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# FmHA BIOMASS ENERGY PROGRAM

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## HEARING BEFORE THE SUBCOMMITTEE ON AGRICULTURAL CREDIT AND RURAL ELECTRIFICATION OF THE COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY UNITED STATES SENATE

NINETY-SIXTH CONGRESS

SECOND SESSION

OCTOBER 17, 1980—LINCOLN, NEBR.

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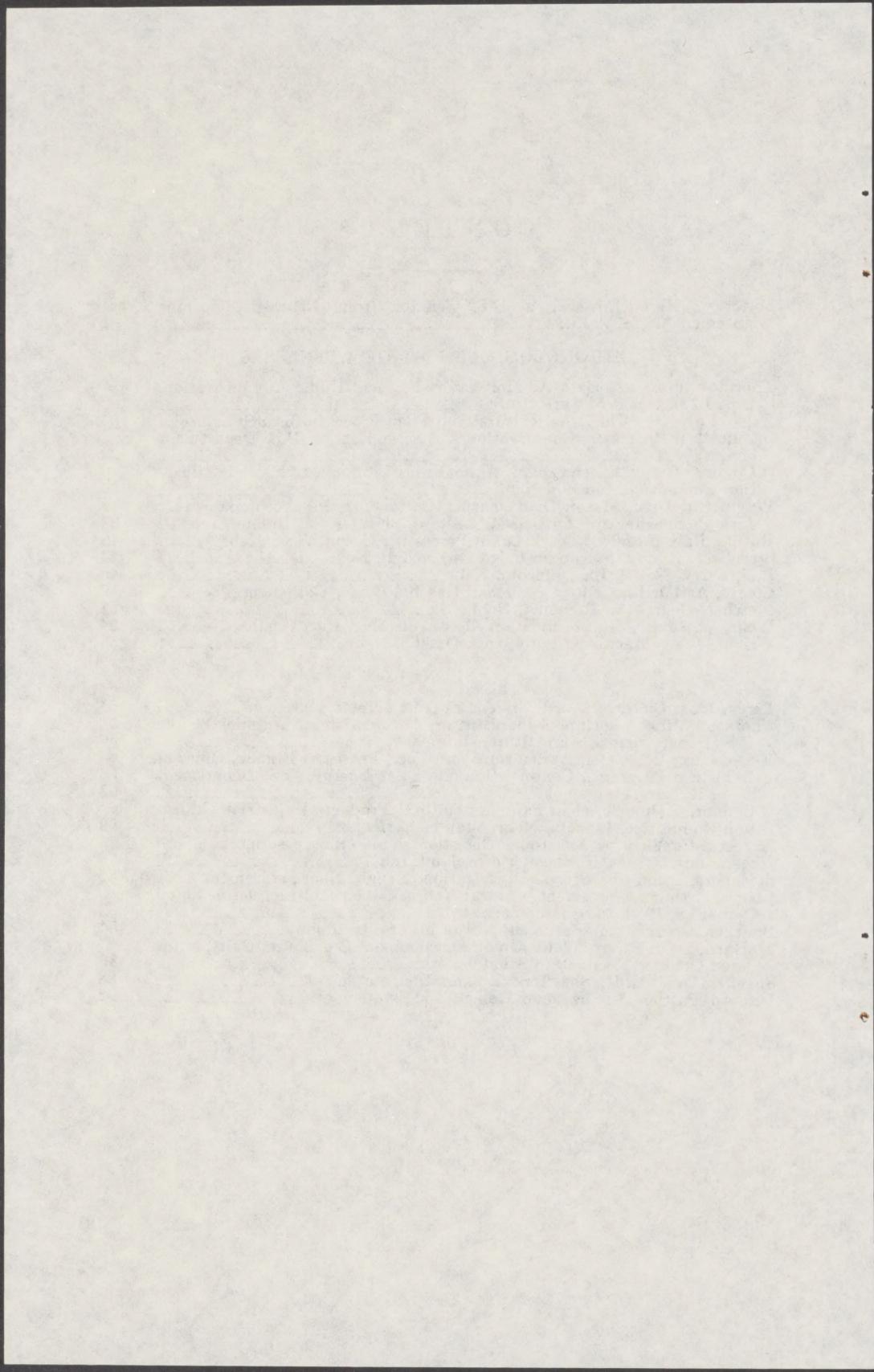
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## FmHA BIOMASS ENERGY PROGRAM

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FRIDAY, OCTOBER 17, 1980

U.S. SENATE,  
SUBCOMMITTEE ON AGRICULTURAL CREDIT  
AND RURAL ELECTRIFICATION OF THE  
COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY,  
*Lincoln, Nebr.*

The subcommittee met, pursuant to notice, at 9:30 a.m., in the Cottonwood Room at the East Union, East Campus, University of Nebraska, Hon. Edward Zorinsky (chairman of the subcommittee), presiding.

Present: Senator Zorinsky.

### STATEMENT OF HON. EDWARD ZORINSKY, A U.S. SENATOR FROM NEBRASKA

Senator ZORINSKY. I'd like to call to order our hearing on biomass energy programs. My name is Edward Zorinsky, Senator for the State of Nebraska, and I have called these hearings for the purpose of taking a look at title II of the Energy Security Act—the Biomass Energy and Alcohol Fuels Act of 1980—to determine if the law and the regulations which implement it will provide the kind of assistance to biomass development that Congress envisioned when we passed this legislation. We need to review the implementation of this act by the Department of Agriculture and the Department of Energy. We particularly need to assess whether the programs authorized by this law are reaching farmers, ranchers, and agricultural cooperatives.

Events in the past few weeks have demonstrated again how imperative it is that we free ourselves from OPEC dominance. Foreign crude oil is now selling for \$34 a barrel. This is an increase of 40 percent over just a year ago. The continued availability of this oil, even at these high prices, is seriously threatened by the war between Iraq and Iran, countries which export almost half of the oil used by the free world. Prior to the Middle East conflict, we were told that we had an oil glut, with stocks more than adequate to fuel America through the winter. Now we are told that we may soon face another period of tight supplies.

There is an alternative to OPEC dominance over our energy resources. We have it in our own backyard. Biomass—organic matter which is available on a renewable basis—holds the key to energy independence for the United States of America. Biomass energy can be either alcohol produced in a traditional still or methane—biogas—produced from waste material through a process known as anaerobic digestion.

This resource is literally everywhere—in the feedlots and cornfields of Nebraska, the dairy farms of Wisconsin, the hog confinements of Illinois, the poultry houses of Arkansas, the industries which process our farm products and the cropland which produces our grains. America's forests and the landfills of major urban centers are other potential sources of biomass energy.

We in Nebraska know well the potential for alcohol production. A single bushel of corn will produce 2.55 gallons of ethanol. If only 5 percent of our country's corn crop were used to produce alcohol, we could reduce our consumption of imported oil by approximately 50,000 barrels a day. If the entire Nebraska corn crop were distilled to make alcohol, the State could produce 2 billion gallons of ethanol a year.

Alcohol production offers the dual advantages of an additional renewable energy source and a new and constant market outlet for grain.

In addition, gasohol feedstocks need not be high quality grain. Crop residues such as corn stalks, distressed grain, wood wastes, and other waste products, such as cheese whey, all can be distilled to make fuel. From these products alone Nebraska could produce nearly 1 billion gallons of alcohol each year.

The United States produces approximately 83 billion dry tons of farm animal and product wastes each year. These wastes can be used as the feedstock for anaerobic digestion to produce approximately 868,127 million cubic feet of biogas per year. This gas supply can be used to generate more than 38 billion kilowatt-hours of electricity per year. The waste heat from this conversion process can provide the energy input for alcohol stills which will have the potential to produce 4,883 million gallons of ethanol.

The benefits from converting this biomass into energy are impressive. This will enable us to reduce our oil imports by the equivalent of 155 billion barrels per year, and thus reduce our trade deficit by \$5,270 million per year.

Using these wastes to produce energy will also solve another of our pressing problems. The U.S. Environmental Protection Agency may be obligated to spend over \$9 billion to mitigate pollution from these farm waste streams. Putting these wastes into energy production will reduce the pollution of rivers and streams as well as provide the fuel we need to keep America lighted and moving.

Development of biomass fuels will create new jobs and opportunities in rural and urban areas alike at a time when our sluggish economy can use this boost. More importantly, development of our biomass fuels potential will be a direct benefit to agriculture. With the incentives provided in the law, farmers can utilize the technology necessary to assure a constant supply of fuel for their operations.

American agriculture has the potential to supply not only the 4 percent of our total energy consumption that it consumes, but it also has the potential to produce a surplus of energy that can supply other needs. Farmers can benefit from another market for their crops and for agricultural residues, whose value is now largely lost. At a time when farm income is expected to decline by 25 percent, the benefits of this legislation are particularly crucial for the well-being of the agricultural sector.

Because of the importance of the biomass energy program to this country and to our farmers, I was delighted when the Energy Security Act was signed into law in June. I was also pleased to see the Department of Agriculture move quickly to propose regulations and to schedule regional hearings to get public input into these rules.

I am, nevertheless, concerned about the USDA's implementation of the act. The conferees to the Energy Security Act envisioned that the Farmers Home Administration would take the lead in implementing this program and, in fact, the Agency has been given primary responsibility within USDA for the biomass program.

While the Farmers Home Administration has ample experience in administering loan programs, their proposed regulations seem to indicate that they do not understand the intent of Congress. We want to move aggressively to provide a range of incentives to small and medium-sized producers who will form the backbone of the biomass industry.

In light of this purpose, I am troubled that the Farmers Home Administration has failed to meet the statutory deadline for publishing final regulations. As I read the law, the rules were due in final form on September 28. It is now October 17 and we still do not have final regulations. Proposals were to be solicited 30 days after the final regulations—on October 28. When Assistant Secretary Mercure testified before a House committee recently, he indicated that awards would probably be made in December. The Congress intended that this program be implemented quickly. We cannot afford to wait. Every day we fail to implement the biomass program costs us \$165 million.

I am also concerned that Congress adopted a range of incentives for the program and yet the administering agencies have to date ignored half of them. Title II provides authority for price and purchase guarantees and yet nowhere in the regulations do I see rules for these kinds of programs. Price guarantees are a way to encourage construction of onfarm production facilities. I wonder if the biomass program can be truly successful in helping farmers become energy producers without this kind of important assistance.

I am troubled by statements reportedly made by USDA officials charged with implementing this law that few farmers will qualify for assistance because their projects will fail to meet the Farmers Home Administration guidelines. The Farmers Home Administration guidelines should be written to accommodate the special needs of the farmers. That's what the law is all about. In fact, Congress specified that requirements for small-scale producers should be streamlined and that their paperwork burden should be reduced. We want to make it as easy as possible for farmers to qualify, not put insurmountable obstacles in their path.

Moreover, the Agency's track record in approving proposals demonstrates an unwillingness to provide funding. We will be hearing later today from a gentleman with a farm run entirely on biomass fuel. He has shown that farmers can put biomass to work for them. Yet, he was repeatedly turned down in his efforts to secure Federal support. Unfortunately, his is not an isolated case. In fiscal 1980, \$100 million was specifically targeted for business and industrial loans for alcohol plants, although other funds were available. In the last 11 months of the fiscal year, the Agency has awarded only \$17 million of this amount.

Interestingly enough, in the last 2 weeks of the fiscal year, commitments totaling in excess of the \$100 million targeted were given final clearance. Apparently the Farmers Home Administration can support the development of biomass fuels if pressed hard enough.

What is perhaps of even greater concern is the lack of support for onfarm production of biomass fuels. Only \$237,000 of the \$10 million set aside for onfarm projects has been allocated. I frankly do not think that there is a lack of interest in this program. What I suspect, and what I hope these hearings will clarify, is that we need to make changes in the implementation of the Biomass Energy and Alcohol Fuels Act to make sure that the programs it authorizes comply with congressional intent—reaching those recipients Congress envisioned, and providing for the development of domestic biomass fuels that can contribute to America's energy supplies.

Senator Charles Percy of Illinois, my colleague, had hoped to join us here in Lincoln today but was unable to fit this hearing into his schedule. Senator Percy is a long-time supporter of alternative energy development, and he has asked me to insert a brief statement into the record on his behalf. So without objection I will insert the complete text of the statement of Senator Charles Percy of Illinois into the record.<sup>1</sup>

I would now like to call upon our first witness this morning. He's Mr. Jim Thornton, the Associate Administrator of the Farmers Home Administration.<sup>1</sup>

Jim, I appreciate you coming out from Washington to be with us at this hearing and wish to accord you a fond welcome to Nebraska.

**STATEMENT OF JIM THORNTON, ASSOCIATE ADMINISTRATOR,  
FARMERS HOME ADMINISTRATION, U.S. DEPARTMENT OF  
AGRICULTURE**

Mr. THORNTON. Thank you very much, Senator. It's always a pleasure to be back in my home country here in the Midwest; I only lived about a hundred miles from Iowa. And I also want to express our appreciation to you personally as well as to Senator Exon and also other members of the Senate Agriculture Committee who have been not only supportive but have taken some very important leadership in this whole area of trying to develop alternative energy sources for this Nation, not to mention for farmers themselves that are extremely energy dependent.

The committee has been in this field and encouraging things here long before a lot of others in the Government were stressing the importance of getting on with this business of developing alternative energy.

I think all we need to do is to look at our daily headlines to see again the importance of our getting on with this in terms of not only the heavy dependence this country has on foreign sources of petroleum and energy, but also the jeopardy that those sources increasingly are being subjected to.

As you know, the Energy Security Act, which President Carter signed on June 30, 1980, will contribute we think greatly to reducing

<sup>1</sup> See p. 59 for the prepared statement of Senator Percy and p. 60 for the prepared statement of Mr. Thornton.

our Nation's dependence on foreign energy sources. This act authorizes broad new programs for the Department, which are to be commenced with relatively short deadlines designed to insure expeditious implementation. In addition, decisions on each application once these regulations are put in final form, of course are required to be acted upon within 120 days of receipt of that full application.

Furthermore, as you know, the Farmers Home Administration has, in fact, been designated by Secretary Bergland to administer the new biomass energy program under title II of the Energy Security Act. The Agency, I think, has already taken relatively swift and positive steps to insure the implementation of this act, and we think it's proceeding relatively well in meeting our required schedules. But let me for the record repeat some of the things or restate some of the things that we've done in terms of trying to prepare ourself for not only the implementation of this act but in terms of trying to tool up for handling this new type of financing enterprise.

First of all, as you know, we put our proposed regulations in the Federal Register on August 5. We subsequently held three public hearings throughout the country to hear from farmers and from others who are interested in this area to get their comments and their input as it relates to those proposed regulations. I might add that those hearings and the comments that were made, as you will see when the final regulations are promulgated, were very constructive, very useful, and in fact will result in a lot of changes in the prior rules.

The final regulation date we're shooting for now as we published or produced for the Federal Register is October 28 when those final regulations will be promulgated. We're currently literally working almost around the clock including this weekend with our lawyers and others to get those regulations in that final form. We're also proceeding in accordance with other provisions of the act in terms of development and proper data collection systems to meet the certain provisions of that act and monitoring the progress of this program as well as monitoring in general the progress of this Nation in terms of development of alternative energy sources.

We've also in the months of August and September proceeded with holding and conducting important training sessions for our personnel, in particular our engineers, which we have in all of our State offices as well as the national office, in the so-called alcohol and, if you will, biomass energy technologies. As you know, as we finance these systems we've got to be able to understand and know and pass on, if you will, the integrity of those designs and construction methods along with the actual financing and economic feasibility aspects of such financing requests.

Those sessions have been held, and we brought in some of the top engineering companies to work with us in putting those particular sessions on, and they, I think, have proved very successful. I think our engineers probably represent one of the largest cadres of people in the country today, with at least a working knowledge about that technology.

We also, of course, under the direction of Secretary Bergland have set up a so-called new Office of Renewable Resources within Farmers Home, and that office, among other things, although it has broader missions, is working with us in the construction of putting this pro-

gram together. We are also in the process of setting up a wholly new biomass energy loan division that will handle the actual loan making and servicing requirements of this particular program in the national office.

I sent a message out yesterday to all of our State directors requiring them to designate a new biomass energy loan technician; training sessions will be held for those people along with our engineers and other staff that we work with in this area on the 29th and 30th of this month on the final regulations; that is to day, once they're promulgated we'll have an immediate training session in the country to acquaint them in detail with these new so-called final regulations so that they will be equipped to properly understand those regulations, but more importantly so that they can properly advise clients and others in terms of inquiries we get and help guide applicants in the funding of their applications.

Now, of course, while all of this has been going on, we have not, in fact, been sitting on our hands as the chairman has indicated. The Secretary basically set a goal preceding the passage of the Energy Security Act of \$100 million of our Business and Industry Guarantee Authority to get this effort underway prior to the implementation of the Energy Security Act. That particular \$100 million goal, of course, as you've indicated, has not only been exceeded, but I think even much more than you may realize.

As of today we have, in fact, obligated under our regular business and industry program upward of \$350 million in terms of alcohol fuel and ethanol capacity in this country. That would involve the bringing onto production by the end of 1981 some 246 million gallons of capacity of ethanol production. That is about one-half of President Carter's goal that he set earlier this year as the goal by the end of 1981. This effort itself will contribute, as I said, almost one-half of that goal.

The plans that we've announced, some 15, I just might show you to get some idea of the distribution of those, along with some 14 other plans that we have announced earlier, give you some idea where those are located. You can look at this in more detail later, but you'll see the chart here will show you not only where they're located, but also their capacity ranges.

During the process of entertaining applications in the last 4 or 5 months under our business and industry program the demand has been tremendous. While it was a little slow in getting off the ground for reasons related to people getting acquainted with the program and also the time it took to put together the package in terms of lining up engineering, financing, and economic feasibility studies, et cetera, we literally were looking by the end of September at a total of about \$1.2 billion in applications. The response here was quite frankly nothing short of phenomenal in terms of the interest and commitment that I think is here in the country to get on with the business of developing these very important alternative energy sources. Of course, we obviously cannot finance that level under that particular program due to the obvious limited constraint on moneys. And that meant that those above the ones that we have financed we've had to basically turn back for lack of financing and will be considering many of those, at least insofar as Farmers Home is concerned, under the new Energy Security Act when that becomes final. There are a number of large

applications; in fact, I think there was one or two from the State of Nebraska, that did not get funded that will have to now probably go to the Department of Energy because of their size.

As you know, under the Energy Security Act we will only be able to entertain and consider applications involving gallonage below 15 million gallons; anything above that level by the law would have to be handled by the Department of Energy unless the project involves a farm cooperative or involves the production or use of wood—or residues.

But in short, I think that we've gotten this off the ground pretty well, and again in the interest of supporting the President of this country to get on with the job of developing these very important alternative energy sources.

The regulations, of course, we're working on will encourage the production of individual projects—as well as for individual projects, as well as the producers who may wish to join together in some cooperative arrangement. This arrangement will take a number of forms; applicants will be required to provide reasonable assurances that the loan can be repaid with income from the projects. We recognize the importance of onfarm production and have therefore determined that if the use has self-sufficient value on the farm rather than for sale, the applicant would be accorded a credit in fuel displaced when applying for a loan.

I might also add, we'll be taking a policy tact of continuing to finance very small onfarm projects through our regular so-called farm lending authorities as distinct from the Energy Security Act. The reason for that is twofold; one, I think that some of the engineering and other requirements when you get down to very small systems will basically rate this economy's scale in terms of cost. When we go to the onfarm stuff under our regular farm programs we'll avoid some of that, but on another track we'll also be developing and holding meetings in early November with the manufacturers of these smaller packaged systems as well as with large engineering firms to try to work out some system of certification of these smaller plants and stills and so forth that will likely be used on farms. And in that process, in my judgment, it is quite critical that be worked out in terms of testing some of those systems and making sure that they basically protect the farmer who purchases that system to make darn sure that it, in fact, works. And also once we get through that certification procedure, we would suggest that from that point on we would be able to advise our States that they may proceed with funding such systems without having to go through individual-by-individual project reviews, which we hope will expedite the use of such systems in terms of onfarm.

As you well know, Senator, being on the Senate Agriculture Committee and chairman of our Credit Committee, Farmers Home Administration, of course, operates from Aroostook County, Maine to the Northern Marianas, and from Point Barrow, Alaska to the Caribbean through some over 2,000 offices. We're also, of course, operating some 40 individual programs, with our expenditures and investments made through this agency reaching close to \$14 to \$15 billion a year. Our outstanding portfolio as we sit here is in excess of \$50 billion. My point is that this new effort is not the only thing that

we have to be concerned about. Although we welcome it, and I think we'll handle it, I would hope with dispatch as well as with confidence; on the other hand, we have to keep in mind that we also have a great deal of other things to do to help the farmers of this country and other people of rural America who depend upon our credits and financial assistance.

I just might add to that point that last night before I left Washington I was notified by our farm staff that we are expecting now in terms of the extensive drought that has occurred throughout this country in the last several months, that we can expect in the next several months upward of \$5 billion in credit applications from farmers throughout the central and eastern portions of the United States. We will be expected again to respond to these requests in a very timely way within the next 60 to 90 days.

But getting back to our strategy in terms of the final regulations under the Energy Security Act, our basic strategy in administering this act will be to structure insured loans and loan guarantees to mesh as closely as possible with our existing FmHA farm, business and industry, and community facility loan programs. This has been reflected to some extent already in the proposed regulations, which will permit the utilization of procedures that our people in the field are both familiar with and hope the others in terms of banks and other financial institutions who work with us are also familiar. And in the hope of minimizing problems, we think that goal can and should be met.

FmHA is making a concerted effort, as I said before, to insure the technical staff capabilities are available to meet these new initiatives.

It was the Supplemental Appropriation Act which provided the funding for this program, which is \$525 million for the next 2 fiscal years. While obviously that is a lot of money, on the other hand, I think we all must realize that if you take \$525 million and apply it across the Nation, it gets very thin when you bring it down to a State-by-State basis. And my point is that I don't think one should expect that out of this \$525 million we're going to be providing thousands of loans. In terms of the plants involved the total of loans should be in the neighborhood of 300 to 400.

The thing you must remember in this regard is that these plants, big or small, but certainly in the large size, even within the confines of our requirements are very capital intensive. On the other hand, we anticipate the broad usage of funds to establish a good balance, if you will, between small- and large-scale plants. We also hope to emphasize funding for small- and community-size projects, plants whose capacity is below 1.5 million gallons annually and 7.5 million gallons annually, respectively.

While the major emphasis will be on the production of alcohol fuel, of course, other types of biomass production such as methane and wood energy will also be included in terms of funding under this program.

We plan to place special emphasis on encouraging the diversification of feedstocks to be used. While many of the first wave of alcohol projects are expected to be based on corn, it is clear to us that economically viable alternatives to corn are also and should be, in fact, encouraged.

Numerous regional opportunities exist for utilizing feedstocks such as sweet potatoes in the South and Southeast, sugar elsewhere, dairy

products, potatoes, spoiled fruits and vegetables, off-grade grains, and the list goes on, as well as dealing with the area of cellulose conversion in terms of wood. And we intend to do as much as we can within this first cut to try to get as much experience as possible in the diversification of these feedstocks.

Consistent with overall national energy policy, FmHA will accord priority to projects that do not involve the use of petroleum and natural gas as a primary fuel. Again, I think it's clear for anybody who goes through this act that that was meant to be the objective by the Congress in its passage.

Rapid progress is being made in the use of alternative fuels such as coal, wood and wood derivatives, and other products. Our financing activities under this act, as well as those of the Department of Energy, can play an important role in stimulating this trend and in creating a market for such innovative equipment and systems as small coal-fired boilers.

The statute specifically authorizes financial assistance for projects that convert biomass materials into a refined liquid or solid fuel or that convert equipment to directly combust wood or other unrefined biomass into energy for industrial purposes.

FmHA will provide financial assistance again to other nonliquid biomass energy projects with a minimum of duplication of similar technologies. The proposed regulations adhere closely to the statutory language with respect to the scope and types of non-liquid-fuel biomass energy projects that are potentially eligible under this program.

With respect to the primary fuel issue, the use of coal may not be a viable option for many small-scale producers because of the high cost associated with storage, handling, and clean burning. We, therefore, do expect to use flexibility in regard to small projects for which there is no feasible alternative to the use of oil or gas. However, for larger projects for which coal or a renewable fuel can demonstrate cost effectiveness over the life of the plant, the failure to use sources other than oil or gas as primary fuel will weigh heavy against such applicants.

Again, just let me stress that point. We're saying here in terms of the larger projects we will be applying that statutory priority rather rigorously; on the other hand, on your very small projects, and especially when you get into onfarm type operations, we will give much more liberal interpretation and consideration to the use of oil and gas. Some of these small-farm operations are close to natural gas sources or other petroleum sources. And where the economies make that project feasible, we will take that into account for the smaller ones, but on the larger ones we'll hold to that congressional priority, I think, rather rigidly.

Special emphasis will be placed on ensuring that applicants design their plants to permit economical retrofitting as new technologies evolve, especially those utilizing feedstocks such as the celluloses. Technology is changing rapidly, and applicants must be mindful of this to avoid commitments to plants that prove difficult or inadequate over the life of the loans that they're requesting.

The Energy Security Act provides ample latitude for targeting resources on innovative institutional arrangements that offer big potential payoffs. For example, FmHA may utilize its extensive ex-

perience with rural communities to encourage projects exploiting local feedstock and fuel availabilities for biomass energy production purposes. We expect to see—and encourage—many projects involving groups of farmers putting their farm and financial resources cooperatively to work producing and upgrading fuel alcohol so as to diversify the markets in which it can be used. This may also prove to be the most economically viable mechanism for channeling short-term agricultural surpluses into the production of valuable fuels.

Mr. Chairman, that concludes my remarks, and I'd be happy to try to respond to any questions you may have.

Senator ZORINSKY. Thank you. Mr. Thornton, I understand that the Department has recently announced a series of loan guarantees under the business and industry program for alcohol plants. And I notice that several of the loan guarantees were for rather large plants; one loan in Kentucky for a 21-million-gallon plant, one in North Carolina for a 25-million-gallon plant, one in Texas for a 22-million-gallon plant, one in Tennessee for a 50-million-gallon plant, finally one in Ohio for a 60-million-gallon plant. I know that under the business and industry program, unlike under the new Energy Security Act program, no limit is established for the size of plant; nevertheless, I find it curious that Farmers Home should find it appropriate to make loan guarantees for plants that are so much larger than those which Congress deemed appropriate for the agency under our new law. Can you tell me how these particular plants were selected and why the decision was made to guarantee loans for huge operations such as those?

MR. THORNTON. On the latter point, again, the goal, as we saw it earlier this year and through this process of approving these particular loans to which you're referring, is that the first major goal was to bring on line as much as we could and as fast as we could in terms of developing this industry; that is, gallons. And the projects that you're now referring to, as I indicated earlier, were among a total package of about \$1.2 billion in applications. In going through that we were looking again at a variety of factors in that selection process ranging from the quality of the engineering to the amount of equity being put into the type of fuels being used to the kind of feedstocks being utilized and the efficiencies of the plant and when we might expect to see those come onstream. And essentially those are the general criteria we followed, and as I said, in getting on with this business of getting production capacity online as soon as we could.

We recognize that this is only a start in terms of the larger plant; for instance, you mentioned the one in Ohio, that plant will produce some 60 million gallons of capacity. And in terms of the loan that we provided in that instance was something in the neighborhood of \$35 million in guarantees. And in a sense we bought a lot of gallonage. By the way, also the equity on that was some 60 percent, and they're ready to move that plant in terms of fast energy diversion and to get it up and operating soon. But the point is, what this represents, just to give you some idea of the importance of it in terms of corn equivalent to this corn producing area of the country, and that is that the gallonage—most of these plants, not all, but most of them will use corn as a feedstock, the gallonage will represent about 110 million bushels of corn to go through those 15 plants. And the point is that it

will create a major new competition for corn and hopefully will reflect itself in price enhancement, but most will consume corn for that purpose. Let me show you—

Senator ZORINSKY. What is the goal?

Mr. THORNTON. The goal is to get gallonage.

Senator ZORINSKY. What is the Ohio plant using as its source?

Mr. THORNTON. For feedstock?

Senator ZORINSKY. Yes.

Mr. THORNTON. It's using grain, mainly corn from throughout the Midwest.

Senator ZORINSKY. I see. And you felt that there was such a huge supply available in Ohio for that use and the presentation of the proposal was such that it warranted a loan guarantee; that was the determining factor?

Mr. THORNTON. All of the factors that I mentioned in terms of engineering, the equity as well as the quality of the project itself. For instance, we had some large applications that came in to us from this part of the country; one, they came in later and in some cases they did not meet some of these other requirements in relationship to other applications.

Senator ZORINSKY. The number of electoral votes had nothing to do with the selective process?

Mr. THORNTON. No, it did not, Senator.

Senator ZORINSKY. Let me ask you why would a program that has 60 percent equity require a Federal loan?

Mr. THORNTON. Because they couldn't get all the financing. The other thing you've got to remember here, and I think it's so important we do this job right up front in terms of Federal financing, and that is you're not going to find very many private lenders putting up money for these type plants at this point in history until they see more direct experience in these plants and that this industry is here to stay. And the point is, it is very difficult in most cases for people to get private financing.

Senator ZORINSKY. I'm hearing farmers tell me that if they could get private financing, they wouldn't need Federal financing, and yet the Federal financing eligibility requirements are almost as stringent as those for private financing. The conclusion that's being drawn is that there really is no incentive being given by the Federal Government to attract those type of people into the business.

Mr. THORNTON. Well, again in terms of guaranteed loans, those are hard credit loans, those have to be handled like any other, if you will, they are private credit loans. Those moneys come from banks and financial institutions that put money at risk, and all we do is come in and basically back that up to as high as 90 percent in terms of Federal guarantee against loss.

On the insured side that is a direct Federal loan. By the way, I didn't previously mention, but on the guarantee under these regulations, we will require a minimum of 20 percent equity; on the direct loans that we will be making in our final regulations, that will only be 10 percent equity. The point is there will be some differences there as it relates to scale.

Senator ZORINSKY. You held a—

Mr. THORNTON. By the way, excuse me, Senator, I just want to mention something else that I think should be put on the record here. The investment tax credits that the Congress has very generously provided in this area I think are very attractive to investors to get money in terms of front-end money to put into these plants, that combined again with some Federal guarantees to get this industry established, which I would hope once established the Federal Government would basically back out of and let the private financing take it entirely, that's basically our goal.

Senator ZORINSKY. You held a number of public hearings on your proposed title II regulations. Even though your final regulations aren't published, can you tell me what types of changes you're contemplating in the final regulations as a result of those public meetings and the written comments you received?

Mr. THORNTON. Well, again I was just talking about the question of equity. As I recall in the proposed regulations there was an indication there that we were going to give priorities to those applications based on their equity above 20 percent, and we got a lot of criticism on that point, and I think quite frankly I'm reflecting on that correctly. For instance, that will be removed, that is to say we'll just be requiring a straight 20 percent equity in the terms of the final regulations without giving priority to anything above that, and that was a fairly important point in those prior rules. On the other hand, what I think you're going to see in the final regulations, are a number of points and refinements, but in the main you're going to see a fleshing out of a lot of those prior rules where there are big gaps in them. And I would hope, to put it differently, while it's going to add to the paper in terms of the final regulations, that these final regulations will be much more explicit and explanatory to prospective applicants and financial institutions and so forth in terms of stating clearly what it is we do expect and why and so forth.

Also in the final regulations we'll go through the major comments that were made at those public hearings and respond to those in terms of what the position of the agency will be. For instance, on the other side on this question of implementing the provision in the Energy Security Act providing for a price support process and purchase agreements under the act. We stated in the prior rule that we do not intend to implement that and that will remain in the final rule. We don't feel that that is at all necessary, certainly from what we've seen in terms of the interest and willingness to finance this type of industry.

Senator ZORINSKY. As I suggested in my opening statement, it would appear that not enough attention is being paid to individual farmers or groups of farmers who desire to avail themselves of these Farmers Home Administration loan funds. It has also been suggested that the qualifications have been made difficult for this type of group. What specific steps have you taken to correct that situation?

Mr. THORNTON. Well, I'll mention a couple, but before I do that, I think one should, again, put in perspective, that we as an agency, if not as a government, have been thrust into this area for not too long, we've only really been in this for a matter of months. And it's a matter that even from our own standpoint, even with technicians and engineers, et cetera, we have to basically get ourself up to speed.

