THE FEASIBILITY OF MANUFACTURING CHARCOAL AND CHARCOAL BRIQUETTES BY CONVERTING BARKS IN GEORGIA

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INDUSTRIAL DEVELOPMENT DIVISION

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Engineering Experiment Station
GEORGIA INSTITUTE OF TECHNOLOGY
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Summary

Georgia wood-using firms generate bark at a rate of over two million tons in green weight a year. These barks are either burned as boiler fuel or simply burned away as waste in dumps or in tepee burners. Both burnings emit smoke, ash, and off-gases which may be acrid, odorous, and highly unpleasant. Also, these burnings do not conform with the standards of air purity set by state regulating agencies. The current trend toward tightening control on pollution throughout the nation has threatened the profitability of many basic industries, including pulpmills and sawmills. For this reason, the Industrial Development Division has been investigating uses for bark that would have economic potential for Georgia and would help alleviate this pollution problem. Converting barks into charcoal and then charcoal briquettes is a distinct investment possibility.

The current production of charcoal and charcoal briquettes in the United States is estimated at 550,000 tons a year, and the industry has been growing at a rate of 13.8% annually since 1955. Today little charcoal is being used in smelting furnaces for making iron or as "poor man's fuel" in slums; nearly all charcoal currently produced goes to briquetting plants. Charcoal briquettes have become a luxury item used for cooking out. As family income and leisure time are projected to increase in the next decade, outdoor cooking will become even more popular, and charcoal briquette production is expected to continue to grow.

Charcoal-making technology has undergone a gradual change in the last two decades. The traditional method of producing charcoal is in kilns. Raw materials used are largely hardwoods cut from the forests and stacked in the kilns by labor. These kilns are scattered by the thousands in various regions of the United States, and most charcoal is still produced in kilns today. However, limited use has been made of retorts of various designs, which require less time and produce lump charcoal of more consistent quality than do kilns. In recent years, labor has been in short supply in many rural areas and the cost of labor has been soaring. Hundreds of charcoal kilns have gone out of business as a result, and those still existing are operated on a thin profit margin.

In the last seven to eight years, furnaces have been used in charcoal making. They produce charcoal in powdered rather than lump form. The advantages of furnaces are the use of finely divided wood wastes as raw material, continuous

production with large output volume, minimum labor requirements, and no air pollution problem. The production cost of charcoal made by furnaces is substantially lower than that for kilns or retorts. According to trade sources, furnaces will continue to replace kilns and ultimately account for a major portion of the charcoal produced.

There are 11 charcoal plants with carbonizing furnaces in the nation, and they produced about one third of the total charcoal output in 1970. Six of them are in the South, but none are in Alabama, Georgia, and North Carolina. These plants are located where a concentration of wood wastes is available. Thirty-three charcoal briquetting plants are operating in the nation, of which five are in the Southeast. Again, none are in Alabama, Georgia, and North Carolina. All briquetting plants are located near or adjacent to charcoal converting units.

The market for charcoal briquettes is seasonal, with about 80% of the trade conducted between May and September. The distribution of the markets parallels the population density pattern in the nation. Per capita consumption is estimated at 5.5 pounds currently.

There are about 23 companies with 100 or so trade names engaged in the production and marketing of charcoal briquettes in the nation. A survey made for this study indicated that between 48% and 53% of the total production went directly to retail trade. Wholesalers and brokers accounted for between 40% and 46%, commercial trade for between 4% and 5%, and industrial for 2% of the production. It is estimated that about 90% of the charcoal briquettes produced are used for outdoor cooking. Prices of charcoal range from $30 to $40 per ton, depending upon quality and season. Charcoal briquette prices range from $88 to $105 per ton, f.o.b., with $95 per ton as an average.

The charcoal briquette industry relies primarily on rail and truck transportation. Industry sources estimate that approximately half of the nation's production is transported by rail and the remainder by truck. Warehouse storage for the finished product is essential due to the seasonal demand for briquettes. Charcoal briquettes may be shipped up to 1,500 miles, depending upon plant size and marketing policy. Usually buyers pay for freight and handling costs; however, it is common practice for a briquetter to equalize his freight cost with a competitor located closer to a designated market. This freight absorption policy is a means of extending sales to distant markets.

In a six-state area including Alabama, Florida, Georgia, North Carolina, South Carolina, and Tennessee, the demand for charcoal briquettes was estimated at 72,655 tons in 1970, while the production was estimated at 99,000 tons. The South's producers of charcoal briquettes are exporting the excess production to the Midwest and New England regions, where regional consumption is greater than regional production. However, only about a half of the production in the region was based on charcoal in powdered form produced in carbonizing furnaces. The balance was produced either in kilns or retorts with high production costs. There is still room in the six-state area for expanding the production of furnace-produced charcoal based on barks and non-bark wood residues. Analysis of freight rates obtained from railroad and trucking companies shows that any Georgia-based charcoal briquette plant could easily reach a 14-state area in the Southeast as its natural market. The most important factor in establishing a plant is to locate a large enough single source of bark and non-bark wood residues to make the plant economic.

Georgia pulp mills generate about 70% of the two million tons of bark produced in the state each year. Non-bark wood residues produced in the state exceed 3.6 million tons a year, approximately 80% of which are produced by sawmills. With the large volume of barks and non-bark wood residues available in Georgia, establishment of a plant to make briquettes from powdered charcoal produced in furnaces is an opportunity worthy of consideration.

A carbonizing furnace with an hourly output of two tons would use 400 tons of barks or other residues in green weight per day or about 132,000 tons a year. Capital investment would be $825,000 with steam generation. Production costs are estimated at $19.00 per ton of charcoal produced without steam credit or at $6.50 per ton with steam credit. However, the production cost may increase to $35.00 per ton of charcoal produced without steam credit or to $22.50 per ton with steam credit if a charge of $2.00 per ton of green weight is made for barks or non-bark wood residues used.

A two-ton-per-hour charcoal briquette plant would require an initial investment of approximately $600,000 in land, building, and equipment and about $420,000 in operating capital. Production costs, including charcoal at $30.00 per ton, are estimated at $78.50 per ton.

INTRODUCTION

Background

Georgia generates over two million tons of barks in green weight annually. Barks are generally either burned as boiler fuel or simply burned away as waste in dumps or in tepee burners by various wood-using industries in the state. Both burnings emit smoke, ash, and off-gases which do not conform to the air-quality standards set by state and federal regulating agencies. The trend toward tighter control of pollution throughout the nation has put many basic industries, including pulpmills and sawmills, in a precarious position. For this reason, the Industrial Development Division has initiated a program to investigate uses for bark that would have economic potentials for Georgia and would help alleviate this pollution problem.

In a preliminary report entitled "The Potentials of Bark Utilization in Georgia," six potential uses were identified, the first being carbonized bark for briquetting purposes, which is the subject of the present report. All bark products or uses so identified in the preliminary report have two basic characteristics -- established markets and processing methods which can be readily adopted in Georgia.

The market for charcoal briquettes is growing, and the technology for converting barks into charcoal and then charcoal briquettes has been accepted in the trade. Several large charcoal manufacturers in the nation currently are using barks as their primary raw material, and charcoal briquettes made of bark have been sold throughout the United States. The trend in making charcoal has been shifting from kilns and retorts to carbonizing furnaces or, rather, the shift is from roundwoods to barks and non-bark wood residues. This change in charcoal-making technology has offered new opportunities and has provided the basic impetus for conducting this study.

Although this study is aimed at utilizing barks, it can be applied to non-bark wood residues as well, since they also can be used for charcoal making in a carbonizing furnace. Georgia generates over 3.6 million tons of non-bark wood residues annually and a substantial portion of them is being burned as boiler fuel or as waste.

Objectives

The objectives of this study are given below:

1. To provide an overview of the charcoal and charcoal briquette industries in the United States in terms of markets, processing methods, plant distribution, marketing channels, prices and pricing, and transportation.

2. To describe Georgia's potentials as a manufacturing center for charcoal and charcoal briquettes in terms of raw material supplies, the regional market, and freight costs.

3. To provide up-to-date information on investment requirements, production costs, and profit potentials of several commonly sized models of plants for making charcoal and charcoal briquettes.

Information and data for this study were obtained largely first hand, with published literature used as supplementary sources.

PRODUCTION AND DISTRIBUTION OF CHARCOAL AND CHARCOAL BRIQUETTES IN THE UNITED STATES

Production Trends

Historically the market for charcoal and charcoal briquettes in the United States can be divided into three phases based generally upon the uses for the products.[1/] The first phase dates back to early colonial days and continues until the late 1800's. During this period, charcoal was used primarily in the metallurgical field as a fuel to smelt iron ore. As other fuels were developed and used for smelting ore, the demand for charcoal in the metallurgical field decreased. Thus, in the second phase, the principal use for charcoal was as a cheap fuel for heating and cooking. Sales generally were limited to the low-income areas and slum sections of large cities, and charcoal became known as a "poor man's fuel."

The era of suburban living that now exists in the country has brought about the use of the backyard brazier and the introduction of the third phase in demand for charcoal. Charcoal briquettes are used as a luxury fuel for "cooking out," selling for prices that make it almost prohibitive to use as a heating fuel. Briquettes have become the primary outlet for charcoal in recent years. Other uses of charcoal are insignificant in volume today.

Statistics on charcoal briquette production are difficult to obtain. However, some figures on the production of charcoal briquettes in the United States for selected years, based on past publications and recent reliable trade sources, are given in Table 1. Production increased from 79,620 tons in 1955 to approximately 500,000 tons in 1970, representing an annual growth of 13.8% in the last 15 years. According to the Charcoal Briquette Institute, the annual growth varies between 8% and 15%, which is consistent with the above estimate. In recent years, its growth potential has become the most important aspect of the charcoal and charcoal briquette business.

The 1971 production of charcoal briquettes is estimated at approximately 550,000 tons. According to trade sources, imports of charcoal briquettes currently total about 25,000 to 30,000 tons annually, while exports average about

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1/ Ronald Beazley, "Charcoal Marketing in the United States," The Northeastern Logger, February 1958.

Table 1

CHARCOAL BRIQUETTE PRODUCTION
IN THE UNITED STATES, SELECTED YEARS
(in tons)

Year	Production
1955	79,620[1/]
1956	125,000[1/]
1961	235,640[2/]
1963	304,500[3/]
1967	335,000[4/]
1968	375,000[4/]
1969	415,000[4/]
1970	500,000[4/]
1971	550,000[5/]

1/ U. S. Department of Agriculture, Forest Service, Division of Forest Economics Research, Charcoal Production in the United States, July 1957.

2/ U. S. Department of Agriculture, Forest Service, Division of Forest Economics and Marketing Research, Charcoal and Charcoal Briquette Production in the United States, 1961, February 1963.

3/ U. S. Department of Commerce, Bureau of the Census, 1967 Census of Manufactures.

4/ Figures supplied by Aeroglide Corporation, Raleigh, N. C. They represent straight-line projection of reported production by Charcoal Briquette Institute members to cover the entire industry.

5/ Estimated by Aeroglide Corporation, Raleigh, N. C.

10,000 tons a year. Domestic consumption in 1971 (production, plus imports, minus exports), is estimated to be between 565,000 and 570,000 tons. The destination of the exports and the origins of imports are given below:

Exports		Imports	
Canada	2,000 tons	Ecuador	12,000 tons
Others	8,000 tons	Mexico	5,000 tons
		Canada	10,000 tons

Charcoal-making technology has undergone a significant change in the last decade. The traditional method of producing charcoal is in kilns. Raw materials used are largely hardwood roundwoods cut from the forests and stacked in the kilns by labor. These kilns are scattered by the thousands in various regions of the United States. A major portion of the charcoal is still produced this way today, but limited use is made of retorts of various designs. Retorts also use roundwoods, and they produce good quality lump charcoal in larger units and less time than the kiln method.

