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IMPROVED POULTRY HOUSE

GRANT #DE FG44-80R410079

DISCLAIMER

TABLE OF CONTENTS

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SUMMARY

Our project explored the relationship of energy and poultry production in three areas:

1. Methane Production from Litter
2. Broiler House Insulation
3. Broiler House HVAC Systems

I. Methane production from litter offers genuine potential to the industry. Our findings show that while a methane plant would not be popular with individual American poultry producers; the pay back in fuel and fertilizer, if the plant was located in close proximinity to the processing plant, would be favorable. The processing plant offers, at a single site, year round high energy consumption as well as personnel capable of operating a methane plant.

II. Broiler house insulation has been dramatically improved since the outset of our study. Presently, all new installations in our survey area are the "Environmental" houses which are fully insulated. The market forces of higher energy prices have brought this change in the industry and pay back for the increased costs are presently being realized in as little as 24-36 months.

III. HVAC systems have had to keep pace with the introduction of better insulation. The new "Environmental" houses HVAC systems are fully automated and operating on a positive atmosphere principal. Amonia and other problems have been kept in check while reducing air changes per house from a high of 7 per hour to as little as 3 per hour.

INSULATION AND HVAC SYSTEMS

At the outset of our project the design and construction of broiler houses was in a dramatic transition. While growers were building the larger 40' x 400' structures, insulation went from a recommendation to a requirement. At the same time the "Environmental" houses researched at the University of Georgia and in Pennsylvania began to come on line. Two factors were at work here, post embargo high energy prices, and reduced prices for the control equipment necessary to operate a more energy efficient building. The industry was extremely fortunate to capitalize on the basic research that had been carried on since the late 1960's in broiler house design as well as the increased availability of more efficient HVAC systems and controls. Our study shows that while many growers had been able to produce competively a few years ago without serious attention to curtain position and properly closed doors, etc. The increased cost of fuel and electricity forced a change in habits. Adding pressure to this change was the increased efficiency of producers with the well insulated "Environmental" houses with their increasingly efficient and automated HVAC systems. (The less stress from heat or cold, amonia, etc., the better the conversion rate of feed to meat). At the present time, the energy input in BTU's for the new broiler houses is fully one half the amount needed for the older houses. Throughout our survey area growers with the old houses were unable to get contracts renewed on the old style buildings unless they were retrofitted with insulation and the grower was extremely diligent in keeping the house in first class working order and faithfully monitored the ventalation system for maximum efficiency.

In view of the projected world food shortages and the need for improved land utility we were interested in exploring the possibility of placing poultry houses on poor land and in situations where land reclimation was eminent such as in areas of coal strip mining.

The technology of bermed building has been increasing at a rapid rate since the oil embargo. Materials are now available which will soon make it possible to construct a poultry house fully or partially below grade with little additional cost above the "Environmental" house. Factors at work here are the increased value of good farm land, the increased price of aluminum for "Environmental" buildings, improved air filtration systems which will allow even fewer changes of air per hour in the near future. (ILLUS I & II).

From reviewing materials presently available, we estimate that the additional costs of below grade construction at some 25% to 30% higher than that experienced with current environmental housing. Clearly population projections, etc., indicate that the market will ultimately provide the incentives necessary to promote this technology. However, at the present time the industry is faced with over production relative to demand and little enthusiasm will be found for technology with such long pay back periods. It is our opinion that the maturing technology of below grade construction and improved air filtration will cross with land prices and the poultry industries needs late in the 1980's. At that time consideration should be given to developing poultry houses on coal strip mine reclamation sites as a good portion of the expense of berming the building will be absorbed by recamation in the interim, new construction should take advantage of natural land features such as Southeast exposures and wind breaks and building on good farm land should be avoided.

