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QUADRENNIAL TECHNOLOGY REVIEW

CAPSTONE WORKSHOP FOCUS GROUP

DAY II

MODERATED BY STEVEN E. KOONIN

UNDER SECRETARY FOR SCIENCE

DEPARTMENT OF ENERGY

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1000 Independence Ave SW

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Diversified Reporting Services, Inc.

(202) 467-9200

PARTICIPANTS:
STEVE KOONIN, UNDER SECRETARY FOR SCIENCE,
U.S. DEPARTMENT OF ENERGY

JAY APT
RON BINZ
STEPHEN BRAND
ANDREW BROWN
MARK BROWNSTEIN
WILLIAM COLTON
KEITH CRANE
DAVID CROSON
BOB FRI
ARKADI GERNEY
DAVID GOLDSTON
NATE GORENCE
KAREN ALDERMAN HARBERT
CHRIS KING
SARAH LADISLAW
JONATHAN LELAND
DON PAUL
BILL PROVINE
DAN SCHRAG
PHIL SHARP
ELLEN WILLIAMS

DEPARTMENT OF ENERGY OBSERVERS:
ASA HOPKINS
AVI GOPSTEIN
COLIN McCORMICK
CYNTHIA LIN
DAVID CRANDALL
HOLMES HUMMEL
LAUREL MINER
MEGAN CHAMBERS
MICHAEL HOLLAND

P R O C E E D I N G S

UNDER SECRETARY KOONIN: Thank you all for taking a few hours out of your day to discuss further what we are about with the quadrennial technology review.

This seems like a good opportunity to have a somewhat deeper and perhaps a bit less public discussion of some of the issues that we have been flushing out.

Probably the best thing to do is just dispense with some practicalities. First, we will go around the table, just to understand who is here.

I'm Steve Koonin, Under Secretary for Science, and leading the QTR exercise at the moment.

MR. LELAND: I'm Jon Leland with the Decision, Risk and Management Science Program at the National Science Foundation.

MS. HARBERT: Karen Harbert. I run the U.S. Chamber's Energy Institute.

MR. CRANE: Keith Crane, RAND Corporation.

MR. GERNEY: Arkadi Gerney, Opower, an energy efficiency technology company.

MS. LADISLAW: Sarah Ladislaw, Senior Fellow, Energy and National Security Program at the Center for Strategic and International Studies.

MR. PROVINE: I'm Bill Provine with Exxon Mobil, at our headquarters in Dallas, Texas.

MR. SCHRAG: I'm Dan Schrag, I teach at Harvard, and I'm Director of Center for the Environment.

MS. WILLIAMS: I'm Ellen Williams, chief scientist at BP, headquarters in London.

MR. BRAND: I'm Stephen Brand, and I was with Conoco Philips. I'm retired now.

MR. SHARP: Phil Sharp, Resources for the Future, and former member of Congress, but don't hold it against me.

MR. PAUL: Don Paul. I'm Director of the Energy Institute, University of Southern California, and in my first life, I was Chief Technology Officer at Chevron.

MR. FRI: Bob Fri, Resources for the Future, and proceeded Phil as president.

MR. BROWN: I'm Andy Brown, Chief Technologist

for Delphi. I'm also chair of the Board of Energy and Environmental Systems for the National Research Council.

MR. APT: I'm Jay Apt, Electricity Energy Center, Carnegie Mellon University.

MR. BINZ: I'm Ron Binz. I recently retired from the Colorado Public Utilities Commission as chairman. I'm now working with former Governor Bill Raider at the Center for the New Energy Economy at Colorado State University.

MR. HOPKINS: Asa Hopkins. I'm a AAAS Science and Technology Policy Fellow in Dr. Koonin's Office.

MR. FANDEL: I'm Dave Fandel. I'm an advisor to Dr. Koonin on most everything other than this. I've been at the Department since 1983.

MR. McCORMICK: I'm Colin McCormick from the Office of the Under Secretary for Energy.

XXX: We are on the record in the sense of we are being recorded. The notes will eventually find themselves to a website.

We are most of the way through writing a document. Some of you will have advisory status, and

in some cases, for Government employees, we can share it with you, I suppose.

What I would like to do today in as much time as we need, up to three hours, maybe less, maybe more, is to kind of have a free flowing discussion of some of the issues, perhaps some of them that are in there pretty explicitly, and others that we raised yesterday.

Maybe discussion in four parts. I would just like to get reactions to yesterday take away's, what are the lessons you all thought were interesting, for those of you who were there.

Second, I'd like to focus in on this issue of balance again. I came away feeling pretty unsatisfied with that.

We can talk more about the specifics of transportation and electric power as we go along.

Let me just start by throwing the floor open for take away's from yesterday's meeting.

XXX: I'm not sure this was a major one, but it's one I noted. I think there was a sentiment across several panels that the Department of Energy rightfully should have a point of view with respect to

technology choices, that this notion of total neutrality among technologies was sort of a false equity, and that what your choices are should be driven by goals.

Certainly, there was much discussion about the need to maintain optionality and to keep some technologies alive, even if they weren't today thought to be likely to hit the finish line.

I thought at least on my panel and parts of others I was pleasantly surprised actually to hear this notion of we don't pick winners and losers, that that is a much more subtle question than we might have thought at first.

XXX: I think to go along with that, what I heard during the four panels was the idea that some hard choices have to be made, but the idea of maybe being -- I don't know what the right word is -- a communicator with your constituents, stake holders, whoever, in a way that would inform them, that there is a form, for somebody to take the information, gather it up, put it in a form that is explainable to the normal public, so it isn't just here it is, and there is an

uproar over what's being done.

XXX: I agree. Pick winners, you're going to make mistakes, get over it.

The second thing I got out of the discussion was that there are some choices that you can make that are actually greater optimal, somebody used that but in a different context, talking about the environmental stuff.

What I mean is there are a number of technologies that you can say look, these things are not in a multi-criteria decision space, there is going to be greater optimacy.

XXX: Good for all seasons or at least half the year, things that span multiple applications.

XXX: If you have something that is worse than another technology.

XXX: One that I heard that resonated with me was consistency of policy. I even heard "bait and switch" used. In terms of being able to drive the new technology all the way through the commercialization, having some long term consistency of

policy is really important.

It's very difficult to get financed when you are setting up a project if the banks see that there is a policy in place that you're relying on which may or may not continue.

XXX: XXX, one of the things I picked up on, and I forget who said it, but I thought it was great, a great take away, having to do with slide 32. I thought that was a great suggestion.

It laid out the breakdown of the current budget, but the way forward would be, of course, to do that with other agencies as you move toward the final ultimate document.

I think in terms of the balance discussion, that gives you a way forward to wrestle with that issue.

I thought that was a great take away.

XXX: I think XXX was responsible for that, if I remember right.

XXX: It's not only the Government. It is the private sector also. It's really hard to get that information.

XXX: I think that one of the challenges here, and anybody that's been involved with DOE for decades knows, is this idea that consistency of policy would be nice, but it strikes me as a very unlikely outcome.

I think that's just reality. I think one of the key tests of any portfolio is its resiliency to adjustments in policy, because they are absolutely inevitable.

A simple resiliency test, to be a little contrarian, is: how resilient is your portfolio in the light of the fact that you may never have a national energy policy.

If you are dependent on a national energy policy, I would argue you have added an enormous amount of political risk to many projects, which is probably not the thing to do.

The other issue with respect to this question about -- anybody that has been involved in R&D management knows there is always a balance between focus and diversification. You have to do the best you can.

There are tests that I think help you, tests that have to do with long term trends that are going to drive the structure of your portfolio.

The most obvious one, and maybe we will talk about it later, in energy, in just about everything else, there is this underlying super wave associated with universal digitalization that is driving every infrastructure and every process in every business in every society.

There are things that are going to sweep through the system regardless of the policies, regardless of your ambitions, but I do think this issue of recognizing the dependency of the program on specific political objectives has to be viewed as a risk added onto the program beyond the technical risks.

XXX: What I thought was a good recommendation was this focus on program evaluation and measures and metrics. I think you would be well advised to spend a little more money on taking a hard nosed look at how are you evaluating programs, and maybe even looking at different ways of looking at them.

XXX: Not just execution of the program, but the value of the program relative to others.

XXX: Yes. Even historically, I think DOE would be well advised to -- at least it is hard for me to say, looking over the last 30 or 40 years, where have you made big contributions.

There is a little bit of anecdotal evidence about that.

XXX: It's a two tier proposition here. One is you don't get to make all the decisions by yourself anyway at any level. On some, you do, but you're involved in the congressional appropriations, the White House, OMB, and there are lots of other people in this.

This goes to the picking of winners. I don't care which Administration it is, they are going to have choices that are going to get imposed.

That is part of the world in which you live.

I think it is valuable for the Department to have a point of view. It is not independent of the political system, so it is never going to have a point

of view that is wholly independent of that.

What you can have and what I think you should have and what I get from this process is at least there is an underlying analytical collection of data, analysis, and assessment of where we are that tries to be honest and not just let's support whatever priorities have been imposed on us at the top or from the congressional committee, so that it is useful to decision makers throughout.

Whether you folks are willing and able to perform that, you do it to some degree all the time, but that independence, I'll leave that to you.

XXX: Let me just jump in and react to that one. It has been a theme a couple of times.

We don't have that now. The closest thing we have is EIA, which is by design, temperament, pretty conservative, technically, although it does a good job of assessing current data.

That does not have a coherent effect on the research programs. Some of you have heard me say this, the org chart in the Department, you have to go down to

the deputy assistant secretary in FE, in fossil and nuclear, renewables, to find anyone who is an enduring civil servant. Everybody else is vertical.

It all gets wiped out when the crew changes, and as near as I can see, there is nobody in the Department, let alone the Government, who takes a system's view of the technology, resources, impacts, et cetera.

If there is somewhere else in the Government that does that, I'd love to know. I don't think so.

I think you have to change the org chart.

XXX: I didn't hear a lot of discussion about how DOE decides cost effectively to advance the portfolio. XXX is right, there isn't a lot of program evaluation, that not only tells you if the program worked, but something about the nature of DOE's effectiveness.

The anecdotal stuff, some of which I've done, shows that in some cases, like refrigerators, there is a huge benefit of like $10 million, and in other things, like synthetic fuels, you get the opposite of that.

Your problem is how do I spend the money given some portfolio.

XXX: Yes, it's the marginal effectiveness of the dollars we invest. I think there is general recognition that appliance standards, efficiency standards more generally --

XXX: I just want to emphasize a point I made yesterday, and that is the use of the value proposition to help sort out various technologies, but also the use of the value proposition to help the end consumer or customer of the technology to understand the value they are receiving.

