BEFORE THE

122d NATIONAL PETROLEUM COUNCIL MEETING

TRANSCRIPT OF PROCEEDINGS

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Post Office Box 297

310 South Main Street

Lusk, Wyoming 82225 USA

In USA 1-800-435-2468 Worldwide 001-307-334-2423

Worldwide Telefax 001-307-316-0388

E-mail: BUNNWORLDWIDE@aol.com

APPEARANCES:
MEMBERS IN ATTENDANCE:
DANIEL J. O'REILLY
Chair
National Petroleum Council
Retired
Chevron Corporation
MARSHALL W. NICHOLS
Executive Director
National Petroleum Council
ROBERT B. CATELL
Chair
Advanced Energy Research and Technology Center
Stony Brook University

CLARENCE P. CAZALOT, Jr.
Chair
National Petroleum Council Committee on
Future Transportation Fuels
Chair, President, and Chief Executive Officer
Marathon Oil Corporation
CHARLES D. DAVIDSON
Chair
NPC Finance Committee
Chair and chief Executive Officer
Noble Energy, Inc.
GUESTS:
Hon. STEPHEN CHU
Secretary of Energy

Hon. DANIEL B. PONEMAN
Deputy Secretary of Energy
Hon. DAVID B. SANDALOW
Acting Undersecretary of Energy

APPEARANCES (Continued):

SUBCOMMITTEE CHAIRS:

D. CLAY BRETCHES
Chair
Coordinating Subcommittee of the
NPC Committee on Resource Development

LINDA A. CAPUANO
Chair
Coordinating Subcommittee

TASK GROUP CHAIRS:

STEPHEN R. BRAND
ConocoPhillips
Chair
Technology Task Group

TODD WERPY
Chair
Biofuels Study Group

S. SHARIQ YOSUFZAI
Chair
Supply and Infrastructure Task Group

SUBGROUP CHAIRS:

TONY BOCCANFUSO
University of South Carolina
Chair
Hydrogen Fuel Cells Subgroup

CHRIS ERICKSON
Archer Daniels Midlands
Chair
Hydrocarbon Liquids Subgroup

MIKE GALLAGHER
Westport Innovations
Chair
Natural Gas Subgroup

APPEARANCES (Continued):
SUBGROUP CHAIRS (Continued):
WILLIAM N. REINERT
Toyota
Chair
Electric Subgroup

ALAN TAUB
General Motors, Retired
Chair
Engines and Light-Duty Vehicles Subgroup
JOHN WALL
Cummins
Chair
Heavy-Duty Vehicle Subgroup

REGISTERED ATTENDEES:

Feridun Albayrak	IBM falbayra@us.ibm.com
Joey Blanch	Chevron jblanch@chevron.com
Erik Brownsword	EEI ebrownsword@eei.org
Thomas J. Buonomo	Hunt Energy tbuonomo@huntenergy.com
Joseph Caggiano	Chevron JCAG@chevron.com
Eileen Campbell	Marathon Oil Corp. emcampbell@marathonoil.com
Carlton Carroll	API carrollc@api.org
Brian Chase	Chevron bchase@chevron.com

APPEARANCES (Continued):
REGISTERED ATTENDEES (Continued):

Jaycie Chitwood	Toyota	jaycie_chitwood@toyota.com
Valerie Crockett	TVA	vjcrockett@tva-gov
Jack Derickson	Chevron	jderickson@chevron.com
John Eichberger	NACS	jeichberger@nacsonline.com
Ed Feller	Energy Guardian	efeller@usenergyguardian.net
Charles Farago	Southern Ute Growth Fund	cfarago@sugf.com
Christine Fields	Accenture	christine.fields@accentrue.com
Jim Ford	ConocoPhillips	j.m.e.ford@conocophillips.com
Christopher Freitas	U.S. Department of Energy	christopher.freitas@hq.doe.gov
Mike Gallagher	Westport	mgallagher@westport.com
Lynn Garner	BNA	lgarner@bna.com
Avi Gopstein	U.S. Department of State	gopsteinam@state.gov
Susan Gregersen	U.S. Department of Energy	susan.gregersen@hq.doe.gov
Marilyn Harris	MRO	maharris@marathon.com

APPEARANCES (Continued):
REGISTERED ATTENDEES (Continued):

Nakal Havaurkar	Ken Keayeske.com	naklahav@gmail.com
Karen Hifender	Spana	Karen@CFaenerey.oeu
Lisa Hyland	CSIS	lhyland@csis.org
David Ivanovicit	Argus	david.ivanovicit@argus.com
Nancy Johnson	U.S. Department of Energy	nancy.johnson@hq.doe.gov
David Keane	BG Group	David.Keane@BG-Group.com
Sarah Ladislaw	Statoil	sarlad@statoil.com
J. Landers	Dallas Morning News	jlanders@dallasnews.com
Warren Long	ACSF	wlang@cleanskies.org
Deborah Lawrence	Williams	deborah.lawrence@williams.com
Mike Leister	Marathon petroleum	meleister@marathonpetroleum.com
Andrea Lisi	Marathon Oil	andrea.lisi@marathonoil.com
Mark Maddox	RG	mark@maddoxstrategies.com
Bill Maloney	STATOIL	BML@statoil.com

APPEARANCES (Continued):
REGISTERED ATTENDEES (Continued):

Jeff Miller	Miller Oil Co.	JMiller@milleroilco.com
Alby Modiano	U.S.O.G.A.	amodiano@usoga.com
Lauren O'Neal	EIG	loneil@energyinter.com
Jason Plautz	Greenwire	jplautz@etnews.net
David Pumphry	CSIS	dpumphrey@csis.org
J.A. Pyper	Climate Wire	jpyper@ppnews.net
John Reese	Shell	john:reese@shell.com
Bill Reinert	Toyota	bill.reinert@toyota.com
David Roger	Chevron	EROG@chevron.com
Shane Seibel	Southern Ute Growth Fund	sseibel@sugf.com
Jim Shitz	Global Energy Strategics	jshitz@globalenergystrategics.net
Chris Smith	U.S. Department of Energy	chris.smith@hq.doe.gov
Nick Snow	Oil & Gas Journal	nicks@pennwell.com
Greg Stape	ACSF	gstape@cleanskies.com

APPEARANCES (Continued):

REGISTERED ATTENDEES (Continued):

Melissa Stark	Accentrue	melissa.stark@accenture.com
Bill Taylor	KVA	bill.taylor@kvausa.com
Puneet Verma	Chevron	pverma@chevron.com
Knely Webster	Counsel	
Todd Werpy	ADM	todd.werpy@adm.com
Madeline Whitaker		

I N D E X

BEFORE THE

122d NATIONAL PETROLEUM COUNCIL MEETING

The One Hundred Twenty-Second Meeting of the National Petroleum Council was held pursuant to Notice at the Astor Ball Room of the St. Regis Hotel, 923 Sixteenth Street, NW, Washington, D.C., USA, commencing on the 1st day of August, 2012, at 9:00 a.m. ET.

