DOE QTR ALTERNATIVE FUELS WORKSHOP
FOCUS GROUP

DOUBLE TREE HOTEL

CHICAGO, ILLINOIS

WEDNESDAY, APRIL 27, 2011

ATTENDEES:

Mr. Robert Brown

Mr. Harrison Dillon

Mr. Avi Gopstein

Mr. Michael Holland

Mr. Asa Hopkins

Mr. Steven Koonin (Chair)

Mr. Lee Lynd

Ms. Laurel Miner

Mr. Ari Patrinos

Mr. Don Paul

Mr. Bill Provine

Mr. Ian Purtle

Mr. John Tao

Mr. Tom Tarka

Mr. Tarek Shah

Mr. Michael Wang

XXX: Thank you for staying on for this session. And this is an experiment as always, and I think our hope was that this will be a time for a few hours to reflect after a night's worth of thought on what we heard yesterday and perhaps have some more deeper discussion of some of the issues that were raised.

So the team worked diligently all through the night to get a set of questions that will help to guide us in the discussion.

But we will start, perhaps, with the obvious one and get things rolling.

What did conversation yesterday miss, things that weren't said that should have or emphases?

XXX: I think that we might have said more about flexible fuel vehicles. And I would put that in a little context.

I think there are reasons to be excited by fuels, for example. There are also reasons, also fundamental, that they may be more expensive than ethanol, which is more of a known quantity, although producing it from what we would like is still on a hill in front of us rather than behind us.

I think the same thing realistically is

true of electric vehicles. There are reasons to be excited by electric vehicles.

How completely they will satisfy even the light-duty sector is by most people's estimates in doubt.

And so there is a path and we have many parallel paths, obviously. And that's part of the challenge and we are also grateful for that in some ways.

There is a path that hooking up ethanol, which may be very high performing and very inexpensive from other feedstocks than corn, may be a spectacular option for the United States. And flexible fuel vehicles are, as things go, an itty-bitty infrastructure change.

I'm not saying it's trivial, but it seems to me allowing for that possibility, given all of the uncertainties and all of the urgency, would make a lot of sense.

So that was an issue I thought was missed yesterday.

XXX: I kind of had a fairly opposite view, I think. I felt that there is not enough emphasis on infrastructure compatibility and energy density with regard to the outputs of processes.

There is a lot of emphasis on feedstock, which I think is entirely

appropriate.

But when I look at a lot of DOE solicitations or hear people talking, sometimes I feel like as long as you are doing cornstover, you just need a bug that makes something you can set on fire. Whereas, really, the difference between something that's flammable and something that's a fuel is a bigger jump than I think a lot of people realize.

So I felt like that wasn't enough emphasis on those two things, particularly density and infrastructure compatibility.

XXX: Just a quick comment. The challenge of infrastructure I think is a general issue. And as you already know, XXX, infrastructure is by far one of the poorest investments that you can make as a private company, way down the list on its return of capital compared to everything else.

So that's all the challenge of building the industry.

I mean, your gas stations wouldn't make money if it wasn't for cigarettes and coffee.

XXX: What does it cost to build a gas station, roughly? Does anybody know?

XXX: Million bucks. Anyway, I thought the things that were -- one thing that came up at the end in one of the groups that I think was not reflected broadly in the direction is these

two intersects: The intersection of behavior and sociology and technology in the system.

I don't think that should be underestimated in a world in which information and behavioral aspects are connected by the other intersection, which is the intersection of information technology in the system.

And information technology is so powerful potentially that it alters the relationships that -- in any -- any system that attaches infrastructure information technology massively, information technology alters the system.

So I think those are the two things that I thought, you know, that you can argue they are in there and around in there. But I think there is a question about whether the role of energy informatics, or whatever you want to call it, and the intersection of behavioral -- of individual and sociological behavior.

XXX: So there are three separate questions, maybe four. I don't know whether we should make a list and then start in on them or --

XXX: Another one I didn't think we talked about is international cooperation.

XXX: I would agree with that.

XXX: Global effects.

XXX: International interactions because there is the potential technology flight, which is a different kind of dynamic there.

XXX: To expand on that, the difference in importance of having the innovation stay here and having the manufacturing stay here.

XXX: Everything looked under their own individual -- so even though there was quite a bit said in the regional activities, it was only very limited maybe, hearing a little bit from the Department of Defense and something about USDA. Energy covers and transcends all agencies.

And if you are to be successful, you have to mobilize them and have to be creative. And probably the most shoe leather you will expend is not reaching out to the community but to the few key people in the federal government that will make it happen for you.

XXX: So what XXX said about what you are alluding to the infracture -- I know this is an alternative fuel workshop and you are next week having a workshop.

But for the whole exercise we heard infrastructure in the broad context of (inaudible) fuels, look at infrastructure issues across the transportation fuels from those broader prospectives. Because they are aware

the individual workshops are rich.

And I'm sure what is concerned is whether this close comparison will happen with stakeholders coming to the workshop, as each workshop forms for specific area. Maybe at the end of the six workshops things will wrap up together.

XXX: That's a good point.

XXX: So forgive me. But I would like to express in some ways a frustration.

I think humanity has only undergone two prior resource revolutions. We went from hunting and gathering to an agrarian agriculture society. That was number one. That changed everything.

And then we went from an agrarian agriculture society to a presustainable industrial society, which is where we are now.

I think all indications are in the next hundred years we have to undergo the third great resource revelation in history.

Only this time we have seven billion people. We had a fraction of that the two prior times. I meant at the start of it. So nine or ten when we are done.

This time we have one global experiment rather than many parallel experiments. So it seems to me relative to those prior resource

revolutions we have got more people, less time and higher risk.

I don't see any way to look at what we are talking about other than saying, A, it's a revolution and, B, a few centuries from now people will look back and judge us literally saying it was obvious we are drawing down our resource capital.

The obvious challenge of our time was to live off resource income. Forgive me for the editorializing.

But I think this is the defining challenge of our time. And I find it sort of amazing and singular in bioenergy because it's like we can only talk about and imagine infrastructure compatible solutions in what by definition the infrastructure to get through this revolution has to change. Okay.

And so you try that with hydrogen vehicles and try that with battery powered vehicles where we say we are willing to turn the infrastructure upside down. And we, frankly, should take the attitude we are willing to contemplate things that turn infrastructure upside down because there are no other solutions that do that.

The consequence, though, I think -- I actually think this boils down to angst, and uncertainty, ambivalence and indifference,

differences of opinion about feedstock supply.

When you come down to it, I think there is a fraction of folks that don't take biomass seriously as being a really large source of global energy supply and particularly of fuels. And, therefore, you get into the short term, well, this is an interim strategy on the way to something else.

And so in my opinion a pivotal issue is to develop greater clarity on the extent to which and the ways in which biomass can really be taken seriously.

And with all due respect, this goes beyond the billion ton study which has quite a few limitations and constraints and unexplored options, et cetera, et cetera, et cetera.

It seems to me that a very nice progression would get greater -- I think the United States is sitting on more than Saudi Arabia as far as biomass potential, compatible with food, compatible with environmental quality, biodiversity, et cetera. But that's what I think.

If we can get greater clarity on that, I think we would then as a country and as a world, in fact, look at bioenergy differently. And I really think we would look at infrastructure issues differently.

I close by saying it is a singular phenomenon the way as we think about alternative transportation futures. Bioenergy needs to fit into the land use infrastructure. It needs to fit into the existing vehicle and distribution infrastructure.

We don't require that of anything else we are looking at. And if we restrict ourselves to those solutions, whether we are talking transportation or elsewhere, we will drive off a cliff.

And I think it's our responsibility to think more broadly than that.

I will try to speak less. But I had to get that off my chest.

XXX: There was a mention of international collaboration and the feedstock issues.

I want to address the competitiveness. We didn't talk yesterday whether U.S. biofuels can compete in the global markets. I have a question whether we will still be doing this in ten years if, in fact, the developing world decides they want to do this.

The other one is just more -- even sooner is can biofuels compete with bio power in feedstocks in the U.S.

That is a major concern. The power companies can take a lower quality feedstock and

sell it. The farmers are ready to sell it.

XXX: I share that concern with biofuels versus bio power because I think it's a lot easier for the utilities except down east for southern states to throw five, ten percent in their boilers with very little capital involved and can still afford to pay a lot higher biomass per ton than biofuel technologies can.

XXX: I think that also raises the question of if there were to be a price on carbon, would bio power mop up all of the available biomass.

XXX: Even then, look at Europe now, they can afford to pay $100 a ton. They are paying 150 for wood pellets and shipping it over.

XXX: Can I come back to this U.S. competitiveness issue? And, XXX, you started with what I think is the right global perspective, one experiment in the next hundred years.

XXX: Then I went off the rails.

XXX: No. Then you descended into a nationalism that was discordant with that and you say the U.S. is going to -- I mean, there were U.S. centric words there.

If we are really in a global world, grow the biomass and process it where it is most economic.

If we were really serious about getting off of oil, bioenergy and so on, we have to drop the Brazilian bio ethanol tariff. We would be growing biofuels where it's greenest, et cetera, and we don't to that.

XXX: I think we are not left out of that supply, which my experience indicates if you can't make that case to U.S. audiences, you get dismissed.

XXX: XXX, I disagree with some of the things you said. We had that debate yesterday.

But I don't think we spent a lot of time talking about Saudi Arabia and coal and maybe natural gas. And I don't think we spent enough time talking about the alternatives, the fossil alternatives, right.

So if we look at it using the metric of oil security and sustainability and economics and put everything more on an apples-to-apples basis and then make the decisions on where the priorities how to fund it -- because right now you got people in the room who are very much -- and I am possibly one of those that says should be more on biofuels.

But I guess to be honest, I really don't think that may be the right position.

XXX: So I wanted to make two points.

First, to XXX's point about using biomass for power energy generation, certainly,

we can do that. But I don't think that's in game really for the appropriate use of biomass.

Because as we have the coal-firing capability already in the ground, then its value really is a fuel in existing facilities probably, you know, south of $2 billion BTUs, transformed into the transportation fuel of $20 BTUs.

And we need to move towards that spread because we are going to need it.

XXX: If you want to talk about value in the marketplace, bio products is even higher.

XXX: It's four percent of refinery output.

XXX: So there is a huge spread there and we have to go there. We have to capture that value.

The second point I want to make, I think that the United States is missing a huge opportunity with respect to encouraging distributed power generation.

You know, I actually built a number of gas-fired cogeneration facilities in Europe when I worked for XXX in Europe. And I came to the United States and said XXX is interested in energy efficiency, why don't we do that here. And I could not get it done.

XXX: Why?

XXX: Because of the way the power infrastructure is organized.

And the way it has grown up, there is a whole bunch of independently operated, you know, cooperatives and you cannot penetrate that shield.

XXX: If I can build on that, there wasn't a lot of discussion about distributed manufacturing and of power and potentially fuels.

At the ARPA-E conference, you know, the day before we had that town hall on GTL and my colleague that was there with me, you know, there are companies that are saying, well, maybe you can shrink these things down to distributed scale.

So I think there is a question about whether you can distribute manufacturing of fuels. And, of course, you can distribute power. You know you can do that with both gas and --

XXX: Is it a thorium, anything you can do distributed, you do more economically centralized?

XXX: No. What it does it allows for different constructions about how society works.

I think there are -- and especially if you think security is important, the last thing you want is everybody dependent on something

that's hooked together.

So this issue and stationary fuel cells are the real deal. XXX used to use them. We drove all our data centers off them because you couldn't afford to have the data centers go down. And the gas grid never goes down.

XXX: So we are arguing over what we distribute. Do we distribute electrons or do we distribute gas?

XXX: No. I think the broader issue is can you distribute power, fuel.

XXX: Could I answer XXX's question?

In the processing industry, you know, whether it's -- whether it's refinery -- oil refineries or whether it's ethanol plants or whether it's soybean crushing plants, we run all those things.

The energy efficiency increases significantly if you can actually get gas-fired cogeneration installed.