It could also be a great aid in communicating the value of the technology, getting back to your point yesterday about the confusion in society and the marketplace about various technologies.

I think the use of a value proposition can help in multiple ways.

XXX: I just wanted to react to what XXX was saying. I agree with this perspective. XXX said we may never have an U.S. energy policy, and that is likely to be true.

This whole exercise is in some ways part of trying to get one, at least the first step of on the way to one, or the DOE portion of one.

I think it's important, and what we didn't hear yesterday, and what I fear may not be in your document, is not just what DOE can do, but DOE can't do.

Many of their policy objectives, bringing down the price of renewables, well, that's mostly happening now from forces that have nothing to do with DOE, and there are a variety of other examples.

On the other hand, there are some things that DOE can do. More importantly, there are some things that the U.S. Government can do but the DOE can't do, and spelling those out.

I fear that we are not in the weeds enough, and talking about energy policy is not going to be all that useful because we are talking about 10 to 20 particular classes of technologies that DOE is managing. It's a large number but it's not a huge number.

Everything is sort of special case. Talking

about balancing the portfolio is great, but also talking about what are the things that DOE can do in these specific 10 or 20 technology areas, what are the things that DOE could do much better if it had assistance from some other part of the Government, and what are things that really are going to be out of the Government's control.

I think spelling that out will in some ways -- you have an opportunity to define what the QER will cover. I wouldn't waste that opportunity, in some ways of pushing and mandating what the QER should do.

XXX: That goes against a little bit, I think, advice we heard yesterday. Again, I think it was XXX, but I'm not sure. Keep it focused on the technology assessments.

XXX: I understand this is a two tier process. One is the QTR, which is the technology to understand what is happening and what you want to do about technology, and that sounds more like it's R&D, and then the second is QER, which is really the broader thing, which goes into all the policies designed for the marketplace.

XXX: I think it is perfectly consistent. I think you can focus on the technologies. For example, discussion of solar or wind or whatever.

I think within that section, the QTR should be very clear about what is it DOE can do through R&D, through encouragement for deployment, through convening power, through information, whatever, different ways and mechanisms you have.

What are the things you can't do but the Government could do. Be explicit about what is analysis versus what is policy recommendation or actions. That distinction usually gets totally blurred in this town.

XXX: I think one of the big barriers to any energy policy has been that people often want to talk about R&D divorced from policy. I don't think that has any conceivable chance of success.

If the policy tools were discussed in the context of each technology, the refrigerator example, obviously, how these different tools interact with each other, so for electric cars, if you have this much improvement in the battery, then you might need to use

policy tools less, but if not, you need to do it, and it has a time scale.

We all know what the problem is, most of the benefits in a change in technology are societal. It also relates to the organizational problem because the reason everything switches is because these end up being either partisan or philosophical changes, and having some person who is stuck there being whipsawed as each Administration changes, I'm not sure that's going to solve the problem.

I think XXX is right, to separate them to some degree and the policy discussion should be specific to the technologies and scales in terms of time and technology goals.

XXX: XXX?

XXX: You asked about things we took away from yesterday. Let me tell you about one thing I took away from yesterday that was just wrong.

XXX talked about no need at all for social science, all you need to do, and let me quote her, "Just make things cheap, convenient and accessible." Other people talked about educating the public.

None of that is the social science that you need. You need to understand why it is that people make decisions. There is a tremendous degree of advance that's happened in the last ten years in energy focused social science.

XXX is doing some great work on that at the moment which I'm sure he can clue you in on.

I'll give you one example. We have known for 15 years that individuals use a hypobulic discount rate, that is when you say a discount rate of 15 percent, that's not right. They are not using an exponential function because they don't trust you or they don't trust being in a house for 15 years, whatever it is.

There is no work on whether companies do. There is very little work, and all of it anecdotal, on why companies don't adopt many energy efficiency measures that has to do with everything from how it goes to the balance sheet to the fact that the guy you put on that job, their career is over.

Social science is much more important to societal acceptance of the technologies in the QTR than

we heard yesterday.

For those who don't know me, I'm not a social scientist. As a physicist who has gotten his head beat in by doing the wrong things a few times, I now respect greatly social science.

XXX: I'll admit I was not here yesterday. I apologize. I just wanted to bring up two points.

I don't care if you have a Republican or Democrat in the White House forever, you have a disconnect between headquarters and the labs.

While it's interesting and a great business model to give the labs more independence, you know have microcosms of policies at the laboratory level.

The Secretary is a former Director, so he can probably appreciate this, which is here's my policy priorities because I actually have to go out and get my own money, and I think this is the type of projects that are going to sell and attract money.

When you have that, that connective tissue between FEEE, whatever, and their other laboratories, it is becoming more and more fractured, as the labs

seek to become increasingly commercially viable and working for other agencies that have other priorities, sometimes competing priorities, the lab director in many instances is determining what the R&D portfolio is, and by the way, informs the assistant secretaries of the respective bureau's of how they will be cooperating with them and at what level.

We pride ourselves on the crowned jewels of the laboratories, but we have let them get hugely out of control, in my view, in that regard.

We have to do a thorough examination of how that works and whether the model which is we have unleashed them to become more self sustaining is actually the right underpinning for a long term R&D portfolio that is successful.

XXX: Let me give you a more positive spin on that same situation. The labs are the integrating elements in the program that interact with the private sector, and provide the enduring element character that the offices can't.

XXX: That is the positive side. When you get down to at the end of the day how the dollars

are spent, that may be enduring, but it also may be very much apart from where people at headquarters may think their priorities --

XXX: The labs all have their policy interests.

XXX: Absolutely, and they are tied to where their next dollars are.

I just want to make one other point, a different point. I know this was discussed yesterday on the commercialization.

We have got to bring the commercial aspects much closer into the R&D portfolio so that if you are going to make these up and down decisions early on and afford people the opportunity to say you know, it's not going anywhere, if it is done with commercial interests tied to it, it's much more defendable, and probably much more realistic.

XXX: XXX?

XXX: A little bit on what XXX said. Actually, Dr. Holdren yesterday mentioned a 1997 PCAST study. In fact, one of the things in that study that came up, an enduring issue, what's the role of the

labs.

It is the enduring part of the system. It has much longer sense of programs and continuity. Those in industry that have worked with the labs, part of the reason they go to the labs directly is because they are there. They will be there in five years.

Where does the lab fit in, what's the process for managing them as part of the energy technology program, because they will likely outlive, almost certainly outlive any given Administration's ambitions on technology.

As you say, I think that is a real positive part, but of course, the other side of that is the common phrase, "And this, too, will pass."

XXX: The labs are not the majority, less than half, I don't know the exact number.

XXX: I think I just want to reinforce XXX's comments about the value and importance of a transparent framework and how technologies are evaluated.

In my view, this is really nothing more than a

very simple cost/benefit analysis. It's just all too easy when you look at technology portfolio's to start to pursue technologies for technology's sake.

I think the comment was made yesterday also that this almost could be considered a breakthrough for the DOE and setting a framework that could be used for years to come in the future in terms of looking at the overall framework and evaluation, as XXX points out, the commercial aspects of changes in the future.

At the same time, I don't think we want to shy away from looking at pricing externalities. There are a lot of challenges here, the most obvious one, of course, is pricing the cost of carbon.

Again, I don't think we have to shy away from that. We talk about commercial. We can look at the whole picture, or as XXX points out, even the social aspects.

I think that can be done. I don't think it's easy, but I think it can be done. We know when we run the numbers at least that, for instance, picking up efficiencies is kind of the low hanging fruit, but if you quickly start to push the standards too far,

suddenly, the cost of carbon or the cost of carbon emission mitigation is much, much more expensive than say in the power sector, where you might share from coal to nuclear.

I think establishing a transparent framework, and as XXX points out, help with your communications to the public, I think that's a critical element of the whole QTR.

XXX: XXX?

XXX: I don't want to say much about labs. I'm connected to a lot of people. I think you need to tread very carefully on this issue. Obviously, their overall batter boards or policy boundaries should be set. There is no doubt about that at all.

We heard yesterday about somebody recommending start/stop engine technology. That's what these programs are using right now, start/stop. That is as destructive as you can imagine to a bunch of scientists.

I think that relationship ought to be fine tuned. I think it requires a lot of discussion. I'm glad it came up, XXX. I think we need to be very

careful with that.

XXX: On the benefits point, I completely agree, but there are two benefits and you have to keep them separate.

One is the benefit to the country of having the technology. The other is the benefit of intervening to make something happen. They are two very different things.

XXX: We are not a business in the sense that we have criteria that is hard and fast as you all have in the commercial sector.

On the other hand, we have to think like a business but we are willing to take a lot more risk in some ways in the kind of things we do.

XXX?

XXX: On some of the points thrown out here, the value proposition, costs versus benefits, of course, critical things are assumptions, commodity pricing structures, what is the probability of success of any particular technology, and then those can be controlling variables.

It's going to be an interesting debate in

terms of transparency. My hope is get the data on the table and get the right experts together to really nail the assumptions before maybe premature conclusions are made.

I think that is going to be pretty important. Also, it will interact as well with what is appropriate policy, but also the time scale of different technologies. There might be an nth degree technology, let's say there is one, that we can all endorse, and that's the one. It's probably the one that's the hardest to get to in today's reality.

The question is how do you create a portfolio. I didn't hear much yesterday about the time scale of the portfolio. I know in the writing's, there is short, medium, long. That is going to be an important parameter as that plan comes out.

XXX: That's a good balance to mention, related to the balance discussion.

Let me just comment on this need for analysis and really get the numbers and the data. You are involved. Several other folks are involved in the NPC study on transportation where it is trying to do that

in a fair bit of detail.

Not only is it important to get the numbers right, but it's important to get the uncertainties right and to draw your conclusions respecting those uncertainties.

In this business, I've come to learn, and I appreciate comments from people more experienced than I, if it's a 20 percent difference, it's probably not real or relevant. If it's a factor of two or three difference, then you should start to pay attention to it.

Getting that sense of resolution and uncertainty across to the decision makers and general public is a much more challenging task than just saying technology X is going to be better.

XXX: I agree. A sensitivity analysis, what could change in your assumptions that critically might alter your decisions.

XXX: The system doesn't want that. It's let's go do it.

XXX: It is that, by informed by.

XXX: More comments on sort

of what we heard generally?

XXX: One of the factors that can change is the policy.

XXX: You can do anything with policy, if you have the money and the will.

XXX: Just building on that theme, I really love the extension of having the QTR process in all these other venues, and I think the clarity and the planning and actually knowing that stuff is going on is really helpful, but as a lot of people have pointed out, it's really hard to have that kind of continuity across Administrations.

