

## Lignite Resources in Louisiana

### INTRODUCTION

Lignite is a low-ranking, brownish black coal. It is not as soft as peat nor as hard as bituminous coal and has a fibrous earthy texture. Lignites are classified by rank according to heat content. There are two types of lignites: lignite "A" and lignite "B." The heating value of lignite is measured in British thermal units (Btu), which is the amount of heat needed to raise the temperature of 1 pound of water by 1 degree Fahrenheit. The heating value in lignite "A" ranges from 6,300 to 8,300 Btu/lb, and the heating value of lignite "B" is less than 6,300 Btu/lb (Sheridan 1965). Louisiana lignites are classified as lignite "A," having an average heating value of 6,858 Btu/lb (Tewalt 1985).

Lignite is commonly used as an energy source, usually in a power plant where it is burned as a fuel. It can be used as a raw

material in the production of lignite briquettes, fertilizers and livestock feed. Oxidized lignite can be used as a thinner for oil well drilling mud, as an industrial water softener and as a soil conditioner. Other uses include chemical feed stocks, like activated carbon, and conversion to synthetic oil and gas.

### LIGNITE FORMATION

Lignite is a combustible sedimentary rock composed of consolidated and chemically altered vegetal remains. The lignite bearing rock in Louisiana was deposited during Paleocene/Eocene epochs approximately 36 to 66 million years ago. During this time much of Louisiana existed as an alluvial plain and was characterized by low, marshy land with luxuriant plant growth. Lignite originated from ancient plants that flourished in delta

plains and swamps under tropical climate conditions. Leaves, stems, tree trunks, branches, and plant roots were deposited within the swamp basin where the water was stagnant. Thick deposits of partially decomposed vegetal debris (peat) was buried by layers of sediments, such as sand and mud, from alluvial deltaic, and coastal processes. After burial, the lignite-forming process began. Continued burial and the influence of the earth's geothermal gradient subjected the peat to heat and pressure. Eventually physical and chemical alternations transformed the peat into lignite.

In modern time, similar peat formation can be found within the Mississippi River alluvial plain, the River Delta Plain and on the Louisiana coast where peat is accumulating today under conditions similar to these of the Paleocene/Eocene epochs. Conditions for peat formation had to remain stable for very long periods of time. In areas relatively undisturbed by levee sedimentation, the rate of accumulation of peat averages one foot every 300 years (Sites 1995). Also, thick deposits of peat are needed to form lignite because peat is compacted to about one-tenth of its original volume.

### LIGNITE OCCURRENCE

While lignite is present throughout most of northwest Louisiana, significant mineable lignite occurrence is limited to seven parishes. They are Desoto, Caddo, Bossier, Sabine, Bienville, Natchitoches, and Red River. Lignite seams stretch across the northern part of Louisiana in a broad band from the Texas boarder to the northeastern section of the state.

Mineable lignite occurrence in Louisiana is associated with the Louisiana portion of the Sabine Uplift, a 65 by 80-mile (105 by 129-kilometer) relatively flat-topped, asymmetrical dome where Louisiana's two lignite mines in operation are located (fig.1). The Red River Bull Bayou structure is the topographically



Figure 1. Map showing the location of Dolet Hills and Oxbow Mines, Sabine Uplift and other structures (modified from Roland et al. 1976).

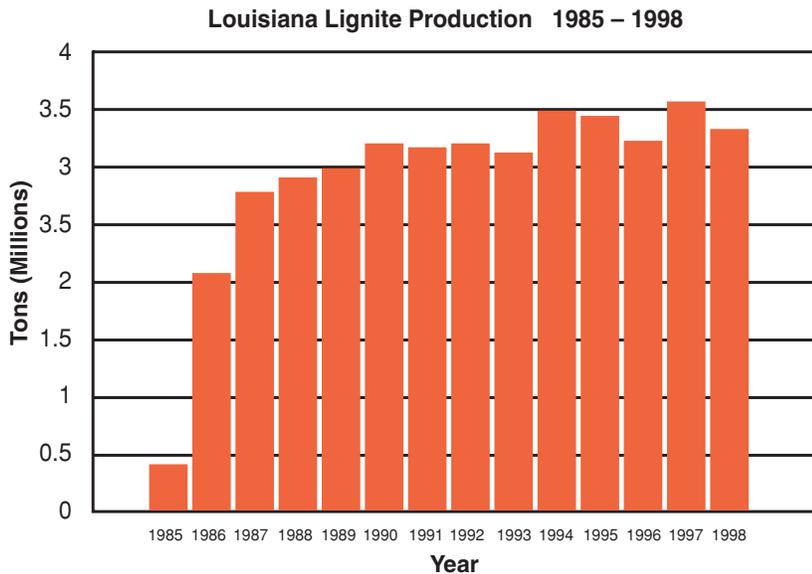


Figure 2. Annual Coal Production in Louisiana from 1985 to 1998 (source: Central Louisiana Electric Co.)

highest part of the Sabine Uplift, which makes the resources economically recoverable.