METHANE PRODUCTION

Our initial approach to this subject centered on the idea that the gas would be used directly in the growing operation and that each grower would operate his own methane plant. (ILLUS III)

From interviews with growers and field representatives we soon concluded this was not the way to go. The BTU potential of poultry litter far exceeds the needs of the individual grower (ILLUS IV & V). Furthermore, if there is one thing that a grower is not interested in is a new piece of equipment on his farm that requires frequent monitoring. Hence, the idea of a simple Chinese Water Digester coupled with a washed concrete floor was quickly abandoned.

While the technology of methane production is quite old, its application to modern farming is in its infancy. Practically all of todays systems use water as the conduit for the bio-waste products and this is prohibitive in a system where the waste must be transported miles to a central methane plant. The bio-funnel as developed in project Godrum offers a viable solution to the problem.

ANAEROBIC DIGESTER

Bio-Funnel: The bio-funnel (an expanding, radial-overflow digester) was designed, engineered and developed by Benny Bjergbaek, Erik Djernaes, Ted Goldberg, and Axel Mouritsen for the County of Arhus and the Danish Ministery of Education as part of Project Godrum.

The bio-funnel is designed to handle solid farming wastes with a dry solid contents of up to 25% - 30%, but can also handle effluent under 10%. The digester is continuously fed through a hydraulic cylinder which presses the fresh material into the digester and up through a funnel. The geometry of the design induces a natural and gentle mixing as the material passes through the funnel and outer chamber. The material splits itself apart as a result of an expanding movement through the digester. This geometry also eliminates the problem of floating scum formation.

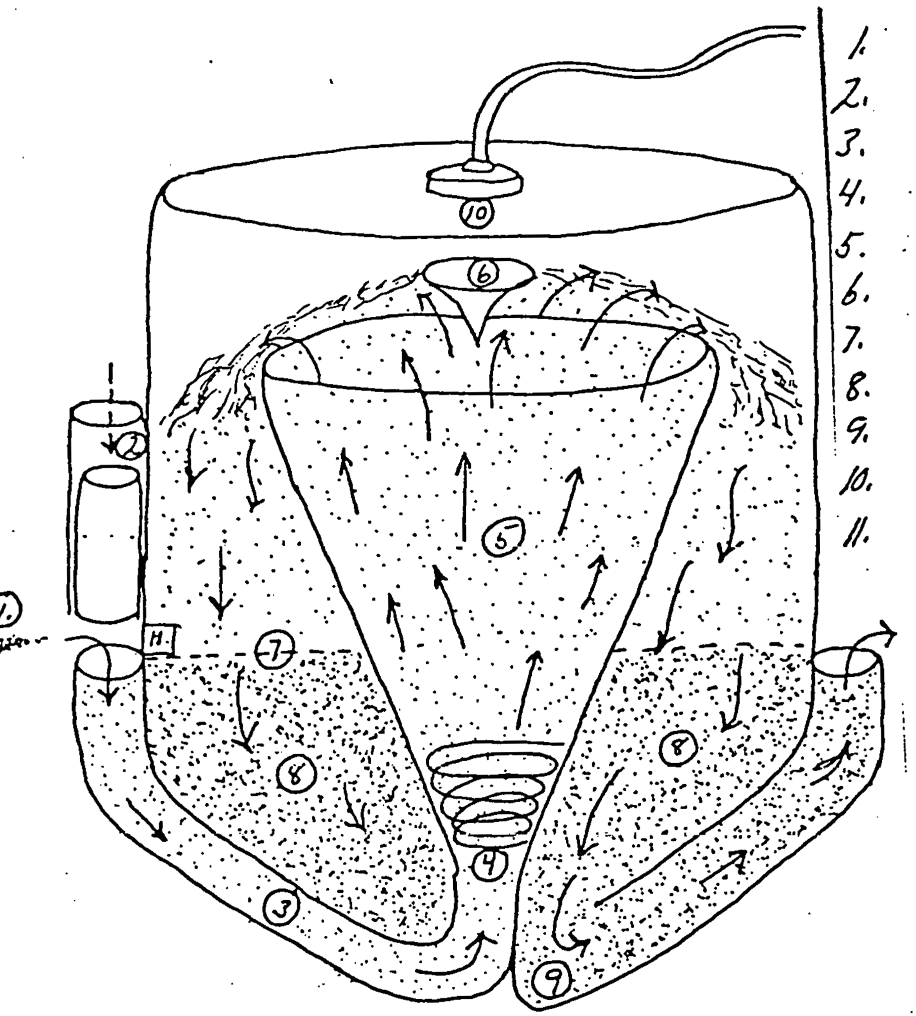
The system is self seeding, and digested material is immediately usable as fertilizer or animal feed.

