VIRGINIA TOBACCO INDEMNIFICATION AND COMMUNITY REVITALIZATION COMMISSION

701 East Franklin Street, Suite 501
Richmond, Virginia 23219

Bio-Energy Oversight Committee Meeting

Thursday, October 5, 2006
2:00 p.m.

Riverstone Technology Building
South Boston, Virginia

APPEARANCES:

Mr. Buddy Mayhew, Committee Vice Chairman, Virginia Tobacco Commission
Mr. Thomas W. Arthur, Virginia Tobacco Commission
Mr. Ralph Byers, Virginia Tech
Mr. Chris Cook, Virginia Farm Bureau
Mr. Jerry Jenkins, Virginia Tobacco Commission, Virginia Farm Bureau
Mr. Ken Moss, Windy Acres Nursery
Ms. Martha Walker, Virginia Cooperative Extension
Dr. Ray Smoot, Virginia Tech Foundation
Dr. Jerzy Nowak (ex-officio) Virginia Tech
Dr. Foster Agblevor, Virginia Tech

The Honorable Frank M. Ruff, Virginia Tobacco Commission
Mr. Works

COMMISSION STAFF:
Mr. Neal Noyes, Executive Director
Mr. Ned Stephenson, Director of Strategic Investments
Mr. Timothy Pfohl, Grants Program Administration Manager
Ms. Britt Nelson, Southside Grants Program Administrator

MR. MAYHEW: Good afternoon, everyone. I'll call the meeting to order, and we can get started. C. D. Bryant couldn't be here, and he asked me to take over.

At this time I'll ask Mr. Neal Noyes, our Executive Director, to call the roll.

MR. NOYES: Mr. Arthur?

MR. ARTHUR: Here.

MR. NOYES: Mr. Bryant?

MR. BRYANT: (No response.)

MR. NOYES: Mr. Byers?

MR. NOYES: Mr. Cook?

MR. COOK: Here.

MR. NOYES: Mr. Courtier?
MR. COURTIER: Here.
MR. NOYES: Mr. Jenkins?
MR. JENKINS: Here.
MR. NOYES: Mr. Mayhew?
MR. MAYHEW: Here.
MR. NOYES: Mr. Moss?
MR. MOSS: Here.
MR. NOYES: Dr. Nowak?
DR. NOWAK: Here.
MR. NOYES: Senator Ruff?
SENATOR RUFF: Here.
MR. NOYES: Mr. Smoot?
MR. SMOOT: Here.
MR. NOYES: Ms. Walker?
MS. WALKER: Here.
MR. NOYES: Mr. Works?
MR. WORKS: Here.
MR. NOYES: We have a quorum, Mr. Chairman.
MR. MAYHEW: At this time do I have a motion that we approve the Minutes of the last meeting?
MR. ARTHUR: So moved.
MR. MAYHEW: Is there a second? All right, it's been moved and seconded. All in favor say aye? (Ayes.) Opposed? (No response.) The Minutes are approved.

First on the Agenda, as written out here, is for us to give you a little bit of a history on the report of our field visit to Alabama. I feel like rather than going into a lot of detail, a lot of it will be covered today by the specialists that we have here, but I would like to say that we had a very productive visit.

Tim Pfohl, myself and Ken Moss and a gentleman from the Department of Environmental Quality, Mr. Brown, all went. The four of us flew out of Danville and stopped off in Athens, Georgia to pick up Dr. Das. Then we went down to Mussel Shoals, Alabama, where we met Mr. Phil Badger and his son. We took a trip a short distance to view the prototype of this pyrolysis equipment. We saw a picture of it at the last meeting. It's been several years since this unit has been functioning. We went through it in detail and spent quite a bit of time looking at the components of it and trying to understand a little bit better, at least in my case, how the whole process worked. I think the idea behind the science of this, and it's not complicated, but the mechanics of it are a bit complicated. This was a work in progress.

Then after lunch we went back to his office, and he presented a slide program and went through some aspects of this that have already been improved upon as far as design by making it simpler and more efficient. He answered all the questions we could think of to put to him. Dr. Das took an extensive number of notes and asked some very good questions, as you see in front of you. You all probably have a copy of his report. He'll go through, and hopefully, we'll all have a chance to review it.

I'll stop with that, and we can move on from that point. I would like to say that I think the trip down there was worthwhile, kind of put some new flesh on the bones in my mind. It impressed upon me that this is still a work in progress, and it's certainly not a refined system by any means, but it's getting there. I think other people in other states are working on the same thing. This is the kind of endeavor that I believe has a lot of merit for the original idea we have in mind. Hopefully, at today's meeting here it will give us all a chance to look at the particulars of it and the details of it and ask any questions we have. Hopefully, we can come to a consensus that this is still a very worthwhile project, remembering all the while it has been funded and has been approved by the Commission and we really don't need to go back to the Commission another time about it, if everybody's comfortable with it here today. I talked to Chairman Hawkins last night, and he is in agreement that we can go ahead and get this thing rolling. Time is slipping by, and it will soon be the end of the year, and we started this thing back in June. I think every week that goes by we get behind a little bit, and things could be going ahead to get everything put in place.

With that said, I'm going to ask Ned Stephenson to introduce our speaker here today.

MR. STEPHENSON: Thank you, Mr. Chairman. Members of the Committee, I'd like to introduce to you Dr. K. C. Das, and before he begins his remarks I'd like to briefly tell you how we got here and the purpose in being here today. As you know, the Commission approved this for some million two hundred thousand, and the Oversight group was impaneled with this grant. One piece of this grant, a $900,000 piece of it, is for the demonstration of a pyrolysis unit. Before the Committee pulls the trigger on the expenditure of that money, the Committee wanted to do some due diligence and asked the Staff to find an appropriate party to do that. We called upon some of our resources within the Commission and at Virginia Tech and some others. Through a series of relationships, Dr. K. C. Das was identified to us as a person who could help us with some due diligence information. I want to say to you that Dr. Das is a hired gun, he does not have an interest in this project politically, financially, or in any other way. He's here to tell you what he knows and give a professional opinion about this type of device and some of the pros and cons that you may need to be aware of. When he is finished today, he has finished his task we have asked him to do, unless you engage him further.

Dr. Das is a professor at the University of Georgia in Athens. He brings with him an engineering assistant, Brian Bibens, and we look forward to your work, Dr. Das. I thank you for being here. I give you Dr. K. C. Das.

DR. DAS: Thank you very much, Ned. I appreciate that introduction. I'd like to acknowledge my colleague one more time, because a lot of the work that is in the report was prepared by him, under my supervision. He did a lot of work, and I appreciate that. He is as qualified to answer these questions as I am.