Presently all lignite production in Louisiana comes from the Wilcox Group of Paleocene-Eocene epochs. This lignite occurs at depths of 200 feet (60.80 meters) or less, which is generally considered the maximum depth for economically surface mining of lignite. Total mineable lignite resources in Louisiana are estimated to be in excess of 1 billion short tons (Johnston and Mulcahy 1984).

### LIGNITE QUALITY

An average analysis of Wilcox Group of lignite in Louisiana would show 0.81 percent sulfur, 10.72 percent ash, 27.08 percent volatile matter, 27.09 percent fixed carbon and an energy content (heating value) of 6,858 Btu per pound. These values are based on 67 analyses on lignite on an "as received basis" (Tewalt, 1987).

### HISTORY OF LIGNITE

Lignite was found in the northwestern part of Louisiana as early as 1812. During that time small amounts of lignite mined from outcrops were used locally as fuel for black smithing and domestic heating. In the early 1900's lignite was used in the firing of brick and in the generation of steam. It made a limited contribution as a power source in the manufacturing of cane

sugar and tiles. Lignite was distilled to produce burning oil, lubricating oil, and paraffin. Also, gas was obtained from burning of lignite. Powdered lignite served as a preservative for the storage of eggs in rural areas.

In the 1950's and 1960's, lignite was considered as a potential fuel for generating electricity in the state but was not cost-effective. Federal legislation enacted in 1978 limited the use of natural gas as a boiler fuel and sparked renewed interest in lignite as an economically viable fuel for power plants. In the late 1970's, Central

Louisiana Electric Company (CLECO) and Southwestern Electric Power Company (SWEPCO) competed with each other for the acquisition of mining rights in the Desoto and Red River parishes. Through lease and purchase methods, CLECO and SWEPCO have acquired the rights to recoverable lignite reserves totaling approximately 150 million tons. Finally the two utility companies agreed in 1978 to combine their efforts and build a 640 MW electric generating plant in Desoto parish and develop nearby lignite resources.

Construction of the power plant began in 1982, and construction activities for the mine began in 1983. In 1985, the Dolet Hills Mine, in De Soto Parish, operated by the Dolet Hills Mining Venture, was contracted to mine and deliver lignite to the power plant. In October 1989, Oxbow Lignite Mine, operated by the Red River Mining Co. in Red River Parish, was opened to provide an additional source of lignite to the power plants. In 1998, Dolet Hills Mine produced 2,342,237 short tons of lignite and the Oxbow Lignite Mine produced 989,204 short tons. Lignite production in Louisiana is approximately 3.5 million tons per year. Figure 2 shows the trend in Louisiana lignite production from 1985-1998.



Figure 3. The Walking Dragline.

photo courtesy of DNR



photo courtesy of DNR

Figure 4. Part of the conveyor belt to the power plant.

## LIGNITE MINING

The lignite is uncovered by surface mining. Surface mining is a method of mining whereby the overlying materials are removed to expose the mineral for extraction. The equipment used during overburden stripping operations are draglines and motorized scrapers. A dragline is an excavating machine that utilizes a bucket operated and suspended by means of lines or cables, one of which hoists or lowers the bucket from a boom.

The Dolet Hills Mining Venture selected a Bucyrus Eric 1570 w dragline with a 320-foot boom (97.28 meters) and a 77-cubic-yard bucket to remove overlying materials. The eight-million-pound dragline used by the Dolet Hills Mining Venture is the largest mining machine of its type in Louisiana (fig. 3).

Once the lignite is exposed, it is removed with a hydraulic backhoe and loaded into a large truck and hauled to a central collection point. From the central collection point, lignite is placed in a 36-inch-wide conveyor belt for a ride of a few miles to the power plant (fig. 4). The conveyor belt delivers 1000 short tons of lignite per hour.

## COAL MINE RECLAMATION

After mining, the land is returned to productive use. Postmining land use consist primarily of managed and unmanaged forest with restoration of some pasture land, fish and wildlife habitat, and water resources.

Reclamation at Louisiana's lignite mines is regulated by Chapter 9 of Title 30 of the Louisiana Revised Statutes of 1950, the Louisiana Surface Mining and Reclamation Act, and Statewide Order 29-01-1, the Louisiana Surface Mining Regulations. These are enforced by the Louisiana Department of Natural Resources (DNR), Office of Conservation. Safety at the mine, however, is enforced by the U.S. Department of Labor, Mine Safety and Health Administration.

Reclamation activities are conducted immediately following each completed mining operation. Once lignite has been removed, the land must be graded to resemble the shape it had before mining took place. After the dirt has been replaced and regraded, the land is planted with native grasses, shrubs, and trees. To date, pine trees have been successfully grown in many of the reclaimed area (fig. 5).



photo courtesy of DNR

Figure 5. Pine trees on the reclaimed areas after mining.

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