In recent years, labor has been in short supply in many rural areas throughout the nation and the cost of labor has been soaring. As a result, hundreds of charcoal kilns have gone out of business and those still existing are operated on low profit margins. Adding to the woes of charcoal makers is the problem of air pollution from the acrid, odorous off-gases from charcoal kilns and retorts. They also may be injurious to the health of some people, especially when in sufficient concentration.[1/] An engineering firm conducted a study of Missouri charcoal kilns and devised smoke-abatement equipment to control off-gases. However, they concluded that the equipment does not appear to be economically feasible for a typical Missouri kiln operation at the present time. According to the study, the present $1.43-per-ton profit realized by kiln charcoal producers would be changed into a loss of 91 cents a ton if such equipment had to be installed.[2/] However, according to a trade source, profits for efficient kiln operators may be in the range of $5 to $10 per ton of charcoal produced in Missouri, Arkansas, and Oklahoma.

1/ Sverdrup and Parcel, Air Pollution Control for Missouri Charcoal Kilns, prepared for the Missouri Air Conservation Commission, Jefferson City, Missouri, 1971.

2/ Ibid.

The most recent development in charcoal making is the carbonizing furnace. Several models have been developed and are in use. These furnaces permit the use of wood wastes such as barks, sawdust, slabs, trimmings, etc., as prime material in making loose charcoal for briquetting purposes. The use of wood wastes as raw material means a saving of between $10 and $18 per ton of charcoal made, depending upon location and the charge made for wood waste. Since roundwood is the largest cost outlay in charcoal making, the economic advantage of using wood waste is playing a major role in changing the charcoal-making trend. In addition, a carbonizing furnace requires very little labor and permits continuous production on a much larger scale than do kilns or retorts. Air pollution control devices can be built in if the off-gases generated are not needed for heating purposes. For these reasons, carbonizing furnaces have been replacing kilns in recent years even though the capital requirements for furnaces are much higher than for charcoal kilns. According to a trade source, the growth of the furnace carbonizing process will continue until it replaces a major portion of the kiln-charcoal production.

Market Outlook

Outdoor cooking has become a national pastime since the end of World War II, paralleling the rise in family income and leisure time. Median family income in the United States increased from $3,031 in 1947 to $9,000 in 1969, and it has been projected to reach $15,500 by 1979.[1/] The five-day work week has become standard in the last quarter-century, and the four-day week is just around the corner. Several large companies have already adopted the four-day week. According to some predictions, the change-over to the four-day week may be more rapid than the switch to the five-day week. The continuing growth of outdoor cooking is inevitable.

Charcoal grills have dominated the outdoor cooking market from the beginning. However, gas grills and electric grills have entered the market in the last few years. According to estimates made by the American Gas Association, 120,000 gas grills were sold in 1965 and approximately 200,000 units were sold in 1969. It is assumed that about one million units of gas grills were sold between 1965

1/ Statistical Abstract of the United States, 1970, U. S. Department of Commerce, Bureau of the Census, p. 322, and "The Spectacular '70s," U. S. News and World Report, June 23, 1969.

and 1970. Based upon per capita consumption of 5.5 pounds of charcoal briquettes and a median family size of four persons, one million gas grills would replace 22,000,000 pounds or 11,000 tons of charcoal briquettes a year, which is equivalent to 2% of the national consumption. However, with the growth potential of the charcoal briquette market at 13.8% per year, gas grills have not yet become a serious threat to charcoal. Electric grills used for outdoor cooking are insignificant in number compared with gas grills. No statistics are available on outdoor electric grills.

Recently, two studies of outdoor cooking were made, the findings of which would be of interest to any potential investor in charcoal, charcoal briquette, or grill manufacturing. The first study was a barbecue grill survey conducted by National Family Opinion, Inc. during September-October 1969. Some of the tabulations are given in Appendix 1.

According to the above survey,[1/] charcoal grills heavily dominate the outdoor cooking market and will continue to do so in the future. Some 64% of the respondents used less than 10 pounds of charcoal per month, and another 25% consumed 10 to 20 pounds.

A second study, conducted by a group of researchers at the University of Arkansas, dealt with consumer preferences regarding the sensory characteristics of foods cooked by different heat sources. Wood-based charcoal was given the highest rating, surpassing lignite (brown coal) charcoal, the gas grill, and oven roasting.[2/] The trends and preferences in outdoor cooking revealed by these two studies indicate that, although competing fuels are not a serious threat to charcoal for outdoor cooking at the present, charcoal and charcoal briquette producers and their associations must plan and promote their products to assure their dominant share of the market in coming decades.

Plant Distribution and Capacities

In 1961 there were 1,977 converting units in charcoal plants in the United States. Among them were 1,497 kilns of various types and 480 "other units,"

1/ Barbecue Grill Survey, National Family Opinion, Inc., New York, New York, 1969.

2/ P. K. Lewis, Jr., T. L. Goodwin, and K. L. Moss, Effect of Charcoal Broiling on the Sensory Characteristics of Hamburger and Chicken Breasts, University of Arkansas, Fayetteville, Arkansas.

which include retorts, ovens, and a wide variety of improved chambers for charcoal production. Ninety-four percent of all converting units were in the East. The Central Region, with 595 units, led all others, followed by the Southeast (Atlantic coastal states) region with 444 units and the Southern (Gulf and interior states) with 429 units. Missouri and Tennessee were the top states in charcoal production.[1/]

In the same year, there were 50 charcoal briquette plants in the nation, which produced about 235,640 tons or 61% of charcoal produced in the United States. These briquetting plants were distributed as follows: Southern Region, 20; Northeast, 5; Southeast, 8; Lake, 4; Central, 7; and West, 6.[1/]

No data are available on the number of charcoal converting units currently in operation, but the number is believed to have been reduced substantially since 1961. There are 11 charcoal plants with carbonizing furnaces in the United States and two in Canada. Nearly all of them are using such waste materials as barks, wood residues, peach pits, olive pits, and pecan shells. One unit, now in the planning stage, would use peanut shells. The 11 furnace-type carbonizers have a production capacity of one to three tons per hour and generally are operated 24 hours a day and 50 weeks a year. They produce about one third of the total output of charcoal in the nation, or about 140,000 to 180,000 tons per year. The approximate locations of these 11 carbonizing furnaces are given in Map 1, and company names and addresses are supplied in Appendix 2. As indicated on the map, two carbonizers are old facilities and the rest are modern plants.

Of the 11 furnace carbonizers, six units are located in the South, four on the West Coast, and one in West Virginia. These plants are located where a concentration of wood residues is available. Since the South supplies almost half of the roundwood needs of the nation on a sustained basis, the region naturally has the largest volume of wood wastes. The trend in making charcoal will continue to shift from kilns to furnaces and from roundwood to wood residues, and the expansion of the charcoal industry in the South is expected to continue.

According to trade sources, 23 companies operate 33 briquetting plants in the United States, marketing their output under about 100 trade names. In addition,

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1/ Charcoal and Charcoal Briquette Production in the United States, 1961, U. S. Forest Service, Division of Forest Economics and Marketing Research, February 1963.

MAP 1
GEOGRAPHICAL DISTRIBUTION OF CARBONIZING FURNACES
IN THE UNITED STATES, 1971

there are two plants in Canada, and one each in Mexico and Ecuador. The U. S. plants produced about 500,000 tons of charcoal briquettes in 1970, and they absorbed nearly all of the charcoal produced in the nation in that year. The 33 plants in the United States, together with the four foreign plants, had a combined capacity of 111 tons per hour and produced approximately 550,000 to 600,000 tons in 1970. Some 666,500 tons are expected in 1971, of which about 75,000 tons were not available in 1970, which indicates that briquetting capacity is still expanding.

Charcoal briquette plants generally are located near or adjacent to charcoal converting units in order to reduce charcoal transportation costs. The geographical distribution and production capacities of the 33 U. S. plants are shown on Map 2. Twenty-one of these facilities produce in the range of one to three tons per hour, 10 have an output of four to six tons, and only two have capacities of seven or more tons per hour. Company names, addresses, and plant locations are given in Appendix 3.

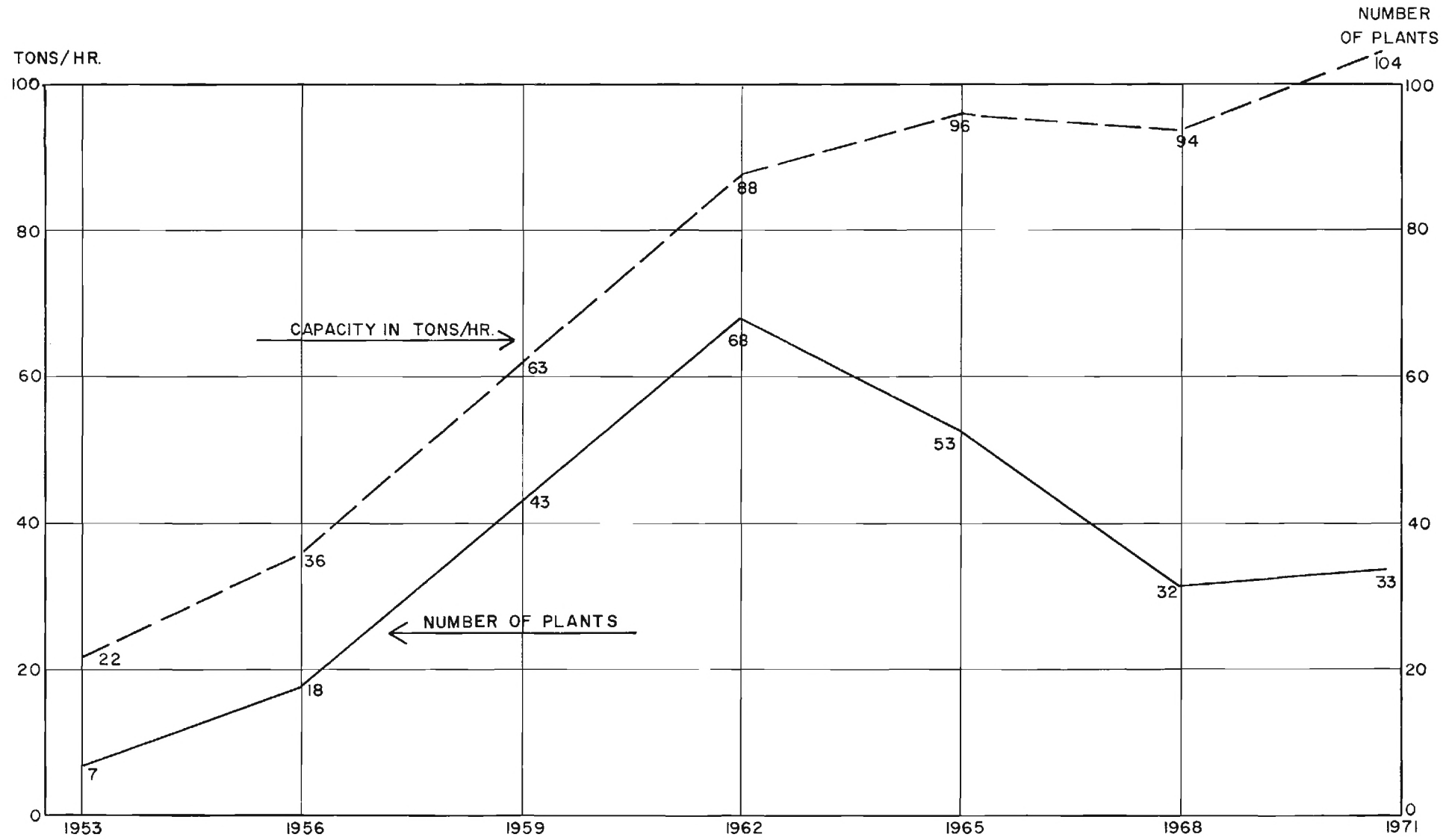
Most of these charcoal briquetting plants are operated 24 hours a day and about 50 weeks a year, except for a few extra-large plants which have not yet been utilized to their full capacities. It is estimated that over 90% of the total capacity is being used currently. This level of operation indicates the growing market demand for charcoal briquettes on the one hand and the necessity for high capital appreciation on the other hand.

