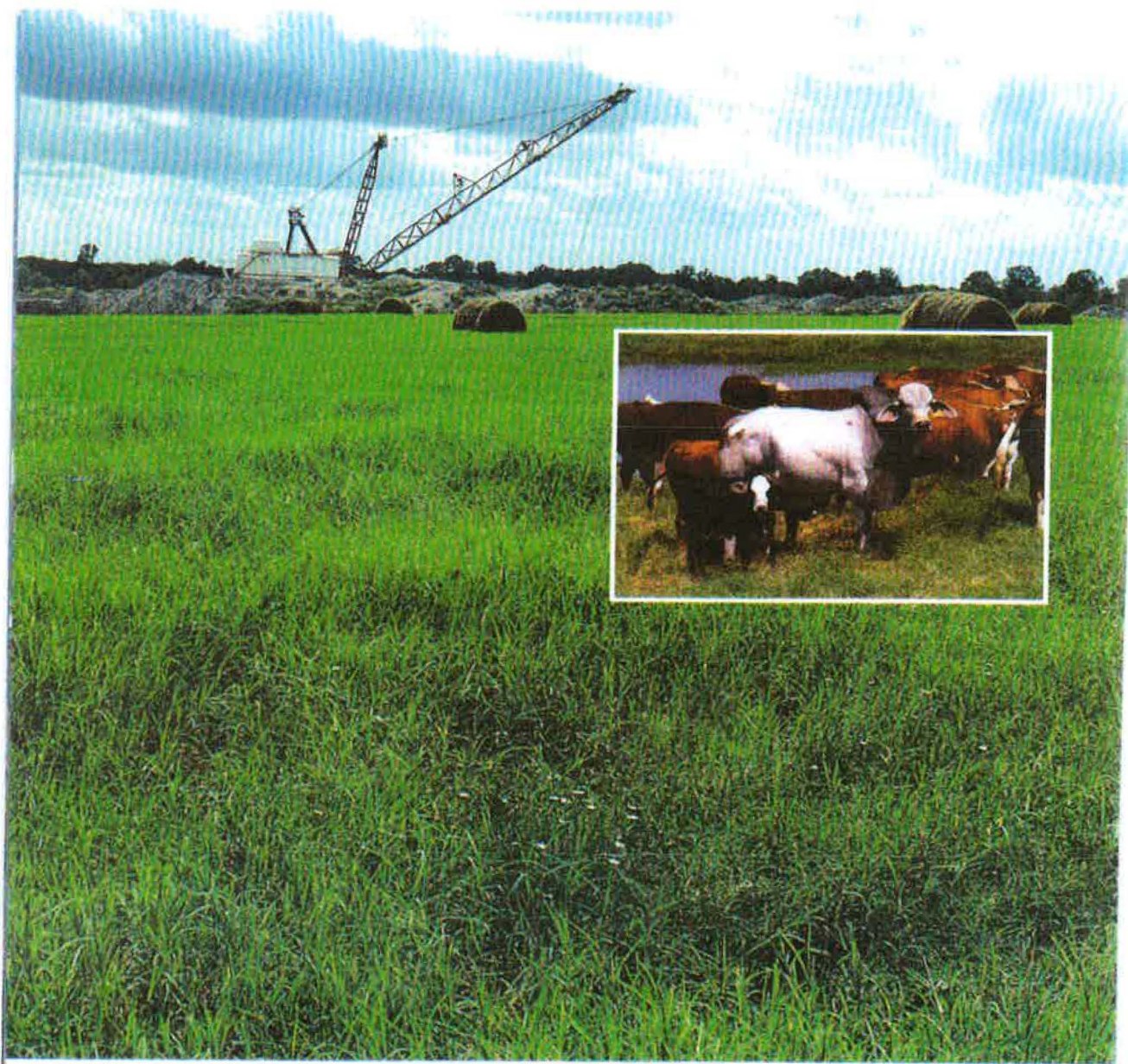
When Texas Utilities began its program to build lignite-fueled generating plants, it could draw on a wealth of experience and expertise from Rockdale. Sales transferred to Texas Utilities Generating Company at the Monticello plant, near Mount Pleasant, and finally accepted a promotion to a supervisory job before his 1975 retirement. Others carried their knowledge to the Big Brown plant near Fairfield and to the Martin Lake plant near Henderson.

And another alumnus of the Rockdale Class of '53—Louis Austin, the "Alabama coal miner" who started as Rockdale mining superintendent—became chairman of the board of Texas Utilities Company.