One of the problems is we all invent our own facts in this town. You change the baseline, you change the assumptions, you change the realities.

I would be really interested if there was a way to bring in some sort of outside force, whether it be the National Academies or some other group, that was able to do sort of historical analysis based on some of the same parameters that you put in something like the QTR, and then kind of on a regular basis, feed that separate analysis into whatever this process is.

It would give it some sort of longevity beyond that.

XXX: America's Energy Future Study, I think, was that. You could argue for a quadrennial update of that exercise.

XXX: To sort of build off that point, I think there are sort of two kinds of cost/benefit analyses that the Department might consider.

One is how to spend its own resources, and then another would be to facilitate something like what the CBO is on budget issues, facilitate essentially an ongoing set of non-partisan norms to be able to evaluate policy for XXX’s former colleagues and for their staff.

I think the energy policy debate suffers enormously from this challenge of knowing norms and how to score policies. I think there would certainly be enormous limitations to what such a facility could provide.

I don't think it should try to answer what the value of carbon mitigation is, the carbon mitigation impact of a policy, but I think it should try to

evaluate this is the cost, this is the cost mitigation impact.

XXX: EIA has done that, in Waxman-Markey, for example, what would be the impact. EIA has done such analysis.

XXX: Kind of following up on what you said, you might want to put in the QTR, if you repeat this exercise, which I hope you do, is that the first chapter of the next QTR is evaluate.

XXX: It's not clear as to what changes.

XXX: Changes against what?

XXX: Against what DOE is doing now.

XXX: We have a long section that we will see if we are allowed to get through about the current state of DOE and more generally, U.S. energy policy.

XXX: XXX, is there any context here for research and transition to U.S. manufacturing? We have a lot of really great research and have a great portfolio, but if you don't have an infrastructure with U.S. manufacturing to transfer that capability to --

XXX: I think we can make that observation, but fixing manufacturing more broadly is probably beyond our scope.

XXX: There was just the big release of the Obama initiative on advanced manufacturing following the PCAST report just on that issue. It was around public/private partnerships that would make those jobs sticky, essentially, by taking advantage of the intellectual resources in this country, but whether that works.

For example, Bruce Sohn of First Solar, will say he wanted to build in the U.S. but he's building in Vietnam because of tax policy, not because of labor or environmental benefits, purely tax.

XXX: That is something -- as a draft, it doesn't make it really explicit, that DOE is only one small player. There are so many other factors that determine the energy landscape that are in the hands of other agencies or entirely outside the Government's control.

I was over at the Council on Competitiveness. They had just been over with the delegation of China,

computing, in particular, but more generally, they came back with an even more severe case of China awe than I have seen.

Long term capital investments, lots of money, strategic thinking, on and on.

Let's turn to the balance question. I'm increasingly coming to a view that -- as the Secretary said at lunch yesterday, we're not going to have a formula. I'm either looking for a story, and I think we sort of got that in transportation, but I'm missing it in the stationary sector.

I can't tell you a story about how to balance clean energy, electricity portfolio, I can't tell you a story about how we balance efficiency other than we should do more of it because it's cost effective and it doesn't cost the Department very much at all.

I appreciate your advice on can we at least tell a story, and that would be enough? Are there more general rules that we should be applying?

Again, balance in many different dimensions, short term versus long term, risk versus surety. You can go on and on with dimensions. Maybe it is just

whatever the Administration thinks it should be.

As we were joking yesterday, the dimensions of balancing are so many that one of the ways you do it mathematically with a high dimensional space is Monte Carlo, and maybe we are just doing Monte Carlo sampling.

(Laughter.)

XXX: That may be as effective as anything else. XXX?

XXX: XXX, let me give you one organizing principle that may apply in some small subset, and that is the question of path dependence.

A decade ago, our colleague, David Keith, pointed out that if the carbon price went high and before natural gas price went high, you get one set of technologies.

If natural gas prices went high before the carbon price went high, you get a completely different set of technologies. Those are sticky because of all the things we know.

It may very well be that you can help organize some piece of the balance by saying natural gas is

likely to stay between 4 and $7 for quite a while. That won't apply to everything. It may help you organize certain things.

XXX: That's a path dependence in externalities. It's also the path dependence internal to the system. Again, I'm thinking about infrastructure in transportation may be too much, but that's a case where incremental changes will be much easier than complete discontinuity.

XXX: Some of us believe in bumps rather than wedges because you get things built and they take over a fair share of the market.

If LADs had come in before CFLs, CFLs would never be --

XXX: Right.

XXX: Have you done an analysis of what private industry is doing? When I think of balance, I think look at the fossil fuels program. Quite rightly, there has been an explicit analysis to say we don't need to do oil, even on the gas side where coal for structural reasons, industry doesn't have the resources.

Have you kind of done a more explicit analysis of which sectors the private sector -- you don't have to worry about it vis-a-vis, or do you kind of jump -- people talk, for example, about batteries, where the emphasis on batteries may have been a little bit mis-emphasized because the private sector has put a lot of effort into that.

XXX: Not to cast dispersions on what we are doing now, because I think it's a good thing, but other people have said the sun shock is probably not as relevant as it might be because industry is going to get there anyway on its own, maybe faster than expected.

XXX: You may want to actually do a more explicit analysis of where you are seeing a lot of private investment and where you might see potential market failures.

There is going to be infrastructure retirement. Right now, we are seeing a built out infrastructure.

Someone said yesterday it depends on what we are going to replace it with. I think we even called

them stupid technologies.

That's part of the story and that's an important part of the story, because I don't think the public quite understands that this isn't a choice between what you have now and what we are trying to force on you, which is the way the story is being cased.

It's what are we going to do next. When it comes to replacement, especially of large generation capacity, public engagement is very, very important. It's very much a public decision, having it at the local and state levels.

I think the story is all the more critical. That goes to some degree looking in the out years, looking at the sort of 5 to 20 to 30 year time frame, when you are looking at retirements of major capital stock in the generation and distribution sector, then you have a choice to make about what to focus on and what your sort of time frames look like in terms of balance of your portfolio.

XXX: Yes, I think this idea of looking at the supply chains, whether they are for fuel, power,

natural resource development or whatever they are, and making an assessment about the role DOE plays in that, because as you said many times, XXX, in your eyes, the Government only got five percent of the system.

I think we have to be careful when talking broadly. I think this group understands it. When you say "we," who is "we?" Private capital investors sitting over here. Utilities think they are the "we," not DOE.

I think on the other hand, because of this position, and some people have suggested this, we can in fact potentially look at the system and put this in context appropriately, like some of the decisions you have made, generally speaking, in oil. Coal, that supply chain has an entirely different structure than oil and gas.

I think there really is something when you say what's the story. You have to tell a story in the context of the whole system and why DOE is here and not here.

XXX: Two thoughts. One is I agree this has to be very much about sort of what is next, a

very clear understanding that status quo is not an option.

We are just talking about what kind of change or what kind of investments coming forward.

Toward that end, two thoughts. One is if you look at the analysis that has been done on what it would really take to de-carbonize the energy space, the fact of the matter is -- going back to the wedges analysis -- there is a whole wedge that is sort of TBD -- to be determined.

We don't even know, which implies that there is a whole host of technological innovation that is coming down the pike that no one can really anticipate yet.

As you think about building your current infrastructure, how do you build it in such a way that it creates the greatest optionality for the future. Flexible systems, adaptable systems.

That brings me to my second point which is this is about energy in an information age. One of the key roles that DOE can play is simply in the facilitation and socialization of information and

innovation.

The example I gave yesterday is the test bed work you guys do, I think, is phenomenally important, not just because it facilitates technology but because it actually creates a reason for people to bring their ideas to you, to the U.S., where we can see it.

Along those same lines, if you think about the implications of smart grid technology, it's about information flows, and giving new information flows to good operators and new information flows to consumers, and with that information, they can do new and interesting things.

XXX: No amount of central planning is going to figure out --

XXX: Make the information available.

XXX: I think that is one of the underlying principles that you should take into account, that DOE needs to focus on the things that really catalyze the private sector and do the most. What are those and to lay those out clearly, as you balance the portfolio, and as you sort of move down and

parse out resources, what are the objectives.

XXX: In other complicated situations that are economy-wide, thinking of we run games simulation to get a bunch of officials together and say what if an IED goes off wherever.

Do we ever have people in energy games, where you get a set of folks from each of the relevant industries, the regulators, the technologists, and put a set of boundary conditions on, multiple boundary conditions, and ask how would you make investment decisions, consumer decisions, operating decisions, and try to get some sense of how the system would respond?

Has that kind of exercise been done?

XXX: I think there's been some things like that in the private sector.

XXX: Within one corporation? Not inter-sector, electricity and oil, for example.

XXX: If I can build on that, I was going to make this comment earlier. Maybe what you do, since you have more confidence in being able to tell the story for transportation, maybe you focus on

transportation as an example, and do what you are suggesting in terms of the analysis as an example of what needs to be done for all of the sectors.

Thereby, be able to show something tangible that people can see and understand, rather than trying to put a lot of resources into crafting the story for all of the sectors, if you have confidence in the transportation, use that as kind of a model.

XXX: I want to build on two things. One, your last comment, and what XXX said, this notion of what we are really doing is deciding what we are going to do next, what are we going to do in the next five to ten years.

The analogy in Government that I like, is in the best cases of resource planning is state and public utility commissions.

We have a resource staff that is fixed, with an expiration date on all the facilities. We know we have some sense of what the demand growth is going to be. We have EPA regulations entering into it, all these things.

It's not a game, but what we used was modeling

the entire system. We did it over and over again with a bunch of assumptions. It wasn't exactly Monte Carlo, but it was almost random.

They tested all kinds of things, including the optionality of the choices we were making in the short term. Of course, we had all the constraints, as I mentioned.

I think there are examples of that where that's done. Again, it's a small canvas as opposed to the large canvas you are working on, but I think that kind of an exercise -- I like your notion of games.

XXX: In a field where the incumbent players have many interests that are at odds with actually what comes next, I think you just have to really structure the game carefully or it's really just a very public lobbying exercise in the scientific arena.

XXX: I want to go back to regulatory, because I think that's important. If you look at the operating principles, that is what is going to be governing what comes next, it's the regulatory framework at the national level, whatever is going to

come out of EPA, but it's not just at the national level.

You look at AEP's decision this morning to abandon their carbon capture. It was a big initiative. It was because they were not confident they could get their rate increased through their local PUCs.

I think you have to address the regulatory framework part of this. No matter what technology has the greatest potential, if the regulatory framework is going to make it obsolete or uncompetitive, how do you actually rectify that? That's an important point to bring into this.