The use of simple materials and techniques and the elimination of a pump and valve system have radically reduced the construction costs. This simplification enables any farmer to build the system Project Godrum uses a hydraulic loading system, which can be bought as standard equipment in Europe, but simple lever-arm or gear-crank plunger could be constructed so that this digester also can be built in underdeveloped countries.

Function Description:

High solid material (manure with straw bedding) (1) is loaded intermittently through a hydraulic cylinder (2) which presses the material through a feeder tube (3) to the bottom of the digester's funnel. The material is preheated by a built-in spiral (4) before it is pressed further up through the funnel (5) where fermentation begins. Passage through the funnel requires about 10 days before the material reaches the top, where it gets pushed over the top edge by despersion hat (6) and into the digester's outer chamber. The water which develops in the fermentation process fills the outer chamber to a fluid level (7) creating a post-digestion zone (8).

The material is removed through a water lock (9), the height of which defines the fluid level in the post-digestion zone. The gas is taken off (10) and could be used to drive a diesel motor-generator as well as fire the gas heaters. A large gate valve (11) can be opened for initial seeding inspection, etc.



1. LITTER (WOOD CHIPS & CHICKEN MANUR.
2. RAM (MECHANICAL OR HYDRAULIC
3. INLET TUBE
4. HEATING COIL
5. DIVERGENCE FUNNEL
6. DIRECTOR CONE
7. POST DIGESTANT LEVEL
8. WET EFFLUENT
9. WATER TRAP
10. GAS OUTLET
11. INSPECTION & RESEEDING PORT

The energy consumption level at the processing plant as well as the availability of personel to man the plant dictate the logic of locating one in close proximity to the other. The processing plant requires ten gallons of alternatly hot and cold water per bird as well as tons of ice and refrigeration for a single shifts' operation, recovering the energy fed to the birds as well as the energy represented in the wood chips will dramatically effect the cost per pound of finished poultry. The key to this objective lies in the development of a high solid digester.