TRANSCRIPT OF PROCEEDINGS

MR. O'REILLY: Good morning, Ladies and Gentlemen. I'd like to call the one hundred and twenty-second meeting of the National Petroleum Council to order.

Welcome, Members of the Council, honored guests, members of the press, and public. I think we have a very interesting and informative meeting for you all today.

For the Members of the Council, if we have no objection, I'd like to dispense with the calling of the roll. We'll use the chalk-in in the Chandelier Room to serve as our official attendance record.

Any member or observer who did not sign

in or who has not checked in, please do so after the meeting so we have an accurate record of attendance at the meeting today.

We also have an extended audience joining us via webcast. The internet audience will be able to follow our presentations today, and at the end of the meeting will be able to download the Future Transportation Fuel Study Draft Report.

I'd now like to introduce to you, and for the Record, the members and the participants at our head table. On my immediate right is the Council's co-Chair, the Honorable Steven Chu, Secretary of Energy.

Mr. Chu. Welcome.

(Whereupon, applause was had.)

MR. O'REILLY: We thank you for being here this morning, and we look forward to having our presentations and report sent to you.

Next one is Clarence Cazalot, Chairman of the NPC Committee on Future Transportation Fuels.

(Whereupon, applause was had.)

MR. O'REILLY: Next, the Honorable

Daniel Poneman, Deputy Secretary of Energy, and the government co-Chair for the Committee.

Daniel.

(Whereupon, applause was had.)

MR. O'REILLY: And, next to Daniel is Marshall Nichols, the Executive Director of the National Petroleum Council itself.

Marshall, welcome.

(Whereupon, applause was had.)

MR. O'REILLY: At the table to my left are representatives from the Future Transportation Fuels Study's Coordinating Committee who have worked for two years to complete the study. It's been a pretty massive undertaking, and they will be introduced to you as the study itself is presented.

So, our primary business this morning is to review the work of the NPC Committee itself, the, the Future Transportation Fuels Study, discuss the findings and recommendations, and to vote on the adoption of the Proposed Final Report as the Council's response to the Secretary's request of a couple of years ago.

Many members of the Council have

provided outstanding leadership, as well as significant commitments of their personal time and their organizations' resources to respond to the Secretary's request fort he important study.

One of the main contributors, or course, if Clarence Cazalot, of Marathon, who chairs that Committee on Future Transportation Fuels, and he will kick off the presentation of the results of the comprehensive study.

So, Clarence, the podium is yours. Be careful here.

CONSIDERATION OF THE PROPOSED FINAL REPORT OF THE NPC COMMITTEE ON FUTURE TRANSPORTATION FUELS:

MR. CAZALOT: Thank you, Dave.

Good morning to the Council, our honored guests, and those of you joining us via the web. Before I begin, I want to say a word of thanks to my leadership team.

Dan Poneman, as already been introduced as my government co-Chair, stayed with us from the inception of the study to the finish. It was a great source of advice and support.

John Watson, our Supply and

Infrastructure Vice-Chair personally provided tremendous support throughout the study, as well as significant resources from Chevron, one of who we will hear from a little later.

John Deutch, who would be here today were it not for being laid up with a back injury, guided the very difficult technology assessment process.

John, I hope you're feeling better, and that you're watching on the web, and we thank you for your service.

Lastly, we have Jim Owens, who did the demand analysis. Jim retired about midway through the study, but he provided us Ian Short to chair the Demand Task Group.

And, Ian, we hope you're watching from your new position in Geneva.

Now for the Study. The Council was asked by Secretary Chu to address, -dress issues that are very complex and far-reaching, and I strongly believe that the Committee's Coordinating Subcommittee, Task Groups, and Subgroups have met the challenge in fine fashion.

They assembled and analyzed the facts, and discussed openly their implications to the environment, the economy, and our nation's energy security. This study is unprecedented in its breadth, depth, and use of subject-matter experts.

The complete report has the potential to significantly enhance our nation's understanding of the promise and prospects for all forms of transportation in this country moving forward. I believe the results of their efforts will help the Secretary and others address the important challenges to commercial-scale deployment of advanced vehicles and alternative fuels at scale over the coming decades.

As we will see and discuss this morning, first, we have existing technology, fuels, and vehicles that are capable of significant improvement. Secondly, we've also identified technology infrastructure hurdles that, if overcome, hold exciting promise to add to the suite of avoidable and affordable fuels in vehicles.

And, last, but certainly not least, we have the great potential for disruptive

technologies and innovations that could take us in new directions.

Ladies and gentlemen, I believe this is a very promising technology story, and, indeed, a good-news story for America's economy, the environment, and energy security. Our objective this morning is to provide an overview of the study's findings and recommendations.

We hope that many of you have read, or will read the report in its entirety, including the topic papers, which will be made available on the NPC website, and take advantage of the study's modeling tools that will also be available on line.

I do want to emphasize that the report itself was full of important details that simply cannot be covered in a 40-minute presentation. The background and analyses that you will find in the report will provide clarification and support for the key findings and recommendations that we, you will hear in the presentation today.

Here to describe the highlights of the report is the Leadership Team from the Study's Coordinating Subcommittee. As Dave said, they have

been at this task, on this assignment for over two years in order to make this date possible.

On my immediate left was Linda Capuano, who chairs the Coordinating Subcommittee.

Next to Linda is David Sandalow, the Coordinating Subcommittee's government co-Chair. We want to thank him for his leadership and engagement throughout this process.

Next to Dave is Bill Reinert, who chairs the Electric Subgroup.

And, next to Bill is Steven Brand, who chairs the Technology Task Group.

And, finally, we have Shaq Yosufzai, who chairs the Infrastructure and Supply Task Group.

I want to reiterate David O'Reilly's earlier recognition of the many members of the Council who provided their outstanding leadership, as well as som significant commitments of their time and their organizations' resources in response to the Secretary's request for this important study.

