GRANT NUMBER
DE-FG05-85 MI 10067

DOE/MI/10067--1

DE92 013560

A PROJECT TO IMPROVE THE CAPABILITIES OF MINORITIES IN ENERGY FIELDS AND A COST BENEFIT ANALYSIS OF AN ETHYL ALCOHOL PLANT

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AUGUST, 1986

Prepared for

U. S. DEPARTMENT OF ENERGY

ACKNOWLEDGEMENTS

The authors wish to express their sincere thanks to the Office of Minority Impact, the U.S. Department of Energy for providing funds to carry out the activities reported in this document. Special thanks goes to Mrs. Barbara N. McKee, Assistant Director/Minority Business Enterprises, the U.S. Department of Energy. Her encouragement and insightful comments throughout the project ensured that all the activities were carried out at a high standard of quality.

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CHAPTER I

BACKGROUND

Introduction

The project being reported in this document had three components: (1) a research project to carry out cost-benefit analysis of an ethyl alcohol plant at Tuskegee University, (2) seminars to improve the high-technology capabilities of minority persons, and (3) a class in energy management. This chapter of the report provides a background on the three components listed above. Chapter II discusses the results from the research on the ethyl alcohol plant, Chapter III discusses the seminars, and Chapter IV details the energy management class.

1. Research Project

The Carver Research Foundation of Tuskegee University has been taking a leadership role in Alabama in researching all aspects of the production of ethanol from agricultural feedstocks. This encompasses not only the specific components of the processes which include ethanol, carbon dioxide, and stillage, but also the concept of integrated agribusiness which ties this concept to feedlots and other operations. To this end, the Carver Research Foundation currently operates an 800 gallon cooker size ethyl alcohol plant on the agricultural farm of Tuskegee University. The rationale for building this plant was that since Alabama's major industry is agriculture, it is imperative that innovative and workable ways be developed to utilize the agricultural products. The staff of the Carver Research Foundation had felt that by producing more fuel within the state and developing a market for this fuel, it would provide a boost to economic development in Alabama and other Southern states.

The method for converting agricultural products to ethanol products is well developed. Corn is a common raw material used since it is high in starch and is a fairly cheap commodity in the United States. However, in states where corn is not abundant, or where other crops are also abundant, studies of the parameters needed to optimize alcohol production from a variety of feedstocks are needed. Thus, under the project funded by the U.S. Department of Energy (and reported here) a study was conducted to determine the economic feasibility of using different feedstocks for alcohol production at the Carver Research Foundation plant. This linkage was extremely helpful in enhancing the capabilities of the Foundation. The findings of this research study are given in detail in Chapter II of this report. These findings are being circulated to the various state government agencies and private organizations. They have implications for industries with waste or starch. As an example, Golden Flake Snack Foods, Inc., of Birmingham, Alabama has expressed interest in the potential for conversion of their potato starch into waste alcohol. The Carver Research Foundation, and hence Tuskegee University will benefit by securing sources of potato starch for its various research projects and by the consequent availability of resources for its faculty and students to conduct research. In addition, the Foundation feels that income could be generated for this project through the sale of alcohol, an aspect of the program to be handled by the agribusiness division of Landmark Company and/or its designee. As reported in Chapter II, the results of the research could be used by farms and cooperatives to evaluate the possibility of using an alcohol plant for becoming self-sufficient in energy and feedstocks. To this end these findings are being shared with farmers and cooperatives in the Southeast, especially minority cooperatives. And as pointed out in Chapter II, Tuskegee University personnel will be willing to assist a potential investor in analyzing financial requirements, choosing an organization form, assessment of the market, and providing technical assistance.

2. Computer Seminars

As business professionals continue to focus more of their time and energy on the challenge of increasing productivity within their organizations, management education has emerged as a clear priority. Management techniques and procedures are constantly evolving often at about the pace of environmental changes. Even the best prepared manager is soon outdated unless he or she takes corrective action.

Managers are bombarded these days by literature and brochures describing executive development programs, management seminars, workshops and short courses being conducted by universities, consulting firms, and management training organizations such as the American Management Association (AMA). Most of their seminars and training programs are either directed to the needs of very small businesses (University Small Business Institute programs would fall in this category), or directed to the executives of large corporations (most of the AMA courses would fall in this category). Very few courses are offered to meet the needs of small to intermediate size businesses that are engaged in energy related activities or other high-tech businesses. The training programs and seminars offered to minority business persons continue to be mostly of elementary level. Even though there is a need for such seminars, the staff of the School of Business at Tuskegee University has felt for some time that now is the time to offer seminars tailored to the needs of minority persons who have been relatively successful in the business world, and are in need of training in high-tech fields, especially use of computers.

Since the U.S. Department of Energy is committed to increasing the share of minority businesses in energy related and other high-tech areas, it was decided to develop a mechanism whereby the Department could help the School of Business in offering seminars in use of microcomputers. Thus, the second component of the project concentrated on offering seminars in use of spreadsheets, data base management, word processing and accounting. The description of these seminars and the benefits derived from this activity are given in Chapter III of this report.

3. Energy Management Classes

Classes (with credit) were offered to Tuskegee University students to study alternative forms of energy sources, evaluate different opportunities available in energy-related businesses and discussion of general topics in the energy field. The main purpose of these classes has been to generate interest among students in energy-related and high-tech businesses. It is hoped that as a result of these classes some business, economics and engineering students will become future entrepreneurs in energy and high-tech areas. The success of these energy-related classes has convinced us to offer the classes again during the coming academic year (September, 1986-May, 1987). Chapter IV of this report gives a detailed description of these energy-related classes.

CHAPTER II

COST ESTIMATES OF THE TUSKEGEE UNIVERSITY'S ALCOHOL PLANT

Introduction

The objective of this research was to determine the economic feasibility of (using different methods for) alcohol production from various feedstocks and waste. Specifically, the research developed an economic model for estimating the cost of ethyl alcohol produced by the Tuskegee University (Carver Research Foundation) plant. This chapter also discusses some of the alcohol and the coproducts produced by the Tuskegee University alcohol plant.

The next section presents a simplified economic model to determine the possible relationship between the levels of alcohol produced (output) given various amounts of the input. Once the relationship between output and inputs have been estimated, then it is possible to estimate the cost of various levels of output assuming various cost for each input. Of course, after costs are estimated, the economic feasibility of converting various feedstocks and waste into alcohol can be addressed. Since not sufficient (reliable) data was collected during the plant's various demonstrations to the public, the production function of the alcohol plant can only be estimated from other data sources gathered for other alcohol plants. Therefore, it is only possible to estimate a range of output levels, given fixed amount of inputs and the cost of each.

Production Function for the Tuskegee University Demonstraton Plant

A production function (schedule) is an "expression of the dependent relationship that exists between the inputs (land, labor, capital, and management) of a production process and the output (alcohol, protein feed, and carbon dioxide) that results (1)." Of course, a production function is an engineering relationship. For example, Table 1 gives a simplified production function for the Tuskegee alcohol plant. An interpretation of Table 1 would be for every bushel (lb.) of corn used, assuming a fixed cooker size (a given amount of) labor and other inputs, 2.4 (.0429) gallons of alcohol could be produced, that is, 100 gallons of alcohol can be produced from 41.67 bushels (2334 lb.) of corn. Therefore, this production function gives a linear relationship where

(1) $Q^* = 2.4$ (each bushel of corn)/or .0429 (each lb. of corn)

The equation assumes a fixed cooker size, a fixed amount of labor and other inputs, and Q^* is the gallons of alcohol produced. However, most production functions are not linear. If they were, then estimating output and cost levels would be fairly straightforward and simple. For example, if a bushel of corn cost $3.50 per bushel, then the cost of alcohol produced per gallon would be $1.46 (3.50/2.4). Therefore, the feedstock cost of 100 gallons of alcohol would be $146.00. Again as stated previously, most production functions are not linear. Leslie (2,p3) describes the three size ranges or scales of operation. They

TABLE 1

SIMPLIFIED PRODUCTION FUNCTION OF ALCOHOL

USING CORN AS THE FEEDSTOCK

Total Alcohol Produced (Gallons)	Bushels (lb.) of Corn	Plant Size (Size of Cooker)	Labor (Workers)	Other Operating Inputs (Natural Gas, Enzymes, Yeast, Water, Electricity)
120	50 (2800 lb.)	3600 Gallons	1/per 8 hours	FIXED (proportional to output)
240	100 (5600 lb.)	3600 Gallons	1/per 8 hours	FIXED
480	200 (11200 lb.)	3600 Gallons	1/per 8 hours	FIXED
720	300 (16800 lb.)	3600 Gallons	1/per 8 hours	FIXED

1 Bushel of Corn = 56 lb.

are the small batch units, which tends to not produce a profit, the intermediate units, which tend to have an annual capacity from 100,000 to 2,000,000 gallons of alcohol produced under continous operation by one man per shift and all operations can be done in one shift per day, and the large units, normally measured in millions of gallons and are designed in most cases to take advantage of available materials and energy.