And the problem is the interface with power companies. I said the problem why we can't get it done is the interface with the power companies.

XXX: And the gains are from the use of the heat, the waste heat.

XXX: Absolutely.

XXX: Let me build on what XXX said on

power versus fuel. I think we know the problem now is the fuel conversion is too cost relative to the power conversion.

But on the other hand, as XXX has elaborated in terms of the potential margins, the fuels area has larger margins than the power area. And the power area has more flexibility to our issue such as greenhouse space and (inaudible).

Energy securities is our transportation issues are our fuel issues.

So we still have to look at what are the issues to stop us getting to fuels from power that is conversion technologies.

I know yesterday it was feedstock, feedstock, feedstock. But I think conversion technologies have to cause the competitiveness and that's where we are going to suddenly see fuels areas offer more potentials in terms of greenhouse gas reductions, energy security benefit.

XXX: So where do you all think the DOE portfolio would be best focused, feedstocks, conversion, better molecules? What needs the most attention these days?

XXX: I would say all of the above.

XXX: A balanced program.

XXX: You have to look -- I think you have to look at the whole supply chain. Okay.

So you can look at the molecule houses that fit into the existing infrastructure on the assumption that, you know, it's transitionary, we have to use the infrastructure we have, all right.

But you have to go all the way back to, okay, I have got a molecule that will fit, how am I going to get there to also ask the questions so where is the feedstock coming from.

And if you can't put that supply chain together, you do not have a deal.

XXX: You need to rely on the USDA and the inter-agency collaboration. I think USDA has a lot of programs moving on feedstock and make sure there's that connectivity.

XXX: When you say feedstocks, make sure you include the logistics of the feedstocks.

XXX: Sure.

XXX: That falls in the gap way too often.

XXX: That's probably USDA's bailiwick or is it ours?

XXX: You all argue over that.

XXX: Or don't forget the orphan in the middle.

XXX: I have gone to both agencies to talk about that. And they point to other

directions.

XXX: Right.

XXX: My answer would be this. I think it depends -- I mean, I think the government should be looking after the long-term and medium-term future as well as the short-term.

And I think the answers to your question are different if you ask what is most impeding things from going forward now versus what is necessary to prepare for, you know, a historic transition.

If you look at it in terms of right now, cellulosic feedstocks are available. Not all of them, but if you have a cellulous conversion process, you can find feedstock in this country. So it's not preventing you from building a first commercial plant.

It's also true there is another agency that has -- in fact, even if DOE decided it wanted to do feedstocks, you would still have to deal with USDA. And so there is that issue.

With respect to molecules, I would observe that you can make any fuel molecule you want and you can substitute it for ethanol in all the existing plants as a thought exercise and even occupy all the world's easily fermentable hydrate and not much changes. Sustainability doesn't change. Rural economic development doesn't change. Energy security

doesn't change.

XXX: Why are we doing this?

XXX: Well, because -- I think there is only one reason. I think that other molecules when they are linked to a strategic feedstock that meets various criteria, which they are not generally in the world today, become important to, again, enabling this large transition, particularly because the most compelling places for bioenergy in the long run, as has been often pointed out, are in the heavy duty sector, in aviation, where the fuels one can make today are not so applicable.

So that's the long-term anticipation part. It's logical to bring on other molecules so that when we have a large scale feedstock compatible with energy requirement we can layer them on.

But without a doubt in my view, the strategic near-term issue is accessing liquid cellulose to produce commercial fuels.

And I would put that above everything else in the short-term list. In the long-term list, there is a suite of things and it would be foolish to only bet on one.

XXX: I agree that that's important. But I think the opportunity for distributed power is equally important.

XXX: In the context of biofuels, which may be not what our circle is restricted to, I don't see distributed electricity as being as centrally important. But people may disagree.

XXX: It's an efficiency issue. And it addresses a number of concerns about the power grid.

So to the extent that we can bring distributed power, efficient distributed power into the grid where we take the load off the grid and reduce the need to install more peak-carrying capacity in the grid and more peaking capacity --

XXX: I have a hard time taking a position against that.

XXX: I have so many ways to make electricity that are low carbon or zero carbon. I just don't see the bio rationale.

I'd rather use the biomass for fuel. It's a lot harder to make fuel.

XXX: I am not saying use the biomass for that purpose.

I'm saying look at how can we more efficiently produce electrical energy. And gas-fired cogeneration is one of those opportunities.

You know, distributed fuel cells is another one of those that are much more efficient than building new power generating

capacity.

I'm not talking at all about biomass. I am saying these are things --

XXX: Distributed generation broadly.

XXX: I want to make a comment on what you said about you would rather use biomass for fuel.

I agree with the comments made earlier about bio power. But biomass is not the ideal feedstock to make gasoline.

XXX: Right.

XXX: We all agree with that, mainly because you have to get the oxygen out.

And I made the comment toXXX last evening that we didn't talk a whole lot about hydrogen because you need the hydrogen to get rid of the oxygen.

And even if you start with coal, you need to -- you need hydrogen. And the cheapest way to make hydrogen is from natural gas. DOE is not spending any money there.

XXX: Right.

XXX: So there is this general question in fuel making broadly -- and I don't care with the rest of the feedstocks. But if you look at your ability to diversify or use coal or oil sands or other feedstocks, making hydrogen and doing it, you know, hyper-efficient in the

production of hydrogen as well as mitigating its downsides, which it has, there is something around that.

Because if you don't produce enough hydrogen, you can't solve some of the other problems.

XXX: Let's talk about that. Then the questions are two-fold if you think about a program to do that.

A, is there enough technical head room? Can you imagine things that are better? What are the barriers?

And, B, is the private sector already sufficiently motivated that the DOE doesn't need to do much? Or what does the DOE hydrogen program look like, I guess?

XXX: They, obviously, got to go to processes perhaps even using other physics.

XXX: No.

XXX: You have to do something completely different.

XXX: It is something that's, obviously, not steam reforming. You don't need to do that.

Is there a question of making a hydrogen and in vast volumes?

XXX: At pressure.

XXX: Hydrogen from an infrastructure standpoint is a real problem both from getting into a pipeline and --

XXX: Not as a fuel. Basically, to make the molecules you want, you have lots of sources of carbon. They can be biomass. They can be coal. They can be oil.

But they are -- but many of them are deficient in hydrogen. And hydro processing is what is a core technology.

XXX: We can still call it hydrogen for transportation to satisfy other people.

XXX: We treat the hydrogen somewhat as an additive to the production process. And if we think hydrogen as an additive for fuel production, I agree we should think outside of the box. SMR is already commercial.

XXX: It doesn't work. You know, we looked -- at BP we looked hard at nuclear heat to make hydrogen. It is not competitive. I don't know if you all have done similar things. It just doesn't work.

XXX: Biomass is the cheapest renewable source of hydrogen.

XXX: Can we make algae and other things that will make the hydrogen for us more directly?

XXX: If you go to the hydrogen compatible fuel pass, you need hydrogen (inaudible).

But you do have the residual biomass

which you could use as feedstock to make hydrogen.

XXX: You don't need hydrogen. You need energy to turn water into hydrogen. And chemical energy is the cheapest way to do that. And that's why I say biomass is the cheapest renewable form.

XXX: Again, once you say what you need is high volumes of hydrogen in order to hydro process whatever your carbon source is, then the idea is various ways to do that, which, you know, is beyond what we do today. If what we do today works, fine. If you have enough natural gas, it's cheaper than if you can make vast quantities of it.

But to add to the diversification of that might, you know -- so I guess that would be a question to think about a little bit more. Do you need another set of ways to make hydrogen?

XXX: Right, given that gas could remain cheap at $4 or $5 and domestic.

XXX: A few more things that have come up. On the power versus fuel, clearly, today in terms of economics, power will beat fuel around the barn for biomass.

As I see it, looking at both the U.S. and Brazilian situation, there is quite a bit of reason to expect the opposite will be true due to the higher margins that XXX referred to.

As far as distributed versus centralized, it's interesting to think about biomass. When people think of biomass plants with a 50-mile encampment radius, it's easy to think of that as distributed.

On the other hand, do the calculation if you want. At ten tons per acre a year, if you look at a 50-mile disk and you do some conversion efficiencies -- and maybe I'm assuming somewhat futuristic ones, but I think somewhat achievable -- that would be five billion gallons of gasoline equivalent can be produced from that.

I can send you the calculation if you would like.

So, fine, you only get 20 percent of that. That's still a billion gallons that doesn't sound so distributed anymore. And maybe one could do it smaller.

My point is people have this idea that biomass is this very low-scale marginal activity because of all the rag picking. I don't think that has to be so.

As far as gasification, it's interesting to note, with cellulosic biomass anyway, no matter what you do, you will have about 40 percent of the original heating value left that you will not convert to ethanol.

And the energy in that far exceeds the processing energy requirements if you do it right.

And as I see it, the most practical and attractive thing to do with that is gasify. And in particular, the waste heat from gasification, it provides the low grade heat provided -- required for the biological processing so you get a very sweet combination.

And, finally, the greenhouse gas emissions per ton of biomass, I think there is a widespread impression that you get both more miles per ton if you convert biomass to electricity, which I addressed yesterday. I believe in comparably motivated scenarios that's not correct.

There is also a widespread impression that you get more greenhouse gas emission reduction per ton of biomass going to electricity than going to liquid fuel.

We published -- I also believe that's incorrect.

So I think some of these notions of biomass is this small scale greenhouse gas inferior miles per ton driven inferior option.

I think it's partly that we have relatively immature biomass fuel technology and we are comparing to either more mature or more easily envisioned other chains.

XXX: Do we need to focus in the DOE more on the early stages, the invention of new technologies? Because a lot of what you were just talking about sounds to me like pretty straightforward integration and plant design? And the DOE probably doesn't need to do much there.

How do we strike that balance in the process?

XXX: I think that's one of the questions. And it gets back to looking at the -- in some level, at a fairly sophisticated level on the supply chain structures.

But one of the things that was mentioned is -- I mean, I guess I put it out to the group. If gasification is a critical subprocess, there is another one that's been around a long time but could undoubtedly use some serious work.

XXX: And it doesn't sound like either/or.

XXX: And it is an area where the industrial owners of the process are not putting much money into. And right now gasification is a super expensive process on that scale.

XXX: And has to be very scaled. It has to be big.

XXX: So there is two issues there.

Does gasification have another development -- because it would be a useful process in general. But its current capital costs, as you know, are making it almost never can do it.

XXX: You have to ask why is that so. People say that over and over, it's expensive. But nobody addresses the question why is it expensive.

XXX: Does anybody know?

XXX: First, you are handling the solid. Then the oxygen is very expensive.

XXX: And you have got enormous redundancy built in because you have to because they are sitting on --

XXX: So cheaper oxygen is also important?

XXX: Well, there is the DOE IPM program.

XXX: And more reliable equipment in terms of -- gas-fired is another factor.

XXX: And the scaling factor is another issue.

Because today, you know, again, if you -- all these things -- this is where maybe a more general comment is, if you can increase the range of scale which processes could be deployed, you also create opportunities to fit into the supply chains that are different.

The idea if you could distribute manufacturing -- we have talked about this with

-- I know, you know, with gas to liquid. If you can ever make one you can really do on a ship, you would have entirely different resource access than you would the way you got to do it now.

So the scaling issue has broader implications to the structure of the manufacturing base.

So if you have some dynamics there and then you look at the processes that are crucial, like producing hydrogen and like producing oxygen and like gasification, if -- and that's not something industry is really working on. It's not clear how you do that.

XXX: Flattening the cost curve is a function of scale.

XXX: And the broader issues of these critical molecules that go into fuel making hydrogen, oxygen.

XXX: That's the same for fossil, right, if we are going to --

XXX: That applies to any feedstock. That's the strength of it. You don't have to pick the feedstock now. And that may -- and if you can distribute manufacturing, you can hook yourself onto resources that might be particularly advantaged in a given situation.

Today you can't to that because it's a

scale issue.