During this period we did get an inordinate number of inquiries, especially among farmers, and basically we were not prepared to respond to many of those things. First of all, we didn't have the program, we were just starting along, if you will; we hadn't provided training for engineering and technical people, to say nothing of our loan people understanding this particular industry. And there has been a lot of confusion; I think I can understand and appreciate why a lot of farmers as well as others may be somewhat frustrated with us in why we were not more responsive and explicit in the past. I would like to think that having provided this training and gone through a number of things here the last several months in terms of our own experience, that that is in the process of changing materially, at least insofar as it relates to our State office personnel.

We have yet to get that down a couple more steps to our district and county personnel, which we have plans to do here in the several months ahead. On the other hand, I think we have to also take into account that while—well, I'll put it quite bluntly, I hope I don't step on any toes; I frankly think that what's happened here is there's more romance than reality as it relates to what a lot of farmers thought or some people tried to sell them in terms of getting into this and getting into it fast.

This business, at least in terms of alcohol production, is a chemical process, and it has certain demanding requirements and certain sophistications in that process. One has to understand that when it comes to plants and plant designs, I think it's of some importance, not just to us as a government agency providing taxpayer money to help finance these systems, but also in terms of helping protect that farmer to realize fly-by-night people will become involved. Oh, for instance, I was down in Arkansas a while back and I picked up a local newspaper, and there was a big ad there and it says—advertising the OPEC killer—\$89.95, and they were being sold. And I don't think they've ever produced more than 3 ounces of alcohol, again that's somewhat of an exaggeration, but somewhere in between that there are other people who are trying to sell these systems.

What, as I indicated before, we intend to do in that area and again in these meetings we're going to be holding in early November, we're going to be calling in manufacturers, reputable manufacturers that are now either into or about to get into fabricating and developing packaged systems, small systems, as well as with some of the larger engineering firms, and sit down and work out with them some process of certifying these systems in terms of proving them up, and once we prove them up that we then can tell our people, look some farmer comes in and wants to buy the Zorinsky system, that's a prudent system, and you don't need to go through an elaborate design and require the bonding and all the rest of that.

Senator ZORINSKY. Well, it's only a conflict of interest.

Mr. THORTON. True, but my point is we are trying to address this so that hopefully we can together with the industry and with farmers come out with processes here that can ensure plant designs and small system designs in which they have some degree of confidence.

In the meantime—farmers, and I've worked with them for 20 years, they're very ingenious people, they're very innovative, they're very hard working, and some of them will think they can design anything

and they'll take on any project, and in most cases do it pretty well, but in these cases there are some dangers and hazards that I think call for a little more sophistication in terms of development of these systems. We hope to be able to work with them and others in terms of both protecting them and making sure that when those products are brought online that they basically are workable products with some integrity.

Senator ZORINSKY. It was my understanding, Jim, that the final regulations pertaining to implementation of title II were by law to be published in final form on September 28. Now I understand that the final regulations won't be ready for at least another week.

Mr. THORNTON. Yes, sir.

Senator ZORINSKY. Could you explain why the delay was necessary; manpower or—

Mr. THORNTON. Yes, there was; as I mentioned at one point in my statement, this is not the only program that this agency has to be concerned about.

We operate some 40 programs, as I indicated before, we'll probably rack up something close to \$15 billion worth of business in this last fiscal year. But anyway, all of those things added up to our not being able to make the September 28 goal. The October 28 figure—or the date that is still legal, is our last date at which we will be in compliance with the law.

I don't wish to burden you and others with all the internal reviews and clearances that we as a Government agency have to go through, but it is a rather taxing process to say the least. And we are going through that and hope we will meet all those tests in a matter of days.

Senator ZORINSKY. What sort of a technical review were you able to give to all the biomass projects approved by the Farmers Home Administration during the last month of fiscal 1980?

Mr. THORNTON. In my judgment, very adequate; they were reviewed in most cases on a preliminary basis at the State level and then subjected to review by our senior staff in Washington.

Senator ZORINSKY. In the comments received on all those biomass regulations the Inspector General's Office expressed concern about the lack of personnel within the Farmers Home Administration to administer the biomass programs.

This goes right back to your previous answer as to the responsibilities you have in other areas. Could you comment on the Inspector General's concern about the lack of personnel within Farmers Home? Do you have sufficient personnel to implement the biomass program, to be very honest?

Mr. THORNTON. No, this will add again a major effort on top of many others that I've already alluded to. This agency has been and remains under great strain in terms of inadequate personnel resources. We have requested within the executive that we be given additional personnel ceilings to accommodate this particular effort. As you probably know while this is happening, we also by another act of Congress have just been given responsibility, sole responsibility for handling all natural disaster lending in this country meaning the Small Business Administration which earlier had had a piece of this is now basically getting out of the business. And we not only have to handle all the so-called credit elsewhere borrowers, we now have to get new class borrowers that can get credit elsewhere but under the law will

be eligible for production loss loans. Again, that requires additional personnel.

So far we have not tied down additional resources here. But yes, that is a critical issue for this agency, not only as it relates to this program, but in general.

Senator ZORINSKY. How many Farmers Home Administration employees will be committed to working full time on the application reviews?

Mr. THORNTON. Well, as I indicated earlier, we're asking that a minimum of one, what we call, a biomass loan technician be designated to handle this program at the State office level. They will be supported by what we call a State loan technician, which is a person who works with them in the preparation of papers and spread sheets, so forth, and they will also be assisted by our trained engineers. All three of those people in terms of the Energy Security Act have already been trained, and then they'll also be brought into this session at the end of the month to be given explicit training on the final rules. In Washington, as I indicated, we'll be setting up a staff, a new Biomass Energy Loan Division, which I have proposed to be a staff of some 17 people, but initially we'll be lucky to have probably in the neighborhood of 6 or 7 on the staff, plus we'll have some engineers.

We are in the process of hiring what will eventually be six but initially three senior engineers, which will be energy system engineers, which we're going to place regionally throughout the country. These will be experts in this area and will be working directly with our State engineers in giving them backup support and guidance and training on the technical side, not only in alcohol, but again in these other aspects of biomass energy. But we're basically taking people that we have on other matters, if you will, and putting them to this task.

I might also mention, and maybe I'm a little bit out of school on this but I'll mention it anyway, I got a call last night from our sister department, the Department of Energy, where they're requesting the head of our B. & I. Loan Division to go over to DOE and help them set up their guaranteed loan program under the Energy Security Act. We're obviously going to cooperate gladly to assist them, but again that adds further to our strains and abilities to handle the paper load that we have to handle.

Senator ZORINSKY. We have spent several minutes discussing the startup time requirement on the administrative side; I think you used the phrase bringing up the speed. I think we forget that many farmers have been looking at this type of project for years. As a matter of fact, this legislation is long overdue. Whereas farmers probably could have promulgated the rules and regulations for this type of legislation many years ago, we are just now attempting to gear up for this legislation. A lot of them have been working on this type of endeavor for years, and we're approaching it as if it's fission—where it's a highly experimental type program. Unbeknownst to many bureaucrats in Washington, many people have had working stills and digesters as a matter of course, not only in the United States of America, but in other countries that aren't as far advanced in research and technology as we are. So I would caution that while we in Washington sit behind our desks and concern ourselves with the

evaluation process, there are many people in our Nation who have already passed that point and actually are producing a valid product.

Included in the draft impact analysis statement accompanying the Farmers Home Administration proposed biomass regulations is the following:

An analysis of inquiries from Farmers Home Administration concerning loans for biomass projects under previously existing authorities showed that only 9.5 percent of the activity was for loans or guarantees under \$1 million—or under 1 million gallons per year of alcohol capacity. Given this level of activity it has been tentatively decided to allocate only \$125 million instead of \$175 million for small-scale projects.

I see a dichotomy here. On the one hand we're saying it's taken us time to get geared up so we really can't get in the swing of things, and yet on the other hand we're saying not many loans are being utilized, so reduce the amount of money available. My question is, isn't it possible that the lack of activity for small projects was a result of inadequate outreach efforts and not a lack of demand for small projects?

Mr. THORNTON. Well, again I don't know the answer as to why we didn't see more smaller applications. We, by the way, did at least sweep, on an informational basis, the State several times on that. And it's kind of interesting, because when I was running around this country and attending meetings and so forth, it was evident there was a tremendous amount of interest in small scale, especially onfarm; but on the other hand, we did not, in fact, Senator, get very many actual small-scale applications. Now, there were some, but it wasn't the surge that would seem to be indicated.

Now, on the question of \$125 million for insured, that number, in fact, will be \$155 million although under the law we can go as high, as I think you've indicated, \$175 million, but it will be about \$155 million from the standpoint of \$35 million will be added to that \$125 million as a part of a formal solicitation process along with some guarantee to really go after some innovative kind of demonstration type projects. But I understand your point, and I think it's a very well taken one, and for whatever it may be worth, under the insured program for a variety of reasons I think you're going to see that we are going to be going after as many small operations as we can, that are economically feasible and that can support financing.

By the way, one of the things that will really force that to happen is that under the insured program we will be making some sort of an allocation of that money between and among the States, and when you spread \$100 to 125 million out, it doesn't add up to all that much, roughly somewhere between \$2, \$2.5 to \$3 million. And that by definition will, I think, put a lot of pressure on our States to look and encourage smaller scale as opposed to larger scale. Even on the guaranteed side when you add it up again within the limited amount of funds, it will hopefully result in our reaching for the smaller intermediate scale as opposed to the larger. But your point is nonetheless very well taken, Senator.

Senator ZORINSKY. Your own impact analysis of the proposed title II regulations suggests that a price guarantee may be necessary to encourage construction of onfarm production and community size upgrading facility. Doesn't the current lack of price guarantee discriminate against the small producers whom this act is also designed to benefit?

MR. THORNTON. Well, I think what that section of the impact statement is referring to is in our guarantee program when we issue a conditional commitment, we do not actually put that guarantee in place until the plant is actually constructed and has reached some minimum performance standards that we will set. That means that in the interim, the bank or some financial institution must provide your own financing.

Under the insured program, that will not be taking place under the final rules. We will, as I said, have lower equity requirements, and also, depending on the size of the plant, we'll make decisions as to whether or not we'll provide that money up front as opposed to once the system is in place. So we really can try to respond to your concern in terms of moving in that direction.

SENATOR ZORINSKY. You indicated previously that you were going to lower the equity requirement to 20 percent, did I understand?

MR. THORNTON. Well, on the guarantee in the proposed regs we had in there that we were going to give priority to those projects that had equity in excess of 20 percent, that is coming out in the final rule. But we will be holding to the 20 percent on guaranteed; on the insured side, the equity requirement there will be 10 percent, again because we recognize we will be dealing with larger scale both farm and onfarm-type systems.

SENATOR ZORINSKY. How did you arrive at minimum cash equity figures?

MR. THORNTON. Well, the other thing one has to recognize in this program, again going back to the guarantee, is that these guarantees can only be issued by law for the construction of these facilities. We cannot issue guarantees under this act for operating capital purposes. So I'm leading up to two points; one of the reasons for the so-called 20 percent equity is to ensure that there is adequate operating capital for these projects. Two, as a matter of normal practice under this agency since we've been in the guarantee business on new enterprises, we've required a minimum of 20 percent since they're obviously higher risk in the sense they're new enterprises; three, we're seeing many projects under the act that come to us under B & I as well as under this one in which I believe you're going to see a lot of limited partnerships. There are problems though, for instance, in securing personal guarantees on the part of some of these limited partners, again as a means of assuring their contained involvement with the importance of that higher equity and the fact that in those cases we require a minimum equity position to be maintained throughout the life of the loan.

SENATOR ZORINSKY. You're applying both a credit elsewhere test and a requirement for cash equity; aren't applicants with substantial cash equity able to secure credit elsewhere?

MR. THORNTON. Not necessarily at all. Especially for this type of industry.

SENATOR ZORINSKY. But they're not precluded?

MR. THORNTON. No, of course not.

SENATOR ZORINSKY. A lot of them have been successful on their own in going out and securing those.

MR. THORNTON. That's correct. The way the law reads here on both the insured and also in this case the guaranteed, there is a credit

elsewhere test, and that is to say on the insured program unlike all of our other programs that we administer there will have to be clear evidence that the party cannot get financing under reasonable terms elsewhere. And in the case of the guaranteed, the law forces us to require of the applicant that the financial institution that is requesting the guarantee would not otherwise provide that financing in the absence of the guarantee.

Senator ZORINSKY. Is it true that Farmers Home Administration has made an administrative decision to cease guaranteeing short-term construction financing? And if that's the case, what effect do you think that decision would have on the development of the biomass program?

Mr. THORNTON. No. The procedures we plan to follow under the Security Act is basically the procedures we follow traditionally under our regular guaranteed and insured programs, which as I stated earlier, under guaranteed we will not—while we will issue conditioned commitments to lenders up front on the issuance of guarantees, on the other hand, that guarantee will not be put into place or effect until all of our conditions are met; and two, the plant is completed in its construction and meets minimum performance requirements. That means, yes, the private sector will have to provide interim financing, but on the other hand, they'll have takeout arrangements based on the issuance of our guarantee. That is the normal practice for this agency; we see no reason to change that, we see no evidence that anybody has deterred interest in seeking financing for this type of project.

On the insured side, again we exercise both policies, depending on the size, depending on the project, sometimes we will issue a check right up front without required interim financing; on the other hand, where we think in terms of the size and the type of borrowers involved, where we think it is to the best interest of the Government for them to seek interim financing, we will request for that. Again it depends on a case-by-case basis.

Senator ZORINSKY. During the October 2 hearing before the House Committee, Secretary Mercure indicated that the Farmers Home Administration would be accepting biomass proposals on six specific days. I was under the impression that these projects were to be analyzed on a first-come-first-served basis. Now it appears that Farmers Home will be batching the applications. This would seem to be slowing down funding for alternative energy projects; would you respond to—

Mr. THORNTON. Yes. In the final regulations you're correct, they are proposing to put various so-called receipt dates on full applications, and they'll roughly come out—let's see, the first day is the date of the issuance of the regulations, and the next one is, I think, like some 15 days afterwards, and they run in 60-day intervals. On the one hand, that is basically for purposes of helping us during these intervals to only batch not in the sense of selection, but we would batch for purposes of meeting requirements under the law to review with the Department of Energy our engineering and other requirements that are required in the law. On the other hand, it does not require us to basically make so-called interval awards as you would get in a so-called formal solicitation batch; that is to say, when we

make announcements, on one hand you could very well make announcement that so many loans have been approved, and on the other hand, it doesn't necessarily mean that those that were not announced on that date were disapproved. It might be true in some cases, in other cases some of those loans may still be in negotiation and may move over into the next interval.

So it's really kind of a mixture, of informal batching, but the batching in this case is really only for purposes of meeting our deal where we review requirements, not for purposes such as I think the Department of Energy will be calling it batching for actual awards where you're either up or down based on the batch.

Senator ZORINSKY. Under the current application procedures for business and industry for farm loans, applicants are required to offer preliminary engineering reports substantiating their proposal.

Mr. THORNTON. That's right.

Senator ZORINSKY. Has this regulation been a barrier to applicants, particularly those with smaller projects?

Mr. THORNTON. Again, it depends on what's small. As you go down in size, yes, all those kinds of engineering requirements and construction method requirements obviously could become a barrier the smaller you get, and also become a major cost item the smaller you get. On the other hand, in terms of modest- or large-size plants it is not a barrier at all, it's a normal practice, whether it's an alcohol plant or any other type of major facility.

It is a very normal thing that one could expect; and I must say to you that any bank getting involved in such an operation, on a larger project would be unwise not to insist on those kind of requirements in terms of their putting up financing certainly on an interim basis even with the takeout being promised by the Government.

Senator ZORINSKY. What steps has Farmers Home Administration taken to reduce the impact of such reporting requirements for small-scale producers? For instance, have you contemplated supplying to your State and district offices the basic design criteria for the different types of alternative energy projects? In other words, a minimum acceptable criteria which would in effect maximize the acceptance of small-scale biomass programs? Wouldn't that help reduce the cost of feasibility studies for smaller scale?

Mr. THORNTON. Yes, sir. And we will be doing some of that in the regulations, but the importance here is what I was discussing earlier regarding the ability to proceed under our regular farm lending programs and then tie that to whether it's under synfuels or under those programs worked out with the manufacturers of these smaller systems certification procedures. Once we can get that established and get some of these so-called smaller plants—package plants—certified, there will be no engineering requirements in terms of those very small operations.

Once we certify them we'll basically tell the field again, if you've got the Smith System or the Rogers System, and so forth, and it has gone through our testing procedures, then it has met our requirements. It's like buying a John Deere tractor or a—

Senator ZORINSKY. So you do anticipate this type of—

Mr. THORNTON. Yes, sir. That's our goal—to basically try to work out such a system. Now, we don't have that today; that is ahead of us.

That's what we're going to be addressing starting the first week of November with the manufacturers of the engineering firms.

Senator ZORINSKY. There's been a lot of publicity about the Department of Energy pasturing money that was to be made available to the Department of Agriculture for biomass projects. Now, I understand that you and the Energy people can't agree on how this money is to be used. Could you bring us up to date on whether or not Agriculture will ever see this money?

Mr. THORNTON. Yes, sir. I talked with Mr. Grenglass, from the Department of Energy, yesterday on this very matter. Basically, what happened is that the Department of Energy—and again I don't know the reasons, I'm sure they were very legitimate—in short, they did not get us that money until very, very late in the fiscal year and basically made it impossible for us to do anything with it at that point in time. So thereby it had to be returned to the Department of Energy with a caveat—with the understanding that they would return it to us in fiscal year 1981, of course, which is now underway.

Mr. Bert Grenglass yesterday promised me that that \$2.3 million in grant money would be transferred to the agency within 30 days. Now, that's all I can report to you in terms of what he indicated to me.

Senator ZORINSKY. Within the next 30 days?

Mr. THORNTON. Right. Now, what you also must understand is that until such time as that money is in fact physically transferred, we cannot move with our proposed regulations for that program.

So that means that once we get the money, we then clear the regulations for prior ruling, which means it's got to go into the Federal Register for 30 days until we get it back—I'm sorry, 60 days, 30 to 60 days; we'll try to cut that as much as they will let us, but it will probably be all total another 90 days before that program is actually ready for implementation.

Having said that, the other thing I think we must appreciate here is that this is a very, very, small program. That \$2.3 million—basically, what we're going to be proposing in those regulations is to work out some grant loan combinations for small biomass systems for on-farm uses essentially, and that is methane systems as well as farm stills, and some methane/still operations in combination. Our best guesstimates are that the most you could probably expect, and again spreading that money throughout the country, is we may get one or two of those projects per State, that's all, but it's an important effort, again I think in demonstrating viable, and if you will, testing on a semi-demonstration basis viable methane as well as small still operations.

Senator ZORINSKY. In the Administrator's 1980 directive, the Farmers Home Administration indicates it will contract with outside experts to review the technical aspects of the projects, including construction cost estimates and predicted plant performance, until the agency's technical personnel have had specific in-depth training in the technical review of alcohol and methane production. Has the Farmers Home Administration personnel received this training?

Mr. THORNTON. Yes, sir.

Senator ZORINSKY. By whom was it conducted?

Mr. THORNTON. We had in about four or five of the top engineering companies of the nation. I don't remember all the names, but it was groups like Vulcan and something like—I remember there were about three or four, but basically companies that have long histories in engineering design in the distillation industry.

Senator ZORINSKY. How many outside contractors are still performing technical evaluations of that operation?

Mr. THORNTON. We're doing very little of that. The only time we do that now since we've gotten our own people through this initial training is where we get involved in a very sophisticated design that's off the standard design and has new features, new technologies, et cetera; at that point we may turn to some outside consultants, but now we don't do it in general.

Senator ZORINSKY. Are you saying currently, you do have the technical expertise to review applications that will be received under the title II program?

Mr. THORNTON. Yes, sir. In the main as it relates to the standard distillation of biomass technologies we now understand; yes, sir.

Senator ZORINSKY. Will you still continue to rely on outside contracts?

Mr. THORNTON. Only when we are confronted with a very unusual design, new features, new technologies that we are not familiar with, then we will seek outside help and consultation.

Senator ZORINSKY. Well, thank you very much, Mr. Thornton, for an articulate presentation. I have a feeling from your presentation that you have attempted to initiate a program in accordance with the intent of the legislation. However, I also get the feeling that a great many of the bureaucrats involved in making these decisions can be termed neophytes.

I hope we'll all learn from these hearings and from the modifications that you propose to the rules and regulations promulgated under this legislation.

Mr. THORNTON. Well, Senator, we think that this is a terribly, terribly important national purpose that we're all involved in here. We're very committed to this, and in particular we are committed to try to bring this technology as fast as we can right out here, if you will, to the farmer in rural America, because I don't need to tell you or people here today the obvious importance of energy dependence the farmer has. He's very far removed from these other sources of energy, and when Mother Nature says it's time to plow or harvest, she doesn't wait for the energy truck to get that job done. My point is we are committed to try to succeed. We might very well be accused of a slow start; I think we've done reasonably well given the time dimensions that we're working under. On the other hand, we are also committed to trying to bring ourself up to some reasonable basis for understanding this technology and this type of financing; one, because we are involved here with Federal taxpayers' funds, and we think it's incumbent upon us in meeting our responsibilities to you and other Members of Congress to do that prudently, and at the same time, yes, we need to continue to be pushed and urged to try to get through as much of this bureaucratic morass as possible in order to get on with the job.

Thank you very much.

Senator ZORINSKY. As long as you're here, I'd like to make a comment with regard to the people I've spoken to that are attempting to get into the biomass program. Possibly some of the explanation is the lack of knowledge within the Farmers Home Administration, but there are people in the Farmers Home Administration that are overzealous in their pronouncement of efficient proposals. They are telling farmers yes, this thing should really go, and then the applicants get turned down on their proposals. Then the farmers come to me and say how come they tell me this is a good program, that it's acceptable in every way, I have the equity, I meet all the tests, and they turn me down on the proposal. This is very difficult to explain to some of these people.

Mr. THORNTON. Yes, is is. I know that, Senator.

Senator ZORINSKY. What I'm saying is that if these people don't know, they ought to keep their mouth shut.

Mr. THORNTON. I couldn't agree with you more. That's very good advice.

Senator ZORINSKY. I'm not going to name names, but some specific instances have been brought to my attention. If there are those in the Farmers Home Administration that are saying that this is a good project, then they ought to encourage the acceptance of that project and follow through and make it acceptable so that the farmer doesn't have to come to his Congressman and say that FmHA said the project meets all requirements, and yet FmHA turned it down. Nobody knows why, and I can't tell them the answer.

Mr. THORNTON. That's good advice, and I hope they follow it.

Senator ZORINSKY. Thank you very much for appearing.

Mr. THORNTON. Thank you, Senator.

Senator ZORINSKY. The next witness I'd like to call Mr. Larry Kelso, Chief, Agricultural and Food Processes Branch, the Division of Conservation Research and Development from the U.S. Department of Energy. Welcome, Larry. I assume you have an opening statement. If you'd like to condense it in your own words, we'll place the statement in its entirety in the record.<sup>1</sup>

**STATEMENT OF LARRY R. KELSO, CHIEF, AGRICULTURAL AND FOOD PROCESSES BRANCH, OFFICE OF INDUSTRIAL PROGRAMS, CONSERVATION AND SOLAR ENERGY, U.S. DEPARTMENT OF ENERGY**

Mr. KELSO. Thank you, Senator. Mr. Chairman, it's a pleasure to be here, and I do appreciate the opportunity to testify to the subcommittee on the energy integrated farm systems projects. I will summarize my statement and enter the entire statement for the record.

I would like to simply state this morning how these projects might be coordinated with the intent of the loan guarantee provision of title II of the Energy Security Act.

This subcommittee and the Senate Agriculture Committee, the Office of Industrial Programs have a mutual interest in the concern with implementing a program to benefit America's agricultural producers by reducing their dependence on foreign supplies of petroleum,

<sup>1</sup> See p. 63 for the prepared statement of Mr. Kelso.

and at the same time providing a technically feasible alternative source of renewable energy that will give our Nation's farmers the power needed on a timely basis for both crop and livestock production.

As I basically understand the focus and the provisions of title II of the act, it authorizes \$600 million to the Department of Agriculture for general biomass energy development. It further states that the Department of Agriculture program is for biomass, and at least one-third of the financial assistance provided is to be used for small-scale projects, which would produce less than 1 million gallons of ethanol per year. That same title also specifies \$600 million of the Department of Energy \$850 million authorization is to be used for biomass projects other than urban waste.

The projects that I shall describe to you this morning are not related to title II of the Energy Security Act, nor do they affect any of the provisions of that act. It is also clear that the act makes no provision for coordination of this program with the intent of the loan guarantee provision of title II. The energy-integrated farm system projects are funded under budget authority granted by the Senate and House Appropriations Committees for the Department of the Interior and related agencies.

Although the U.S. farmer consumes only a small fraction of the total U.S. energy demand, that fraction is extremely important to his productive ability.

Operations such as preplanting, planting, irrigation crop drying, harvesting operations, and so forth, all have to be undertaken within a certain period of time, and usually that period of time is crucial. The economic penalties of not having energy at the precise moment and time it is needed are severe for both the farmer and the consumer.

In the Office of Industrial Programs, and in particular the Agriculture and Food Branch, we have initiated a program of research demonstration and development on energy-integrated farm systems. The objectives of our activity are primarily two:

Development of on-farm integrated livestock-crop-energy production systems that are economic, reliable, require minimum attention and maintenance, and minimize the need for energy and material flow across the farm system boundary.

Second, we have an objective of comparing the energy-integrated farms with conventional farms as to net energy saved, net profit, and soil and water conservation effectiveness.

Simply stated, an energy-integrated farm system is designed to combine the diverse onsite energy sources with one another to provide continuous energy and reduce the farm's dependence upon nonrenewable sources of energy. The objective is to promote self-reliance and self-sufficiency in farming. Conservation is the first step toward this end.

Our program is basically a 4-year, \$8 million program. When we began this solicitation, we had approximately 1,400 solicitations for the PON. We had generated an extreme amount of interest by farmers already doing the type of projects we wish to do. They came in in masses to solicit the money and to ask for information. When the final day came, the door closed, and projects were to be submitted, of these 1,200 to 1,400 people that requested information and requested solicitations, only 40 submitted requests for projects.

Contract negotiations were begun in May 1980 with 12 proposers. And in my testimony there are two tables: Table 1 basically delineates the type of project and the type of technology being requested for investigation. Table II delineates the specific characteristics and estimated objectives of each program.

To date we have awarded seven contracts to seven proposers, two proposers dropped out in the early stages of negotiations, and three are expected to finalize negotiations early this fiscal year.

It just happens to be a coincidence that your being chairman of the subcommittee that your State be awarded one project. It is to the University of Nebraska, and it wasn't done with the electoral votes in mind.

Senator ZORINSKY. Obviously.

Mr. KELSO. Of the seven projects that we have underway I would briefly like to touch on each one of them. Millbrook Farm and Cornell University is the teaming effort. On a 450-acre farm there are 200 head of dairy cattle for which 120 are milking cows. They propose to follow the major following energy concepts: Methane generation from cow manure; cogeneration of thermal and electric energy from methane combustion; production of alcohol from corn; energy conservation in crop production through conservation tillage and substitution of manure for nitrogen fertilizers; energy conservation through waste heat recovery in milk cooling and in recycling of waste water; application of micro-processor control systems to control and monitor energy production in the methane digester, in the cogeneration equipment, in the waste heat exchangers, and in the alcohol production plant.

The University of Nebraska is going to have a demonstration project at their field laboratory farm near Mead, Nebr. It is a self-contained farming operation of approximately 160 acres of farmland devoted to the production of corn, soybeans, and sweet sorghum. It will include a 300-head farrow-to-finish swine facility. The energy-integrated concepts that they plan to demonstrate are: Methane production from swine wastes; production of alcohol from sweet sorghum; solar energy and methane gas use in grain drying, water heating, and space heating for swine production centers; energy conservation of heat and CO<sub>2</sub> from ethanol plant for use in greenhouse system; integration of biomass and solar energy to produce power for irrigation; computerized farm energy management and conservation system; energy conservation in crop production through conservation tillage, conservation of fertilizer, and irrigation scheduling; and energy conservation by optimized construction of swine units.

That is more or less an in detail description of two out of the seven. The other five, one is located at Granja Caribe Farm in Puerto Rico; Del Valle Hog Farm, a 3,000-acre operation near Austin, Tex.; the Aubrey Farm with Georgia Tech Research Institute located north of Atlanta; the North Dakota Agricultural Experiment Station, which is basically 500 acres of cropland with a 100-cow dairy operation; and Foxlease Farm located in Loudon County, Va., with approximately 400 head of Holstein cows with 100 of them producing dairy cows, and a 1,400-acre farm to support their farming requirements.

When we embarked upon this we saw the need and a very severe need for transferring this technology back to the farm operation, and

therefore, we tried very successfully and have negotiated an interagency agreement between DOE and USDA to do what we basically are going to be calling a successful transfer of technology demonstration of this program. The agreement is with USDA Science and Education Administration to accomplish both field management and technical monitoring of all projects under the energy integrated farm systems program.

The Science and Education Administration has employed through the Intergovernmental Personnel Exchange Act a senior scientist with research and agricultural extension background to manage this program. That person will be reporting to work as of this morning in Washington, D.C., and will have joint responsibilities with a member of my staff for the management of the program.

In addition to the overall management and technical monitoring of the programs, we feel that the USDA's unique and broad experience in Cooperative Extension Services will greatly enhance the technology transfer of our program.

I would simply like to conclude by saying that in this time of high fuel prices and potential petroleum shortages, we fully recognize the need for technically feasible systems to insure the agricultural producer's independence from shortages or shutoff of supply that might seriously disrupt the farm production and the flow of foodstuffs through the food chain. It is our intent to work in every way possible to implement the technologies described, and assist the Department of Agriculture, whenever requested, on the implementation of title II of the Energy Security Act.

This is already evidenced by our interagency agreement which predates that Energy Security Act, because we had previously established the need for joint cooperative efforts.

It is my understanding that Farmers Home Administration is already working with the Office of Alcohol Fuels, and that was so evidenced in testimony this morning by my colleague, Mr. Thornton, and the Office of Solar Applications for Industry toward implementation of the provisions of title II for small-scale alcohol projects and biomass projects.

This concludes my summary statement, and I will be happy to answer any questions that you may have, Senator.

Senator ZORINSKY. Thank you, Mr. Kelso. First of all, I'd like to compliment you and the administration for your astuteness in the selection of the University of Nebraska as one of the recipients of this program. Second, to what extent is your office currently involved in planning and developing a national program with long-range objectives to significantly accelerate the use of these and similar systems by the American farmer?

Mr. KELSO. Well, we are basically not currently involved in planning and developing the national program. We have been, by the record, committed to helping the American farmer and to ensuring continuance of energy supply on the farm and the implementation of technologies that would indeed lead to that.

As I indicated in my testimony, we do not have a responsibility under title II, we do not have a congressional mandate. Our budget is one that is generated through the normal channels under the Office of Industrial Programs, it is a very small office. To the extent that we

have the financial resources available to do so, we will continue to expand and continue to plan our program, which we ultimately hope to make it a national program. At present I am not involved in planning the national program.

Senator ZORINSKY. In other words, other than energy cost and availability, there really is nothing being planned in your department to attract farmers to adopt systems being utilized currently?

Mr. KELSO. Not in the Office of Industrial Programs as such. Of course, you are well aware that there is a serious effort going on in the Office of Alcohol Fuels and also in the Division of Solar Technologies, specifically the Office of Biomass Programs, and these are generic technology specific type of operations. They do not in my view address the serious requirement for an integrated onfarm energy system.

The reason I say it in that fashion is quite simply that the requirement that the farmer has and the need to do something on energy integrated farm systems differs somewhat possibly from the intent of the Energy Security Act. There is a need for a local and a residential utilization of alcohol fuels and energy integrated systems at the farm level, because there is no infrastructure set up at the farm level to be able to gather all of the alcohol and take it to a central processing facility, such as a 60-million gallon a year facility. The alcohol produced onfarm at 160 proof can be used more efficiently on the farm than if we have to take it to a cooperative or if we have to truck it to central facilities. Somehow it seems to me to be a ludicrous proposition to construct a 60-million gallon facility and then have to truck corn to it or other grain stuffs where no infrastructure necessarily exists and when this corn has other avenues to the marketplace and other commodity areas. Additionally, I do believe that by an onfarm energy system we really give the American farmer an option to do other things with his grain and other things with his commodities that he does not have presently available to him today.