In any comprehensive look at this, that has to be taken into account.

XXX: This isn't a comprehensive look. This is the DOE part. There is no question the regulatory and the tax policies and the policy, for example, for extractive industries, really important, maybe much more important than the DOE. This is the first step. This is just the DOE part of that.

XXX: Correct. If you look at, for example, smart meters, and Baltimore Gas and Electric

went through a big thing to have smart meters. They went to their local PUC for a very small rate increase, what everybody thought was a no brainer, and they got turned down.

There was a lot of money that had been put into that, public and private.

XXX: I'm agreeing with you. Regulations control in many cases what technologies when.

XXX: Some people said the DOE should be anticipatory of regulations. Carbon price some day, we should be working on the technologies, CAF□ standards, you can go on and on, and that we should be doing the research that facilitates and eases those regulations.

Of course, at that point, etiology comes in. What do you think the regulations should be going forward.

It may be an organizing principle, but maybe not a very stable one for the Department.

XXX: It's not stable but that's okay.

XXX: Yes and no. If it's

a four year cycle over which that posture changes.

XXX: We've seen that. Four years ago, it looked like the carbon price was around the corner, and today, it looks like it is very far away.

That's the real politics of this, and you can't get away from that. At the same time, I think if you have a broad statement of objectives, that you and XXX Chu always lead with, and then talk about in the QTR in some ways the particular strategies that DOE is taking on each of the technology classes -- frankly, if it were even more factual, just a statement of what the strategies are that the DOE is taking, realizing that four years from now, the strategies might change because the landscape might change.

Things today with low natural gas prices look very different than they did a few years ago when natural gas was at $12.

Those things change. Welcome to the energy world.

XXX: That suggests to me that typically, when people think of DOE, particularly in the stationary source base, they think how can DOE help

bring technologies along. There is certainly some rationale to that function.

What this discussion suggests is what DOE can and should be doing is helping decision makers make better, smarter decisions about the energy future.

One part of that is access to good information, so that means putting even more emphasis on EIA and other sort of information clearinghouse type functions that DOE performs.

The other piece of that, XXX, I think goes to your game theory idea, can DOE help create more sophisticated decision making tools.

With every respect to XXX and the work he has done out in Colorado, at the end of the day, IRP processes tend to be rather assumption driven and sort of limited by sort of the "what is" and will never get you to hey, how do I approach this set of investments when there is a disruptive technology that shows up, or a disruptive political or regulatory situation that shows up.

There is a need for better -- I've seen this in the context of grid planning and grid operation,

where our current set of analytical tools really fail, even today, to take into consideration all of the innovation that's going on in the distribution side of the system.

XXX: Let me just pick up on something XXX said. You have different time scales. One of those time scales clearly is moderate. In that time scale is when the question of path dependence is important.

You can say look, natural gas prices are going to stay low for a while, let's put fair emphasis on natural gas CHP, something like Dean Kamen, Sterling Engine, or micro-grids. We think that is liable to have a fair chance of happening, and moreover, if it does happen in the short term, it's really going to affect the long term.

XXX: You kind of play to the near term conditions?

XXX: You do some of your portfolio in near term, and you say because we're doing that, because we're taking advantage of these near term conditions, it ain't going to last forever, but it's going to be a path dependent determinant, and it could

last for longer than we think.

Look, we built 60 gigawatts a year of natural gas in fixed generation for two years a decade ago, and that overhang has had tremendous consequences, some good, some bad. It determined the landscape.

XXX: XXX?

XXX: I want to go back to some of the comments I've heard here about the inability to define the regulatory and policy environment going forward for the next five to ten years in each of these sectors.

I would suggest that probably on the transportation side, those items are better known. We know what the fuel economy standards are going to be, at least until 2016. We even have some insights into what they might be beyond that, 2017 to 2025. There are studies being done, not only on fuel economy but also on the environmental side.

I'm going back to the suggestion I made earlier about taking transportation as a model, as to what could be done.

In other words, in the QTR, at a high level, you can frame it up in terms of what needs to be done

across all six areas in your policy and strategy, and some of the road blocks and implications and needs, and take transportation where some of those things are better known, to show what could be done by example.

That way, it gives the regulators, the policy makers, some insight into what they need to do to help us solve the situation.

Rather than expending a lot of resources trying to get a set of assumptions, which there will always be folks who object, you can't get agreement, things change, use the transportation one where it's known out for the next ten years fairly reasonably as a model for consideration as to what that QER might need to look like.

XXX: Trying to think about why do you feel like you have a narrative for transportation but you don't for stationary.

The defining reason is because we have a largely national regulatory set of drivers for transportation. State policy is not the same driver.

XXX: Except for California.

XXX: Except for California, to some

degree, being reigned in. We have a largely state driven, 50 states, doing lots and lots of different things, stationary energy policy.

If you're in the business sector, it makes it very complicated thinking about what kinds of investments and how to deal with that.

I'm on the stationary side, and I think that's why it's hard to come up with a single narrative about where to think about technology investment.

I think one role the DOE could play that would help sort of normalize and standardize that is sort of two hats.

There is sort of the referee hat and the sort of incubator hat. I think in the enhanced referee hat, would make itself more available to state policy makers, and help score and transfer knowledge, and potentially just wearing that hat would help normalize and standardize, understanding the limitations of it.

I think that is something the DOE could do.

XXX: Another reason on the technology side is clean electricity generation. There are differences among the technologies, but the end

product is all the same. We are going to make electrons.

In transport, you look at all the levers we have, efficiency, natural gas, hydrogen electricity, biofuels.

There is a differentiation among them in more than one dimension. I think it is easier to discuss the differences and start to understand what the choices should be, whereas in electricity, it's a lot harder.

XXX: There is also huge regional differences there. EPRI has begun to point that out by their regionalized prism analysis. I think that is an essential difference.

XXX: Up until the increase in CAF standards, we had tremendous lobbying pressure not to increase the CAF standards.

There was a major political shift in the country partly because of the oil price increases, and then suddenly we had a pretty strong political consensus of this is what we want to do, and because the market had shifted, I think the manufacturers

shifted as well.

I think the differences are less institutional and more you had a policy shift to one side.

XXX: You would get regional solutions, which would be very different from each other.

XXX: I think this regional issue is one of the things I noted actually, in fact, after the head of the Texas Railroad Commission got up and said it's very clear, their view, about power, about resource development, it is not the same as you are going to get in the Northeast, California, or other places.

You see this all over. Anybody that has been in the energy business moves around.

Some of the producer states. They are natural resources states. Their wealth comes from drilling, digging, and selling.

They are going to have a very different view of this whole issue than someone who is a consumer state.

I think that issue is probably much more prevalent in the power sector than it is in transport, but there are differences.

XXX: The difference is there is more driving in Missouri than in Manhattan.

XXX: No question. The Northeast Corridor and the West Coast/California have a different view of what is automobility than you get in Missouri or Texas.

XXX: I appreciate what Andrew was trying to say in terms of focusing on transportation, but I think that's a mistake, in my own view.

I think the QTR -- remember, we're not talking about what should DOE's policies be going forward. We're talking about a report. The impact of that report is going to be, I think, clearest if it describes clearly what DOE's approach to the different technologies in its portfolio are.

I think of all the different technologies, probably in the electricity sector, you have more of them to describe. Just because it's murkier because of the complicated question of what is the price of carbon, if ever, how is EPA going to deal with this, how are the different states going to respond to building grids that may change state differences in electricity prices.

All of those questions. Yes, they are difficult questions. All the more reason for DOE to state clearly what its strategy is.

By the way, whenever I hear XXX Chu talk, he seems to be very clear on what his strategy is on just about every technology.

Frankly, just a clear statement of that is essential.

XXX: Acknowledging the murkiness.

XXX: Acknowledging the murkiness.

XXX: I agree with XXX. I think the report is what is it that DOE can do. Even in the murkiness, there are threads that go all the way through. You need to identify those threads.

Okay, there are these regional issues, what would you do. Maybe there is some base case type of outcomes you could put out there, what if, here is what we would do.

It's one of these things that a year from now, you come back and you re-work it and you re-work it. I don't think this is something that you say this is set

in concrete, this is the way it's done.

I think you begin to lay it out, and then put it on the table.

XXX: The murkiness is what set of policy instruments do you use. For example, because of the price on carbon, the loan guarantee program for certain technologies seems like kind of a silly idea, given that they are not economical. We have talked about that before.

Three years ago, loan guarantees sounded like a very good idea because the price on carbon, there was no question it was going to happen. Now, putting a loan guarantee on a CCS project, it is really dumb.

That's fine. There are other instruments. There are direct loans. There is just paying for the whole thing. There are various approaches. Fine.

QTR can lay out what those strategies are and match the instruments with the technologies.

XXX: The QTR will be comprehensive.

This is productive. I think it is time to take a 15 minute break. We will reconvene at 10:30 and

maybe get into more specifics. Thanks. Let's break until 10:30.

(A brief recess was taken.)

XXX: I had thought that we might take this last half to go into some details on the transportation and stationary, but some of my colleagues in the back who are responsible for putting this document together thought it might be more useful for this group, which is diverse but experienced, to have a bit more discussion about how could this be useful, how should we phrase things in the document, what will give it more impact, and that kind of discussion.

Let me put one point on the table to get that conversation started. We are shying away from saying explicitly "no" in the document for various technologies, but rather taking a softer tact, saying should be de-emphasized, or saying these things have higher priority and not saying something has lower priority. A somewhat softer stance.

Does that sound right? Should we be sharper? There was some discussion that we really need to have a

point of view. I can tell you the system does not like to do that.

XXX: This may seem repetitive with my earlier comments, but I think the key thing there is explaining, helping the public better understand there are tradeoff's here.

All these technologies by themselves look good at face value, but society has to struggle with the cost/benefit analysis of each technology.

A good example is we can talk about the promise of electric cars and what it takes to get there, but at the same time, share with the public the costs, the kind of functionality constraints.

I think it helps inform the public as to why we can't do all these things tomorrow, and what are the impediments to kind of get there as an end game.

I think that hugely makes the QTR much more useful to people, because then they have a better sense of why these things can't happen immediately, and what kinds of things we have to work on.

XXX: In terms of technological impediments, kind of a motivating discussion of why you

are investing in these technologies, what the hurdles are?

XXX: There are 19 technology assessments, everything from nuclear to biofuels, batteries, efficiency, and so on. We do have that kind of assessment coverage.

We really need to go to the next step and talk about policies for each one of these, but at least there is some attempt to paint a realistic technical landscape for each one of these.

There is the question, I won't say narrative but synthesis, in the main document that says this is the landscape, these are the ones we think could matter more than others, and that's where the Government should be giving priority.