XXX: I think it's extraordinarily unlikely that the first cellulosic biofuel plants, at least the first biological cellulosic biofuel plants will include gasification.

So I put that combination at least in the preparing for the future category, which I'm all about, by the way.

But just to underscore one other very sweet thing in the thermodynamic parts of this discussion, it's really advantageous. Something we are going to need to deal with in large scale bioenergy is handling the inorganic elements that come along.

I mean, for example, if you look at that for algae, it's a huge, huge challenge, nitrogen, phosphorous, potassium. And there are advantages to have a reducing chemical environment from the point of view of recovering, and particular nitrogen.

At the SASOL coal gasification plants today, they recover 70 percent of the nitrogen from coal as ammonia. Whereas if you burn that stuff, you end up with NOx.

So there is a really nice -- I think the integration -- this integration goes on and on. But, again, I don't think it's what's going -- I don't think it's what's going to crack the nut first.

XXX: When we talk about integrated bio refineries, that's not what we mean; is that correct, that kind of process integration? We think more about product integration. Historically we have not.

XXX: When I look at the actual one that's in progress right now and I look at some of the loan guarantees -- and this gets into USDA as well. If you look -- we want these big plants making all this cheap fuel.

If you look at a corn wet mill, the starch makes the cheap fuel, but there are all these other things that support the ability to make the cheap fuel. Same with an oil refinery.

And I don't feel that it's necessarily appreciated how important it is to have those other things that are worth more when you are planning around the entire operation.

And I think that that's -- I mean, there was a USDA loan guaranty -- I think it's still out right now -- where the requirement has to be 51 percent fuel.

So I don't know who picked that number, you know, okay, fine. Well, that is a cut off that is going to make it impossible for a lot of these things to get financed and built.

And it's a bit of an arbitrary cutoff. It's not like when you run a corn wet mill or an

oil refinery, you have -- once you have that capacity and you are using it to sell your highest value stuff, you are going to use the excess capacity to sell -- to, you know, make your lowest value stuff.

Just like they do in Brazil with ethanol instead of sugar for food. And I think it's a model that's hard to get away from if you want to build things at that kind of scale.

XXX: But ill-appreciated by the government?

XXX: Yes.

XXX: It was actually over appreciated by the government for a period of time.

From about 1998 to 2004, the only thing DOE was talking about in biomass was integrated bio refineries and they emphasized chemicals much more than fuels.

So these pendulums tend to swing.

And one of the dysfunctional -- I mean, look, we all agree there is only one commercial reality and that is high value, relatively low volume coal products add a lot of margin. And it's one reason fuels are cheaper today.

I think all of us see that reality.

One mistake the DOE made back then was they would have research solicitations that were supposed to sort of embody that integrated product concept, which I thought it was just

silly.

In fact, you innovate on given paths and given targets.

But there was a solicitation, if you didn't have three products, you were simultaneously innovating one, I thought it was unresponsive to the reality of what innovation is.

XXX: Two points regarding that. One from a sausage making perspective, when evaluating technologies and the co-products are more than 51 percent or more than 50 percent, you really run into a problem of how are you evaluating the co-products and what is your real process.

And I think from an evaluation standpoint of evaluating solicitations, we get into trouble where we are like, okay, what is the real value of that product going to be and should we go forward with it.

Second, at the scales we are talking about, we do saturate markets and fairly quickly. And that's another concern. It doesn't mean it's a barrier necessarily, but it's a concern.

XXX: XXX, can I go back to your question earlier a few minutes ago about what kind of work should we be supporting for the

DOE?

My observation is the Office of Science does very good, wide open discovery research. The EERE is very prescriptive in their technology development.

And what you are missing and what you are losing is new ideas, not discovery, but here is a technology that should be explored.

And an example is hybrid processing where you combine both biochemical and thermal chemical.

There is no opportunity in the DOE that I can discover to get those ideas put forward. You don't have programs on solicitation in the technology development that say let's see some new ideas, give us a new idea.

Instead, it's operate for 2,000 hours with this catalyst. That's what I see coming out of the EERE, and maybe that is their mission.

But I think then, again, you have a gap between the fundamental research, the discovery research and this commercialization activity.

XXX: How do you incentivize that? I think there is definitely a need for that. But then it's almost as if you need to -- I mean, you can do a systems analysis, but the pilot or the demonstration is the key in those integrated technologies.

And that's where I see the difficulty or the high cost in evaluating those types of situations.

So I definitely think we should go down that path. But from a realistic standpoint, how do we test it?

XXX: Bob is absolutely right. If you want these technologies that we are pushing to commercialize to progress to be low cost -- because after all, the first commercial embodiments aren't things you run out to replicate without loan guarantees and the like.

There needs to be a full pipeline of innovation. And there is a huge gap and a key reason in my opinion in the absence -- somewhat absence of the recognition of the problem perhaps. If you look at the review audiences, if you look at the review audiences for these two kinds of solicitations, if you are doing a bioenergy research center-type review audience, it's the leading academics in the field, most of whom actually don't know about commercializing technology and aren't oriented towards that and are predisposed towards discounting anything about that.

And then just imagine the review audience for a loan guaranty, it's a completely different beast.

XXX: Even the EERE, I have often said -- and I get shut down -- I want an office of applied science.

If you look in the universities, they have a sciences, physics, chemistry, and there is engineering. And somewhere in the middle, there is a department of applied science. And there is a good reason for that.

XXX: Let me add to what XXX said. You share with XXX expressed to some extent, though, I would say my observation was in the last several years and the EERE side, the prescription feature becomes less relative to 20 or 10 years. So they do move to (inaudible).

But, overall, I think we have to think about the general question you raised in your talk. That is are we going to broaden our technology pursuit or are we going to narrow our technology pursuit so we can put our limited resources to make a big splash.

I think that's a general question for the DOE to address.

And, of course, we hear yesterday and I will continue to hear that and I do not think that's a question which has easy answers.

XXX: Even how to do we get to an answer.

XXX, I know XXX has major investments, large research programs. And you

have got to be wrestling with this thing internally as well, how do you narrow the funnel, when do you narrow the funnel, when do you bridge the gap.

XXX: In listening to the conversation, I think what's challenging from the government perspective is one facet of the problem.

You have EERE coming out with let's build a commercial facility but can't do any research under that grant. But the whole concept of let's build faster, maybe take more risk requires you to address resource gaps at that scale.

So, in essence, you are asking both for what's needed and you are saying -- there are two things that are needed. And you can't have the other. You have to find it some different way.

So, in essence, my argument is that we are pushing it too quickly down that pipeline and we're focusing more on the research and really getting that do it like in a grand scale.

So you still do it quickly, but you do it at the right scale and then build a big facility.

Innovation at the large scale is slow, expensive and wind up failing just because of

its own weight. I really worry that that's what is upon us potentially.

XXX: We are making it harder just by cutting that research.

XXX: It's very prescriptive. I understand because of the legislation and legality and a lot of times it becomes very prescriptive. I worry about it becoming overly prescriptive that it's motivating failure.

XXX: You can bring up legalities in some of these solicitations, for example, when they don't exist. That's very convenient, especially for people that consider the federal system to be totally opaque.

My attitude here is -- what I mentioned in passing yesterday -- is don't try the frontal assault when you can get in through the side door.

For example, if you work harder to try to get a joint solicitation across several agencies, you can accomplish that. You can have the facility, for example, funded by EERE and have a piece of the energy department or a piece of the defense department and the Office of Science at some point.

It isn't impossible. It just requires more work and creativity to do that.

We did some of that in the global chain program, for example. When we had joint

solicitations and individual agencies and individual agency managers who managed to squeeze in their particular piece -- I don't know if you remember some of that, XXX -- it takes more work, but it can be done.

And it's more likely to happen as opposed to EERE change its DNA or the Office of Science change its DNA.

XXX: In learning from you yesterday, I don't know what the form of government in terms of MOUs and how the inter-agencies work together.

Why at XXX have we formed a lot of joint ventures? It's to solidify that partnership and enable it and also create that solid mission of saying parts have to come together.

It's like the USDA, DOE, feedstock conversion products. If it doesn't naturally come together, whatever we can formally do to bond them together, I think that's what is going to make this successful.

By keeping all the parts separate and discrete, DOE, Office of Science, EERE, USDA, we have to figure out a way if you are going to move it forward to do it in an integrated fashion.

XXX: It's not easy. But it can be

done.

XXX: You would say that that's better than to rearrange the boxes? You can't manage a reorganization of the DOE?

XXX: No. I don't think that was on the table. That's why I didn't bring it up. But I think that should be highly thought about.

XXX: That can happen, of course.

XXX: Even incremental changes in the boxes would be useful.

XXX: I will add something. As XXX put it, of course, my observation is somewhat limited. I see Office of Science is, you know, (inaudible) is considered political influence in U.S. market.

So EERE does lead to your actual bags carried with its own fighting.

So how do we as community in order for the long vision achieve technology investment that's meaningful? All we can say is DOE gradually to shed from political influence from Capitol Hill what they want instead of from (inaudible) evaluation of what this country needs to give us.

XXX: So I think this exercise and other exercises are a first step in that direction.

I mean, we don't -- I don't think we know well enough yesterday what a sound

technical program looks like to go to ask for or to be able to defend against encroachments.

Once we get that story down, then you can fight the political battle, I think.

XXX: Maybe this is like picking winners, getting back to your question of which industry you have a competency based model for research and you have a project based system. I think they intertwine.

You know, it's always good to have excellence in competency. But at the end of the day, you make the money from the project. It's not an either/or. It's kind of both complimentary.

It's more like the competency model where you have the Office of Science, you have EERE where it's more upstream/downstream sort of approach.

It has to come up through some review cycle and review board and there is reasons to kill something. I'm not saying it lives forever. But get a little bit more of that project mentality.

XXX: The Office of Science does have a project mentality, but it applies it to the facilities. Go build the world's accelerator or NSA the biggest laser. And it does it well.

But we have never applied that to

energy.

XXX: The project is to support a competency than a project to support reality.

XXX: You have, I think, independently hit on a way we have started to talk about the department, at least among the team in three modes.

One is a technology push mode, which is your project orientation. A second is in a capability or competency mode. And there is a third for the department, which is an informal mode, helping inform regulatory agencies, helping inform industry itself of best practices, policymakers, things of that sort.

XXX: There's a trustworthy third party.

XXX: I think that that is a very useful parsing in the different ways the department can be working.

XXX: When you are describing project, you think about it being outcome oriented.

XXX: Yes.

XXX: Yes. Something with a well defined goal, milestones, metrics, blah, blah, blah.

XXX: That project given the political realities, how would we implement that in the government where that necessitates us choosing an endpoint, marshaling resources

towards it and we choose against somebody and then, you know, the political forces and political winds start blowing?

XXX: One of the things that -- in my short term in government I have seen is a difference in opinion about metrics and about technology readiness, et cetera, et cetera, across different areas of government and the department specifically.

You talked about information. Is there a need to come to some consensus? I don't think that's --

XXX: On?

XXX: How much wind can we deploy? How much biomass is there? Those types of things, stuff that is really important to us going down a pathway.

XXX: Resource assessments.

XXX: Certainly the materiality of things matters.

But at this stage, you know, whether it's 50 percent wind is the practical upper limit or 40 percent, it hardly matters. It's bigger -- significantly bigger and big enough to make a difference.

XXX: I guess what I'm getting at is if part of our informational standpoint is informing policymakers, policymakers see

documents and say we can have 50 percent wind and then they make policy of it. And they don't have -- maybe that's from one arm of the department and they don't know that there are caveats.

So is there some way we can mitigate that? It seems like a lot of overhead if we didn't get there.

XXX: Couple things on that. I think it's an interesting comment.

Clearly, already, you have -- it's a very restricted role, nonetheless, quite successful. You have an information agency.

XXX: That helps.

XXX: If you were to hop over to the Department of Interior, all the way back to its formation, the reason for its existence at the geological survey was to do resource assessments of the United States: Oil, gas, minerals.