And, for those of you who responded to these requests to make people available, and their

significant commitment of time for this study, my personal thanks to all of you for your support.

We now want to turn to the consideration of the Proposed Final Report of the NPC Committee on Future Transportation Fuels. On behalf of the Committee I'm pleased this morning to present the results of this comprehensive study to the Council Membership for your consideration and action.

And, Linda Capuano will now lead off the presentation.

Linda.

MS. CAPUANO: Thank you. Thank you, Clarence.

Over the next 40 minutes we will briefly cover the breadth of the study, review the top five study findings, and the five recommendations. First I will briefly remind you of the study's scope.

Slide 2 is a reminder that Secretary Chu has asked for a study of future transportation fuels prospects through 2050, for auto, truck, air, rail, and waterborne transport. The study addresses fuel demand, fuel supply, infrastructure,

and technology, and will advise on policy options and pathways for integrating new fuels and vehicles into the marketplace.

The study considered factors such as energy efficiency, environmental impact, energy security, and economic competitiveness, and specifically considered Secretary Chu's supplemental request for us to address what actions industry and government could take to reduce transportation greenhouse gas emissions by 50 percent in 2050, relative to 2005.

Slide 3 shows the study's struct-, the study's organized with a committee on future transportation fuels, and executive committee, and a coordinating subcommittee, with task groups for demand, supply and infrastructure, and technology.

Slide 4, Clarence Cazalot chairs the Study's Executive Committee, with Dan Poneman as government co-chair. The diversity of participation shows in the Coordinating Subcommittee and the 300-plus study members represented in the next slide.

Eleven percent of the study members

represented end users such as Federal Express, Wal-Mart, United Airlines, and the American Trucking Association, as we consider the demand for moving people and goods in 2050.

Twenty-four percent represented fuel suppliers such as Chevron, Exxon-Mobil, ConocoPhillips, Air Products, Encana, and Archer Daniels Midlands. And, 24 percent represented transportation manufacturers, such as General Motors, Toyota, Volvo, Westport Innovations, Cummins, and Packard, as we considered vehicle requirements to supply the demand for moving people and, and goods in 2050.

We also recruited a good representation of academics, engineers, government, legal, and finance, such as Duke University, Resources for the Future, and the Department of Transportation. But, as you see on the, on the right, at our heart this is a technology study, with 70 percent of the participants having technol-, technical backgrounds complemented by participants specializing in policy and economics.

Slide 6 shows our guiding principles.

We operated under a number of guiding principles, in particular, clarifying our assumptions and considering the environmental, economic, energy security impacts of our analysis.

Beyond the diversity of our membership, the study has been equally broad in surveying work that has gone before. We maximized the use of prior studies.

The Bibliography has reached over 400 references. And, the study complemented the review of published work, with more than 20 briefings on current activities.

Slide 7 summarizes the briefings we have received on fuel and vehicle technologies; For example, from MIT, BMW, and the National Academies.

Slide 8 summarized the briefings on environmental and, and efficiency, and infrastructure and investment; for example, from Carnegie-Melon, DOE, Department of Transportation, and the Pew Center, to name a few.

We are also communicating and reaching out. Slide 9 lists presentations we have made and are scheduled to make during the course of this

study. You can see the three expert reviews, presentations to engineers, and relevant academic and professional conferences.

Slide 10 shows the study structure. The study began by examining individual fuel and vehicle options for biofuels, electric, hydrocarbon liquids, and natural-gas and hydrogen fuel cells. Seven subgroups analyzed the potential to maximize the commercial availability of each vehicle fuel type, independent of competition from the other vehicle types.

Todd Werpy, of the Ar-, Archer Daniels Midlands, chaired Biofuels. Chris Erickson, of ExxonMobil chaired Hydrocarbon Liquids.

Mike Gallagher, of Westport Innovations, chaired Natural Gas. Tony Boccanfuso, of the University of South Carolina, chairing Hydrogen Fuel Cells, and Bill Reinert, of Toyota, chairing the Electric Subgroup.

Alan, Alan Taub, retired from General Motors, chaired the Engines and Light-Duty Vehicles Subgroup, with John Wall of Cummins chairing the Heavy-Duty Vehicle Subgroup.

While the Supply and Infrastructure and Technology Task Groups considered the technical and other barriers in each fuel vehicle system that must be overcome to commercially be available by 2050, the Demand Task Group considered the range of 2050 transportation demand for passengers and freight.

The integration of the individual fuel vehicle supply chains to meet 2050 demand was accomplished by five subgroups: Reporting Integration, chaired by Peggy Montana, of Shell; Data Integration, chaired by Gene Tunison, of ExxonMobil; Integrated Vehicles, chaired by Clay Phillips of General Motors; Infrastructure, chaired by Charlie Schrier, retired ExxonMobil; and Greenhouse Gas Emissions, chaired by Dave Rogers of Chevron.

Slide 12 shows the integration -- how the individual supply chains are represented pictorially by the three-by-three matrix by integrated supply and demand. We considered potential fuel/vehicle mixes that could result when multiple fuel/vehicle types competed to meet 2050

demands to move passengers and freight.

The horizontal axis represents the mobility demand in 2050. The study used the EIA AEO 2010 as the reference case, using the high and low oil price scenarios to consider the range of demand.

This provided a credible, well-documented, and public-available starting point. The vertical axis represents the mobility, supply, moving from low, lower technology development to aggressive technology and infrastructure development analysis.

And, since we considered accelerating alternative fuels in vehicles, our analysis spent more time looking at the aggressive development cases represented at the top of the matrix. The study examined at a variety of fuel/vehicle combinations relative to environment, economic competitiveness, and energy security by considering characteristics like greenhouse gas emissions, cost of mobility, oil uses, and a robust fuel supply, to name just a few.

This integrated work culminated in five

top-level findings. We will cover each of these individually in the next slides, but they are summarized for you in Slide 12.

Bill, Bill Reinert of Toyota, and Chair of the Electric Subgroup, will discuss the finding related to fuel economy.

Stephen Brand, retired CEO of ConocoPhillips, and Chair of the Technologies Task Group, will discuss the findings related to technology and infrastructure challenges.

And Shariq Yosufzai, VP at Chevron and Chair of the Supply and Infrastructure Task Group, will discuss the findings related to greenhouse gas emissions and energy security.

I will now turn the discussion on fuel economy finding on Slide 13 to Bill Reinert.

MR. REINERT: Thank you, Linda.