Table 2 gives estimates of the relationship between alcohol production and various feedstocks (the production functions) and the amount of protein feed obtained from the process. These estimates are assumed not to vary much regardless of annual production capacity and are average output of alcohol produced per ton/pound of the feedstock. However, Farm Fuel, Inc. (3) requested governmental permission to build intermediate alcohol plants for profit which were intended to produce 25 gallons of alcohol per hour, 600 gallons per day, and up to 210,000 gallons per year, in 1979. Table 3 reveals Farm Fuel, Inc. pre-estimated production function and the production function derived from an experience of a dairy farmer (see appendix B-1), with an alcohol plant. Note in Table 3 the differences in cooker sizes, amount of corn utilized, and alcohol production levels for Farm Fuel, Inc. and Holt's Dairy Farm. It is highly improbable that Farm Fuel, Inc. was able to build alcohol plants as efficient as projected given the Holt experience and other evidence. Table 3 also gives an estimation of the TU alcohol plant's production function for corn assuming the same

TABLE 2

ESTIMATED AVERAGE YIELD[1] OF ALCOHOL AND PROTEIN OF VARIOUS FEEDSTOCKS

Material	Gallons per lb.	Gallons per ton	Pounds (lb.) of Protein per ton
Wheat	.0425	85.0	690
Corn	.042	84.0	640
Sorghum (An average of grain and cane)	.0375	75.0	560
Rice	.03975	79.5	580
Barley	.0396	79.2	580
Molasses, Blackstrap	.03525	70.4	-
Oats	.0318	63.6	580
Sweet Potatoes	.0171	34.2	580
White Potatoes	.01275	25.5	300
Sugar Beets	.01015	20.3	264

[1]Probable yield from a short ton (2,000 lb.) of the raw material, calculated from the average fermentable sugar content.

Source: P. B. Jacobs and H. P. Newton, U.S. Department of Agriculture, Misc. Pub. 327, December, 1938. This table was deprived from information contained in Alcohol Fuels Workshop, presented by Butler Research and Engineering Company, St. Paul, Minnesota to Farmers Home Administration, U.S. Department of Agriculture and the Economics Development Administration, U.S. Department of Commerce, December 1979.

Weight Conversion

Bushel of Wheat	= 60 lb.	Bushel of Corn	= 52-56 lb.
Bushel of Barley	= 48 lb.	1 cwt.	= 100 lb.
Bushel of Oats	= 32 lb.	Bushel of Potatoes	= 60 lb.

TABLE 3

ESTIMATES OF VARIOUS PRODUCTION FUNCTIONS OF ALCOHOL USING CORN AS THE FEEDSTOCK

Firm	Total Alcohol Produced (Gallons)	Plant Size (Cooker Size, Gallons)	Bushels (lb.) of corn (Batch)	Water (gallons)	TAKA-THERM (lb.)	Diazyme (lb.)	Sugar (lb.)	Yeast (lb.)	Energy Source	Fuel Used (Type)	Alcoholase I (oz.)	Alcoholase II (oz.)	Labor (workers)
Farm Fuel, Inc.	200* (125)	1500	52 (2912 lb.)	312	2.6	6.5	.65	1.3	Not Given				
Holt Dairy Farm	240 (230-250)	3600	100 (5600lb.)	2500	2.0			5.0	16 hp Boiler	13 gal/ Diesel 51 gal/ Used Oil	40	30	1 (8 hours)
Tuskegee University (TU)	47-50	800	19.64 (1100 lb.)	628	.61			1.0	30 hp Boiler	(Natural Gas)	8	6	1 (8 hours)

*Farm Fuel, Inc. probably overestimated their proposal total amount of alcohol produced given the number of bushels of corn used and the plant size.

ratio of gallons of alcohol produced per pound/ton of corn as given in Table 2 (Table A1 and A2 in Appendix). A batch of corn weighing 1100 lbs. (19.64 bushels) should produce approximately 47-50 gallons of alcohol per eight hours of 150 gallons per day or 52,500 (150 x 350 days) gallons per year. TU's alcohol plant would be considered a small unit. However, a batch of sweet potatoes would only be expected to produce 1.4 gallons of alcohol per hundredweight (cwt.) as oppose to 2.4 gallons per bushel of corn. Sweet potatoes used as feedstock should reduce the production of alcohol from approximately 47 gallons to 27 gallons, a decrease of 42.6%, given the same amount of inputs other than feedstock. Of course, if sweet potatoes are 43% cheaper than corn, then both feedstocks would be equally feasible, assuming all other factors are the same, that is, for example storage cost being similar, etc. The price of corn and sweet potatoes would influence their economic feasibility. This question will be addressed later in a different section.

Mathematically, the TU's alcohol plant production functions for corn and sweet potatoes may be expressed as

(2a) Q* (Gallons of alcohol produced) = 2.4 (per bushel of corn)

or

= .04285 (per lb. of corn)

(2b) Q* = 1.4 (per cwt. of sweet potatoes)

or

= .784 (per bushel of sweet potatoes)

or

= .014 (per lb. of sweet potatoes

These production function estimates will be utilized in the next section to derive estimates of the cost of the various input/ output levels.

Alcohol Production Cost Estimates for the TU Plant

A generalized production function of the TU alcohol plant can be expressed with the following model

(3) Q* (Gallons of alcohol produced) = a + b(amount of feedstock) +c(labor input) +d(plant size/ cooker size) +e(other operating inputs)

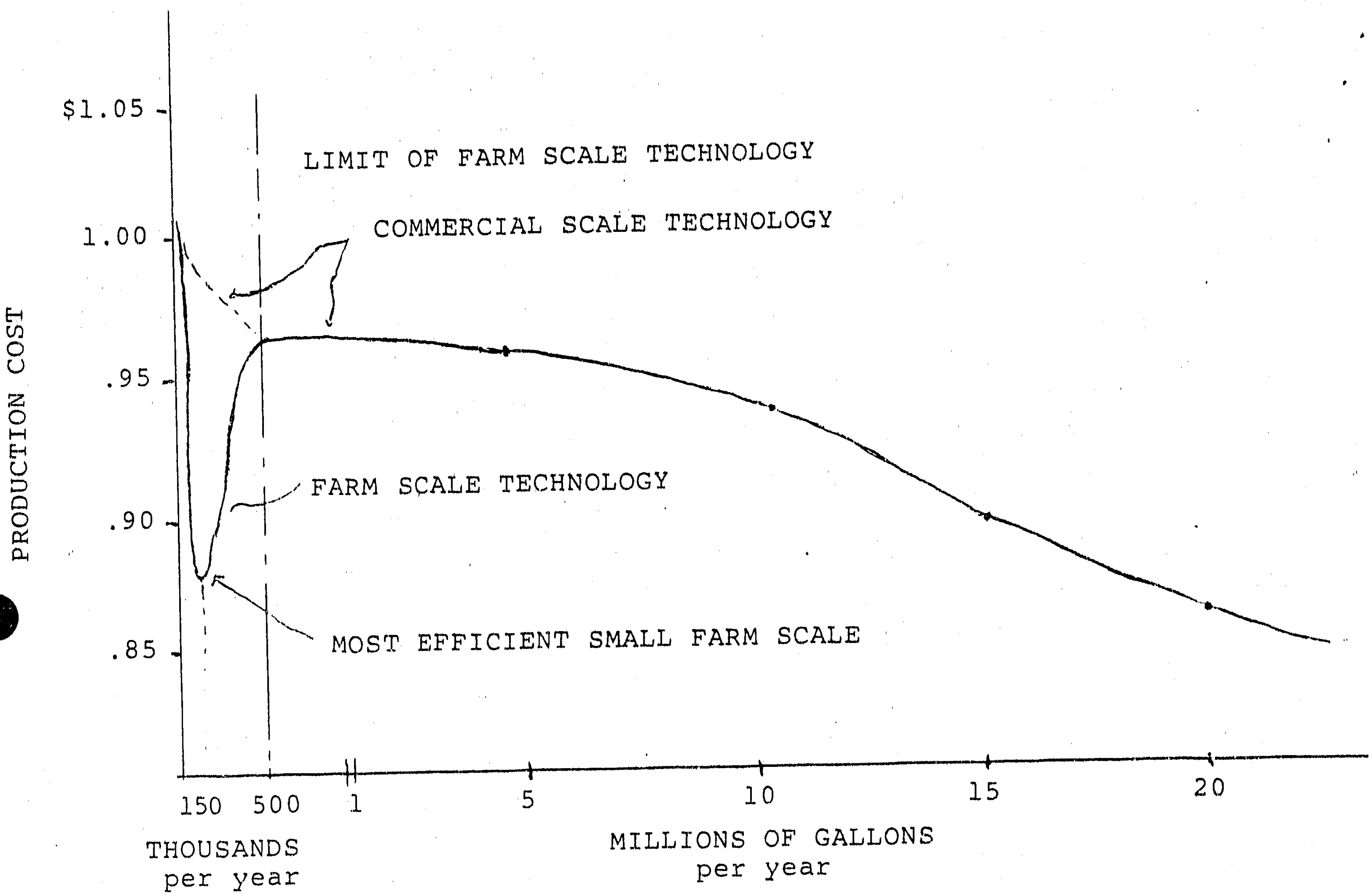
where the parameters a is assumed to be zero, b takes on the values given in Table 2 (Table A1 and A2 in appendix), c, d, e are estimated from Table 3 and are assumed to be the same for each feedstock. For various levels of Q* and it corresponding input levels, estimates of production cost may be derived utilizing the following model (4).