Is there equivalency broadened across the energy system? You know, they do oil and gas, that's part of the story. But there is other things in the story.

And that includes infrastructure issues, processing and all these other things.

If you said DOE's role is to have this informational picture and perhaps in some ways be the most sophisticated and complete in its view, that incorporated EIA and had some of the

elements of the USGS model on resource assessment, would that be useful?

I would argue that would be useful. And I don't know who else is going to do it.

XXX: I'm trying to understand what the EIA and what the USGS does.

XXX: Well, go to the other parts of the energy system. You have the solar part. You have the wind part. You have the biomass part. You have the processing technology. You have the infrastructure part.

USGS doesn't do any of those. USGS assesses the current state of technology, forward look at technology and what resources can be extracted.

XXX: It's the system. It's not just the individual technologies that we have evaluated.

XXX: No. It's a look at the whole geologic resource base and how it can be monetized.

Is there an equivalency for the energy system as a whole? And I can argue as complex as the energy system is, there probably is. In fact, the big shortcoming of all energy systems that you see is they don't have enough of the parts.

XXX: And it's interesting because

this line of discussion is now present in a number of different forums I have been in, that there is the need for some central analytic capability systems.

Some people throw in the social sciences which we will get to in awhile, to just credibility inform both programmatic choice and policymakers, and we don't have that.

XXX: And everybody else, investors, companies. Because right now -- I mean, and whatever internal work they might do themselves is still complimentary.

But they can plug it into something that's comprehensive enough to let them understand the boundary effects.

XXX: I don't think it's one computer model. It's comprehensive.

XXX: Question about the calling of any permanent institution or system that we are doing this type of work -- and I remind you about the Department of Homeland Security which has been now in effect for close to ten years and is a total disaster in terms of supposedly merging all these capabilities and it's supposed to be a great sum total of individual parts.

I think not to go beyond the energy challenge and what was discussed earlier about creating a task force that has at least not something permanent associated with it, it has a

sunset, you know, an objective to make a very thorough assessment and make some decisions that may be periodically revisited but not made in infrastructure.

XXX: Why was that not America's energy future?

XXX: Well, that's a good question.

XXX: I will tell you why. And I said this to Peter when he presented the answers. Maybe you are there. I don't remember.

You know, it was great. He talked about all the pieces, but there was no real economics and no rules about how do you assemble a system, whether it's a research system or the energy system as a whole.

XXX: It wasn't a lack of trying. It's too many stakeholders and too many representatives of individual cases. It would have taken us many years.

And the second report on increasing biofuels production has suffered. Hopefully you like the result when it comes out.

XXX: I mean, there is a trade-off to having an institutionalized activity. But the value -- the ongoing consistency value that outlasts public swings in the political winds of the USGS databases and the EIA databases, no task force, no report can ever do that.

XXX: This is a rand or an item for energy or --

XXX: And one of the things about energy is that it is information rich. The energy system produces vast quantities of information. Most of which --

XXX: I just caution against proposing something that's permanent, especially in the strong anti-government climate we have.

XXX: We were talking about this actually over breakfast. Put out an RFP and put it in the one of the national labs or universities.

XXX: Expand the EIA.

XXX: But some enduring nonpolitical --

XXX: It's great value, that you can go back look at things and you have a basis comparison, some reasonable understanding about it's -- you know, it's evolved.

XXX: And we are agreeing on a basis? We can work forward from this basis that everybody can agree on.

XXX: At least a transparent techno-economic analysis.

XXX: And there is an analysis.

XXX: Whether we agree with it or not, at least it's transparent.

XXX: Isn't that the institution that

should distribute the QTR for this to be a periodic thing?

XXX: That would make a good idea.

XXX: I would think it might be good in this context to think through the relationship with the IEA, who is kind of -- I'm sure people have their own opinions of it -- but it's carrying out some of those functions for the world now.

And rather than creating something totally freestanding that's U.S., it might be worth thinking about.

XXX: IEA, A, has become super politicized in my view. It's taken on political objectives as opposed to informational objectives.

XXX: I would say it's probably like our best band monitoring posture. We are grateful to the global system and contribute to it, but we want our own because it's something we can understand.

XXX: Can I comment on international? We touched on this. And I hope we it get deeper information at U.S. competitiveness.

I don't know what's the definition. I think maybe some exercise will come out some day what the U.S. definition of competition versus collaborations. What U.S. competitiveness

meant.

Are we going to talk about some broader context, say, if other countries pursue alternative fuels, new energy, let's (inaudible) oil from other countries to use, whether it's secured at a global level?

Do we treat that or who thinks we have our R and D investment, we are going to have our technology? Beside we use domestically to benefit ourselves, we want to envision the technology export. Let's set our ultimate goal for international collaboration.

So things are still vague for those of us working the international collaboration area.

XXX: All right. Excellent set of questions. Anybody got any responses, thoughts?

XXX: We have not seen an opportunity to collaborate internationally through the DOE provided supporting for that activity.

XXX: What about more generally?

XXX: More generally, we go out there and make those on our own.

But, you know, they are collaborative in the sense that we meet at conferences or we send E-mails and exchange information, but we actually don't work together except on rare instances where both parties have a bucket of money that has no restrictions on IP.

XXX: We have no joint cellulosic

ethanol projects with Europe, for example, or do we?

XXX: No. I think all the activities I personally participate are primarily in the information exchange.

XXX: There has been not zero, but perhaps what could be expanded.

But there are interactions particularly between the U.S. and Canada, which is -- you can argue Canada is part of the energy system. As a practical matter, they are.

But that's one. That's the easy one to do, of course, in many ways. But there are some and even in the bio area.

XXX: Fossil, the golf Mexico is Texas and Mexico, right?

XXX: Basically, it's basic science. ES, U.S. is mostly in the basics. Synthetic biology is one example.

XXX: Basic science.

XXX: Right. So we have -- you all may not know, we have a clean energy research center established between the U.S. and China. And it is focused on three areas, carbon capture and storage with coal-firing, vehicle efficiency or precompetitive vehicle research, I guess. And the third is building efficiency.

And, frankly, we have not sorted out

the cooperate, compete dimensions of those activities.

Some of you may be involved, actually, in some of the negotiations now. I would be interested to hear your perspective on are we making progress in sorting out these dimensions or not?

XXX: I think we do. And I think in the IP area, it says each country will do its own technology. So it's a clear for IP related R and D.

I think the area everybody agrees is the area that most countries should work together as a standard infrastructure, how we can work together to pursue common issues so we are not going to go to two separate paths there. And add if technologies are going to be the global scale, they are suddenly --

XXX: So it's a standard issue.

XXX: Standard issue, code, infrastructure and how we can engage the whole country, U.S. and China, to pursue efficient technologies. I think it's very clear there.

There is still some disconnection in terms -- because in order to work in those common areas, information exchange is critical from both sides, two-way street.

On the Chinese side, they trade information exchange here even as a sensitive

area in general, as specifically if those two -- three centers, in that area, we engage from Argonne and we observe that activity.

And we still work with them to communicate the information exchanges in order to (inaudible) the information you had in mind for those general purposes.

XXX: Could I ask another aspect of the international dimension, how is the U.S. position in terms of its RD and D internationally?

And let me start first in the biological conversion routes. Do we need the world? Are there other folks who are moving more rapidly? Does it matter?

XXX: I think we need the world, but I don't think it's any kind of a foregone conclusion that it's going to stay that way.

XXX: I think we lead the world in some of the most attractive initial application overseas.

Someone made the distinction earlier between generating the technology and building the plants. But I think it's pretty clear we lead the word, actually.

XXX: I generally agree with that. I mean, the feature we talked about generally right now is to discount the Brazilian sugar

industry. That's kind of a forerunner there.

XXX: How about on the thermal chemical conversion issues, whether it's CTL, GTL, BTL?

XXX: Europe does quite a bit in that area. But I think the U.S. perhaps is well respected. And I think a lot of parts of the world aspire to do some of those things, including Brazil.

For example, they see the need to improve efficiencies.

XXX: But we are not practicing CTL in this country and we are not doing GTL to my knowledge.

XXX: From a commercial standpoint, I think we are.

XXX: I think that's where we fall off. Just looking at deployment, because we are not deploying, we are not selling the technology. So we never get the market. We have the knowledge base.

XXX: I think if you look at the -- certainly, there is a range that I would agree with the bio assessment.

But I would say that on traditional fuel processing, the U.S. is still a primary origin point in the process as evidenced by the fact that most of the licenses around the world for that technology come out of the U.S., even

though the U.S. is not building any new refineries.

And I was going to say that on the resource extraction industries, you have still the center point for the development of oil, gas and coal technologies. We are dominant probably.

Brazil's oil development is a direct result of technology transfers from the U.S.

XXX: To your question a while ago about, you know, focus on new invention versus accelerating, developing, deploying, you know, the technology is going to migrate. And we will build these plants all over the world. And, you know, people will start to copy, even maybe misappropriate.

If we don't keep the innovation happening here, then what do we have if the manufacturing is overseas and copied?

XXX: So how do we keep the innovation going here? We need some manufacturing here, even if it's just as an adjunct to the innovation.

XXX: I think this needs to be an attractive place for people to not just get an education but just to stay.

XXX: The whole purpose of this exercise, somehow this issue can be exposed to

some level that is we can have technology innovative discovered here.

But if we have manufacturing advantage, then operations, Chevron, DuPont, are going to go to other countries to build, to use technologies to make as was clear in the last 20 years as what has happened in China.

So how do we envision ourself when we continue to pursue and invest in R and D here? But how can we benefit more? They just, you know, sell technology to some extent.

I think Shell gas is a good example in terms of selling technologies and get more then just certain technologies.

Now, we have the Chinese companies come to buy some U.S. companies with Shell gas technologies.

So is that what we envision or (inaudible) others that are going to buy the companies with technology or we want to have manufacturing capability ourselves?

XXX: The big companies have a choice. We had this in BP. And I'm sure Chevron, DuPont, Shell. You can move your R and D over there also. You have the manufacturing over there for the reasons we talked about. And you see lots of research centers getting established in China or India. So then we have lost everything.

XXX: At least.

XXX: I think in order to keep that capability here, we need to build plants. And part of the reason China is building plants is they have an energy plan and vision. And they have a political well.

XXX: And a system.

XXX: Completely. Right. But they also have a long-term vision that they are following. And they are making choices along the way.

You saw that when they had like nine CTL plants and they trimmed it back to three. But they have a vision. And we don't have that.

XXX: Well, I'm not sure I would agree we don't have it.

It's important to understand -- I agree with on the research and innovation. The U.S. has one resource base that the rest of the world doesn't have now, at least at the scale. And that's the researching systems, order of magnitude are bigger.

So there is that. And that's an important aspect.

Remember multi-nationals, I think the key aspect is it doesn't matter whether you are building -- from a competency point of view, knowledge point of view, development point of

view, innovation point of view, it doesn't matter whether you are building the plant.

If you are the operator, you are going to integrate that knowledge across the globe. That's what you do. That's what multi-nationals do.

Having said that, if you don't have a home base, there is no question in the long run that's going to do something.

But the good news is, as everybody is saying, U.S. has the resource base. That's -- ultimately, you can argue that's a differentiating position compared to almost anybody else.

So the question we would ask is what are the barriers to keep you from doing it here.

XXX: Speaking the biomass resource base?

XXX: Biomass, coal, gas.

XXX: We have a good biomass resource. It's not better than everybody else's.

XXX: No, but it's better than Europe. It's better than other equally advanced economies.

XXX: But we don't have the political system.

XXX: That's now, so what are the barriers?

XXX: We are talking about it.

XXX: The other thing you have in the U.S. is you do have a long-standing set of -- and they are shrinking in number.

But you do have a long-standing set of multi-national organizations that do this for a living. They have capital. They have technology. They deploy globally. They serve global markets. They aggregate. And they move their knowledge about. And other countries have those too. The U.S. has more of them.

XXX: We also have more start-ups.

XXX: That's part the innovation system.