The trends in the number of charcoal briquette plants and their total capacities in the United States since 1953 are illustrated in Figure 1. The number increased from seven plants with a total capacity of 22 tons per hour in 1953 to 33 plants in 1971 with a total output of 104 tons per hour. Total capacity climbed rather steadily over the 18-year period, although the number of plants currently is about one half the peak of 68 in 1962.

The average plant size decreased from three tons per hour in 1953 to 1.3 tons per hour in 1962 and then increased again to 3.2 tons per hour in 1971, as shown below:

MAP 2
GEOGRAPHICAL DISTRIBUTION OF CHARCOAL BRIQUETTING PLANTS IN THE UNITED STATES, 1971

FIGURE 1
CHARCOAL BRIQUETTE PRODUCTION CAPACITY IN THE UNITED STATES, 1953 – 1971



SOURCE: AEROGLIDE CORPORATION, RALEIGH, NORTH CAROLINA

Year	Tons Per Hour
1953	3
1956	2
1959	1.5
1962	1.3
1965	1.8
1968	2.9
1971	3.2

As part of this study, a survey was made of the nation's charcoal briquette producers to obtain current information on the industry. Seven manufacturers responded. They operate 10 of the 33 plants in the United States, and will account for between 174,000 to 214,000 tons of the 1971 estimated production of 550,000 tons. All producers surveyed produced part of the charcoal required for their briquetting operations. Three indicated additional outside purchasing of charcoal to supplement their own production. At least one plant relies upon char from pulpmill boilers as the main source of briquetting material. Boiler char or fly ash is a leftover material from fuels such as barks and wood wastes used in boilers. The char has low heat value and must be mixed with coal, lignite, or charcoal when it is used in briquettes. Briquetting plants located close to pulpmills, according to trade sources, commonly use boiler char. However, the mix differs from plant to plant.

Markets and Marketing Channels

Charcoal during the 1800's was used for many things other than making iron. Some of the uses seem strange today. People cleaned their teeth with it. It was used as a purifying agent for water, making gunpowder, printing ink, black paint, and even as highway material. In the cities the charcoal vendor sold from his cart at 40 cents a barrel (the price at about 1865).

In 1961, 51% of the charcoal produced was sold to briquetting plants, 28% to jobbers, 18% to industrial users, and 3% to others.[1/] According to trade sources, most of the charcoal produced today goes to briquetting plants.

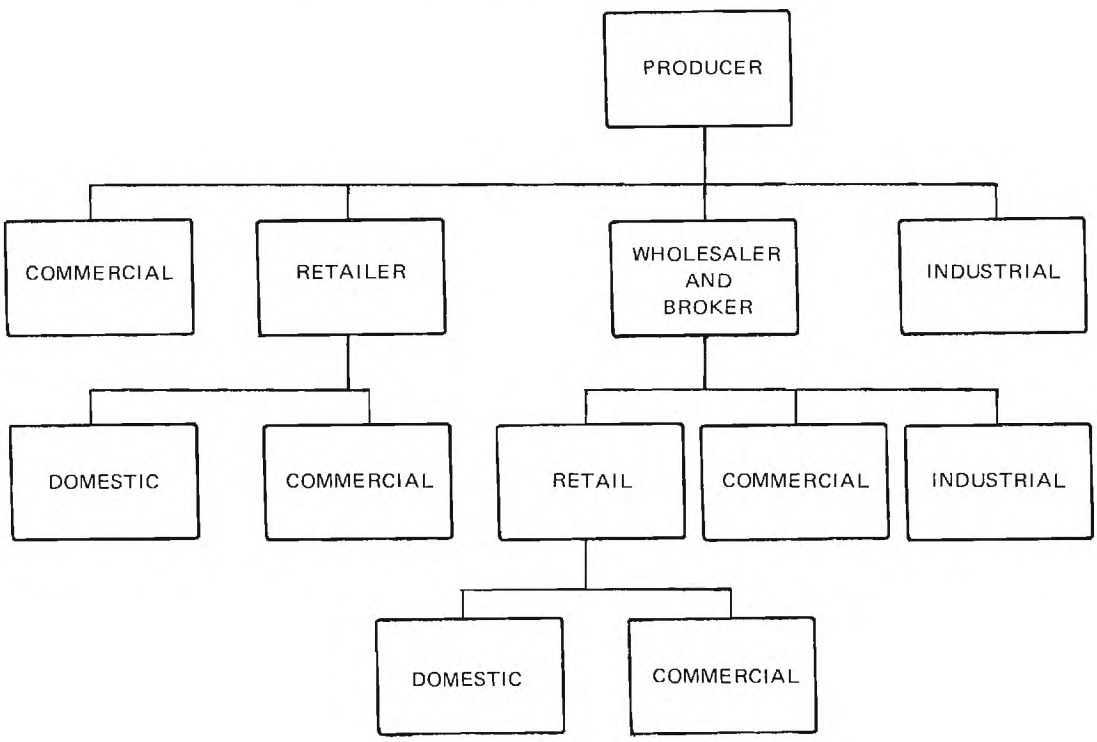
1/ Charcoal and Charcoal Briquette Production in the United States, 1961, U. S. Forest Service, Division of Forest Economics and Marketing Research, February 1963, p. 5.

Industrial and other uses still consume some, but the volume is small. Since briquetting plants use the bulk of the charcoal produced and the majority of them purchase charcoal only as a supplement to their own charcoal production, the trade in charcoal is not so widespread as it used to be. Independent charcoal producers sell directly to briquetting plants.

The market for charcoal briquettes is seasonal, with the period from May to September accounting for about 80% of a year's consumption. The distribution of the markets generally parallels the population density pattern in the nation, although there are some variations in per capita consumption among regions. Current per capita consumption of charcoal briquettes in the United States is estimated at 5.5 pounds. The northern region and the Great Lakes states are the heavy consuming areas, followed by the southern region and the West Coast.

Charcoal briquette producers use a number of channels for distribution of their product to the market. Figure 2 shows the distribution channels used by the surveyed manufacturers. The number of channels used by any one producer varied, with the smaller producers using only one channel and the larger manufacturers employing all four or a combination of the four.

FIGURE 2
DISTRIBUTION CHANNELS FOR CHARCOAL



Between 48% and 53% of the total production of the surveyed manufacturers went directly to the retail trade. The wholesaler and broker accounted for between 40% and 46%, while the commercial trade accounted for between 4% and 5% and the industrial sector for 2% of production.

Six wholesalers located in different parts of the United States were interviewed. They indicated that between 20% and 40% of their sales were to commercial customers. Purchases by retailers accounted for about 60% to 80% of wholesale charcoal briquette sales. Industrial sales by most wholesalers were very small or nonexistent.

Eventually, the majority of the nation's charcoal briquette output is sold at the retail level. The commercial trade is the next largest outlet. If the small industrial sales of wholesalers are ignored, then the retail and commercial trade account for about 98% of U. S. consumption.

Although no data are available on the final end uses of charcoal briquettes, estimates made by trade sources indicate that outdoor cooking accounts for 90% of the national consumption. Principal retail outlets for charcoal briquettes are supermarkets, with an estimated 75% of the retail trade; convenience shops, 20%; and hardware stores and filling stations, 5%.

Prices and Pricing

Since charcoal briquettes are the end product of charcoal making, trade and pricing activities are focused on this product rather than charcoal. The charcoal trade is generally limited between independent charcoal producers and briquetting plants. The price of charcoal ranges from $30 to $40 a ton, depending upon quality and season.

Although the price policies of charcoal briquette producers differ to some extent, in general, f.o.b. factory pricing is practiced. Industry sources estimate that the prices of charcoal briquettes range from $88 to $105 per ton, f.o.b., with $95 per ton the average. However, the market quotations for charcoal briquettes from the manufacturers shown in Table 2 are somewhat higher.

Charcoal briquette pricing varies according to the season, the quantity shipped, the quality of products, and marketing policy. Prime prices generally prevail in the peak season between May and September. Carload or truckload shipments receive volume discounts. High-grade charcoal briquettes command

Table 2

PRICES FOR CHARCOAL, HARDWOOD, RETORT, BRIQUETTES, FEBRUARY 1971
(in dollars per ton)

Size	Description	Price
5 lb.	Paper bags, carload, works	$122.00
10 lb.	Paper bags, same basis	110.00
20 lb.	Paper bags, carload, f.o.b. plant	108.00
40 lb.	Paper bags, same basis	104.00

Source: Oil, Paint and Drug Reporter, Schnell Publishing Company, New York, New York, February 15, 1971, p. 32.

better prices than low grades which may be extended by lime, coal, lignite, and boiler char or fly ash. Briquette producers may reduce prices in order to keep the commodity moving and to make room in their warehouses for new production.

Profit margins in the charcoal briquette industry range from $10 to $30 per ton, with $20 to $25 per ton not an uncommon occurrence. The variance in profit margins among producers can be attributed to a number of factors, such as size of the producer, management skill, and raw material used.

Among the six charcoal briquette wholesalers surveyed, two grades of charcoal briquettes were sold by four companies. The high-grade briquettes generally were made from hardwood, but the basis of the low-grade briquettes varied. Lignite, coal coke, and a hardwood blend were materials used for the briquettes which the wholesalers classified as low-grade.

The price structures of the high- and low-grade charcoal briquettes are shown in Table 3. The high-grade briquette prices were fairly uniform across the nation. The low-grade briquette prices showed a larger variance in prices, which probably reflected the difference in raw materials and, hence, raw material costs. As pointed out previously, low-grade charcoal briquettes may be made of boiler char mixed with coal and lignite, and their prices can be much lower than those of high-grade charcoal briquettes.

Information on profit margins for wholesalers was available from only two wholesalers. For high-grade charcoal briquettes purchased by the carload, the profit varied between 7% and 19% of wholesale prices. The variance in profit

Table 3

CHARCOAL BRIQUETTE WHOLESALE PRICES FOR SELECTED CITIES, FEBRUARY 1971

	5 lb.		10 lb.		20 lb.		40 lb.	
	High Quality	Low Quality	High Quality	Low Quality	High Quality	Low Quality	High Quality	Low Quality
Atlanta	$0.39	$0.38	$0.72	$0.69	$1.39	$1.29	-	-
Chicago	0.43[1/]	-	0.78	0.73	1.47	1.34	$2.86	-
Houston	0.396[2/]	-	0.74	-	1.42	-	2.75	-
Los Angeles	0.40[3/]	0.373[4/]	0.73	0.59	1.42	1.14	2.62	$2.24
San Francisco	0.40[5/]	-	0.735	0.59	1.43	1.14	2.79	-
Washington, D. C.	0.42	-	0.76	-	1.46	-	-	-

1/ 5 5-lb. bags - $2.15

2/ 6 5-lb. bags - $2.38

3/ 6 5-lb. bags - $2.40

4/ 6 5-lb. bags - $2.24

5/ 6 5-lb. bags - $2.40

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margins can be attributed to the different sizes and the separate price structures for different type of customers. For low-grade charcoal briquettes purchased by the carload, the profit ranged between 10% and 30% of the wholesale price.

Prices at the retail level were obtained from supermarket chains located in five of the nation's cities. Supermarkets are important retail outlets and are estimated to account for 75% of the retail volume of briquettes. All of the supermarket chains surveyed purchased their briquettes directly from the factory. The retail prices in supermarkets are shown in Table 4 for both low- and high-grade briquettes. Two of the outlets carried their own private brands. The 10- and 20-pound package sizes were the most popular, with three supermarket chains selling a greater number of the 10-pound package size and the remainder the 20-pound package. None of the chains sold the 40-pound bag of charcoal briquettes.

The demand for charcoal briquettes is seasonal, with the season varying according to location. In general, the retailers estimated that they sold between 70% and 80% during the period from April to October.

Table 4

SUPERMARKET CHAIN STORE CHARCOAL BRIQUETTE PRICES
FOR SELECTED CITIES, FEBRUARY 1971

	5 lb.		10 lb.		20 lb.	
	High Quality	Low Quality	High Quality	Low Quality	High Quality	Low Quality
Atlanta	-	-	-	$.65	-	$.99
Chicago	-	-	$.79	-	$1.39[1/]	-
Houston	$.43	-	.79[1/]	-	1.59 1.29[1/]	-
Los Angeles	.59	-	.99 .79-.89[2/]	-	1.79 1.59-1.69[2/]	-
Washington, D. C.	.39	-	.69	-	1.35	-

1/ Private label.