(4) Total Production Cost = (Price of Feedstock) (Amount of Feedstock Used)
+ (Price of Labor)(Amount of Labor Used)
+ (Price of Enzymes)(Amount of Enzymes Used)
+ (Price of Fuel)(Amount of Fuel Used)
+ (Price of Yeast)(Amount of Yeast Used)
+ (Price of Water)(Amount of Water Used)
+ (Price of Electricity)(Amount of Electricity).

Figure 1 estimates the most efficient input/output relationship with the assumption that the small farm scale is utilizing the most automated plant (in 1980 prices). However, it is expected that the average production cost to be higher for the TU plant (assuming prices remain the same from 1980 to the present), particularly since the output cost estimates for the Holt Dairy Farm (Appendix B-1) were approximately 33% higher than those given in Figure 1 for a small scale operation. Production cost are emphasized because the TU plant was not built with university's fund (no capital cost). Therefore, the major concern will be on production cost as output varies. The TU's alcohol plant (production) cost function will be higher than the Holt's production function. A review of Figure 1 reveals that the output levels with the most significant cost reduction possible exist for the farm-scale or small cooperative scale using the most advanced technology and for the larger scale plants producing in the 15-20 million gallons per year range. Table 4 reveals an estimate of equation (4) for the Tuskegee University's alcohol plant per batch (1100 lb.) of corn. The cost is estimated to vary from $113.46 to $146.06 depending whether the boiler (natural gas) is utilized at minimum ($3.00 per hour) or maximum ($6.30 per hour) capacity.

Table 5 includes estimates of the range of total cost (column 8) and average cost per gallon of alcohol produced (columns 9, 10, 13 and 14) under various assumptions for each feedstock. Given batches of either wheat, corn, barley and

FIGURE 1



NOTES:
1) Starch Based Systems
2) Production Costs Only. Does Not Include Capital Costs, Taxes, or Return on Investment.
3) Sources:
   - 66,000 gpy - See Income Statement in Workbook
   - 5,000,000 gpy - Calculated for Workshop
   - 10,000,000 gpy - See Statement in Workbook
   - 15,000,000 gpy - Calculated for Workshop
   - 20,000,000 gpy - Average from Studies by Stone Webster and Bohler Brothers

Source: Alcohol Fuels Workshop, December 1979, Butler Research and Engineering Company, St. Paul, Minnesota.

TABLE 4

AN ESTIMATION OF PRODUCTION COST PER BATCH (1000 lb.) OF CORN AT THE TUSKEGEE UNIVERSITY'S ALCOHOL PLANT ASSUMING THE HIGHEST AND LOWEST FUEL (NATURAL GAS) COST

Input	Estimated amount of the input	Estimated price of the input	Highest Cost of the input	Lowest Cost of the input
START-UP COST:				
Water[1]	628 gallons	$ .002 per gallon	$ 1.26	$ 1.26
FEEDSTOCK COST:				
Corn[2]	1100 lb.	$ .048 per lb. (2.59 per bushel)	52.80	52.80
OPERATING COST:				
Fuel[3] (Natural Gas)	8 hours	$6.30 - 3.00 per hour (Maximum - Minimum) Capacity - Capacity	50.40	24.00
Enzymes[4]	Varies	$ .06 per gallon of alcohol produced (assuming at least 30 gallons will be produced)	1.80	1.80
Yeast[5]	2.5 lb.	$2.00 per lb.	5.00	5.00
Labor[6]	8 hours	$4.00 - 3.35 per hour	32.00	26.80
Electricity[7]	Varies	$ .06 per gallon of alcohol produced (assuming at least 30 gallons produced)	1.80	1.80
		TOTAL OPERATING COST	$91.00	$59.40
		TOTAL COST	$145.06	$113.46

[1] It is assumed that in order for the alcohol converation process to take place the cooker, mash cooler, and fermenters (3) must be filled with at least 628 gallons of water each during continous operation. However, initially only 628 gallons of water is needed for a batch of feedstock to convert to alcohol. The price of water is taken from the October 1, 1984, Tuskegee rate schedule. See Appendix B-4-1.

[2] The price of the feedstocks will vary with the seasons of the year. Therefore, the estimates in this report are taken from the Wall Street Journal, July 20, 1985. (see Appendix B-3) The price of sweet potatoes was obtained from Mr. Dowdell, Macon County Agent, Tuskegee, Alabama. These prices will probably change during the next year.

[3] Natural gas prices were obtained from Mr. Cannon, Manager, Alabama Power - Tuskegee Office for the boiler.

[4] Enzymes prices are taken from Fuel From Farms: A Guide to Small-Scale Ethanol Production, Solar Energy Research Institute, Contract No. EG-77-C-01-4042, February 1980, Table VI-1, Case Study assumptions, p. 76 (Appendix B-2) adjusted (50%) fifty greater for inflationary effects. We are assuming that at least 30 gallons of alcohol will be produced from the various feedstocks. Of course, it can vary from 47 gallons for corn to 11.81 gallons for sweet potatoes. Electricity prices are also taken from Fuel From Farms: A Guide to Small-Scale Ethanol Production adjusted for inflation.

[5] Yeast prices are adjusted for inflation and were taken from the Holt Farm experience (Appendix B-1). The wage or price of labor is the minimum wage rate (lowest) and four (4) dollars per hour.

TABLE 5

ESTIMATION OF PRODUCTION COST PER BATCH FOR VARIOUS FEEDSTOCKS AT THE TUSKEGEE UNIVERSITY'S ALCOHOL PLANT

(1) Start-up[1] Cost	(2) FEEDSTOCK	(3) Estimated Gallons[2] of Alcohol Produced per 1100 lb. of FEEDSTOCK	(4) Price[3] (Cost) of the FEEDSTOCK per lb. (per bushel)	(5)=(4)(1100) TOTAL FEEDSTOCK COST	(6) Estimated Range[1] of Operating Cost	(7)=(1)+(6) Estimated Range of Start-up and Operating Cost	(8)=(1)+(5)+(6) Estimated Range of TOTAL COST
$1.26	Wheat	46.75	$.047 per lb. ($2.82)	$51.70	$91.00-59.40	$92.26-60.66	$143.96-112.36
$1.26	Corn	46.20	$.048 per lb. ($2.59)	$52.80	$91.00-59.40	$92.26-60.66	$145.06-113.46
$1.26	Barley	34.98	$.045 per lb. ($2.15)	$49.50	$91.00-59.40	$92.26-60.66	$141.76-110.16
$1.26	Oats	34.98	$.043 per lb. ($1.38)	$47.30	$91.00-59.40	$92.26-60.66	$139.56-107.96
$1.26	[4]White Potatoes	14.03	$.03-.015 per lb.	$33.00-16.50	$91.00-59.40	$92.26-60.66	$125.26- 77.16
$1.26	Sweet Potatoes	11.81	$.095 per lb.	$104.50	$91.00-59.40	$92.26-60.66	$196.76-165.16
$1.26	Sugar Beets	11.17	$.315 per lb.	$346.50	$91.00-59.40	$92.26-60.66	$438.76-407.16

[1] See Table 4.