A key finding of this study is that fuel economy can be dramatically increased in both the light- and heavy-duty sectors due to advancement and application of existing and new technologies. Internal-combustion engines are likely to be the dominant propulsion system for decades to come,

with liquid fuel blends continuing to play a significant, although reduced role.

Our integrated analysis found that individual fuel economy can improve with the application of technology, and that overall fleet fuel economy could improve as the work process make these technologies more affordable and applicable to the mass market.

Reduced vehicle weight, improved aerodynamics, and reduced rolling resistance are highly desirable, because they apply to all vehicle types, regardless of propulsion system or fuels used. But, they tend to provide incremental improvements.

Technologies that improve the technologies of intern-, internal-combustion engines are also desirable because they apply to many different fuel types, including internal-combustion engines, liquid fuel hybrids, plug-in hybrids, and natural-gas vehicle, vehicles.

According to a liter-, literature survey for this study, the following results are possible by 2050, relative to 2005 conventional vehicles.

These results are going to be expressed on a mile-per-gallon gasoline equivalent basis.

For internal-combustion light-duty vehicles combining light-weighting with smaller displacement engines, max turbo charge, improved transmissions, we can expect up to 50-percent improvement in fuel economy. The most dramatic impact of fuel economy effects come from powertrain hybridization and electrification, which has eventually built up to 100-percent improvement for hybrid vehicles, up to 300-percent improvement for fuel-cell electric vehi-, vehicles, and up to 400-percent improvement for battery-electric vehicles.

In the heavy-duty sector more significant improvements of up to 100 percent are possible through improved aerodynamics, improved rolling resistance, powertrain improvements. Again, this is based on literature research, not the findings of this group.

Based on the assumptions and inputs used, the study analysis found that each fuel/vehicle system could become economically

viable by 2050. This is due largely to the faster cost reductions for alternative technology when compared to more mature technologies, and oil prices that rise faster than alternative fuels.

These draws market -- These -- This draws alternatives in advanced technologies into the market. When oil prices are high, the rate of technology adoption for fuel economy and alternative fuels is likely to increase.

And, su-, -- And, a sustained price spread favor alternative fuels and potentially encourages the adoption of some alternative vehicles. Because alternative vehicles tend not to be economically viable when oil prices are low, reducing the cost of these technologies to create a value proposition for consumers isn't necessary to gain a meaningful market share.

It is important to note the study did not examine how other factors might eliminate potential alternatives. So, this study does not hypothesize a single-point fuel/vehicle system, nor does it hypothesize a portfolio of such systems.

Internal-combustion engines, again, are

likely to be the dominant propulsion system for decades.

Next slide, please. Okay.

This slide shows the energy consumption by fuel type resulting from both the heavy- and light-duty vehicle analysis. These results cover all oil-price scenarios derived from AEO 2010, and a portfolio in which all vehicle fuel systems are competing.

The assumptions in this scenario are detailed in the report. As you can see from this slide, there is great potential for natural gas and biofuels to replace petroleum in the future.

There is a wide range of outcomes of all fuel types. Looking at 2010 versus 2050, we can see that increase in vehicle miles traveled tends to overcome the advancements in technology.

So, energy, transportation energy may increase even by 2050. One thing to note is that, that this is for vehicle-on-road use.

If you look at the slides for electricity and hydrogen, they appear very small. But, this is because the high efficiency of these

powertrains means they use very little energy on the road.

That doesn't mean that they won't get marginally. As stated previously, this will continue to play a large role in the sect-, sector.

And, this concludes my remarks. Now I'm going to turn it over to Steven Brand, Chair of the technology testing.

MR. BRAND: Thank you, Bill.

Let me begin by going through the subject-matter experts on this slide. And this, those experts -- And, they were a significant part of this study.

And, it's what made this study somewhat unique. And I would just note the John Deutch also chaired this group of folks, and it was a challenge at times for him to manage this group.

The peer reviews were conducted by these experts on topics important to this study. Their role was to review the technical content of the study for consistency, standardization, normalization, and completeness of analysis.

Just to give you an example of who this

group included, we have Yet-Ming Chiang, of the Univers-, or, MIT, and also A123 Batteries. And, we evaluated and reviewed the electric-vehicle chapter, and worked on the electricity section of the, of the analysis.

John Heywood, of MIT, was one of the expert on engines. And, Rob Fraley, who is in industry, was at Monsanto, provided biotechnology expertise input.

As you can see, these world-renowned experts represent both academia and industry. And, also it should be noted that beyond tech-, we had expertise beyond technical technology.

We had experts in economics and policy, such as Severin Borenstein, University of California at Berkeley, and Rob Topel of the University of Chicago.

Now I want to see the next slide. And, as Clarence noted, this study is unique in its scope, evaluation, analysis, and technology in the review process.

We evaluated over 250 technical and nontechnical hurdles, and after a very systematic

analysis, thorough evaluation, and three technical reviews with the subject-matter experts, we arrived at and downsized that group to 12 priority technologies that are shown on this slide.

The study provides insight into these hurdles, and what needs to be overcome for wide-, wide-scale commercialization of advanced-fuels vehicle systems by the year 2050. The 12 priority technologies were arrived at by applying five primary selection criteria.

One was: Do we realize the performance that was, should be anticipated? Or, could we?

Attaining acceptable costs. That means: Will we be able to reduce the cost of the technology?

Will we accelerate deployment?

Will there be an acceleration of technology development in the deployment? For example, could we bring the technology forward, say, what we perceived today, maybe 20 years out; you know, ten years out?

Could we reach scale of material volume? That is, will we be able to have the ability to

reach a commercial materiality and commerciality and scalability?

And, finally, do the technologies help facilitate fuel-dispensing infrastructure? So, as we do this, we have a technical assessment being produced by the peer-review process.

During the first peer-review process, we looked at the technology scope and team composition. The experts evaluated and validated baseline data, and they also looked at the credibility and the comprehensiveness of the data set used as the basis of the analysis going forward.

In the second review we looked at technology-improved powertization process. And, most importantly, during this second review, we looked at and made sure there was a normalization and a standardization in the analysis along the pathway so that when we went to the integrated analysis we had a consistency there.

And then also in the third review we looked at specific technology issues and power records. And in that third review we, which was a

final review, we looked at and confirmed that the priority technology hurdles, and we reviewed the approach to the integrated analyses and some of the initi-, initial int-, integration results.

In addition, we provided over 20 -- In addition, we provided over 20 study briefings during the presentations with the study groups just on topical subjects that addressed specific topics and specific issues, and specific technical points. These presentations were also supplemented by written summaries.