XXX: I really come back to -- so there is some parts of the absence of developing political will in the United States that are way beyond any of us to change.

But I come back to this point that I think that the sort of corner -- at least for the part of this discussion that rests on biomass, which I don't think is the whole thing, if we are here to talk about alternative fuels, I respect that.

But for that piece, I think that a lot of the inability to move forward is a general uncertainty about the feedstock issues. And I think part of that is somebody wants to see something from some feedstock other than an agricultural crop.

XXX: Do you think it's that technical or it's just the uncertainty about future price regulatory market conditions, whatever you want to call it?

XXX: I don't think it's that analytical. And I personally think people often talk about the need for education. And I work with people in Europe on some of these issues and some of them are experts on GMOs.

I have come to the opinion on the GMO issue, I think the fundamental division of opinion is public and the experts are less divided.

I actually think in bioenergy it's the other way around. I think it's the experts that are divided and disagreeing with each other, even when people getting together are drinking Kool-Aid, which may not describe this group.

But I think the public is interested. But you have whole organizations about -- public organizations about anti-GMO.

Frankly, some of the environmental groups are getting close to that on bioenergy. But they are mostly opposed to the only bioenergy they see.

So I think a lot of the inability to really do all these grand things boils down to uncertainty about the feedstock issues, which will be partially provided when people see the

train pulling out of the station on other feedstocks. But that won't be enough. It needs more of an intellectual development in my opinion.

XXX: It's the whole supply chain, it's not feedstock. It's not just conversion. It's not the end-product market. But it all has to come together.

Any particular weak link we are going to kill the proposition. And at least from a motivation perspective, from a business perspective, it ties back to policy and that policy -- the reason I believe a lot of the innovation here at least versus other parts of the world, probably outside Brazil, we have a pretty solid policy. You know, why is Europe not doing much in the sector?

We can argue a lot of reasons for it. One is their policy tends to be not supported. It's more a directive. And it's not a mandate. It's brought to individual country levels and it gets diffused very quickly.

So if we can keep teeth to that policy and say there is a market there in the U.S. and that market is going to be real.

XXX: Well, we have RFS-2 and that hasn't done a whole heck of a lot on the cellulosic side.

XXX: When push came to shove, it was dialed back. So up until that point I said yeah, great. But they didn't really run the real experiment.

XXX: You all who are closer to it, what would have happened if the government didn't dial it back and just said that's the law?

XXX: I think you would have had more money stepping up to the plate to fuel the production side of the industry.

XXX: I think consumers will pay for it.

XXX: We are paying for it now.

XXX: I don't think there was a chance in hell they wouldn't have dialed it back. By a wink and nod that was the understanding.

XXX: So the goals are everything.

XXX: On the other hand, I think some of -- if you look at the numbers between now and 2020 and think some of us, myself included, thought the goal was unrealistic anyway.

XXX: From the beginning.

XXX: From the beginning.

XXX: Here is where that energy analysis institute or whatever would have helped.

XXX: I thought the EPA would come up to say something about the goal, whether realistic

or not realistic, they were foreign countries. And I was surprised EPA did not comment on that at all.

XXX: In response to whether it would make a difference, when I think of the XXX board, which includes oil industry representatives, they are much more concerned with the (inaudible) than they are with RFS. Hands down.

We have people from -- we have board members from the oil industry that say who is going to want what you are making. And that's a blend well issue.

And it's only in the U.S. In fact, I reminded them, that's not a global situation, that's a U.S. situation. So you can imagine where that leads your attention.

XXX: I would agree with what he said. So that's number one.

I think the bailout clause is number two. Then it's an issue of how committed are you?

XXX: Right.

XXX: Speaking to what you talked about as far as the supply chain goes, there is also an issue of you can have your whole supply chain taken care of and you can have a NIMBY issue. And we have seen a lot of projects ready to go,

they had a location, they had bio and feedstock and everything and had technology. And NIMBY came up and they couldn't. NIMBY, not in my backyard.

XXX: A general problem to manufacturing is not an issue. You know that.

XXX: So what are the -- there is NIMBY. There is clearing. There is the banana business. There are financial regimes, labor costs, all of these don't work in the right direction.

XXX: There is at least reason to be optimistic. I don't think -- well, there is reason to be optimistic that biomass-based plants will have positive rather than negative backyard connotations.

The reason I say that is if you look at the way the corn co-ops in Iowa respond to ethanol plants, all right, their municipalities want to do anything they can to move this along. It's regarded as home-grown, supporting the economy and the rest of it.

We are actually observing the same thing in the northern peninsula of Michigan where the paper industry is exiting and they are just praying we succeed.

XXX: So those 30 biomass plants in New York state somebody talked about yesterday, that should be a done deal or there is going to

be a lot of problems.

XXX: Nothing is going to be a done deal. We have things that bite you like odor and all sorts of things.

I don't think it's necessarily an uphill slope either. It needs to be done with care.

But any time you are engaging the producers, you are not going to locate a facility away from the producers. And if you would, you would get NIMBY. If you are engaging the producers, it's not hopeless.

XXX: That is a question of the hazard level of the facility and for the biochemical process. And these are not biohazard facilities.

Not unlike how corn is proliferating in the U.S., we are not expecting a huge NIMBY problem. There is different people with different projects. That doesn't exist and it's like how can you come faster.

I am not saying it won't be a problem. We haven't built it yet. So to us, we are not seeing it.

XXX: Just to add a little color to that, there are some state environmental groups in Michigan who are a bit concerned about what all of this might mean for the forest health.

We have other environmental groups saying how can we help and we will try to calm them down.

So, again, I'm not saying it's a done deal, but it's not hopeless.

XXX: In Pittsburgh we have a history of resources extraction and chemical plants and whatnot. So when dealing with Marcellus Shale ethane and the wet gas, people want to locate a facility in the Pittsburgh/West Virginia region.

We have that same thing, everyone wants that facility to be here. At the same time then you will have an MSW plant or a plant that wants to take chicken parts and it's a huge waste stream and they have a place to build it. And it's a high populated area and people don't want the plant built because there is some issue.

And so it -- you are right, it totally depends on the people in the region.

XXX: There are going to be processes and places you can go to create bad situations. That's going to be everywhere. I think there is enough opportunity right now.

XXX: Why don't we take 15 minutes or 20 and we can reconvene at about 20 after. Good, thanks.

(Short recess taken.)

XXX: This has so far been a really good discussion because I think we touched on a

lot of things that are QTR generic.

And I think for us on the team also, it's been interesting because a lot of the discussion is validating the thinking we have been having over the last couple weeks about how we talk about these things and what really needs to be done.

I would like to bring things back to a little more fuel specific, not we all, but we the team are going to have to write something about this.

And I'm trying to figure out how to ask you all the right questions so that we get something that's going to help us with the writing.

And I can start with the highest level one. When we write down, you know, the DOE's portfolio principles in the field of alt fuels are the following, what do we put in that blank?

XXX: In terms of the metrics on how to select what to do?

XXX: That's right. We have heard many different things we could be working on, all the way from full-scale demo and deployment or the cellulosic pathway or ethanol or drop-ins, many different choices.

I'm not asking about the specific choices now. I'm asking the principles by --

how do we tell the story, saying these are the things we want to work on because.

XXX: One significant impact to the U.S. is fuel market. We know that's at least several billion gallons of potential fuel could be made from that.

XXX: Okay. So one level is materiality as we have been talking about it.

XXX: Yeah.

XXX: Where would you set that level of materiality?

XXX: Cost competitive.

XXX: Well, we will get to the money in a minute. There is money, materiality and maturity I think are the criteria at least so far.

Let's talk about materiality for a minute. If I can only do a billion gallons a year, if it were diesel, you would say that's pretty good.

XXX: It depends on how much money you are putting in to support it. So I think the lesser the opportunity, the lesser money.

XXX: Million barrels a day, that's what ethanol is today. That's enough to move the needle. That will adjust the rest of the petroleum system at that scale.

XXX: I will add an amendment to this. I have said maybe a million barrels is too high

to use.

But I think maybe it says something like if this is some small volume but it's transition to something paper.

XXX: So, I mean, there is a cost of learning curve. But unless you could be sure you get to a million gallons a year --

XXX: The theoretical market, you are not ever going to achieve the theoretical market.

So I don't think we have numbers in the billions of gallons at least for what we think. You are going to get some fraction of that market potential.

So the question is you look at, you know, doing a research project or proposition. If you can't get at least a billion gallons, I would say you are wasting time.

XXX: If you believe -- and I do, if you believe the biomass resource-based story world-class resource-based, if you believe you have world-class other resource bases, then you ought to aim for something big enough to matter, another million barrels a day out of biomass or a million barrels of synthetic fuel.

If you start to do a million barrels a day from efficiency, then you really made a difference in the security structure.

So, yes, it may be a little high. But it's not -- you know, it's not an inconceivable number. In fact, it's not an overwhelming number if you look at the size of the resource base.

XXX: How much you make in generic would be in that statement. If you talk biomass in general, not all biomass is created equally.

XXX: It's a good place to start. Maybe we can start teasing out. Okay, where is it, how accessible is it.

XXX: You know, if it's not going to get you a million barrels a day.

XXX: Half may be big enough. But it has to be in a factor of two or that.

If it's a hundred thousand barrels a day, it's not enough to make a difference.

XXX: I agree with that and I agree with XXX. It doesn't have to be in the first embodiment.

I point out one utility of that is to weed out things that are motivated by other purposes, but people want to wave the bioenergy flag. And I think soy bio diesel. I think it's a case in point. So I think it's useful to weed those things out.

If I were telling the story, XXX, in addition to talking about the need that's being responded to and in addition to talking about

the materiality and the cost competitiveness of the response, which I think are necessary pieces, when it got to actually talking about sort of the structure or framework for the actions taken, I would say it is the DOE's intent to both get important things going in the near term that can over time act catalytically so that the private sector moves them forward and they get into the development curves sooner.

XXX: Acceleration.

XXX: Acceleration, both accelerate to initiate near-term change and also to anticipate long-term change.

And I think it's very logical to have a different set of -- first of all, to actually be explicit about how you are allocating resources between those two. And, secondly, to plan for them differently.

I think it helps make it coherent thinking about it and it helps make it coherent to understand it. And things fall out as to what they are important for. It's just helpful, I think.

XXX: I was thinking -- you know, first of all, I agree with what XXX said about the million barrels or something in a factor to that.

I look at it more like a

two-dimensional thing. On one side you look at the oil security, greenhouse gas, environmental sustainability and the cost competitiveness.

And along the other axis would be then coal, natural gas, biomass and have everything gone under consideration rather than just concentrate on biofuel.

XXX: Right.

XXX: The one question I have is should we write our statements as targets or goals, which, you know, a million gallons or a billion gallons or whatever.

The government has a long, long, industry of doing that. One can argue whether that's effective.

Another question is are there policy statements that we can be making about what the role of the program is in the alternative fuels.

That's a different way, right, of thinking about it, which of those is most useful and which is most effective.

XXX: Goals are problematic. And the reason they are problematic is because the DOE doesn't make this happen.

You can talk about potential and possibility. And you can talk about the policy gap that would help achieve that.

But since the DOE doesn't control that, I think you don't want to -- this is XXX'S

umbrella organization across the different agencies might set goals because they might have the power to implement it, maybe not. But DOE clearly doesn't have it by itself.

XXX: Instead of setting goals, the recognition that these are drivers that -- these are the scale of things that for energy in the national interests should be achieved, that you -- and you recognize the context. So you are not going to drive programs that are not going to at least enable progress, enable the achievement of things at that scale.

You are right, you can't set them as goals for DOE because DOE can't do anything.

XXX: Our words are enable, facilitate, catalyze.

XXX: But did you recognize this is a legitimate ambition and it is within technical resource risk and means to achieve them?

There's a lot of other players and a lot of good things that have to happen around them.

But those are legitimate. If you were to get to those kind of numbers, even approximately, you would have shifted the energy system materially in the United States.