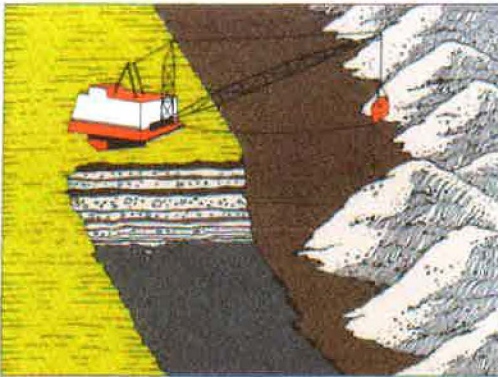


The Mining Company's newest innovation, the cross-pit spreader, has proved its capability as a safe excavation and conveyor system. This equipment, which weighs 4,350 tons and is nearly a fifth of a mile long, enables recovery of deep lignite deposits in the most economical manner.

Thirteen giant draglines now operate at seven lignite mines, which supply the three TU System lignite power plants. The largest in operation scoop the earth off lignite seams with buckets that hold 100 cubic yards, or about 130 tons, of dirt. The buckets hang at the end of "booms," some of which are longer than a football field. The machines, which weigh up to 12½ million pounds, are electrically powered and, therefore, almost silent in operation. Sandow, a fourth TU Electric lignite plant, is supplied fuel by Alcoa.



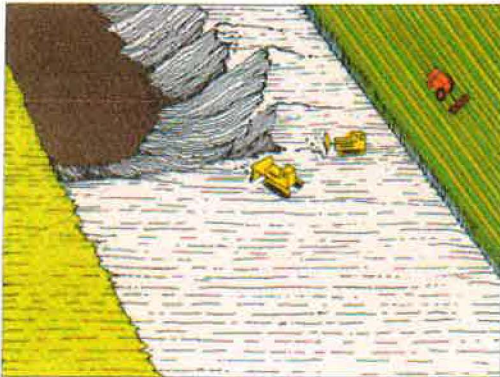
As mining continues nearby, grass is growing and cattle (inset photo) are grazing again on land once surfaced mined to obtain the lignite beneath. Almost as soon as land is mined, reclamation efforts begin to return it to productive use. Trees, grasses and shrubs are planted to provide food, shelter and nesting opportunities for wild and domestic animals and ponds are constructed to provide water.



1. The earth, or "overburden," lying over the lignite seam is scooped off with a giant dragline.



2. When the earth is removed, the lignite is dug out and loaded into haul trucks.



3. After the lignite is mined, the earth is replaced in the pit. The surface is recontoured and planted with vegetation.

Bringing back the land.

Surface mining is more efficient, cheaper and much safer than underground mining—as the laborers who mined lignite in underground shafts around the turn of the century would attest.

It does, though, have an obvious effect on the surface of the land.

"It's pretty apparent," said the late TU Board Chairman C. A. Tatum, "a big open pit is not a pretty sight. It's a terrible looking thing."

At the time the TU System companies were embarking on their joint program to build lignite-fueled generating plants, there were no laws requiring the reclamation of strip-mined land. Texas passed such a law in 1975, and the U.S. Congress in 1977.

The TU System began reclamation as soon as it began mining lignite at the Big Brown plant in 1971. "We started out planning right to begin with to make restoration and make it look good," Tatum said. "Rather than just promise what we were going to do, we went ahead and did it."

The reclamation program, through which the mined land is recontoured, planted and put back into wildlife habitat or agricultural use, is endorsed wholeheartedly by the System employees who implemented the program.

"I think I'm something of a conservationist," says Abo Schwarzer, who was involved in the initial reclamation at Big Brown and today is manager of operations for the Mining Company. "I firmly believe you need to put the land back to productive use. When we started mining at Big Brown, we immediately started putting the land back. We felt like we had to do that to be good neighbors in the community."

"Besides, it's just the thing to do."

Learning from the land.

When the commitment was made to the System's lignite program, a number of other decisions had to be made too. Biggest was a commitment to the environment. Although no federal or state strip mining laws yet existed, the TU System knew it would reclaim the land. But the commitment went further than that. It embraced the soil, air and water too.

In 1969, well before a full-scale environmental program was developed for the System's lignite operations, TESCO hired research biologist John Tilton to oversee various environmental aspects of power plant operations. TESCO was the first utility company in the state to hire such a specialist. Tilton started the wheels turning to form what was to become the System's environmental research program—an environmental program unique to the electric utility and mining industries.