Senator ZORINSKY. Is there likely to be a broad need for education and training so that farm operators can profitably operate and maintain biomass systems?

Mr. KELSO. Yes, indeed. There is a need for a broad-based training program. I think that over the years the Cooperative Extension Services of USDA have done a magnificent job, and this isn't meant to be a platitude, but they have done a magnificent job in assisting the farmer and bringing to the farmer new technologies and improved technologies. What we really need here is we need to be able to get to a point of having commercial systems available with commercial warranties and guarantees that the farmer can buy in the open market, just like Mr. Thornton said earlier, something that is not being peddled to him for which he does not know whether it is a good or bad system, and something that can be integrated into the cooperative extension mechanism to be able to transfer that technology and assist in the training of the American farmer on what to buy, how to buy, how to use it and where to use it.

Senator ZORINSKY. In your perspective, what can this committee do to help the farmer find solutions to their energy problems now and in the future?

Mr. KELSO. I'd say that's a very broad and a very difficult question, Senator. I think from one point of view we need to take a look at the financial assistance that the farmer requires. I know that in the previous testimony you discussed extensively the possibility of a farmer getting private loans versus public loans. I think that as evidenced in our own procurement situation where we have gone out on solicitation, we have found in our requirement of a cooperative agreement with 50-percent cost-sharing requirement that the farmer indeed has a difficult possibility of getting private capital. In a couple of instances we have sent some of these people to FmHA to secure guaranteed Government loans to the extent that they could participate by the matching fund rule under our program. I am not sure that the intent of the law is going to help the farmer that much, simply because of the education and training problems, because certain problems that exist on getting the farm community interested in doing something.

It's very easy for a farmer to go out and buy a tractor, because it's something commercially available, but the dream of having an energy integrated farm system that could reduce his dependence on outside sources of fuel by 40, 60, 70, 80 percent, whatever the number is, depending on the farming operation, is one that in certain cases may be more dream than reality, and he has to have something in the way of financial incentives, tax incentives or other mechanisms that would permit him to easily get into it. I think the thing that we have overlooked is that the farmer's primary interest in being a farmer is farming operations and not necessarily energy systems, and for him to suddenly have to go out and put together a proposal, put together a complicated engineering scheme to come in with a project request for funding is something that they're not equipped to do.

We somehow have to ease the burden and facilitate for the farmer a mechanism for being able to get ahold of a grant opportunity, if that's the way it should be, to come in with a very minimal technical request to do the work required on-farm. I think that the projects that we have funded will certainly lead to models and to prototype systems or to model systems that someone could look at and say OK, here is a farming concept that uses the various energy integrated technologies. How much will that cost if it's not an R. & D. program? We attempted to take a brief look at that in table 2 of my testimony. The amount of research and development and demonstration funds going into a project like the one at the University of Nebraska is almost a \$2 million total project of which 50 percent is being cost-shared by the university through State agencies and State funding mechanisms. The other 50 percent is coming out of my office. That project, if available and implemented at the farm level by a farmer, should not cost more than \$150,000, \$200,000 as a package, yet the farmer, as a general rule, doesn't have the financial resources, at least in the private lending world, to be able to go out and say to his banker I'd like to borrow \$200,000 against this, because it will reduce my net farm operating costs by  $x$  number of dollars, my return investment will be 6, 8, 10 years.

A banker is not likely to lend a farmer that kind of money for that type of project if he is there at the same time asking for \$125,000 to buy a new combine. The combine is directly related to crop production, the energy system will not be in the banker's mind. Part of that has to

do with the lack of training and understanding in the financial world of what this could do in reducing operating costs.

Senator ZORINSKY. Have you ever spoken to bankers in Nebraska?

Mr. KELSO. Yes, sir.

Senator ZORINSKY. And they've told you that energy costs have nothing to do with the cost of production and the ability of a farmer to pay back loans?

Mr. KELSO. No, sir, not energy costs.

Senator ZORINSKY. Well, why wouldn't energy enter the mind of people lending money especially since it's a major cost in irrigation, as I'm sure you know? When you mention irrigation around these parts, you're talking about pumps and talking about fuel and energy costs, and maybe even the unavailability of energy to provide that irrigation at all. That in turn reduces the number of bushels per acre, which in turn increases the cost of production, which in turn reduces the ability of a farmer to repay a loan to a banker.

The banker gets very nervous when he starts talking about energy costs. I see some small town bankers back there sitting in the audience, and I'm sure if we were to ask them to come up here and ask them if energy were to double or triple in cost whether they feel their outstanding bank loans would be less secure just due to that one factor. I think it's part of the overall picture and I don't think any banker is not thinking about it, as you've indicated in your statement, because they're very nervous about the cost of energy around these parts.

Mr. KELSO. Yes, Senator, they're very nervous about it, and they do give it a thought. As you say, the situation is turned around from not being so energy intensive from the cost point of view they used to be 10 years ago to what is now a very intensive energy cost.

However, in the recent situation with the project that is proposed in Indiana when the farmer in that particular instance had a loan commitment, what he thought was a loan commitment, for \$1.2 million for his cost share of the cooperative agreement, when it came time to sign the final papers, the banker pulled out and pulled out for reasons that may not have been entirely associated with energy, but had to do with the overall credibility of the systems of the farmer's ability to carry on the project of what was construed as being by the bank in the banker's own terms higher priority items given the farmer's overall financial picture. And when a banker sits down and looks at the entire balance sheet of what is being proposed, and you're looking at say an energy-integrated system that might have a 6- to 10-year payback versus a piece of equipment that might have a 2-year payback, the priorities are assigned accordingly. And those priorities oftentimes have nothing to do whatsoever with energy costs or energy philosophies or energy concerns.

Senator ZORINSKY. That's one of the problems that exists today. Rural bankers are a lot closer to the reasons why farmers go broke than are these large banks—I don't know to which bank you're referring, but I venture to say that the banks that are closely related to farm operations are sensitive and cognizant of the priorities that we're talking about. And I would think that what's good for one farm in Illinois, I think you said, may not necessarily be good for all the farms in the United States.

Mr. KELSO. That is correct. It varies by State and by regional and geographic area.

Senator ZORINSKY. In August 1979 your office issued a program opportunity notice for grants for integrated energy systems. When this notice was filed, did you know how much money you had available for these projects?

Mr. KELSO. Yes, sir, I did; \$8 million.

Senator ZORINSKY. How many submissions did you receive?

Mr. KELSO. Forty submissions.

Senator ZORINSKY. How many did you fund?

Mr. KELSO. We selected 12 for funding, we currently have 7 funded.

Senator ZORINSKY. Have you got any others that are still under active consideration?

Mr. KELSO. We have three additional projects that we plan to have funded before the end of this fiscal year; we have two that have tentatively withdrawn, one of which may come back in as a potential project.

Senator ZORINSKY. Of the \$8 million that you had available in fiscal year 1980 for integrated farm systems, how much of that amount actually went to operating farms for the development of onfarm integrated energy systems?

Mr. KELSO. I would say 60 percent; I don't have the precise number, but at one point in time it was \$4½ to \$5 million out of the \$8 million for actual on farm. The other \$3 million basically were split between the University of Nebraska, which did not have a commercial farm—by "commercial" I mean a private commercial farming operation involved, and North Dakota State, those are the only two projects that do not incorporate as part of their teaming effort a private farm outside of the university system, all others have private farmers involved. And in all cases, I might add, we have tried to make the farmer the prime contractor responsible for carrying out the project. It seems to us it would be more credible to the other members of the farming community if that farmer himself had interfaced with us and had been the one cognizant for and responsible for carrying out the project.

Senator ZORINSKY. Section 2120 requires the Secretaries of Energy and Agriculture to establish the energy equivalent of the 15 million gallons of ethanol 30 days after enactment of the law. Has this energy equivalent determination been made?

Mr. KELSO. I do not know if it has been made, Senator. I'm not in that particular area, and that is not something that's been under my responsibility. I would be happy to get the—

Senator ZORINSKY. Could you submit it for the record?

Mr. KELSO. Yes, sir.

Senator ZORINSKY. Have potential applicants for biomass funding been made aware of this?

Mr. KELSO. I'm not sure that they have yet, Senator.

Senator ZORINSKY. Would you agree with recent administration statements that farmers may not be able to safely handle certain types of onfarm alternative energy facilities?

Mr. KELSO. Yes, sir, I think that is a fair assessment. Not all systems that are available on the market are as safe as they might seem to be. I just heard this morning at a meeting with researchers from

the University of Nebraska a situation where a still during a demonstration blew up and apparently sent seven people to a burn unit. Recently the Department of Energy itself had a crisis at the University of Missouri at Rolla where two people were killed on a gasification project. I think we have a lot of safety concerns yet to overcome and to ensure so these systems can be safely placed just like any other system can be placed in the hands of the farmer. It is still not uncommon today after 50 years of development or more that we hear people on the farm are losing a leg or a hand in a hay-baling operation. And I can assure you if you've ever run one of those, you know exactly the danger I'm talking about. A wire is loose, the man reaches down with his arm to grab it, and the arm is gone. So safety is always a concern, and yes, I do believe some of these systems are not ready to be safely placed in the hands of just anybody in the farming community.

Senator ZORINSKY. Thank you very very much, Mr. Kelso, for your articulate presentation.

Mr. KELSO. Thank you, Senator.

Senator ZORINSKY. Since our witness list this morning is rather long, in the interest of time I would ask the witnesses to please limit their oral testimony to about 5 minutes. You may summarize your statement and, of course, we will include your complete statement in the written record. I'd like to call Mr. Ralph O'Connor, the chairman of the Nebraska Agricultural Products Industrial Utilization Committee. Welcome, Mr. O'Connor.

**STATEMENT OF RALPH E. O'CONNOR, CHAIRMAN, AGRICULTURAL PRODUCTS INDUSTRIAL UTILIZATION COMMITTEE, LINCOLN, NEBR.**

Mr. O'CONNOR. Thank you, Senator, Mr. Chairman. My name is Ralph O'Connor. First of all, I'm speaking in behalf of Mr. Sorum, who is putting on a presentation at Omaha at the present time. And I will submit this memorandum to you people, and I'll make my statements mighty short because I know time is of essence in this deal.

In opening statements I want to read into the record that I am the chairman of the Nebraska Agricultural Products Industrial Utilization Committee. This agency, usually referred to as the Gasohol Committee, which we feel we're going to get the name changed in the Nebraska Legislature this year so people know what it is. It was established by the legislature in 1971 and is charged with assisting the private sector in the development of a grain alcohol industry in the State. I also speak as a grain farmer who has a strong interest in seeing this market for my commodities succeed.

The Nebraska Gasohol Committee has been actively involved in the alcohol fuel movement for several years, and we have seen the concept of converting agricultural products to liquid fuel grow from an idea to a reality. Gasohol is being marketed with great success in all parts of the country. Gasohol sales in Nebraska account for 4.5 percent of all gasoline sold in the State. I was informed by telephone this morning that our neighbor, the State of Iowa, has exceeded 11 percent; in other words, the gasoline sales in the State of Iowa has

gone beyond 11 percent in the gasohol field. That is a remarkable increase. It shows that gasohol in the Nation is here to stay.

I'm going to delete the rest of my presentation; I want to make a few remarks. First of all—

Senator ZORINSKY. Without objection your entire statement will be included in the record.<sup>1</sup>

Mr. O'CONNOR. That's fine. Thank you, Senator. First of all, I think we should keep in mind the quality of alcohol is going to be produced, whether it's on the farm level, or whether it's on the commercial level, or whatever it is. Eighteen months ago I spent 3 weeks in the country of Brazil reviewing plants in the farm level, the State level. We traveled through five different States. In our last meeting involving plants the Secretary of Energy of Brazil warned us, and these are his words, and I'll quote:

By all means do not make the mistake that we made here in Brazil. Build the quality alcohol that is second to none, make it the nearest thing to true anhydrous that you can, 190 proof or above.

That is speaking of Brazil; we're here in Nebraska where we have over 100-120 degree differential in a 12-month period. This is something that we've got to recognize, if we're going to have a quality product that the public is going to accept, it has to be 200-proof alcohol and nothing short.

We of Nebraska have worked on that; we've got our policy set up where we have a 5-cent tax credit for anhydrous alcohol, and that's what we intend to keep.

We hear a lot of things about gasohol sales haven't caught fire. I think they have caught fire and are burning quite rapidly. Some of the reasons for this are who's putting these articles out. And I'll read you just one part of an article, it says: "The reason for the energy imbalance is that producing corn based out of all commercial farms is requiring other fuel to derive the distillation process." They're absolutely right. We're not talking about natural gas, we're talking about using coal. I don't think we should use natural gas on a plant of commercial basis, the small basis maybe, that's correct, we can do it, but we've got another plan, another idea right here in Nebraska. We've had an organization, the Development Corp., that went into a food processing plant—I'm not going to mention the name, I think the Senator knows who it is—a process that was studied, thousands upon thousands of dollars spent on a feasibility market engineering study presented to the Department of Agriculture, presented to the Department of Energy and the Farmers Home Administration. And lo and behold, they sent the man out themselves from Washington in the name of Dr. Weldon Barton. He inspected the site, he inspected their feedstock supply, gave us very good approval of it.

I was able to accompany him on his trip while he was here, we had a long discussion here in the airport in Lincoln. He liked what he saw, he took the information back to Secretary Bergland. Secretary Bergland liked it because it was a food processing plant. It scalped three different major ingredients from this grain before it went into the distillation part of it, the fermentation. It took the protein, the yeast fodder, and

<sup>1</sup> See p. 69 for the prepared statement of Mr. O'Connor.

one other, bran, if you want to scalp in that deep, out of corn. I didn't know there was bran in corn, but there is. They took it off out of the front end directly into human food chains and fermented the starch into sugar in turn into alcohol. And this plant is so large that the alcohol is considered a byproduct, the other three major ingredients are considered the main product.

Yes, it's St. Paul, Nebr. And I hate to say that a group of people that form the Development Corp. that have done their own engineering, spent thousands upon thousands of dollars, done their study, presented it to the Department of Energy, to the Farmers Home Administration, and the first thing we hear—or the last thing we hear was this. It's too large a plant, you're over the \$15 million limit. They didn't tell them that in the beginning. Now they say go to the Department of Energy. They've been to the Department of Energy, they're back to Farmers Home Administration, they're back to the Department of Energy now.

So where are these people sent? They're not here to testify today, because they don't know which way to turn, and they spent the money, and they got a very viable product. It's an engineering firm that's been examined, been checked out, it's the Chemapec Corp. of Woodbury, N. Y., and it's the only one of its kind. And those very people along with four other engineering companies put on a seminar here, which we held as sponsor, the utilization committee did, here last March. They put this on right here in this same campus complex, and they proved to the public that this is feasible. And in turn we can't get the USDA or the administration, or whoever is holding the reins, I don't know, to buy a project such as this.

They looked at this on Washington's Birthday at St. Paul, they liked it, they got on the plane, they went down to Liberal, Kans., and put out \$11 million for a plant. When St. Paul was going to use coal to operate their plant, they went on down and accepted one at Liberal, Kans., that use natural gas, and give an \$11 million guarantee loan. You people decide the answer, it's above my knowledge.

In regards to a \$15 million loan guaranteed by the Farmers Home Administration, I think the plateau is entirely wrong. My administrator, Mr. Todd Sneller, testified in Des Moines not long ago that it was the wrong figure to use. And the reason is this: Your charts and all your curves and everything will show from the major engineering firms I've heard men use here, some, even an individual witness here this morning, they say that the most profitable, feasible, economical picture is \$20 million at a very minimum, and the Farmers Home Administration has limited it to \$15 million, and then you go to the Department of Energy. I don't think \$15 million is the one to use at all.

Senator ZORINSKY. Thank you, Mr. O'Connor. I appreciate your comments and certainly share your concern.

Mr. O'CONNOR. Thank you, Senator. I've got a few more things, but I think what I'll do is rewrite some of this and submit it to the committee.

Senator ZORINSKY. Fine. We'll keep the record open so that those that do want to submit additional testimony can do so. I'd like to ask you a question. In recent testimony before a House committee, USDA officials intimated that one of the reasons only limited amounts

of assistance were going directly to farmers for biomass projects was that there was some question as to whether farmers were capable of safely handling onfarm alternative energy products. Do you share this belief that farmers are not capable of handling some alternative-energy technology safely?

Mr. O'CONNOR. I think the farmers are very capable. Now, I'm not going to say 100 percent, but not every farmer builds an alcohol plant. But I think the plant that's built right down here in the southwest part of Nebraska that some of you people, I understand, are going to inspect this afternoon, is a very appropriate sized plant; it's a 300,000-gallon capacity. The feedstock itself will be grain; distilled grains will be fed to the livestock right there on the spot. Every farmer can't do it, but the farmer himself is more capable of inventing things—not patenting—than probably the majority of the people in the Nation. After all, agriculture is the greatest industry in the world, and who's running it, notably the farmer.

Yes, they can do it if the redtape and everything was cut from from Washington. These people are getting discouraged. They'd like to be able to build their plant and go on and get a loan or loan guarantees, and they're entitled to it.

Senator ZORINSKY. Thank you very much. I appreciate your presentation.

Mr. Dick Waybright of Mason-Dixon Farms in Gettysburg, Pa., accompanied by Jack Sheaffer and Pat Ledford, Sheaffer & Roland, Inc.<sup>1</sup> Welcome to our State of Nebraska. I went by Gettysburg not too long ago on the way back from the successful outing with Penn State and Nebraska, the football game recently played in Pennsylvania. Gettysburg is a delightful place; welcome to our State. And Joe Paterno is still a very good coach.

**STATEMENT OF DICK WAYBRIGHT, MASON-DIXON FARMS, GETTYSBURG, PA.; ACCOMPANIED BY JACK R. SHEAFFER AND PATRICIA A. LEDFORD, SHEAFFER & ROLAND, INC.**

Mr. WAYBRIGHT. Thank you, Senator, for the invitation to come here and give me the opportunity as a farmer to explain some of the experiences of making our farm self-sufficient in electricity and, hopefully, in portable fuel.

The reason that Mason-Dixon Farms built a digester which started to operate a little over a year ago came as a result of seeking a better method of handling manure from our dairy herd, and to be energy self-sufficient. We had used liquid manure for the last 20 years, a good way, but it has two major disadvantages; one, the fact that arge quantities of water have to be transported to the field, and objectionable odor is associated with the system.

Our observation of liquid manure storage showed us that low-level biogas naturally is produced in the storage. About 8 years ago I started to locate someone who could help us build a digester so that all the gas could be collected. After much research and talking to a lot of people who have varying levels of expertise on the subject, I

<sup>1</sup> See p. 70 for a reprint of "A Synergistic View of Anaerobic Digestion" submitted by Mr. Sheaffer and p. 87 for the prepared statement of Mr. Sheaffer.

located Sheaffer & Roland and their subsidiary Energy Harvesters of Chicago convinced me from their experience with digesters, that they were my best hope of getting a proper design for a digester on a farm.

A synergistic approach was decided for the total plan for our farm. The digester has greatly reduced the odor from manure handling. The sludge from the digester is collected in a holding pit and then pumped through a manure squeezer which separates the water from the cellulose.

We have found that the cellulose makes an excellent bedding for the dairy herd; and, in fact, we no longer use straw as bedding, which in turn makes it possible to change our crop rotation to corn and alfalfa and not have to grow small grains.

The water portion of the sludge is pumped at center pivot irrigation and fertilized within the crops. Our first year of experience with this approach has taught us that the crop gets more nutrients from manure and without odor. To our surprise, the generator which runs on the biogas from the digester is able to supply all the electricity that we use on the farm. When we complete our second digester and use all the manure from the herd, we will be able to generate about 1½ times the electricity that the farm used last year, which was about \$30,000. In addition, we will have enough waste heat from the generator, which we are now wasting, to ferment and distill at the rate of 40 gallons per hour of anhydrous alcohol fuel for our farm tractors and trucks. In fact, it will be more than enough—when this phase is completed, the farm will not only be self-sufficient in electricity and portable fuel, but will also be a supplier of energy.

I still haven't gotten over the fact that we milk cows with electric milkers and the power for the electricity comes out from under her tail.

We have been feeding our herd 40 pounds per day of 80 percent brewer's mash that is purchased from a brewery in Baltimore. It has reduced our need to feed soybean meal to balance the ration. This has reduced our feed costs per herd by 22.6 percent. In addition, we have experienced a 10-percent increase in production.

Good business practices tell us that we should be using the waste heat from the generator to make the alcohol from a portion of the grain that we raise before the corn is fed to the cattle, and then we will have our own source of brewer's mash for the herd.

I am excited about what we have learned about being able to produce all our own energy needs for the farm and still be able to sell some.

We won't need to get oil from uncertain sources around the world. I am convinced that agriculture can and should be energy self-sufficient. As a nation that is strong in ag production we must look in this direction, if only to help the family farm eliminate the high cost of energy, thereby guaranteeing their survival instead of ever-increasing energy costs, and in this will cause a moderating effect on the consumer prices.

It seems Government wants to get into the details and technology of energy production. Their role should be financing. Farmers and engineers are quite capable of developing the systems that will work on the farms. We have no need for payments of bureaucrats and professors to review our plants and hold up development. I believe

that agriculture, which is the largest single business in America, has the good judgment to make the determination when its system is cost effective and when they should sign on the dotted line on the loan, which they will be paying back.

I hope that you have grasped my belief that farms can and should be producers of energy. It is good business for the farmer, and any time that that happens that will improve his cash flow and will in turn be good for our country. I believe that America must develop its energy resources with all cost-effective systems, and by so doing will have many sources of energy instead of being dependent on the fossil fuels only.

Let's decentralize our energy resources with all available cost effective systems.

Mr. Swanker, vice president of TMI, which is located about 30 miles from our farm, visited us in February. He was amazed to see our system, which he said cost less than one-half of initial dollars per kilowatt to build compared to their nuclear plant. Our waste is a very positive plus for our crops. TMI wastes and potential dangers are still a national concern.

Senator ZORINSKY. For the record, do you want to clarify what TMI is?

Mr. WAYBRIGHT. It's the Metropolitan Edison's nuclear powerplant.

Ms. LEDFORD. Three-Mile Island.

Senator ZORINSKY. What's commonly known as the Three-Mile Island nuclear powerplant?

Mr. WAYBRIGHT. Yes. I believe the potential for biogas digesters is becoming recognized as a real plus for agriculture. The fact that thousands of people continue to visit our farm and go away convinced that the synergistic approach that we have taken holds real promise for answers to energy, which will assure continued food supply.

Food is the tool we can use to support each other regardless of race, nationality or creed. We must learn to look first at human needs. Let's make sure American farms continue to have the means to produce a bounty of food and help eliminate some of mankind's suffering.

Although the arms race and energy crisis is important, the international food supply issue is mandatory for survival. To me, this is the issue we're discussing, the bottom line is energy to produce food.

And I would like to add that what we have done on the farm we have done with our funding. We are kind of excited about completing the project. We have applied to DOE for a grant to complete the total farm energy integrated system so that the many visitors will be able to view it in its entirety on a working farm.

So far DOE has not seen fit to support our efforts. Thank you.

Senator ZORINSKY. Thank you very much, Mr. Waybright. Pat Ledford, would you like to make some comment?

Ms. LEDFORD. In the interest of time, I'll keep my testimony brief.<sup>1</sup>

There is one example I would like to put forward here as a comparison to situations now for farmers trying to become energy independent; and that was the early thirties, the TVA years, the electrification of farms. At that time the power companies felt that money needed to streamline out into rural areas was much too much, because

<sup>1</sup> See p. 92 for the prepared statement of Ms. Ledford.

farmers did not use electricity—that's quote—farmers were indifferent to electricity and that farmers would not know how to use electricity.

It was not until David Lillianthal argued that farmers were no different than urban dwellers; nor was their intellectual level any lower than urbanites, that the possibility became more of a reality of stringing wire out to the rural areas. And that was done by TVA through REA with purchase agreement guarantees to manufacturers of appliances and much cooperation on the part of different agencies in the Government to make it work, but it had to be made to work. And I think the same thing needs to happen here and is not at this point.

Mr. Waybright's facility is a commercially viable system. He's providing almost all of his electricity off of half of his cow herd.

We have another client called the Baum Dairy. The Baum Dairy made an application to FmHA for a loan guarantee and 5 months later was awarded a loan at 14½ percent interest.

While DOE has given away 33 percent of many millions of dollars to the oil industry and 13 percent to utilities, and farmers came under what might be called 7 percent or miscellaneous. Small farms that came in under the 7-percent category called miscellaneous got very little money on a grant basis. And as I said, the Baum Dairy was after much adieu in 5 months given a 14½-percent loan. That's the most small farms are able to look for in this area now.

Between the Mason-Dixon Dairy, which has been used as a model by Government agencies such as DOE and Farmers Home, they've had something like 7,000 people in 9 months out to look at the digester on the Mason-Dixon Farm. The Department of Energy and the Farmers Home Administration have held it up as a model of what could be done in alternative energy, and yet DOE is now saying that they don't think they're going to be able to afford Mr. Waybright any loan of grant moneys.

I will stop at that so we can move on to Dr. Sheaffer's testimony. Senator ZORINSKY. OK. Jack Sheaffer.

MR. SHEAFFER. I will take this chance to briefly summarize. It appears that our discussion today focused on, do we get more by going with a few big systems or many small systems. And it appears that we made a decision that to reach production goals we need to go with a few large systems.

And I guess what I would like to point out is that the cost of producing ethanol is very sensitive with respect to how we produce it. If we produce it in an integrated farm system—by that I mean we take the grain that the man was going to feed his animals with anyway, convert it into alcohol, take the brewer's mash and feed the animals, we take the manure from the animals and we digest it, take the gas from the digester and generate electricity and take the waste heat from the generation and use that in the still, then the cost of producing alcohol is very small. In fact, you can see cost in producing a gallon of alcohol somewhere in the vicinity of 50 to 70 cents a gallon, if it's done in this kind of a system. Furthermore, if we use this kind of a system, we don't have farmers competing for a grain crop as a feedstock. If the alcohol is produced independently of where the animals are, it's very easy to see the adverse effect on purchasing feed for animals.

To show you what a single farm can do, there's been a detailed energy balance made of Dick Waybright's facility with the second digester and a small still. If that were done, the single farm would offset 4,672 barrels of oil a year; that's approximately at \$190,000. In addition, the electricity and alcohol is worth \$466,000 a year from just a single farm. What it shows is you don't need too many single farms to reach a goal of 22 million barrels of alcohol per year by the end of 1982. In fact, the potential in the United States, if we simply took animal manure from combined operations, the waste from slaughtering the animals and the 900 million pounds of wasted whey in the United States, if we took those three waste sources, which as you said will cost perhaps \$9 billion to treat as pollutants, if we took those waste sources and fed them into digesters and then linked the still to the digester, then that effect would be we would offset 155 million barrels of oil a year far in excess of the 22 million goal for the end of 1982.

So what I guess I'm saying is I feel that small systems, onfarm systems, make the most sense, and that there are many that could be built. There are thousands waiting right now for assistance.

I'd like to make two suggestions. One is that there may be a different way to fund onfarm operations. And I would suggest that we look at the model that we used in municipal sewage treatment plants, whereas, each municipality knew that sometime it would get some assistance. And the whole essence was to achieving long-range goals and not too much attention to the technology, the planning process, the engineering. And that program has worked out fairly successfully, and we have sewage treatment plants in virtually every city, community in the United States, and we did it in a very short period of time.

Another suggestion is I feel it would be desirable if we had a national indepth research effort, not to come up with a still or a digester, but to evaluate what the effects of onfarm energy production would be. And let's take all the different myths that the farmers can't handle, they might get killed, it will lead to soil erosion because of the growing crops and bad soils, take all those myths and systematically evaluate them and weigh those against what might be positive aspects so that one could speak authoritatively of what will be the impact if we were so bold as to let many thousands of farms begin to generate energy in the United States.

Senator ZORINSKY. Thank you very much for your presentation, Mr. Sheaffer. Why do you feel that this type of a chain or cycle of methods of energy production has not been recognized as being qualified for Federal assistance in this area? Is it the fact that maybe there are not enough cattle in Washington to raise enough manure to create the anaerobic process?

Mr. SHEAFFER. I think, perhaps it's viewed as proven technology no longer worthy of research money. And I'm saying this, I know, in the presence of Larry Kelso, but Dick Waybright's single digester produces 35,000 cubic feet of biogas per day. The combined production of biogas from the seven awards that he has made is 35,406 cubic feet of biogas for over \$4 million in awards for getting what Dick Waybright would double with \$50,000 more. Now, perhaps that's not as intriguing a research subject, but I feel that the approach should be taken of getting many many of those digesters and stills across the country,

because if the banker is a problem, as was alluded to, he's going to be a problem until he begins to see a number of these working.

Senator ZORINSKY. Do you feel that possibly Washington is trying to reinvent the wheel; in other words, that we've got current methodology that is proven, but yet they're looking for a more sophisticated, exotic methodology with which to encourage production?

Mr. SHEAFFER. I liken it to the model T. I'm not saying that Waybright's digester is the ultimate, and he wouldn't say it is, either, and every one that's built is modified slightly. But Henry Ford had to build a lot of model T's, and I'm sure there was an engineer in Ford Motor that said hey, wait, if you give me another 6 months, I can put in an automatic shift, but he decided to go with the millions of model T's. And I'm saying the millions of model T's make sense, because the payback on a digester like Dick Waybright has is 3 to 5 years. So if there's some really great thing 5 years down the line, he could blow this one up and start over again, he's gotten the money back. Meanwhile, we've offset billions of dollars of oil imports. And I guess I'm saying I believe the order is extremely important, and that onfarm production is important, otherwise we get what has been testified to, you get alcohol being produced at far greater costs than gasoline, and then have we helped control inflation?

Senator ZORINSKY. Mr. Waybright, why in your estimation were you refused any help from Farmers Home?

Mr. WAYBRIGHT. Senator, I'm a farmer who is really amazed at the increase of Government and how it operates. I guess my biggest frustration has been one department says this, and you'll be hearing from me in 10 days, and I'm amazed at how the buck gets passed around. There seems to be nobody responsible, I guess is my one word, and apparently there's pet projects that—

Senator ZORINSKY. Nobody responsible for that given decision or no responsible people?

Mr. WAYBRIGHT. Well, I think there's a lot of responsible people there, but their hands are tied in so many cases. I haven't proved it, but Joe Blow over here has to go through his department, he holds veto power, and so on down the line. I thought the Department of Energy was created to cut all the redtape, and they apparently have 12 or 15 steps yet that it all goes through.

Senator ZORINSKY. I'm going to tell you how they derive this \$15 million cut off—it will appall you—because I was there. This bill goes on the floor of the Senate, and obviously they ran into an obstacle, because we in Agriculture were trying to assure that farmers would get a fair portion of the dollars that we were appropriating in this bill. And all of a sudden it became apparent that a fight was going to develop on the floor of the Senate. So they went into a quorum call. A quorum call is a dilatory tactic, a parliamentary procedure on the floor of the Senate so that everybody can go to the cloakroom and find out what's going on and try to resolve the difficulties that are taking place on the floor. And that's exactly what they did. They went into the cloakroom, Bennett Johnson and Russell Long and several other Senators, and there was about three rows of them, and they were all shouting and screaming in there, and I was trying to get up front so I could hear what was going on in the cloakroom. Somebody yelled \$15 million; it was like an auction. Before you knew

it, that was the number decided upon. And within 3 minutes, although 90 percent of the people—the Senators in that room didn't know what they were talking about, they came back out of there with a compromise of \$15 million. And that's exactly how it happened.

So I concur with you when you say that possibly sometimes Government is not cognizant of what takes place out in the field. Theoretically we can compromise back there, and we can adjudicate and we can dream about what should happen, but out here in the fields, your field and all the farmers' fields, is where the actual training grounds and proving grounds are going to be. As somebody earlier mentioned, possibly the demarcation line should be \$20 million, and if so, we're not going to be hesitant in amending the law, because I guess we're going to have to learn by experience what's been done wrong. I'm sure we're going to find a lot more wrong than right when it comes to promulgating rules and regulations.