Also, along with the priority technologies, we also identified potential disruptive innovations. And on this slide are a few of the examples that we came up with.

These disruptive innovations are such a magnitude that they are game-changers. Any one of them would be transformational in the transportation environment, and can move us off of the accelerated technology course utilization curves into new paradigms.

However, I want to make sure that it is understood that these innovations are not required

for wide-scale adoption of the fuel/vehicle advancements that were identified with the 12 priority technologies.

These innovations were not considered as a core technology analyses and evaluation, and obviously they're not in, not inclusive of all basic research opportunities, nor is the list exhaustive. These disruptive innovations do represent opportunities to shift the cost curve by advantaging a specific pathway, or creating a completely new pathway.

They can shift the cost curve relative to fuel/vehicle technologies, creating a significant advantage for a technology. And, in concert with the disruptive innovations noted, the study also commissioned topic papers to supplement certain topics they have provided as part of the study.

Of these 25 papers, about a-third of them are also disruptive in character and nature, and so we included this third in the "Disruptive Innovation" section of the report.

In addition to the priority hurdles,

there are also other hurdles that need to be overcome to introduce alternatives in the advanced fuel, fuels in vehicles. And, this finding that's shown on this slide addresses the challenges to deploy, to the deployment and commercialization which revol-, revolve around a need for infrastructure and the consequent investment.

In that regard, there are two major challenges to ascheme-, to, to achieving wide-scale commercial deployment. The first challenge is, is relatively obvious.

It's overcoming initial period of, of long utilization of the infrastructure. The second challenge is, is one of achieving infrastructure technology advances that are required for some of the fuel pathways, such as biofuels, where you need to overcome technology hurdles related to production, or hydrogen may need to overcome hurdles, or must overcome hurdles related to dispensing.

And, then the third challenge we arrived at was a significant research and innovation cost that would be needed to introduce new tech-, new

technologies, new fuels in vehicles, and we did not try to quantify this, but it is fairly significant.

We identified, also, several strategies to mitigate this transition issue, or these issues, and focus, by focusing on the current development of the infrastructure. For example, building on existing infrastructure to minimize initial investment.

In other words, you can say take electricity and biofuels to leverage existing grid in liquid fuel infrastructure. Or, in natural gas you can leverage fuel distribution infrastructure along heavy-duty freight corridors.

And, in that vein, the use of local corridor or niche application deployment could be used for such methods where loads of deployment could improve dispensing infrastructure usage.

And, finally, another opportunity for employ-, current deployment is through flex fuel, biofuel, ultrafuel, plug-in hybrids to facilitate transitions. This would allow vehicles to operate in a fuel that is available when it's needed.

It would also allow for the building,

albeit it's going to be over a period of time, of wider availability of new fuel dispensing infrastructure be long structure.

That concludes may remarks on that technology and infrastructure analysis and evaluation, and now I'd like to turn it over to Shariq, who will discuss the findings on greenhouse gas emissions and energy security.

MR. YOSUFZAI: Thanks, Stephen.

As Linda mentioned during her remarks, at its heart this is a technology study. And, as Stephen just alluded to, there are substantial technology and infrastructure hurdles that must be overcome.

But, what we wanted to do here is to provide a perspective on calculated greenhouse gas emissions on a per-mile basis, as well as address the question that Secretary Chu posed to us as a supplemental question on perspectives to get to a 50-percent reduction in greenhouse gasses from the transportation sector by 2050 relative to a baseline of 2005.

At the outset, let me say that we used

carbon coefficients from Argonne National Lab's Greek model. Many of you are familiar with this.

It's very comprehensive. It has 85 fuels and 100 pathways.

It is very credible, and it's very transparent. So, most of the calculations are done on the carbon coefficients that are included in the Greek model.

So, let me take you through the slide and each of the subbullets. As part of our calculation, we did find that every vehicle system, whether it was light-duty, medium-duty, or heavy-duty, did achieve substantial reductions in greenhouse gas emissions on a per-mile basis, and up to 40 percent.

Relative to what portfolio produced the lowest, in the light-duty segment, internal combustion engines, hybrid internal combustion engines, plug-in electric vehicles fueled with E-85 blends of advanced biofuels, excluding greenhouse gas emissions associated with indirect land use change, as well as fuel-cell vehicles with hydrogen produced by steam methane reforming of natural gas.

These combinations resulted in the lowest greenhouse gas emissions in the light-duty sector.

In the medium-duty and heavy-duty sector, the combination of natural gas and all the improvements in medium- and heavy-duty engines, aerodynamics that Stephen and Bill talked about, resulted in the lowest greenhouse gas emissions on a per-mile basis.

The second finding alludes to the fact that we based our calculations on the assumptions used in the AER 2010. And, during this period of time, the vehicle miles traveled in the light-duty sector increases from 60 to 80 percent, and in the heavy-duty sector, by 100 percent.

So, even though there are substantial improvements in the greenhouse gas calculations on a per-mile basis, when you look at the vehicle miles traveled, this counteracts those improvements.

The study did find a narrow set of conditions that resulted in about three percent of the light-duty portfolio that we studied that

achieved a 50-percent reduction in the greenhouse gas segment in the light-duty segment. And, these included a sustained higher cost to driving, primarily driven by sustained oil prices assumed in the AEO 2010 records case, which led to reduced BAT; valuing fuel economy over the useful life of the vehicle of 17 years; assuming availability and expanded use of economic and commercially available advanced biofuels.

Light-duty portfolios were also characterized by significant shares of FCEVs, or fuel-cell electric vehicles, and limited shares of CNG vehicles. Conditions that resulted in the lowest medium-duty and heavy-duty greenhouse gas emissions included nearly a two-time improvement in heavy-duty trucks, significant penetration by natural gas, and the availability of advanced biofuels in light-duty vehicles.

However, the study did not identify any portfolio of fuel vehicle systems that provide a clear and cost-effective path to lowering transportation sector greenhouse gas emissions by 50 percent by 2050 relative to 2005.

In order to do that, additional strategies will be required. And, if you turn to Page 41 and 42, at the end of your deck is a supplemental section.

You'll see those addressed in detail there.

Now, let's turn to the subject of energy security. I see my friend Clay Bretches there in the first row here.

And, he very ably led a companion study that was alluded to earlier here called "The Prudent Development of North American Resources," which said natural gas is big news, but oil is big news also in North America. Clearly, affordable energy that is accessible and reliable contributes to national security.