Yes, it's not just tell the story about any given technology, but why this one looks more attractive than the others.

XXX: What would one say? If you took one of those 19, what would they say at the end of that summary? That would help me at least assess where the value might come from and how that document might be

used.

XXX: And the metrics.

XXX: I think the wind one is thought to be pretty good.

XXX: It talks about evolution of costs, capacity factors at a given site, it talks about deployment, it talks about the role of policy in deployment, DOE history and accomplishments, current state of the industry, technical potential going forward, what are some of the barriers, turbine architectures, reduced costs in integrating the system, demonstration of deep water off shore, high performance modeling of wind farms. You can go on and on.

It says these are the things we could do, and if we were successful, it has cost targets here for 2030 and 2020, and so on.

What it doesn't say, of course, is why would you do wind instead of solar or nuclear or whatever.

XXX: It doesn't say what the value prop is for that technology.

XXX: I think any reporter or congressional office, the thing they are going to ask

is what is DOE doing because of this that I don't already know.

If there is no answer for that, because there could be other purposes for the document, there needs to be this is not what this does, instead what it is doing is X. I think that's the question you need to be able to answer or substitute something else for it.

XXX: In the end, what is the real budgetary or problematic impact.

XXX: It doesn't have to be I'll be spending Y rather than X.

XXX: In response to XXX's comment about this doesn't have the value proposition and the balance of why this versus that, I actually think it's the opposite.

I actually think this comes before that. I think the whole value of this document is to put the history about the constraints, the technology opportunities, what is coming down the research pipe in the distant future, in the near future, all of that together, plus I think what is lacking is what is DOE's near term strategy over the next few years, that has to

be in there as well, but then part of the statement can be the balancing of the portfolio overall, and deciding how much resources goes to nuclear versus wind versus solar, and how all that gets balanced.

First of all, we know that's a complicated thing and it's not just DOE's decision. It's Congress' decision, the White House.

That is the whole point of this document. This document lays out all that information so those decisions can be made in theory in a more intelligent way than they are today.

XXX: A lot of the value of this exercise we think is in just the frame. There are the six strategies. That data, which had never actually been put together in that way, so we can understand what the Department is doing.

XXX: You might think of it as instead of the technical stuff following, you might actually think of the technical stuff which then leads to the decisions. It is an important framing issue.

XXX: If its main use was internal, I think that's fine. That has to be made clear.

Otherwise, people are going to have a different set of assumptions and view the document as a failure because it doesn't help the external.

XXX: That is really what I was trying to get at, an understanding, who is the audience for the document.

Getting back to your original question of how best to use the document, unless you understand who that audience is, you can take it in a number of ways.

I agree, the value prop thing is something that would come after the assessment. That's why it is so important to understand who the audience is and how you are going to position the document, and to be able to explain what's next.

I like your suggestion there about framing.

XXX: I would really urge you to take advantage of a module design. When I read through the 40 page document, I was really struck by the wealth of information and the hyperlinks at the beginning of it, and in particular, I said gee, I know 25 entrepreneurs just in Dallas who would really want to read this right now, about 100 things you need to know about energy

policy in the United States, right away.

Then once I got past about page eight, I would say they were no longer the audience. Have a structure saying if you're interested in new business creation, here's where you would go. If you're interested in budgetary issues, here's where you would go. If you're interested in technology development, here's where you would go.

XXX: Understand that not all of us have seen the document.

XXX: Very few people have seen it.

XXX: There is a lot of really interesting things. I could see which sections would go with which people. Choosing a path and saying go down this way if you're interested in this area could make it much more functional.

XXX: Another way to do that is to write the big thing, which is all of the details and everything else, and then do abstract --

XXX: Right, a tour guide.

XXX: I thought it was useful for the

Department to identify the sources that it found most influential. I don't know if there is any way to do that or whether it's even advisable. I found it very interesting and very helpful.

XXX: I actually skipped the first 15 pages. For those in Congress, those in D.C., the whole restatement of what the grand energy challenges are isn't terribly helpful. They want to go to the sort of meat of what does the structure of DOE -- what is it going to contribute to this problem and how is it going to be structured to deal with it.

In terms of the structure of the report, I think it is important.

XXX: We have different audiences concentrating on different things.

XXX: Who is the intended audience?

XXX: My understanding was to match what the military does, which is try to have a very sophisticated thing that sophisticated people in Washington, outside of Washington, can look at and challenge, and four years later, you can go back and look at again and say we have to go this way or that

way.

In fact, I would urge you strongly if that's the purpose to put that clearly at the outset as to what this is designed to do, and put yourselves in a position where we know this is an iterative learning process instead of oh, no, we can't say that because then we will have it absolutely wrong four years from now.

The goal here is to advance our understanding in this country on where we are and what we might focus on.

I hope you can start with that foundation. That is not a document for the general public. There will be a few journalists that will look at it or people that will look at specific sections.

You can do whatever you want with executive summaries and all the rest of that, but I would go back to trying to make sure we have somewhere some serious persistent effort to identify what's happening and what we are doing about it.

XXX: We have several different audiences. We have the policy community. We

have the research community, the people who are actually doing this and looking for where's my technology or what should I be working on.

You have the private sector who is looking for clues on what we are trying to do, and then you have the general public.

XXX: How you release it will have an effect on how it is seen. If it is released to the press first and that is a story about well, they didn't really say anything, that will limit its use to these other audiences who might otherwise be interested.

I think that's part of a strategy. I think one thing to do is really the model and not just sort of a vague analogy. I'm not sure where that is.

I'd look at what questions come out after the QTR comes out and what the press reports are, and if that actually is applicable here or not, and relate to that I think what other analogies there are for this kind of report.

The way you describe it in terms of the internal, oddly, the thing that came to my mind is maybe closest to the Pentagon papers. How do we get to

where we are, and we are going to go back and look at everything we did and then we'll figure out what to do going forward, and God forbid anybody else ever reads it. That part, obviously, doesn't apply.

I think thinking of those analogies and particularly looking at how the QTR is received would be useful.

XXX: Isn't the DOE staff a major audience?

XXX: Absolutely. I think it's a great idea to go ask sort of some key staff on the Armed Services Committees and at the Pentagon. All you need is about four or five people, how do people receive this, what do they think its value is, and then replicate it.

XXX: We did talk a lot to the Pentagon folks as we were getting into this exercise about how they did it and so on.

XXX: There is history here, too, which is when we decided on the recommendation of the QER from the PCAST committee, it was specifically with awareness that the first QDR was not as well received

as the third.

Part of this was establishing a process that not necessarily the first time but over a period of a decade or two would lead to a more stable course through energy policy. That was the point.

XXX: I worked on the QDR. I think you don't want to get too --

(Laughter.)

XXX: I think it becomes very important to think about you are kind of in essence fixing some market failures or doing some basic research which this huge private sector, trillion dollar business, is not accomplishing, as opposed to DOD who has concerns about national security, and the QDR really focuses on what weapon systems we need to buy.

I think this is a good discussion, you really want to make this a big campaign, make sure it gets out there, explain what you do and why you do it.

I don't think DOE does a great job of explaining to the public on that score. It is a good opportunity. It's very difficult from QTR.

XXX: Just two points. On those

technology assessments, if they come out, to use the wind example, validating the study, that we could be 30 percent wind by 2030, and then the next one is we could be 30 percent of this, all that will do is the American Wind Association will pick that up and then lobby.

XXX: Try to get some realism and normalization across the technology assessments, but the truth may be that any one of these or a few of them are equally valid choices, and then the synthesis of it at the beginning, this one looks better than that because, despite what it says in the technology assessments.

XXX: Right. The other point is on your cost "projectories", you say our objective is to get it to this cents per kilowatt hour.

I would strongly encourage you to have an off the record closed door session with some of the private sector.

If on day one, they come out and they go not doable, nobody will use it. I think there are some in here that probably bear some further discussion.

XXX: Part of the problem

has been the technology assessments have been worked on by the lab folks and the Department folks, and it has been tough to involve the private sector.

XXX: I understand. I think you will be better served and the veracity of what you are putting out there will not be undermined by people immediately saying not doable.

XXX: Or we can do much better than that.

XXX: Absolutely.

XXX: I think that in order for it to have an impact, I think you want to have as much of a point of view as possible while managing your internal and external politics.

I think a way to do that is to have it have sort of micro nuggets of some very particular things in particular areas, so if it's wind and offshore, your two research problems or very particular things that is a signal to people who work in that industry and who research the industry, this is our point of view about something we really need to learn, resolve, so we can have an impact.

That is sort of a micro level. I think the macro way to have an impact is to point at some norm's about cost/benefit analysis that can be used across the different sectors.

You don't pick the winners. You do pick some norm's and you recognize that if these norm's were applied, there would be some winners and losers to some degree in your report, and push policy makers towards thinking, doing this sort of systems thinking and thinking cross sector and using these norm's to make their evaluations.

XXX: One of the things we heard yesterday several times was the organizing role of greenhouse gas mitigation in everything we do.

I guess the question is what role is that third rail going to play in this document. Will the Department endorse the de-carbonization of the power sector, just as a starting point.

If you don't or you can't, a lot of these things don't make as much sense as they might otherwise.

XXX: Within those, you can

give greater or lesser priority to economics, security, at least in transport.

XXX: One of the potential audiences is Congress. It is important to recognize the political lens in which your programs are seen, and the utility for which this document might have to Congress.

Especially as it relates to your particular role in the energy innovation enterprise.

We are watching this play out. As we speak, on the Floor, with energy and water development, there is a debate, which is what is the appropriate role of Government, and is the appropriate role of the Department of Energy technology programs.

We have seen -- it has been very interesting because it is almost sort of a schizophrenic -- even in the same sentence, members will say obviously conflicting things about technology development, about the innovation enterprise generally, about the ability of industry to innovate, about the scale of the energy challenge.

I think it is important for you throughout the document to recognize what your value added is, and

constantly point out this is what DOE does. This is the capability of the Department of Energy.

If it is something as simple as light sources for materials characterization, things that industry isn't going to do.

It's also important from the political context to have industry and specifically some of the folks here at the table who are arguably the most technologically advanced industries in the world, that there is some third party verification that says actually, these are things we are not going to do. They are very interesting, but we are either not interested or we're not structured to do it, we don't have the capabilities.

That is something Congress needs to see. Right now, Congress thinks if it's interesting, the market will do it. There is very little recognition of the gigantic gray space in between.

XXX: Why does DOE need to be in this. I think that's right. I would say in terms of company verification and for the people who are really ideological -- that helps with some, but not others.