What we intended to do during this time was to evaluate the technology, and I was familiar with the technology before this assignment. I was not to the degree to which I am right now, because we had to go through the process of signing the non-disclosure, and we were given the detailed report of their performance. We actually went outside and looked at it.

Previously I had only seen performance reports as presented by Mr. Badger at conferences. This was a lot of learning to me and helped me understand exactly where the technology is.

The report contains a lot of detail, and we're prepared to answer any questions and things that come up today or in the future. What I'd like to do during the next ten minutes or so is present the highlights of what we think is critical for consideration of this group.

Let me first start off by saying, let me show you a picture, and you might have already seen this. This is one view of the system that we are looking at. It's basically mounted on a skid. This goes through the hopper on the left and goes through the reactor, the dryers on the top and the reactor on the other side, and you can probably see through here, they're not very clear pictures, but the reactor system is on this side, and that's the hopper that provides the feeding. From a perspective of what is going on inside, the flow diagram is a lot more useful. So let me start at this end where the biomass is fed into a dryer initially. The analyses we conducted were based on a trial which is a 40-hour trial, and then you have the preliminary biomass. You can do the same thing with wood. Almost anything we start with, you have to have some kind of drying. There's a dryer in there, and once the biomass is dried it goes into a reactor. It doesn't have a very specific schematic of that, but basically the reactor is a rectangular box. It's about maybe three or four feet tall, and the biomass is entering the rectangular box from one side. From the other side the heat carrier, this is a material that is heated at a very high temperature and causes the biomass to increase in temperature. When these two materials are mixed together, the temperature of the biomass increases to our target, which is about 450 degrees Celsius, and the box is here. At that point the biomass breaks down into char and vapor. Vapors are coming out and going down in this direction. The vapor contains two things. One is the gas which is non-condensable, and the other is the bio-oil, and that's the product that we're interested in out of this system. It goes through a condenser system here. The oil is collected, and the gases are either reused or vented. On the top, the way you have char and the heat carrier that's going through to a screened separation device that separates the char used for the heat carrier return to this group here.

Overall, our summary conclusion is that what we saw at the visit, and also throughout the report that we read that was presented to us by ROI, was from an engineering perspective, very realistic claims, and this is based on our own experience in the laboratory and study of the literature, both in the research side and the commercial literature. Just to give you an example, the claim of the percentage of bio-oil that is available in a process like this, you see numbers like 60 percent on the table there. This is a claim that's not unrealistic. In fact, you can get up to 75 percent if the rate of heating is high enough. However, they actually have obtained in this system, and in some cases it's true, and in some cases it is not true. The work in progress is a good way to put it. Every time I asked a question to Mr. Badger or the ROI representative, if they didn't know the answer, they said, I don't know the answer, which to me is a very good place to be, as far as the way they presented the technology.

Now, one thing I want to point out as our primary consideration. Work in progress, there were multiple upgrades that were presented to us when we made that visit, and these are all upgrades that are necessary. From an engineering perspective they are reasonable and achievable upgrades, and I'll go through some of them in the nest few slides. Obviously, any time you make an upgrade or a change, how effectively that upgrade is implemented is going to impact whether it's going to work or not work. That's a goal that I'm not in a position to make yet, feedback or an assessment, and I'll leave it at that.

A couple of other conclusions: One of the major concerns is that we only had one set of data to work with, and that was the 40-hour run I referred to. For a company in this stage of development, that's not at all unusual. The data we did see seemed very reasonable and consistent. The other concern or conclusion I came up with, that when we make mechanical changes to any system there's always an intended effect and unintended effect. There's the unintended effect of not achieving the goal we set out to achieve. It's a hard thing to figure out how to handle that. One suggestion is that if someone in this group were to work closely with ROI, both on the design and the fabrication side, this will provide some kind of check on the system of upgrades, and there may be other ways to do that, also.

This slide and the next slide, there are six areas that I thought were important. These are the first three, and there is also a list of nine things in your abstract and summary. The two that I'm not going to talk about, because I think it's fairly straightforward, talk about six of them. These are, first of all, the char handling and the separation. I recently found out that is not an issue, because that has been modified. All I'm referring to here is when we studied that.

MR. MOSS: The design, but you haven't built that. Upgrading the design is not proven yet, and no reason to think it will not work.

DR. DAS: You're right. Let me comment on that, for those that are not familiar with that, and I'll show you what I'm referring to. Once in the reactor, the heat carrier and the biomass, and the biomass is breaking down, and you have char that remains with the heat carrier. You have to take into account when you separate these two and recirculate the heat carrier. The way it was set up when we visited is a process of taking it through what's called bucket elevator, and you'll see in the report that is mentioned. When we get to the end of the bucket elevator past where there is a way to separate it using the screen. Both of these were not effective, we are pointing that out, but it's not something that's continuing to be an issue or problem.

The second big potential challenge is the condensation system. Generally, the pressure of the gases coming out of the reactor about 450 Celsius, you cool it down to remove the oil, and the way that's done is using a condenser. The condensers we saw were air-cooled condensers, they were not rapid cool condensers. The lowest temperature went to about 27 degrees Celsius for a two-stage system. There could be significant improvement. In fact, I was kind of surprised that didn't shoot for lower temperatures.

MR. MOSS: Addressing the condenser, I talked to him; he's using the organic fluid. So the fluid heats that, rather than an aerator.

DR. DAS: The goal is to get it from the 450 in the reactor to something like room temperature or even below, one step. If that is achieved, then you're able to get very high oil ooze.

MR. MOSS: That's in the new design that controls the temperature.

DR. DAS: The correct system has the power, and the power is essentially oil, hydrocarbon-like oil that has too much particulates, and those may be organic and not very useful. They're not included in the analysis of oil use, and that's why the report says that the oil heat is 19 percent or so. This is the second one.

The third area, and I can expound on each of these a little more, the third area was the redesign of the reactor itself, where the vapors coming out would actually be removed before the biomass. Right now it's set up in the opposite direction. Maybe in the next slide it will make more sense.

The three other areas are, in any of these systems, in the large commercial systems, the charcoal and the gases used in this process are used as energy for running the system. This system is also conceptually designed like that, but it was not operated like that in the previous, this is an area which I don't think is very hard to do, but it has to be done in order to increase the efficiency. The reactor temperature of 500 is actually the threshold temperature. It was mentioned of using improved seals, and that's another area.

I've got three slides, and the next three, starting with this one, and each one is on the first three issues. This one talks about the heat carrier. Separation of this, the current system has a bucket carrier, and that's not going to be the case anymore. The primary goal of any modification is to reduce the char carryover, and this is the goal. If that is achieved with a new system, we're in much better shape. I'm pointing out what happens if it is not achieved. If you have char that exists with the heat carrier, when you go back to reheating the heat carrier the char will continue to pyrolyze, and you will end up with a lot of char in all of the system, and this can create problems.