In the years ahead, the U.S. transportation sector could have an access to a broad array of economically competitive fuel systems. And, as the Prudent Development study showed earlier, increased North American energy production if both hydrocarbons and natural gas, enhances our national security in energy, and

increases the affordability and accessibility of conventional fuels.

Creating energy diversity certainly provides for national security, but so does reliability. And, though disruptions occasionally occur, as happened with Katrina and Rita and other black-swan events, the existing U.S. petroleum, natural gas, and electricity systems are reliable, they're robust, and they allow for relatively rapid recovery in the case of disruptions.

So, Linda, that concludes my remarks, and I'll turn it back to you.

MS. CAPUANO: Thank you, Shariq.

Moving to Slide 21, we'll now look at the five study recommendations that derive from our findings. First, should Government should promote the same funding in other resources, either by itself or in combination with industry, in precompetitive aspects of the 12 priority technology areas identified, as well as in areas that could lead to disruptive innovations?

As Stephen commented, the priority technologies are essential to commercialization by

2050, but they are challenging. And, while the disruptive innovations are not required for commercialization, any one of them can be transformational and lead us to a new paradigm.

But, it's too close, too soon to choose between those two next recommendations. There is a great deal of uncertainty regarding which individual fuel vehicle systems will overcome technology hurdles to become economically and environmentally attractive by 2050.

Therefore, government policy should be technology neutral, while market dynamics drive commercialization. However, the Government can help smooth a path for commercialization.

The third finding, the Federal Government should take a leadership role in convening state, local, private-sector, and public-interest groups to design and advocate measures to streamline the permitting and regulatory process in order to accelerate deployment of infrastructure.

The Government can also help improving uniforming, uniformity, and reduce the uncertainty

in greenhouse gas emission calculations. When evaluating greenhouse gas reduction options, the Government should consider full life-cycle environmental impact and cost effectiveness across all sectors.

It should also continue to advance the science behind the assessment methodologies, and integrate life-cycle uncertainty into policy frameworks.

And, finally, -- Excuse me. And, finally, the study members found sharing of different industry perspectives eye-opening.

Understanding challenges from different points of view, fuel/vehicle infrastructure and technology has given us perspectives that we believe are necessary for successful acceleration of advanced fuel and vehicle commercialization.

Also, the priority technologies which, described, are extensions of current technology and all, are all doable with the appropriate focus and cooperation. We, therefore, recommend that fuel, vehicle, and technology providers should consider existing or new voluntary forms that include

federal and state governments and other stakeholders to address concurrent development of vehicles and infrastructures.

This is a good-news story. Through technology advances, the American driver will have a choice of fuels and vehicles that are more energy efficient, environmentally friendly, and energy secure.

And, this concludes the presentations on findings and recommendations. Thank you

THE CHAIR: A sincere thanks to the Team here this morning and all 300 who worked on this study.

Mr. Chairman, the Future Transportation Fuels Committee, at its meeting on July twelfth, unanimously supported moving this report to the full Council for approval. Accordingly, it's my pleasure to move that, first, the Council adopt the report, subject to final editing; two, approve the transmittal letter to Secretary Chu; and, third, approve publishing on the NPC's website the study's topic papers and modeling tools.

Mr. Chairman.

MR. O'REILLY: Thank you, Clarence, and also subcommittee leaders for assembling this very comprehensive report.

So, I have a Motion that the NPC approve the report, subject to final editing, approve the transmittal letter to Secretary Chu, and approve providing the additional materials on the Internet. Do I have a second?

A MEMBER: Second.

MR. O'REILLY: Thank you.

Are there any comments or questions from the Council members of this final report?

(Whereupon, no response was had.)

MR. O'REILLY: Okay. We have a Motion and a Second to adopt the Proposed Finding Report of NPC Committee of Future Transportation Fuels.

All those in favor, say, "Aye."

(Whereupon, a response was had.)

MR. O'REILLY: Opposed?

(Whereupon, no response was had.)

MR. O'REILLY: Okay, the Report is adopted without objection.

I'd like to thank the Vice Chairs of the

Committee, the Chairs of the Subcommittee and Task Groups, and the many volunteers who have to complete the work.

Above all, I'd like to thank you, Clarence Cazalot, for a dedicated and wise leadership of this project.

So, Mr. Secretary, it is with great pleasure that the National Petroleum Council submits the report to you. The effort that went into this study was exhaustive, and, as you have heard, considered the input of over 300 participants from diverse perspectives, including the Committee and its various subgroups.

We are particularly grateful to you, Mr. Secretary, for the cooperation and support of your Department, as well as that of other government agencies, and that we trust that you and others in national, state, and local governments will find the assembled data, the base, databases, analyses, and insights useful in addressing the appropriate balance among environmental, economic, and energy security goals.

And, the Council looks forward to

sharing these study results with you, the Administration, and the public.

Next, we will receive a brief update of what has transpired on the NPC Prudent Development Study which we reported to you last September, or it was presented as part of the Council's response to your request, Mr. Secretary, for advice on North American oil and gas resource development.

Since September, the report and its messages have resonated with a broad roof of policymakers and relative users. Several users have given numerous presentations to explain the report to a varied set of audiences, and a summary listing of those presentations are in the members' packages on the table before you this morning.

Jim Hackett, who chaired the study that produced this report, could not be with us today, but Jim has asked Clay Bretches, the study Chair of the Coordinating Committee, to give us an update.

And, so, clay, would you come and give us an update this morning? Thank you.

UPDATE ON THE NPC PRUDENT DEVELOPMENT REPORT:

MR. BRETCHES: Thank you, Mr. Chairman.

And, good morning, NPC members and guests.

Jim Hackett regrets that he cannot attend today, but sends his regards, and asks that I update the NPC membership on the year's activities since you approved the report we did last September and presented it to Secretary Chu. And, after I briefly recap the study's process and its key messages, I will bring you up to date on recent activities and progress in implementation of our recommended steps forward.

As you will recall, the genesis of the report occurred in September, 2009, when Secretary Chu issued a letter requesting that the National Petroleum Council address five key tasks: Assess the North American resource base; describe the operating practices and technologies that will be used to minimize environmental impacts, expanding accessible sources; assess supply and demand through 2035, with views through 2050; identify emust-, emission reductions stemming from increased use of natural gas; and advise on policy actions that will allow permanent development consistent

with national objectives for the environmental protection, economic prosperity, and energy security.