[2] Adjustments were made from information given in Table 2.

[3] All feedstock prices are taken from the commodity section of the Wall Street Journal, July 24, 1985 expect for sweet potatoes prices, which were obtained from Mr. Dowdell, Macon County Agent, Tuskegee, Alabama. Sweet potatoes prices are based on the quoted North Carolina prices.

[4] The estimated range for white potatoes were calculated by adding the lowest (highest) feedcost to the lowest (highest) start-up and operating cost.

TABLE 5 - CONTINUED

(9) = (8)/(3) Estimated Range of Average Costs per gallon of alcohol produced for each FEEDSTOCK	(10) = (7)/(3) Estimated Range of Average Costs per gallon of alcohol produced WITHOUT Feedstock Cost	(11) Estimated lb. of Protein Feed (10%) from each Feedstock	(12)=(11)($.10 per lb.) Estimated Cost Reduction (Benefit) of Protein Feed	(13) = ((8)-(12))/(3) Estimated Range of Average Costs with Protein Feed Benefit (Farmer's Cost)	(14) = ((7)-(12))/(3) Estimated Range of Average Costs WITHOUT Feedstock Cost and with Protein Feed Benefit (Tuskegee University's Cost)
$3.08-2.40	$1.97-1.30	379.5	$37.95	$2.27-1.59	$1.16-.49
$3.14-2.46	$2.00-1.31	352.0	$35.20	$2.38-1.69	$1.24-.55
$4.05-3.15	$2.64-1.73	319.0	$31.90	$3.14-2.24	$1.73-.82
$3.99-3.09	$2.64-1.73	165.0	$16.50	$3.52-2.61	$2.17-1.26
$8.93-5.50	$6.58-4.32	319.0	$31.90	$6.65-3.22	$4.30-2.05
$16.66-13.98	$7.81-5.40	319.0	$31.90	$13.96-11.28	$5.11-2.44
$39.28-36.45	$8 26 5 43	145.2	$14.52	$37.98-35.15	$6.96-4.13

oats, the total cost estimates will tend to be the same (column 8). For white potatoes, the total cost will probably be 15% to 46% less, depending upon the productive capacity, when compared to to wheat. However, sweet potatoes' and sugar beets' total cost per batch should be somewhat higher, particularly sugar beets. If one estimates the appropriate number of gallons of alcohol per batch (column 3) and the average cost per gallon (column 9), then a more realistic evaluation of the possible cost situation can be observed. For example, it has been estimated that the per gallon cost of producing alcohol from wheat will vary from $3.08 to $2.40 (column 9). Note for sweet potatoes the average cost probably will vary from $16.66 to $13.98. Table 5 reveals the possible average cost for farmers (column 13) and Tuskegee University (column 14) if cost reduction benefits from protein feed is included. For example, a farmer's cost will possibly vary from $2.27 to $1.59 per gallon of wheat produced alcohol, given an alcohol plant with same productive capacity as the Tuskegee University's plant. However, Tuskegee University's average cost, assuming the protein feed benefit and no feedstock cost, will probably vary from $1.16 to $.49 per gallon of wheat produced alcohol. It appears that if the Tuskegee University's alcohol plant can produce at the minimum average cost, then producing alcohol from wheat ($.49), corn ($.55), barley ($.82) and oats ($1.26) appear to be economically feastible given present gas prices ($1.26 per gallon). Therefore, alcohol production from white potatoes, sweet potatoes and sugar beets does not appear to be cost effective alternatives even if the University does not incur the feedstock costs and receives the protein feed benefits.

One must excercise caution with the estimated average costs since they do not include transportation cost, that is, the cost of transporting the feedstock to the University's alcohol plant. If these cost are significant and are incurred by the University, then the estimated average costs will be higher. Of course, if any input cost change, then the average cost ranges will change. In all probability, the input price will change, particularly the feedstock cost. Again as previously stated, we are assuming a linear production function, where the output and input relationship is constant, that is, inputs and output move the same percentage and direction when inputs change and cost would change by some constant proportion. If the relationship is a declining one, that is, as one uses more inputs (percentage wise), output would increase less percentage wise and average cost will be higher (greater). However, if the relationship is an increasing one, that is, more inputs causes output to increase more percentage wise than the increase in inputs, then the average cost will be less. The latter situation is less likely to occur given the law of diminishing marginal returns (where more inputs will eventually cause less output (percentage wise) assuming a fixed plant size).

The feasibility of marketing the alcohol and its byproducts will depend upon the conditions whether the price of the alcohol and the byproducts are at least as low as other competitor's prices and the quality is comparable. Of course, if these conditions are not satisfied, then marketing the products will be difficult at best. However, the alcohol plant must be allowed to produce in order to evaluate the feasibility of the products. Figure 2 allows one to trace through the full potential benefits to Tuskegee University assuming those benefits can be monetized. There are three areas of benefits: (1) direct sales, (2) on-university (farm) uses, (3) indirect university benefits.

Transportation cost is a major factor in determining the radius over which stillage might be utilized economically. Table 6 gives major costs incurred by one feed manufacturer for a small fleet of trucks operating in Alabama.

TABLE 6

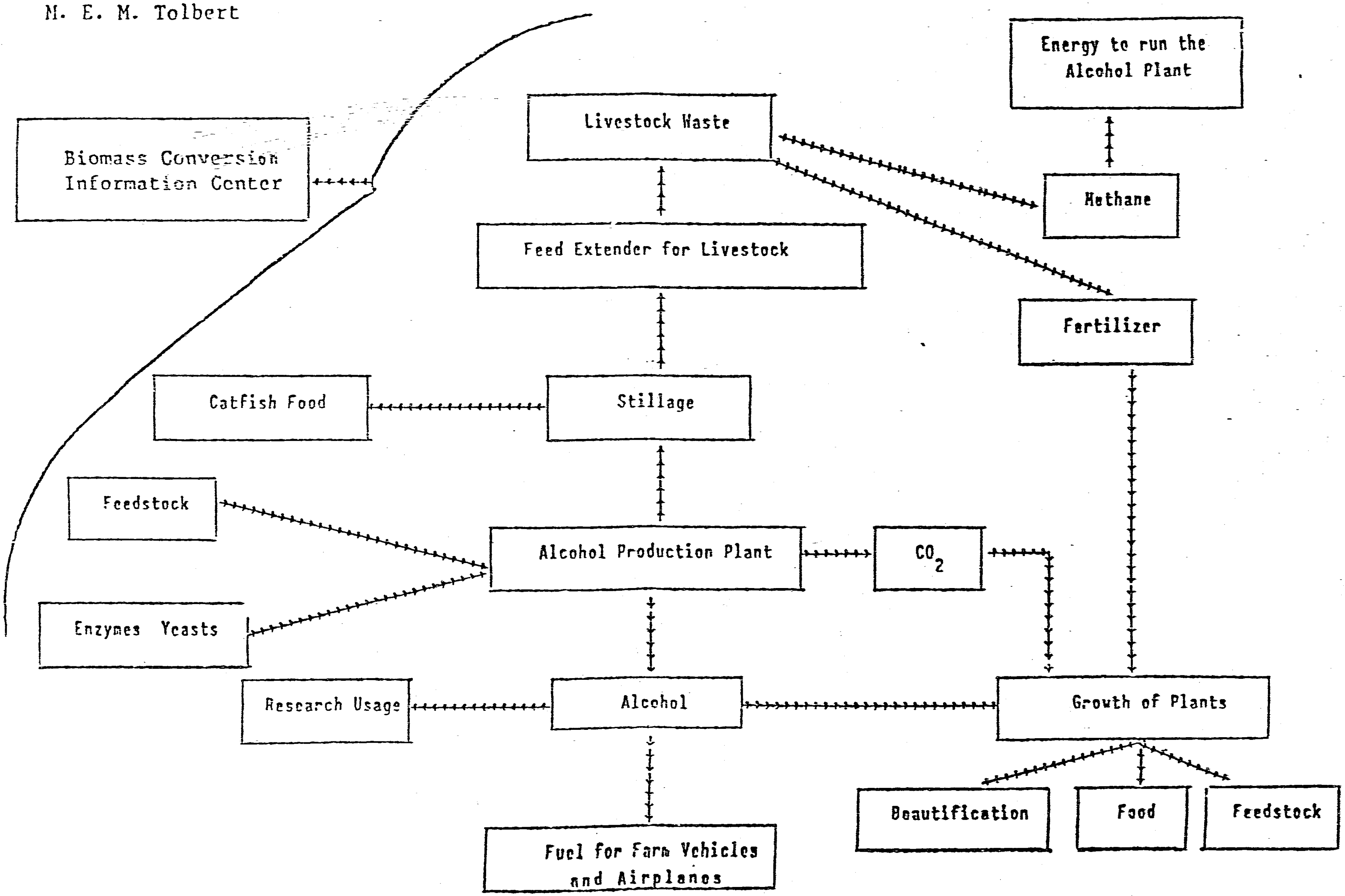
Transportation Costs for a Typical Feed Mill Operating 20-Ton Capacity Truck in 1978

Cost Item	$/mile	$/mile
Fixed expenses		0.11
Labor		0.50
Variables		
Maintenance & Repair	0.14	
Tires	0.03	
Fuel, Oil & Grease	0.12	
Other	0.04	
Total Variables		0.33
Total		0.94

Source: USDA, Small-Scale Fuel Alcohol Production U.S. Government Printing Office, Washington, D.C. 1980.