MR. MAYHEW: When I was there I didn't know what the heat carrier was, maybe I missed it if somebody explained it. It's got these little pellets, and they're inaccessible, and you heat these over and over. The pellets are, it's all mixed with the wood material that you're pyrolyzing, and then after it's done it's job, recycles back, and it's reheated and reintroduced. So the heat carrier is a conglomerate of pellets, is what it amounts to.

DR. DAS: Most of the time these things are removed in a cycle. Most particles of this density, if that's done, that would be the safest. Now you're going to go after the magnetic separation.

Now, this slide, reducing the handling of the material. Once the bucket elevator has come out of the picture, and just so you know, the bucket elevator is something that is basically eight to ten feet long, and it's moving very hot char and the heat carrier through the column that is eight or ten feet long. There is a lot of heat loss there, and the vapors are coming out. All the things are avoided if you have minimum of handling of hot materials.

The next generation is based on magnetic separation. That is expected to work much better and not have any of these problems. If we achieve that, then this design is not an issue, but that's something to watch for. The condensation, you recap the condensers which are essentially the vapors going through the tubes, and there's air on the outside that cools the hot vapors starting at about 450 degrees Celsius coming out of the reactor. It goes to 166 68 27. It's all right to do this in three steps. What I'm not certain about is that what happens between 450 and 166? In that first step, all we know is that there is the tar trap in the middle, and it's removing a lot of the condensation between the first step, the reactor and the condenser. We believe that there's probably a lot of condensation, because 166 is a fairly low temperature for vapors. That needs to be also modified. If you have a tar trap, it's very likely to collect tar particles, and once that is done, then essentially that material is not very useful. We didn't actually have a chance, I don't know if you had a chance to see the oil sample. We were shown some in a box, and I'm not sure if it was related to the actual tests. Generally the bio-oil sample has very low particulate matter. I had the specifications that said how much a particulate matter can have. The greater it has, the more unstable it is. So that affects storage property and that sort of thing. Getting a good bio-oil is also very critical. That's my second point.

The third one is about relocating vapor exhaust. Going back to the visualization of the reactor, the rectangular and the mass comes from one side, and the heat carrier from one other side, and the vapor that is generated keeps going up. That's the system as it currently stands. Mr. Badger was going to modify it so that the vapor goes down, which is a better way to do it, because you don't have contact between the vapor and the fresh biomass.

That's the modification that needs to be done and appears to be a very straightforward and important improvement and very useful, but with all kind of reactor changes, you have to see it to know if it works and does it cause any other unexpected changes in performance. With that said, we'll go to the other upgrades.

The system using the char and gas widely done and not a very hard thing to do once you have a consistent amount of flame and there's sufficient energy in the gases to continue to heat it. We can also improve the emissions, because it's a combustible hydrocarbon all the way, and this is a good thing, as far as the Environmental Protection Agency air quality permit. It also provides better efficiency energy-wise. Increasing reactor temperature is not a very difficult thing and reheats the heat carrier; between that and controlling the contact time you can pretty much achieve any temperature.

MR. MOSS: Does that also increase the volume of the heat carrier for the biomass?

DR. DAS: Yes.

MR. MOSS: You get a better or more rapid increase?

DR. DAS: Those are fairly straightforward process controlling improvements.

The report that we looked at that I mentioned several times, where the seals were breaking, and when that happens, that's a result of the pressure that pushes the vapor outside, and that creates the operating problem very straightforward. You have to have improvement and get better seals, and that costs more money and has a longer life and works better.

Just to kind of summarize, this stage talks about the upgrade that we feel more comfortable with and pretty straightforward. The previous three upgrades, the first one is pretty much resolved, and the other two we strongly recommend that you have some kind of a little more interactive upgrading process. From what we've seen on the ground of what Mr. Badger has been able to achieve, it's reflected here.

UNIDENTIFIED: On the yield of 19.7, that was using chicken manure only, and Mississippi State, I don't know if they've provided you the information and their yield of 50 percent, I don't know if they probably told you that they were using wood only, and the issue of the litter and all the particulate --

DR. DAS: -- Yes. The 50 percent claim is not at all atypical. We're routinely getting 40 to 50 percent. The process we're using in our laboratory is much slower. The faster the heating rate the higher and the more oil, of course we've learned that from other technologies up to 75 percent.

DR. AGBLEVOR: A lot of that depends upon the, the lower end on the temperature, and it depends on the velocity of the vapors leaving the system. If you have aerosol, it doesn't matter how low the temperature can go, you need the cycle, the condenser system. You can have the condensers up front, but you need, and it has to come down the line, and you'll achieve 60 and 70 percent. I think you said it's easy to achieve that, but it's not so easy with wood. The wood biomass, if you want to achieve 70 percent oil yield, most of the time you can get 50, 55, that can be easily achieved, but to get 60 to 70 or 75 requires refinement of the condensation system.

DR. DAS: Someone reported there was no data to support that, and I asked that specific question, and he said that basically the conversion factors were based on some previous work, but it's not out of the realm of possibility.

UNIDENTIFIED: The same with char, 30 percent.

DR. AGBLEVOR: Once it gets into the char, most of the time the char acts as the catalyst, and one of the reasons why biomass oil is very unstable is because of the char heat cells in the catalyst, and until you recognize that's 70 and there's a lot of chemistry there and a lot of things you're doing, acting as a catalyst, and because of the pyrolysis, there is no oxygen in there, and when it is formed and the size of it, and those having to come in contact with, and when it hits a certain point it will gasify and will not release the vapor, and it'll gasify, and when it does it forms a, that is why the oil that's produced --

DR. DAS: -- Yes, that is why char will be present in the gas, and it will convert to attract the hydrocarbon, and further the gases and the oil you need goes down. And then as the char leaves, the oil storage becomes an issue. To me, achieving the highest oil yield is not so much a critical issue, because you do need a good bit of the char to run the process. If you get to 50 percent consistently with a reasonably good quality oil, it's better than being at the edge, getting 60 percent. Any time your system could go out of balance, and that's my perspective on that technology. You're absolutely right, those are critical operating issues.

UNIDENTIFIED: What is your overall opinion of the feasibility? I'm asking about the bottom line. We know there is some risk involved.

DR. DAS: Yes, there is some risk involved. If you can manage the risk, that’s one thing --

UNIDENTIFIED: -- I think it's important for the Committee to understand that if you're going to pay for that technology you've got to get them, whoever you had contact with, they're very reluctant, as you pointed out in your conversations with him. They hold it closer to themselves, and they're not willing to, they're looking for the best opportunity to commercialize.