Participation in the study was broad, with over 400 participants from large organizations and beyond. As a reminder, over 50 percent of the participants came from outside the oil and gas industry, and in total, the participants in the study represented over 100 companies, agencies, and institutions.

Starting at the top, our four major findings began with the fact that the natural gas resource base is enormous, and its development is potentially transformative for the American economy and energy security.

Second, and surprising to me, was the fact that the North American oil resource base was larger than previously thought, and offered substantial supply for decades ahead, and can help the United States reduce oil influence from outside of North America.

Third, Americans will need natural gas and oil for much of their energy requirements for

the foreseeable future, even as alternatives become available.

And, finally, perhaps one of the most important findings is that in order to realize these enormous benefits of these resources, safe, responsible, and environmentally acceptable production and delivery must be achieved.

Based on these findings, we recommended five core strategies: More focus on improving resource development through regulation; a better understanding by policymakers of environmental impacts from fuel and technology choices; continued efforts to tap economical energy-efficient opportunities; substantive enhancements to energy markets, particularly as we see oil and natural gas in the energy mix; and, lastly, support of intellectual capital with roots involving energy technology and innovation.

Prudent development was a recurring theme for the study. And, prudent development was simply defined as a balancing of impacts on both the environment and the public, with the benefits of energy security and economic prosperity.

Prudent development is essential for public trust and confidence, a requirement for continued and expanded access, and furthermore, for the long-term growth and success of the industry.

Now for what has occurred since the report last September. The publication and dissemination of the report, the communication of the steady stream of messages, the industry's commitment to prudent development practices, the growing recognition of the abundance of resources in North America, and finally, policy actions.

As to the publication and distribution of the report, following the approval, the report went through final edits and data checks, and was printed in two volumes, summary, and full-volume report versions. Many printed copies have been provided to NPC members, study participants, government, and other interested parties.

In addition, the report volumes and a wealth of support information have been made available for public reading and downloading from the NPC website. These include the two report volumes, 55 topic and White Papers, multiple slide

presentations from the September NPC meeting, and many of the numerous briefings that have been given over the past year.

Also included are the Press Release on the report, and webcasts about the September approval, and the press conference that followed thereafter. Since this study's completion, study leaders have delivered over 75 presentations to diverse groups of audiences here and abroad.

In addition to the NPC membership, the broad range of audiences included the White House staff, members of the executive departments and agencies, such as the Interior, Commerce, and EPA, and, of course, the Department of Energy; regulatory bodies, such as FERC, NRD, and NRDCC; congressional committees and staffs; international groups, including the International Energy Agency, Canada, and China; national trade and op groups; various nongovernmental organizations; associations and professional societies such as AGA, ABI, IP-double-A, the National Academies of Sciences, and the Society of Petroleum Engineers; investor groups, administrators, and those involved in the

power generation and petrochemical sectors; universities that include Rice, Stanford, Johns Hopkins, and others.

And, we continue to receive requests from a very diverse group of audiences for presentations.

The report's first recommendation was to support prudent development, including steps by the oil-and-gas industry such as establishing Regional Councils of Excellence, increasing community involvement, and improving the measurement and reduction of methane emissions.

I am pleased to report that our industry is committed to these goals and their implementation. Over the past year the Operations Chair of Recommended Practices Group, a consortium of 11 of the Nation's largest natural-gas and oil producers, was established and made public the Recommended Standards and Practices for exploration and production of natural gas from operations source.

This group is highly consistent with the NPC's Council of Excellence recommendation, and the

group's efforts have been received and endorsed from STRONGER, the State Review of Oil and Natural Gas Environmental Regulation.

Other such groups, as the Hungerford (phonetic) Task Force in south Texas are exploring the establishment of forms for ensuring standards and practices, as is the Various Sands Winship Initiative in Alberta, Canada. Efforts are also underway for Councils of Excellence in Rocking's (phonetic) areas of operation.

In addi-, in addition, regulations are being approved, thanks to efforts of STRONGER, helped in part by additional funding from the Department of Energy.

With regard to fugitive emissions, industry is working with EPA to improve measurement and reduce methane emissions associated with the development and transmission of natural gas. Also, Energy-led initiative is underway which studies methane emissions from wellhead to burner tip and is including multiple industry participants.

Industry help support the widespread and varying recognition that the abundance of natural

gas in North America, as well as a great new source potential for oil; further, that the development of these oil and gas resources will make a significant contribution to our nation's economic, energy security, and geopolitical well-being.

The world recognition has been evidenced in numerous articles in the national and international press and other media, including articles by David Ignatius, Bob Sanderson, and also by NPC members Robin West and Dan Yergin. Statements also by the President, other members of the Administration, Congress, and other government officials, investment decisions by electrical, chemical, and other industries, and growing recognition from other public and private readers.

The NPC Prudent Development report is quoted in many hearings, public discussions, and other forums. Ultimately it is not the measurement of progress.

In my opinion, NPC's report have contributed to actions including the President's April, 2012, Executive Order supporting safe and responsible development of unconventional domestic

natural-gas resources, the multi-agency mor-, Memorandum of Understanding to bolster interagency corroboration on unconventional oil and natural-gas research between the Departments of the Interior, Energy, and EPA.

States, BLM, and industry are taking steps to publicly disclose the chemicals in hydraulic fracturing through means such as FracFocus, providing foundations for establishments of Councils of Excellence, heightening awareness of STRONGER, and how this group can improve States' regulatory performance, and accelerating dialogue between FERC and harmonizing power and natural-gas industries, which is paramount now that natural gas has come to a parity with coal for power generation.

And, finally, contributing information and advice to the international agencies golden rules of sure gas development, invest in foreign countries striving to develop their indigenous resources.

In summary, I believe that the NPC Prudent Development Report has been well-received

and has had an impact, not only on development and use of domestic natural-gas and oil resources, but is having a significant impact on greater development as well. The North American gas and oil industry is clearly the leader in unconventional resource development and is also looked to for prudent development practices that will have far-reaching impacts around the world.

Mr. Chairman, this completes my update. I'll be glad to answer your or any of the members' questions.

MR. O'REILLY: Stay there. Before you move away, --

Are there any questions from NPC members for Clay?

(Whereupon, no response was had.)

MR. O'REILLY: Okay. Thank you very much, Clay.

Appreciate that, that, that report, and all the work that, that has been done by those involved in that study to further communicate it. And we're almost a year now since it has been delivered to Secretary Chu.