FIGURE 2

CARVER RESEARCH FOUNDATION
M. E. M. Tolbert



The current costs are more than likely greater than the costs shown in Table 6. As an illustration, if the truck operating costs are $1.00 per mile and a 20-ton (4,800 gallon) load is assumed, then the cost per mile per gallon of stillage is $0.0002 per mile per gallon or $.0004 per delivery mile. If stillage has a value at the farm of $0.075 per gallon, then the plant value drops to zero for a 188 mile delivery radius. Thus, it would seem that as opposed to direct sales, a small scale alcohol plant best enhances the opportunity for self-reliance. The majority of the measurable and unmeasurable benefits would then accrue from on-farm and other University uses.

It has been demonstrated that ethanol can be used in farm equipment as a blend with gasoline in spark ignition and diesel engines (4). Thus, Tuskegee University should be able to reduce its gasoline costs by using ethanol blend for farm machinery and fleet of other university vehicles. Protein by-products, such as stillage, can be fed to farm animals of the Agricultural Experiment station, Department of Agriculture, and School of Veterinary Medicine. In addition, the celluclosic co-product from the plant could be directly fermented to produce methane gas or dried for use as boiler fuel. Methane could be used for grain drying and livestock confinement heating. It has been estimated that for every 100 pounds of feedstocks fermented, approximately 44 pounds of carbon dioxide are produced. Approximately 70%-80% of the carbon-dioxide produced is recoverable (5). Thus, Tuskegee University's plant, using corn with an output of 52,500 gallons per year, can be expected to produce approximately 442,500 pounds of carbon-dioxide. The gas from the fermentors would be relatively pure carbon-dioxide if the fermentors were relatively tight and would be suitable for many uses. As the gas is removed from the fermentors, it could be dried, and compressed for storage. Carbon-dioxide is frequently used to preserve the quality and color of many agricultural products including fresh fruits and vegetables. The color of meat can also be maintained in an inert gas atmosphere. All these are possible uses given the fact the Tuskegee Unviersity farm produce a wide variety of fruit, vegetables, and meat. Carbon dioxide can also be used in Tuskegee University laboratories for research and experimentation.

The type of by-products from an ethanol plant, and thus the associated monetary values will depend upon the nature of the organization, that is, whether it is primarily a grain, vegetable, or a livestock farm. Every situation is different and the Tuskegee University plant can only serve as an example to illustrate some of the products from an ethanol plant. For a different setting, Tuskegee University personnel will be willing to assist a potential investor in analyzing financial requirements, choosing an organizational form, assessment of the market, selecting financial sources, and providing technical assistance.

NOTES

[1] Spencer, Milton H. and Louis Siegelman, Managerial Economics: Decision Making and Forward Planning, Richard D. Irwin, Inc., 1964, pp. 258-286.

[2] Feed and Fuel from Ethanol Production, Proceedings from the Feed and Fuel from Ethanol Production Symposium, Philadelphia, PA, September 15-16, 1981.

[3] Fuel from Farms: A Guide to Small-Scale Ethanol Production, Solar Energy Research Institute, February 1980, pp. B-25 - B-26.

[4] Paul J. K., Large and Small Scale Ethyl Alcohol Manufacturing Processes from Agricultural Raw Materials, Noyes Data Corporation, 1980, p. 434.

[5] Hunt, Daniel V, The Gasohol Handbook, Industrial Press Inc., New York, NY 1981

[6] The Gasohol Handbook, p. 220

APPENDIX A

A-1

AVERAGE YIELD[1] OF 99.5 PERCENT EtOH ALCOHOL PER TON

Material	Gallons
Wheat (all varieties)	85.0
Corn	84.0
Buckwheat	83.4
Raisins	81.4
Grain Sorghum	79.5
Rice, rough	79.5
Barley	79.2
Dates, dry	79.0
Rye	78.8
Prunes, dry	72.0
Molasses, blackstrap	70.4
Sorghum cane	70.4
Oats	63.6
Non-Wood Cellulose (approx.)	62.0
Figs, dry	59.0
Sweet potatoes	34.2
Wood (approx.)	34.0
Yams	27.3
Potatoes	22.9
Sugar beets	22.1
Figs, fresh	21.0
Jerusalem artichokes	20.0
Pineapples	15.6
Sugar cane	15.2
Grapes (all varieties)	15.1
Apples	14.4
Apricots	13.6
Pears	11.5
Peaches	11.5
Plums (nonprunes)	10.9
Carrots	9.8

[1] Probable yield from a short ton of the raw material, calculated from the average fermentable sugar content.

Source: P. B. Jacobs and H. P. Newton, U.S. Department of Agriculture, Misc. Pub. 327, December, 1938. Modified to include cellulose and wood.

Taken from: Alcohol Fuels Workshop, Presented for Farmers Home Administration/U.S. Department of Agriculture and Economic Development Administration/U.S. Department of Commerce, December, 1979. Presented by Butler Research and Engineering Company, St. Paul, MN 55112

A-2

COMPARISON OF RAW MATERIALS
FOR ETHANOL PRODUCTION

Raw Material	Gal Ethanol	Protein Yield	%Protein dry
Corn	2.6/bu	18lb/bu	29-30
Wheat	2.6/bu	20.7/bu	36
Grain sorghum	2.6/bu	16.8/bu	29-30
Average starch grains	2.5/bu	17.5/bu	27.5
Potatoes(75% Moist) 12-14	1.4/cwt	14.8/cwt	10
Sugar beets	20.3/ton	264/ton	20
Molasses (50% sugar)	0.4/gal	68/ton	20

Source: National Gasohol Commission.

Taken from: Fuel from Farms - A Guide to Small Ethanol Production, Solar Energy Research Institute, February 1980, Appendix D, D-8.

APPENDIX B

B-1

HOLT'S

Production Costs

The cost of producing ethanol from a 100 bushel batch of corn is as follows:

Corn - 100 bushels @ $3.50/bushel	=	$ 350.00
Fuel - 13 gallons of diesel @ $1.24/gallon	=	16.12
- 51 gallons of used oil @ $0.15/gallon	=	7.65
Enzymes - 32 oz. of taka-Therm @ $0.16/oz.	=	5.12
- 40 oz. of Alcoholase I @ $0.22/oz	=	[illegible]
- 30 oz. of Alcoholase II @ $0.53/oz	=	15.90
Yeast - 5 lbs @ $1.00/lb.	=	5.00
Labor - 8 hours @ $4.00/hour	=	32.00
Water -	=	5.00
Electricity	=	6.00
Fix Cost	=	10.00
TOTAL COST	=	$ 4[illegible]3.59
1850 lb. of 27% feed @ $0.10/lb.	=	185.00
TOTAL LESS FEED	=	$ 278.59

My cost for 240 gallons of ethanol produced from 100 bushels of corn is then $298.59 or $1.16 per gallon

Source: Feed and Fuel from Ethanol Production; Proceedings from the Feed and Fuel from Ethanol Production Symposium, Philadelphia, PA., September 15-16, 1981.