DR. DAS: I think the question with this system, and it depends on how well the application and engineering design is done and implemented. If that's done well, it's not unreasonable to make it work.

DR. AGBLEVOR: I think "challenge" might be the right word. This has only had a 40-hour run when, so you consider engineering technology the process, you don't jump from 40 hours to lasting, at least from what I know. You have to go through a certain process. Then you go to the next step and then the next step, because you want to minimize your risks. Forty hours, in an engineering sense, is minuscule. The only way you can have a chance to verify parameters you're using and because like in any chemical engineering system, this is a chemical engineering system, you need a steady pace. Forty hours is low. You might run a 40-hour test and shut down the system. Actually, the risk is very high, and everybody should be aware of that. It's not a slam dunk. If everybody is comfortable with the risk level, then you won't get any surprises, because there are a lot of these parameters that have not been tested.

DR. DAS: Let me ask you this, and I'm not being critical, but the fact that the system is a five-ton-per-day design, the design system, but was only operated under three tons per day. When driving up, we were talking about this, and we've thought about this question for almost two weeks now, and what we've come away with is that obviously that's not how the process is going to run daily. If I was backing this thing, I'd like to see at least 100 hours, even longer, probably an intermediate scale. He doesn't have it, because primarily the fact that he doesn't have the funds to do it, because it's not a very inexpensive test. Your point is that that should be recognized by the Committee, there are certainly risks. From my engineering perspective, risk is something that is more on the management side than on the operating side or the technical side. The solutions exist out there. If you're doing this, solutions exist, but to implement those solutions you need a good engineer and good fabrication.

MR. MAYHEW: I think we've got that, right?

DR. DAS: I think you do.

MR. DAVENPORT: I'm curious to know, Dr. Das, and you may have already covered this but, and I might have missed it, the design, the baghouse, and the particulates that are coming out, are you satisfied that under normal conditions would meet the air quality controls that are required?

DR. DAS: Let me answer you this way. When I visited the site and looked at the system they didn't have the baghouse, but they had a cyclone, and they did not have any emission data; at least I wasn't given any. I don't know the specific performance of this system, but I looked at the literature on several other systems of particulate matter and the various standards. Most of them are within the ranges of what is regulated in the United States, and I'm not specifically sure about in Virginia of the guidelines. Massachusetts is on one of the reviews we looked at. Many of the European numbers are within the range. The numbers are within the range that's reasonable.

MR. DAVENPORT: When you take it to a larger size, it would be a shame for us to have it and not be able to operate it because you can't meet the air quality control standards. I'm not saying you couldn't do it by adding a baghouse.

Have you done modeling to figure out what you feel like the cost per gallon would be of the product that's coming out of this? I guess you have to assume you're going to have to stabilize it.

DR. DAS: Not necessarily, depending on how long you're going to store it before you use it. To answer the first question, I have not done for this specific process an economic analysis, because I don't know a lot of the operating costs and capital costs. But it can be done, and I would assume the numbers, but whether it requires stabilization or not depends on the application. From what I understand, you're looking at a combustion application?

DR. AGBLEVOR: Depending upon the use, and depending upon how much is in the oil. The oil can react within the line, and it's possible in some cases, depending on where you have identified, you have to identify that, and then based upon that you can identify and stabilize or do some of --

DR. DAS: -- You're speaking of the filterization process?

DR. AGBLEVOR: Yes.

MR. DAVENPORT: The longevity of it whereas the heat chamber, do you feel comfortable that the way it's designed and the structure of it is such that it would have longevity commensurate with what we want, and would it be fairly simple, the way it's designed, to rebuild it?

DR. DAS: I would think it would be very simple to rebuild, basically a rectangular box with no moving parts inside. You have the reactor and a lot of other stuff around it. I don't see any reason why it should not last. I think if anything were to start falling or breaking it would be things like the auger and motors and those kinds of things, but the reactor itself is actually fairly simple to construct, I would think.

DR. AGBLEVOR: I wanted to make a comment about the cyclone. Unless you have high efficiency, you're speaking of 99 percent. One percent of your particulate, that becomes very significant. With a system like this it's prudent to install a baghouse, and that way you reduce your emission level.

DR. DAS: From what I remember, there was no baghouse here. You're right, there are issues, and I guess by the time you get down to the temperature and get it low enough reactivity is not an issue. Like you pointed out, once you have char deposits you look for further reaction, char formations and those kinds of things. Operationally it can be a headache when you have to deal with a bag and filter, but it's being done, and you can get a higher temperature as a result.

DR. AGBLEVOR: Were the tar traps mentioned?

DR. DAS: It was not mentioned. I would think it would be very high, and the oil was less than 20 percent. What was left, I think, was another 30 percent, let's say, assuming 50 percent, the other 30 percent I would say, as much as 20 percent of that was in the tar. I think, from the little bit we have worked with condensation systems, I think you could get a pretty good condensation in one step if you did it rapidly enough. The tar is essentially a product of the reaction in the pipes. It's created after the pyrolysis process.

MR. MAYHEW: Are there any other questions from anyone?

MR. JENKINS: We've been taken with this project, and do you recommend tackling these various problems?

DR. DAS: I'd put it out more as a perspective of what is the highest risk to the lowest risk. You think you almost have to do more than one at a time. Let me go back to that list. Turn that slide to that one. The first one is essentially not such a big discussion point, but if you had to choose to only do one relocating the vapor would be a simple thing to do, as something that's preferable to do before you start anything else.

The ones on the next list are essentially, of these three the one that is easiest and most useful is the seal. The other two are improvements in the system. Just because you didn't do it doesn't mean that the systems are not going to work. You can still use propane for a few more months, and then start handling the char and gases. Once you do that, overall cost and efficiency goes up.

MR. MAYHEW: How much of the change in the various components of this system if you upscale to something commercial level? Do you think it would be more small units working together? We talked one time about having one big unit which you limit the size to make modulars and just add modulars. If you had a problem in one, the rest of them would keep running, rather than trying to put all the eggs in one basket and make a big unit. If you upscale and make modulars, do you foresee any problems in just increasing the size of everything and up-scaling it, the modular form?

DR. DAS: Yes, I would not foresee up to a modular form, and that point probably be at least twice as big as this. The five tons per day can maybe go up to eight or ten tons per day without significantly changing the arrangement. That may be the modular size, because I thought this was a fairly small system. In fact, if you go up in size you can get some efficiency that you do not have at this stage. But you use the ability to transport it. I don't foresee this as something that you could move around every week kind of thing. It is moveable, but not frequently moved.