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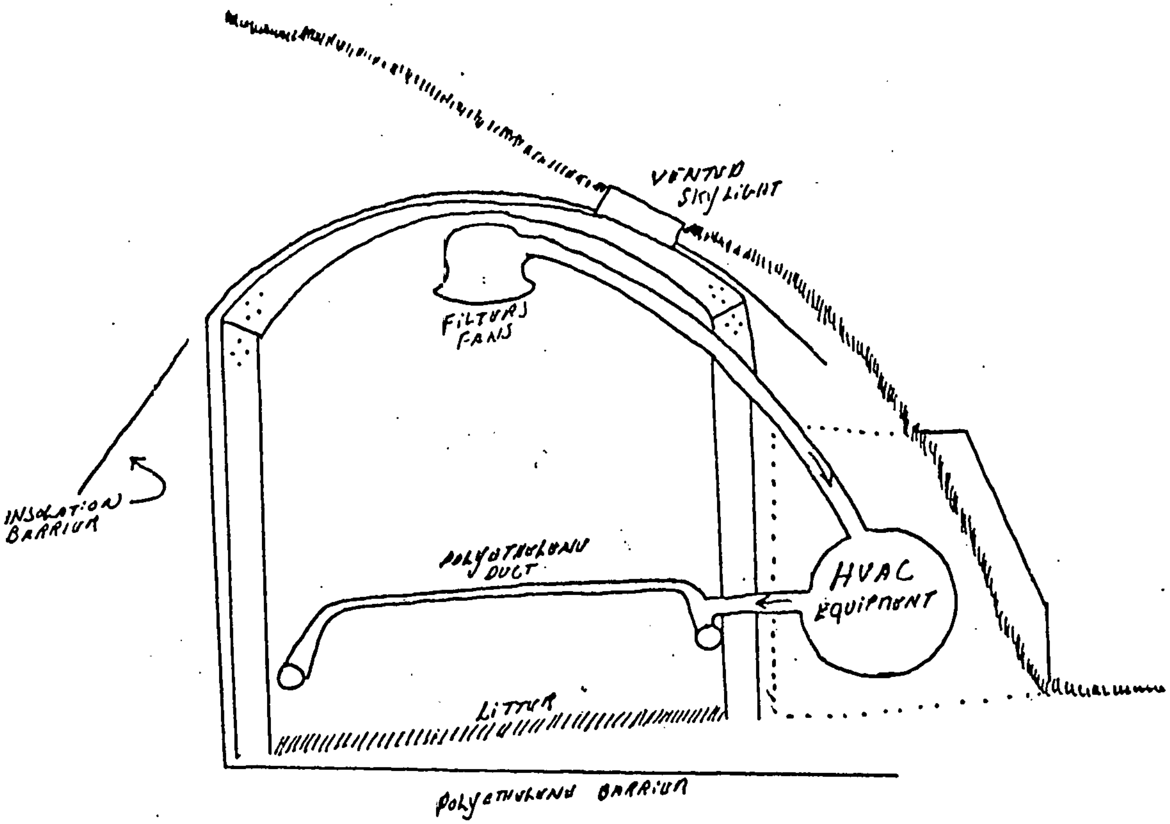