B-2

TABLE VI-1. CASE STUDY ASSUMPTIONS

- Corn is the basic feedstock.
- 25-gal EtOH/hr production rate.
- Operate 24 hrs/day; 5 days/week; 50 weeks/yr.
- Feed whole stillage to own and neighbors' animals.
- Sell ethanol to jobber for $1.74/gal.
- Sell stillage for 3.9¢/gal.
- Corn price is $2.30/bu (on-farm, no delivery charge, no storage fees).
- Operating labor is 4 hrs/day at $10/hr.
- Corn stover cost is $20/ton.
- Equity is $69,000.
- Debt is $163,040; at 15% per annum; paid semi-annually.
- Loan period is 15 yrs for plant; 8 yrs for operating capital and tank truck.
- Miscellaneous expenses estimated at 12¢/gal EtOH produced.
- Electricity costs estimated at 2¢/gal EtOH produced
- Enzymes estimated at 4¢/gal EtOH produced.

Source: Fuel from Farms - A Guide to Small Scale Ethanol Production, Solar Energy Research Institute, February 1980, p. 76.

B-4-1

CITY OF TUSKEGEE

...FROS
...RMAN PRO TEM

...ILMEN
...K H. BENTLEY
... IVEY
... WELL
...AM PETERSON

JOHNNY FORD, MAYOR
TUSKEGEE, ALABAMA 36083
205/727-2180

LINDA J. CARROLL
CITY CLERK-TREASURER
CAL WILSON
ADMIN. ASST. TO MAYOR FOR COMMUNITY DEVELOPMENT
FRED D. GRAY
CITY ATTORNEY
J. B. WALKER
CHIEF, POLICE DEPT.
LUTHER CURRY
CHIEF, FIRE DEPT.
HATTIE M. KING
PURCHASING AGT.
PATRICIA K. SOLOMON
COMPTROLLER
SYLVESTER JOHNSON
DATA PROCESSING MANAGER
WILLIAM TURNER, JR.
SUPT. LIGHT DEPT.
LEONARD PITTS
SUPT. WATER/WASTE DEPT.
WILLIE COPELAND
SUPT. SEWAGE TREATMENT
JIMMY PADGETT
SUPT. WATER TREATMENT
WILLIAM FOSTER
PUBLIC WORKS DIRECTOR
MARTHA D. SWAN
PERSONNEL DIRECTOR
SAMUEL D. DAVIS
BUILDING CODES INSPT.
EDDIE MOORE
SUPT. SANITATION DEPT.
ERNEST ROBINSON
SUPT. STREET DEPT.
FRANK WALKER
RECREATION DIRECTOR
JOANN NEWTON
DIR. SR. CITIZENS
CLINTON JACKSON
SUPT. [illegible]

RESIDENTIAL UTILITY RATES
Effective Date: October 1, 1984 Billing

MONTHLY RATES:

Electricity: Code E-1

$7.00 customer service charge; plus
6.09 per KWH for first 1,000 KWH; plus
6.09 per KWH for all over 1000 KWH (summer rate - June thru October)
4.72 per KWH for all over 1000 KWH (winter rate - November thru May)

PLUS APPLICABLE TAXES AND FUEL ADJUSTMENT

WATER: Code W1

$2.00 per thousand gallons
Minimum: $8.00 (up to 4,000 gallons of water)

SEWAGE: Code SE

$1.68 per thousand gallons of water used
Minimum $5.04 (up to 3,000 gallons of water used)

GARBAGE: Code GA

$5.00 per dwelling

RESIDENTIAL DEPOSITS

Lights: $60.00
Water: $25.00

MONTHLY ELECTRIC RATE SUMMARY

Residential - E1

7.00 customer service charge; plus
6.09 per KWH for first 1,000 KWH; plus
6.09 per KWH for all over 1000 KWH (summer rate - May thru Sept.)
4.72 per KWH for all over 1000 KWH (winter rate - Oct. thru Apr.)

Commercial - E2 (Less than 25 KW demand)

7.00 customer service charge; plus
7.99 per KWH for first 2000 KWH; plus
6.94 per KWH for all over 2000 KWH

Industrial - E3 (25 KW demand and above)

4.64 per KW of Billing capacity; plus
5.57 per KWH for first 30,000 KWH; plus
4.30 per KWH for all 30,000 KWH

Veterans Administration Hospital - E4

4.45 per KW for Billing Capacity; plus
4.51 per KWH for the first 500,000 KWH or less; plus
4.09 per KWH for the next 500,000 KWH or less; plus
3.98 per KWH for all over 1,000,000 KWH

Tuskegee Institute - E5

4.45 per KW for Billing Capacity; plus
4.51 per KWH for the first 500,000 KWH or less; plus
4.09 per KWH for the next 500,000 KWH or less; plus
3.98 per KWH for all over 1,000,000 KWH

Cotton Gin -E6

294.70 for the first 2000 KWH; plus
8.47 per KWH for all over 2000 KWH

Non-Profit -E7

7.00 customer service charge; plus
7.25 per KWH for all energy

Municipal -M1

4.22 per KWH of all energy

Street Light

5.00 without pole
6.50 with pole

CHAPTER III

COMPUTER SEMINARS

The purpose of the second activity funded by the grant from the U.S. Department of Energy was to provide microcomputer training to minority businesses, especially those minority persons working or planning to work in energy-related businesses. Thus, efforts were made to contact the potential participants. The Small Business Development Center (SBDC) at Tuskegee University was extremely helpful in trying to identify the minority businesses that might benefit from the seminars. The director of the SBDC at Tuskegee University contacted a number of offices of SBDC's in Alabama and Georgia to obtain addresses and telephone numbers of the target population for extending invitations to the seminars.

The seminars focused on the use of spreadsheets, data base management, accounting, and general computer use including word processing. Documents, including a background of microcomputers, were prepared for distribution to the participants (see Appendix). The seminar leaders prepared other material as needed for each of the different seminars. Consultants from Systems and Computer Technology Corporation, Detroit Michigan, Office of Computer Services, Henry East and the School of Business at Tuskegee University were used as consultants for planning and delivery of the computer seminars. The seminars were held on October 21 and December 5, 1985 and February 24, 1986 in the School of Business at Tuskegee

University. The grant was helpful in the purchase of two Zenith (IBM compatible) microcomputers and a variety of software. These microcomputers, along with other microcomputers available in the School of Business, were utilized for training. All the seminars consisted of two parts--(1) theory and background of the computers and the software and (2) actual work on the computers. The equipment and the software purchased with the grant from the U.S. Department of Energy is maintained in the School of Business and will be available in the future not only to the students, but for any business person that wants to evaluate the software packages. Thus, there will be ongoing benefits to minority businesses from the seminars that have been conducted. As an example, Rhodes Motor Company, a minority owned Chrysler automobile dealership in Central Alabama has purchased a microcomputer system as a result of the information gathered during the seminars. In the months ahead, the faculty of the School of Business will be assisting this business in computerizing its service records. Thus, the offering of the computer seminars has generated benefits that would go beyond the grant period. Appendix to this chapter has summary of the evaluation for each of the seminars.

Even though the computer related seminars offered at the School of Business at Tuskegee University were successful to a degree, it was felt that this activity was not realizing its full potential. The main reason being that some of the minority and small businesses located in metropolitan areas do not want to leave their businesses and travel to Tuskegee to attend the seminars. As a result the personnel involved with the project came to the conclusion that it is essential that workshops on the use of computers be held in two metropolitan areas. It was felt that this will allow minority business enterprises located in those two areas the opportunity to learn about the latest high-technology business applications with emphasis on use of computers. Additional funds were requested from the U.S. Department of Energy to carry out this activity which was not included in the original project. Tuskegee University cost shared some of its resources especially in the form of personnel salaries.

One seminar was offered in Birmingham, Alabama on August 21, 1986. The Small Business Development Center (SBDC) of the University of Alabama at Birmingham (UAB) was helpful in site selection, physical arrangements and publicity for the seminar. The seminar was held at Carrie-Don Marshall Center and local newspapers and radio stations were utilized to attract seminar participants. The topics chosen for the seminar included data base management, accounting and budgeting. Consultants from Miles College and Ypsilanti Michigan were used for this seminar.

The second seminar was offered in Montgomery, Alabama on August 25, 1986. The SBDC at Alabama State University in Montgomery was helpful in site selection, physical arrangements and publicity. Once again the topics chosen for the seminar were data base management, accounting and budgeting. Outside consultants were used to assist the Tuskegee personnel.

APPENDIX

Background

The microcomputer market has received a great deal of attention recently. When microcomputers first appeared, they were used by hobby oriented engineers, programmers, electronics buffs and other technically competent and inquisitive individuals.