DR. AGBLEVOR: Looking at the reactor itself, how easy is it to scale up the reactor? Is that much more difficult? What is your opinion of that?

DR. DAS: I'm thinking of the reactor only as a reaction chamber. It's like a box, that itself I would not actually scale it up.

The issue itself is really the input material. You're scaling up the input, but the reaction is gone pretty much, maybe a little taller. Once the char and the heat carrier goes down, from there you could pretty much double that. Right now, I think the way I recall, it was a three-inch auger that was moving these materials, and it's very conceivable to add more to them. You could at least double, and maybe even go slightly larger. Technically, there should be no reaction, you don't want to lose the heat, but there should be no reaction, because all the materials are essentially taken out, but in reality that's not the case, because there's always going to be some kind of continuous pyrolysis. That was evidenced, because when we were walking around, we saw oil about everywhere you could think of. That's being minimized.

DR. AGBLEVOR: That's the scale out then, because normally when you have the part and that you're mixing that's different from not only the heat, the biomass then you scale up and then across, and you don't have any physical odor, from the way you describe it, it's just the box. What are you going to see, you're going to have mixing problems.

DR. DAS: The actual heat transfer problem.

DR. AGBLEVOR: The scale size would increase, and consequently all the biomass yield, and there's limitation because of the heat and the mass.

DR. DAS: The way I understand it is that the reaction, or you're mixing two materials, and the reaction is occurring, at least in theory, it's occurring homogeneously across the entire reactor. There should be no variation between the top of the reactor and the bottom or left side or right side. If you increase the diameter of the vessel, and as long as you continue to put them simultaneously, you should get the same reaction. It's a good question.

DR. AGBLEVOR: In a small percentage it's easy to control. You can see that in the reactor at times.

DR. DAS: I'd like to know what you think, five tons is a very small reactor. Assuming 50 percent moisture, that would be about one dump truck a day of biomass, very little. In Georgia, the reactor was actually even bigger, and it's not portable, it's conceivable at least three times or maybe two times, at least, ten tons per day. I feel comfortable with that.

SENATOR RUFF: Ten tons a day you don't think would run into an environmental problem?

DR. DAS: I'd have to look this up. It would depend on the material. It could but I don't know the answer.

SENATOR RUFF: Did you say that the --

DR. DAS: -- Somewhere in the ten thousand per day range.

SENATOR RUFF: Does the State of Georgia regulate that?

DR. DAS: No.

DR. NOWAK: How is the efficiency of this particular reactor? How does this compare to others?

DR. DAS: When you say efficiency, you're referring to the oil?

DR. NOWAK: Yes.

DR. DAS: It's comparable, and the rates are slightly higher, higher than 60 percent. But from another efficiency point of view, I think the amount of energy you put in using a system like this would be less than what you would use if you have to heat a lot of fluid gas, and that's not present here.

DR. AGBLEVOR: You're recycling the gases?

DR. DAS: I would say if you integrate as much heat as possible, the pyrolysis in a fluidized system would be higher than in the static system. There is not much carrier gas, so to speak, assuming the heat losses are comparable in efficiency. The fluid bed allows you much more control.

DR. AGBLEVOR: Better control, and there's no limit to your scale up, independent, unless you have a clean cut material you can pyrolyze almost anything, if you don't have any hard material.

DR. DAS: As long as you don't jam up the auger. In a fluidized system you're blowing everything into a gas stream, you won't damage any moving parts, but in a system like this you have to be a little more careful.

DR. AGBLEVOR: There is one system, in your report you mentioned a reactor. One of the things we still have to keep in mind is the reactor. One time they want to demonstrate how you pyrolyze, they didn't run more than five minutes, and it was over. The particle went in and went around, and it impacted it and bored a hole through the reactor.

DR. DAS: That would be difficult to work with, but that's a good point. That's a critical thing to keep in mind in a system with a lot of augers, have to be careful about what you put in there. If it is fluidized you can provide more control, then you need to have significant skills to start with; it's a tradeoff.

MR. MAYHEW: What are we looking at here? If you have enough money you could go ahead and buy a system that works great, no bugs and it's proven, state-of-the-art. We don't have enough money to do that, and we're trying to come along and have something hopefully that would grow into being a usable product and usable device where there might be some patent rights that someone could be taken advantage of. Is that where we stand? Are we trying to do something that someone has already done, except we're doing it on the cheap, is that what we're doing, or is there so much science involved that the whole thing is still evolving and there is no perfect system out there yet, and we're trying to come along and come up with something good, better than what somebody else has? Where do we stand?

DR. DAS: That's a tough question for me. Let me put it this way. This particular system, I think, is unique. It's not the same system, and it has some similarities, it's not the same system. This is much larger and has some different mechanical components. With that said, yes, there are some technologies that you can buy that are more advanced than this and cost more money but less headaches. As Mr. Moss is pointing out, it's a longer commitment, and you don't have any shares. I think there is more opportunity that if you feel as a state or as a Commission that you're going to take this risk and if that technology is supported, you might go to the next level which you might not otherwise. In fact, right now you could partner with a similar company doing hydrogen production and we are supporting them. If we didn't support they would just die, not that it's a bad technology, but it's just that the startup, they're not all lining up to make it move to the next stage.

MR. MAYHEW: You mean an invalid relationship between ROI and the Commission, or whoever would want to do it, I guess it's a question of money.

DR. DAS: Probably there are no surprises to ROI, most of it we got from them, they told us this. What we're pointing out is that when you get to the negotiating table, you have to point out that these are risks that you're taking and somehow kind of share the risks with ROI, write into their contract some language. I'm not a business consultant, but I think that you know better how to do those things.

MR. MOSS: That's an important point, if the Commission goes with this, they're taking a very active role in helping ROI develop this, and therefore the Commission certainly has a right and benefit from taking that risk, and that should be in a comparison form with the others, that it's not just giving him a PO number and telling him to fill it in. This is a development deal, so it's important, they've got a lot invested; they should be in a position to benefit. ROI will benefit, and so will the Commission. It certainly has a right to benefit, because they're taking the risks. This is an opportunity risk associated with developing this, and you have to decide if it's worth the risk or not. The Commission is certainly entitled to benefit. The Commission represents the benefit of the community, that's what we're trying to achieve here, community improvement. Therefore, the community will benefit if this will work.

DR. AGBLEVOR: When we talk about benefits, most of the benefits from technology development will come from your intellectual property, and that is the driving force. When you look at this one, for instance, I don't think we want to say there's pie in the sky. You cannot claim the right to those; you have to buy those patents from him. The benefit you would derive from that is the fact that they will have a product in the community not from these developments unless you can invent something new, not from what is already there, because that's his bread and butter that you're trying to buy from him. Let's not emphasize community benefit too much. The community would benefit after this is refined and creates jobs, it won't be from this technology.