XXX: I think those are important. I was surprised by the number of metrics and

specific goals and deliverables in the DOE's strategic plan.

So you are going to write them down and say have a reduction from baseline there to that. You better have a program or some management process behind that or don't write them down.

XXX: There is this disconnect.

XXX: Maybe one way to justify an elevated and more empowered energy entity is to say Mr. President -- you don't have to choose this one, you can choose any of the last five -- you keep making promises, you keep looking to the DOE to deliver and, in fact, we don't have the wherewithal to do that.

XXX: And it's not just money.

XXX: A lot of these goals came about, XXX, remember, there was a government performance and results act that made federal managers have goals for their programs. And if it wasn't numerical and time, you know, specific, then they sent it back. Right?

XXX: We have had in putting together the strategic plan an ongoing discussion with other parts of the government about extensive goals versus intensive goals, basically. And so many gigawatts of wind.

This is not in the department's purview as XXX said to make happen. We just can't.

It's regulation and business.

XXX: That's always been business. People that don't know government think that DOE is a regulatory agency.

XXX: You can still track the nation's progress towards the goal and ask yourself where can I be a catalyst and make that happen.

So I think you can frame it in a project way to be supportive of that goal but challenge yourself to say that versus just saying it's out there and I'm here and I can't connect the dots.

XXX: So we have talked about already the materiality criterion.

Let's talk about the money criterion. You know, is $3 a gallon good enough if you could confidently get to that or do we need to go lower?

XXX: Wholesale or retail?

XXX: Whatever it takes to make a real business case absent government incentives.

XXX: Are you talking about the criterion for the entry technology?

XXX: I will give you the learning curve. I will give you scale and learning curve. $3.

XXX: That's pretty good right now.

XXX: I don't think that's the appropriate way to look at it, frankly.

And -- because, you know, we have talked about bio diesel. It's very evident that the world supply of vegetables oils is now highly correlated to the petroleum price. Five years ago that was not the case.

XXX: Corn too.

XXX: If it's not at will.

XXX: The supply is correlated?

XXX: No, the price. The price of vegetable oil on the market is highly correlated to the gas oil spot runner to be specific.

We use soybean oil, actually, as the benchmark. Everything else in the world is priced off that.

I think it's inappropriate to actually say a number. I think that you have to recognize that these correlations are going to occur. And the same thing is going to happen, ultimately, to biomass.

It's going to correlate today to petroleum price. So, therefore, I could suggest that we try to think about it in terms of that correlation.

I don't know whether it's going to be 60 or 300, frankly.

XXX: But that's the same kind of uncertainty that enters into a decision to build

GTL plant or CTL plant, right?

XXX: I think there's a distinction between cost and price. And any benchmark metric could be set as a function of cost.

XXX: Cost of what?

XXX: Required selling price, right, because that includes your return.

XXX: So you have the cost of the raw material. It is typically pick a number, 60 percent, two-thirds of the end product. Then you have got the conversion efficiency and you have got the conversion cost.

You have got depreciation. And you add those things together to get to a cost that you -- financial cost that doesn't include any profitability. So the calculation is --

XXX: Add 15 percent to that for profitability, whatever number you like, and that's the benchmark you are trying to shoot for.

XXX: At the end of the day, I don't think the purpose is to justify a price. I think it's to justify something is worth doing.

And if you want to make that argument building some things XXX said, it seems to me you can say, look, at 50 to $100 per dry ton, which is a pretty broad range, and you can get a lot of biomass, even at the lower end of that

side today, but until cost effective biomass conversion processes start making it fungible with energy, it's going to keep -- that's the being thing that's going to equate with oil.

Biomass is not equated with oil now, although agricultural crops are.

XXX: The demand for that purpose is not there.

XXX: That's my point.

XXX: When you start to create demand --

XXX: But that requires successful cost effective processes, in which case you are over the hump. We are talking about getting over the hump.

So to me what you say is, look, at least we are partially talking about that.

I mean, at $50 to $100 -- and you can make it 150 if you want.

But at 50 to 100 biomass is from a third to a half cost per giga-joule of oil. And I think one could say, look, take a stand back from all the detail models, is this stuff intrinsically harder to process than oil. I personally think no. It's a solid. That's a pain in the ass.

However, it's more chemically substituted, which means you can do more with it. And you can do vastly more with

biotechnology, not once, but twice, once on the feedstock and once on the conversion process.

To me that level of argument is about as convincing as the long thing with the 15-year discounted cash flow and all the rest of it.

XXX: I don't want to try to solve that.

XXX: I think the challenge of setting costs, they depend on the business model. Well, you have to make some assumption about the nature of the business.

I think there is an analytical role -- and this will get back to the information. There's an analytical role that will look at a range of perhaps outcomes and say that this technology investment could be a lever to reduce the capital costs of this component by (inaudible).

But setting an output cost may not be valuable from a technology point of view. At least when we used it do it internally, that's very difficult.

But what you can do is we can say we can make this piece this. And then when we integrate all the rest around it, technically and from a business point of view, that looks okay.

But, ultimately, the people who do that

won't be DOE.

XXX: Right. We should have an informed confidence that this could be economically competitive.

XXX: A techo-business analytic capability is useful. The idea of setting hard targets on specific thoughts may not be valuable.

XXX: What you are going to find out is none of these technologies compete yet with petroleum. So it's a futile exercise unless you view it as now let's start playing with the numbers and see what is it going to take in order for processing to get these costs down, where is the major bottleneck.

XXX: If somebody gets clever enough to put together a combination of assets and businesses and say, you know, this is getting in range, maybe I can start to think about doing something, they may have a model how they are going to do that that you might not have.

So I think the cost issue is not -- in the end, it's the investor that does the cost issue, not DOE.

XXX: You get back into the cycles there. I can see talking about targets without incentives. But if it's targets without some supportive policies or mandates or segregations of market, I mean, you start to lose all aspects

of environmental concerns in the proposition. Those are boundaries.

So my assumption is there is a supportive policy environment that says these things will get to market.

Now it's a question of getting to market where it doesn't perturb the overall fuel supply cost approach. So it doesn't double the price at the pump. So you are bringing forward a high cost of manufacturing product.

So you can look at it as setting some threshold, saying we believe that it's almost like a cap on it. If the technology can't be perceived at least less than this, it's uninteresting.

But to say an exact number what this needs to get below eventually one day I think it's difficult.

XXX: Somebody suggested GTL as kind of a cap or the benchmark or whatever. If it can't be GTL at $4 gas, then we shouldn't be doing it.

XXX: If you don't know enough to make a case, that doesn't mean you get written off. But it does put you in a different category. I would tend to put algae in that category, but I may be wrong.

XXX: It would be steps in that

direction.

XXX: So another third dimension, a

third dimension is maturity and time scale, how long do you think it's going to take here to get to material impact?

You know, it seems to me if it's 10 or 20 years, great, all right, we can do that. If it's 50 years, we shouldn't be spending a lot of time on it.

XXX: It's like a return on investment analysis, where are you. And the further out it is, the higher the discount rate that you apply.

XXX: Estimated cost is adversely related to ignorance.

XXX: What I would like to say is it's a better pipeline approach. We believe something is going to pay off and like cellulose gas line, we expect this potential in that time frame and that time frame, when are electric cars coming.

Look at all your goals. What's the pipeline time frame knowing that you've got the cars come out with less clean electricity, but which are going to transform into clean electricity. Showing the connectivity can be

important.

XXX: That doesn't mean maybe you don't do really long-term things, but they are just part of a portfolio.

So I come back, if this is just a financial deal, I know how to construct a portfolio, all right. I mean, efficient, frontier, at least it's some guidance.

How do you build a portfolio with things that are much more difficult to quantify to compare apples and oranges together?

XXX: I think there is one issue we need to address in the metrics before we get to that and that's the carbon loading.

You mentioned other -- the other important criteria.

XXX: I can put that in the money. I can put that in competitiveness and say price of carbon of $50 a ton or whatever. I think you can put that.

How do you build a portfolio of technology?

XXX: XXX, isn't there an issue of whether or not the government would invest eugnostically in technologies that were a carbon wreck, but were so cheap they can still compete? At least to me there is a question there.

XXX: Yes. Where are your principles, basically.

XXX: That's a short-term principle versus a longer term principle. Could you do that for the next 20 years?

XXX: I am making a separate point, monetizing carbon may have its limitations in this context, I think.

XXX: If the oil price goes up to $200 a barrel, CTL starts to look pretty interesting independent of CCS or not.

XXX: I think you have to recognize the carbon management pricing issue in the portfolio as clearly one of the future scenario pathways. Okay.

I mean, there are other ones that say, you know, you have been involved in the National Intelligence Council. So there are studies that say, where this is an all out, you know, who survives in the world scenario, that can go out the window. We will survive, but we will build the dikes and the hell with everyone else.

So if you get that kind of security mode where it's survival mode, that can go away. I think in today's world we have to have a reasonable -- and the question is how is that represented. And I think there is the price. That's one way. But there are other ways to think about it.

The whole low carbon fuel standard

model, which says it's an integrated supply chain view of carbon management, not a straight up model.

XXX: At least in the near term, it does not potentially get both of them together before you necessarily start saying I need to jeopardize the environment to find my energy stream.

I think that there is enough out there -- I will use bio as an example -- of untapped potential that could be brought to the table to bring both together.

XXX: Are there other dimensions besides the money, maturity and materiality we should be thinking about?

XXX: Some independent assessment of probability of technical success. I mean, what's the technical challenge and how surmountable is it? It gets back to the time scale question. So maybe they are hand in glove there.

So having a disciplined process that has some objective point of view. So I think in picking winners with the government, everything is political, I presume.

But, I mean, could you put together, police it in these advisory groups to give a formal -- run a formal process whether it's the national academy of engineering or sciences or

what form it needs to go to? There has been some studies in the past done.

XXX: We have done that for the sun shop. So there is one in which the department decided that it's interesting enough and likely enough to make a concerted push. And that was after a fairly careful analysis of what the private sector was doing and what the technology was.

XXX: It may be a detail. But it's important that you give people with an idea a chance to make their case.

All world changing ideas start out as minority views. If you are always governed by the majority view, you will never innovate.

In other words, you can have a review board, but the review board should be responding to a case made by an innovator as opposed to saying, well, we got together the best thinking people and people all think this is hopeless.

XXX: I look at them like third-party reviews. You are bringing the case forward to respond to. It can be nonbinding. It's a matter of being informed.

XXX: So we do that in the science arena. That is the mode of business, send me your proposals.

XXX: Not so much as it moves to DOE

within the application side.

XXX: So you think that that's a good way to be doing business on the application side?

XXX: No. Too constructive.

XXX: The solicitations have been send me your proposal for cellulosic ethanol. So you are missing a lot of technology opportunities.

That's what has been missing, I think, from the DOE.

XXX: I'm frustrated by all the stuff I can't propose in cellulosic ethanol. I'm dead serious. Because they have been so overprescribed.

XXX: Yes.

XXX: So the problem is overprescription.

XXX: Hyper-prescription.

XXX: What Bob said is true too.

XXX: There is another layer I put on top of the grant proposal -- and I don't know that I have an answer or a suggestion.

But the extent to which you are trying to focus on the experts what they are best at versus forcing integration between unit operations which ultimately you end up at different companies and how realistic -- I mean, you wouldn't have the undersea robot guys having to work with the guys that build gas pumps.

They are too far apart from each other.

And some of these things, you know, when I look at these and I can nail this and I can nail this, but you are going to make me work on feedstock logistics, you know. Or I'm going to have to partner on it, okay, fine, but it's not always a great fit.

XXX: But somebody has to bring it all together in the end to make it all work.

XXX: Catalyzing innovation and catalyzing a complete supply chain are not the same.

The DOE acts as if you are trying to catalyze the whole solution instead of paying somebody to do something they do well. I couldn't agree more.

XXX: I think that's roles and responsibilities; that's EERE versus the Office of Science. That's the enablement in the Office of Science and more about bringing together all the pieces in EERE and make it happen to the point of we can see industry taken -- it seems to me like the launching pad in the industry is EERE in the industry.