I do think it is a legitimate question, why DOE and why this particular piece of it, and you have to be able to answer that.

XXX: I think having those explicit DOE value added in the document is a really good idea but also not feeling like you have to be definitive about that across a period of eight years.

I think the role of DOE can change, and one of the problems with that is some things change and they can't change their position or they feel like that is set in stone.

Things are changing fast enough in some of these industries that you could change that over time, and I think that is something that could track along with this process.

One of the things about the QTR that is beneficial, and I think there are a lot of things that are not good about it, is people know relative to other documents that come out where it stands.

I agree with XXX. Having the other documents that are guiding documents for DOE thinkers in there was really helpful, especially when they came outside

of this Administration's purview. Oh, they took a document from eight years ago. It's useful still, good to know.

I think it would be really helpful if you were able to say we know the QTR relates to the QER in this way, how does it relate to other strategic documents that DOE is putting out, and make that fairly explicit. Then you can bound what's in the QTR probably more usefully, and give it more authority by doing that.

XXX: Very good. XXX?

XXX: I guess building on these things, one thing I haven't heard, I didn't hear it yesterday, and it's not completely clear how it goes in, over the long, long term, one of the things that DOE -- along with other Federal agencies -- in the long, long term, the funding of basic energy sciences, the funding of advanced technologies like advanced computing at the national labs, there is a competency and capacity building role from Federal investment in R&D.

Any of the big companies -- when I was at Chevron, I was always asked first and foremost, the fundamental investment in basic energy research and

advanced technology platforms, like computing, serve a long purpose for industry over generational scales.

Defense has done this, too. I guess I keep thinking if DOE went away, and that gets away from well, industry is going to do all of it, industry wouldn't do that.

This capacity and competency building comes from funding universities, comes from the national labs.

I don't know how many times when we were at Chevron we worked with Los Alamos and Livermore on things that had to do with the fact that they had the fastest machines in the world, and we wouldn't have done it if we couldn't have done it.

It's kind of woven into the fabric. I think capacity building, especially given the fact that for all the excitement about changing the infrastructure, you better do something about the fact that two-thirds of all the people in the energy business are over 50.

If you don't build that out -- I think DOE has a role in that.

XXX: Before I turn to

Mark, I will just note more coffee has arrived.

XXX: I agree with that wholeheartedly, and that goes to this issue of sort of the facilitation piece of this, the incubator piece of this, which I think is just absolutely a mission critical piece.

The only other thing I was going to say is to the extent that you feel compelled to make a case for one technology over another, and I've heard cost/benefit bandied about many times, I agree with the organizing principle of carbon, but again, I would remind you that there is this environmental principle that also applies.

One of the things that I think could be useful in an effort to look at various technologies and their relative advantages and disadvantages is advancing the dialogue over the full range of environmental trade- off's as to teach of these technologies.

Whether that is water consumption, land use impacts or toxic impacts on toxic materials, whatever, there is a wide array of things, but DOE is not known historically for its sophisticated thinking when it

comes to environmental impacts as it relates to energy technologies.

You can make a huge contribution to the future of the agency by starting to embed that into how you think about these technologies now.

XXX: Very good. As we think about the technologies, there is this kind of liar's poker that goes on with learning curves. I think Mark Twain is quoted on statistics.

There are many players in the system to distort learning curves, whether it's the researchers, small companies, big companies, advocates for one technology or another.

Somehow getting at the truth of them is at the heart, but it is very difficult.

XXX: XXX, I'd just like to reinforce very strongly what XXX was talking about and say I would not let that just be underlying everything else. I would pull that out, this is one place where I bet you can find the most universal agreement from Government role of anything, from industry and everybody else.

After all, President Reagan, they made that a high principle, we will do basic research. We won't do your commercial stuff, but we will do that.

Let's preserve that. Given what's happening in the world, getting that intellectual infrastructure and what are those large scale projects, that should be first and foremost.

XXX: To what extent do we run the danger if we put that right up front, you guys just want to sand box and you're not going to have any sort term impact.

XXX: No. Don't worry about that. Help people understand what is important and what's going on.

XXX: The idea of sensitivity analysis was brought up earlier. There is a particular kind of sensitivity analysis that you do on portfolio's which has a somewhat misleading name of "reduced cost analysis."

Reduced cost analysis basically says here's what we are going with now, but if this particular type of change happened, if this particular type of miracle

happened, we would change our mind.

It has to be this big before we are going to move to a new solution.

I think you could get a huge amount of press from Exhibit 6 in some appendix if you said well, we haven't put a lot of emphasis on biofuels, but if it moved this far before our next report, we would have a big section on it. That is like a huge target for the entrepreneurial and research community to say either think big or go away.

XXX: We do have sections that say if these breakthrough's happen, this would be a part of the next QTR five years from now.

XXX: Think about that in terms of the portfolio. It's not just one technology at a time.

XXX: When do you attack the most critical research uncertainty to say when does it deserve a bigger part of the portfolio, and to make certain that you are plan enough optionality in this, again, there could be a preferred mode, but enough funded critical optionality in the funding scheme to say wait five years to revisit something, but you are

actually working to make those other things successful, maybe in a more limited way, but you attack them in a much more targeted direction.

When we look at anything that might be construed as the preferred pathway to critically look at the sequence of events that need to happen through that system to be commercially successful.

If we take each one of those, one has ten steps, but we might say the biggest cost/benefit reward, but you have ten steps, and each one of those steps is 50 percent probability versus another one which has a slightly lower cost/benefit trade-off, but there are three steps and a higher probability.

Let's be rational in terms of the complexity of what we are bringing to the table.

XXX: Pay off certainty.

XXX: I think it will be a big factor.

XXX: Let me just build on what was said here a minute ago, which is you may want to start with talking about what the R&D expenditures in this industry have been.

It would probably be a good way to start. It

really is a piece of framing that people need to understand on why there is a DOE. EPRI spends $320 million a year on electricity. You guys spend I don't know how much on electricity. $450 million spent on power.

XXX: Just to take issue with that, you have to go by utility by utility, provider by provider, and add it all up.

XXX: I have.

XXX: It's not inconsequential. The data is not very good out there, quite frankly.

If you go on the other side, the transportation side, it's unbelievable in terms of the amount of money that has been invested.

XXX: XXX, does it exist, transport R&D, funding on the vehicle side?

XXX: I think it's better.

XXX: XXX, it has been explicit in a lot of this discussion, and maybe it needs to be brought out as a theme in the report, the centrality of electricity.

XXX: XXX, if you have some utility

data, XXX and I have been in the industry for a while, and the utility by utility experience is essentially nothing.

XXX: I had to push as chairman for the utility to undertake what we call cutting edge projects, whether it was methane digesters, and it was integration of concentrating solar with coal plants, things like that.

That kind of research, it just doesn't exist.

XXX: The precise numbers don't matter. If it's less than 100 million, that's good enough to know.

XXX: We talked about this earlier, cost. Looking at the consumer side of things, one of your parameters that has to be in your cost/benefit analysis is what is the threshold for an acceptable cost, and that goes back to the PUC and what's an acceptable rate increase to accommodate the cost increase.

As you look through the whole stream, if you will, and you are looking at the technology, you have to be able to look at how much the cost curve will be

bent versus the expenditure that is required, and do you have that framework in place that will allow that to be cost recovered.

Nobody in the business community is a philanthropist, and they are not going to do things because they just feel good about it. They are accountable to other people, shareholders, consumers, et cetera.

Like it or not, that has to be a central part of any evaluation that people will gravitate to.

XXX: Let's go to transport where there is a little bit more direct consumer impact and interest on the price, because the price of generation is a smaller part of the cost of residential electricity.

Is it in the end true that consumer economics are really going to determine everything for transport?

XXX: First of all, DOE's impact on transport is going to have no bearing on the price over the next five and probably ten years. We know that.

You have to be very careful about mis-advertising.

XXX: That's true in generation, too.

XXX: Yes, that's true. Less true in generation. I would argue, for example, what DOE did in coal bed methane had a material effect on natural gas.

XXX: It took ten years.

XXX: Yes, but that pales in comparison to what it is going to take on transportation. A million electric cars is not going to move the price of oil at all.

XXX: That, I agree with.

XXX: On the other hand, what we haven't heard much discussion of was the fact that Bill Gates' group and the PCAST report called for a substantial increase, and the number PCAST pulled out of the hat is they just took Bill Gates' number, $16 billion.

I have no idea whether that number is right. Nobody does.

We all agree there is a call despite the budgets and the deficit and all the issues in the

economy for a substantially larger public investment in R&D in the energy space.

I haven't heard you articulate that you are taking advantage of that wind at your back, but essentially it would be a good idea to say okay, given this portfolio, if we are going to move towards much higher levels of public investment in energy, what would I do, and what would we do as DOE?

Not all that money will go to DOE, but a lot of it. Obviously, you are not going to get $16 billion overnight. It's going to be decades or more.

There's an 18 wheeler coming at you in the front and a slight tail wind at the back.

XXX: What would be the impact of additional investment in energy R&D.

XXX: Even though it goes counter to the current politics, I would argue for it.

XXX: I think a discussion up front on the transport subject, it would be justified to talk about again the customer base. There is some differentiation when you talk about who ultimately will be the decision makers, getting back to your original

question.

Not only do you have a consumer side, but you have the operator side, at least in terms of one dimension. In terms of another dimension in terms of providers, I think that is a different customer or set of decision makers than the others.

I'm thinking in terms now of on the one end, you have folks who provide the enabling fuel, the enabling utilities, et cetera, for that transport sector, and then at the other end, you have the users or customers of it; right?

The other dimension is the fact that DOE does not control that entire value stream.

I think a discussion of the role that DOT and others might play would be justified in that analysis.

A discussion up front, I think, of that difficulty would be important.

XXX: Going back to XXX's point, obviously, you have to weigh that against how much more difficult the clearance process gets.

XXX: There is a real appetite by other agencies to engage in this, particularly DOT.

XXX: I think implicitly and to the extent possible, the report should be able to answer, especially if money is going down, what the priority is, and if it's going up, where do you put the marginal dollars.

I don't think you want to explicitly do anything that makes it sound like this is part of the debate of whether DOE gets more money.

If implicitly you can't answer that question in both directions, then I'm not sure what you would gain.

XXX: We are shying away of putting in explicit budget numbers over five years, but saying more directionally this is something we think should be emphasized or this is something that has a lower priority.

XXX: The report would seem to be even more responsible if you make an attempt to de-conflict with other programs at other agencies.

Take biofuels and look at the Department of Agriculture is doing versus here, and you say while this may have a high value, we are not going to do

anything on it because Agriculture is doing that.