2/ Price range is for stores located in northern California, and the variance in price can be attributed to difference in transportation costs.

Information on profit margins was available from one of the supermarket chains. The profit margin, which varied according to purchase quantity and package size, ranged between 8% and 25% of the retail price. As a rule of thumb, a typical pricing situation can be outlined as follows:

$100.00	price per ton f.o.b.
- 5.00	5% brokerage fee
$ 95.00	net price paid to producer
+ 7.50	freight and handling expenses
$102.50	cost to chain stores

The cost of $102.50 per ton is equivalent to $0.51 per 10-pound bag. Retail prices for a 10-pound bag range from $0.69 to $0.89, or $138 to $178 per ton.

Transportation

Most briquetting plants are located either near or adjacent to charcoal converting units, making transportation costs minimal. The farther the distance that charcoal must be shipped to a briquetting plant, the higher the production cost per unit of charcoal briquettes will become. It is common

knowledge in the trade that charcoal shipments should be in the form of briquettes rather than as lump or loose charcoal and that charcoal shipments should be kept to a minimum.

The physical distribution of charcoal briquettes involves both transportation and warehousing. Warehouse storage for the finished product is essential because of the seasonal demand for briquettes. Inventory is especially high in spring. Briquette plants operate the entire year, but 80% of briquette sales occur during the period from May to September. Industry sources estimate that a plant should have warehouse space equal to 25% to 30% of its annual production. The majority of the manufacturers have their warehouses located at the charcoal briquetting plants.

The charcoal briquette industry relies primarily on rail and truck transportation. Industry sources estimate that approximately half of the nation's production is transported by rail and the remainder by truck. The survey of charcoal briquette producers revealed that approximately 57% of their production was transported to the customer by truck. Rail accounted for an estimated 42% of production, and the remainder was shipped by other modes of transportation. "Piggyback" service was used by some of the manufacturers.

Charcoal briquettes may be shipped up to 1,500 miles, depending upon plant size and company policy. In most situations, buyers pay for freight and handling costs. However, it is common practice for briquette producers to equalize their freight bills with competitors located closer to a designated market. This freight absorption policy is a means of extending sales to distant markets.

GEORGIA AS A CENTER FOR CHARCOAL AND CHARCOAL BRIQUETTE PRODUCTION

Raw Materials and Potential Plant Locations

Since the main purpose of this study is to promote the use of barks or any kind of wood residues in the manufacture of charcoal and charcoal briquettes in Georgia, an examination of the volume of wood residues generated by various wood-using concerns in the state is appropriate. Wood residues can be classified into two main categories -- barks and non-bark residues (slabs, edgings, trimmings, veneer cords, veneer drips, cull pieces, shavings, sawdust, and sanderdust). About 70% of the barks generated in Georgia come from pulp and paper-related mills, and approximately 80% of the non-bark residues are generated by sawmills. The total volume of barks produced in the state exceeds two million tons in green weight annually, while the non-bark residues exceed 3.6 million tons a year. These estimates were made by the Industrial Development Division based on data supplied by the Georgia Forestry Commission.

A breakdown of the estimated production of barks in Georgia in 1967 by primary wood-using industries and by forest survey districts (see Map 3) is given in Table 5. Estimates were made on the basis of tonnage of pulp produced in that year, ratio of roundwood and chips used, and average amount of bark generated per cord of pulpwood. Since pulpmills contribute such a large proportion of the barks generated in Georgia, the locations of these pulpmills and estimated bark volumes generated annually in each location are of interest. Table 6 gives such locations and volume estimates for 1967.

Pulpmills and other wood-using plants generally use barks as the main source of boiler fuel in their operations, but some pulpmills have switched to gas or other heat sources for better efficiency in recent years. Sawmills, which generally do not require a boiler, burn away barks as waste in dumps or in tepee burners. These bark burnings, either as boiler fuel or as waste, emit smoke and ash and do not conform with the standards set for air quality in Georgia. The tightening enforcement of air quality regulations in the state may force pulpmills and other wood-using concerns to change their methods of bark disposition. Making charcoal and charcoal briquettes is one of several alternatives proposed.

The estimated production of non-bark wood residues in Georgia in 1967 by primary and secondary wood-using industries and by forest survey districts is

MAP 3
FOREST SURVEY UNITS OF GEORGIA

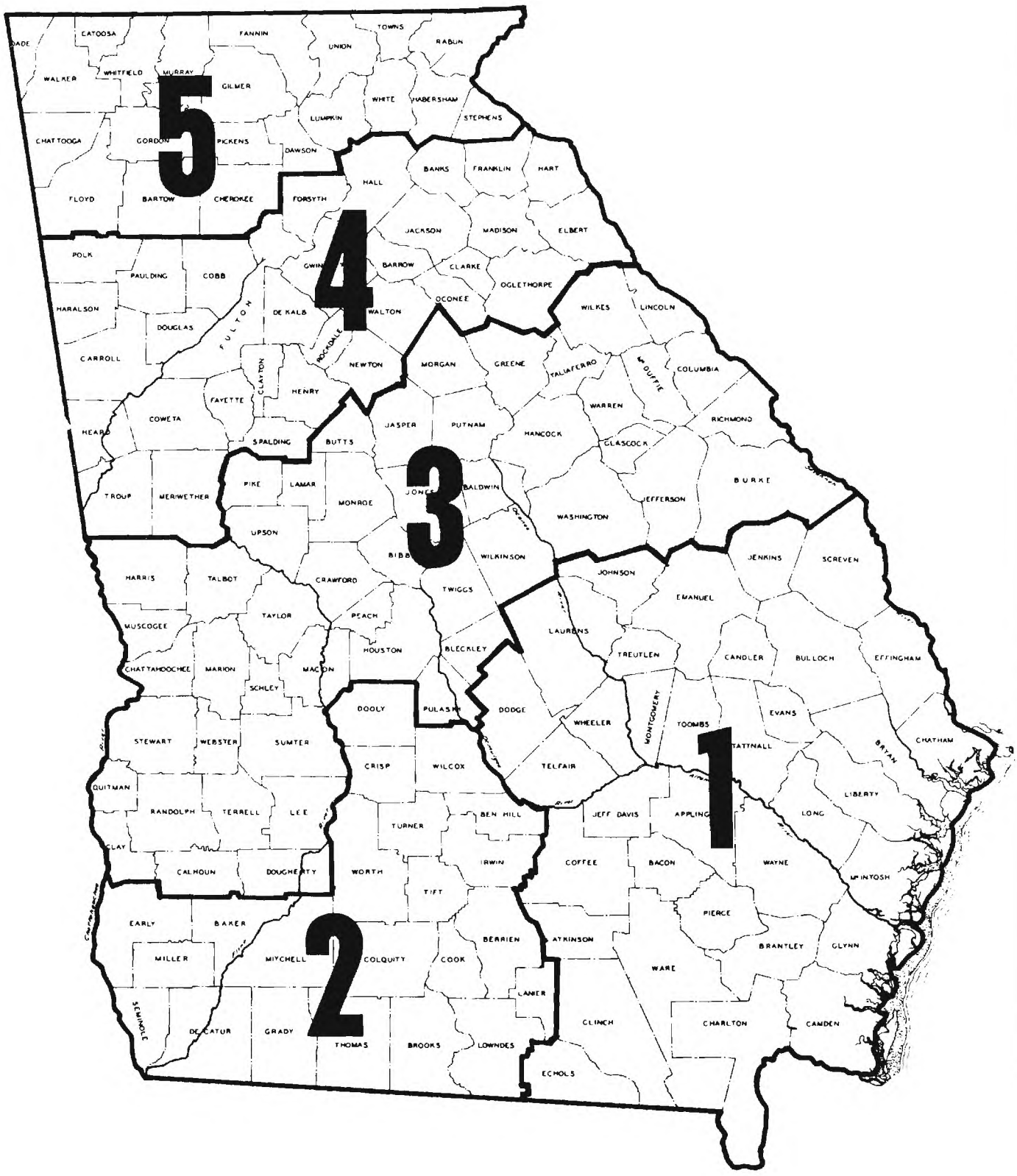


Table 5

ESTIMATED PRODUCTION OF BARKS BY PRIMARY WOOD-USING INDUSTRIES AND BY FOREST SURVEY UNIT IN GEORGIA, 1967
(in thousands of tons)1/

Forest Survey Unit	Pulpmills	Sawmills	Veneer & Plywood Plants	Treating Plants	Total
I	765	91	31	22	909
II	276	97	18	20	411
III	255	183	33	10	481
IV	-	62	8 2/	10 2/	71
V	165	69	—	—	243
Total	1,461	502	90	62	2,115

1/ All tonnage is in green weight, which contains 50% to 60% moisture.

2/ In the "Total" column, this figure is artificially split 50/50 between the two forest survey units in order to reach separate totals.

Table 6

ESTIMATED BARK VOLUME GENERATED BY GEORGIA PULPMILLS IN DIFFERENT LOCATIONS, 1967
(in thousands of tons)

Location	Volume	Location	Volume
Augusta	118	Riceboro	44
Brunswick	129	Rome	165
Cedar Springs	187	Savannah	342
Jesup	74	St. Marys	110
Macon	137	Valdosta	89
Port Wentworth	66	Total	1,461

given in Table 7. Estimates were made on the basis of finished output by each given industry, estimated roundwood or lumber required, and ratios of wood residues generated. Of the 3.6 million tons of non-bark wood residues generated in 1967, sawmills accounted for 80%, veneer and plywood plants for 14%, and the remaining 6% was generated by plants manufacturing furniture, cabinets, millwork, fixtures, boxes, pallets, and containers and by wood treating operations. Wood residues generated by plants making plywood, furniture, cabinets, millwork, fixtures, boxes, pallets, and containers are generally dry, with a moisture content of about 15%, while those generated by sawmills and wood treatment plants are in a green condition, with 50% to 60% moisture content.

Disposition of wood residues by various woodworking concerns is a complex problem. With the exception of veneer and plywood plants and wood treating plants, other woodworking operations do not require boilers which would use wood waste as fuel. Most non-bark wood residues generated in the state are either sold or burned as waste. Since sawmills account for about 80% of the non-bark residues generated in Georgia, their methods of disposal of wood wastes are of interest. The disposal pattern revealed by a survey conducted by the Georgia Forestry Commission is given in Table 8. As indicated in the table, bark and sawdust were the two least utilized items. Most of the slabs and edgings were sold for wood chip purposes, and planer shavings were sold for use as poultry litter and for making wood particleboard.

The volume of bark and/or non-bark wood residues required to supply a charcoal-making facility is in the neighborhood of 400 tons in green weight a day and about 132,000 tons a year. This supply should be concentrated in one place to avoid expensive hauling of residues. There are not many individual plants in the state which could generate 400 tons of wood residues a day; however, pooling of wood residues in a given location is a distinct possibility. Many of these locations are not only the centers of pulp and paper-related activities, but also the focal points of various wood-related manufacturing operations. Wood-using industries are so diverse and so scattered in the state, it is difficult to provide a list of choice locations for making charcoal and charcoal briquettes.

Regional Market

As pointed out previously, charcoal briquettes may be shipped up to 1,500 miles to market. The whole eastern United States would be the marketing area

Table 7

ESTIMATED PRODUCTION OF NON-BARK WOOD RESIDUES
BY PRIMARY AND SECONDARY WOOD-USING INDUSTRIES IN GEORGIA, 1967
(in thousands of tons)

Forest Survey Unit	Sawmills	Veneer & Plywood	Furniture	Cabinets, Millwork & Fixtures	Wood Treatment	Boxes, Pallets & Containers	Total[1]
I	560	162	13[2]	4	24	2	758
II	614	103		3	19	3	746
III	1,041	184	21	8	13	8	1,276
IV	353	47[2]	27	20	14[2]	1	431
V	382	—	30	4	—	3	447
Total[1]	2,950	496	91	37	70	14	3,658

1/ Total may not add up due to rounding.