MR. WAYBRIGHT. One other comment I'd like to make, Senator, is the thing that frustrates me is, as I said, we spent our own money to build the digester, because we wanted to build it last year. And we were able to, and we were hoping that we would have a normal crop year this year so that we could finish the digester, build the second phase of it so it would use all our manure. Unfortunately, we had less than 2 inches of rain since the beginning of June in Pennsylvania in our area, and the resulting corn crop was 20 bushels to the acre instead of 120. And as a result, our cash flow on the farm, we have to bite the bullet and make the dollars meet. While it would take us about \$50,000 to build the second generation digester, which I think from a national picture it's sad that it isn't being built, not that I have any particular desire to have it done on my farm, but from the year's experience we have identified certain things that we feel pretty positive that can really enhance digesters on farms.

Senator ZORINSKY. Do you feel your process is dangerous for a farmer to use?

MR. WAYBRIGHT. No, I don't. I have a comment to make that a lot of people ask me, is it complicated to operate? And I say if a farmer can keep a drag on a manure spreader, he can certainly operate a digester. It's a case if you can shove it down a hole, you can make it work.

That's one of the things we have learned, we've read all the books, we've heard all the experts, and we were almost afraid to even try to build it, but we are simply amazed at the simplicity of operating a digester simply by heating to 95—we can actually run it up to 112 degrees and there is little difference as far as continuity in production.

Senator ZORINSKY. Pat, when you indicated that there are a lot of visitors to this process, and the Department of Energy holds it up as a model—

Ms. LEDFORD. Yes. Mr. Waybright can probably address exactly who's been out there better than I can, but certainly many DOE people and Agriculture people. I've wanted to comment on something, that \$15 million, 33 percent of that went to oil companies and/or subsidiaries of oil companies who've verified that.

Senator ZORINSKY. That's why Russell Long and Bennett Johnson of Louisiana were very concerned about how much of this money got away.

Ms. LEDFORD. And 13 percent of it went to utilities. Now, the thing that troubles me here is that farmers might get, if they can constantly squeak through the regulations that are followed by Farmers Administration, a guaranteed loan at a very high percentage rate, where an oil industry or a subsidiary of an oil industry can get grant money, keep the money, don't pay us back.

Our utilities can pull 13 percent out of such a sum of money in these grant moneys, where someone like Mr. Waybright is being given a very terrible time.

There was an article in the Washington Post, and the reporter ended up entitling it, "Not the Same Old Manure: Agriculture Doesn't Know Energy From Shinola," which will give you an idea of the opinion—

Senator ZORINSKY. I read it.

Ms. LEDFORD. At any rate, the next day—Dick, wasn't it the next day at 11 in the morning? It was a Sunday paper—oh, it was the same morning—

Mr. WAYBRIGHT. Sunday morning.

Ms. LEDFORD [continuing]. At 11, DOE was on the phone—Mr. Waybright, we understand you have a nice digester out there. They knew his digester was out there, they had been out there in hordes to look at the digester, but in the Washington Post article there was—Mr. Homberg?

Mr. WAYBRIGHT. Yes.

Ms. LEDFORD. On the telephone saying we would like to send our DOE representative out with grant papers to fill out for you on your farm tomorrow, which in fact he did do.

Now, Mr. Waybright has been told by the Philadelphia people that if he sees the \$50,000 grant by Christmas, which he probably will not, he will be lucky. There are a lot of politics there just—

Senator ZORINSKY. He will be lucky.

Ms. LEDFORD. Just this one situation will give you an idea of all the others.

Mr. WAYBRIGHT. Senator, you may be interested in this comment: I'm amazed at the farm countries that sent delegations. Israel has sent their Minister of Agriculture to visit our farm. They sent engineers there to follow up, China, Yugoslavia, East Germany; in one week we had 15 foreign countries visit, and the interest in many of the other countries who recognize that this is a viable source of energy.

Now, obviously we aren't going to supply our total energy in this country from cow manure, but I think the way we've really got to look at it is the fact that the agricultural food production chain, if it can be its energy producer and not be dependent on these outside sources, to me from a national priority, it has to have a lot of merit; in fact, it might be worth as much as a couple of missiles from a national standpoint.

Mr. SHEAFFER. If I could make a comment; there are hundreds of digesters I know that are in various stages of initiation, and some of them are held up by the most creative obstacles that I have seen, and it's not all Federal. I know a large dairy operation in New York which wants to blend the waste cheese whey, which is a terrible odor, with the manure. And they are held up because the whey has to be transported in a truck, you know, from its current site to the digester.

Thus, the State—has determined the need for a public hearing and the securing of a permit. And meanwhile, it will probably drag on so that the digester cannot be built, you know, during this construction season.

An application for a Farmers Home Administration loan guarantee requires a good deal of analysis. The resulting report represents a fair sized book. An on-farm energy system essentially must be engineered before an application can be submitted. And then the question is, who pays the cost? Also, there are problems with the short-term and the long-term loan guarantees. In general, it appears that a farmer must first build his on-farm energy elements, have it certified and operating, and then Farmers Home Administration will guarantee the loan. The obvious question is how to finance it before the loan guarantee is secured. If the Federal Government is going to help finance on-farm systems, it should take some of the risk.

Senator ZORINSKY. Also, you bring to mind a situation that's been brought to my attention. When an application is turned down and the reasons for the turndown are pointed out, the DOE and USDA ask for a resubmission of that application. The applicant says will you point out what's wrong, and when I resubmit it can I use basically the same application with the exception of changing what was wrong in order to comply with your request? No, you have to redo the entire thing. This is from some guy sitting there behind a desk making maybe \$80,000 a year, and you're spending \$2,000 on a reapplication because the padding on his chair is a little thicker than what the applicant's chair is. This disturbs me, too, because I'm not saying that everything is evenhanded in Government. This individual got the wrong person to talk to in that department maybe. It's very easy to say no, we want you to resubmit the entire application, those are a few well-chosen words, but that is the voice of somebody that doesn't know what the hell they're talking about.

Mr. SHEAFFER. They don't realize the cost of preparing applications.

Senator ZORINSKY. I would agree with Mr. Waybright on his comments about other countries coming to see what you're doing, while our country will pussyfoot all around your operation and maybe a year from now recognize that it may have some value.

I've been in the Ambassador of South Africa's home for dinner, Ambassador Donald Sole, just a couple of months prior to the energy crisis, and he said, "Senator, do you know that half of the gasoline in South Africa comes from the liquefaction of coal. It's an old process," he said. "In fact, all the German scientists after World War II came to South Africa, and they developed the process for us." He said to that day, the United States of America and its Government had never even asked them how they do it, why they do it, or when they do it. And that's because we're going to invent our own way of doing things, and we're going to bankrupt many people who have the simple solutions to the problem while we intensify our search for complex solutions.

I want to thank you very much for the distance that you came to testify at our hearing. If you've got any money left over from your farming operation, which most operate on a deficit, you might want to stay over and watch the football game tomorrow morning.

Mr. WAYBRIGHT. I had another thought on that, Senator. I know you're fairly close to Washington; I'd simply like to extend a personal invitation here if you're heading up toward Penn State to see a good football game, stop by the farm.

Senator ZORINSKY. Thank you very much.

Next, a panel of witnesses: Mr. Ray Ratliff, with the York Grain Processing Corp. in York, Nebr.; Randy Sternberg of Sternberg Irrigation, Neligh, Nebr.; and Larry Ball, of Nabal, Inc., Lincoln, Nebr. Will those three panelists please come forward?

Ray, do you want to start?

**STATEMENT OF RAY RATLIFF, PRESIDENT, YORK GRAIN  
PROCESSING CORP., YORK, NEBR.**

Mr. RATLIFF. I'll start out, if you want me to. My name is Ray Ratliff and I live at York. I welcome this opportunity to appear before your committee and discuss several issues relating to small plant alcohol production. I am president of York Grain Processing Corp. which was organized for the purpose of establishing an alcohol plant in York County.

My interest in alcohol fuels goes back quite a few years. In 1971 I was appointed by Governor Exon as a member of the first gasohol committee, and within that association, I served as chairman of the committee and as administrator. I believe that an alcohol fuels program actively pursued would do several things: One, reduce our dependence on foreign supplies; two, reduce our balance of payments to foreign petroleum producers; and three, with the world situation in general and Middle East in particular, I feel that a strong alcohol fuels program in the United States would enhance our national security.

In terms of our relations with Farmers Home Administration, I am not prepared to come before this group and either praise or condemn. As this is being written, we are preparing a proposal for Farmers Home Administration for a loan guarantee. In regard to Mr. Hanks, State Director of the program, and Mr. Longan, Director of Business and Industry Section, both have indicated their fullest cooperation. The group which I represent has had limited experience with Farmers Home Administration. We have no way of knowing if the program disproportionately favors large-scale producers and we are not prepared to seriously comment. We feel that because the large-scale producers are better financed than we, they will to some extent have better access to funds than we do.

And it has been very interesting this morning, and I wish the man from Farmers Home Administration, in discussing the loans that have been made, had mentioned to whom these were made. I strongly suspect that they were oil-industry oriented.

The smaller-scale entities can be encouraged or seriously discouraged by the amount of paperwork to process a loan. We do recognize that Farmers Home Administration is in effect putting tax money on the line, and we expect that all precautions are being taken. We have no means of knowing their expertise. I would say that if I had direct knowledge of unnecessary, deliberate or arbitrary delay in processing a loan, I would speak up.

Our corporation board of directors, in deciding what size plant we should build, traveled many miles and viewed many plants of varying sizes and design before we decided which one would best suit our purposes. Obviously, we have to build what we can afford, but a larger plant would have taken anywhere from 30 months to 3 years to construct. We believe we can accomplish this within 90 days once approval has been given for our modest-sized plant—a quarter-million gallons—which may seem small to those people who envision multi-million-gallon plants.

Land O'Lakes, a Midwest-based farmers cooperative, very recently purchased a small alcohol plant for experimental work at their farm at Bonner Springs, Kans. The reason they did that was to secure data and information for their farmer cooperatives to use who may be interested in building small plants of their own. The information they expect to get would include energy requirements, proper design, proper grain preparation, proper enzymes to use, water requirements, and finally and probably most important of all, to put together some economic figures that farmers or farm cooperatives may well be able to use. What Land O'Lakes Cooperative is attempting to do is separate the sheep from the goats, and believe me, there are goats, thieves, and fast-buck artists in this business. This is a new field for most of us, and there are people who are trying to take advantage of this situation and sell the farmers anything they can. What Land O'Lakes Farmers Cooperative is doing, in my viewpoint, is to be highly commended. They are doing exactly what the University of Nebraska should have done 8 or 9 years ago.

Gentlemen, there is an aspect to this that may or may not be discussed by somebody else, and I am thinking about our national security. I am led to believe that if we ever, and hopefully never, engage in an armed conflict with Russia that larger energy plants will automatically become primary targets. I am referring to plants like the Archer Daniels Midland at Decatur, Ill., probably the largest alcohol plant in the United States. I also make reference to the larger electrical generating stations and the larger petroleum refineries, all of which contribute very heavy to a national defense effort. I would like to offer for your consideration that a large number of small, seemingly insignificant alcohol producing plants which would not land themselves as targets could still produce fuel to maintain vital communications, services, and functions in event of large scale disaster. The military have a word for it and it's called dispersal.

I've got about two more paragraphs, and I'll finish.

Also, I would like to suggest that any alcohol plant of a commercial nature, regardless of size, be designated as a national defense utility such as are railroads, communications, pipelines and probably many other facilities of which I am unaware. This among other things would discourage vandalism and harassment. The status of a national defense utility means that in event of any sabotage or vandalism that the Federal Bureau of Investigation is immediately called in.

I would also like to suggest that the smaller commercial plants be given a higher priority for natural gas use. We can well understand that after a plant reaches a designated size that natural gas is no longer an appropriate fuel and is actually through a pricing mechanism priced out of sight and for these plants approaching a designated

energy requirement, coal is the final fuel. We would like to see that plants below that size be given a higher usage priority by the Federal Power Commission.

Thank you, Senator.

Senator ZORINSKY. Thank you, Ray. Randy?

**STATEMENT OF RANDY STERNBERG, STERNBERG IRRIGATION,  
NELIGH, NEBR.**

MR. STERNBERG. My name is Randy Sternberg.<sup>1</sup> I'm representing Sternberg Irrigation, and we own a plant in Neligh, Nebr., which my partner and I bought without the aid of Farmers Home Administration.

My testimony today will consist of three major parts. Part one will be why we need small farm alcohol production systems as opposed to large multimillion-dollar plants. Part 2 will be why these small alcohol systems should be financed by Farmers Home Administration. Part three will be my opinion of the present Farmers Home Administration lending program for fuel alcohol production system. And I will go through and just hit the high spots of this testimony to save some time.

One of the big problems with a large plant, multimillion-dollar plant, is the distiller's grain. When the distiller's grain normally comes out of the first phase, it's very high in moisture, between 70 and 80 percent. And on a large-plant basis it has to be dried, which takes a tremendous amount of energy, and that's what we're trying to save. Feedability of the wet grain is much better, because the moisture in it aids the digestion. So the small plant in that case is better and can better utilize the distiller's grain in a wet fashion, which makes it much more flexible in that area.

And that also goes right into transportation. The very large plant has to transport all of its corn in. If we start talking about the Ohio plant that the man from FmHA mentioned earlier, he is actually on the edge of the Corn Belt, which is going to take a tremendous amount of transportation going in and going back with the distiller's grain. On a small basis like that, corn is never cheaper than it is at the farm base. At that point in time after that, it goes up with every segment. So there's high transportation costs with the large plants versus the small.

History shows us that as the farmer goes, so goes the Nation. So the small-plant concept would strengthen the farm economy, which would then strengthen the economy of the Nation, which I think we did several times before this.

Alternate fuels, if a large plant is set up to use coal or set up to use natural gas, it's going to be very very difficult for it to vary from that, to advert from that. A small plant is way more apt to be able to use wood, or solar, or methane or any other source of alternate fuels.

Another very large aspect is our so-called waste water. For every gallon of alcohol produced, approximately ten gallons of waste water are going to be submitted. This waste water is water with some

<sup>1</sup> See p. 80 for the prepared statement of Mr. Sternberg.

grain fines in it, and it can be fed at that point, or it can be used as fertilizer. And I don't think we should be using the term "waste," because actually it's only waste if it's not used.

There are several universities in the South that have contacted our company and want to do extensive research on it for the feeding of fish, like in catfish farms and things like that. So the large plant is going to have much more problems with this waste water and have to use lagoons or sewer systems to dispose of it, where the small plant owner could very likely just feed it to his cattle or irrigation water or fertilizer.

The small plant is more apt to give us immediate production than a large plant. We're looking, as Ray mentioned earlier, from 2 to 3 years before these multi-million-dollar plants are going to go on the line. And I believe with the war going on in the Persian Gulf that immediate production might be very, very necessary. And I would hate to think that we waited 2 or 3 years so that we could have 60 million gallons a year and be too late.

The small plants can go in, as Ray mentioned, in 60 to 90 days, if we could get approval on financing.

As to why these small plants should be financed by FmHA, I think we've hit that real good on some of the other testimonies. One of the big things is lenient terms and interest rates. If the small plant owner, or any plant owner becomes discouraged with FmHA's leading program, he's going to try to seek other sources, which could very well be nonreputable sources, and which would increase the percent of failures in this new industry, which I don't think we should have.

We need the strong financial backing that our Government is capable of giving us, so we should have a little bit more ease in trying to acquire these FmHA finances.

The final segment of my testimony is what I think of our present FmHA finance program. And I'm going to hit some of the good parts, and I think the best feature of the program is the strict specification requirements. It's very very important that we don't have nonreputable manufacturers producing small alcohol plants. It does nothing but hurt the industry.

Right now the FmHA program has a 60-day trial requirement necessary, which was mentioned earlier today. And that 60-day trial program starts when the plant is on the line actually producing alcohol. So right there, which it may seem very insignificant to the people in Washington, becomes a very large problem for us in the State of Nebraska; No. 1, we need the money to start to build our project, not after we have completed it and run it for 60 days. I appreciate the fact that they're trying to change that, but I think it's—in the State of Nebraska we're going into the winter now, and the month that they're going to take the change it could very well be next summer before we can do anything with it.

A performance bond could very well do the same thing. If a manufacturer of a specific plant is prepared to put a performance bond on this plant, which if the plant does not function like it's supposed to function, the Government would get its money back and the whole deal would be a clear thing. So I think that we can go into immediate production with a performance bond, which I think the FmHA people

are working on—I haven't got a straight answer from anybody as to whether they are or aren't.

Lagoons, that's probably the other very large hangup. The man's got his financial background put together, he's hired his economists that come through and do all the paperwork, and now we get to the point of what's he going to do with his so-called waste water. And in one particular case, the lagoon was going to be closer to the house than 1,000 feet, so now we're spending weeks trying to figure out a way that we can move the lagoon around to make the situation work, which in fact, we may not even need a lagoon. And they're considering everything on the waste end of it as waste, as an animal waste, and you ask them if they have analyzed anything, no, they haven't. And I know that there's several plants running right now, and I brought two samples of waste water that I'm going to give the university and have them analyze it so that I can give them some analysis of our waste water. So hopefully that will speed that up.

There is the extensive economic studies. I cannot see any reason if we have went through the steps of pinpointing a manufacturer, we have said at this point that that particular alcohol plant is capable of functioning, there has been millions of dollars spent on feasibility studies already, and that have proven that alcohol will be a fuel, I can see no reason to have 2-, 3-, 4-, 5-year extensive cash flow projections put together that can be nothing more than guesswork to meet requirements of a loan for an alcohol plant. An individual farmer could go in and spend \$75,000 to buy a new combine and not have any more requirements there than anything else. I see no reason why we should have any more stricter requirements for an alcohol plant than we do any other piece of machinery.

Thank you for letting me speak.

Senator ZORINSKY. Thank you very much, Randy. Larry Ball, would you like to make a few comments?

#### STATEMENT OF LARRY BALL, NABAL, INC., LINCOLN, NEBR.

Mr. BALL. Senator, thank you for the opportunity to appear here. I'd like to say the last time you and I sat this close was at another alcohol related meeting in Omaha when you were still mayor, which had to do with the implement as opposed to the use of fuel, so it's good to see you again.

My company, Nabal, was formed 18 months ago to build a plant for a group of investors from Fairfield, Nebr., called Agrifields. We thought at the time our expertise was as organizers, managers, packagers, and we would still profess to have that ability. We contracted with this group to build a plant. We hired a "competent" engineer, paid him a large amount of money and watched him do nothing. We fired him, went to some purveyors of equipment and bought some equipment that has since proven it will not work, so we have replaced it.

I guess we have some experience with the con artists and incompetence and inadequacy in this business, we are also rebuilding two plants that were built by someone I think who is honest and promoted alcohol to the benefit of everyone in this room.

We're rebuilding one plant in Wisconsin and one plant in northeastern Nebraska. We have obtained financing from Small Business

Administration on three of our plants. I should say we've got four other contracts, we built two, and we built in Fairfield twice.

But I'd like to say this about the need for protection from the Federal Government for this industry, we have with our investors and ourselves managed to come through all of this, we've got excellent engineering on the line now, we know where we're at, and we know there are a lot of other suppliers of machinery and engineering in this business that have come through the same thing. We're in the risk phase of the business, and had there been the type of protection that I've heard proposed off and on a year and a half ago, a lot of folks would not be here today testifying as to their potential success in this industry. I think we need to recognize that it is in the risk stage and let the business go the way it is from that standpoint.

Concerning that, there are several things in the proposed regulations that I would like to comment on. One, we have found in the last 18 months that there are certain things that alcohol plants need, at least from our philosophical point of view, to guarantee proper conversion of starch to alcohol in order to guarantee feasible use of the plant. And what I'm saying is you have to have proper sanitation facilities, you have to have a proper type of note involved, you have to be able to do things automatically as opposed to physically.

We have a plant that some of you folks will see this afternoon where the operator has run 30 feet up in the air and dropped 30 feet to the ground and turn valves that alter the plant. We have a portion of it automated, and I think that our next plants all have to be entirely automated. And to that I'd like to say that the million gallon plant size specified in the Farmers Home Administration with a million dollar top limit for financing is inadequate. I think most competent engineering firms in the United States will say it will cost somewhere between \$2 and \$3 per productive gallon, annual productive gallon, to produce a plant in that size capable of operating efficiently. We project our cost at \$2 a gallon. Not that that's a great concern, except if you want 1-million-gallon-size plants, you're going to be spending \$2 million to \$3 million to get that.

The guarantees that are proposed in the proposed regulations; one, the one I really find offensive is the retainage. Farmers Home proposes to retain 10-percent of the gross proceeds from the contract in an interest bearing account for 1 year. I don't know how many folks in this room have had experience with a contractor. I've had some, and I want to tell you that that's a fast way to go broke. I don't know of any banker that would finance that. I don't know what good that 10-percent retainment in an interest bearing account is going to do to the contractor, and you're going to limit that contractor to building very very few plants, or you're going to say to him I want you to charge an extra 10-percent so you continue to have that cash flow to operate. I think that ought to be stricken from the proposed regulations.

The second matter I would state concerning performance and payment bonds; I find a lot of people in this industry do not understand what a performance and payment bond is. A performance and payment bond says that the contractor will assemble the bucket of bolts according to blueprint and pay for the materials and the labor. It does not say that the project will work. Could you get or could an insurance

company or bonding company write a bond that will guarantee that it will work? Yes, but they won't, number one; number two, for a contractor to get a performance and payment bond he has to qualify with an underwriter under three categories: character, capacity, and capital.

Now, I'm not going to comment on my shining character, but I would like to comment on capacity and capital. There are not too many contractors, builders, purveyors of equipment of this business that have a lot of capital today that are new. There are not too many that have any capacity. Capacity says how many plants have you built before for how much value. There are not too many folks that have built a lot of plants before. And if you're going to lay that kind of restriction on a contractor; you're not going to get your plants built, the American farmer and the American public is not going to have an alcohol fuels program, at least on a decentralized basis. You may have a lot of large plants, but the small, the moderate-sized commercial plants or farm plants, you're not going to have.

Another thing is feasibility. We've heard a lot of comments this morning about the pain of structuring feasibility studies, the pain and cost of doing all the preengineering to approach Farmers Home or Small Business or DOE only to be rejected. I think feasibility studies on small plants are meaningless. They cost anywhere from \$5,000 to \$20,000; they don't really do anything. They can be done as a package, a prepackage on a prepackage plant much cheaper than requiring an in-depth feasibility study. We all know we need fuel, we all know that fuel is going to be an increasing cost, we all know a lot of things that could be done a lot simpler than having a very expensive feasibility study.

The last thing I'd like to comment on is the loan system. Our experience with Small Business Administration has been successful, but it's also been painful. We have folks in all cases into a project with their own funds, in all cases needing to get additional funds to finish, in all cases costing them interest daily, and then approach Small Business Administration or any Government agency and find out it takes longer to get a loan than it takes to build a project. It's really ludicrous; what's the problem? My experience has been that an officer receives the information, it is his responsibility to act upon that, but the things that intercede, such as meetings, talks, vacations, sickness, coffee breaks, lunch breaks, all of these things slow down the process of obtaining loans. A lot of these things are necessary.

All I say is there has to be some smoother system within the organization to process these loan applications faster than it takes to build the project.

Thank you.

Senator ZORINSKY. Thank you very much, Larry. Just for the record, because of the mention by Ray Ratliff on the recipients of the latest round of loan guarantees, I am informed that as far as the U.S. Department of Agriculture knows, only 1 of the 15 projects involves any oil company, and that was for a 32-million-gallon plant in Ohio; it involved the Ashland Oil Co. and the Ohio Farm Bureau.

I think this panel has brought to light and put a focus on feasibility studies. I think certainly, probably, some are valid to initiate and

some are invalid to initiate. As a general rule of thumb, Government, from my observation in the 4 years I've been in the Senate, readily accepts the study philosophy, because that's a time delay element that they can use in order to retrench and reevaluate their own thinking. And I say this from personal knowledge. Four years ago when I got to the Senate, Senators received free haircuts. I didn't think Senators should have free haircuts paid for by the taxpayers. We had a caucus meeting on it, and the question arose that we would have to buy a cash register if they started charging for haircuts, and then they'd have to get a bookkeeper, because it would require payment of sales tax to the District of Columbia, and then they would have to go out and find out what the market value of a haircut was, because they didn't want to undercut private enterprise—not that they weren't undercutting them with free haircuts—but now if they were to set a price on a haircut, it would have to be in line so all the employees wouldn't go someplace else to get a haircut. So the final resolution to that problem was that they initiated a study on haircuts rather than resolve the problem initially.

It was a 6-month study, and that's why I say to you that the basic philosophy of the bureaucracy is to go with these studies in most instances. But I do agree with you, it's a time-consuming factor. If the knowledge is readily available, some of these studies are redundant and only tend to gather dust on the desk of someone or in the file cabinet of someone in the future. Oftentimes when those studies are looked at, they're so antiquated and outdated it's time for a new study. So I would agree with you with respect to reducing some of these studies. And knowing government, as I do, it's possible to have two procedures exactly alike with studies on each. We only need a study on one. Whatever that study shows certainly would do for the other.

I know there are some people from the engineering firms that are going to appear here on the panel. You know, Government's always been good for work for attorneys and for engineering firms and for accountants, but unfortunately, the people that have to pay for those services are getting in a position where they no longer can afford them.

Gentlemen, I'd like to thank you very much for taking your time to present your views to this hearing. Thank you.

The next panel consists of Mr. Art Claeys of Central Nebraska Gasohol Corp. of Gothenburg, Nebr.; Mr. George Boucher of Ravenna, Nebr.

Art, do you want to start?

**STATEMENT OF ARTHUR L. CLAEYS, CENTRAL NEBRASKA  
GASOHOL CORP., GOTHENBURG, NEBR.**

Mr. CLAEYS. Thank you, Senator. My name is Art Claeys from Gothenburg, Nebr. We have a plant that we've been working on for the past year and have submitted to the Farmers Home and have kept telling us we've got to keep putting more and more projects in front of us; I think primarily they're challenges. We've got all of our money, we've got a plant, it's going to produce 5 million gallons using corn as a feedstock, coal is the initial energy by distributions within 25 miles of our plant.

We took the performance that we got from the engineering company, took it to Arthur Anderson and spent \$1,000 to ascertain that it's a profitable venture, which it is.

We've had all kinds of meetings. I've had with Farmers Home, in their district and at their State level, and until we got Mr. Hanks interested in it, nothing has been forthcoming from him. Mr. Hanks, after an hour and 45 minutes of asking questions, stated that our project should be OK'd, but was turned down by another gentleman in their organization, Mr. Longan, because we don't have all the technical data. We can't start technical data without getting an engineering study and an engineering study costs money. This is the reason why we're looking for our loan guarantee so that we can further this thing on and build it. We started building this plant 6 months ago. We got all of our money; and then another thing they say we can't use the firm we're getting our money from, because it's outside the State of Nebraska. There's no firm in the State of Nebraska that's going to put up \$17 million.

Senator ZORINSKY. Is there any law that says you have to get your money from within the State?

Mr. CLAEYS. He says we can't use them because they're not through a bank. They're going to put the money through a bank, a local bank. The moneys that we're getting from an outside source is coming through our local bank.

Senator ZORINSKY. And they say you can't do that?

Mr. CLAEYS. That's what he told me. We can't use that, because we're not going through a local bank.

Senator ZORINSKY. Are they using American money?

Mr. CLAEYS. Yes; they are. As a matter of fact, they've spent a lot of moneys putting things in Washington, if it wasn't for their money that they borrow from other sources to find other companies that put things in Washington, these other firms would never have done it. Yes, we're using American money.

The thing is, we're a finance depleted area, and the farmers are in pretty bad shape up in our way. And no where can we raise \$1½ to \$2 million with an equity up front. This man says all we need is a 90-percent loan guarantee, and he'll put every penny on the line through our local bank. I don't know how else we can go about doing this. That's one of the things that I wanted to bring forth to this thing. I had written you a letter and stated the whole thing, and I'd like to put that in the record.<sup>1</sup>

Senator ZORINSKY. With no objection, that will be entered into the record.

Mr. CLAEYS. No objection.

Senator ZORINSKY. That is it then?

Mr. CLAEYS. Yes, sir, that's all I've got. I'm just saying that we don't seem to have any method of communication with the Farmers Home. They say one thing in Washington, they say another here. They say well, go to Washington, and they say you're going to end up eventually by us getting it done. If the man that's in charge of the State Farmers Home Administration says OK, you should be able

<sup>1</sup> See p. 82 for the letter from Mr. Claeys to Senator Zorinsky.

to get your loan guarantee and another man that's below him says no, I can't see any reason why we shouldn't get it.

Senator ZORINSKY. I think we made the point earlier that there is some apparent miscommunication within the Department itself.

Mr. Boucher.

#### STATEMENT OF GEORGE A. BOUCHER, RAVENNA, NEBR.

Mr. BOUCHER. I have been making alcohol since May 30, 1978, at my ranch at Ravenna. It's a small plant, makes approximately 20 gallons an hour; we have 28,000 gallons of fermentation.

Before I say anything more about the plant, I'd like to make a statement or two. I think if we're completely honest in the alcohol business, we would have to say that it's a profession that the blind are leading the blind. Farmers are having much trouble getting finance. Farmers are finding out that it's very important to become a brewmaster before they learn how to run an alcohol plant. One thought comes to my mind that if a statement that I heard from Senator Zorinsky is right, he said if the farmers got enough for their crops to pay their debts, there wouldn't have to be so many loans. I think that's a profound statement. I believe no one will argue that here this morning that statement sounds true. We will either get this energy program on flow, or we're going to end up trading young men's blood for oil overseas.

I have been across the country one and a half times talking about alcohol. I am not an expert in large plants. I have been with the people in Perdue, I have made trips to Gulf's enterprise, which I think is, from a layman's standpoint, at Fayetteville, Ark., anyone going into the alcohol business should go through their plant that they're running there at the University of Arkansas. They feel like I do, that there's a good chance that grain is, we hope, going to become so high priced that alcohol will be made from the biomass. So I have a few things to say about what I think a farmer should do in the alcohol business in the now period of time.

I made application from the experimental permit from Chicago in 1978, and they said they didn't have any forms for a farm plant. So they sent me out alcohol manufacturing of a beverage plant, which consisted of 124 pages. Any more when you're talking about how many pages do you fill out to get your paperwork done, we don't measure it in pages any more, we measure it in pounds. I worked until 1979 in December with the people on the permit, and they informed me that they would have new plant forms to send out and my application papers would go to Omaha in January 1980, and they would be much shorter; they were, there was 88 pages. Finally, I got them made out in July, I got new ones, and they said that I could go ahead and cancel my \$60,000 bond that I had had up for 2 years. So Senator Exon and I in working with the Secretary of the Treasury, I think we cut a lot of redtape, and now you don't need any bond until you've made 10,000 gallons. And I think that was a big help.

I'm still making alcohol from my own grain on my own tractors, for my own tractors, and I'm experimenting and have built carburetion for cars and tractors now using 150-proof alcohol, and this was tested by Dr. Portch from Butte, Mont., DOE office. I am also telling you

that we are getting twice the mileage from the use of 150-proof alcohol than we got with gasoline on the same car with Dr. Portch and two of his assistants.

I have made many stills of the 1-bushel size, and Dr. John McFee of the Energy office out of Butte, Department of Energy office have tested my plants as to energy balance and material balance. We got 2.611 gallons of alcohol from a bushel of ground corn using up 54 pounds of wood. I use wood in firing my plant. We also ran the still on propane for them, and the propane cost per gallon of alcohol was 55 cents a gallon, it was 11 cents a gallon with coal. And when we ran whey through there to make alcohol from the Ravenna Cheese Plant, that ran up the cost of that whey, heating that whey, 100 gallons of whey you get 2 gallons of alcohol, it ran it up too high, and they did not finish the test.

I applied for an SBA loan to build a plant along with ranching and worked on that 9 months and never got it. I went to Lenard Hanks at FHA, and he said he could get me a loan probably in 35 to 45 days, but one thing after another seemed to change and finally had to go to B. & I. Division of FHA, and that's taken 11 months, and it is now about ready to close, but only with half of the amount that I asked for and needed. The excuse was that I didn't have enough collateral. My plant was went over by an accredited appraiser at \$345,000. I needed \$475,000, and so far it looks like we're going to get \$250,000 which will be for it. I felt a little like the Wright brothers at Kitty Hawk who didn't have any collateral, but look what happened there since.

I have sold cattle and 2 years of corn to build this plant and to get ready to manufacture small plants, because this is my idea of the way a farmer should go is learn to walk before he runs in the alcohol business.