XXX: In biofuels, we are pretty well aligned with USDA. We work pretty closely together with them.

XXX: Can I pick up on something XXX said in passing? XXX said a million cars isn't going to affect the price of oil very much or even at all.

Is there anything we can do short of explicit regulations or price incentives, taxes or whatever, to affect the price of oil?

XXX: There are a tremendous number of economic studies about demand for more vehicle fuels. The flip side of that is if you reduce demand by a gallon, there is an effect on price. You can look at those studies.

XXX: But I have global demand going up at a million barrels a day a year, and I have OPEC trading supply at the level of half a million barrels a day every six months, which is what they have been doing.

Can I or the U.S. really affect global oil prices?

XXX: Sure. I think the response to that -- I don't want to get into this too much -- the supply side response is that current prices -- there are a whole host of what used to be called unconventional, but oils out of Alberta, Venezuela, the Iraq situation.

XXX: What you can do is reduce our vulnerability.

XXX: Yes, but can we change the price really. XXX?

XXX: I guess the way I look at it is a little differently. I would argue it is probably this in all these things, it's a pathway issue, not can I adjust the issue on oil price, no. Can you look at issues that could over time shift the supply curve by bringing on a major resource in a fashion that you could responsibly tolerate.

For example, North America, if you count the U.S. and Canada, probably some disagreement maybe, but I would argue it has at the very least one of the largest unconventional resource bases on the planet, in both what we used to call source rocks but now produce

out of them, in both Canada and the U.S. Huge bodies for oil and gas.

You have the oil sands, one of the single largest deposits.

To me, if DOE can say these are the critical technical issues that would allow this development and meet other objectives, including environmental objectives, and it would help the system, not that you are going to do it, then I would argue that's the class of things that maybe make sense to do.

You're going to re-engineer the subsurface if you are going to produce out of shales. You are fracturing cubic kilometers in rock, can you do that, what are the issues associated with it.

XXX: If you look at the pace --

XXX: You're adjusting that curve. You're not adjusting the price.

XXX: You can also change your strategies, your six strategies, alternatives to those. You would have to broaden it about increasing the diversified supply of all fuels.

XXX: Yes, but you still will sell anything that is a hydrocarbon at the global oil price.

If you look at the rate at which we have been able to bring new resources on, the Gulf of Mexico was 800,000 barrels a day over a decade. Ethanol is 800,000 barrels a day.

XXX: A million barrels a day, it's the unit size that makes the difference.

XXX: That is a really heavy lift to do a million barrels a day of incremental production domestically.

XXX: DOE can certainly encourage using its convening power and some of the infrastructure discussions.

It's not yet clear whether that's a good pathway or not, but it is something that could change the industry.

XXX: It's a ten year dead end.

XXX: I would just like to comment on the economic issue of lowering the price of oil and whether we believe it's reasonable or not, EPA believes

it is reasonable, as we are looking at biofuels' regulations and greenhouse gas, that EPA is doing, economic modeling which we are working very hard to replicate right now, which includes rebound effect.

They are counting against biofuels the possibility that if we go up in use of biofuels, it will drive down the cost in some sense of gasoline and there will be increased use in the United States, there will be increased use worldwide.

Whether or not we believe that's true, EPA believes that is true, and that in itself is now coming back to counter balance, actually, drive against moving towards the use of biofuels and other internal sources of fuel.

XXX: I don't know if you can lower price, but one thing I do wonder is whether or not you can do something about volatility of price, which is what I think probably matters more.

Insofar as some of these options create more production capacity in the system and more flexibility in the system, you have maybe achieved something.

I know from some conversations I've had with

folks over at the State Department, for example, they have become very interested in this idea that gas technology actually enables countries like Saudi Arabia to do more with natural gas for their own domestic consumption, and freeze up their oil capacity to again play that balancing role on the world market.

Some of this also depends on what DOE sees as its scope of influence or activity, how much of the work that you do is involved in partnering with other nations, technology transfer, for example.

XXX: I don't know what the Saudi oil consumption is internally, probably about the same as the U.S. per capita, and they have eight percent of the people or something.

XXX: The Middle East is the second fastest growing region.

XXXSTEIN: I wouldn't necessarily get live or die on the exact numbers, but I think you have colleagues in other parts of the Government that are thinking about this at least conceptually.

XXX: On your million barrels a day, you take into account the Arctic, expansion in the

Gulf, and Keystone pipeline, and you already way over a million.

XXX: Keystone pipeline, how long is that going to take? At least a decade; right?

One of the charts we put in, just to sharpen this discussion a little, global demand and superimposed what a million barrels a day would look like over ten years, number 16.

You get a sense of what it would take to shift the global supply demand balance, and four million barrels a day over ten years, which is what is shown in that triangle, I don't think the U.S. has done in the last 40 years. Maybe we did it in the 1950s.

It seems to me it is hard to increase domestic production at a rate that is going to materially shift the global market.

XXX: That goes back to things that are outside your control. Number one, GOI, and secondly, tax structure. These global companies have a choice of where they put their marginal dollar, and increasingly, those dollars are going to other places

because of the tax structure incentive. The tax structure is more inviting in other markets.

This could be very different with a different set of policies.

XXX: Of course.

XXX: I think that goes back to something said earlier, do we explicitly say in this document that we're not going to do things or we are going to de-emphasize things.

I think one of the problems that I think people see with this Administration's policy on the oil security side is anything that was seen as internally inconsistent with the pathway was thought to be a waste of dollars because you should be putting it in an area that just needs more dollars than we have.

That is somewhat naive; right? As you see with what's going on with oil prices now, the Administration can very quickly come to terms with the importance of energy security in the near term.

There is an appropriate role for where DOE could and should be spending dollars in terms of oil supplies, natural gas supplies, probably natural gas is

more widely accepted, but certainly on the oil supply question, that keeps you in the game in a relevant way, at least in terms of being able to engage in that conversation, which I think a lot of people would say DOE is sort of languishing.

It informs your decisions. It allows you to be a player. It allows people to recognize that you understand what a huge portion of the market and how fast all that is changing these days.

I think the document should explicitly state where you think your strategic priorities are in that area, even if they are not big, but where you think you need to be in that game.

XXX: What's your value added in terms of technology?

XXX: Do you need the DOE.

What value added could we bring.

XXX: XXX, I guess when we talk about oil price, I would say, of course, that is just one part of the overall economic analysis of energy alternatives.

As we look out to the future, we agree that

the demand for oil is going to go up, mainly because of developing countries' living standards improving, and oil demand in Europe and the U.S. is going to go down. It is a pretty good news story.

Our view is there is going to be plenty of supply at the kind of pricing we are seeing, and there is still going to be a valid consumer value proposition for a long time.

The question is can we do better. Can we have better security of supply through diversity. Can we reduce carbon emissions.

XXX: Security of price.

XXX: Security of price, reduce the volatility because of further diversification.

I guess we ask the question, what's the role of DOE. My main point would be supporting the notion of basic R&D. This is an area that we have talked about, companies not being philanthropists, and I agree with that, but I don't think the DOE is a philanthropist either.

I think they have a clear mission, and this is money well spent. This is not philanthropy. If

anything, I guess I would say in the QTR you can raise the issue of the greater leverage you get with basic research versus, for instance, funding development projects.

I'll use as an example, improving CCS. We know that works.

I think all the oil companies are pretty comfortable with that technology because we do that kind of thing all the time.

XXX: Satisfied with the integrity?

XXX: That's a whole separate issue. I'm saying rather than take a billion dollars, for instance, it's expensive technology, which we believe would work, you can give 1,000 researchers a million dollars each.

For me, I feel like there is a lot more leverage, and that's a space only that DOE -- only the Government can really take a position on.

XXX: I think from our standpoint, it would be basic research. Business today, what is the value added from DOE.

I think XXX alluded to oil shale. We have a huge holding in oil shale, not oil sands, oil shale. Exxon is out there. It is going to take a little bit to get that economic.

It's an adjunct to say what's happened in the oils, shale gas. We have gone out there. Once you get it started, then you have the incremental add on and you get better and better.

Really, the research has been in the field. It's been just in time research. We go out there and work with the service company and work through the issues and do some of that. There has been some basic work, but basically it's been out there.

There are some areas, like oil shale. What can be done. Shell spent 30 years out there.

What is it that would enhance accelerating technology advancements in that particular field.

I think the value added for us in the hydrocarbon world is basic research.

XXX: All those technologies would still be price takers rather than price influence.

XXX: That's right. If they are successful --

XXX: I understand.

XXX: I agree with the points. Continuing activity in Western economies relies on us seeing opportunities in diversification and energy security, where we can fill the need to find a market in a more diversified set of products.

That means basic research, looking at new products, looking at new product spaces. I think one of the things DOE does that is profoundly valuable is big demonstration projects.

That intermediate stays between the very basic research and the next step, that kind of missing link, where you go from the concept that looks like it might work to how do I start to work out the nitty-gritty of actually bringing it into a deployment.

That's a huge thing that DOE can do, and others cannot.

XXX: We have not discussed demo's. It is one of the things I had scribbled down as what I wanted to cover with this group.

I want to continue with the oil discussion for a little while, and then turn to demo's.

We may want to talk about what can and can't be done about oil, but it seems in the context of gasoline prices, in context of the entire report, the larger point is regardless of what happens in that arena, these things have to be done anyway for the kinds of reasons we have been talking about.

Part of the point is the extent to which the price volatility doesn't affect most of what you're doing in a QTR, because it is looking at the alternatives.

On basic research, I think it needs to be clear what is meant by that. Most of what the basic research is that the Department spends on has nothing to do with this discussion very directly at all.

On basic energy sciences, computing, to some extent, the biology.

XXX: Right. I have a comment on demo's, so I'll wait until we get to that.

XXX: Anybody else on the oil discussion?

XXX: I think that is something DOE could do as an organizing body, to say look, it's not so much that we are concerned with thinking about oil and $10 versus $150. We are trying to make sure it doesn't go to $500 and stay there for years.

Thinking about out of the money call options to protect us against long periods of going in the wrong direction. I think that needs to be thought about in a multi-technology fashion.

XXX: I do think it is very important to acknowledge that different sectors regard the sort of stages of development very differently, and they have different terminology.

That is important because you are putting a bunch of words on paper that are going to use the terminology, and you are going to have different audiences.

Basic research to industry is very different than basic research to DOE, OMB, or Congress. That makes a big difference politically. I can tell you it's a very big difference politically.

It's making a difference on the Floor right

now about how much money you get to do this stuff.

If XXX were to go on the Floor today and say actually, this stuff that you are called applied near market research is very much basic to us, we would have a different debate on the Floor.