MR. MAYHEW: The real benefit would be is if we get a unit that really works well. A few breakdowns and long term perfected to the point where people want to use it, not so much that we want to own the rights and gain something from intellectual property, but working together we can come up with a better unit than the one he's going to try to build for us now and then make improvements on it, and hopefully in not too long a distance, with the help of Tech also, they can come into this picture and play a major role, help improve it and develop it and get it to where it does what we'd like it to do. If we have some ancillary benefits, that's good too; that's really not the major goal, I don't think.

DR. DAS: The technology where it is, and I think this is communicated where we would like it to be and then, this may take one year and may take longer, and we're not there yet. There'll be some major modifications to try to make sure it works efficiently, and if you reach a point where you have something that's good, that's when, or if he wants to commercialize it, that's not really an unreasonable request.

DR. AGBLEVOR: You can buy the rights.

DR. DAS: You can buy the rights?

DR. AGBLEVOR: You buy the first right of refusal.

DR. DAS: The other part is maybe it's what you can come up with, whatever you're comfortable doing, maybe set up a manufacturer here. That's long-term benefits to the state, like jobs and taxes and that sort of thing. If oil prices soar, and you all know about that, as long as the technology is in a development stage that you do similar things like continuous research, and there's all value in that, I believe, and that value is certainly long-term.

DR. AGBLEVOR: I don't dispute that.

MR. BYERS: We could review the, because changes in the language, Mr. Davenport is chairman, the patent in and of itself is rather unique, unless you're going to do some commercialization of the technology, and certainly it's possible if the Commission goes this way, to get an exclusive license that would be for the tobacco region and have exclusive rights for marketing. If you do that, you still have to make a deal on what percentage goes to the holder of the patent, but whatever arrangement you would have. But all of that is something that could be developed.

MR. MAYHEW: Are there any other questions? All right. I think we've really learned a lot from your presentation and the questions. We very much appreciate your coming today.

I guess next is Dr. Foster Agblevor.

DR. AGBLEVOR: All right, I'm going to demonstrate by using the board, and I hope everyone can see it. I'm giving out a handout, and I hope it will give everybody an idea of what I'm talking about. We've talked about all kinds of technology here, talked about the pyrolysis and the gasification, and there's a lot of work around this. I just wanted to take a few minutes of your time just to go through what all these technologies are about and where you want to be, what you want to do to help the communities.

I'm going to start by using this little box right here. I'm going to write here "biomass," and we have several things that are going to happen here. Right here we have RP. In Virginia we talk about peanuts, and we have corn, we talk about soybeans, et cetera. Out here we have grain. We have corn, barley, and wheat. If you look at this, if you think about any technology, these are all the pieces you have. As I said, if you think about any technology, and here you can look at your interests. We hear a lot about biodiesel, and we've been talking about biodiesel right here. In my mind there's some confusion about which one of the biodiesels. If you take any of these and refine it and you add items, just minimal, when you get here, there's a mixture of biodiesel. You can use any wood, in this over here you can use oil. You can go to any restaurant and collect, or you can get plastics and collect them and bring it home and you put it in your garage and just make sure the kids don't get into it. You can save all these items and bingo, you have it, and that's why it's called biodiesel. You can use oil from the restaurant or peanut oil, you can produce the biodiesel, and when you look at the cost of that, anyone can do it. You can do it in your garage. If you take the corn you can drain that, what we call wetmilling, from the wetmilling you can get corn oil, drymilling there is no corn oil. If you do that, you have your starch. You hydrolize that, and you get the glucose. When you get glucose here, you know what these people are making now. At Virginia Tech I tell the students it's really made from corn. All this is made from the corn. You can also take it right here, and here you're going to get the ethanol. So 80 of these grains, corn, wheat, barley, oats, going to make ethanol from it. If you go to the tropics, they don't worry about corn or wheat or barley. In Virginia we don't have enough corn, as far as I know. People say when you use corn you don't get what you should. That's only true if your yield is very low. So, if you take wheat, barley, or you have enough of those things, then you can do the same thing like everybody else is doing. We have a lot of forests, and we have our fields, and we can grow a lot of things. For me, technically, this is where I put all my eggs. This would be my focus. Unless you can find a way of producing these oils in Virginia at a reasonable cost, I don't think you can compete. Let's look at three things you can do here. You can take these materials, if you treat it and you hydrolyze it, again you have your ethanol. The question is, how far have we come along these lines. We still have a lot of technological problems. Until we solve those problems we cannot produce ethanol at a reasonable cost. When you take lignocellulose, we take advantage of that.

The wood process, by the time we get it, it might be $80 a ton, and you cannot make any money doing that. So we then have this very high temperature with no oxygen, and you have bio-oil. I hope you're following me using this chart. You can take that bio-oil and heat to a higher temperature and gasify it. When you gasify it, you move to another stage. These fuels have different characteristics from the biodiesel, and I don't want to confuse you. When people are talking about this, the biodiesel is this one, another route is gasification. If you make bio-oil you break it down, and here you make it and you get syngas, that makes the hydrogen, and then here you get your fuel. To get the diesel fuel there are two routes. You go this way, or you go that way. If you gasify the coal, you get the fuel. When you look at all these that I'm talking about and combine all this here, we call that a bio-refinery. You can get a lot of products out of this. If you're in the corn industry, follow this one here, and you can call that a bio-refinery. The question is, what is the difference? We call it a refinery because when you go to any petroleum refinery what you have is crude oil to get gas, and when you see that we now take corn oil and you end up with ethanol here, what is the difference? We call it a bio-refinery. We're talking about a bio-refinery of the future here, and it's not the same as that one. This one right here, the bio-oil, I showed you one route here, you gasify it and then get fuel, that's what we're doing. You can forget about this one. This is a complex formula. There are 5,000 different components over here. So if you get a petroleum scientist, you might make smoke out of this, you can make liquid smoke, maybe, out of this. If you achieve that, then you have bio-refinery. This one is based upon the corn oil, and this one is based on this. In a nutshell, that's what we're talking about.

DR. NOWAK: You characterize the technology advancement as far as this technology, the soundness of it, and then potential return and benefit.