I think every farmer, if he's going to have a plant on his place, should learn to become a good brewmaster before he can operate a plant. I know many of the people building larger plants, and they're doing a fine job of teaching the farmer.

I have offered to train anyone wanting to run a plant that when they come to my place—and we've had over 3,000 people, and from many foreign countries, they all seem very interested. I think it would be very wise on the average small farmer, if he is going into the alcohol business, I don't think that he should invest over about \$20,000 to start until he knows that he wants to make alcohol and will be successful doing it. Another thing, I think that farmer plants should get half of the money allotted by the Government for alcohol plants, not all of it, 70 percent, 80 percent, or 60 percent go to tremendously large operations. I think the large operations have many problems coming.

I also design plants for 1-, 10-, 20-bushel-size-batch plants that can be made to run continuous, if the farmer wants to put in his own fermentation tanks. My batch plants will heat shops and garages while they make alcohol. We have also drawn up one of the 10-bushel-size plants, put it in a 20-foot-square building with cement blocks and well insulated with small rocks in it, and a person could heat their home taking the heat out of these rocks that would be wasted in making alcohol otherwise.

When the wood fire dies down at night, they can still draw the heat from the stones around the alcohol plant to heat their home, and in the morning when you heat up your beer and start the mash boiling, you will still get 170-180 proof alcohol.

We have another model which is a combination alcohol and liquid fertilizer plant so that we can use the offal water for mixture of making liquid fertilizer so we can quit using anhydrous ammonia that will ultimately ruin our farm land, and it is now spoiling our underground water with high nitrate. The fertilizer made with using this stillage water and other ingredients you need for your crops will and can be put through the irrigation pipe and have practically no leaching and the farmer can save 35 percent on the cost of his fertilizer and get larger yields to help save our underground water supply.

I have talked with this gentleman who's in charge of Gulf Oil at Arkansas for the feasibility of this idea. He thinks it should be gone into more.

I have another page, and—I know I'm out of time, but—

Senator ZORINSKY. If you want to summarize that last page, George.

Mr. BOUCHER. I think I would suggest on loans for alcohol plants to farmers, No. 1, they should be made as low an interest as possible, and possibly we may have to have farm-finance-educated personnel to do a better job of getting the farm-type of loan. It's a possibility we might need to put the loan money in the banks for the local banker to loan, then you could probably get a loan in a few days. But from the FHA people that I have talked to, they all would be glad to have the loan paperwork made much shorter if the directives would come out of Washington to let them do it.

I think there's many facets of their loan agreements now that are dictated from FHA headquarters, as I have talked to Mr. James Lee before he passed away in Washington, they're dictated from Washington, and the people out in the State here get the blame but I doubt that I know of any FHA people who are not repeating the language that they get from Washington as to how to make these loans.

I sincerely hope that these loans from FHA can be speeded up. I sincerely hope that their regulations won't completely discourage farmers from making applications for the loans, so they can make their own fuel.

I had an idea and presented this to the Carter administration that retired people, like they did in Germany, older people should take small plants and make alcohol, and the alcohol that they produce they sell it and so much of the money that they derive from alcohol, they could sell it and help live on social security pay and pay back 25 cents a gallon, 20-25 cents a gallon from the alcohol made to pay for the plant.

I certainly would like to have the balance of what I asked for in the loan. I would like to put a cellulose addition, biomass addition onto the plant. I have 300 tons of sargo waiting. We can make more alcohol from a ton of sargo than we can a field of corn. I have proved that you can make as much alcohol from the stalk of corn as you can from the ear. I've made alcohol from alfalfa, fodder beets, corn stalks, milo stubble, pine trees, corn, and, of course, all the grains. It's a surprising thing how the poor quality grain that has been spoiled

in storage that you can use and make alcohol and still make a good animal feed out of it.

I think these funds should be divided up, if they come from the Government that the big end of the funds go to plants for farmers to use and those with sufficient collateral that an important part of these funds should go for research and development for on the farm and people who have proved that they can be successful in making alcohol but do not have the collateral to expend the money that's needed.

I thank you kindly, Senator.

Senator ZORINSKY. Thank you, Mr. Boucher, and thank you Art Claeys for your presentations, and hopefully for a major contribution to our hearing.

The final panel of Jim Wells of Wells Engineering in Omaha, Neb.; Robert Hoff of Energy Complexes, Inc., Sioux Falls, S. Dak.; and Mr. John Wright of Martin K. Eady, Inc., Omaha, Neb.; would you come forward?

Mr. WELLS. I believe that Mr. Hoff was not able to be here. I don't know if he sent in written testimony or not.

Senator ZORINSKY. We have a letter from his company, which we will enter in the record as if presented in full. Mr. Wells, do you want to begin?

**STATEMENT OF W. JAMES WELLS, JR., PRESIDENT, WELLS  
ENGINEERING, INC., OMAHA, NEBR.**

Mr. WELLS. Yes. My name is W. James Wells, Jr., and I'm president of Well Engineers, Inc., a small consulting engineering firm in Omaha, Nebr. Our firm has been very active in the alcohol fuels program over the last 18 months. We have prepared four feasibility studies and are currently developing preliminary plans for a 4-million-gallon-per-year alcohol plant in Kansas and a 10-million-gallon-per-year plant in southwestern Minnesota. The potential investors for all of these plants, significantly enough, have been small groups of farmers, not large investors by any means.

On August 27, 1980, I addressed the USDA Farmers Home Administration hearing in Des Moines, Iowa, on proposed regulations for biomass energy and alcohol fuels loans and loan guarantees. As of the date of this hearing those regulations have not been finalized. I would like to reemphasize my concern about the nature of the proposed regulations which have requirements and limitations that may restrict and deter the involvement of the financial community, investors, engineering community, and manufacturers and contractors in financing, designing and constructing grain alcohol plants.

My understanding of the purpose of the insured loan and loan guarantee program is to stimulate the development of a new industry and to share some of the risk that is inherent in trying to move such a massive program forward in as expeditious a manner as possible. The proposed regulations may inhibit this movement if they require mandatory performance bonds and liquidated damages. While these devices are protective measures to both the plant owner and loaning institution, they should not be considered as the only alternatives available.

New companies entering the alcohol fuels field with viable technology may experience delays or rejection when trying to obtain a performance bond. Performance bonds require several years of history of building similar facilities in the size and dollar ranges of proposed plants. Obviously in most instances this requirement cannot be met, and I seriously doubt whether any newer firms will be able to obtain performance bonds. By utilizing escrow agreements and/or some form of Government assurances this problem could be avoided while maintaining the integrity of the industry.

The regulations that spell out the contractual agreements between the owner and the contractor should be as absolutely flexible as possible in order to encourage the greatest number of potential investors and the greatest number of individuals with new ideas and technologies to put together a project. The requirement that liquidated damages must be paid by the contractor to the owner should be a matter of agreement between the owner and the contractor, and not a demand by the Farmers Home Administration.

The Farmers Home Administration, through its financial assistance program, has a tremendous potential for encouraging the development of a whole new industry that will have the capability of producing alcohol from grain in an energy efficient manner with small plants located throughout the grain-growing areas of the United States. However, if the proposed regulations are overly restrictive and inhibiting in their financial requirements, many companies, designers, contractors, and owners will be prevented from designing and building new plants because of their failure to obtain financing for the projects. It is hoped that the 20-percent-equity requirement for loan guarantees can be liberally interpreted to include operating or working capital and other up-front costs such as engineering and legal costs.

The Farmers Home Administration financial assistance program has the opportunity to firmly establish and encourage the growth of the alcohol fuels industry in the United States. The more participative instead of directive the program is, the more guaranteed its success will be. In my opinion, the proposed regulations have been developed with the primary goal of assuring that under no circumstances will the Farmers Home Administration ever lose any of their loan money because of the inability of an alcohol plant to produce the quantity and quality of alcohol for which the plant was designed and within the agreed construction period. If the guaranteed loan program is going to provide the necessary assurances and encouragement to the alcohol industry rather than be a detriment to that industry, then they should restructure the regulations to be more flexible.

The regulations should recognize that there may be some plants that may not perform at the levels for which they are designed and that FmHA may have to make good on their loan guarantees. This should be expected and recognized as part of the price to be paid to develop this new industry as quickly as practical. In my opinion, the public has assumed that there will be some risk in the loan guarantee program and that this program is the Government's way of assuming a portion of that risk.

I have some other comments I'd like to make concerning this matter of the retainage that was addressed earlier. Farmers Home Administration has an excellent reputation in the farming community and in rural America. We've worked with them on many programs that they have including building water treatment plants for municipalities. They are an excellent agency to work with, and I'm a little chagrined at where they seem to be on this alcohol program. I think they're marching to the tune of a different drummer right now rather than from rural America. I see what's going on now as a result of talking and listening to much larger organizations, large engineering firms, large companies that are involved in building huge plants, and I don't see that they're reaching down and into rural America to pull out the expertise that is there and ready to move forward.

Regarding interim financing, a comment was made earlier that FmHA didn't see the requirement of having performance guarantees met before they would make their final commitment (in effect operating the plant before they would make their final commitment) as a problem.

I was at the hearing in Des Moines, and there were several people that said that's a very serious problem. And I don't know whether that word didn't get back to the FmHA people that make the decisions, but it is a serious problem. I believe that Mr. Hoff's letter addresses that point. I also think that is a serious problem, and I would hope that they would take another look at that. And the other strong point I want to make is this matter of including working capital in the equity requirement. Twenty-percent equity is tough, it's greater than the 10 percent that was originally envisioned, but it's double tough if they will not include working capital in that 20-percent equity.

Senator ZORINSKY. Thank you, Mr. Wells. Mr. Wright?

**STATEMENT OF JOHN WRIGHT, MARTIN K. EADY, INC., OMAHA, NEBR.**

Mr. WRIGHT. I have no prepared statement, but I just want to confirm some of the comments in the statements that have been made. As a contractor I have two interests; one is that as a citizen of our country helping to solve our energy problem, and also as a contractor in the construction business what this energy program has to offer in that area.

We do only general contracting work, of course, have the finances, the personnel, and the equipment to do the building, but as far as furnishing the bond to guarantee the operation and performance of a plant, we would not be receptive to that. We also would expect to do no financing and receive timely progress payments during the progress of the construction work, and at the completion of the job as shown by the drawings or plans or specifications, we would receive our retainage, and responsibilities and the performance of the plant be that of others.

That's all I have to offer.

Senator ZORINSKY. Thank you. In a recent letter to the Senate Permanent Subcommittee on Investigation, an Atlanta-based engineering firm made the following statement:

We do not recommend that farmers operate small ethanol plants on their farms. To date we have found their designs and operations to be extremely dangerous.

What is your reaction to that statement, Mr. Wells?

Mr. WELLS. Well, I would say that the thing that needs to be recognized here is that any time you begin with a brandnew industry, in effect, small and onfarm alcohol projects, that there is going to be a tremendous surge in development of technologies for that industry. The initial projects are not going to be, by any stretch of the imagination, the ultimate, but they are a first step. This first step has to be taken, and I don't see that we're looking at somebody's loss of life and limb. I feel that from where we are right now, in relationship to when he probably made that statement, that there have been major improvements made in development of small plants. I've seen several small plants, one of them was Randy Sternberg's plant at Neligh, Nebr. It is a very fine plant. I see no major safety problems in that plant. I know that there are new developments underway now on improved technologies for small plants. I also feel that you need to recognize where the comment came from and whose interest is being served if that statement is believed.

Senator ZORINSKY. Mr. Wright, do you want to make a comment on that same question?

Mr. WRIGHT. No; I really don't.

Senator ZORINSKY. In your judgment, in either of you gentlemen's judgment, what kind of technical assistance does the applicant for a smaller project need from the Farmers Home Administration?

Mr. WELLS. I was very encouraged by the comments that were made earlier about the training program that Farmers Home Administration is going through. Very frankly, I believe that Farmers Home should have the technical competence to review proposals that are submitted to them and to pass on the judgment as to whether or not the technologies that are being presented are viable and have an excellent chance of working. They should be able to make that judgment. It has been my opinion, in looking at the regulations, that FmHA was substituting restrictions in terms of performance bonds, performance guarantees, liquidated damages and retainage, et cetera, as a substitute for being able to effectively evaluate a program and determine whether or not there is a good enough chance for it to go ahead to warrant guaranteeing a loan. I think that what they really ought to be doing is to have the technical capability to review those applications, determine whether they're adequate and pull back a little bit with all these restrictions that they have on the program, because very frankly, it's tremendously inhibiting. I know from experience, I'm not just dreaming this up, on the work that we have done that financing is what's holding up five projects right now. There's no question about it. And the more restrictive the equity problem is, the tougher it is. So to me the substitution of the point you're making, adequate technical people, rather than all these restrictions, is the approach that ought to be taken.

Senator ZORINSKY. In addition, the economic feasibility continues to change based on the inflationary spiral and the increased cost of construction as all these delays are incurred.

Mr. WELLS. That's right. The increased cost of construction and the relationship between the price of alcohol now, which has not gone up primarily because of the importation of Brazilian alcohol and the price of corn which has gone up, further compounds the economics. To me that's a short-sighted concern right now, because the Brazilian

alcohol will not always be here, and the price of corn is not always going to be \$3.61 for March corn, or whatever. So we can't look at the economics on a short-term basis, because 5 years down the road we're not going to see corn go up the way gasoline prices have gone up, and gasoline prices are going to take another jump, no question about it. There is a current surplus, but that's not going to be forever either. So right now I think the pressure is a little bit off. Nobody's really feeling the pressure like they did several years ago, but by the time it gets back on again, we will have lost a lot of time, and we really ought to be getting these projects underway.

Senator ZORINSKY. Well, thank you very much, gentlemen, for participating with us in this hearing. This concludes our testimony for today. Thank you all for coming and for your contributions to the hearing. The hearing record will remain open for 10 days so that anyone wishing to insert further material or other statements may do so by sending it to my office here in Lincoln or to the Senate Agriculture Committee or my office in Washington, D.C.

Thank you very much for your participation. We're adjourned.  
[Whereupon, the subcommittee adjourned, subject to call of the Chair.]

## APPENDIX

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### STATEMENT OF HON. CHARLES H. PERCY, A U.S. SENATOR FROM ILLINOIS

I appreciate the opportunity to provide a statement for the record of this important and timely hearing. I commend Senator Zorinsky and the staff of the Senate Agricultural Credit and Rural Electrification Subcommittee for their commitment to improving the quality of government programs designed to promote alcohol fuels production.

We are all keenly aware that the security and economy of the Nation have been gravely threatened because of continuing dependence on imported oil. Right now, about 40 percent of the crude oil from which we get our gasoline and diesel fuel is produced outside of the United States. Last year, this translated into a \$56 billion loss to the domestic economy, higher prices at the pumps, and a worsening of inflation. If the current conflict between Iran and Iraq escalates beyond the borders of those two nations it could have grave consequences for the free world—further threatening the production of Middle Eastern oil and, in turn, the stability of the world economy, including that of the United States. Indeed, just two days ago, I released a report by the Congressional Research Service which states a closure of the Strait of Hormuz could result in the price of oil soaring to \$100 per barrel.

In order to free ourselves from the grip of OPEC, the Nation must be committed to encouraging the development of alternative energy sources. In this regard, I believe that one of the most essential elements in the drive for U.S. energy independence must be the full development of fuel grade alcohol as an alternative to gasoline.

Earlier this year, President Carter set an alcohol production goal of 500 million gallons annually by the end of 1981. Clearly, if given the highest priority, this goal can be exceeded. For example, in my home state of Illinois alone, dedicating 30 percent of the corn crop to the production of alcohol fuels would double the President's 1981 national goal. But if we are to succeed, the federal government must be ready and willing to support those who are dedicated to achieving an energy independent America.

The Farmers Home Administration (FmHA), an agency of the Department of Agriculture, and the Department of Energy, have been mandated by the Congress to provide technical and financial assistance that will further the commercial development of alternative fuels. It is the responsibility of the Congress to closely monitor the administration of these federal programs to ensure their success which is now so vital to the Nation.

On August 12, 1980, I chaired a hearing of the U.S. Senate Permanent Subcommittee on Investigations, of which I am ranking minority member, in Springfield, Illinois, to explore how existing Federal machinery can be further streamlined to expedite alcohol fuels development. Illinois farmers, the Illinois Director of Agriculture, and Illinois businessmen were among the witnesses who testified at the hearing. They all agreed that there exists a tremendous potential for developing alcohol fuels and expanding the national market for gasohol.

However, one disturbing point was driven home forcefully during the day: Illinois farmers and entrepreneurs have been frustrated in their efforts to develop the alcohol fuel alternative. Specifically, the farmers testified about their difficulties in obtaining loan guarantees for alcohol fuel production from FmHA.

James E. Thornton, Associate Administrator of the FmHA, conceded at the hearing that his agency's performance has not been adequate, and he pledged that it would improve. Since then, FmHA has held public hearings around the country to gather comments on a new FmHA loan and loan guarantee program for projects costing up to \$15 million.

This October 28th the FmHA is scheduled to issue regulations governing implementation of the financial assistance program for alcohol fuel development created by Title II of the Energy Security Act of 1980 (Public Law 96-294). One Hundred Twenty-five million dollars of the approximately \$525 million authorized under this program will be allocated for insured loans on small-scale projects, and \$400 million will be used for loan guarantees on medium-scale projects. The amount authorized is significantly larger than last year's sum, and it is hoped that the projects funded by these programs will help the Nation to exceed the Administration's national alcohol production goals.

Notwithstanding this encouraging development, the alcohol fuels industry needs more than money to become a major force among the growing array of alternative fuels. The federal government needs to increase its technical assistance to the many entrepreneurs and farmers who want to make a contribution to the national effort but are inexperienced in meeting federal program requirements. For instance, at the Springfield hearing, testimony was received indicating that state and local FmHA officials were either uncooperative or uninformed when applicants requested assistance so as to conform with the loan guarantee application process. The government officials who administer these programs must adopt a more positive and aggressive attitude in promoting alcohol fuels and other alternative energy sources.

Since the Springfield hearings, some promising actions have been undertaken by FmHA. During August and September, the FmHA conducted special training courses for fifty FmHA Business and Industrial chiefs and about 100 loan specialists. These officials will be stationed throughout the country at the state and local levels and will be available to assist farmers on production design and application requirements. It is hoped that this will eliminate unnecessary delays by allowing small-scale application to be processed at the state level without being forwarded to Washington for final approval.

I am encouraged by these preliminary indications of increased federal activity in the alcohol fuels arena. However, they only represent the beginning of a long and difficult mobilization effort. If the federal government is allowed to become complacent in the administration of these programs, the promising opportunities for the development of alcohol fuels offered by the Energy Security Act could be lost.

The Permanent Subcommittee on Investigations, working together with this and other Congressional committees, will continue to monitor closely federal efforts to promote the full development of alcohol fuels. This will include a review of FmHA's performance in administering its alcohol fuels loan program. I will expect, in light of that agencies continued assurances, to see great progress made during the coming months.

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STATEMENT OF JIM THORNTON, ASSOCIATE ADMINISTRATOR, FARMERS HOME ADMINISTRATION, U.S. DEPARTMENT OF AGRICULTURE

Mr. Chairman and members of this Subcommittee, I am pleased to appear before you today to report on USDA's progress in implementing the financial assistance program authorized by Title II of the Energy Security Act of 1980 (Public Law 96-294). The Energy Security Act, which President Carter signed on June 30, 1980, will contribute greatly to reducing our nation's dependence on foreign energy resources. This Act authorizes broad new programs for the Department, which are to be commenced within short deadlines designed to insure expeditious implementation. In addition, decisions on each application must be announced within 120 days of its receipt by the Agency.

As you know, the Farmers Home Administration (FmHA) has been designated by Secretary Bob Bergland to administer the biomass energy and alcohol fuels program within USDA. This Agency has already taken swift and positive steps to ensure that implementation proceeds on schedule. I can report to you that to date, our major activities have included the following:

Proposed regulations were drafted and published in the Federal Register on August 5.

A series of public hearings were held on these proposed regulations at Macon, Georgia, on August 25; Des Moines, Iowa, on August 27; and Lubbock, Texas, on August 29. A total of 82 witnesses were heard at these hearings.

72 written comments were received on the proposed regulations through September 4.

Final regulations are being prepared based upon public comment, as are application and loan servicing procedures.

A data collection system is being developed for FmHA State and sub-State offices to report on the number, type, size, location and other characteristics of projects that are funded as well as the number of applications in the pipeline.

Training sessions were held during August with FmHA State Office engineers, and orientation sessions were held with FmHA loan officers on the financial and technical aspects of fuel alcohol projects and on the statutory directives of the Title II loan and loan guarantee programs.

Other related activities during this period include the staff response to virtually hundreds of telephone and mail inquiries about the program.

A new Office of Renewable Resources within the Farmers Home Administration is being created to assist, among other things, in the overall implementation of the program.

Mr. Chairman, even while work is proceeding on implementing this new program, the FmHA is now carrying out a major alcohol fuels funding effort under its regular Rural Business and Industry (B. & I.) Loan Guarantee Program.

Earlier this year, President Carter committed \$100 million of Fiscal Year 1980 loan guarantee authority to fund fuel alcohol plants as a prime component of the Administration's annual production goal of 500 million gallons of fuel alcohol capacity by the end of 1981. I can report to you that Secretary Bergland has announced funds obligated under that particular program far in excess of our \$100 million goal. The Secretary has announced \$341,600,000 in loan guarantees for fifteen new plants in fourteen States. These plants will produce an estimated 246 million gallons of ethanol per year, an amount which will go a long way towards meeting the President's goal.

Title II of the Energy Security Act authorizes USDA to make insured loans or loan guarantees for small-scale projects, defined in the Act as having annual ethanol capacities of less than 1 million gallons or its equivalent in other forms of biomass energy. The main emphasis in the small-scale program will be on insured loans, and it is projected that approximately \$125 million loan guarantee for such projects will be made.

For projects over 1 million gallons per year of ethanol capacity, the Act authorizes USDA to offer loan guarantees. If we assume that \$125 million of the \$525 million available, will be for insured loans, we would have about \$400 million for guaranteed loans for small or intermediate scale projects.

FmHA is currently in the process of finalizing the regulations for this program. The final regulations will include substantial changes from the draft regulations based on the written comments and hearing testimony presented.

The regulations will encourage energy production on an individual project basis, as well as to producers who may wish to join together. This encouragement will take a number of forms. Applicants will be required to provide reasonable assurances that the loan can be repaid with income from the projects. We recognize the importance of on-farm production and have, therefore, determined that if the use has self-sufficient value on the farm, rather than for sale, the applicant will be accorded a credit in fuel displaced when applying for a loan.

I might also add that FmHA fully expects to continue the eligibility of small projects for farm ownership (FO) loans.

FmHA's extensive State, sub-state and county organizational structure will be utilized to carry these programs to the people of rural America. FmHA has over 2,000 County, District, and State Offices. Last year, these offices and FmHA's national headquarters staff made 294,890 loans and grants totaling \$14.6 billion.

The State Offices of FmHA are staffed with experienced engineers, financial analysts, loan officers and architects. District and County Offices are run by men and women who know their regions, intimately and who understand finance and loan operations. This is especially important with respect to the small-scale program for which we are responsible under the Energy Security Act. Our field personnel are uniquely situated to evaluate these proposals in the context of farm operations and economics.

FmHA's State and sub-state resources are supported by extensive technical and financial personnel at the national headquarters level as well as by specialists from other USDA agencies.

Our basic strategy in administering this Act will be to structure the insured loans and loan guarantees to mesh closely with existing FmHA Farm, Business and

Industry, and Community Facilities programs. This has been reflected in the proposed regulations, which will permit the utilization of procedures that are familiar to many potential applicants as well as to banks, insurance companies, contractors, and others.

FmHA is making a concerted effort to ensure the technical staff capabilities to meet these new initiatives. FmHA engineers from every State met for two weeks of training in September to study the program and formulate patterns of practice and procedure. Similar training and orientation programs and sessions for other State and district personnel will also be scheduled. These specialists will, in turn, train other State, District and County staff to administer this program.

The fiscal year 1980 Supplemental Appropriations Bill (Public Law 96-304) provided for \$525 million to fund the programs authorized by the Energy Security Act. Since this money comes directly to the Department of Agriculture, without any pass through arrangement with other Federal departments, we expect to be able to expeditiously implement the program.

FmHA anticipates a broad usage of the funds to establish a good balance between small and large scale projects. We hope to emphasize funding for small and community size projects, plants whose capacity is below 1.5 million gallons annually and 7.5 million gallons annually, respectively.

While the major emphasis will be on the production of alcohol fuel, other types of biomass production such as methane and wood energy will also be included.

We plan to place special emphasis on encouraging the diversification of feedstocks to be used for manufacturing fuel alcohol. While many of the "first wave" of alcohol projects are expected to be based on corn, it is clear to us that economically viable alternatives to corn need to be encouraged.

Numerous regional opportunities exist for utilizing feedstocks such as sweet potatoes in the south and southeast, bagasse in the sugar country, sugar beets in the west, whey in dairy country, potatoes in Maine, spoiled fruit and vegetables in Florida and California, and off-grade grains and other agricultural products throughout the country. Many of these regional feedstock possibilities open up the option of using lands not suitable for corn and other grain production to participation in the Federal alternative fuels programs. We intend to encourage lands considered marginal for grain farming to be developed responsibly in terms of land conservation and environmental protection.

We are also very much interested in cellulosic conversion and in the utilization of agricultural residues and wastes for methane generation. Projects involving co-generation will also receive special consideration. Consistent with overall national energy policy, FmHA will accord priority to projects that do not involve the use of petroleum and natural gas as a primary fuel. Rapid progress is being made in the use of alternative fuels such as coal, wood and wood derivatives, and others. Our financing activities under this Act, as well as those of the Department of Energy (DOE), can play an important role in stimulating this trend and in creating a market for such innovative equipment and systems as small coal-fired boilers.

The statute specifically authorizes financial assistance for projects that convert biomass materials into a refined liquid or solid fuel or that convert equipment to directly combust wood or other unrefined biomass into energy for industrial purposes.

Examples of eligible projects to produce non-liquid fuels include the conversion of animal waste into methane gas and projects to densify wood or wood and agricultural residues into pellets or other compact energy forms.

FmHA will provide financial assistance to other non-liquid biomass energy projects with a minimum of duplication of similar technologies. The proposed regulations adhere closely to the statutory language with respect to the scope and types of non-liquid full biomass energy projects that are potentially eligible under this program.

With respect to the primary fuel issue, the use of coal may not be a viable option for many small-scale producers because of the high cost associated with storage, handling and clean burning. We, therefore, expect to use flexibility in regard to small projects for which there is no feasible alternative to oil or gas. However, for larger projects for which coal or a renewable fuel can demonstrate cost effectiveness over the life of the plant, the failure to use other than oil or gas as primary fuel will weigh against the applicant.

Special emphasis will be placed on ensuring that applicants design their plans to permit economical retrofitting as new technologies evolve, especially those

utilizing feedstocks such as the cellulose. Technology is changing rapidly, and applicants must be mindful of this to avoid commitments to plants that prove difficult or impossible to update.

The Energy Security Act provides ample latitude for targeting resources on innovative institutional arrangements that offer big potential payoffs. For example, FmHA may utilize its extensive experience with rural communities to encourage projects exploiting local feedstock and fuel availabilities for biomass energy production purposes. We expect to see—and encourage—many projects involving groups of farmers putting their farm and financial resources cooperatively to work producing and upgrading fuel alcohol so as to diversify the markets in which it can be used. This may also prove to be the most economically viable mechanism for channeling short-term agricultural surpluses into the production of valuable fuels.

Mr. Chairman, this concludes my prepared statement. I would be happy to answer any questions.

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STATEMENT OF LARRY R. KELSO, CHIEF, AGRICULTURAL AND FOOD PROCESSES  
BRANCH, OFFICE OF INDUSTRIAL PROGRAMS, CONSERVATION AND SOLAR ENERGY,  
U.S. DEPARTMENT OF ENERGY

Mr. Chairman, members of the Subcommittee, I appreciate the opportunity to testify on the Energy Integrated Farm Systems projects, and how they might be coordinated with the intent of the loan guarantee provision of Title II of the Energy Security Act of 1980. This Subcommittee and the Office of Industrial Programs have a mutual interest in the concern with implementing a program to benefit America's agricultural producers by reducing their dependence on foreign supplies of petroleum, and providing a technically feasible alternative source of renewable energy that will give our Nation's farmers the power needed on a timely basis for crop and livestock production.

As I understand the focus and provisions of Title II of the Energy Security Act of 1980, it authorizes \$600 million to the Department of Agriculture for general biomass energy development. It further states that the Department of Agriculture program is for biomass, and at least one third of the financial assistance provided is to be used for small scale projects, which would produce less than 1 million gallons of ethanol per year. Title II also specifies that \$600 million of the Department of Energy \$850 million authorization is to be used for biomass projects other than Urban Waste.

The projects that I shall describe to you are not related to Title II of the Energy Security Act, nor do they affect the provision of the Act. It is also clear that the act makes no provisions for coordination of this program with the intent of the loan guarantee provision of Title II. The Energy Integrated Farms System Projects are funded under budget authority granted by the Senate and House Appropriations Committees for the Department of Interior and Related Agencies.

ENERGY INTEGRATED FARM SYSTEMS

The energy required for agricultural production in the United States is less than 3 percent of the total U.S. energy consumption. This includes energy used directly for the production of crops, commodities and livestock, indirect inputs such as fertilizer, and capital inputs.

Even though the U.S. farmer consumes only a small fraction of the total U.S. energy demand, the small fraction is extremely important to his productive ability. For example, it has been calculated that a doubling of energy prices would lead to only a 5 percent reduction in total energy use in agriculture. In other words, there are only a few areas where the farmer could cut his energy use with currently available technology and still maintain his current production levels. Another fact which puts this situation into sharper focus is the finding that a doubling of energy prices would increase raw commodity prices 13 percent on the average. An energy shortage or reduction of 10 percent, though, would lead to a 55 percent increase in raw commodity prices. The reason for this inelastic demand for energy by U.S. agriculture is the seasonal nature of farm operations. Operations such as preplanting, planting, irrigation, crop drying, harvesting, etc. all have to be undertaken within a certain period of time. The economic penalties of not having energy at the precise moment it is needed are severe for both the farmer and the consumer.

The Agriculture and Food Processes Branch initiated an RD&D program on Energy Integrated Farm Systems (EIFS). The objectives of the activity area are the following:

Development of on-farm integrated livestock-crop-energy production systems that are economic, reliable, require minimum attention and maintenance, and minimize the need for energy and material flow across the farm system boundary;

Comparing energy integrated farms with conventional farms as to net energy saved, net profit, and soil and water conservation effectiveness;

In furtherance of these objectives, a Program Opportunity Notice (PON) was issued by the Branch in August 1979. The PON described the Branch's interest in the application of energy conservation technologies and alternative energy sources on the farm which do not deleteriously affect productive capacity or product quality. The purpose of the PON was to provide an opportunity for interested parties to propose energy integrated farm system demonstration projects to the Department of Energy. All major farm operations were included such as poultry, beef, vegetable, grain, and others. The intent of the program was not to change the mix of commodities on a particular type farm or to combine operations, although these factors were not eliminated.

To be considered for support pursuant to the PON, proposers were required to own or otherwise legally have the full use of the farm on which the demonstration would be conducted; the scope of the project was limited to the agricultural production area. Another criterion for consideration was that the proposer be willing and able to cost share the project at the 50-percent level as a minimum.

The PON closed on November 16, 1979. A total of 40 proposals were received, of which two were rejected by the program office as nonresponsive, one was a duplicate submittal, four were not applicable to the PON and two were late submittals. The remaining 31 proposals were considered for technical evaluations. The technical review panel, composed of seven engineers and agricultural specialists from USDA and the Pacific Northwest and Idaho National Laboratories, evaluated the 31 proposals on the following technical criteria in descending order of importance:

Technical feasibility and potential for overall reduction in use of scarce fuels.

Relevant qualifications, capabilities, and experience of the proposed key personnel and the percentage of their time dedicated to this project.

Extra consideration to those proposers who incorporate innovative solar energy concepts in their design (heating, cooling, wind bimoass, etc.).

Degree of integration of alternative practices to achieve a total integrated farm system.

Capability for developing effective transfer to the public.