2/ In the "Total" column, this figure is artificially split 50/50 between the two forest survey units in order to reach separate totals.

3/ Less than 500 tons.

Table 8

GEORGIA SAWMILL RESIDUE DISPOSAL, 1967
(in percentage)

Kind	Sold	Burned as Fuel	Burned as Waste and Given Away	Total
Barks	1.22	6.25	92.53	100.00
Sawdust	23.09	7.92	68.99	100.00
Slabs and Edgings	86.76	-	13.24	100.00
Planer Shavings	64.06	12.59	23.35	100.00

Source: Georgia Forestry Commission, Wood-Using Industries in Georgia, 1968, p. 9.

for a Georgia-based charcoal briquetting plant. After examining the distribution of existing charcoal briquetting plants, one may feel, however, that the Southeast may be the natural market for a briquetting plant located in Georgia. In addition, because of the bulky nature of charcoal briquettes and the relatively low product value, it is logical to assume that the six-state area in the Southeast which includes Georgia and the surrounding states of Alabama, Florida, North Carolina, South Carolina, and Tennessee should be considered as the main base for marketing.

The demand for charcoal briquettes in the six-state area is estimated at 72,655 tons for 1970, or about 14.5% of the national production. This figure is based on a total population of 26,419,922, as reported in the 1970 Census of Population, and an estimated per capita consumption of 5.5 pounds. The 1970 population breakdown by states is as follows:

Alabama	3,444,165
Florida	6,789,443
Georgia	4,589,575
North Carolina	5,082,059
South Carolina	2,590,516
Tennessee	3,924,164
Total	26,419,922

There are five charcoal briquetting plants in the six-state area, two each in Florida and Tennessee and one in South Carolina. (See Map 2.) Those five plants produced about 99,000 tons of charcoal briquettes in 1970, an amount which exceeded the regional demand by 36%. Their excess production is exported to the Midwest and New England regions, where regional consumption is greater than regional production. However, an analysis of the structure of the industry and local conditions reveals that there may still be room for expansion of the charcoal industry in the six-state area if certain approaches are taken.

Of the five briquetting plants in the area, three produce charcoal in furnaces as part of integrated operations. However, they also must purchase lump charcoal from independent producers to supplement their own charcoal. The fourth plant depends on its own retort-produced charcoal as well as purchased kiln charcoal. The fifth plant in the area uses purchased boiler char as its main source of raw material. Boiler char costs less than lump charcoal produced either by kiln or by retort, but it may be higher than furnace-produced loose charcoal when the gas generated in the furnace process is used as a source of heat. Loose charcoal produced in a carbonizing furnace can be the lowest-cost material if it is part of an integrated operation and if the gas generated can be utilized. Of the 99,000 tons produced in the area, about one half was furnace-produced charcoal based on wood residues. There is still room for expanding this kind of charcoal production if a sufficient concentration of wood residues can be found.

Potential Market Penetration and Freight Advantage Area

The potential degree of market penetration is difficult to ascertain without knowledge of product quality, pricing, production cost, and many other factors. However, based on the estimated market for charcoal briquettes in the six states in 1970 and the distribution of the five existing briquetting plants in the area, a theoretical rate of penetration was derived. (See Table 9.) A Georgia-based plant may be expected to sell over 20,000 tons of charcoal briquettes in the six-state area, based on a 28% market penetration. Since Alabama and Georgia have no briquette plants at the present, they are assumed to absorb the largest share of the total penetration. Although Florida is saturated with two briquetting plants, the market potential there

Table 9

POTENTIAL PENETRATION OF THE CHARCOAL BRIQUETTE MARKET
IN THE SIX-STATE AREA BY A GEORGIA PLANT, 1971
(in tons)

State	Estimated Market	Rate of Penetration	Potential Market
Alabama	9,500	.50	4,750
Florida	18,600	.10	1,860
Georgia	12,600	.50	6,300
North Carolina	14,000	.25	3,500
South Carolina	7,000	.25	1,750
Tennessee	11,000	.20	2,200
Six-State Area	72,700	.28	20,360

should not be overlooked. Certainly shipments would be made to distant markets as well whenever prices and transportation costs were favorable.

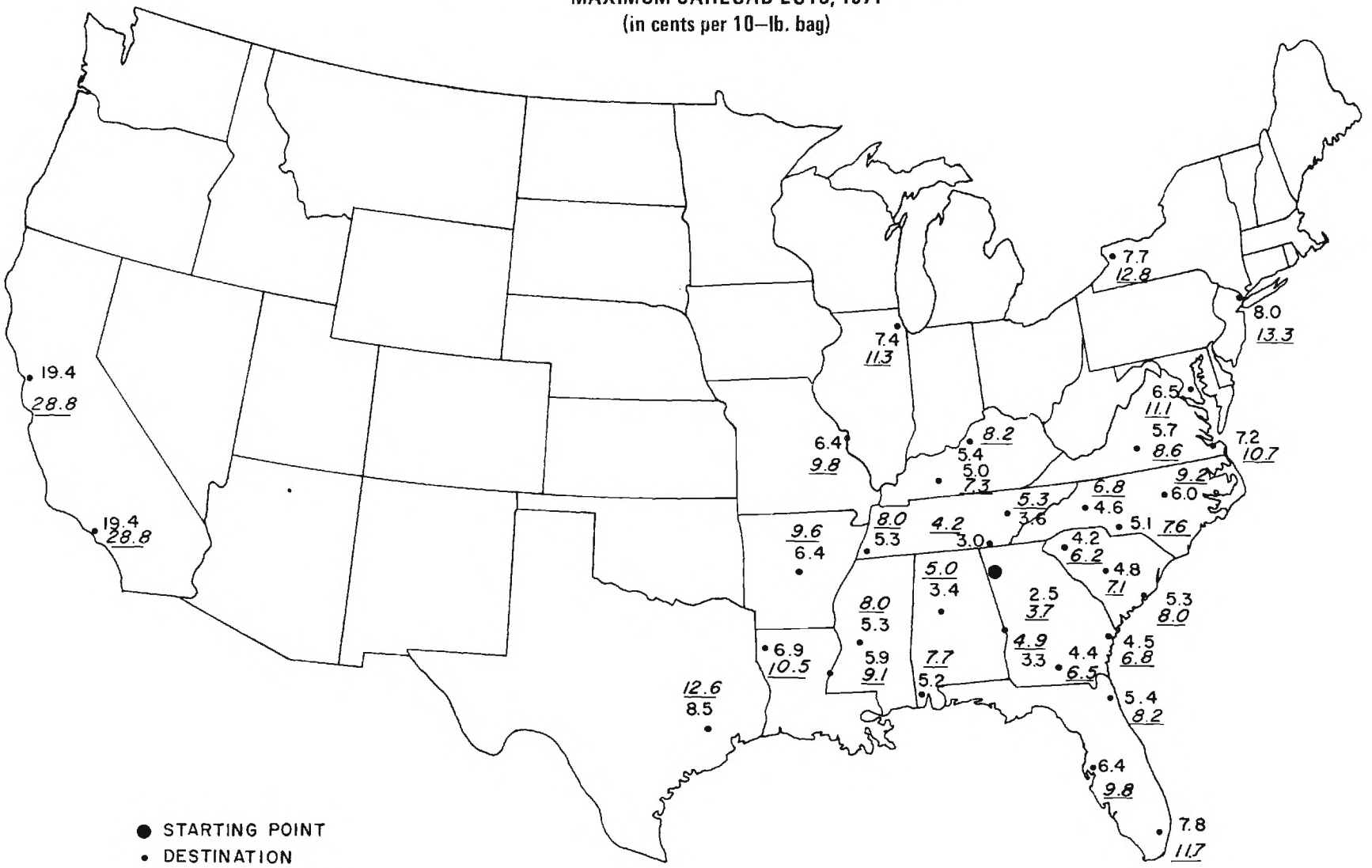
Railroad freight rates for shipping 10-pound bags of charcoal briquettes in carload lots from Rome, Georgia, to various points in the nation are shown on Map 4. These rates are given for both maximum and minimum carloads, with the latter commanding the higher rate. The rates range from 2.5 cents to 10 cents for a 10-pound bag or $5 to $20 per ton of charcoal briquettes shipped. If a producer could afford to pay as much as 10 cents per 10-pound bag in transportation cost, the whole eastern United States would be within reach. How high the rate could be allowed to go would depend upon a given plant's production costs and profit margin. The rates presented in Map 4 were selected from quoted rates in cents per 100 pounds given in Appendices 4 through 6.

Truck freight rates per 10-pound bag of charcoal briquettes from Rome, Georgia, to various southeastern destinations are shown on Map 5. The rates shown are for volume shipments. Although the charcoal industry uses trucks extensively, not all manufacturers use common carriers. Contract trucking is used by a number of producers. The freight rates for contract trucking are not published in tariffs and are determined by negotiations between the shipper and carrier. Quoted truck rates are given in Appendix 7. According to trade sources, contract rates are lower than quoted rates.

MAP 4

RAILROAD FREIGHT RATES FOR CHARCOAL BRIQUETTES SHIPPED FROM ROME, GEORGIA, FOR BOTH MINIMUM AND MAXIMUM CARLOAD LOTS, 1971

(in cents per 10–lb. bag)



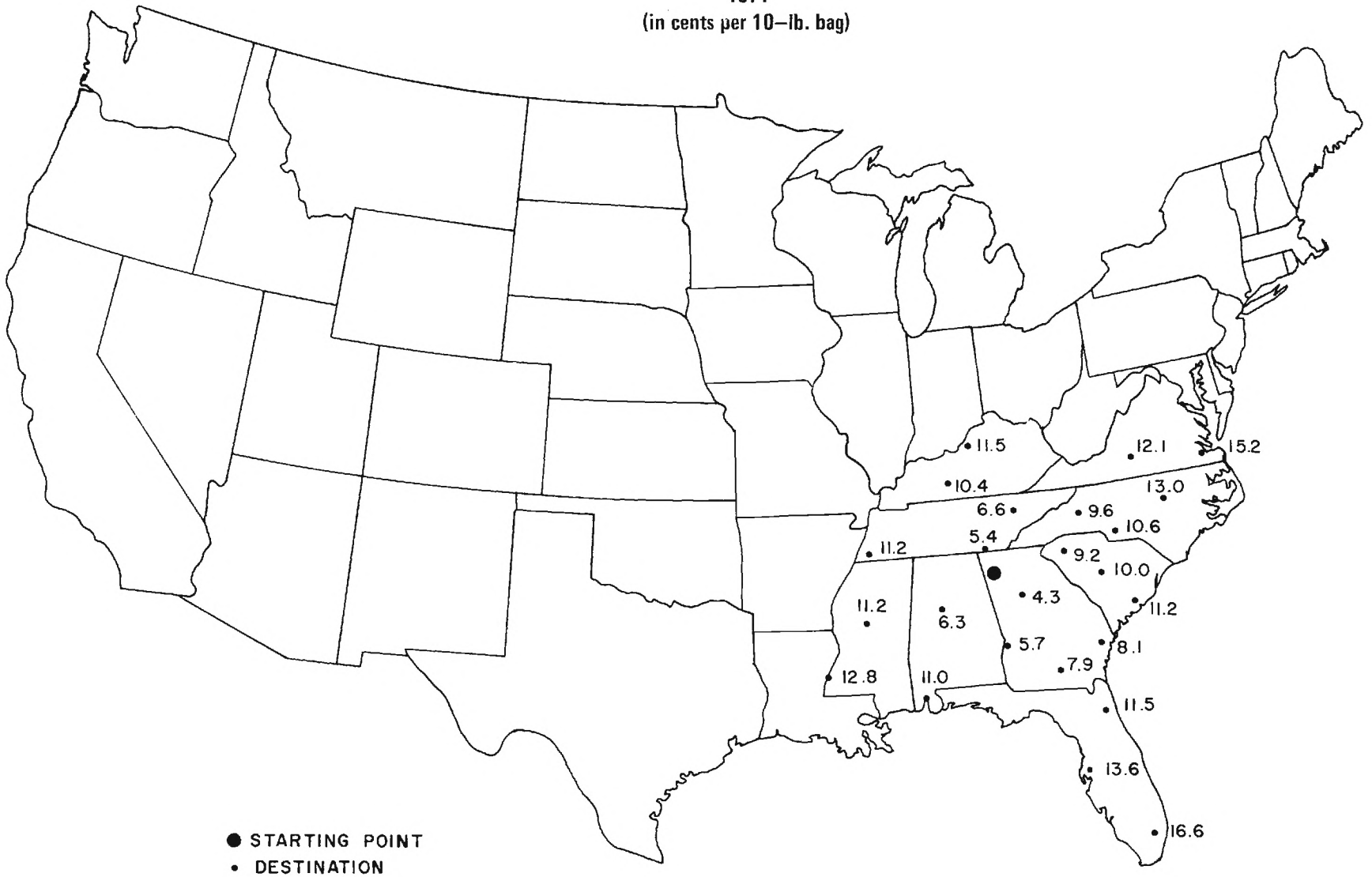
● STARTING POINT

• DESTINATION

MINIMUM CARLOAD

MAXIMUM CARLOAD

MAP 5
TRUCK FREIGHT RATES FOR CHARCOAL BRIQUETTES SHIPPED FROM ROME, GEORGIA, FOR VOLUME SHIPMENTS, 1971
(in cents per 10–lb. bag)