But, you know, for EERE, they have had solicitations that are more open, not saying bring me your crazy ideas, but bring me conceptual ideas.

So they are moving along those --

should there be more, yes. Should some be less prescriptive, yes. But they are not all bad either.

XXX: I agree with you completely. But I think it raises the question for DOE. What is DOE's construct and role in this integration?

Because integration, if it doesn't happen, then you have got nothing. There is no outcome.

XXX: So isn't that the private sector?

XXX: But the question is, is there a role that enables that and it probably has different dimensions and considerations than the basic science role.

XXX: Or the technology development role.

XXX: Technology development role. And it's, nonetheless, important.

And it may be crucial -- and here is where I think DOE could have a role. There are supply chains which are basically if you are going to ramp them up and make them part of the energy solution -- we talked about geothermal as a great example. The supply chains are broken. They can simply not function because the industry itself has not been constructed around that for a long time.

One could argue coal to liquids has exactly the same problem. Resource owner and process are not same. That might be important.

So I think those areas where integration will be important to advance the goal, but the supply chain itself is simply deconstructed.

So what is the role of DOE in maybe initiating activities that would eventually reconstruct that supply chain both with existing entities and these new entities that fill in the cement?

XXX: I guess there is some merits and some focus from the government on time scale purposes, not everybody worrying about the infinite amount of time in the future. It's sort of like who is really hyper-focused on delivering something in the next two years, who is really hyper-focused about the potential in the next 10 to 20 years.

Again, EERE should be more focused on the let's make this thing happen in the next two years. And Office of Science is like I'm going to worry about the 10 to 20 years trajectory of research.

XXX: This came up in your breakout session yesterday morning, the concept of hitting lots of singles and incremental developments and deployment to get to an end

goal as opposed to counting on the home run.

XXX: Are we in the DOE too focused on the breakthroughs and not enough on the -- you know every press release we put out has got breakthrough in it.

Is the mentality still too much breakthrough and not enough singles?

XXX: XXX, are we not going back in history? Some of us are old enough to remember in the Carter Administration we had all these pilot and demonstration projects with coal and fuels. And when Reagan went away, there was a sun fuels court but they never built anything. Are we not retreading that?

XXX: And I talk a lot to John Deutch who was the agent for that. Are we not retreading the same thing and how do we avoid the same mistakes?

XXX: The question is were they mistakes?

XXX: If we went ahead about those projects, we would be in much better shape today.

XXX: From an energy security standpoint, we would be in a much better standpoint.

XXX: Greenhouse gas not so much.

XXX: Try to address your question, I

would not like to see the DOE be less breakthrough focused because I'm thoroughly convinced that the world needs breakthroughs in energy and the DOE globally is, hopefully, going to be effective in that.

You know, sometimes you look at choices you try to avoid. You know, choosing between breakthroughs and making steady process is a discussion that if we can avoid would be nice to have.

I see -- the much clearer place I can see where there is really a deficiency, you know, it's interesting because you actually said 0 to 2 years and 10 to 20, which leaves a gap of 2 to 8.

XXX: Or 2 to 10.

XXX: I think that the reality is if you only bring the mind-set that would enable 10 to 20 without thinking of the 2 to 8, it will always be 10 to 20.

XXX and I were talking about this at the break. And, again, I mentioned the different review audience. If you are writing to a science review audience -- I actually think the DOE has an opportunity to build a new culture that's in the middle and a great need.

And I think the way to do that, one of the ways to do that is to try to get mixed review audiences and actually target the

investigators not like you need to choose if you are doing research or if you are doing commercialization, but, rather, we are targeting and valuing and celebrating the middle, which you can make a coherent argument is where DOE could have the greatest effect. And right now there is a valley.

XXX: It's a 0 to 2, meaning if you don't hyper-focus, more than likely half of those are going to drift to the 2 to the 10. That's where I'm at. And we are hyper-focused on solidifying something that's going to have a near-term impact. If not, you say 2 to 10, it's like you might as well say 10 to 20.

People come up with concepts that are unrealistically far enough away, they try to self justify.

XXX: So to rephrase this question what is the minimum time frame that the DOE should be looking at for impact, given that industry -- to design a plant, to build a plant, to deploy it? That is the 0 to 2 year time frame.

So what is the time the DOE should be looking at for these impacts?

XXX: Does industry have the near term well enough covered?

XXX: I will address your question

indirectly. I think that's where you need to -- let's say, if you work for the transportation sector, that's where even you have battery technologies in the cost to come down from $300 per kilowatt hour.

You still take some significant amount of time for the critical mass that's a number of years down the road. Maybe that's where you need to think about a consistent benchmark.

Are we talking about to build a plant to produce fuels next year? Or are we talking to use fuels near the fleet with significant amount of fuels?

That's where the cars, the fuel production will have to be together.

XXX: But the deployment time scale you can't do much about. It is the first commercial viability, I think, that we can talk about.

XXX: It shows the inter-activity between Congress and the DOE if it's always a breakthrough on something future. I worry about the impact of the DOE then changes its discussion and rhetoric that has influence on the short-term policy issues.

So the stuff that you have created 5 or 10 years ago starts changing the rhetoric to where the policies start to go away, that you kill your near-term potential because you are

always shifting off to the longer term potential.

So that's a dynamic that I worry about. Yes, there has been a lot of money and a lot of focus. It's not the only solution, it's not the solution.

But, you know, if you don't push something over the goal line and you keep distracting away from that, you are going to keep doing that.

XXX: It's a hard slog to do engineering work. And if we had started this when Jimmy Carter had initiated it, I think we probably would have solved most of these problems. It took a short time to go to the moon from having no technology to do that.

So I ascribe to the notion that we just need to -- we need to get started on it and we need a nimble organization to lead that.

And I just got back from DOE, a rebudget that took us a year to accomplish. So add that year to whatever this time frame that we are talking about.

And I know -- I believe RPE is trying to solve some of those problems. Is that successful? Can that be applied?

XXX: So we are thinking and talking that language, okay, to take the lessons learned

from RPE and apply them to the rest of the things.

XXX: I would like to add that to the list of possibilities.

XXX: You know, as a practical matter, when you are managing a research portfolio, even the -- it is a ten-year project to get to a certain level of capability or deliverability, there is a road.

But every year or every two years you are looking at this thing and saying this isn't going to work and you shoot that one. And you start another one.

So portfolio management has more dynamics. You don't go to somebody and say, here, you go come back in ten years with the outcome.

So I think it's important for people to understand that.

XXX: It's hard in the government to kill things.

XXX: The single most important thing you can do is to kill things. It's much more important than -- it's the bad things are much more likely to drag you down than the good things are to carry you.

Venture capitalists would say the exact same thing.

I think the issue of process around the

ability to turn the portfolio in pursuit of a longer term objective, the right management term, access to new ideas, killing the ones that aren't working, that's a management process.

If you don't have that management process, then these longer term things are very hard to get to.

XXX: So that discussion is a dramatically different world view of what a DOE R and D program does in the sense if you establish, you know, a five-year or ten-year goal and you work towards it and the last push in the last two years to get it across the finish line, that's a wildly different set of performers than the ones who got you to the research line.

Is it real to us -- you know, when we could come out with a statement that says we will have -- we will achieve these technical goals and we will turn over the performers dramatically to achieve that, the political resistance to that is staggering.

XXX: Plus then you are managing it, which you don't want.

XXX: That goes completely in the face of we shouldn't be picking winners and losers.

A lot of the discussion had been in

the -- you know, too much about the technology. I'm trying to extract as a former oversight staffer, former Hill staffer, what would be the language that I would put in legislation that, you know, my former bosses wouldn't vote on and trying to extract out of this conversation that policy language "the Secretary of Energy shall" and fill in the blank.

It's hard to extract out. We are looking in the PTR for those policies. That's what we need to be driving toward.

It's easy to put in a goal, which Congress has a long track record of doing -- or administrations having a track record of coming out to a goal. They are easy to generate. They are hard to build programs around. They are hard to then -- and, of course, it's hard to turn the performer base over to achieve those goals.

So what's the policy statement for the -- for DOE in the fuels?

XXX: I got a suggestion if you went to one where you killed programs, now you don't even need targets anymore.

What you are looking at is comparing selecting your metrics and looking at them every year for these technologies and see which ones are getting closer to those metrics. And the ones that aren't you throw out.

You don't even have to say the target is $0.10 a gal or whatever. It is which ones are marching down towards those metrics factors.

XXX: O&R (sic) used to have a rule, maybe they still do, thou shall turn over 10 or 15 percent to your portfolio every year.

Does that sound like the right sort of thing?

XXX: Here is the other practical thing. If you look at the world that we are coming into on a budgetary basis, if you do not have the ability to turn over your portfolio, you will have no new program because -- if you can only get new programs by having new resources, then you will run out of that quickly. And then you are locked in.

XXX: We have run out of that.

XXX: You must be able to kill programs to add new programs in a budget where you are not going to get any more money. You all know, we have been there.

XXX: They time out a lot of programs.

XXX: Yeah, you can do the retirement strategy.

XXX: To answer your question on what is the policy statement, is the policy statement that some group or entity will review the review

and come up with a metric that this area has to hit? And then you do the review of the programs every two years.

So, I mean, this is kind of building on what you just said, Don. It's do we institute an entity that comes up with what we have talked about, metrics and standards.

And so do we come up with a techno-economic analysis that says, okay, the target is production costs have to be this or around this area? We are going to determine what feedstock costs have to be in the range of et cetera, et cetera.

And then you have a research portfolio and if they are not showing progress towards that on a two-year review cycle --

XXX: It depends on what you are trying to do. If you are trying to build a foundational capability through bioenergy research centers, that's different. And that would have a different set of objectives.

But on the other hand, three or four years down the road, if you are looking around saying, oh, this is not working and I have to do something to it, okay, that's just management.

If you have projects where you are going to have more specificity because that's what you want to have, then you have it.

So I think it's not -- there isn't one

thing. And then the question is how do you manage the balance. How do you get enough shots at those objectives with enough -- and then how do you manage them?

XXX: Does the current GPRA infrastructure for managing portfolios and research portfolios cover that, the GPRA?

XXX: No.

XXX: It's wildly disconnected from budget reality.

XXX: Maybe what I would like to say is, I mean, the secretary shall track and enable programs in the pipeline for both short, medium and long-term impact.

So if you are not funding them, you are at least tracking the progress to show that you are creating a future energy industry for the U.S. based on all your parameters by competitiveness, environmental.

XXX: So it's an informational function.

XXX: Yes. So even when you remove yourself, you can say, well, I'm counting on the industry to deliver here. We are transparent, we are counting on the industry to put together, and here is how they are doing it, here is the dynamics.

XXX: But the risk of doing that is

things don't get done, the commercialization, innovation doesn't happen.

XXX: You identify.

XXX: I am saying not enable where you need to. I am saying in the longer term you fund more research. The short, medium term you fund more demonstration.

I don't want to lose -- so you as you turn up the industry, there is accountability from the DOE to track all you created in the industry in this country. And that to me is a monitoring process, which I don't necessarily think happens today.

XXX: There is also the environmental issues associated with the industry that is a legitimate government scientific goal.

XXX: So I would like to underscore the point that's been said several ways. You can do short, medium and long term. You can use a baseball analogy with little league, minor league and major leagues. You can also talk about commercialization, applied science and basic science.

And this business about axing programs and the time constants and whatnot play out very differently across that.

And I think DOE would be improved if it had some people who actually thought about that middle ground.

But I would like to inject in this -- and this goes both to how you tell the story and how you manage it -- the single biggest lesson I have learned in my career of research management and applying for grants -- and I learned this first in academia and now I'm seeing it remarkably similar in the private sector -- it matters what you do first. Because if you pick things that are going to be highly motivational when they succeed, they engender more resources and the thing gets rolling.

Whereas, if you pick the things that don't matter, obviously, if you knew they wouldn't matter -- but I don't think we are very good about thinking about this.