Adequacy of proposer facilities, instrumentation, management planning and techniques which the proposer possesses and offers and which are considered to be important for achieving the objectives of the proposal.

The proposals were scored, rank-ordered and costed out according to projected dollars as provided in the business cost proposal. Nineteen proposals were judged to be clearly satisfactory. When the cost proposals were fully evaluated, it was decided, based on projected dollars, that sufficient funds were available to award contracts to the 12 top proposers.

Contract negotiations were begun in May 1980 with the 12 proposers. Table 1 presents these proposers and the major integrated energy concepts to be demonstrated.

To date contracts have been awarded to seven proposers; two proposers dropped out in the early stages of negotiations and three proposers are expected to finalize negotiations early this fiscal year.

Table 2 delineates specific design characteristics and estimated objectives of each project.

#### PROJECT DESCRIPTIONS

Millbrook Farm (and Cornell University) is a privately operated dairy farm near Ithaca, N.Y., consisting of approximately 450 acres with 200 head of dairy cattle of which 120 are milking cows. The farm produces dairy products, raises corn and alfalfa and sells cows. During the project, the herd will be increased to 300 head of which 180 will be milking cows.

The expanded operation will require approximately 122,500 kwh of electricity, 8,700 gallons of gasoline, 3,100 gallons of diesel fuel and 2,400 gallons of heating oil. Total energy usage will be equivalent to 533 barrels of oil per year.

As illustrated in Tables 1 and 2, Millbrook Farm plans to develop and demonstrate the following major energy concepts:

Methane generation from cow manure.

Cogeneration of thermal and electric energy from methane combustion.

Production of alcohol from corn.

Energy conservation in crop production through conservation tillage and substitution of manure for nitrogen fertilizers.

Energy conservation through waste heat recovery in milk cooling and in recycling of waste water.

Application of microprocessor control systems to control and monitor energy in the methane digester, in the cogeneration equipment, in the waste heat exchangers and in the alcohol production plant.

Implementation of these energy integrating concepts is estimated to save approximately 80 percent of purchased energy.

Project manager is: Dr. Larry P. Walker, Agricultural Engineering Department, Cornell University, Ithaca, N. Y. 14853.

The University of Nebraska Field Laboratory Farm, which is a component of the University of Nebraska near Mead, Nebraska, is composed of approximately 160 acres of farmland devoted to the production of corn, soybeans and sweet sorghum. Presently there are no animals but the farm will be expanded to include a 300-head farrow-to-finish swine facility. Existing on the farm are center pivot and gated pipe irrigation systems. The gated pipe irrigation system is powered by a photovoltaic solar array.

Integrated energy concepts to be demonstrated on this project are:

Methane production from swine wastes in an anaerobic digester.

Production of alcohol from sweet sorghum.

Solar energy and methane gas use in grain drying, water heating and space heating for swine production centers.

Energy conservation of heat and CO<sub>2</sub> from ethanol plant for use in greenhouse system.

Integration of biomass and solar energy to produce power for irrigation.

Computerized farm energy management and conservation system.

Energy conservation in crop production through conservation tillage, conservation of fertilizer and irrigation scheduling

Energy conservation by optimized construction of swine units, and by control of ventilation and temperature.

The specific energy conservation objective for this farm demonstration project is drastic reduction of all petroleum inputs.

The project manager is: Dr. William E. Splinter, Department of Agricultural Engineering, University of Nebraska, Lincoln, Nebr. 68583.

Granja Caribe Farm (and the University of Puerto Rico) is the Commonwealth's largest modern poultry farm. It occupies 6 acres and a new 10-acre layer farm is under construction nearby. There is currently 1 henhouse operating with 12,000 hens. During the life of the project 2 additional henhouses will be built bringing the total capacity of the layer farm to 36,000 hens.

All of Puerto Rico's energy is supplied from nonrenewable fossil fuels—approximately \$1 billion worth of petroleum is imported each year. For this reason, it is especially important that some effort be made to reduce this unusual dependence on off-island sources of energy.

The project expects to demonstrate the following integrated energy concepts:

Production of methane for electric energy by the anaerobic fermentation of poultry waste.

Wind energy conversion system used for water and effluent pumping.

Solar energy collection system to generate hot water for use in brooder operation.

Production of feed and fertilizer by anaerobic fermentation of poultry waste including wasted feed, feathers and broken eggs, feed supplements.

A major reduction in petroleum use will be achieved by the use of methane produced from poultry waste. An additional energy reduction is possible by substituting fermented waste products such as chicken manure, broken eggs and feathers for synthetic fertilizer. An added energy saving feature is a decrease in waste disposal requirements. Energy conservation is achievable by using the secondary effluent from waste treatment for crop irrigation and as a growth medium for algae protein production. By solar drying the algae, a blendable solid nutrient-rich feed supplement is produced.

The project manager is: Dr. Michael Erdman, Center for Energy & Environmental Research, University of Puerto Rico, Caparra Heights Station, San Juan, Puerto Rico 00935.

TABLE 1.—INTEGRATED ENERGY CONCEPTS TO BE DEMONSTRATED

Project	Alternative energy sources							Energy conservation					
	Methane	Alcohol	Biomass combustion	Solar	Wind	Green house	Digester byproduct for fertilizer	Tillage	Irrigation	Fertilization	Pest control	Waste heat recovery	Optimized buildings
Millbrook Farm and Cornell University	X	X					X	X		X		X	X
University of Nebraska	X				X	X						X	
Granja Caribe and the University of Puerto Rico	X				X							X	
Del Valle Farm and SUMX	X	X					X	X		X	X	X	X
Aubrey Farm and Georgia Tech	X		X		X		X	X		X	X	X	X
North Dakota State University	X						X	X		X		X	X
Fox Lease and Center	X						X	X		X		X	X
Odom-Golightly and Energy Management Co. <sup>1</sup>	X	X	X	X		X			X			X	X
Fertile Acres and Oasis 2000 <sup>1</sup>	X					X						X	X
Nelson Farms and Agfarm <sup>1</sup>	X					X				X		X	X
Wilcox Farm <sup>1</sup>	X					X				X		X	X
Farmland Agriservice <sup>1</sup>	X		X									X	X

<sup>1</sup> Approved projects awaiting contract negotiations and awards.

TABLE 2.—PROJECTED SPECIFICATION, PERFORMANCE, AND ECONOMIC DATA

Data	Project						
	Millbrook Farm and Cornell	University of Nebraska	Granja Caribe, University of Puerto Rico	Del Valle and SUMX	Aubrey Farm and Georgia Tech	North Dakota State University	Foxlease
Digester size (gallons).....	60,000	13,000	74,400	30,000	85,000	30,000	30,000
Methane production rate (cubic feet per day).....	8,200	1,680	4,536	3,990	8,000	4,000	5,000
Electricity generator capacity (kilowatts).....	15	( <sup>1</sup> )	12.5	10	15	-----	10
Alcohol production (quantity) (gallons per day).....	75	<sup>2</sup> 200	-----	24	75	-----	65
Stillage produced/consumed (pounds per day).....	150	<sup>2</sup> 430	-----	51	( <sup>1</sup> )	-----	140
Estimated savings.....	\$13,000	\$6,000	\$7,000	\$14,400	\$27,500	\$7,000	\$12,000
Typical investment.....	\$122,000	\$105,000	\$95,000	\$55,000	\$172,000	\$90,000	\$55,000
Payback (years).....	9	17.5	13.5	4	6	13	5
Total funding.....	\$1,532,000	\$1,720,000	\$1,013,000	\$818,000	\$689,000	\$797,000	\$1,354,000
U.S. Government funding.....	\$766,000	\$860,000	\$639,000	\$409,000	\$378,000	\$398,000	\$677,000

<sup>1</sup> Not available at this time.    <sup>2</sup> Per batch.

Del Valle Hog Farm is a 3,000-acre operation located near Austin, Texas. Except for 10 acres devoted to farm buildings and swine facilities, the remaining acres are devoted to grain for feed. Approximately 650 animals are fed continuously throughout the year in a confined feeding operation. The farm has its own feed mill in which milo, a maize type grain, is processed to a hog feed product by blending it with soybean meal. The hog operation requires 47 kwh/day of purchased electricity.

Integrated energy concepts to be demonstrated are:

Methane generation from swine manure to produce electricity and heat for alcohol fermentation and distillation.

Waste heat recovery from engine/generator to produce hot water for heating of the digester reactors and the hog feeding pens.

Alcohol production from milo, and distillation to 170 proof using methane and generated electricity.

The energy integrated operations are directed toward producing all of the farm's average electrical energy requirements from methane and providing excess methane and electrical output to operate an alcohol facility. The alcohol produced will be used in the farm vehicles which will be modified.

The project manager is: David A. Malish, SumX Corporation (Prime Contractor), P.O. Box 14864, 1300 E. Braker Lane, Austin, Tex. 78761.

Aubrey Farm (and Georgia Institute of Technology Research Institute) is a family owned corporation located north of Atlanta. Total acreage is 18,000 of which 1,200 are devoted to crops and dairy operations; the remaining acreage is timberland. The dairy operation has a milking herd of 250 cows and approximately 350 additional heifers, calves and other cattle. Adjacent to the dairy operation, corn is raised on 300 acres to provide silage for cattle feeding. Feed is mixed from corn silage, cotton seed, liquid protein and, sometimes, molasses. Manure from 210 cattle is currently flushed from the sloped concrete floors, collected in a sump and pumped to a 1.5 acre lagoon.

Present energy requirements for the farm are 16,000 kwh per month of electricity, 10,000 gallons per year of diesel fuel for farm machinery, 9,700 gallons per year of gasoline for trucks, and 20,000 gallons per year for liquified propane gas to heat the milking parlor and mobile home.

Major integrated energy concepts to be demonstrated include:

Anaerobic digestion of cattle manure to produce methane for an engine generator to provide electricity for the farm—with waste heat recovery to produce hot water.

Use of digester sludge as feed supplement or fertilizer.

Use of wood as fuel for heat and solar energy as a source of heat for the milking parlor.

Fermentation of grain grown on the farm to produce alcohol for use as a motor fuel.

Farm energy audit and subsequent implementation of energy conservation practices.

All of the energy requirements are expected to be supplied by the proposed on-site systems fueled by renewable energy sources produced on the farm.

The project manager is: Richard S. Combes, Director, Technology Applications Laboratory, Georgia Tech. Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Ga. 30332.

North Dakota Agricultural Experiment Station (and North Dakota State University) has dedicated dairy facilities and an agronomy seed farm, similar to many leading dairy operations in the North Great Plains area, to this project. The farm consists of 500 acres of cropland, a dairy operation of 100 milk cows plus additional calves and bulls, and housing specifically designated for this project. The cash crop consists of wheat, barley, sugar beets and sunflowers. Oats are grown for feed and bedding and corn is raised for silage.

It is planned to demonstrate the following integrated energy concepts:

- Generation of methane from manure.

- Use of milk-to-water heat exchanger and rock bed heat storage in dairy operations.

- Solar collector energy system for space heat in dairy barn.

- Efficient solid-liquid separation in manure collection system.

- Digester effluent to be used as fertilizer.

- Energy conservation by improved agricultural practices such as conservation tillage, pest management and soil testing for efficient use of fertilizer.

Implementation of these concepts should result in 25 percent reduction in the crop production energy requirement, 50 percent reduction in water heating input and 60 percent in purchased fuel for space heating. Fuel oil consumption in the dairy operation should be reduced from 13,300 gallons per year to 10,000 gallons per year.

The project manager is: Dr. H. Hirning, Agricultural Engineering Department, North Dakota State University, State University Station, P.O. Box 5435, Fargo, N. Dak. 58105.

Foxlease Farm located in Loudon County, Virginia, is a dairy farm with 400 head of Holstein-Friesian cows and 100 producing dairy cows. The 1,474-acre farm is divided into 1,074 acres of cropland, 200 acres of pasture and 200 acres of woods and buildings. The farm exports \$75,000 per year of breeding stock and produces 2.5 million pounds of milk annually.

Annual energy use is approximately 230,000 kwh of electricity, 6,400 gallons of gasoline, and 5,900 gallons of diesel fuel.

The project will demonstrate the following integrated energy concepts:

- Production of 200-proof anhydrous alcohol from corn.

- Methane generation from cow manure by anaerobic digestion.

- Hot water requirement supplied by waste heat recovery from milk chillers.

- Protein supplement replaced by distillers' dried grains.

- Production of electricity from methane.

- Conversion of engines to burn alcohol fuel.

- Nitrogen converted to soluble form in methane generation for use as fertilizer.

- Use of ethanol byproducts to generate methane in anaerobic digester.

- Use of methane for heating, electricity generation and alcohol manufacture.

Upon implementation of these concepts the ethanol produced will eliminate the purchase of gasoline and diesel fuel. The distillers' dried grains, a by-product of ethanol fermentation, will eliminate the purchase of protein feed supplement, and the methane generated will be used to supply 80 percent of the electrical requirements.

The project manager is: John Archbold, Foxlease Farm of Archbold Investment Co., Upperville, VA 22176.

As stated earlier, this program is a four year effort. The first phase, ranging from 6 to 12 months, will be devoted to system design and analysis while the second phase, approximately 12 months in length, will be devoted to construction, installation and start up of the equipment, e.g., anaerobic digester, alcohol distillation plants. Final characteristics of equipment will not be determined until after completion of phase one. The third phase of the project will be devoted to demonstration (operation, data collection and reporting). During this last phase, the participant shall provide Government officials and interested members of the public with access to the site of the demonstration to view its operation at reasonable times and in reasonable numbers of persons.

In order to successfully transfer the technology demonstrated in this program, the Department of Energy established an interagency agreement with USDA

(Science and Education Administration) to accomplish the field management and technical monitoring of all projects in the Energy Integrated Farm Systems Program. The Science and Education Administration has employed through the Intergovernmental Personnel Exchange Act a senior scientist with research and agricultural extension background to manage the program. In addition to the overall management and technical monitoring of the programs, the USDA's unique and broad experience in Cooperative Extension Services will greatly enhance the technology transfer of the program.

The Office of Industrial Programs is cooperating with a number of other offices and agencies in the conduct of this program. Communication is maintained with the following:

- DOE Office of State and Local Programs;
- DOE Office of Alcohol Fuels;
- DOE Office of Solar Applications for Industry;
- DOE Office of International Programs;
- National Academy of Sciences;
- National Science Foundation;
- U.S. Department of Agriculture;
- U.S. Department of Interior;
- U.S. Agency for International Development;
- Various farm and agricultural trade associations.

#### CONCLUSIONS

In this time of high fuel prices and potential petroleum shortages, we fully recognize the need for technically feasible systems to ensure the agricultural producer's independence from shortages or shut-off of supply that might seriously disrupt the farm production and the flow of food stuffs through the food chain. It is our intent to work in every possible way to implement the technologies described, and assist the Department of Agriculture, whenever requested, on the implementation of Title II of the Energy Security Act. This is already evidenced by our interagency agreement which predates that Energy Security Act, since we previously had established the need for joint cooperative efforts. It is my understanding that Farmers Home Administration is already working with the Office of Alcohol Fuels and the Office of Solar Applications for Industry toward implementation of the provisions of Title II for small-scale alcohol projects and biomass projects.

This concludes my statement. Thank you.

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#### STATEMENT OF RALPH E. O'CONNOR, CHAIRMAN, AGRICULTURAL PRODUCTS INDUSTRIAL UTILIZATION COMMITTEE, LINCOLN, NEBR.

My name is Ralph O'Connor. I am the Chairman of the Nebraska Agricultural Products Industrial Utilization Committee. This agency, usually referred to as the Gasohol Committee, was established by the Nebraska Legislature in 1971 and is charged with assisting the private sector in the development of a grain alcohol industry in the State. I also speak as a grain farmer who has a strong interest in seeing this alternative market for my commodities succeed.

The Nebraska Gasohol Committee has been actively involved in the alcohol fuel movement for several years, and we have seen the concept of converting agricultural products to liquid fuel grow from an idea to a reality. Gasohol is being marketed with great success in all parts of the country. Gasohol sales in Nebraska account for 4.5 percent of all gasoline sold in the state. The market does exist, and we must now move to fully supply this market by constructing grain alcohol production facilities.

The Congress of the United States recognized this fact when they passed the Energy Security Act (Public Law 96-294). If alcohol fuels are to make their maximum contribution to our country's energy future, we must not delay in bringing these plants into existence. The Energy Security Act provides the Department of Energy and the Department of Agriculture with a vehicle to provide financial assistance.

However, the implementation of this program has proven to be a bureaucratic nightmare for persons and groups in the state wishing to build fuel alcohol plants. In general, the Department of Agriculture, through the Farmers Home Adminis-

tration, has jurisdiction over projects below 15 million gallons of annual capacity and the Department of Energy has jurisdiction over projects of 15 million gallons and above. While this fact was made clear in the proposed rules for implementation published by FmHA on August 5, 1980, and restated in the Federal Register, October 9, 1980, there has been a great deal of confusion on the part of local FmHA officials as to the limits of their participation. This confusion appears to be attributable to a lack of communication between Federal and County FmHA offices. State officials must be given clear and consistent guidelines on which to base their activities and make these guidelines available to local offices.

Alcohol production for fuel use is a relatively new and highly technical field and FmHA officials must avail themselves of competent technical advice when evaluating these proposed projects. There are a number of different processes and designs put forward for their consideration, and there must be a framework for reliable evaluation of the merits of an individual proposal. The state and local offices are in the best position to make these evaluations, as they are more aware of local conditions and realities than their Washington counterparts. We strongly encourage that FmHA officials in Nebraska be granted the authority to provide proposed projects in the state with the most effective and expeditious service possible. The urgency of this program requires that political considerations in Washington be subordinate to the equitable distribution of funding for alcohol plant construction.

The application period has also proven to cause undue delay in implementation. The solicitation notice and application guidelines should be issued simultaneously rather than waiting 30 days to issue application guidelines. This is especially important since the FmHA has assumed that "a great deal of planning and action on proposed projects will already have been undertaken by serious, potential applicants." Final planning to meet specific requirements could be well underway if the requirements were stated at the times the solicitation notice is issued. Rapid implementation of this program should be a priority in order to prevent project delays and uncertainty in the investment community. The proposed timeline, as it now stands, presents the probability of a 10-18 month waiting period between submission of the application and project approval. While prudence is desirable in approving projects, undue delays can literally add millions of dollars to the cost of certain projects.

In closing, I would ask that the program be streamlined to the greatest extent possible. "Red tape" is a constant hindrance to persons seeking financial assistance from the government, and every effort should be made to eliminate unnecessary and costly delays. Excessive requirements also serve to discourage and add cost to legitimate projects. The stated goal of encouraging commercialization of biomass processing facilities can only be accomplished if the FmHA is prepared to work with legitimate entities in a manner which will not cause costly delays.

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[The following material was furnished by Mr. Jack Sheaffer in support of his oral testimony which appears on p. 33.]

#### A SYNERGISTIC VIEW OF ANAEROBIC DIGESTION

(Prepared for the Corporation for Public/Private Ventures, by John R. Sheaffer, Patricia A. Ledford, Bernard C. Naglevoort, J. David Mullan, and Lee T. Rozaklis of Sheaffer & Roland, Inc.)

#### AN OVERVIEW

Anaerobic digestion of waste can play an important role in meeting the nation's energy needs. An anaerobic digester contains active bacterial populations which, in the absence of oxygen, produce biogas from organic matter. The bacterial community that generates the biogas is substrate specific. Therefore the composition of the bacterial colony will vary for different types of wastes. Best results are obtained when the bacteria are fed a uniform source of waste. The bacteria are also sensitive to pH levels, preferring a neutral or slightly alkaline environment.

Biogas is a mixture of methane  $\text{CH}_4$  (typically 60 percent) and carbon dioxide,  $\text{CO}_2$  (typically 40 percent). One cubic foot of biogas has an energy value of approximately 600 BTU's. Biogas is derived from renewable sources of waste materials.

In comparison, natural gas contains 1,020 BTU's per cubic foot and is derived from nonrenewable geologic deposits.

Feedstock for anaerobic digesters can come from a variety of sources. This paper focuses on three: animal manure, animal processing wastes, and whey.

Anaerobic digestion can be considered a renewable alternative energy source. Such systems, by their very nature, are multipurpose systems. Traditional energy systems historically have been evaluated as single purpose systems. The one exception is hydroelectric power generated at a multipurpose dam and reservoir. Evaluated as a single purpose system, the benefits of anaerobic digestion will be underestimated.

Forbes made an intriguing observation about multipurpose anaerobic digestion. It pointed out that these operations produce a synergy, not a conflict, between energy and the environment.<sup>1</sup> The production of energy by anaerobic digestion enhances the quality of the environment and has the capability to reduce costly pollution abatement measures. Furthermore, in this transitional period for energy sources, anaerobic digestion of wastes will assist the nation in replacing imported nonrenewable energy resources with domestically produced renewable energy. Finally, by utilizing a nonfossil fuel carbon source to produce energy, anaerobic digesters will not contribute to the increasing worldwide levels of carbon dioxide in the atmosphere, a phenomenon of great environmental concern to scientists.

#### FEEDSTOCK FOR ANAEROBIC DIGESTERS

The total livestock/poultry population in the United States is estimated to be 1,202,813,000. This number represents an increase of about 15 percent since the 1974 Census of Agriculture.

These farm animals produce an inevitable by-product of an estimated 136 million dry tons of manure annually. Approximately 60 percent of this estimate could be available as digester feedstock from animal confinement operations.

The slaughtering of livestock and poultry for food products produces huge quantities of digestible wastes. To provide an indication of magnitude, the estimate of livestock and poultry slaughtered each year is 4,380,780,058. An estimated 1,601,789,000 pounds of digestible wastes are produced in this process. Essentially all of these wastes could be fed into digesters.

Over 25 percent of milk in the United States is used for the production of cheese and cottage cheese.<sup>2</sup> Liquid whey is a by-product of this process. For every one pound of cheese produced there is a residual of eight pounds of liquid whey. For every pound of cottage cheese produced the whey residual equals five pounds. Cheese production results in nearly 2.4 billion pounds of whey solids of which 1.4 billion pounds are converted into dried whey, whey products, and lactose. The remaining whey—over 900 million pounds of whey solids—is disposed of in liquid form. This quantity could be used as feedstock for a digester.

Another potential benefit of digestion is refeed. Digestion would not reduce significantly the nutritional value of the whey for that purpose.

#### ENERGY PRODUCTION

The anaerobic digestion of these various feedstocks will produce a substantial flow of benefits. Included among the direct benefits are heat from burning the biogas in a boiler or furnace and electricity produced by burning the biogas in an engine-generator. Waste heat from the engine can be used as an energy source for ethanol production. The digested residual can be separated into solid and liquid portions. The solid material can be used for bedding in dairy operations, for soil amendments, or as livestock feed supplements. The liquid can be applied to the fields as fertilizer, or it can be used as a nutrient source for intensive aquaculture to produce edible and digestible by-products. The removal of the biogas and the cellulose fibers for bedding will reduce the original weight of the raw manure by as much as 24 percent. This reduced weight conserves both manpower and energy when it is applied to the fields as fertilizer.

If 60 percent of the manure produced in the United States, all of the animal processing wastes, and the 900 million pounds of waste whey are anaerobically digested, a significant quantity of renewable energy will be realized. An estimate of the energy potential is presented in Table 1.

<sup>1</sup> Forbes, May 12, 1980, p. 168.

<sup>2</sup> Assessment of whey situation, H. Res. 230, Hearing before the Subcommittee on Dairy and Poultry, U.S. House of Representatives, 96th Congress (July 24, 1979).

The 868 billion cubic feet of biogas produced annually can be burned to generate 38 billion kilowatt-hours of electricity per year, at an efficiency of 25 percent. This represents the amount of electricity needed to supply 5.6 million houses, approximately eight percent of the occupied housing units in the United States. (The average annual electrical consumption of a household is 6,800 kilowatt-hours per year.) This is equivalent to the amount of electricity which would be produced from 61 million barrels of oil per year. The waste heat from the engine-generators will provide 195 trillion Btu's of energy per year. This amount of waste heat is sufficient to run stills which can, in turn, produce 4.9 billion gallons of anhydrous alcohol per year. This would offset the consumption of 65 million barrels of oil per year.

TABLE 1.—ENERGY PRODUCTION FROM ANAEROBIC DIGESTION

Feedstock	Millions of dry pounds	Millions of feet of gas <sup>1</sup>	Billions of Btu's <sup>2</sup>
Manure.....	163, 200	856, 500	513, 900
Animal processing wastes.....	1, 601	7, 307	4, 384
Whey.....	900	4, 320	2, 592
Total.....	165, 701	868, 127	520, 876

<sup>1</sup> An average of 5.24 ft<sup>3</sup> of biogas can be produced per dry pound of digester feedstock.

<sup>2</sup> Biogas has an average value of 600 Btu's per cubic foot.

Source: Williams J. Jewell, "Energy Agriculture and Waste Management," (Ann Arbor, Mich.: Ann Arbor Science Publishers, Inc., 1975.)

Conversion to electricity	Millions of feet of gas <sup>1</sup>	Millions of kilowatt-hours <sup>2</sup>
Manure.....	856, 500	37, 632
Animal processing wastes.....	7, 307	321
Whey.....	4, 320	190
Total.....	868, 127	38, 143

<sup>1</sup> An average of 5.24 ft<sup>3</sup> of biogas can be produced per dry pound of digester feedstock.

<sup>2</sup> Conversion of biogas to electricity can be accomplished on an agricultural scale at an overall efficiency of 25 percent.

Source: Williams J. Jewell, "Energy Agriculture and Waste Management," (Ann Arbor, Mich.: Ann Arbor Science Publishers, Inc., 1975.)

Waste heat for still	Billions of Btu's <sup>1</sup>	Millions of gallons of ethanol <sup>2</sup>
Manure.....	192, 712	4, 818
Animal processing wastes.....	1, 644	41
Whey.....	972	24
Total.....	195, 328	4, 883

<sup>1</sup> Approximately 50 percent of the waste heat from an engine-generator unit can be reclaimed.

<sup>2</sup> Anhydrous ethanol can be produced at an average energy input of 40,000 Btu's per gallon.

Source: Williams J. Jewell, "Energy Agriculture and Waste Management," (Ann Arbor, Mich.: Ann Arbor Science Publishers, Inc., 1975.)

#### DIGESTED RESIDUAL

The digested residue is a nutrient rich and essentially odorless, thick liquid. In circumstances where manures are high in cellulosic materials, dairy cow manure for example, a manure squeezer can be used to separate out a portion of the solids. These solids, now a spongy-textured material, can be used for animal bedding and other purposes. The remaining nutrient rich liquids and some solids are now more easily managed as a fertilizer. If there is no economic benefit to be derived from separating the solids, the entire digested residue can be applied in a nuisance free, nonodorous manner to the land as fertilizer. When this done, approximately 8 billion pounds of nitrogen and 2 billion pounds of

phosphorus will be available as fertilizer.<sup>3</sup> At an application rate of 150 pounds of nitrogen per acre, enough material is available to fertilize 54 million acres of corn. Substantial amounts of energy are needed to produce nitrogen and phosphorus fertilizers. Thus, additional savings in energy, the equivalent of 29 million barrels of oil (\$1.015 billion), will be realized by replacing commercial nitrogen fertilizers with recycled digested residue.<sup>4</sup>

#### ENVIRONMENTAL QUALITY BENEFITS

In addition to energy and fertilizer values, the anaerobic digestion of manure, animal processing wastes, and whey will produce other environmental benefits. The digested materials are stabilized and are essentially odor free. Thus, "nuisance" and air pollution problems associated with the interface between agricultural and urban areas are controlled. In properly managed animal manure has been cited as a point and nonpoint source of pollution that has degraded our nation's waterways. Leachate from confined animals can be viewed as either a point source or nonpoint source of water pollution. Manure, improperly applied to farmlands, can run off into waterways and constitute a nonpoint source of water pollution. Proper storage of the residual until it can be applied will help to mitigate nonpoint sources of pollution from agricultural runoff. Thus, anaerobic digestion will mitigate the magnitude of the investment needed to control agricultural point and nonpoint pollution sources.

EPA has made several estimates of the financial needs for mitigating pollution from confined animals. A twenty-year program formulated in 1978 estimated that from \$2.30 to \$2.88 billion will be required.<sup>5</sup> In March 1980 dollars, these estimates increase to \$2.83 to \$3.54 billion.<sup>6</sup>

An earlier EPA study (before the passage of the Federal Water Pollution Control Act Amendments of 1972 and the 1977 Amendments) estimated that from \$150 to \$200 million (1972 dollars) would be required to mitigate water pollution from confined animals. When this estimate is adjusted to 1980 dollars, it increases to \$287 to \$384 million.<sup>7</sup>

The Rural Clean Water program of EPA has budgeted \$50 million to study 13 major sites. These sites, which encompass approximately 1,300,000 acres, will be evaluated in terms of nonpoint sources of pollution. In the absence of any more detailed studies and using the 1978 estimates, it can be concluded that \$2.83 billion will be allocated to mitigate water pollution from confined animals under current programs. Congressional Hearings on "Assessment of Whey Situation" addressed this matter. It was reported that the beneficial use of whey protects the Nation's environmental health and economic well being. For example, utilization of 1.4 billion pounds of whey solids per year has the effect of reducing the Nation's waste load of a population equivalent of 15 million people, or by a population equivalent to the combined cities of New York, Chicago, Philadelphia, Baltimore, and Washington, D.C.

"Construction and operation of waste disposal facilities with this capacity would obviously cost the Nation billions of dollars needlessly. And, Mr. Chairman, did you know that if none of the U.S. whey supply was utilized, its disposal would require waste treatment facilities (secondary treatment) with a population equivalent of about 26 million people—more than 10 percent of the U.S. population?"<sup>8</sup>

Applying these estimates to the remaining 900 million pounds of whey per year, anaerobic digestion has the potential to forego waste treatment facilities

<sup>3</sup> Raymond C. Loehr, "Agricultural Waste Management" (New York: Academic Press, 1974), pp. 517-542.

<sup>4</sup> William J. Jewell, "Energy, Agriculture and Waste Management" (Ann Arbor, Michigan: Ann Arbor Science Publishers, Inc., 1975), p. 323.

<sup>5</sup> Telephone communications with U.S. EPA's Lynn Shuyler and Walter Rittall, 12 May 1980.

<sup>6</sup> Bureau of Labor Statistics, Department of Labor, Consumer Price Index, All Urban prices, March, 1980=239.8 and 1978=195.4 (Yearly Average). The 1978 prices are multiplied by 1.23 to adjust to the March, 1980 price level— $P_{1980}-P_{1978}=0.23+1=1.23$ .

P1979

<sup>7</sup> Bureau of Labor Statistics, Department of Labor, Consumer Price Index, All Urban prices, March 1980=239.8 and 1972=125.3 (Yearly Average). The 1972 prices are multiplied by 1.91 to adjust to the March 1980 price level— $P_{1980}-1972=.91+1=1.91$ .

P1972

<sup>8</sup> Statement of Jerry T. Hutton, Vice President, Governmental Relations and Scientific Affairs, Foremost-McKesson Foods Groups, before the House of Representatives Subcommittee on Dairy and Poultry (July 24, 1979).

that would have the capacity to manage a population equivalent of 9.7 million. This capacity would require a construction cost of \$2.25 billion. This estimate was derived from EPA data on national new construction secondary treatment project costs (using 100 gallons per capita per day and 10 million gallons per day treatment plant capacity units) adjusted to current cost levels.<sup>9</sup>

The estimated 1,601 million pounds of animal processing wastes (see Table 2) would require an expenditure of \$4 billion to achieve a similar level of treatment (secondary treatment only). This estimate was derived on the same basis as the estimate for pollution control of cheese whey.

Pollution abatement costs that will be offset by a comprehensive anaerobic digestion program total \$9.08 billion in capital expenditure, which could be saved. This sum would pay for the construction of 55,000 anaerobic digesters of the 800-dairy herd size—\$9.08 billion/\$165,000. These digesters would have the capacity to generate 35 billion kilowatt-hours of electricity with an annual value of \$1.75 billion at rate of \$.05/kwh.

#### A TABULATION OF BENEFITS

The potential benefits which can be produced by an anaerobic digestion program are tabulated in Table 2. These figures clarify the potential role anaerobic digestion can play in filling national energy needs.