Charcoal

Information on the operating conditions and investment requirements of a carbonizing furnace has been obtained from Nichols Engineering and Research Corporation, which has designed and built nine plants with carbonizing furnaces out of the 13 operating plants mentioned in the previous section. Loose charcoal converted from barks and non-bark wood residues in furnaces is good material for briquetting purposes. The biggest problem is to locate a large enough single source of bark and non-bark wood residues to make a plant economic. It is advised that at least half of the required residues be produced at one site; the remainder should be procured from a distance of no more than five to ten miles from the charcoal plant. Some highlights concerning the furnace, off-gases, investment costs, and potential returns are given below.

Carbonizing Furnace. The Nichols Carbonizer is a multiple-hearth furnace which permits continuous production of charcoal under conditions allowing maximum control. This ability to control is important for briquetting charcoal since any degree of volatiles content can be achieved. The furnaces are available for charcoal production rates from one to four tons per hour. These furnaces are usually scheduled to operate 8,000 hours per year, which means three shifts per day including weekends. Running on three shifts for five days is acceptable, but single-shift operation of this continuous furnace is not practical.

Operation of the furnace is not difficult. The principal operating variables are feed rate and temperature. The feed is adjusted to compensate for varying moisture content, and is controlled by adjusting the raw wood feed conveyors. Temperature is controlled by varying the air admitted to the furnace. Little or no fuel is required, as the wood gases are burned in the furnace to provide all the heat that is necessary.

Quality charcoal can be produced in the carbonizer from any species of bark or raw wood and from any mixture of species.

The most important consideration in planning an installation is to accurately determine the quantity of raw wood waste continuously available. The carbonizer must operate uninterruptedly; therefore, it must have a steady

supply of feed. The smallest economical quantity of waste material that can be considered is about 100 tons per day measured on a dry basis. With feed at a moisture of 40%, this amount would yield one ton of charcoal per hour in the smallest carbonizer. An output of at least two tons per hour is preferred.

The next most important consideration is an accurate measurement of the moisture in the feed, as moisture has a great effect on furnace capacity. As an example, larger carbonizers can produce about two tons per hour from 40% moisture feed, but only 1¼ tons per hour when the moisture is 60%.

Moisture content can vary with the season or can change if different wood sources are used at various times during the year. In planning, therefore, an accurate moisture profile of the feed for an entire year should be established. Poor estimates can lead to the installation of a furnace that is unable to meet production requirements during certain times of the year.

The feed to the furnace should be as nearly uniform in size as possible. This means that all slabs, sticks, etc., must be hogged before feeding to the furnace.

Furnace Off-Gas. Only a portion of the wood gases are burned in the furnace to produce charcoal, with the remainder available for useful work such as generating steam. As a rule of thumb, one ton of charcoal produced will yield about 25,000 pounds of steam.

When there is no use for the off-gases, they can be burned in refractory-lined stacks and discharged to the atmosphere. This emission will meet the standards set by the National Clean Air Act. Where more stringent standards are set, the off-gases can be incinerated and scrubbed before discharge. Where steam is generated, no pollution control equipment is required. This pollution control equipment adds about $100,000 to $150,000 to the cost of a furnace.

Capital Requirements. A one-ton-per-hour plant including steam generating facilities (25,000 pounds per hour) is budget-estimated at $550,000. A two-ton-per-hour-plant with capacity for 50,000 pounds per hour of steam is estimated at $825,000. Included in these estimates are the costs for auxiliary equipment such as wood hogging, storage and conveying, and product cooling and conveying.

Operating Costs. The analysis below for a two-ton-per-hour plant with steam generating facilities shows that charcoal can be produced at a cost of $6.50 per ton. This analysis assumes no cost for the waste wood feed, a situation which exists for large sawmills and pulp plants. If the waste must be trucked in, the cost can be figured on the basis that 16 tons of wood waste at 50% moisture are required to produce two tons of charcoal.

(1) Basis: Two-ton-per-hour plant, 8,000 operating hours per year, capital investment $825,000.

		Cost per Ton
(2) Costs:	Labor (2 men/shift @ $2.75/hr. + 22%)	$ 3.36
	Utilities - 500 hp - 2.0¢/kwh	2.61
	Maintenance - 5%/yr. on investment	2.57
	Depreciation - 10-yr. straight line	5.15
	Supervision	.50
	Insurance and Taxes - 5% of investment	2.57
	Miscellaneous	2.00
		$18.76 (or $19.00/ton gross)

(3) Steam: Assume steam fuel cost at 50¢/1,000 lbs.
50,000 lbs. of steam/2 tons charcoal = $12.50/ton charcoal

$19.00	per ton gross
-12.50	steam credit
$ 6.50	net cost of charcoal per ton

If a charge is made of $1.00 per ton of barks used, the production cost of charcoal would be $27.00 per ton without steam credit or $14.50 per ton with steam credit. If a charge is made of $2.00 per ton of barks used, the production cost of charcoal would be $35.00 per ton without steam credit or $22.50 per ton with steam credit. However, it should be realized that without steam, a two-ton system would cost about $600,000, which would change investment and depreciation.

Potential Returns. Based on a two-ton production per hour, a selling price of $30.00 per ton, f.o.b., a production cost of $19.00 per ton of

charcoal, and with no provision for interest on money borrowed for investment, six possible returns are given below:

(1) Without steam credit and without a charge on barks or other wood residues used.

Profit before taxes	$176,000
Profit after taxes	88,000
Depreciation (10 years)	82,500
Cash flow	170,500
Payout period	5 years

(2) With steam credit and without a charge on barks or other wood residues used.

Profit before taxes	$370,000
Profit after taxes	185,000
Depreciation (10 years)	82,500
Cash flow	267,500
Payout period	3 years

(3) Without steam credit and with a charge of $1.00 per ton on barks or other wood residues in green weight used.

Profit before taxes	$ 48,000
Profit after taxes	24,000
Depreciation (10 years)	82,500
Cash flow	106,500
Payout period	8 years

(4) With steam credit and with a charge of $1.00 per ton on barks or other wood residues in green weight used.

Profit before taxes	$242,000
Profit after taxes	121,000
Depreciation (10 years)	82,500
Cash flow	203,500
Payout period	4 years

(5) Without steam credit and with a charge of $2.00 per ton on barks or other wood residues in green weight used.

Profit before taxes	(-) $ 80,000
Profit after taxes	(-) 80,000
Depreciation (10 years)	82,500
Cash flow	2,500
Payout period	330 years

(6) With steam credit and with a charge of $2.00 per ton on bark or other wood residues in green weight used.

Profit before taxes	$114,000
Profit after taxes	57,000
Depreciation (10 years)	82,500
Cash flow	139,500
Payout period	6 years

It can be seen that the profit potential of operating a charcoal plant depends on many variables, such as steam credit and charge on barks or other wood residues used. Of the six potential returns given above, only one ends with a loss. The costs of the raw material used and the steam requirements in operation should be weighed heavily. Since pulp and paper-related mills generate the largest volume of barks in the state and their operation requires steam, charcoal making is a distinct possibility for them. Although the steam generated in charcoal making would not be sufficient for a pulpmill boiler, gas fuel can be used as a supplement. Also, the conversion of barks and non-bark wood residues into charcoal may be considered as a way of getting rid of wood wastes without worrying about the problem of air pollution. According to a trade source, if a large charcoal producer does not want to go into briquette production himself, the possibility of getting a briquetter to build a briquetting plant adjacent to his charcoal plant is very likely.

Charcoal Briquettes

Current data concerning capital requirements, profit potentials, and personnel requirements for three common-sized briquette plants have been obtained from the Aeroglide Corporation, which is the largest designer and supplier of complete briquette plants in North America. The three plant sizes described are one ton per hour, two tons per hour, and four tons per hour of charcoal briquette output.

Estimated capital requirements are given in Table 10. Investment in land, buildings, and machinery would total $391,256 for a one-ton plant, $598,973 for a two-ton plant, and $1,044,422 for a four-ton plant. For operating capital, a one-ton plant may require $210,000, a two-ton plant $420,000, and a four-ton plant $840,000.

Several comments should be borne in mind when reviewing the estimated capital requirements presented in Table 10:

(1) Plant site costs can vary tremendously. A modest plant site cost is shown because most briquetting plants are located in remote places. In the case of a paper mill, it probably already has enough space to locate such a plant adjacent to its present operation.

(2) Building costs do vary across the country, but the figures shown are applicable for the Southeast or Mid-South.

(3) Electrical wiring in each case is based on $60 per horsepower.

(4) The first item under machinery -- charcoal handling/bins -- is required as a surge between a multiple-hearth furnace and a briquetting plant. Storage in each case will cover three days' production. Multiple bins are included so various ingredients can be blended.

(5) The recommended standard briquette plant includes dust control equipment to meet national clean air standards.

(6) Installation labor was figured at $5 per man-hour.

(7) Installation technician was figured for four, six, and eight weeks, respectively, and the start-up technician for four weeks for each plant.

(8) The operating capital, as well as the briquette storage capacity, was chosen to handle roughly 40% of one year's production.

Large storage space and dust control equipment were not considered years back, but now they are essential to the business. In recent years, improvements have been made in automatic packaging equipment, presses, dryers, and mixers. A new charcoal briquette plant may require six months for construction and another three months as a shakedown period, reaching full production in the second year.

Table 10

ESTIMATED CAPITAL REQUIREMENTS
FOR 1, 2, AND 4-TON CHARCOAL BRIQUETTE PLANTS
IN GEORGIA, 1971

Plant Site	Plant Capacity 1 Ton/Hr.	2 Tons/Hr.	4 Tons/Hr.
Land, RR Spur, Blacktop, etc.	$ 10,000	$ 15,000	$ 20,000
Buildings			
Charcoal Storage @ $2.50/Sq. Ft.	7,200	12,000	18,000
Briquette Mfg. @ $3.50/Sq. Ft.	21,000	30,240	41,160
Briquette Storage @ $2.75/Sq. Ft.	99,000	198,000	396,000
Electrical Wiring	8,550	13,900	24,000
Air, Water & Fuel Plumbing	2,300	3,200	4,500
Office, Bathrooms & Showers	2,000	2,500	4,000
Total Buildings	$140,050	$ 259,840	$ 487,660
Plus 5% Contingencies	7,003	12,992	24,383
Total	$147,053	$ 272,832	$ 512,043
Machinery			
Charcoal Handling/Bins	$ 29,300	$ 49,175	$ 81,685
Standard Briquette Plant	145,000	180,000	275,000
Freight - Average	2,000	3,000	4,500
Installation Labor & Tools	13,500	18,500	26,550
Accessory Equipment	19,250	27,900	40,150
Spare Parts Inventory	2,500	3,500	5,000
Shop Equipment	2,500	3,000	3,500
Installation Technician	4,500	6,750	9,000
Start-up Technician	4,500	4,500	4,500
Total Machinery	$223,050	$ 296,325	$ 449,885
Plus 5% Contingencies	11,153	14,816	22,494
Total	$234,203	$ 311,141	$ 472,379
Summary			
Total Initial Capital	$391,256	$ 598,973	$1,004,422
Total Operating Capital	210,000	420,000	840,000
Total Capital Required	$601,256	$1,018,973	$1,844,422

Source: Aeroglide Corporation, Raleigh, North Carolina.