One of the first things Tilton did was recommend hiring Dick White to help set up and run the System's environmental effort. White had worked with Tilton at the Texas Parks and Wildlife Department and was an aquatic biologist by training. Tilton was sure he had the right man for the job.

Early on, as part of the overall effort, the two proposed a unique research program where scientists would independently study the effects of mining and power plant operations on the environment.

White and Tilton knew the first, and most important, consideration would be deciding who would conduct the research. Since most environmental concerns were being raised by people in the academic world, they reasoned, why not involve the academic community in the research? They decided top graduate students, selected by a steering committee that included distinguished professors from various scientific



A fish sampling is conducted near the Big Brown units.

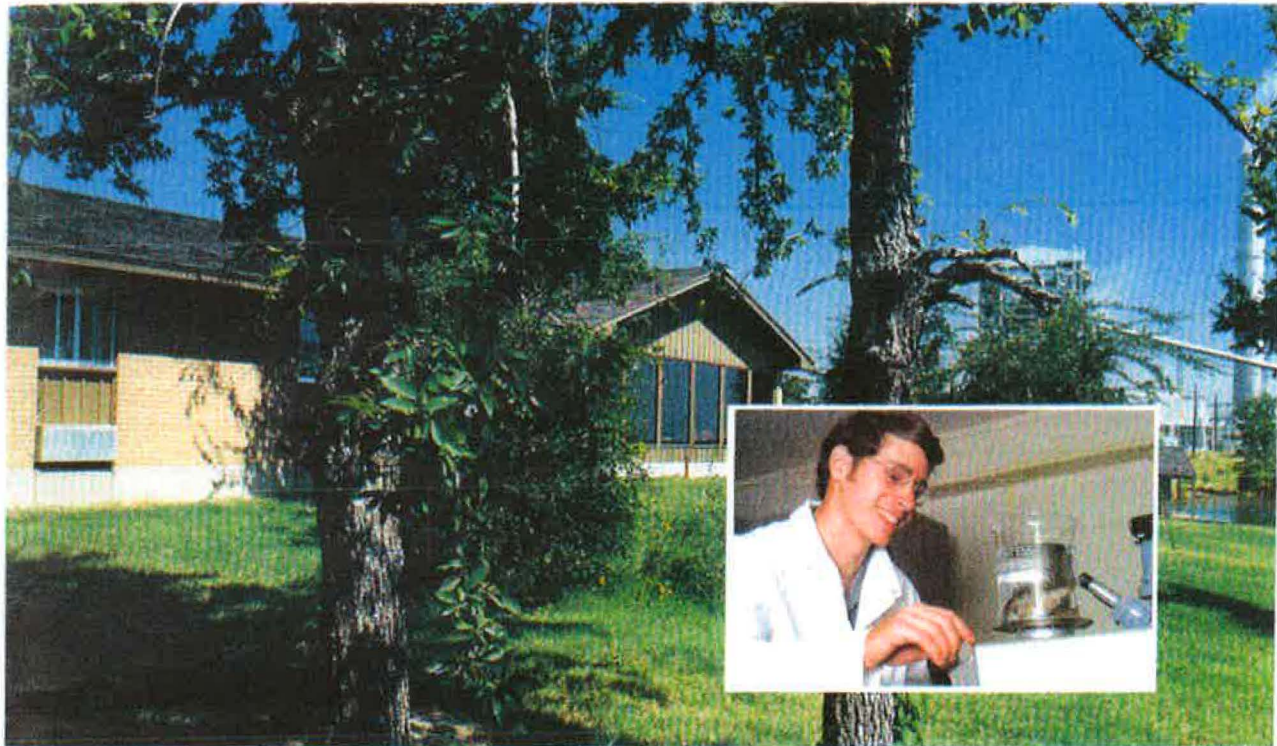


Air pollution-control equipment on all System lignite units helps ensure that air-quality standards are met.

fields, would provide objective research and results.

The proposal White and Tilton made seemed daring at the time. The System companies would fund the research but would have neither editing nor publishing rights to the finished studies. All research findings would be published in open scientific literature.

A research center was built at Big Brown, almost within the shadows cast by the generating units. The facility affords graduate students a place to live and laboratory facilities. Basic living expenses are provided by the System, and students have free access to any System facility to carry out their research.



The Environmental Research Center is located only several hundred yards from the Big Brown generating units. The center provides research fellows (inset photo) with a lab as well as lodging while they carry out their projects.



This research program showed that row crops would grow successfully on reclaimed land.