TABLE 2.—BENEFITS FROM AN ANEROBIC DIGESTION PROGRAM

Benefit	Energy equivalent in Btu's year	Equivalent barrels crude oil (millions)	Amount (billions)
Electricity.....	0.13×10	61	<sup>1</sup> \$1.90
Alcohol produced by waste heat from engine-generator.....	.46×10	65	<sup>2</sup> 9.77
Bedding/soil amendment/refeed value of solid effluent.....	NA	NA	NA
Fertilizer value of liquid effluent.....	.20×10	29	<sup>3</sup> 1.96
Pollution control.....	NA	NA	<sup>4</sup> 9.08
Reduction in weight to be taken to the field.....	NA	NA	NA
Total.....	.79×10	155	22.71

<sup>1</sup> Based upon electricity prices of \$0.05 per kilowatt-hour.

<sup>2</sup> Based upon anhydrous ethanol prices of \$2 per gallon.

<sup>3</sup> Based upon ammonia-nitrogen fertilizer prices of \$0.24 per pound.

<sup>4</sup> These figures reflect capital costs only; O. & M. costs are not included.

NA: Not available.

The 155 million barrels per year of crude oil equivalent that would be replaced is 2.3 percent of the nation's 1979 annual energy consumption (estimated to be 18.55 million barrels per day or 6,571 million barrels per year crude oil equivalent, excluding conversion losses).<sup>10</sup> In 1979, the nation imported 7,94 million barrels per day of crude and crude products, or 2,998 million barrels per year crude oil equivalent.<sup>11</sup> The 155 million barrels per year of crude oil equivalent produced by anaerobic digestion represent 5.3 percent of this total. At the current rate of imports, 5.9 million barrels per day, it would offset 7.2 percent.

Counting only the biogas used to generate electricity directing, the resulting 38,143 million kilowatt-hours represents 1.8 percent of the 2,170,000 million kilowatt-hours consumed in the nation in 1979.<sup>12</sup> Moreover, compared with nuclear power, the often-mentioned electric power source of the future, the 38,143 million kilowatt-hours of direct electric power from biogas represent 13.8 percent, or a full one-seventh, of the 276,031 million kilowatt-hours of electricity generated from nuclear power facilities in the nation in 1979.<sup>13</sup>

Unless evaluated in a multipurpose, synergistic manner, the benefits of anaerobic digestion will be underestimated. To illustrate, this evaluation shows 0.79 x 1010 BTU's (0.79 quads) of energy could be produced by a comprehensive program (see Table 2). When this number is compared with an estimated 0.27 quads

<sup>9</sup> "Construction Costs for Municipal Wastewater Treatment," U.S. EPA, January 1973-1977. Document dated January 1978.

<sup>10</sup> Russell G. Thompson, "U.S. Energy Situation" (Houston: RGT, Inc., and Evans Economics, 1980), Figure 4.

<sup>11</sup> Ibid.

<sup>12</sup> Ibid.

<sup>13</sup> Ibid.



parlor with twelve units operating 20 hours a day, and a milk processing and bottling plant. These and other electrical demands associated with the farm resulted in an electric bill of approximately \$35,000 in 1979.

#### MANURE HANDLING

The farm uses a free-stall system in three cow barns, one of which is 740 feet long. Manure removal is accomplished by flushing water down the sloping gutters of the barns twice a day. The manure then flows through a collection pipe into a settling basin where excess water is drained off and recycled to the flushing operation. The settled concentrated solids are scraped into a concrete mixing box from which they are pumped to the anaerobic digester. Figure 2 presents a schematic layout of the anaerobic digestion system as it fits into the farm operation. Manure from about 700 cows enters the digester daily.

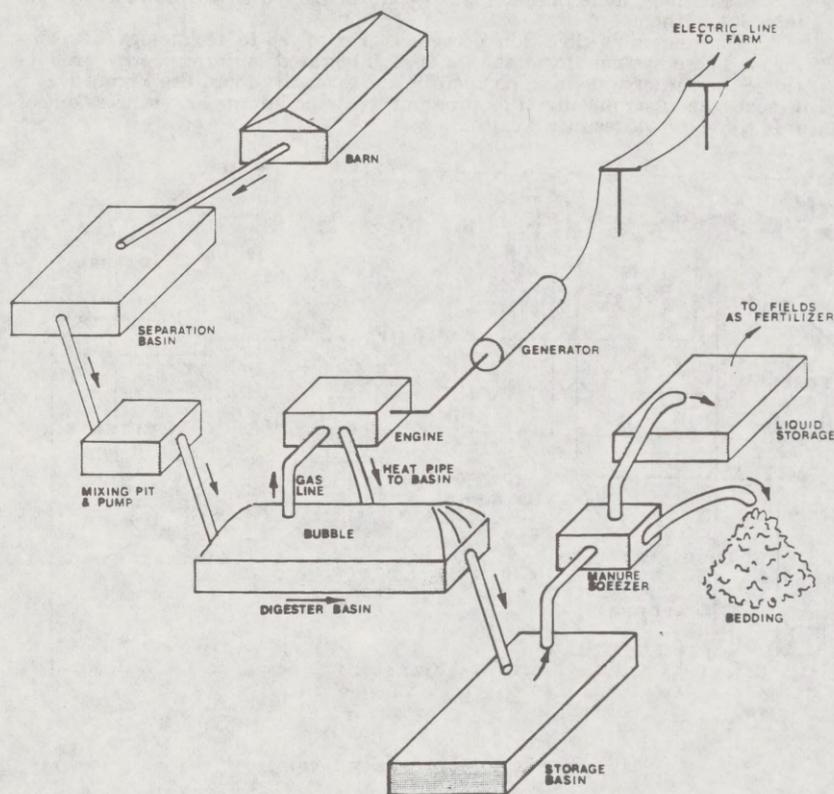


FIGURE 2.—Schematic of the Digestion at Mason Dixon Farm.

#### SYSTEM COMPONENTS

The anaerobic digestion system has two major components: the digester and the engine-generator set. These components are discussed briefly in the following sections.

##### *Digester*

The digester is a reinforced concrete tank, 15 feet deep, 20 feet wide, and 92 feet long. It has a capacity of 180,000 gallons. Manure is pumped from the mixing box through a 6-inch pipe into one end of the digester. The manure is brought up to optimal digestion temperature (97 degrees Fahrenheit, plus or minus 5 degrees

Fahrenheit) by heat from a series of hot water pipes extending down the middle of the tank. Carefully installed insulation prevents heat loss from the outside walls of the digester and the manure surface. In this "plug flow" arrangement, fresh manure entering the tank each day forces older digested material out the far end. Residence time for the manure is approximately 15 days. A concrete basin holds the digested material until it is beneficially used.

Over the top of the tank is a flexible, reinforced hypalon gas storage bag that is tightly secured to the tank walls. Biogas generated from the manure moves up through the digester and is trapped in the bag. As gas is stored, the bag expands into the shape of a loaf of bread. A 3-inch pipe conveys the biogas to a Roots blower, from there to a gas meter, and then to the engine-generator.

#### *Engine-Generator*

The engine-generator unit is a 125-kilowatt, dual-fuel engine-generator which can run on a biogas-diesel fuel mix or on diesel alone. Optimally the mix consists of 90 percent biogas and 10 percent diesel fuel. The diesel fuel is needed for ignition of the methane in the biogas and to lubricate the engine. The engine-generator adjusts its power output automatically to meet the fluctuations in demand for electricity on the farm.

The engine is cooled by water circulating through the digester which, in turn, heats the digester. A remote radiator provides additional engine cooling when needed.

The generating unit, assembled by Stewart & Stevenson, uses a Detroit Diesel engine and a Delco generator. It has a dual-fuel carburetor which allows different mixtures of diesel fuel and biogas to be burned, depending upon gas availability and the demand on the generator. The start-up of the digestion system is accomplished by using 100 percent diesel fuel in the engine to provide the heat necessary to warm manure sufficiently so that biogas is produced. As biogas is generated, it begins to replace some of the diesel fuel until as little as 10 percent diesel fuel is required. The generator, with a 125 kilowatt nominal capacity, operates at 240 volts AC, providing both single and three-phase power, with an average output of 170 amperes. Peak loads can go to 150 kilowatts and 500 amps. The system performs most efficiently (about 23 percent) using 90 percent biogas and 10 percent diesel fuel at full load. Efficiency in this engine drops at lighter loads.

#### SYSTEM OPERATION

Normal operation of the system requires about one-half hour of labor per day, less time than previous manure handling systems required, according to the farm operators. This involves pumping the collected manure into the digester, checking gauges, and recording pertinent information. The motor oil for the engine is changed every 240 hours. The engine should require an overhaul after 2 to 3 years of continuous operation. The overhaul should take one day to complete, according to Stewart & Stevenson, who would be able to provide this service.

#### PRODUCTS

A number of products result from the anaerobic digestion system at Mason Dixon Farms. These include fertilizer, bedding material, and biogas, which is converted to electrical energy.

#### *Fertilizer and bedding material*

Digested effluent has a pH of 7.2-7.5. It is essentially odor free since prolonged heat and a hostile environment during the 15-day process of decomposition have destroyed almost all pathogens. This digested residual can be separated mechanically into solid and liquid components. At Mason Dixon Farms a Surge TRU manure "squeezer" achieves separation of about 95 percent of the solids. The separated solids are a spongy-textured material which has a moisture content of about 70 percent. The remaining solids and liquid residual are available for application to croplands as fertilizer.

At Mason Dixon Farms the extracted solids are used as bedding material for the dairy cattle. It has been found that:

1. Sawdust, previously purchased for bedding at a cost of \$40 per load, 100 loads per year, is no longer needed.
2. The incidence of mastitis has dropped dramatically. Cases of *E. coli* were monitored during a test period. Such cases dropped from four in a ten-day period using sawdust to zero with digested manure solids. Staphylococcal and streptococ-

cal mastitis dropped from ten cases in a ten-day period to five with digested manure solids. (Cows suffering from mastitis require medical treatment and cannot be milked for production until the disease is curtailed. This results in the loss of production of at least seven milkings per case. In economic terms, there is a cost of about \$100 per case of mastitis.)

3. Lime, mixed with the sawdust to kill bacteria, is no longer an expense to the farm or a health risk to the dairy animals.

4. Drying solids to 10 percent moisture using exhaust heat from the engine-generator provides a bedding material that is used in calf pens.

5. Neighboring farmers have asked to purchase the digested solids as bedding for their own herds. Not only has an expense been mitigated, but a potential profit may be realized.

If the ten-day test period is extrapolated to a year, the savings will approximate \$36,000. This savings is made up of reductions in veterinarian expenses, reductions in milk loss, and elimination of the cost of sawdust and lime. (The retail cost of the Surge TRU system is about \$13,000 for the "squeezer" alone. A separate pump may be needed along with other facilities for handling of the squeezed solids and residues).

### *Biogas*

Biogas yield of the anaerobic digester has been monitored by periodic readings of the gas meter. The operation and maintenance of the digestion system have gradually improved since the start-up of the digester, accounting for a general increase in gas production. The system has yet to achieve its maximum biogas production rate. Present indications are that biogas production should stabilize at about 40,000 ft<sup>3</sup> per day from the manure from 700 cows.

Energy output is, of course, the major benefit of the system. The desire on the part of Mason Dixon Farms to become energy self-sufficient initially prompted the installation of the anaerobic digestion system. The generator produces, on the average, about 70 kilowatts per hour (56 percent of its 125 kilowatt capacity.) Thus, approximately \$30,000 worth of electricity is being produced yearly (at a rate of \$0.05 a kilowatt hour).

Plans are underway to digest the manure from 1,200 cows with the addition of a second digester. When this is done, the farm will meet all of its own electrical requirements and plans to sell any excess electricity to Metropolitan Edison, the local utility. Metropolitan Edison has offered to buy all the excess electricity Mason Dixon Farms can generate for 3.33 cents per kilowatt-hour.

## ECONOMIC ANALYSIS OF ANAEROBIC DIGESTERS

This Chapter presents a benefit:cost analysis of anaerobic digesters for three different dairy herd sizes: 800 head, 400 head, and 200 head. It is acknowledged that a digester could be used at other installations such as feedlots, swine and poultry operations, slaughterhouses, and cheese plants. The dairy herds are used solely for illustrative purposes.

The benefit:cost ratios for the dairy operations were calculated on an average annual cash flow basis over the life of the digesters, assumed to be 20 years.

For purposes of this analysis, the only benefits considered are those associated with the conversion of the biogas into electricity. As explained previously, this assumption ignores the multiple benefit nature of biogas production, which should be considered a major attribute of the anaerobic digestion system.

The anaerobic digester, by producing on-farm energy, has the potential to replace energy purchased from a utility. Can the value of the energy produced justify the investment in an anaerobic digester? If it does so, the multipurpose benefits that also accrue simply add to the attractiveness of the investment.

### BENEFIT COST ANALYSIS

Table 3 shows that the benefit:cost ratios of the three different digester sizes are all favorable. The B:C ratio for an 800-head dairy herd digester is 2.22, for a 400-head dairy digester it is 1.64, and for a 200-head dairy digester it is 1.10. This is without either investment and energy tax credits or the value added for nonenergy products (e.g., pollution abatement, material value of the effluent solids, or the fertilizer value of the effluent liquids). It also ignores the potential value of waste heat from the engine-generator set which could be put to use, for example, in supplying energy for an on-farm alcohol facility.

Conservative assumptions and methodologies were used to calculate the average annual benefits and costs. These are:

All physical and mechanical components of the anaerobic digesters were assumed to have only a 20-year life with no salvage value at the end of this period. This assumes that even buildings and storage pits have no use after 20 years.

Capital costs were assumed to be 100 percent financed at an interest rate of 10 percent per year for 20 years at a constant payment rate (debt retirement rate) of 11.746 percent per year. This assumes a high annual interest cost.

TABLE 3.—ANNUAL BENEFITS AND COSTS OF ANAEROBIC DIGESTION SYSTEMS FOR DAIRY FARMS OF 800, 400, AND 200 HEAD

	800 head	400 head	200 head
<b>Costs:</b>			
Construction—capital costs.....	\$19,381	\$15,387	\$12,979
Operating costs:			
Repair and maintenance.....	626	500	418
Taxes, insurance, and contingencies.....	1,682	1,334	1,126
Supplemental diesel fuel.....	14,428	7,214	3,686
Total operating costs.....	16,736	9,048	5,230
Total annual costs.....	36,117	24,435	18,209
<b>Benefits:</b>			
Reduced amount of purchased electricity.....	80,150	40,073	20,057
Benefit: Cost ratios.....	2.22	1.64	1.10

Three categories of operating costs were assumed: repair and maintenance of the engine-generator set, the flyte pump and the hypalon cover; taxes, insurance and contingencies; and supplemental diesel fuel. Over the life of the digester, these costs were assumed to increase annually: repair and maintenance; taxes, insurance and contingencies by a uniform amount based on 10 percent of the initial year's cost; and diesel fuel by a uniform amount based on 15 percent of the initial year's cost (assumed to be \$1.00/gallon). These uniformly increasing costs then were converted to a constant average annual amount at an interest rate of 10 percent per year (conversion factor of 6.51 times the uniform annual increase).

The only benefit assumed was the value of replaced electricity that the farmer no longer purchases from the electric utility. The value in the initial year was assumed to be \$0.05/kwhr, increasing annually by a uniform amount equal to 15 percent of this initial year price or \$0.0075. This uniformly increasing value then was converted to a constant average annual amount at an interest rate of 10 percent per year (conversion factor of 6.51 times the uniform annual increase).

#### NATIONAL PERSPECTIVE

From an economic perspective, the "energy crisis" can be viewed as a twofold problem: rising costs and shortages of nonrenewable supplies. Both imply increasing costs for energy. While the economic effects of the energy crisis are complex, it is useful to focus upon fundamental relationships in order to achieve a clear and meaningful analysis.

The current high price of energy reflects to a greater degree the long run cost of depleting nonrenewable energy resources rather than the short run cost of extraction, refinement, and distribution. The marginal cost, and hence price, of producing energy from nonrenewable sources reflects both of these aspects of the energy problem. First, producing an additional unit of fossil fuel (say, oil or natural gas) is physically more difficult than producing the previous unit. Hence, costs and prices increase progressively (or exponentially) faster as more nonrenewable energy resources are consumed.

Second, there is a finite amount of nonrenewable energy available at any cost over time. At some time the supply of all extractable fuels will be depleted. Some analysts have suggested that the time horizon for depletion of some critical fossil fuels—oil, natural gas, and uranium-235—will be in the foreseeable future. It has been suggested that the world will deplete its reserves of these fuels in

20 to 50 years. To extend the availability of these fuels, conservation is being promoted. In the market place, conservation is achieved through higher prices which reduce demand and encourage a shift to the use of renewable or more available alternative energy resources. Both rising costs of production and shortage imply increasing prices of nonrenewable energy resources, at a progressively faster ratio, in the future.

To break this pattern of spiralling energy prices, it is necessary to eventually shift to a renewable energy resource base. Renewable energy resources are subject to neither the exponential nature of the marginal costs of production nor to the certainty of depletion. At some level, the price of renewable energy resources becomes relatively stable, fluctuating only incrementally in relation to supply and demand pressures.

The nation, therefore, is confronted with essentially two choices. In essence, the first choice amounts to recognizing that the economy is in a state of transition from its reliance on an inexpensive (sometimes subsidized) nonrenewable energy base to a renewable energy base. The choice is to proceed with the transition now, or to hope for technological advancements in converting coal, the main nonrenewable energy resource available in ample supply, into liquid and gaseous forms.

The second choice is whether or not the transition will focus on high technology nuclear development (e.g., the fusion, or "breeder" reactors) or on solar energy development in all of its forms, (e.g., direct sunlight, falling water, wind, wave, biomass, and ocean thermal).

Energy produced through the anaerobic digestion of farm animal wastes is a renewable source of reliable energy. It can contribute significantly to stabilizing the cost of food and fiber production, and consequently, enhance revenues to the farm while stabilizing prices for the consumer. It also should be viewed as the first step in the development of economical farm stills that will produce ethanol.

From a national perspective, biogas is a substitute for energy produced by utilities from nonrenewable resources. The reduced demand for the energy produced from nonrenewable resources will extend the "life" of such resources. In the short run, there is the potential to use the displaced energy to stimulate other sectors of the economy.

It is instructive to compare the capital costs of anaerobic digestion with the most often mentioned energy source for the future: nuclear power. The cost per unit output (\$/kw) for recently completed nuclear plants is approximately \$1,500/kw. This is twice the \$750/kw estimated at the beginning of the long process (7 to 10 years) to build nuclear plants. It is estimated that a new plant begun in 1980 will also double in cost to \$3,000/kw. Ultimate disposal of spent fuels may add substantially to this cost.

Ascribing full system costs to electricity, the 800-head digester will cost \$1,774 per kilowatt capacity. The smaller size digesters cost considerably more than this value—\$2,848/kw for 400 head and \$4,804/kw for 200 head. This comparison shows that an 800-head digester is cost-effective with a typical nuclear plant in 1980. In terms of future nuclear plants, even the 200-head digester, the most costly, appears to be competitive, particularly if the synergistic benefits are considered.

The capital cost of anaerobic digesters will increase only gradually and could actually decline as this relatively simple technology is produced on a mass scale. Moreover, the synergistic benefits and the secondary environmental control benefits of anaerobic digestion will help offset the cost of electricity produced by anaerobic digestion systems. Nuclear waste disposal, by contrast, requires a very large public cost, which should be allocated to the cost of producing electricity in nuclear power plants.

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STATEMENT OF RANDY L. STERNBERG, STERNBERG IRRIGATION, NELIGH, NEBR.

I was born and raised on a farm in Nebraska. After finishing high school, I joined the United States Air Force, after serving four years, I returned to Nebraska and bought the farm on which I now live with the aid of FmHA. I have been in the farming business now for seven years.

I have been studying alcohol production for the last 2 years. One of which I spent on research and one studying various designs of alcohol production systems, before purchasing the plant I now own, operate, and market. Therefore, the information given in this testimony is gathered through practical experience.

My testimony today will consist of three major areas. Part one will be why we need small on the farm alcohol production systems as opposed to large multi-million dollar plants. Part two will be why these small alcohol systems should be financed by FmHA. Part three will be my opinion of the present FmHA lending program for fuel alcohol production systems.

As for my preference for small plants versus large ones, one of the by-products of any alcohol plant is the distillers grain. When it is produced it is about 70 percent moisture. If the plant is on the farm, it can be fed daily without going through a drying process, which large plants will have to do to store it. This drying process takes a tremendous amount of energy which cuts down the efficiency of a plant. Wet distillers grain also has a greater feedability because the water in the grain aids in digestion. I have enclosed a copy of the analysis of the distillers grain from our plant with a copy of my testimony.

The small on the farm plant will strengthen the farm economy because the distillers grain which is produced is a high protein feed. It will substantially reduce the need to purchase expensive protein supplements. The individual farmer will be able to increase his income by converting his home grown grain into this high protein feed and fuel alcohol.

A large plant will have to buy and ship in all of its grain as well as drying and transporting out the distillers grain. This creates high transportation costs that the small plant does not have.

History shows us that as the farmer goes, so goes the nation. With the small plant concept, the strengthened farm economy will in turn strengthen the rural communities.

The small farm plant can utilize family farm labor, because the machinery is not complicated to operate. This will decrease labor costs and increase plant efficiency. The large plant will be required to use highly trained technicians which will increase their costs.

The small plant will also be more likely to use alternate heat sources, such as residue or wood burning in the production. A large plant will not have that versatility. For every gallon of alcohol that is produced there will be approximately 10 gallons of waste water. This waste water must be used either through feeding, fertilizer or disposed of through lagoons. As you can see, the smaller the plant the easier it will be to utilize this waste water for fertilizer or feed. This will again increase the efficiency of the small plant owner. It will be more difficult for the large plant owner to utilize this waste water in these applications. Therefore, he will be more apt to dispose of it through lagoons or sewer systems and receive no benefit from it.

At the recent convention of the National Gasohol Commission, the following resolution was passed. "Whereas President Carter has signed the legislation known as S-932 that contains more than \$1 billion for distribution through the USDA and the Department of Energy to be used for an immediate increase in the production of alcohol fuels during this fiscal year. Therefore, be it resolved that the National Gasohol Commission requests the President, the Department of Agriculture and the Department of Energy move this money into action channels and that the designated \$1.3 million be dispensed immediately for production facilities, not feasibility studies." With a small plant the need for extensive feasibility studies is unnecessary. Therefore, the small plant can be put into production much faster. There is also less machinery to build and less need to purchase grain storage, because of the now abundant on farm grain facilities. Also many of the on farm plants will be housed in existing farm buildings.

For these reasons, it is now possible to go into immediate production and I believe that due to the international concern for alternate fuels, that immediate production is most definitely necessary.

A large number of small plants scattered throughout the nation versus a small number of very large plants will give us more ability to maintain a constant flow of alcohol. If one or two of the large plants were shut down for any reason, it would greatly disturb the flow of alcohol.

If our nation becomes dependent upon our production of alcohol for fuel, the small plant concept will have a large bearing on national security. The plants will be spread out and less likely to be attacked by our enemy.

The family farmer has already proven himself as the most efficient segment of the economy. Let's give him the chance to make us independent of other nations for our fuel.

As to why these small plants need to be financed by FmHA, the potential small plant owner is likely to be acquainted with FmHA procedures and the local FmHA personnel and vice versa. Therefore, the ground work on the majority of these

applications could very well already be done, which would speed up the process of the loan.

The more lenient terms and interest rates will make it easier for the small plant owner to establish a good cash flow. Therefore, the percentage of successful plant owners will be higher. This will aid in the continuous flow of alcohol that I mentioned earlier. Without the aid of FmHA and its sound financial backing, potential plant owners will be forced to seek other financing such as non-reputable sources. This could result in a high percentage of non-successful operations, which will be detrimental to this new industry.

Our nation must have alternate fuel sources. Alcohol will be a major fuel source. This new industry needs our government's financial backing. I would like to take this final segment of my testimony to express my feelings about the present FmHA program for alcohol production systems. I would like to thank Senator Zorinsky and all the other people who have started the wheels turning on this program. Without the dedication and determination of these distinguished people, I am sure that we would not have come so far so soon.

One of the best features of this program is the strict specification requirements that the small plant manufacturer must meet for their plant to be eligible for this program. This will eliminate the possibility of a non-reputable manufacturer getting into this new industry. However, I do feel that a 60 day trial requirement is unnecessary. I believe that the ability of a plant to function can be determined in a much shorter time period, or a performance bond could meet these requirements.

The FmHA's environmental concern is commendable. One of the assets of alcohol for a fuel is its low pollution rate. Therefore, we certainly don't want to pollute our air or streams while producing it.

Let's analyze our so called "waste water". It is water with a small amount of grain fines. This can be used as feed immediately or stored to be used later as fertilizer or irrigation water. The only time it is actually waste is when it is not used. Therefore, we should put less emphasis on lagoons and more on alternate uses. There are several ways of handling the waste water without a lagoon being required. An underground storage tank could hold one or two days production and then be fed or applied to the fields as mentioned above.

I see no reason for the extensive economic studies that are now required for an FmHA alcohol fuel production loan. The economic study should not be any more extensive than for any other loan. If the individual meets the financial requirements necessary to service the loan, the fact that he's buying an alcohol plant should have no bearing.

I would like to close by thanking Senator Zorinsky for allowing me to testify before this committee.

CENTRAL NEBRASKA GASOHOL INC.,  
Gothenburg, Nebr., October 8, 1980.

Re: Meeting with Farmers Home Administration—Wednesday, October 7, 1980.  
Hon. Senator EDWARD ZORINSKY,  
Federal Building—Room 294, Centennial Mall North, Lincoln, Nebr.

DEAR SENATOR ZORINSKY: Mr. William Waldo from State Office of the Farmers Home Administration called Mr. Dean Kugler, President of the Gothenburg State Bank and asked for him and myself plus one other officer from Central Nebraska Gasohol Corporation to meet with the State Farmers Home Administration officials.

Attending the meeting from Central Nebraska Gasohol Corporation—Dean Kugler, Dean Goad and Arthur Claeys. Representing Farmers Home Administration—Mr. Leonard Hanks, State Director; James Longan, State Chief-Business and Industrial Loans; William Waldo and Kenneth Oerter, District Director, North Platte, Nebraska. Meeting convened at 10 A.M. in Mr. Hank's office.

The entire discussion revolved around our project, the building of an alcohol plant in Gothenburg, Nebraska.

Many questions were asked about (i.e.) people involved—size of plant—source of feedstock—storage of feedstock—source of initial energy—plant location within community—who is World Wide Construction Services, Inc.—who is Pedco International Corporation—how many personnel to operate plant—type of personnel from professional area—cost of plant—has World Wide constructed any alcohol plants—who is the lender—who is the lead bank.

All the above questions are answered within the letter, feasibility study, pre-application or application given to Farmers Home Administration.

All of the above documents have been available since February 27, 1980, but the preapplication had to be submitted first according to Mr. Longan before we could submit an application.

The preapplication was submitted on June 25, 1980, and approval given on August 11, 1980. We found out about the approval from Washington, D.C., by calling and inquiring of the Farmers Home Administration. All of this was brought out at this meeting.

After much discussion as to our project and the amount of information we have submitted plus the amount of information we are going to receive pertaining to the proforma from World Wide Construction, which has been given to Arthur Andersen & Company to break down and analyze the proforma to determine if the plant is profitable, all this before submitting for a loan guarantee. All the accounting and lawyers costs being paid by Central Nebraska Gasohol Corporation, including the cost of our feasibility study, instead of seeking grants, I believe we are sincerely seeking to build an alcohol plant.

We have also found a source of financing the entire cost of the plant from a private source all hinging on the 90 percent loan guarantee commitment.

Also discussed were the States of Iowa and Illinois where the 90 percent commitments were being given. Mr. Hanks believes they were given, hinging on receiving the technical data after it is received by the organization.

Questions being asked in the application are to be answered from the engineering study and this study cost upward of \$100 to \$500,000, depending on which design firm is doing this study.

We are seeking the 90 percent loan guarantee commitment in order to obtain this engineering study. Mr. Longan claims these studies should not and do not cost this much.

A proper study for each area does cost upwards to \$100,000. Some organizations use the same study regardless of the area the plant is being built, they have many copies and charge what the traffic will bear.

After all the discussions, Mr. Hanks stated that he could see no reason why we could not receive our 90 percent loan guarantee commitment in order to obtain an engineering study, in order to answer the technical questions asked in the application.

At this point, Mr. James Longan stated no, they could not, as we have not given the Farmers Home Administration answers to the technical questions asked in our application. Also, the financial area does not answer the Farmers Home Administration criteria.

We have been seeking this 90 percent loan guarantee since February 27, 1980. We have tried to answer all questions honestly.

The meeting was adjourned at this point with Mr. Longan stating if each of us understood the Farmers Home Administration's criterias and there can be no other way.

To me, it seems a question of going over their heads and this is the way to stop all the bypassing of the chain of commands. As I was told, if Farmers Home Administration in Washington, D.C. told you to do certain things, then go and let them do the job, but your going to do it my way sooner or later. The only reason we called the Farmers Home Administration in Washington in the first place is because of the answers I received when I asked questions such as, "I'm ignorant and can't ask any intelligent questions about alcohol production" and "I don't know a darn thing, better ask someone upstairs."

Well, Senator, a person becomes discouraged at times with all the bureaucracy one runs into within the framework of the Government. Expeditious implementation of the loan guarantee program should be a priority in order to prevent delays, for the longer we wait, the more it is going to cost to build our plant.

The flood of paper requirements measure in many inches and the needing of clincher words, phrases and catch phrases are necessary, or so it seems.

The Farmers Home Finance Program is not serving the needs of Agriculture or the request of the President. We need realignment of government thinking, funds and the stream-lining of receiving loan guarantees. I believe the momentum in the bureaucracy at all levels is not recognizing that renewable agriculture alcohol has moved to reality.

One wonders if bureaucracy is ever going to get the message and implement the wishes of Congress and push for a full-scale development of agriculture alcohol as the fuel available now as a renewable source.

I asked the question at a seminar in Columbus, Ohio, "Will all Farmers Home Administration personnel be knowledgeable about this new area of biomass, grain to be used for fuel?" The answer, "Absolutely, all our personnel will be informed and be knowledgeable." All the requirements an applicant must meet before receiving approval complicates and delays application process and delays the goal of rapid commercialization, except if you have an oil company as a partner.

The Farmers Home Administration presents the application to you as a challenge, not as an encouragement to help forestall our dependency on foreign oil. The various agencies within the Government seem to want everyone to wait for the next announcement pertaining to the alcohol fuels program.

Thank you, Senator, for your help and may changes in procedure of acceptance be forthcoming in the next session of the Congress.

Sincerely,

ARTHUR L. CLAEYS, *President.*

[The following material was furnished by Mr. George Boucher in support of his oral testimony, see p. 51.]

PROJECT: BOUCHER RURAL PRODUCTS, BEEFMAKER CATTLE CO., RAVENNA, NEBR.

*(Reprint from Department of Energy Book Test by John McFee)*

George Boucher has been making and experimenting with fuel-grade alcohol since 1958. He built his first still from the designs of Dr. Mercia who made his first still in Holland in 1891.

Boucher has developed two small, experimental models for farm use—a 1-bushel and a 10-bushel unit. The stills are batch types; each is wood-or propane-fired and uses a variety of feedstocks. Boucher has produced approximately 3,000 gallons of 180-proof alcohol with the two units. The 10-bushel unit sells for \$6,000; the 1 bushel for \$2,400. He also has a full-scale plant under construction that has 12" diameter towers capable of producing 27 gallons per hour.

#### FEEDSTOCK/PREPARATION

Boucher has used corn, alfalfa, potatoes, sweet sedan, sargo, fodder beets, wheat and ground wood.

To prepare the feedstock, Boucher always uses a wet extruder. For corn, he also recommends grinding or milling the crop through a No. 100-mesh screen; this extra step raises the alcohol production per bushel of corn by almost 20 percent according to Boucher.

#### COOKING

The tank is half filled with water, heated to 150° F and the liquefaction enzyme is mixed in. (For the 10 bushel unit, the cook tank is 450 gallons. for the one bushel unit it is 55 gallons.) The corn is added and the mixture is boiled (about 212°F) for 20 minutes. Boucher stresses that enzymes should be in the water before adding the corn. When the cook cycle is complete, the mash is cooled to 170°F with cold water and the saccharification enzyme is added. After about 20 minutes the mixture is cooled to 90°F with more cold water and ready for fermentation. Boucher uses and recommends Biocon enzymes and yeast. Final volume is approximately 30 gallons of water per bushel.