DR. AGBLEVOR: The most advanced technology we currently have is the corn refinery, and that technology, the only thing we get out of it that we didn't have before, you could use the sugar cane, but if you convert it, it's not as sweet as sugar cane, but it's pretty close. It's been investigated. If you come to this one, the biodiesel one, then that's a very simple technology, and anybody can do it. People are going that way every day, because you can take certain ingredients and make biodiesel out of it. You have to refine it, of course. You can't take it straight, you'd lose more money than you'd ever make doing that. You have to refine this, it's a refining process, which costs money. So if you get a refinery to remove all the junk, then you could be ready to use it. I don't know if you could get enough supply in your area to have an impact. If you think you can, that might be an easy way to make money. Sell it for what, $2.59 a gallon? When you compare all these things, you have to consider what's the most efficient. That's certainly one to challenge, and you have to develop that. If you look at the pyrolysis and then you consider the gasification and make this, it's a long way to come. You'll hear things on radio and TV. You'd have to give yourself five or ten years to be able to grow grass in your backyard and make ethanol out of it, and you have to be realistic, and we don't have that. You must remember you have to be realistic. I don't want to discourage you from funding something like this, but I don't want you to get your expectations so high and you can't deliver, then everyone feels bad. We have to balance and be realistic with the science. All this that we've been talking about, there's no doubt about it, because you have this energy, and we're talking about engineering. There are a lot of things you can achieve using various tests, but to translate that, that's a big challenge.

MR. MOSS: Can we burn the bio-oil?

DR. AGBLEVOR: Yes.

MR. MOSS: So, is it feasible, can we have the bio-oil as a substitute for diesel fuel?

DR. AGBLEVOR: Yes, you can do that. You have to identify your system to burn. So long as you realize what it is. If you make enough money, then move on to the gasification, and that'll be the next case. That's why some companies are doing it.

MR. MOSS: I'd like to point out for the record that the State of new Hampshire has done a study on heating oil. In the northeast there are 124 percent diesel fuel used for heating, as opposed to transportation, meaning there is more used for heating purposes than transportation, and nationally that's about 24 percent. The market for heating purposes is very large, and that's diesel fuel and not including propane. The premise would be there is certainly enough business to justify an oil refinery than other things. I think it's a business model worth pursuing.

DR. AGBLEVOR: In western Europe that's what they're doing, they're concerned about heating.

DR. DAS: Can I make a comment about the corn bio-refinery? One of the things that impressed me when I was doing part of the study. The United States corn-for-ethanol industry really began after the '70's oil crisis. Here historically when you consider the ethanol for years but to produce it in large quantities for purposes of not drinking it is largely 25 years. When it started in the U. S., the cost of converting corn ethanol was $2.75 using fermentation. Over the 30 years it has gone down to about 85 cents a gallon. That's the typical technology, it takes about 25 years to get to the point of maximum efficiency. At that point the only thing that's holding the technology is the cost of the feedstock. The things that make that happen are increased reaction rates, and you have greater use of corn. In my assessment, we're very early in the process of pyrolysis. I look back to 1920 before petroleum was refined commercially, and everything started, and people quit doing it. Now we're going back looking at some of those technologies, like corn oil for example, there are ways to get activity out there, and ethanol out of wood base. Maybe in another ten years or so we'll probably get there. I know you have quite a big poultry industry in Virginia. Are there commercial facilities using poultry fat?

DR. AGBLEVOR: Yes, they're using it as fuel. They call them poultry farms, but then there's also this animal feed, and that is a complication.

MR. MAYHEW: Are there any other questions? If not, we certainly appreciate your presentation. Before we end, I would like to put it to this group that I think it's time to go ahead and make a decision on this thing. We've studied it now extensively, and I hope and believe that we all have a pretty good understanding of what the real challenge is here to see this thing and to get where we want it to go. Likewise, if you don't make an attempt, someone else will move on it. The money has already been approved, and a lot of work and study has gone into it. Mr. Badger down in Alabama is willing to take nine items of concern and do his very best to improve on those with this new unit we're considering purchasing from him for somewhere in the neighborhood of $150,000, which has already been appropriated, you might say, or approved. Unless there is some real dissent here, if anyone else on the Committee would like to speak to this, I'd like to hear it. I'd also like, before we leave, someone to offer a motion that we approve or disapprove this purchase and move this thing forward.

SENATOR RUFF: Mr. Chairman, what is the capacity of the one we're thinking of purchasing?

MR. MAYHEW: The one we're thinking about purchasing?

MR. MOSS: Two dry ton, it would be about four wet ton.

MR. MAYHEW: I think the very most we can hope for this is not something that's set up and start running a week at a time which will produce a lot of bio-oil and thinking about where we're going to sell it. I think the most we can hope for is a unit that we can tweak and work with Virginia Tech with and make improvements and hopefully get to a point that in the not-too-distant future maybe even make another unit that would improve on that one, and then go forward to commercialize it some and not get bogged down in a ten-year deal. I could see where it could go for more than one year. At the same time, advance the cause of new alternative fuel, giving our local farmers another market to sell their wood products. I think that's the most realistic idea we can put forward here, rather than something that's pie in the sky, we're going to have something immediately, and everybody is going to get wealthy off of it, that's just not realistic and won't happen. I think we owe it to all the people that put so much effort into this to give them the benefit of the doubt, since we've gotten this far. That's just my opinion. If anybody wants to take another shot at it, let's hear it.

DR. NOWAK: I'd like to supplement what you said. I think we'll have to form a partnership, ROI with a joint venture in the development of the technology because it, at least or as far as I understand it, we'll have to update it. Then there is engineering that is significant, and you have to integrate it, and we just need to have a partnership, I believe.

MR. MOSS: The licensing agreement probably we'll have to discuss that as a contractual, the last thing we want to do is develop this thing, and then we want to control the value of it so it's part of a purchasing agreement. So I'd recommend that we incorporate some reasonable expectation as far as licensing. It's not going to be a hundred percent exclusive, I don't think, at least regional or maybe more. What's the feeling of the Committee, how do they feel about that?

MR. MAYHEW: I discussed with Ned before the meeting that particular, what you just said. He said it's up to the Commission for the background and wherewithal to proceed with it and get it worked out for us.

MR. MOSS: This is going to be a big input from Virginia Tech and the Commission funding-wise.

MR. NOYES: Staff will be talking to Frank Ferguson, as well. I believe it's an administrative matter, rather than a policy matter; if the Staff gets the direction to proceed and investigate the nature of the contractual relationship, we'll be happy to do that.

SENATOR RUFF: Mr. Chairman, it seems like to me there ought to be one motion that we enter into an agreement with them to produce one machine and at the same time to negotiate the best deal we can to enter into a partnership. That's my motion.

MR. MAYHEW: Do I hear a second?

MR. ARTHUR: Second.