In the last few years, manufacturers have begun to offer user-oriented microcomputer systems. At the heart of a microcomputer is a microprocessor that performs arithmetic/logic operations and functions, such as the Central Processing Unit (CPU) of a large computer. With the advent of the microcomputer and the microcomputer systems, the planner and managers of small cities have an opportunity to improve the performance of their transportation systems on several fronts. They can reduce dependence on labor to perform routine tasks. Much of the arduous bookkeeping and record keeping can be done via automation. Heretofore, technology has lagged behind need, but the advent of database systems makes this feature available on even very small microcomputers.[1]

The advent of the microcomputer system means that the manager of a small organization has access to tools and information never before available. In one sense, the microcomputer can perform tasks that were previously too time consuming. Second, it can perform tasks that were too difficult before,

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[1]William D. Haueisen and James L. Camp, Business Systems for Microcomputers, Prentice Hall, Inc., ENglewood Cliff, New Jersey, 1982.

such as large scale mathematical modeling that might take thousands of trial-and-error iterations.

It should be recognized that the microcomputer is only a computational tool. Effective use requires two additional ingredients both of which are more difficult to manage that the hardware itself. First, it requires microcomputer programs or software that is capable of guiding the microcomputer through complicated tasks. Software is expensive and there is very little in the market that is of acceptable quality. Second, before a microcomputer can be a resource, the business manager needs the education to use information in an effective way. If stacks of reports come out of the microcomputer but wind up in the wastepaper basket, the microcomputer is not a resource; to the contrary it is a liability.

TERMINOLOGY: The following terminology will be helpful in understanding the findings reported in Chapter III.

Hardware: The most visible part of any microcomputer system is a hardware. Hardware is the tangible equipment: the metal box, tape machines, television-typewriters, and so on. Usually hardware comes in pieces that are connected together. The heart of the microcomputer is the central processing unit or CPU, which is frequently located on a board on the microcomputer box.

Software: The weak link in the microcomputer revolution is software--the programs that run on the microcomputer and perform the tasks required. The costs of program development have steadily risen to the point where in many cases the software costs exceed the cost of the hardware.

Application programs perform specific data-processing or computational tasks to solve an organization's information needs. A software called RUCUS was developed by UMTA, the U.S. Department of Transportation. Its main function is in the area of bus scheduling.

Problems with most of the application programs are that they were developed for larger computers and cannot be readily implemented on a microcomputer to solve a problem.

Systems: When hardware and software are assembled together and address a particular problem (such as running a transportation system) the total configuration is called a system.

Distributed Data Processing: Before the introduction of microcomputers, emphasis was on developing large and more powerful mainframes. With the advent of microcomputer technology, development has proceeded on both large and small scale computer fronts. Distributed data processing decentralizes the computer power usually moving portions of it to subsidiary locations. The reason for this may be that locations are widespread with each location having unique requirements. In addition, the purpose of data processing power distribution may be managerial as well as technical. Distributed data processing can be a powerful, interactive management tool for strategic analysis, for off-period performance tracking, or for scenario development as part of the planning process.

LOOKING AHEAD

It has been estimated that by the end of the current decade, 60 percent of the civilian population of the U.S. below retirement age will interact with microcomputers on a daily basis.[2]

Presently, the microcomputer industry is in the midst of an evolution from 8-bit to 16-bit processors. Sixteen-bit processors are faster, have twice as many data paths and larger instruction set and, consequently, are much more powerful. If they are compatible with the remaining hardware, they clearly point the way of the future.

Even though sixteen-bit microcomputers are picking up momentum as a greater variety of vendors and operating systems enter the market, the question still remains which should the smart user stick with? Some experts expect continued use of 8-bit computers because there is a "tone" of software out there for 8-bit computers. On the other hand, some experts like Dr. Harold C. Kline, Senior Vice-President of Future Computing, Inc., believe that sixteen-bit computers will become the new standard for professional use. According to him, "As 16-bit systems proliferate, the memory limitations of 8-bit machines will become apparent. By logical progression the growth rate for 8-bit software will slow down. More software will soon be written for 16-bit computers."[3]

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[2] Larry Bramblett, President, Mag Inc., Presentation at the Invitational Dean's Meeting of the American Association of Collegiate Schools of Business (AACSB), January 25, 1983, Atlanta, Georgia.

[3] Harold C. Kline, "Special Report: Look Ahead." Business Computer Systems, January, 1983, Page 57.

Sixteen-bit machines are already making their mark in both the hardware and the software categories. Many companies have already introduced 16-bit machines. Others are ready to enter the market.

Seminar: Practical Use of Personal Computers in a Business

Date: October 21, 1985

COURSE EVALUATION

Please use the following scale to indicate your response to the statements below: SA=strongly agree; A=agree; UN=undecided/not applicable; D=disagree; SD=strongly disagree.

1. The training you attended:
   was sufficient for my purpose.
   a) 50% SA b) 50% A c) __ UN d) __ D e) __ SD
   gave me a good working knowledge of the subject presented.
   a) 90% SA b) 10% A c) __ UN d) __ D e) __ SD
   allowed me to acquire practical skills and knowledge needed to manage my business effectively and efficiently.
   a) __ SA b) __ A c) __ UN d) __ D e) __ SD

2) Did you believe the information was presented effectively?
   a) 100% Yes b) __ No c) __ No opinion

3) Did you believe that the material presented in the course was practical?
   a) 100% Yes b) __ No c) __ No opinion

TRAINER

The specific trainer's: (If more than one, rate each by name.)
a) capacity to hold participant's interest was:

Name	Very good	Good	Undecided	Fair	Poor
Dr. T. S. Sara	100%				

b) organization of the program was:
very good 100%
good ____
undecided ____
fair ____
poor ____

c) level at which topic was presented:
very good 90%
good ____
undecided ____
fair ____
poor ____

d) communication skills were:
very good 100%
good ____
undecided ____
fair ____
poor ____

CLIENT PROFILE

1. Sex: ____ Male ____ Female

2) Veteran Status: 1 ___ A Vietnam Veteran 2 ___ A Non-Vietnam Veteran
   3 ___ Not a Veteran

3) Racial/Ethnic Status:
   1 ___ American Indian or Alaskan Native 2 ___ Hispanic 3 ___ White
   4 ___ Black, not Hispanic Orgin 5 ___ Asian or Pacific Islander
   6 ___ Other race (specify, if desired) ____________

4. Education:
   1 ___ Less than 12 years 4 ___ College degree
   2 ___ High school graduate 5 ___ Some Graduate school
   3 ___ Some college 6 ___ Graduate school degree

Current Age: ____________

ADDITIONAL COMMENTS/OBSERVATIONS: (OPTIONAL)

Seminar: Accounting Systems for Small Businesses

Date: December 5, 1985

COURSE EVALUATION

Please use the following scale to indicate your response to the statements below: SA=strongly agree; A=agree; UN=undecided/not applicable; D=disagree; SD=strongly disagree.

1) The training you attended:
   was sufficient for my purpose.
   a) 33% SA b) 50% A c) 11% UN d) 11% D e) __ SD
   gave me a good working knowledge of the subject presented.
   a) 22% SA b) 67% A c) __ UN d) __ D e) __ SD
   allowed me to acquire practical skills and knowledge needed to manage my business effectively and efficiently.
   a) 11% SA b) 39% A c) 39% UN d) 6% D e) __ SD

2) Did you believe the information was presented effectively?
   a) 78% Yes b) 12% No c) __ No opinion

3) Did you believe that the material presented in the course was practical?
   a) 83% Yes b) 7% No c) __ No opinion

TRAINER

The specific trainer's: (If more than one, rate each by name.)
a) capacity to hold participant's interest was:

Name	Very good	Good	Undecided	Fair	Poor
Henry East	40%	35%	5%	20%	

b) organization of the program was:
- very good 33%
- good 60%
- undecided ___
- fair 7%
- poor ___

c) level at which topic was presented:
- very good 15%
- good 75%
- undecided ___
- fair 10%
- poor ___

d) communication skills were:
- very good 30%
- good 70%
- undecided ___
- fair ___
- poor ___

CLIENT PROFILE

1. Sex: 67% Male 28% Female

2. Veteran Status: 1 11% A Vietnam Veteran 2 17% A Non-Vietnam Veteran 3 56% Not a Veteran

3. Racial/Ethnic Status:
   1 __ American Indian or Alaskan Native 2 __ Hispanic 3 6% White
   4 89% Black, not Hispanic Orgin 5 __ Asian or Pacific Islander
   6 __ Other race (specify, if desired) ___

4. Education:
   1 __ Less than 12 years 4 28% College degree
   2 17% High school graduate 5 11% Some Graduate school
   3 33% Some college 6 6% Graduate school degree

5. Current age: ___

ADDITIONAL COMMENTS/OBSERVATIONS: (OPTIONAL)

Seminar: Data Base Management
Date: February 24, 1986

COURSE EVALUATION

Please use the following scale to indicate your response to the statements below: SA= strongly agree; A=agree; UN=undecided/not applicable; D=disagree; SD=strongly disagree.