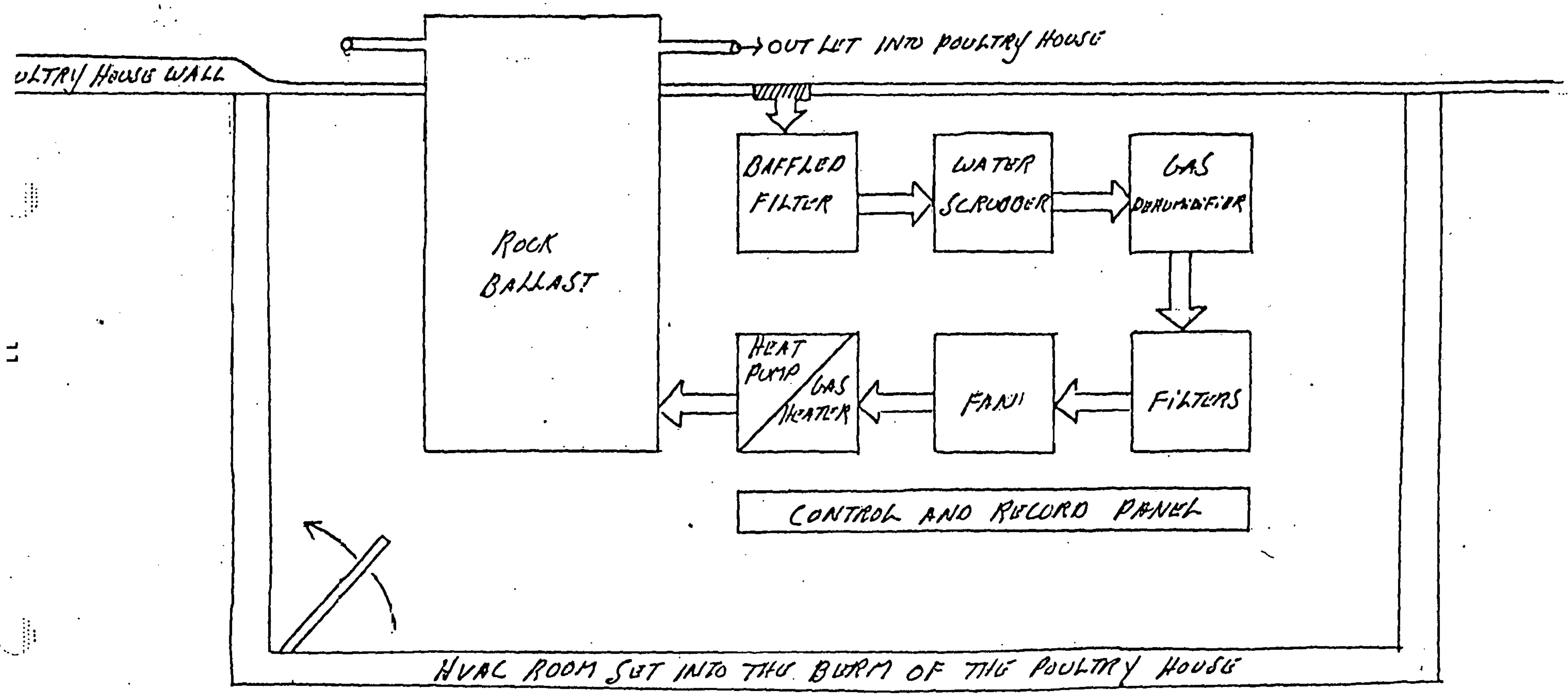
The Poultry Growers of Alabama