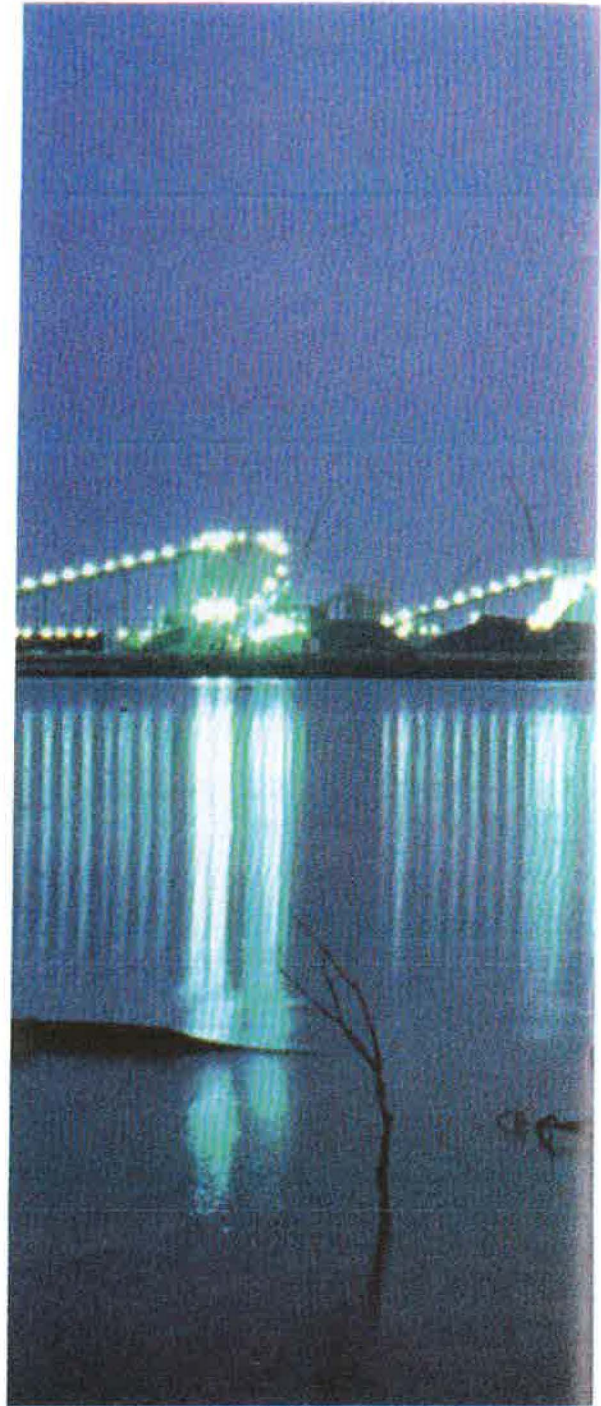
Postlude.