1) The training you attended:
   was sufficient for my purpose.
   a) ___ SA b) 50% A c) 25% UN d) 25% D e) ___ SD
   gave me a good working knowledge of the subject presented.
   a) 50% SA b) 25% A c) 25% UN d) ___ D e) ___ SD
   allowed me to acquire practical skills and knowledge needed to manage my business effectively and efficiently.
   a) 25% SA b) 25% A c) 25% UN d) ___ D e) 25% SD

2) Did you believe the information was presented effectively?
   a) 75% Yes b) ___ No c) 25% No opinion

3) Did you believe that the material presented in the course was practical?
   a) 75% Yes b) ___ No c) 25% No opinion

TRAINER

The specific trainer's: (If more than one, rate each by name.)
a) capacity to hold participant's interest was:

Name	Very good	Good	Undecided	Fair	Poor
Larry Noyes	33%	67%			
Paul Pitts	33%	67%			

b) organization of the program was:
very good ___
good 50%/50%
undecided ___
fair 50%/50%
poor ___

c) level at which topic was presented:
very good 33%/33%
good 67%/67%
undecided ___
fair ___
poor ___

d) communication skills were:
very good 100%/100%
good ___
undecided ___
fair ___
poor ___

CLIENT PROFILE

1. Sex: 25% Male 75% Female

2. Veteran Status: 1 ___ A Vietnam Veteran 2 ___ A Non-Vietnam Veteran
   3 100% Not a Veteran

3. Racial/Ethnic Status:
   1 ___ American Indian or Alaskan Native 2 ___ Hispanic 3 25% White
   4 75% Black, not Hispanic Orgin 5 ___ Asian or Pacific Islander
   6 ___ Other race (specify, if desired) ___

4. Education:
   1 ___ Less than 12 years 4 25% College degree
   2 ___ High school graduate 5 ___ Some Graduate school
   3 75% Some college 6 ___ Graduate school degree

   Client Age: ___

5. ... COMMENTS/OBSERVATIONS: (OPTIONAL)

CHAPTER IV

ENERGY SEMINAR

In the academic year, August, 1985 thru May, 1986, the School of Business at Tuskegee University offered a course entitled "Energy Seminar". This class awarded credit for the successful completion of the requirements. The main purpose of this course was to generate interest among students in energy-related and high-tech businesses. It is hoped that as a result of these classes some business, economics and engineering students will become future entrepreneurs in energy and high-tech areas.

The main objectives of the course were that the students should become knowledgeable of:

1. The most common energy sources
2. The methods of production in each source
3. Cost/benefit analysis -
    a. commercial potential-fuel, light, heating/cooling
    b. safety factors involved in production and use
    c. pollution from processing and use
4. Student potential as an entrepreneur in energy related fields.

The structure of the course was built around macro and micro topics in the field of energy. The major topics discussed were as follows:

Macro Topics

1. Students were asked to read articles on the cost/benefit of different sources of energy - coal, geothermal, hydroelectric, nuclear, oil and solar.

2. Articles were assigned on the world energy picture. For example, study of OPEC pricing policy, effect of falling oil prices on the U.S. economy.

3. Other

Micro Topics

1. Technical

   - Energy audits for private homes and commercial buildings

   - Cost/benefits of different energy saving devices, e.g., solar and insulation

   - Study of energy management at various companies (energy conservation)

2. Practical Exercise

   - Study of the Tuskegee University alcohol plant

   - Design an energy-savings plan for Tuskegee University

The course outlines and grade results are given in the appendix to this chapter. The success of these energy related classes has convinced us to offer the classes again during the 1986-87 academic year.

APPENDIX

BUSINESS 404-22 INDEPENDENT STUDY - ENERGY SEMINAR

INSTRUCTOR - Marius Jones, Jr., Director
Tuskegee University Small Business Development Center

CLASS TIME - TBA

CREDIT HRS - 1 semester hour

INTRODUCTION - Society is using up certain nonrenewable fossil fuels--oil and natural gas--at a frightening pace. This situation has created new problems and concerns. These are to be examined from an entreprenuerial perspective.

PREREQUISITES - No preparatory course required - designed for sophomores and above.

- Topics covered in a logical progression - macro (general) and micro (specific).

WORK - Course will consist of discussions, lectures and outside reading. Regular attendance with class participation is mandatory. The class will meet at a minimum of one hour each week. (Tentative: Thursdays at 2:30 - Room TBA)

ASSIGNMENTS - Assignments will be designed to gather information on various energy forms. That is, what alternatives do businesses have to energy usage and the cost/benefit thereof. Also, the problems confronting those business concerns operating in energy-related fields, locally, nationally and internationally.

TEXTBOOK - No required text. Students will need access to various journals and trade publications for resource, research and reference work.

TEST - None

GRADING -

Written assignments	25%
Oral participation	25%
Attendance	10%
Design an energy-saving plan for TU	40%
FINAL GRADE	100%

OFFICE HOURS - Open daily

TUSKEGEE UNIVERSITY

SPRING SEMESTER 1985-86

CLASS ASSIGNMENT: BUSINESS 404-22

INSTRUCTOR: Marius Jones, Jr.
Small Business Development Center
1103-A Old Montgomery Road (Old Tuskegee Federal Savings & Loan building by campus bookstore)
727-6307

OFFICE HOURS: Daily

OBJECTIVES: From a business prespective, discuss all phases of the below listed energy sources in detail:

1. what it is
2. method of production
3. cost/benefit analysis
   a. is it a good product to sell commercially as a fuel, a light source, etc.
   b. is it a good fuel source to use in heating and/or cooling an office building, a home, etc.
   c. safety factors involved, pollution, etc.

ENERGY SOURCES	DATE DUE
1. Coal	January 31
2. Natural gas(es)	February 14
3. Hydroelectric	February 25
4. Geothermal	March 21
5. Nuclear	April 4
6. Solar	April 18

NOTE: Discussion papers are to be neatly written. (They may be typed, but not required.) There is no maximum or minimum word requirement. Subjects must, however, be thoroughly covered to receive maximum credit.

FINAL ASSIGNMENT: DUE BY MAY 8, 1986 - Design an energy-saving plan for Tuskegee University

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QUARTER	INSTRUCTOR	SUBJECT	LEC. HRS.	LAB. HRS.	CREDIT HOURS	SCHOOL CODE	SUBJECT	SECTION	
DEC 1985	JONES M	BUS			1	B	404	04	51 TB

CLASS ROLL - TUSKEGEE INSTITUTE - TUSKEGEE INSTITUTE, ALABAMA

	STUDENT'S NAME			SCHOOL & CLASS		STUDENT'S NO.	GRADE	REMARKS
1	GRANT	PATRICK	L	B	3	51498	C	
2	MCDUFFIE	CHERYL	D	B	3	89805	B	
3	PARKER	CYNTHIA	L	B	4	61030	C	
4	TURNBOW	VICKIE	R	B	4	60441	A	
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SUMMARY OF GRADES GIVEN IN THIS REPORT

A 1 C 2 E ____ W.P. ____ No. IN CLASS 4
B 1 D ____ I ____ W.F. ____ No. PASSED 4

DATE: 12-16-85

INSTRUCTOR'S SIGNATURE: [signature]

QUARTER	INSTRUCTOR	SUBJECT	LEC. HRS.	LAB. HRS.	CREDIT HOURS	SCHOOL CODE	SUBJECT	SECTION	HOUR
MAY 1986	JONES M	BUS			1	B	404	22	TB 52

CLASS ROLL – TUSKEGEE INSTITUTE – TUSKEGEE INSTITUTE, ALABAMA

	STUDENT'S NAME			SCHOOL & CLASS		STUDENT'S NO.	GRADE	REMARKS
1	FAGAN	TAWANDA	Y	B	3	66383	B	
2	NGWIRI	CECILIA	M	B	3	67783	C	
3	WASHINGTON	ANGELA	[illegible]	B	4	66079	A	
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SUMMARY OF GRADES GIVEN IN THIS REPORT

A ______ C ______ F ______ W.P. ______ NO. IN CLASS ______

B ______ D ______ I ______ W.F. ______ NO. PASSED ______

DATE

INSTRUCTOR'S SIGNATURE

END

DATE FILMED

7 / 1 / 92