#### FERMENTATION

Boucher rehydrates his yeast for at least 1 hour before adding the yeast to the fermentable mash. He is also experimenting with fermentation enhancement products from Biocon, and follows Biocon's recipe when making his alcohol from corn. He has worked with Biocon over the years and helped them develop the procedures they now recommend. Fermentation is usually complete within 72 hours and Boucher says the alcohol content in the mash averages 10½ percent using corn.

#### DISTILLATION

Boucher designed his own one and ten bushel distillation columns; the packing material is glass beads. The temperature at the top of the column is controlled at around 172°F with cold water coils. His production rate is approximately

three gallons per hour of 180 proof alcohol for the ten bushel system and .7 gallons per hour for the one bushel unit.

Each system has a stripper and rectifier section in one column. The ten bushel unit is 16'2" tall with a 6" diameter column; the one bushel is 9'8" tall with a 3" column.

#### DISTILLERS GRAINS

Boucher does not separate the distillers grains from his stillage. He uses the whole stillage because "it's a shame to waste all that protein in the liquid." He mixes the stillage with molasses and bentonite before putting it into lick tanks. The cattle, especially the calves, feed well on the mixture.

#### PRODUCT USE

George is using the fuel grade alcohol he produces to run some of the vehicles on his farm. He has found that the alcohol-powered trucks have performed well. George also supplies alcohol to people using it for experimentation, and does some experimenting on his own. A neighbor has converted a tractor to fuel alcohol, and claims it performs better than its unmodified counterpart.

#### ENERGY INPUTS

Energy consumption to fire the batch stills is about 55,000 Btu's/gallon of ethanol. Also some electricity is needed to run the stirring motors. Boucher has his own wood supply, so wood costs only \$15 a cord and energy costs are less than 10c/gallon of ethanol. When he uses propane, energy costs are 55c/gallon and for coal, 11c/gallon of ethanol.

#### MANPOWER REQUIREMENTS

From feedstock preparation to final distillation, Boucher estimates that it takes eight to ten manhours to make a batch of alcohol. Most of that time the unit is self-operating and only occasional checking is required. Boucher noted that it takes the same amount of time to run the one bushel experimental model as it does the ten bushel model.

#### CONTAMINATION-HOUSEKEEPING

For the small experimental units, Boucher uses no extraordinary housekeeping routines, other than general cleaning; the cooking cycle "sterilizes" the system during each batch. However, for farm-sized units with auxillary fermenters he recommends using one tank for fermentation while the other is being cleaned with caustic soda and flushed well with water.

#### DESIGNER COMMENTS

Boucher has these tips for people buying a farm alcohol still: (1) know what the seller has done; (2) get a guarantee on the unit you buy; (3) don't buy a still until you have trained at an operating facility and learned how to make alcohol; (4) ask the seller to include training/instruction as part of the deal; and (5) learn from the mistakes of others.

Boucher has plans for small pot stills in three sizes: one bushel, ten bushel, and 30 bushel; he also has plans for 12', 18' and 24' columns.

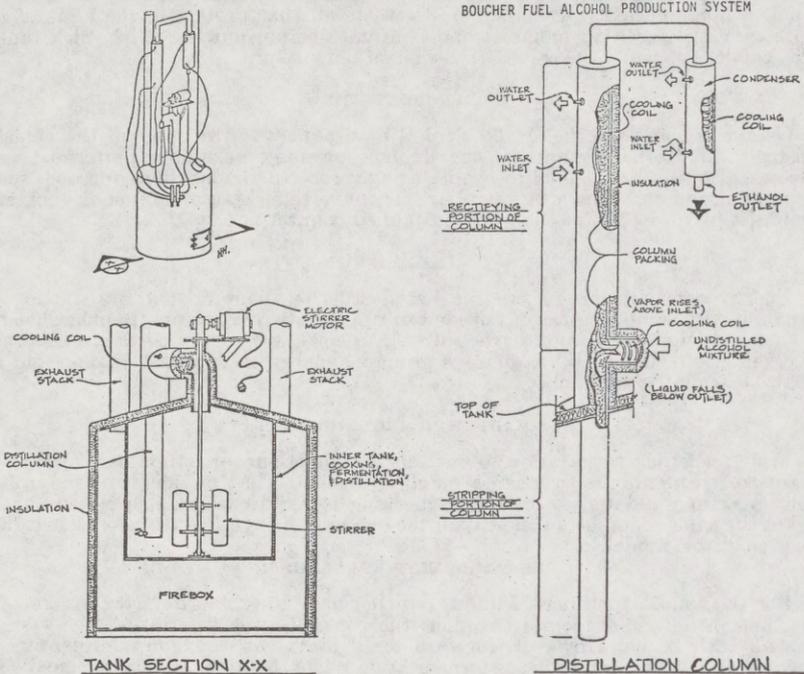
These large stills will come but more technology is needed such as being furnished by the Biomass Research center of U. of Arkansas under the able guidance of George H. Emert, Director. Plants like these will prove cellulose conversion is the answer.

Alcohol can be made from grains, but at the present time the only feasible way is to use small stills to become fermentors, the small still technology is here for the livestock man to feed the offal, water from mash should be used for fertilizer or used in livestock drinking water, CO<sup>2</sup> will be very valuable in liquid Fertilizer or processed for fuel for farm use.

The answer to alcohol for fuel is the biomass cellulose conversion from Fodder Beets, Sweet Sudans or any cellulose such as garbage, trees etc. always keep in mind when thinking of stills for farm use, first, learn to walk before you run with alcohol making, buy a still from manufacturer that will take your small plant in on larger one, if you buy a plant that only handles grain you will be buying an instant antique, think of buying digester tanks for your plant instead of fermentors and a plant that will be able to work with biomass produced alcohol as well as grains, potatoes etc.

Note: In hot weather use a little clorox in cooking water, never put in finely ground corn until enzyme is thoroughly mixed and temperature is at 150 degrees, cook 30 minutes after boiling point has been reached. Might need little penicillin with yeast to hold down bacteria.

We burn 150 proof alcohol in carbureted engines along with gas to heat engine and for cold weather starts. Propane and alcohol work together well also.



UNION DEVELOPMENT Co.,  
Tulsa, Okla., October 13, 1980.

Hon. EDWARD ZORINSKY,  
U.S. Senate,  
Washington, D.C.

DEAR SENATOR ZORINSKY: Robert Hoff of Energy Complexes, Inc., Sioux Falls, South Dakota, has passed along to me a copy of your letter of October 2, 1980 in which you announced a hearing to be held in Lincoln on October 17th with regard to the Farmers Home Administration Loan Guarantee Programs for fuel alcohol as provided in the Energy Security Act of July 2, 1980.

I regret that I will be unable to attend this meeting since I have a previous commitment to lead a church renewal program in Albuquerque, New Mexico. However, we are intensely interested in the subject matter since the Farmers Home Administration has just announced loan guarantees for plants in Montana, Iowa and Louisiana for which our company is committed to do the design, engineering, construction and start-up work. On the surface, this appeared to be the satisfactory culmination of over one year's work by our team in which we brought on stream the first commercial fuel alcohol plant in the United States.

However, we understand that the terms and conditions of these loan guarantees are such that the Farmers Home Administration, in contradistinction to the intent of the Energy Security Act, is transferring the risk for these new alternate energy enterprises from itself to the interim financing institutions, the engineering companies and the shareholders of the respective projects. It is our understanding that the guarantees will not be issued by Farmers Home Administration until the plants have been constructed and have proven their operating capabilities at the design

rate. Thus, interim financing is contingent upon bonding by the engineering company. Most of the engineering companies in the fuel ethanol business are, like ourselves, relatively small businesses that do not have the capability of making multimillion dollar cash bond, since the bonding companies are not in the risk taking business and demand liquid assets in proportion to the bond being issued. Therefore, it appears that unless the terms and conditions of the Farmers Home Administration guarantees are changed to comply with the intent of the Energy Security Act in which the government assumes a risk taking role in order to provide alternate energy for the United States, Union Development Company will be unable to build any of the plants for which the loan guarantees have been announced. We have contacted some of our competitors who also have reliable processes and find their situation the same as ours. It is not realistic to expect either bonding companies or financial institutions capable of supplying interim financing for construction to assume the risk the Farmers Home Administration was intended to bear. Nor is it reasonable to expect the shareholders of these fledgling companies (who have already been asked to put up a least 20% equity into the project and in many cases substantial personal guarantees) to assume this risk.

Union is indeed willing to assume the risk involved in the new technology of fuel ethanol to the extent of its financial capabilities. However, those capabilities are limited to the terms which we initially proposed to the Farmer Home Administration. Our reputation is that we stood by the Waurika, Oklahoma facility until it was producing anhydrous alcohol and distillers' dried grains at the designed rate. From the lessons learned in this plant, we have every reason to believe we can easily do so for subsequent plants; we simply do not have the financial capability of making the bond required by the financial institutions.

Therefore, we respectfully request that you as Chairman of the Subcommittee on Agricultural Credit and Rural Electrification exert whatever influence possible to bring the policies of the Farmers Home Administration in line with the intent of the Energy Security Act and thereby allow implementation of the fuel ethanol projects which have been announced. Union stands ready to negotiate a mutually satisfactory solution to this impasse at any determined time or place. However, due to the impending winter season, some of our projects require almost immediate implementation in order to avoid a costly delay of construction.

Cordially yours,

DEAN R. McHARD, *President.*

Enclosure.

COMPARE UNION'S PROVEN FUEL ETHANOL PROCESS ECONOMICS

Plant size, gallons per year	660,000	1,320,000	2,640,000	5,280,000
Capital investment, turnkey <sup>1</sup> .....	\$1,300,000	\$2,500,000	\$4,750,000	\$9,000,000
Pro forma operation (dollars per gallon):				
Ethanol sales.....	2.00	2.00	2.00	2.00
DDG sales <sup>2</sup> .....	.40	.40	.40	.40
Total sales revenue.....	2.40	2.40	2.40	2.40
Raw materials—Corn at \$3 per bushel.....	1.20	1.20	1.20	1.20
Cash operating expense.....	.45	.42	.40	.38
Interest and depreciation.....	.48	.45	.42	.40
General sales and administrative expenses.....	.12	.10	.09	.08
Total.....	1.05	.97	.91	.86
Pretax net profit <sup>3</sup> .....	.15	.23	.29	.34
Depreciation add back.....	.26	.24	.23	.21
Cash flow available for principal repayment and owners accounts <sup>4</sup> .....	.41	.47	.52	.55

<sup>1</sup> Assumes coal fuel, anhydrous ethanol, and distillers' dried grain at 14 percent moisture.

<sup>2</sup> Assumes detoxification of gluten prices as more plants come on stream.

<sup>3</sup> The investment tax credit and business energy tax credit eliminates Federal income taxes during the crucial initial 2 to 3 years of operation.

<sup>4</sup> When interest is excluded, the return on investment exceeds 30 percent on the smallest plant and 40 percent on the largest plant.

## STATEMENT OF DR. JOHN R. SHEAFFER, SHEAFFER &amp; ROLAND

## ON-FARM ENERGY PRODUCTION INVENTORY AND PROSPECT

I am pleased for this opportunity to appear before the Subcommittee on Agricultural Credit and Rural Electrification. My testimony reflects our experiences in attempting to both stimulate and understand the Department of Agriculture actions with respect to on-farm energy production. Also, I have attempted to outline the potential effects of a nationwide program of on-farm energy production.

## OUR PERSPECTIVE ON CURRENT PROGRAMS

Anaerobic digestion of organic wastes to produce biogas is a contemporary technology. The system at Mason Dixon Farm has demonstrated the appropriateness of the technology. Anaerobic digesters can be fitted into a small scale farm operation.

The demonstration at Mason Dixon Farm triggered a variety of responses from Federal officials. Initially there was an outpouring of interest. Officials from the Department of Agriculture, Department of Energy, Department of Defense, and EPA have inspected the facility. In addition, several Congressmen have gone to Mason Dixon Farm for first hand inspection. Overall, the response has been enthusiastic. The system was described in the Washington Post as follows:

While not technologically imposing, the Mason Dixon system is not exactly a Rube Goldberg contraption held together with baling wire and desperate hope. It is simple, but not simple-minded. Manure from about 700 cows is flushed to a pit where the solids are separated out and sent to a basin tightly covered by a big black plastic cover that keeps oxygen out. In the oxygen-free atmosphere under the bag, bacteria and other microbes devour the solids and then die, their decay producing a gas that expands the bag like a giant balloon. The gas is 60 percent methane and 40 percent carbon dioxide.

The gas is used as a fuel to run a generator which produces electricity. Converting the gas' BTU's into kilowatts is not as efficient as burning the gas directly, but Waybright wants to utilize the generator's considerable waste heat to make alcohol from corn grown at the farm. There is a controversy about whether alcohol production is cost-effective when its operation requires a fuel such as petroleum. But when waste heat is used, there is a clear net gain.

The problem so far with alternate energy, which America is supposed to exploit so it can become less dependent on imported petroleum, is that what sounds wonderful on paper ("harnessing the endless power of the sun," etc.), in reality can be horrendously expensive and/or susceptible to frequent breakdowns.

When Waybright decided to try to make Mason Dixon energy-independent, he cast a cold eye before he put up \$100,000 for cow power. (He received not one dollar of federal help for the methane digester.) "There are a lot of pie-in-the-sky ideas," he says. "I wanted a system that worked. I'm not an altruist. I wanted to make a profit."

What is the evidence?

Since cow power went on line at Mason Dixon on October 2, 1979, there have been eight days of down time, but in no instance was there a problem with the methane operation. The bugs were in the conventional generator, which kept shorting out because of a poorly designed connection.

When a second digester is added to the present one, Waybright and his consultants, Sheaffer & Roland, Inc., of Washington, estimate that after 20 years, the methane operation alone (not counting the yet-to-be-built alcohol still) will have produced an accumulated net gain of \$1.8 million (subtracting total capital and operating costs) from the benefits of reduced purchase of electricity.

In putting together their balance sheet, Waybright and Sheaffer & Roland estimated that the farm's electricity bill from Metropolitan Edison would increase on the average of 6½ percent over the 20-year period. A spokesman for the utility said that was a "conservative" estimate.

One of the interesting byproducts of converting manure to methane is a fluffy, odor-free material that cows prefer as bedding over sawdust. Since Waybright started putting this material in the barns, cases of mastitis (an udder disease) among his Holsteins has dropped dramatically, raising the cows' annual milk production. Waybright estimates that the bedding change results in direct and indirect savings of \$36,000 annually, but this too is not calculated in the benefits

column, nor is the value of the more stable form of fertilizer left behind after the methane extraction.

There is yet another benefit that is kept out of the balance sheet. Because the manure at Mason Dixon is totally utilized as methane, fertilizer, and cow bedding, none of it contributes to what is being recognized as a major source of pollution—animal wastes that are washed off farmland into streams and rivers. Billions of dollars have been spent on new and improved sewage treatment plants, but none of that money can clean up water polluted by agricultural wastes. The Federal Environmental Protection Agency estimates that the total cost of the cleanup would be about \$9 billion.

But the main attraction of cow power is that, coupled with alcohol production, it can help turn farms into energy producers instead of consumers (and wastes). As Waybright says "Food production all depends on the next boatload of oil coming in. If we could make the farmer energy-independent, that would be worth a couple of missiles in the silo."

Many other newspapers and magazines carried similar stories. Widespread awareness of energy production through the use of anaerobic digesters was generated. It appeared that the stage was set for aggressive government action. This is not what is occurring, however.

In August 1979, reacting to the gas lines and diesel fuel scarcity earlier in the year, the U.S. Department of Energy requested proposals for Energy Integrated Farm Systems. Up until the last month of the fiscal year—September 1980—not one single dollar was granted to farmers under that program. Furthermore, only \$2 million actually was made available for the program.

In April of this year, the Secretary of the Department of Energy and the Secretary of Agriculture worked out an agreement for the Department of Energy to transfer money to Agriculture (\$2.3 million) for grants for on-farm energy systems, to help build at least one demonstration system in each state. Moving right along with its usual sense of urgency, the Department of Energy announced the transfer of the funds three months later, on Independence Day, the 4th of July. (I suppose they may have said something about energy independence.) But, of course, the money was not transferred until August. The Department of Agriculture then announced its grant program. However, not to be outdone by the Department of Energy, Agriculture bound itself up in red tape and could not get instructions to its field offices in time to approve projects before the end of the fiscal year, September 30. Agriculture gave the money back to the Department of Energy. There was no announcement of resumed energy independence for our farms.

In the recent Synfuels legislation, Congress made \$525 million available to the Department of Agriculture in loan and loan guarantee money for alcohol programs. Now it would make sense to see that farms, where alcohol fuel is needed to insure our food supply, would receive the benefits of the money under that program. However, such reasoning did not prevail and on-farm energy production systems have little, if any, priority standing for these funds.

#### POTENTIAL EFFECTS OF A NATIONAL PROGRAM

Anaerobic digestion of agricultural wastes can play an important role in meeting the nation's energy needs. Feedstock for anaerobic digesters can come from animal manure, animal processing wastes, and surplus whey. An anaerobic digester contains active bacterial populations which in the absence of oxygen produce biogas from organic matter. The bacterial community which generates the biogas is substrate specific. Therefore, the composition of the bacterial colony will vary for different types of wastes. Best results are obtained when the bacteria are fed a uniform source of waste. The bacteria are also sensitive to pH levels, preferring a neutral or slightly alkaline environment.

Biogas is a mixture of methane  $\text{CH}_4$  (typically 60 percent) and carbon dioxide,  $\text{CO}_2$  (typically 40 percent). One cubic foot of biogas has an energy value of approximately 600 BTU's. Biogas is derived from renewable sources of waste materials. In comparison, natural gas contains 1,020 BTU's per cubic foot and is derived from nonrenewable geologic deposits.

Anaerobic digestion systems, by their very nature, are multipurpose systems. Traditional energy systems historically have been evaluated as single purpose systems. The one exception is hydroelectric power generated at a multipurpose dam and reservoir. Evaluated as a single purpose system, the benefits of anaerobic digestion will be underestimated.

Forbes made an intriguing observation about multipurpose anaerobic digestion. It pointed out that these operations produce a synergy, not a conflict, between energy and the environment.<sup>1</sup> The production of energy by anaerobic digestion of agricultural wastes enhances the quality of the environment and has the capability to reduce costly pollution abatement measures. Furthermore, anaerobic digestion of agricultural wastes offers the potential to achieve the goals of the Energy Security Act with respect to replacing imported nonrenewable energy resources with domestically produced renewable energy. Finally, by utilizing a nonfossil fuel carbon source to produce energy, anaerobic digesters will not contribute to the increasing worldwide levels of carbon dioxide in the atmosphere, a phenomenon of great environmental concern to scientists.

#### AGRICULTURAL WASTES FOR FEEDSTOCK

The total livestock/poultry population in the United States is estimated to be 1,202,813,000. This number represents an increase of about 15 percent since the 1974 Census of Agriculture.

These farm animals produce an inevitable byproduct of an estimated 136 million to 210 million dry tons of manure annually. Approximately 60 percent of these wastes could be available as digester feedstock from animal confinement operations.

The slaughtering of livestock and poultry for food products produces huge quantities of digestible wastes. To provide an indication of magnitude, the estimate of livestock and poultry slaughtered each year is 4,380,780,058. An estimated 1,601,789,000 pounds of digestible wastes are produced in this process. Essentially all of these wastes could be fed into digesters.

Over 25 percent of milk in the United States is used for the production of cheese and cottage cheese.<sup>2</sup> Liquid whey is a byproduct of this process. For every 1 pound of cheese produced there is a residual for 8 pounds of liquid whey. For every pound of cottage cheese produced the whey residual equals 5 pounds. Cheese production results in nearly 2.4 billion pounds of whey solids of which 1.4 billion pounds is converted into dried whey, whey products, and lactose. The remaining whey—over 900 million pounds of whey solids—is disposed of in liquid form. This quantity could be used as feedstock for a digester.

Another potential benefit of digestion is refeed. Digestion would not reduce significantly the nutritional value of the agricultural wastes for that purpose.

#### ENERGY PRODUCTION

The anaerobic digestion of these various feedstocks will produce a flow of synergistic benefits. The initial energy source is biogas. Table 1 tabulates expected biogas production per animal and per pound of volatile solids in the feedstock. Electricity can be produced by burning the biogas in an engine-generator. Waste heat from the engine can be used as an energy source for ethanol production. The digested residual can be separated into solid and liquid portions. The solid material can be used for bedding in dairy operations, for soil amendments, or as livestock feed supplements. The liquid can be applied to the fields as fertilizer, or it can be used as a nutrient source for intensive aquaculture to produce edible and digestible by-products. The removal of the biogas and the cellulose fibers for bedding will reduce the original weight of the raw manure by as much as 24 percent. This reduced weight conserves both manpower and energy when it is applied to the fields as fertilizer.

If 60 percent of the manure produced in the United States (to be conservative, the low estimate of 136 million dry tons per year is used in the analysis), all of animal processing wastes, and the 900 million pounds of waste whey are anaerobically digested, a significant quantity of renewable energy will be realized.

The 868 billion cubic feet of biogas produced annually can be burned to generate 38.1 billion kilowatt-hours of electricity per year, at an efficiency of 25 percent. This represents the amount of electricity needed to supply 5.6 million houses, approximately eight percent of the occupied housing units in the United States. (The average annual electrical consumption of a household is 6,800

<sup>1</sup> Forbes, May 12, 1980, p. 168.

<sup>2</sup> Assessment of whey situation, H. Res. 230, Hearing before the Subcommittee on Dairy and Poultry, U.S. House of Representatives, 96th Congress (July 24, 1979).

kilowatt-hours per year.) This is equivalent to the amount of electricity which would be produced from 61 million barrels of oil per year. The waste heat from the engine-generators will provide 195 trillion BTU's of energy per year. This amount of waste heat is sufficient to run stills which can, in turn, produce 4.9 billion gallons of anhydrous alcohol per year. This would offset the consumption of 65 million barrels of oil per year.

TABLE 1.—EXPECTED BIOGAS PRODUCTION

Production (unit)	Gas/day (cubic feet)	Electricity/year (0.06/kWh)
Dairy cow (1,400 lb).....	43	\$40.36
Feedlot steer (900 lb).....	28	26.28
Finishing hog (135 lb).....	5	4.69
Chicken (layer).....	.36	.34
Whey (gallon).....	5	4.69

A manure squeezer can be used to separate out a portion of the solids from the digested residue. These solids, now a spongy-textured material, can be used for animal bedding and other purposes. The remaining nutrient rich liquids and some solids are now more easily managed as a fertilizer. If there is no economic benefit to be derived from separating the solids, the entire digested residue can be applied in a nuisance free, nonodorous manner to the land as fertilizer. When this is done, approximately 8 billion pounds of nitrogen and 2 billion pounds of phosphorus will be available as fertilizer.<sup>3</sup> At a application rate of 150 pounds of nitrogen per acre, enough material is available to fertilize 54 million acres of corn. Substantial amounts of energy are needed to produce nitrogen and phosphorus fertilizers. Thus, additional savings in energy, the equivalent of 29 million barrels of oil per year will be realized by replacing commercial petroleum or natural gas derived nitrogen fertilizers with recycled digested residue.<sup>4</sup> In total, the importation of 155 million barrels of oil per year could be offset by a nationwide program of on-farm energy production.

#### ENVIRONMENTAL QUALITY BENEFITS

The anaerobic digestion of agricultural wastes produces environmental quality benefits. The digested materials are stabilized and are essentially odor free. Thus, "nuisance" and air pollution problems associated with the interface between agricultural and urban areas are controlled. Improperly managed animal manure has been cited as a point and nonpoint source of pollution that has degraded our nation's waterways. Leachate from confined animals can be viewed as either a point source or nonpoint source of water pollution. Manure, improperly applied to farmlands, can run off into waterways and constitute a nonpoint source of water pollution. Proper storage of the residual until it can be applied will help to mitigate nonpoint sources of pollution from agricultural runoff.

On-farm anaerobic digestion systems will mitigate the magnitude of the investment needed to control agricultural point and nonpoint pollution sources. As much as \$9.08 billion in estimated pollution abatement costs could be offset by a comprehensive anaerobic digestion program of agricultural wastes.

#### A TABULATION OF BENEFITS

The potential benefits which can be produced by an anaerobic digestion program are tabulated in Table 2. These figures show the potential role anaerobic digestion of agricultural wastes can play in meeting the goals set forth in the Energy Security Act—60,000 barrels per day of alcohol by December 31, 1982 (21,900,000 barrels per year).

The 155 million barrels per year of crude oil equivalent that would be replaced is more than seven times the quantity called for in the first target goal.

At the current rate of crude and crude product imports, 5.9 million barrels per day, on-farm energy production has the potential to offset a continuous basis 7.2

<sup>3</sup> Raymond C. Loehr, "Agricultural Waste Management" (New York: Academic Press, 1974), pp. 517-542.

<sup>4</sup> William J. Jewell, "Energy, Agriculture and Waste Management" (Ann Arbor, Michigan: Ann Arbor Science Publishers, Inc., 1975), p. 323.

percent of our petroleum imports. In terms of dollars, there is an impact of \$6.2 billion annually (\$40 per barrel used in the calculation) on the balance of trade. An additional \$9.08 billion in pollution control facilities is offset. The annual costs of such facilities is estimated at \$1.03 billion (20-year amortization at 9½ percent interest).

TABLE 2.—BENEFITS FROM AN ANAEROBIC DIGESTION PROGRAM

Benefit	Energy equivalent in Btu's year	Equivalent barrels crude oil (millions)	Annual value of benefits (billions)	Annual costs offset (billions)
Electricity.....	0.13×10	61	<sup>1</sup> \$2.29	\$2.44
Alcohol produced by waste heat from engine-generator....	.46×10	65	<sup>2</sup> 8.82	2.60
Bedding/soil amendment/refeed value of solid effluent....	NA	NA	NA	NA
Fertilizer value of liquid effluent.....	.20×10	29	<sup>3</sup> 1.96	1.16
Pollution control.....	NA	NA	NA	<sup>4</sup> 1.03
Reduction in weight to be taken to the field.....	NA	NA	NA	NA
Total.....	.79×10	155	13.07	7.23

<sup>1</sup> Based upon electricity prices of \$0.06 per kilowatt-hour.

<sup>2</sup> Based upon anhydrous ethanol prices of \$1.80 per gallon.

<sup>3</sup> Based upon ammonia-nitrogen fertilizer prices of \$0.24 per pound.

<sup>4</sup> These figures reflect capital costs amortized over 20 yr and 9.5 percent interest; O. & M. costs are not included.

Another way to evaluate the effects is to tabulate the value of the resources generated by the use of the biogas and the resulting products. The 38.1 billion kilowatt-hours represents 1.8 percent of the 2,170,000 million kilowatt-hours consumed in the nation in 1979. At \$0.06 per kilowatt-hour, the annual value of this electricity is \$2.29 billion. Moreover, compared with nuclear power, the often-mentioned electric power source of the future, the 38,143 million kilowatt-hours of direct electric power from biogas represents 13.8 percent, or a full one-seventh, of the 276,031 million kilowatt-hours of electricity generated by all the nuclear power facilities in the nation in 1979.

The 4.9 billion gallons of alcohol produced annually has a market value of \$8.82 billion. This is more than five times the 1982 production called for in the Energy Security Act. The annual fertilizer value of the liquid by-product of digestion is \$1.96 billion. In total, \$13.07 billion in annual benefits are produced and will be realized and \$7.23 billion of cost for imported crude and pollution control facilities will be offset.

The importance of anaerobic digestion of agricultural wastes becomes even more significant when the following concepts of agricultural wastes concerning feedstocks and processes are taken into consideration:

1. All of these wastes will be produced whether we want them or not.
2. Some of these wastes are not expensive pollutants.
3. The linking of anaerobic digesters with stills in on-farm operations converts wastes into wealth.
4. On-farm energy production systems have the potential to produce energy from the corn needed to feed their animals, thereby avoiding the creation of competition for corn as non-farm stills would do. If such competition would exist, it would increase the prices to both farmers and consumers alike.

#### STATEMENT OF PATRICIA A. LEFORD, SHEAFFER & ROLAND, INC.

I am pleased to have this opportunity to appear before the Subcommittee on Agricultural Credit and Rural Electrification.

There is a specific example I would like to put forward here as a comparison of the situation for farmers now trying to become energy independent and an earlier situation when energy was a crucial issue.

The 1930's were a time when electricity was perceived as sophisticated and enduringly plentiful. Urban areas had advanced overall from the gaslight to the Edison Lightbulb. The effects of this contemporary form of energy were causing far-reaching advances on American industry. The urbanite was establishing a comfort zone never before achieved in the history of mankind.

The thought occurred to some of those in positions of responsibility that the time had come to advance electrification out into the rural areas. This thought, however, was not unanimously accepted. The private power companies foresaw both financial and practical problems with the provision of electrical power to the agricultural areas of America.

They said:

1. The money needed to extend the power lines would not be repaid by the revenue received because the farmers would not use enough electricity.
2. Farmers were indifferent to electricity.
3. Farmers wouldn't know what to do with electricity.
4. In order to finance the provision of electricity to rural areas, the rates for urban users would need to be increased. Thus, the provision of electricity to rural areas would be a punishment to urban dwellers.

David Lillianthal was at that time on the Board of Directors of the Tennessee Valley Authority (TVA) and later became the Director of the Atomic Energy Commission in 1946. He argued that:

1. Farmers were no different from urban dwellers in their intellectual levels.
2. Farmers had a greater need for electricity than the average urbanite.
3. If given the opportunity to have electricity, revenues received from rural usage would finance the extensions.
4. The greater the use of electricity the lower the cost, thus the extension into rural areas would actually lower the cost to urban users.

Rural electrification was first tried in Alcorn County, Mississippi in 1934. TVA established an electric co-op and loaned the co-op the money to extend the lines. TVA then established the Electric Home Farm Authority (EHFA) as a separate agency from the TVA. The purpose was to develop agreements with major appliance manufacturers such as G.E. and Westinghouse, whereby the design of appliances would be redirected toward consumers and the quality increased. The EHFA guaranteed purchase in quantities large enough to allow the participating manufacturers to lower the cost to the consumer. As more electric co-ops and distributors were organized by the TVA, agreements were enhanced to allow the co-ops to show and distribute the appliances. They handled the sales and collected payments in small amounts through monthly bills at 5% interest. Consumers were given 12 to 15 years to pay the balance on an appliance such as a refrigerator or stove.

It worked.

The Rural Electric Administration (REA) was then organized and worked in cooperation with the TVA. REA took over the construction of power lines and the organization of co-ops.

The Georgia Power Company began doing the same thing and found it highly profitable. Georgia Power was followed by Alabama, Mississippi, Duke, North Carolina and so on. . . .

Success was guaranteed for one very important reason. This enthusiastic project was undertaken with the perspective of government cooperation with citizens to provide power to rural America.

We did this in the 1930's because we perceived great social benefit to be derived from providing power to our agricultural producers. Now, 40 years later, we have perceived that great social and economical benefit can be derived from the development of a biomass fuels program. There are several options available to Government in pursuit of an alternative fuel capability. Because of the great importance placed on these programs by Government, you would think our DOE and Department of Agriculture would be actively pursuing any reasonable options in the development of this technology. We unfortunately have found this is not the case.

Mr. Waybright's facility is a commercially viable system. He's providing almost all of his electricity off of half of his dairy herd.

We have another client called the Baum Dairy. The Baum Dairy made application to the Farmers Home Administration for a loan guarantee. Five months later they were awarded a loan guarantee at 14½ percent interest.

DOE has given away 33 percent of what amounts to many millions of dollars in grant monies to oil industry subsidiaries, and 13 percent to utilities. Farmers come under miscellaneous—or the final 7 percent. Small farms that came in under the 7-percent category entitled miscellaneous obviously received very little grant money. And as I said, the Baum Dairy was, after 5 months, given a 14½-percent loan guarantee. That seems to be the most government assistance small farms are able to look for in this area now.

The Mason-Dixon Dairy has been used as a model by Government agencies such as DOE and Farmers Home. Mason-Dixon has had something like 7,000 visitors in 9 months looking at the digester. The Department of Energy and the Farmers Home Administration have contributed a large percentage of that figure and have a model of what could be done in alternative energy. Yet DOE is now saying that they don't think they're going to be able to afford Mr. Waybright any loan or grant monies for the final phase of his on-farm energy system.