Estimated production costs and potential returns for one-, two-, and four-ton charcoal briquette plants are given in Table 11. The costs include fixed costs and variable costs. Fixed costs are salaries, maintenance, depreciation, insurance and taxes, and interest. Variable costs include charcoal, grain starch, bags and containers, utilities, labor, brokerage, travel and promotion, association fees, and management incentives. The production is based on 300 days a year. Annual production is given at 7,200 tons for one-ton plants, 14,400 tons for two-ton plants, and 28,800 tons for four-ton plants. Total production costs on a per-ton basis are estimated at $89.50 for one-ton plants, $78.50 for two-ton plants, and $71.50 for four-ton plants.

Profit potentials depend on the sales prices of charcoal briquettes and the scale of production. Prices given range from $90 per ton to $105 per ton, f.o.b. For a two-ton plant, profit before taxes ranges from $165,000 to $381,600 a year.

Some comments on estimated production costs and profit potentials are given below:

(1) Salaries are estimated, but they are reasonable.

(2) Accounting procedures do vary, but the given depreciation schedule is acceptable.

(3) Since there are many variables to consider, the miscellaneous item was juggled slightly to make the fixed cost per ton come out to an even 25 cents.

(4) The price of charcoal is currently running about $35 per ton. This is based on cordwood, where a great deal of labor is involved. According to estimates made in the previous section, charcoal can be made in a multiple-hearth furnace for $19 per ton. If steam is to be generated, this cost can be lowered to $12.50 per ton. In view of these facts, a $30 figure is realistic.

(5) The bags and masters were based on pricing obtained in the spring of 1971.

(6) In the case of utilities, gas was figured at 65 cents per thousand cubic feet, electrical power at 1½ cents per kilowatt hour, and process water at 5 cents per thousand gallons.

Table 11

ESTIMATED FIXED COSTS, VARIABLE COSTS, PRODUCTION VOLUME, AND PROFIT POTENTIALS FOR 1, 2, AND 4-TON CHARCOAL BRIQUETTE PLANTS IN GEORGIA, 1971

	Plant Capacity		
Fixed Costs (annual)	1 Ton/Hr.	2 Tons/Hr.	4 Tons/Hr.
General Manager	$ 15,000	$ 17,500	$ 25,000
Sales Manager	-	10,000	15,000
Plant Manager	7,800	9,000	12,000
Secretaries	5,720	6,500	11,700
Engr./Maintenance	6,000	6,900	7,800
Building Depreciation - 40 Yrs.	3,501	6,496	12,192
Machinery Depreciation - 10 Yrs.	22,305	29,633	44,989
Insurance & Taxes - 2%	7,262	11,123	18,751
Interest, Initial Capital - 7.25%	28,366	43,426	72,821
Interest, Operating Capital - 6%, 6 Mo.	6,300	12,600	25,200
Maintenance & Miscellaneous	5,746	8,822	13,747
Fixed Costs (annual)	$108,000	$162,000	$259,200
Fixed Costs (per ton)	$ 15.00	$ 11.25	$ 9.00
Variable Costs (per ton)			
Charcoal @ $30.00 per Ton	$ 30.00	$ 30.00	$ 30.00
Grain Starch @ 10% per Ton	8.34	7.92	7.52
Bags & Master Containers	8.49	8.07	7.67
Utilities - Gas, Power & Water	3.54	3.03	2.79
Labor @ $3.50 per Hour	17.50	11.73	8.14
Brokerage @ 5% of $90	4.50	4.50	4.50
Travel & Promotion	0.50	0.45	0.40
Association Fees, CBI	0.15	0.15	0.15
Management Incentives	1.00	0.90	0.80
Miscellaneous	0.48	0.50	0.53
Variable Costs (per ton)	$ 74.50	$ 67.25	$ 62.50
Summary			
Production (days/year)	300	300	300
Production (tons/year)	7,200	14,400	28,800
Total Cost (dollars/ton)	89.50	78.50	71.50
Profit Before Taxes			
@ $ 90/Ton F.O.B. Plant	$ 3,600	$165,600	$532,800
@ $ 95/Ton F.O.B. Plant	$ 39,600	$237,600	$676,800
@ $100/Ton F.O.B. Plant	$ 75,600	$309,600	$820,800
@ $105/Ton F.O.B. Plant	$111,600	$381,600	$964,800

Source: Aeroglide Corporation, Raleigh, North Carolina.

(7) Pricing on briquettes in 1970 averaged about $90 a ton, f.o.b. plant. Word was out earlier in 1971 that it would be up to a base of $100 a ton.

Estimated personnel requirements for one-, two-, and four-ton charcoal briquette plants are given in Table 12. The management staff may range from four to six, while plant workers may vary from 14 to 28. In the case of a one-ton plant, the plant manager probably would do the maintenance work and also take the place of one or two foremen shown in the table.

Table 12

ESTIMATED PERSONNEL REQUIREMENTS BY SHIFT
FOR 1, 2, and 4-TON CHARCOAL BRIQUETTE PLANTS

Salaried	1 Ton/Hr. Plant	2 Ton/Hr. Plant	4 Ton/Hr. Plant
President/General Manager	1	1	1
Sales Manager	-	1	1
Plant Manager	1	1	1
Secretaries	1	1	2
Engineer/Maintenance	1	1	1

	Shifts			Shifts			Shifts		
Hourly	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Briquette Plant Foreman	1	-	-	1	-	-	1	-	-
Charcoal Operator	1	1	1	1	1	1	1	1	1
Briquette Operator	1	1	1	1	1	1	1	1	1
Packaging Foreman	1	-	-	1	-	-	1	-	-
Packaging Operator	2	-	-	3	-	-	6	-	-
Pallet Loader/Masters	2	-	-	4	-	-	8	-	-
Warehouse Foreman	1	-	-	1	-	-	1	-	-
Forklift Operator	1	-	-	2	-	-	3	-	-
Utility/Masters or Loading	1	-	-	2	-	-	2	-	-
Total Hourly	11	2	2	16	2	2	24	2	2
Average Men/Shift	5.0			6.7			9.3		

Source: Aeroglide Corporation, Raleigh, North Carolina.

APPENDICES

Appendix 1

BARBECUE GRILL SURVEY

1. If you own one or more outdoor barbeque grills, what kind are they?

	Total	
	No.	%
Total Owners of Outdoor Grills	568	100
Type Owned		
Gas Grill	59	10
Electric Grill	11	2
Charcoal Grill	875	153
Total Mentions	945	166

2. If you own an outdoor charcoal type barbeque grill, approximately how many pounds of charcoal do you use monthly?

	Total	
	No.	%
Total Owning a Grill	568	100
Number Pounds Monthly		
Less than 10 Pounds	364	64
10 to 20 Pounds	144	25
More than 20 Pounds	30	5
No Answer	15	3
Non-Owners of Charcoal Grill	15	3

3. If you own an outdoor barbeque grill, what type of grill will you probably purchase next?

	Total	
	No.	%
Total Owners of Grills Responding to the Question	335	100
Type Will Probably Purchase Next		
Gas Grill	47	14
Electric Grill	7	2
Charcoal Grill	293	87
Total Mentions	347	103

Source: National Family Opinion, Inc., New York, New York, 1969.

Appendix 2

MODERN FURNACE OR RETORT CHARCOAL PLANTS
IN THE UNITED STATES AND CANADA, 1971

Atlantic Forest Products	New Brunswick, Canada
Dierks Forest Products	Dierks, Arkansas
Hood Charcoal Company (Dizzy Dean Company)	Pachuta, Mississippi
C. B. Hobbs Corporation	Santa Clara, California (old carbonizer) Elk Grove, California
Home Charcoal Company	Alexandria, Louisiana (old carbonizer)
Kingsford Company	Beryl, West Virginia Springfield, Oregon
Muskoka Charcoal	Huntsville, Ontario, Canada
Olsen-Lawyer Lumber Company	Medford, Oregon
Ragsdale Company	Conway, South Carolina
Royal Oak Charcoal	Memphis, Tennessee
Pioneer Charcoal (Timberland Products)	Ocala, Florida

Appendix 3

CHARCOAL BRIQUETTING PLANTS IN THE UNITED STATES, CANADA, AND MEXICO, 1971

ARKANSAS CHARCOAL CO.
P. O. Box 12450
Memphis, Tennessee 38112
901/324-5516
Mr. Andrew Sigel

Production Plant:
Paris, Arkansas
501/963-2030

ATLANTIC FOREST PRODUCTS LTD.
P. O. Box 129
Minto, New Brunswick, Canada
Mr. Dave Jackson

Production Plant:
Minto, New Brunswick, Canada
506/327-3311

BRIQUETAS MEXICO, Sociedad Anonima
Apartado Postal 684
San Luis Potosi, S.L.P., Mexico
2-77-02
Ing. Luis O. Ibanez S.

CUPPLES COMPANY
7800 Bonhomme
Clayton, Missouri 63105
314/725-6154
John K. Wallace, Jr.

Production Plant:
Floyd Charcoal Company
Salem, Missouri
314/729-4134

GREAT LAKES CARBON CORPORATION
333 N. Michigan Avenue
Chicago, Illinois
312/372-5445
Mr. Lowell E. Wills

Executive Office:
299 Park Avenue
New York, New York
212/935-2400
Mr. Milton Kaplan

Production Plant:
Marion, Ohio

C. B. HOBBS CORPORATION
P. O. Box 180A
Santa Clara, California 95052
408/262-3550
Mr. C. B. Hobbs, President

Production Plants:
Foot of Dixon Landing Road
Santa Clara, California
408/262-3550

10000 Waterman Road
Elk Grove, California
916/685-3925

HOOD CHARCOAL COMPANY
P. O. Box 4875
Jackson, Mississippi 39216
Mr. L. M. Ferrell, Vice President,
General Manager

Owned by:
Masonite Corporation
29 N. Wacker Drive
Chicago, Illinois 60606

Production Plant:
Pachuta, Mississippi 39347
601/776-2171

HOME CHARCOAL COMPANY, INC.
P. O. Box 814
Alexandria, Louisiana 71301
318/442-5757
Mr. Walter J. Redmond, President

HUMPHREY CHARCOAL CORPORATION
Box 45
Brookville, Pennsylvania 15417
814/VI9-2302
Mr. R. C. Humphrey, President

HUSKY BRIQUETTING, INC.
P. O. Box 380
Cody, Wyoming 82414
307/587-4711

Production Plants:
Drawer 1
Dickinson, North Dakota
701/225-6023

Route 2
Hixton, Wisconsin
715/963-2172

Box 2670
Isanti, Minnesota
612/724-5573

Box 308
Waupaca, Wisconsin
715/258-3281

Muskoka Charcoal Company
P. O. Box 1030
Huntsville, Ontario, Canada
705/789-5583

IMPERIAL BRIQUET CORPORATION
Kenbridge, Virginia 23944
703/676-8238
Mr. A. R. Mahaney, President

JAYHAWK CHARCOAL COMPANY
Chetopa, Kansas 67336
316/BE6-7256
Mr. "Red" Webster

KEETER CHARCOAL COMPANY
Branson, Missouri 65616
417/334-4195
Mr. James P. Keeter, Manager

Production Plant:
Branson, Missouri 65616
417/334-4888

KINGSFORD COMPANY
Box 1033
Louisville, Kentucky
502/582-2801
Mr. Owen Pyle, President
Mr. Jim Greanias
Mr. Walt Umenhofer

Production Plants:
P. O. Box "B"
Springfield, Oregon
503/746-9601

Belle, Missouri
314/859-3321

P. O. Box "K"
Parsons, West Virginia
304/478-2911

Cumberland Corporation
Burnside, Kentucky

OLD HICKORY CHARCOAL, INC.
Mountain View, Missouri 65548
417/934-2291
Mr. V. Smith, President

PINE-O-PINE CO., INC.
523 W. 22nd
Box 7325
Houston, Texas 77008
713/864-7977
Mr. Lawrence Lynn

Production Plants:
Char-Time Charcoal Division
Box 1167
Jacksonville, Texas 75766
214/586-3081
Mr. J. C. Swanson, Jr.