Putting things in those categories of basic and applied and demonstration, it doesn't actually serve us very well when we are trying to have a more universal conversation about innovation.

XXX: I worry about -- we were having a side bar here about the price. What we would like to have is whatever it is, it's this, rather than this, from a business standpoint.

This is you are forecasting, trying to budget, trying to do all this. It's up and down, up and down.

Back in the 1980s, we had the hockey stick approach, that it was going to go on forever. 500 isn't going to be there very long, it's going to be very painful and come right back down.

I think that is one thing the oil industry has learned, don't count on the hockey stick going up forever.

I don't think you can control price, no matter what we do, because you have a commodity out there, and it's supply and demand. I learned that back in Economics 101, butter and bread. If you have more butter, the price goes down, if the price goes up, you use less.

I think you have to go back to the basics, the idea would be not so much around pricing, but around volatility, but from a business standpoint, it would be absolutely tremendous if we could just have this across the board.

XXX: Can we turn to demo's in the last time we have? The Department has a long history in demonstration projects. They are expensive. They take a long time. They have been of mixed success.

If you're not going to demonstrate something that is economically competitive or within shooting distance, say 20 percent, of being competitive, should we do it at all?

How do we do cost share, should private industry have skin in the game, or should we just go

from demo anyway. How do we better capture the learning from the demo's that we do, given there is going to be private sector investment?

How do we well document the failures as well as the successes? There are a whole host of issues like that.

I'll just throw the floor open for comments on that.

XXX: Have you ever had a home run? I think demo's are always stacked up for failure. If the purpose of the demo is for technology which will not be competitive, then in a commercial sense, it has failed. You never get credit for what you provide in terms of knowledge.

If it's a big success, maybe the private sector would -- I would be very cautious on demo's.

XXX: I'd like to go back to the Department's early history with nuclear power. We can argue whether that was a success or not. It does provide 20 percent of our electricity. It didn't take just one demo. It was a whole series.

XXX: XXX, I don't know if this

involves demo's or not. I just want to make the pitch I made yesterday. The primacy of the issue of whether CCS is feasible, is acceptable, environmental, economic in a logistical sense.

If it turns out it is not, we have a different problem, a qualitatively different problem than we do assuming it's in.

Again, the Mountaineer experience was already recited this morning. That joins the procession of truncated failed CCS projects.

The scale of utilities' production of CO2 is nothing.

I don't know what the answer is. None of us do. That is so fundamentally important at the beginning of this process, not 20 years from now.

XXX: I can't help but quickly say something about CCS, which is I do agree if there weren't any, it would be a game changer. There is no question. If it weren't in the mix, it would be a game changer, although somebody who works on it and all of my colleagues in industry, one of the fundamental obstacles is price.

By the way, most of the work on price is done on an average basis as opposed to the niche markets where in fact the marginal cost is actually relatively low.

I think DOE, even taking out FutureGen, has been amazingly successful in half a dozen projects. The fact that Mountaineer isn't going to go forward, it is because they anticipated a price on carbon and now there isn't one. This is straightforward.

There is nothing fundamental that CCS is failing there. It's policy.

As far as demo's, I think this is a complicated thing. I would say in certain areas, and CCS might be a nice example, some demo's are essential.

I would say there are some rules for demo's that are not always followed. We were talking about this at the break. FutureGen, I think, is the wrong way to do it.

I think demo's have to be done on a commercial basis. Companies have a profit maximization effort. They will try to keep the costs as low as possible. They are not going to waste money by making it a white

elephant and building in all sorts of bells and whistles that aren't needed.

The whole point of a demonstration is to show to industry it can be done as economically as possible. If you let a contractor, the way DOD runs things, or the way Battelle runs things, there is no incentive for profit -- there is no incentive for keeping costs down, and it's a disaster.

The second thing is I would resist the efforts that I hear from Silicon Valley including a former assistant secretary out on the West Coast who will go nameless -- who pushes very hard for setting up a demonstration institute for crossing the Valley of Death.

You hear this all the time, because what they have discovered in the clean tech world is they thought they were a technology company and they end up being a development company, a project company, construction development company. The truth is they're not. They don't have enough money. VCs don't have enough money for project developments. They don't know what they're doing. They don't have billion dollar bank rolls.

As a result, they can't do multi-billion dollar projects. Frankly, that Valley of Death is there for a reason, and it's a very good reason.

I think we should be very, very careful to only provide a bridge across the Valley of Death in situations where we really think we need that bridge.

I would say CCS meets that standard. Not necessarily because it's going to be there, but because it looks to everyone like it's an essential ingredient, so therefore, it's an optionality thing.

XXX: A couple of things. I'm sure XXX and XXX are familiar with this.

When we build demonstration projects internally, the real objectives were -- you already had done pilot plants, and you have already done the lab work, so now what are the two questions left?

Can you scale it up and what are the economics, and can you basically produce, integrate it into your supply chain or facility in any effective way.

These are always the challenges. Does it scale, does it integrate. That's the nature of energy.

It has to do both.

There is the question about how you structure demonstrations to do that, and I tend to agree with XXX's comment. I might distinguish that from what I think XXX said.

If I had good success at building what I would call "test beds," which are different, and this depends on the supply chain structure, if you have a supply chain structure where there is an army of people that are trying to get into the business, and they are not at the scale of the integrators already, there is a lot of usefulness to plug into something that has this issue and then come away and say it's a nice technology but it's not going to work because it doesn't integrate well enough.

I would distinguish between the mega demo projects, in which case now I think you really do need -- I always ask the question, if a company can't afford to build a demo project, how the hell is it supposed to build ten more if it works.

I think that is the argument I would have against that.

The test bed, I think that's different. Chevron built a solar test bed in the San Joaquin Valley. That works good.

XXX: CCS is not the only demo on the table these days. Small module reactors is another one we're talking about seriously. There are probably a couple of others I've forgotten.

XXX: I would endorse the idea of a full spectrum of activity, from a test bed up to large demo's. When I said "demo's," I didn't mean just great big huge demo's. The full spectrum is important.

I also would be careful about not judging the success of such a project solely on did we come out at the end with a commercial product that somebody can just walk away with and use.

A huge amount of these test beds and demo's is working the bugs out. Industry, like everybody else, knows how much time, how much effort you spend doing the industry scale analog of figuring out what cables you need to make your experiment work.

Being able to work through some of those processes, help people develop capability, what you

will find is participants will walk away having understood, developed internal capability, and will be able to build on it, even if the demo itself or the test bed itself was not an economic success.

XXX: Two short comments. One is I think the test beds and demonstration projects are necessary, just as I think XXX had referred to, throughout your innovation process, use them selectively to prove out a point, prove a concept, et cetera, but I think any of these projects can benefit from the use of a robust value proposition, which is more than just a statement of cost/benefit.

It is what are the technology challenges, what are the competitive issues you are trying to address, and at the end state, what you are trying to achieve from a commercialization perspective.

It's not just the technology. It's about what are you going to do with the technology, what are the head winds you have to face and accomplish.

The success rate could be improved for these projects if there was a value proposition.

XXX: Before I turn to

XXX, what we have also understood is different sectors mean different things when they say "demo."

XXX: That's right.

XXX: It may be let's put 100 CNG vehicles out there and see how consumers use them, a very different kind of thing.

XXX: I don't know if this is useful. I agree with everything that has been said about demo's. Bigger demo's in particular have had way more of a political motivation than a technical or economic one, both on the company side, where the motivation is often don't make me do anything because see, I'm working with you, and on the political side, look, we're doing something, so leave us alone.

They are not designed to succeed on any other level. That tendency is greater the bigger they are.

On Valley of Death, I agree with what XXX said, but I think in terms of using that, Valley of Death has now become like a RIP Valley.

It's anything that's not bench research or making widgets, it is now in the Valley of Death. If it's going to be used, it's another one of those terms

that is useless unless it's defined, because it is just a code word for give me money, and I used the terms, so don't analyze what I'm talking about.

XXX: On the kind of demo that XXX was talking about, it is really essential that the private sector be in control of that kind of a demonstration.

I had the privilege of sitting through watching AEP design an IGCC plant, $100 million dollars. Totally different approach.

FutureGen is not going to supply information that is useful. I don't know about the skin in the game part of it, that's very complicated.

You just can't have the Government designing a thing that is to be used to figure out whether you can integrate it.

Demonstration is simply not a necessary step in the process.

XXX: Can I explore the IGCC example for a second, at least as we have been thinking about it. It was a success but not a success, what we did with IGCC.

We demonstrated the viability of it, maybe

even commercial viability of it, but there remain, how many IGCC plants in the U.S. now, 15 years after things were demonstrated?

XXX: I think that is an unfair statement, XXX. IGCC, part of it is the way the utilities are structured away from co-production of chemicals.

Part of it was also those demonstrations came just before a time when we built a few gas turbines but almost nothing else. I think it's partly historical.

The fact that you now have half a dozen IGCC projects around the U.S. going forward, I think it is a look through a slightly longer historical lens; that's all.

XXX: I actually look at the whole IGCC phenomenon much like I look at the hydrogen phenomenon. It was the answer to the wrong question.

The issue was sequestering CO2. It wasn't finding new ways to combust coal.

IGCC answers no question other than what is a different way to process coal. If the IGCC program had been more focused on poly-generation, because we are

thinking about using coal as a feedstock for chemical production, as a way of creating some float in the petroleum, maybe that was an interesting way to do it.

If you are looking at IGCC as a CO2 strategy, the money was completely wasted. It would have been much better off put into sequestration itself, and back in control technologies, for the existing fleet.

XXX: IGCC as an example of a demo that did not have a commercial impact.

XXX: There are large scale projects which gather essential data which are not demo's. An example, suppose we are interested in enhanced GSO. Something like 50 holes around the world in groups of three are going to be required to understand the fracturing of the granite, the heat flow from flowing aquifers above the hot rock.

It is a billion dollar program. It is an international program. It is not a demo. It's gathering essential data for scale. It's a large scale research program.

That's absolutely a DOE function, along with DOE's partners around the world.

Let's be very careful to differentiate those from commercial demo's.

XXX: Doing a demonstration that proves IGCC works. There was a lot of work looking at how you would design one. That is the kind of information you want to take advantage of.

XXX: I will throw the floor open for any last comments, before I thank you.

XXX: Will we get a list of the participants by e-mail? Is that possible?

XXX: Yes. This has been wonderful. I think really substantial content for the kind of topics we need to worry about as we prepare our final document.

You will all eventually see the whole thing for comment. We look forward to hearing whether you think we listened to you all or not.

(Laughter.)

XXX: This has been really good. Thanks to everyone.

(Whereupon, at 11:55 a.m., the workshop was concluded.)

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