When you go to the question of how we should prioritize, before you get to everybody's pet answer, think of it structurally in terms of, well, which would be the greatest things that would make the greatest difference if we succeeded in terms of engendering the resources to get other things going.

This the basic pitch you make to venture capitalists. We can do the first things and after people see that, there will be more resources available, the value of the enterprise will increase.

XXX: That's good.

XXX: Doing that across the board of the commercialization, applied science and fundamentals, that's sort of like your six-task level way to think about it, it seems to me.

XXX: Good. I will turn to my team to ask whether we have some things uncovered yet.

XXX: I would just like to raise this notion. We have to decide whether we should be making fuel molecules in the field or factory.

So there is an RP solicitation. So we should be making molecules in the field. In fact, nature is not going to do anything different than what we do.

When you take cellulosic biomass, you are deoxygenating it, frankly. When I take it, we deoxygenate it. When nature says it's going to produce a molecule, it starts with carbohydrate and it deoxygenates it.

We haven't asked the question as where to do that. We say it should be in the field. And some folks are saying where did that basis come from.

I doubt that analysis has been done. And it's a systems analysis. You have to look at that whole value chain and ask where are you going to do that because, ultimately, your photosynthetic efficiency goes down if you are going to deoxygenate in the field and is that the best place to do it.

XXX: And there are people who are capable of doing that analysis.

XXX: To generalize that, if you look at that, that observation in the context of a three-tiered or three-column commercialization, applied research and basic research, it sounds to me like that's anticipating applied research. Someone is trying to innovate.

Rather than having a solicitation on just that topic which somebody thought up, I would much rather have an annual open solicitation where you would have to actually make your case and then you are really tapping into the distributed genius, which the DOE doesn't do very effectively.

And so somebody could make a great case for saying I see a way to think about doing this in the field that gets around the problem that XXX and XXX couldn't think of and maybe they are right, God bless them, let them go.

The problem is right now, literally, just to fit one idea, A, you probably have to wait literally 3 to 5 years until the solicitation came along. And, B, it would ask you to link with all sorts of these things you aren't familiar with and kind of dilutes your effort.

I think that's the reality of dealing with DOE solicitations as a consumer.

XXX: Could I add one bias with regard to this? And this is just as a biologist.

You know, you are talking about things that are going to get people excited in the nearer term. Doing work in higher plants is a fundamentally longer term thing. I'm not saying we shouldn't do it. People do it. We have been doing it forever.

But seed to sea is six months. You know, in a colony on a plate, it's overnight or a few days.

It is hard to make fundamental changes in higher plants in a rapid time frame.

XXX: I would argue some of the DOE role there is to develop tools and methodology that would let that cycle go more rapidly. And I think some of that work, and XXX would know, at least as of a few years ago, goes on in BER, irrespective of application. And that's a legitimate goal for DOE.

Should we be in the plant breeding business or plant improvement business?

XXX: I don't think so. It's covered.

XXX: No.

XXX: You guys covered it.

XXX: The seed guys have to sell seeds. And most of the important plants for these

applications are perennials, which has a basic business problem.

And so it seems to me there my advice would be it may not be what DOE ought to do, but between USDA and DOE make sure it's not the orphan child.

If neither does it, there is something important that is not happening.

XXX: All right. What else have we left out here?

You know, I think as we have been talking, framing our problem, the QTR problem, as how do we tell the story of what we work on and what is probably the simplest and most productive way to think about what we are doing, right, and tell the story to our funders, to the public, to the private sector.

And, you know, my only sense again is we have not been very good at that. And these discussions maybe illustrate how difficult it is to do that.

XXX: Let me say something. Don't consider the broader audience. You rattled off several groups. You have to pick those people or groups that really matter.

XXX: And your suggestion would be?

XXX: It depends on circumstances. Certainly key people on the Hill are extremely

important.

Sometimes you don't need to waste a lot of shoe leather informing people that either have already made up their mind and are never going to change or their opinion doesn't matter.

So don't waste all your bullets. Just focus them on where it matters.

And you can do is -- you can have a pretty informed and intelligent decision as you approach the point that you need to make the sale.

XXX: I don't completely agree with that. Because, ultimately, you have to convince the voters and their representatives that this is worthwhile and that they get behind it.

So in Iowa, we spent a couple of years convincing the people of Iowa -- I traveled all over the state. I talked to any group that was interested in it.

At the end of the process, they built us a $32 million resource program. No federal funds, no private funds. They made that investment because we convinced them it was important to the state of Iowa. And I truly believe that.

You know, you are not going to fool them over this. I truly believe that we convinced them to make that investment.

I think the same thing with the DOE.

You have to convince them this is the future.

XXX: I'm not saying what you described isn't necessary of the time talking to him what he should. What you described is absolutely necessary. And we have many examples of how the public objected to things when they didn't have enough information or fed the wrong things.

There's only a limited amount of energy that he would have. And it should be very laser-like focused when it matters.

I did this job -- it's not as an important job as he has -- in my area for 17 years. When I did this job, I realized very soon, you know, several years into my job that I was addressing a much larger audience than I should be addressing it. And I should be a lot more targeted and more strategic in where I applied the little pressure that I had. That's my point.

XXX: I was going to say I think that what you are saying is that having the right message to the right members of Congress as the funders is absolutely necessary. But I do not think it's sufficient.

In fact, in something like DOE where, ultimately, you have been talking all day about how you demonstrate something actually happens,

if you don't have a message on the other side to both the research community that's going to do the work and the private sector that's actually going to make it happen, then you end up with a program that pretty soon people are saying they are going to be with their lobbyists saying you don't have to do this, they are not getting anywhere, we will do it.

And in a budget constrained environment, you need all the allies you can get.

XXX: The other important audience is actually internal to the department. We have gone around and spent a lot of time appointing other groups from the different energy offices, Office of Science to talk in sessions like this.

And the variance in the opinions about what the DOE should be doing, is doing and so on is astounding.

So just -- and that's really what we need to work on first, what is the story that we can then tune it and target it and so on. But we still don't quite have the story.

XXX: So the internal audience is key to get everybody headed in the same direction. And that sometimes takes, you know, time and you got to get through chain management in order to get everybody headed in that direction.

XXX: If you look at the Pentagon,

which started under McNamara six or seven years as secretary in the late '60s, that was the beginning of an analytic framework for how the defense budget was spent. And it took 20 years to get that bedded down inside the department.

XXX: Could I suggest the message is -- we simply we have no other choice, ultimately. We have to figure out how to take solar energy and use it for both clean fuels. And I believe there was a national academy report that --

XXX: Why does it have to be solar says the guy who is a nuclear physicist? We need to take some kind of energy and make good fuels.

XXX: We need carbon. We need renewable sources of carbon. And you are not going to do that. And you are not going to do that geothermally. You are going to have to do that through carbon fixation. You are going to do that through solar energy.

XXX: Hearing you talk, XXX, it came to me -- this is very familiar the idea of getting the people together at the DOE.

And I realized my wife is a public school teacher and she has been doing it for 27 years and has had five principals in that time. And sort of the mentality amongst the teachers is -- and she is a very inspired teacher at a

relatively inspired school.

But, nevertheless, the mentality is, oh, we got a new principal with a new idea, but this too will pass.

And so I think you have got these career people with their own ideas and their own thoughts about what's going on. And they are kind of like this too will pass.

What's needed in the challenge -- and it's not easily, obviously, and you, obviously, think about it more than I do -- is how to transform that culture to say we really are going to change and what's necessary to make that happen.

XXX: XXX, with the perspective of some distance now, how to we do that?

XXX: First of all, it's not impossible. It's not a case of giving up.

It is strategic. And, you know, again, don't let the perfect be the enemy of the good or the gratuitous expressions apply here.

Just don't try to get in through the front door all the time, try to get in through the side door. Build partnerships.

Some longevity in a position is important, of course, so that you can be trusted after awhile when you have given your word and you haven't gone on. And you build things. It does happen.

XXX: I think you have to create the vision, communicate the vision and then act on the vision.

Everybody sees, okay, he does mean -- his behavior is supported by what he said he was going to do.

XXX: How important is the organizational structure as aligned with the vision? Or can you make it work with -- we have a particular organization in the department right now and that comes not only -- is it expressed not only in the offices in people who talk with one another, but in the way in which funds are allocated, the way in which the activities are overseen by Congress.

XXX: It's nice to reorganize if you have the ability. But it isn't necessary. You can work around the system, if again you build the right personal human connections.

Again, I harp back to the examples I lived through.

In the global change program, we ran the program. We were all low-level individuals. But we conspired with an important and not important, but very active, very dynamic, very creative OMB examiner. So through the first several years of the program, we overruled our boss and our bosses' bosses because we had

managed to govern through the purpose, you know, funding.

And so we didn't particularly care or we didn't appear in all the (inaudible) and we are listed as principals in all these documents at that came out. We were making things happen and that was our -- that was our thrill.

Eventually, when we became these people that were listed, we weren't as effective.

XXX: But if you want the most efficient impact for what you are doing, you argue you would want to organize, you know, be supportive of that. And I would say you also want to have continuity between administrations.

XXX: The program is 20 years old and it's going on. It's the global change program.

XXX: I'm saying as a general concept. We, as XXX, if you want to make something happen, you have to make it happen, it's going to be how difficult is it going to be in that situation.

XXX: I don't think we could have done any better than we did.

XXX: But changing the organization is difficult. That's a lot of time and resources that you got to put the energy behind.

If the current organization can do the job, it's much better to do it --

XXX: Let me bang on the current organization for a minute. I have gotten in trouble for saying this, but it's just factual.

When you look at the org chart in the department, you have to go down to the assistant below the assistant secretary level in each of the offices, to the deputy secretary in FEE, in NE to find a career person.

There is nothing that endures and ties the department together. And I think that's a fundamental structure failure.

XXX: Let me add it's an unidentified person to make this comment.

My comment is the human resource. If we are going to suggest to more for DOE that we have 10 or 15 percent of our portfolios kill on an annual basis, do we have the right people to make that position inside of that DOE.

And I worry that in some programs we do not have the right people in the right position to make that decision.

So with that, are we going to change our personnel policies to have some minimum background to hire in the positions.

That's are -- or are we going to establish external technical committees to make at that decision on behalf of DOE.

XXX: They can advise.

XXX: Talking about working together and marshaling resources, there is certainly a lot of loyalty and competition between the different national labs.

And there have been lots of attempts to prevent stove piping. But it's very entrenched.

XXX: Let me make another comment on the personnel issues. If you go to the Office of Science and you look at the people working in program management there, you know, very good people and they are in it for the science. You know, otherwise, they would be in a university or national lab or something.

Whereas, you get to the more applied technologies, you have people who can and often do have as much impact and make more money personally by working at an industry. There is that other avenue that you tonight have so much in the sciences.

And I think that influences the kind of people on average that we can attract into the federal government, not to say that there aren't some very good people. But it's a factor.

XXX: That's why I worry about whatever portfolio. I'm struggling with the same question to high risk, high reward and should you have a metric I am going to kill a certain percentage of my program.

If you really are managing a portfolio

well, that's what should occur. I do worry about seeing a specific target and there -- it should be easy to irrationally achieve the targets. It's the discipline behind that. What's the justification behind that.

XXX: You know, if you had a fixed budget and you want to have programs and you, therefore, had to eliminate programs to add programs, that's another driver.

If you have to go in and get more money to add new programs, somebody probably ought to be asking and what is it that you eliminated before you showed up here.

XXX: It's a zero sum game. It's a function of you need to kill more when you get to a later stage.

XXX: All right. We have reached the appointed hour.

You know, quality discussion has been great. I very much value the experience, the diversity of experience that we have had around the table. I think it's been really useful.

These do keep getting better and better, these kinds of suggestions. And this has followed the mode.

So thanks much. If you have further thoughts, send me or Asa, Avi, Laurel, Mike an E-mail. We may be back in touch with specific

follow-ups later on. Thanks much.

(End of meeting.)