MR. MAYHEW: It's been moved and seconded that we contract with ROI to purchase this machine we've talked about at length and also have the updates from Phil Badger, the gentleman that's supposed to do it for us, if he's willing to incorporate new changes and updates, and at the same time that the Commission and Virginia Tech or whoever work out the details to protect our interests as far as how we work together on this. That's a little different, how I restated it, but we have a motion and a second. Any discussion?

MR. JENKINS: One clarification. I assume that we'll be relying on that entity to do most of the research and work. We're looking at protecting the money that we invest, but how much input would Virginia Tech have, or anyone else?

MR. MAYHEW: I think Virginia Tech is our key player.

MR. JENKINS: I mean as far as developing procedures to update and make them better.

DR. NOWAK: Usually, in the end when the product is ready and according to the input of the partner to do the specifics when the patent is developed, but I think the experts will have to deal with that.

DR. AGBLEVOR: There are two things that have to be done, the partnership, or just buy the machine and run it yourself. If you have the partnership, then what will happen once the machine is built, Virginia Tech will get involved, and then when you get all the process money and any modifications, then the Committee would have a right to go through it, but if you just buy the machine and just run it, then we don't have much.

MR. MAYHEW: It was my understanding from the very beginning, the first observation we heard was that Virginia Tech was going to be a major player, and it was a machine that needed a lot of improvements. That was the whole reason for getting started. At least there was something out there that we could work, and we don't have that now, but if we could get it at a reasonable price, then it would be worthwhile going forward.

MR. JENKINS: That's where I'm a little confused, when you start talking about intellectual property. If we're going to buy this machine and then turn it over to the people at Tech to work on it and try to improve it, then are we going to buy the machine but still in effect subsidize the group to make these updates?

DR. NOWAK: I think investing in the development process, rather than buy the machine. In the end the outcome of the investment, there would be a machine, that's how I understand it.

MR. BYERS: It would seem to me that ROI would be the principal of this machine. They would develop it, but we would play a constant role making sure that these things were done that Dr. Das recommended, kind of a process-improvement role. Our responsibility would be the overall grant to Virginia Tech. I don't see that this is going to be a lot of intellectual property created at this particular stage.

MR. JENKINS: You hit the key word there as far as input, consultant, rather than actually, but if you go back to the idea of the combine. They bought the combine and whatever they started with and then built a separate head to go on it, and they turn it over as intellectual property with the makers of the original machine. We're not talking about that, we're going to be the consultant. Is that your point?

DR. AGBLEVOR: I think we want to do more than that. When everything is ready, we can develop a partnership rather than consultant.

MR. NOYES: A partnership rather than a consultant.

MR. JENKINS: I think we need to understand that before we vote on this motion.

MR. MAYHEW: The details of all this can be worked out later, but it can't be worked out here today. It's too complicated and involved, and I think that's where we depend on the Commission and Virginia Tech to do what's right with it. I hope something results from this that's worthy of us talking about it. I'm not making small of that, we may get something great. I think we're getting too far ahead of ourselves trying to tie down too close right now when we don't even know and we really haven't even gotten off the ground yet.

MR. JENKINS: I think you need to decide on the basic premise of what the plan does. I'm not talking about a lot of detail. And that's just my opinion.

MR. DAVENPORT: You've got somebody here that's got a product, and how bad does he need us, and K. C. can probably talk about that, but the reality of it is that he has already said that basically it's his product and he owns the intellectual part of it ,and any modifications done to it are basically in his purview. You buy something from him, and you operate it, maybe from that Foster and others would say maybe there could be something created, a whole different product. Certainly you're talking about a lot bigger product than this is. This is more just something that you're going to get used to the feel of what you're doing. Ken, you say that if you're really going to have something you can't make money on this?

MR. MOSS: No, there has been a study done on this. I can't quote the research that was done, and it is upscale.

DR. AGBLEVOR: There is one thing, and when you transfer, and you must remember it's not verified and no one said what is that process for in the reactor. Like you have a pot and you throw everything in there and you cook it and something comes out great, what we call a determined approach, and it works. But how and what is behind it, therefore how can you improve upon it.

MR. DAVENPORT: We have a division at Virginia Tech that deals with negotiated contracts, and we have a lawyer tuned into that specifically. So I would say that you find out real quick how important it is to this person or the supplier, this affiliation, because assuming at this point it's critical to whether it will actually end up being a product or not. I don't know if you recognize that or not.

Mr. Jenkins, all this will be straightened out pretty quick. I look for greater things and maybe a whole different product than what this unit does.

MR. MOSS: It goes back to the VPRI original plan, if you go under that basis where the ROI combined with Virginia Tech and you tie it up there; and to me, that's the best way to approach it. You can file for a patent, and that would tie it up right there and cover that. You'd have to share some of the benefits of the existing, but I guess in the end if you go commercial with it, what percentage is commercial versus Virginia Tech and what that side of it is. Nonetheless, VPROI would tie it up back to Virginia Tech.

MR. MAYHEW: I think the intent of the motion that is on the floor and seconded that we move forward and purchase the machine and leave it up to Virginia Tech and the Commission to work out the fine details. Any further discussion? All in favor say aye? (Ayes.) All opposed, no? (No response.)

Do we have the next meeting date?

MR. NOYES: We haven't set that yet.

MR. MAYHEW: Then I'll ask if there is any public comment?

UNIDENTIFIED: I'd like to start and pass this around. These are some wood products and under very high pressure and the right amount of moisture, about ten percent moisture. What we are doing is looking at compounding post-consumer recycled material with some additional processing that I'll go into at a later date. What we're finding with this material here, we're finding that in processing this we're getting a very good large flame. With these particular ones we're getting on the order of 13,600 BTU's. We're also seeing a burn time 50 percent longer. What I'm saying is that we're seeing a longer burn time and a longer time scale for the release of more heat. We'll have more as we go, and we'll start making pellets that look a lot more like this. Thank you.

MR. MAYHEW: If no one else has anything to add, if there's nothing else, we'll stand adjourned.

PROCEEDINGS CONCLUDED.

CERTIFICATE OF THE COURT REPORTER

I, Medford W. Howard, Registered Professional Reporter and Notary Public for the State of Virginia at large, do hereby certify that I was the court reporter who took down and transcribed the proceedings of the **Virginia Tobacco Indemnification and Community**

Revitalization Commission Bio-Energy Oversight Committee Meeting when held on Thursday, October 5, 2006 at 2:00 p.m. at the Riverstone Technology Building, South Boston, Virginia.

I further certify this is a true and accurate transcript, to the best of my ability to hear and understand the proceedings.

Given under my hand this 15th day of November, 2006.

____

Medford W. Howard

Registered Professional Reporter

Notary Public for the State of Virginia at Large

My Commission Expires: October 31, 2010.