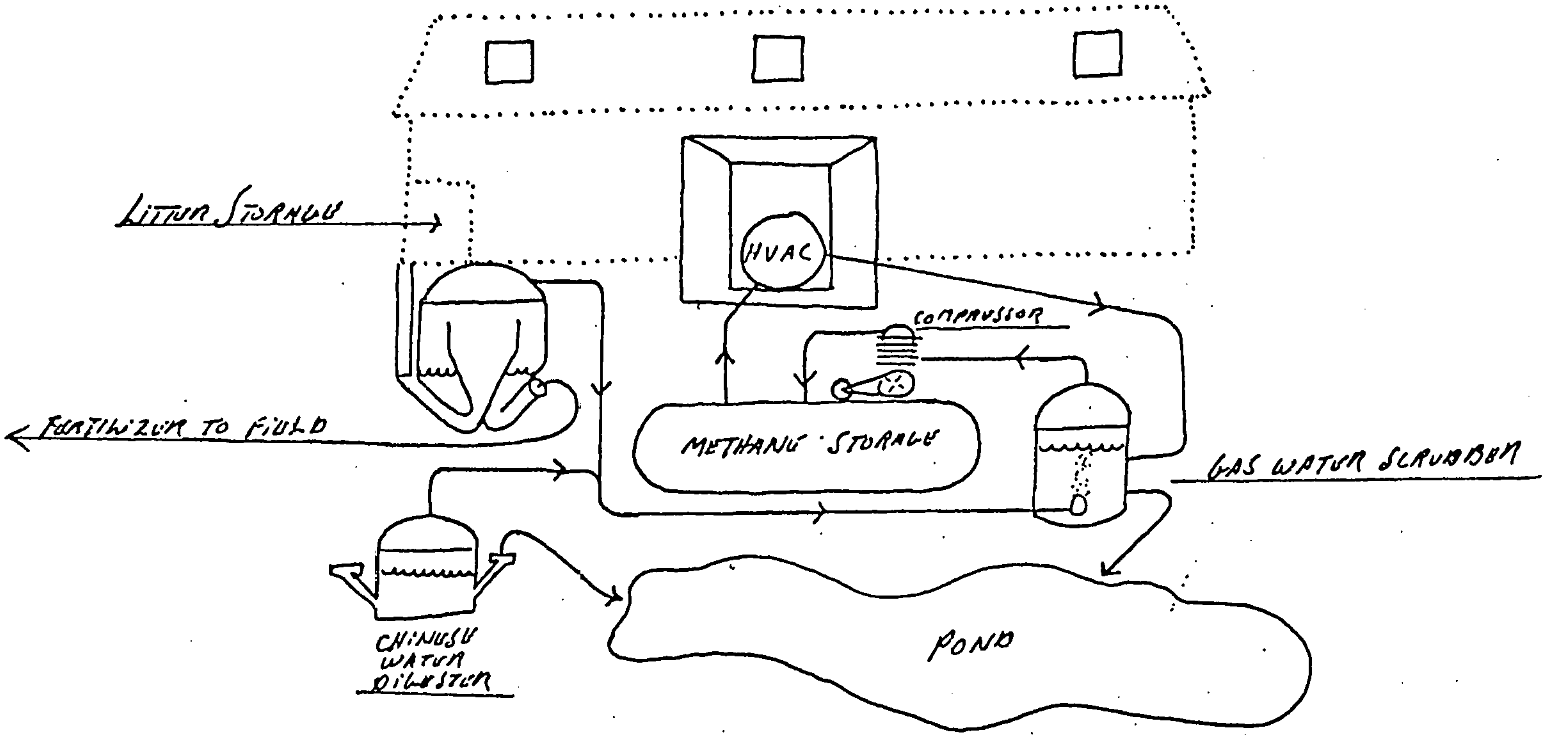
APPENDIX


VENTED
SKYLIGHT
FILTERS
FANS
INSULATION
BARRIER
POLYETHYLENE
DUCT
HVAC
EQUIPMENT
LITTER
POLYETHYLENE BARRIER

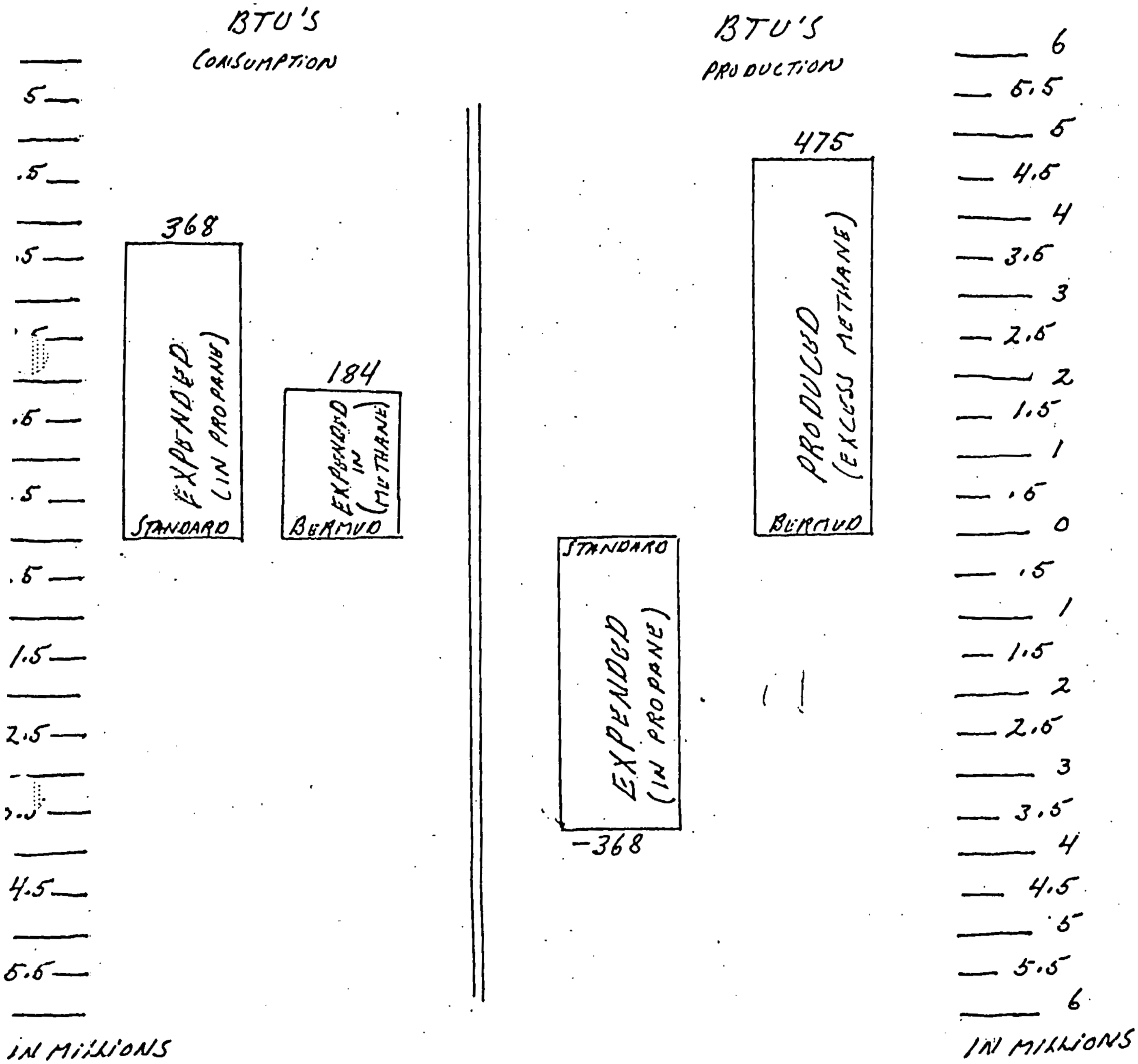


HVAC SYSTEM

ILLUS II


LITTER STORAGE
FERTILIZER TO FIELD
HVAC
COMPRESSOR
METHANE STORAGE
GAS WATER SCRUBBER
CHINESE WATER DIGESTER
POND

ILLUS III


BTU'S
CONSUMPTION
368
184
EXPENDED (IN PROPANE)
STANDARD
EXPENDED IN (METHANE)
BERMUD
IN MILLIONS
BTU'S
PRODUCTION
475
PRODUCED (EXCESS METHANE)
BERMUD
STANDARD
EXPENDED (IN PROPANE)
-368
IN MILLIONS

ILLUS. IV

Illus II

POULTRY MANURE POTENTIAL IN BTU'S

20,000	number of birds
x26	pounds of manure pr year pr bird
520,000	pounds of manure
-50%	unusable (dried out)
260,000	pounds of manure
-50%	undigested or non volatile solids
130,000	pounds of manure
x4,000	BTU's pr pound
520	million BTU's

Total BTU's Potential 2,080 Million
(520,000 lbs x 4,000 BTU's)

WOODCHIP POTENTIAL IN BTU'S

40' x 400' x .25'	size of wood chip bed
x5	beds pr year
20,000	cubic feet of wood chips
x3	pounds pr cubic foot of wood chips
60,000	pounds of wood chips
-20%	of the wasted wood chips
48,000	pounds of wood chips
-50%	of undigested wood chips
24,000	pounds of wood chips
x5,800*	BTU's pr pound (alowing for some hardwood chips)
139.2	
	Total BTU's Potential 348 Million

*Pine shavings are used for litter, but some hardwoods may be present.

COMBINED POTENTIAL OF WOOD CHIPS AND MANURE AND ILLUSTRATION OF STANDARD POULTRY HOUSE BTU CONSUMPTION

139.2	million BTU's from wood chip digestion
520.0	million BTU's from manure digestion
659.2	million BTU's total actually available
-368.0	million BTU's total expenditure of standard Alabama poultry house*
291.2	million BTU's surplus

*Our research indicates the average 40' x 400' Alabama poultry house consumed 4,000 gal of propane last winter at an average cost of 62¢/gal = $2,480.00 Our survey included nine growers in east Alabama.