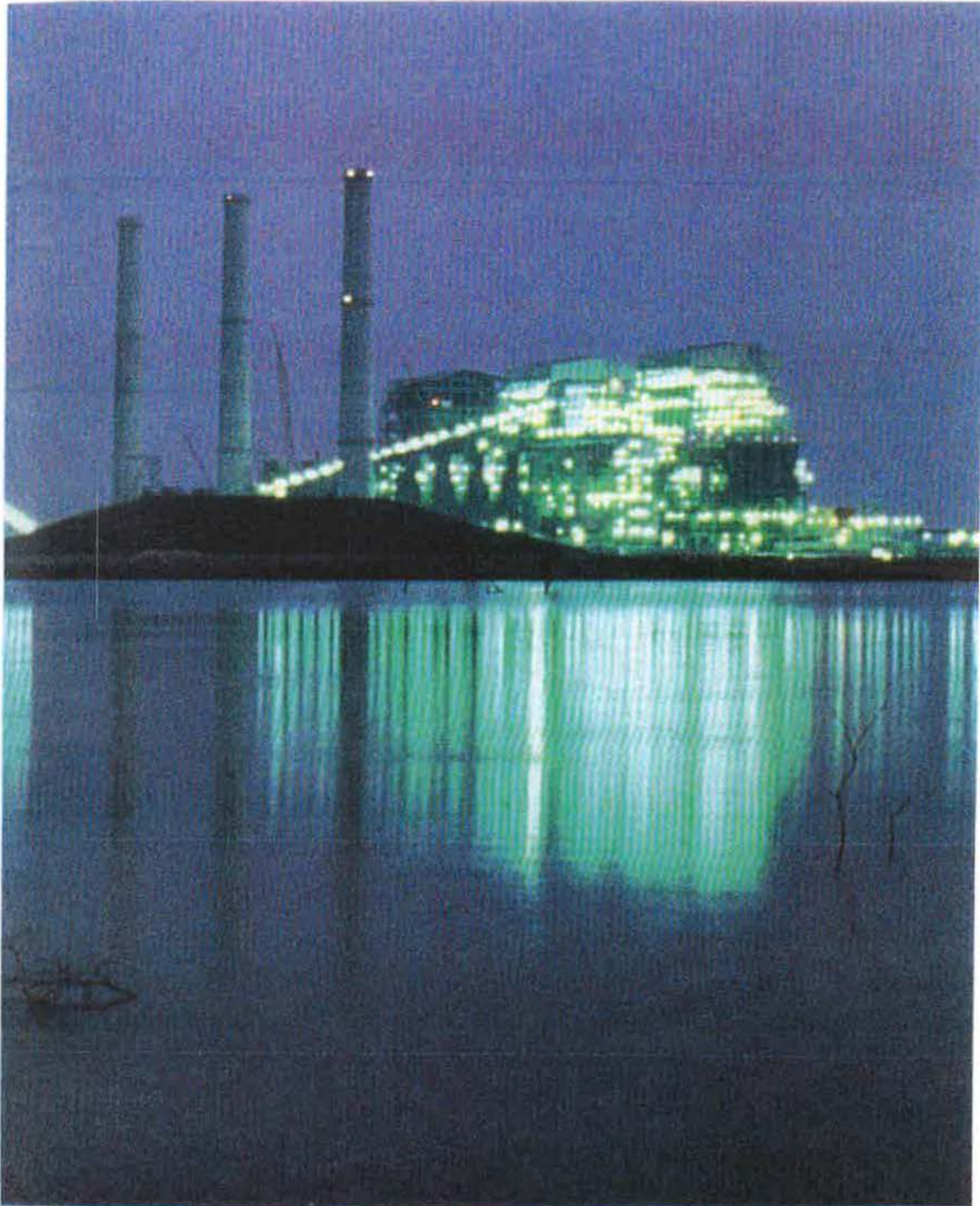
In the interim since ground was broken for the two Big Brown generating units in 1968, the TU System has built two more lignite power plants—the three-unit Monticello plant near Mount Pleasant and the Martin Lake plant near Henderson with three units in operation. A fourth System unit was also completed at the Sandow facility and additional System generating units are expected to meet future energy needs.

Today, lignite plants are providing about half the electricity generated by TU Electric, whose divisions include DP&L, TESCO and TP&L. And it is being provided to customers at a sizable savings. So far, using lignite has saved TU Electric customers over four billion dollars compared to what they would have paid for the same amount of power generated by higher-priced natural gas.

Thanks to the foresight of those early lignite pioneers, the System has reserves adequate to provide fuel for the lives of its existing lignite plants and those planned for the future.

The Martin Lake plant, near Henderson in Rusk County, has three 750,000-kilowatt generating units in operation. The System has a total generating capacity of 5.8 million kilowatts at its lignite plants. The cost of lignite still averages considerably less than half that of natural gas.







The Malakoff dragline, in the background, had a bucket capacity of eight cubic yards and was considered huge at the time. Today, draglines up to 100 cubic yards in capacity are being used by the TU System.

And prelude.

Lignite is not the ultimate energy source, any more than natural gas was. Lignite, too, is a finite resource, and there isn't enough of it to make all the electric power needed.

Knowing this, the System looked toward the power of the atom and the added fuel diversity it would bring. The Comanche Peak nuclear plant near Glen Rose will be capable of producing 2,300,000 kilowatts of electricity for the 1990s and beyond.

Other resources that will be used to meet customer needs include load management and energy conservation programs to reduce the need for new generation, combustion turbines, cogeneration and a life extension program for existing gas-fired plants.

"We can't ever quit looking down the road. We never have and we never will," says TU Board Chairman Jerry Farrington. "Back in 1926 when they started using that Malakoff lignite, I suppose nobody could conceive of life in the '80s and '90s. Even when we started buying up the lignite in the late '40s, it must have been hard to imagine what life would be like 30 or 40 years away. But we were planning for the future even then.

"Well, when we used to say 'the year 2000' that sounds like a long time off, but it's not anymore. Time goes by in a hurry, and we've got to be ready. People depend on us now and they're going to depend on us then."