Char-Time Charcoal Division
Box 547
Lewisville, Arkansas 71845
501/921-4994
Mr. Herb Morgan

PIONEER CHARCOAL COMPANY
Box 1799
Ocala, Florida 32670
904/629-0005
Mr. Joe Crace
Mr. Don Crace

T. S. RAGSDALE COMPANY, INC.
P. O. Box 937
Lake City, South Carolina 29560
803/394-8567
Mr. T. S. Ragsdale, Jr., Vice President

Production Plant:
Conway, South Carolina

ROSEVILLE CHARCOAL & MANUFACTURING COMPANY
P. O. Box 1188
Zanesville, Ohio 43701
614/452-5473
Mr. Ray E. Longstreth, President

Production Plant:
Bentree, West Virginia

ROYAL OAK CHARCOAL COMPANY
P. O. Box 38
Memphis, Tennessee 38101
901/525-4391
Mr. T. C. Clarkson, Vice President, Marketing

Production Plants:
P. O. Box 865
Cookeville, Tennessee 38501
615/526-9761

P. O. Box 38
1648 Thomas Street
Memphis, Tennessee 38101
901/525-4391

P. O. Box 2459
White City Oregon 97501
503/826-2756

SECCA (Parent Company - COFIEC)
Guayaquil, Ecuador
Ing. Fernando Gonzalez, Acting
General Manager

Production Plant:
Guayaquil, Ecuador
(operated by T. S. Ragsdale)

STANDARD MILLING COMPANY
1009 Central Street
Kansas City, Missouri 64105
816/BA1-8200
Mr. Paul German

Production Plant:
Meta, Missouri
314/229-4210

TIMBERLAND PRODUCTS CO., INC.
4124 Boulevard Center Drive
Jacksonville, Florida 32207
904/398-1126

TWIN LAKES CHARCOAL
Cotter, Arkansas 72626
501/435-6784
Dr. M. O. Raine
Mr. Tom Stiles
Mr. Charlie Welsh

WESTERN BARBECUE SUPPLY COMPANY
Sallisaw, Oklahoma
918/SP5-4410
Paul Mothershed, President

WEYERHAEUSER COMPANY
Dierks Division
P. O. Box 1060
Hot Springs, Arkansas 71901
501/623-7762
Mr. Austin H. Bell, Charcoal Sales
Manager

Production Plant:
P. O. Box 38
Dierks, Arkansas 71833
501/286-2201

Appendix 4

RAILROAD FREIGHT RATES FOR CHARCOAL BRIQUETTES
FOR SELECTED SOUTHEASTERN DESTINATIONS, 30,000 POUNDS MINIMUM
(in cents per 100 lbs.)

	From Georgia							
To	Augusta	Brunswick	Cedar Springs	Macon	Rome	St. Marys[1/]	Savannah	Valdosta
Alabama								
Birmingham	76	83	67	67	50	111	83	76
Huntsville	82	92	77	73	56	97	92	88
Mobile	92	91	71	80	77	105	94	80
Florida								
Jacksonville	68	45	62	67	82	45	52	49
Miami	102	86	98	101	117	91	92	88
Pensacola	91	82	58	76	77	91	83	68
Tampa	88	71	76	82	98	73	76	64
Georgia								
Atlanta	50	60	57	40	37	64	60	57
Augusta	-	54	63	44	57	56	44	56
Columbus	56	59	44	41	49	72	60	50
Savannah	44	38	60	60	68	52	-	48
Valdosta	56	43	43	50	65	43	48	-
Kentucky								
Bowling Green	96	105	96	88	73	117	105	101
Louisville	101	116	105	96	82	126	111	111
Mississippi								
Jackson	100	100	83	88	80	111	101	92
Natchez	108	108	94	98	91	113	111	101
North Carolina								
Asheville	59	80	92	73	68	92	73	83
Charlotte	56	76	91	73	76	86	67	82
Greensboro	68	83	100	82	86	97	77	92
Raleigh	71	83	101	83	92	97	76	92

Appendix 4, Continued

To	From Georgia							
	Augusta	Brunswick	Cedar Springs	Macon	Rome	St. Marys 1/	Savannah	Valdosta
South Carolina								
Charleston	52	56	80	68	80	69	45	67
Columbia	43	61	80	60	71	76	52	71
Greenville	49	73	82	62	62	86	67	76
Tennessee								
Chattanooga	73	83	80	62	42	97	82	80
Knoxville	76	91	86	71	53	103	86	86
Memphis	101	107	92	92	80	117	108	100
Nashville	88	98	88	80	62	105	98	96
Virginia								
Norfolk	88	98	116	100	107	110	91	105
Roanoke	80	96	108	94	86	109	88	102

1/ Higher freight rates due to a relief line arbitrary charge of 9 cents per hundredweight.

Source: Louisville & Nashville Railroad.

Appendix 5

RAILROAD FREIGHT RATES FOR CHARCOAL BRIQUETTES
FOR SELECTED SOUTHEASTERN DESTINATIONS, 80,000 POUNDS MINIMUM
(in cents per 100 lbs.)

	From Georgia							
To	Augusta	Brunswick	Cedar Springs	Macon	Rome	St. Marys[1/]	Savannah	Valdosta
Alabama								
Birmingham	51	55	45	45	34	64	55	51
Huntsville	54	60	52	50	38	69	60	58
Mobile	60	59	48	53	52	66	61	53
Florida								
Jacksonville	46	31	42	45	54	31	35	33
Miami	68	57	64	67	78	60	60	58
Pensacola	59	54	38	51	52	60	55	46
Tampa	58	48	51	54	64	49	51	43
Georgia								
Atlanta	34	41	39	27	25	50	41	39
Augusta	-	37	42	30	39	45	30	38
Columbus	38	40	30	28	33	48	41	34
Savannah	30	26	41	41	45	35	-	32
Valdosta	38	29	29	34	44	36	32	-
Kentucky								
Bowling Green	63	69	63	58	50	78	69	67
Louisville	67	77	69	63	54	84	74	74
Mississippi								
Jackson	65	65	55	58	53	74	67	60
Natchez	72	72	61	64	59	82	74	67
North Carolina								
Asheville	40	53	60	50	46	61	50	55
Charlotte	38	51	59	50	51	58	45	54
Greensboro	46	55	65	54	57	64	52	60
Raleigh	48	55	67	55	60	64	51	60

Appendix 5, Continued

To	From Georgia							
	Augusta	Brunswick	Cedar Springs	Macon	Rome	St. Marys 1/	Savannah	Valdosta
South Carolina								
Charleston	35	38	53	46	53	47	27	45
Columbia	31	42	53	41	48	51	35	48
Greenville	33	50	54	42	42	58	45	51
Tennessee								
Chattanooga	50	55	53	42	30	64	54	53
Knoxville	51	59	57	48	36	67	57	57
Memphis	67	72	60	60	53	78	72	65
Nashville	58	64	58	53	42	69	64	63
Virginia								
Norfolk	58	64	77	65	72	73	59	69
Roanoke	53	63	72	61	57	71	58	68

1/ Higher freight rates due to a relief line arbitrary charge of 6 cents per hundredweight.

Source: Louisville & Nashville Railroad.

Appendix 6

RAILROAD FREIGHT RATES FOR CHARCOAL BRIQUETTES FOR SELECTED U. S. DESTINATIONS FOR MINIMUM AND MAXIMUM CARLOADS (in cents per 100 lbs.)[1/]

To	From Georgia							
	Augusta	Brunswick	Cedar Springs	Macon	Rome	St. Marys[2/]	Savannah	Valdosta
Arkansas								
Little Rock								
40,000	119	125	106	108	96	126	126	116
80,000	80	83	71	72	64	85	85	77
California								
Los Angeles								
40,000	288	316	288	288	288	316	288	288
80,000	194	242	194	194	194	242	194	194
San Francisco								
40,000	288	316	288	288	288	316	288	288
80,000	194	242	194	194	194	242	194	194
Illinois								
Chicago								
40,000	133	141	133	126	113	153	141	138
80,000	90	94	90	85	74	102	94	93
Louisiana								
Shreveport								
40,000	125	125	106	111	105	126	126	118
80,000	83	83	71	74	69	85	85	78
Missouri								
St. Louis								
30,000	119	128	114	111	98	143	126	123
80,000	80	86	76	74	64	95	85	82

Appendix 6, Continued

To	From Georgia							
	Augusta	Brunswick	Cedar Springs	Macon	Rome	St. Marys 2/	Savannah	Valdosta
New York								
Buffalo								
30,000	138	151	151	141	128	152	144	152
100,000	83	91	91	85	77	92	87	92
New York								
30,000	125	135	147	135	133	136	128	141
100,000	74	81	90	81	80	82	77	85
Texas								
Houston								
40,000	128	157	123	141	126	141	143	130
80,000	86	107	82	94	85	94	95	88
Washington, D. C.								
30,000	100	113	133	113	111	118	105	120
100,000	57	65	80	65	65	69	59	72

1/ Since this table was compiled, all freight rates have been increased by 6% except for Missouri as of April 12, 1971.

2/ Higher freight rates are due to relief line arbitrary charges.

Source: Louisville & Nashville Railroad.

Appendix 7

TRUCK FREIGHT RATES FOR CHARCOAL BRIQUETTES
FOR SELECTED SOUTHEASTERN DESTINATIONS, 30,000 POUNDS MINIMUM
(in cents per 100 lbs.)

	From Georgia							
To	Augusta	Brunswick	Cedar Springs	Macon	Rome	St. Marys	Savannah	Valdosta
Alabama								
Birmingham	106	118	92	92	63	123	118	106
Huntsville	115	130	110	104	71	136	130	123
Mobile	130	128	100	112	110	130	132	112
Florida								
Jacksonville	96	57	82	92	115	45	65	61
Miami	146	121	138	144	166	115	130	123
Pensacola	128	115	73	106	110	115	118	96
Tampa	123	100	106	115	136	87	106	87
Georgia								
Atlanta	61	74	63	48	43	76[1/]	74	69
Augusta	-	63	74	54	69	54[1/]	65	69
Columbus	68	72	47	49	57	74[1/]	74	61
Savannah	54	45	69	61	81	-	49	58
Valdosta	69	52	52	58	79	58[1/]	55	-
Kentucky								
Bowling Green	136	149	136	123	104	155	149	138
Louisville	136	164	149	136	115	166	158	158
Mississippi								
Jackson	141	141	118	123	112	146	144	130
Natchez	155	155	132	138	128	161	158	144

Appendix 7, Continued

To	From Georgia							
	Augusta	Brunswick	Cedar Springs	Macon	Rome	St. Marys	Savannah	Valdosta
North Carolina								
Asheville	74	112	130	104	96	118	104	118
Charlotte	71	106	128	104	106	110	92	115
Greensboro	96	118	141	115	121	123	110	130
Raleigh	100	118	144	118	130	123	106	130
South Carolina								
Charleston	65	71	112	96	112	76	57	92
Columbia	55	77	112	76	100	92	65	100
Greenville	61	104	115	65	92	92	65	87
Tennessee								
Chattanooga	104	118	112	82	54	123	115	112
Knoxville	106	128	121	100	66	132	121	121
Memphis	144	152	130	130	112	155	155	141
Nashville	123	138	123	112	82	144	138	136
Virginia								
Norfolk	123	138	164	141	152	144	128	149
Roanoke	112	136	155	132	121	169	123	146

1/ Arbitrary charge of $15 per shipment for intrastate shipments.

Sources: Baggett Transportation, Inc.
Georgia Highway Express, Inc.