Before I invite Dan Poneman here to introduce Secretary Chu, I just want to take this opportunity to thank the, the DOE and its people for their involvement with the NPC. I think the fact that we've got three top members of the Department here on the podium today is the indication of their level of engagement with the NPC, and the importance attached to the work the Secretary commissioned from us just three years ago.

So, please, let's give them a round of applause for their involvement.

(Whereupon, applause was had.)

MR. O'REILLY: I would now like to invite Dan Poneman, Deputy Secretary of Energy, to say a few words and introduce Secretary Chu.

Dan, come on up. Watch your step.

MR. PONEMAN: Yeah. Thank you, Dave, and thank you for your stellar leadership of NPC for all these years.

And we have benefitted enormously from your leadership. I want to say that life is too short to work on B problems.

I think what we've heard all this morning shows that National Petroleum Council has absorbed that lesson. With the prudent development of North American oil and gas resources as the subject for today's meeting, I'd like to acknowledge Joe Hackett and Clay Bretches on their earlier study.

Whether you are looking at our quadrennial technology review, whether you are considering the transformation of our gas markets, whether you are looking at the President's all-of-the rest strategy and his commitment to the transformation of our vehicular fleet, it is clear that the study that is the subject of today's meeting, future of transportation fuels is one that is of vital importance to all of us.

And, I would just like to reiterate, before introducing the Secretary, from the Department's perspective, our enormous gratitude to the NPC for taking on this task, and for the comprehensive and thorough approach it is taking to the stewardship of this report. And, in this respect I'd like to acknowledge, first and

foremost, the outstanding leadership, patience, determination, balance, and drive that Clarence Cazalot has demonstrated from the beginning.

So, I'd like to ask for a round of applause for Clarence.

(Whereupon, applause was had.)

MR. PONEMAN: Clarence, well-supported by Linda Capuano and her team that is away, partially there and partially here on the dais, as earlier acknowledged, John Deutch, John Watson, Jim Owens. They've all been incredible leaders in helping steward this report to the moment that we are now experiencing of its presentation and approval by the Council.

I'd also like to acknowledge the tremendous work by my colleagues. Here you have David Sandalow, but former, Arun Mujamdar and Steve Koonin spent a lot of time working on this, and technological aspects of the report have been very much a product of, of their support.

Now it is a distinct honor and privilege to have the opportunity again to introduce Secretary Stephen Chu to all of you. In addition

to having brought to the Department of Energy a level of scientific depth and analytical integrity that is absolutely unprecedented, he has been a thought leader in every sector of the President's army of energy strategy.

He has not only contributed analytically, but he's contributed practically. And, I think all of us owe a bit of gratitude to him for the extraordinary work he and a team of scientific colleagues put into the effort to address that very challenging situation we face in the Gulf of Mexico.

The President has relied on him extensively as the thought leader and as the rational voice and driving force behind all of the above energy strategy that is bringing us to a new level of energy security, as we've already heard a bit here this morning, and new levels of prosperity for our nation.

It is an effort that is well-launched, it continues to benefit from his wisdom and his guidance, and it is my pleasure to introduce to all of you, then, again, Secretary Stephen Chu. Thank

you.

(Whereupon, applause was had.)

SECRETARY CHU: Thank you. This is a weak stage.

It's a very short back. In case you take a long step, I guess you just disappear.

I, I'm, I'm very happy to be here and appreciate all the work; or course, David O'Reilly for all his leadership on National Petroleum Council. As Dan Poneman said, we're especially appreciative of all the hard work that have been done that have been put into these two reports, especially the, the Future Transportation Fuel Cell.

Clarence, thank you again for your hard work and the Committee's hard work. It's not only hard work.

As I've listened to you, I, I will promise you, as I did before, I'm, I'm kind of a sponge for this sort of stuff, so I read every word. I haven't done it yet.

But, I, I was listening to -- Especially since it's, by and large, a technical report. And,

I've looked at the list of subject-matter experts, and I know two-thirds of them, some very closely.

And, the -- I would have loved to be a fly on the wall during those discussions. They, they are not shy and retiring types.

But, but, it's important that we have reports like this from the NPC. And, very important -- It's very important because these are questions that really need the voices of all the stakeholders in the country.

We need the voices of all the stakeholders in the most analytically dispassionate analysis of what's going to happen, what is happening, and what will happen in the future. I would also like to say that when I charged the Committee a while back, I did it with malice aforethought.

I -- What's the malice? Well, it's, you know, two-thirds -- This isn't the type of a charge that -- Well, you know, so I was asking you to predict what will happen in 40 years.

Now, ultimately, if you ask me what will happen in 40 years, the first thing I'll say is,

"Whatever I say will probably be wrong." If you just think about it, Wright Brothers' first flight, December, 1903.

Sixty-six years later, man on the moon. Who'd-ah-thunk that would have happened?

So, a lot can happen in 40, now 38 years. Still a lot can happen.

So, we will conduct that. And let me make a few, a few brief remarks.

First, particularly transportation energy is something that is very important, especially in the United States, as, as it's a very important part of our energy needs; to many, the most important in many respects. And, it's the second-highest expense for most American household budgets.

For families making less than $50,000 annually, it can be the largest expense. The largest overall expense in their budget is transportation, not housing.

So, that's one of the things. Point number two, it's reported out that we, that if you just turn the clock back ten or 15 years, no one

would have suspected what is rapidly being realized, not only in North America, but in all the world, about the new potential resources that the technology for finding both con-, quote, conventional oil, but, but the technology of getting those reserves out of the ground at higher and higher fractions, where maybe several budgets ago it used to be 30 percent; now you expect 50 percent, and, by golly, in some instances you better get 70 percent, and still increase a factor.

Not only shale gas for gas, but shale gas liquids, and now shale oils. I remember briefing Secretary Bodman in the secret room in Department of Energy.

I don't know why it was secret. This is, this is maybe eight years ago.

And had the Secretary of Treasury was there, the head of the AEC was there, and we were talking about various energy solutions, tools, and why energy independence, especially in transportation. And, there was some question about shale oil.

And, this was not that long ago, but at

that time the theory was you can only get shale oil out by expending massive amounts of electricity to heat up the rock. Okay?

Remember that? Not so long ago; during Secretary Bodman's time.

So, things have radically changed. Now, having said that we -- It is our belief as a country, as an industry, and the Department of Energy, to make sure that these resources are developed, but developed in the most environmentally responsible way possible.

This is something we really believe, and we very much are asking for funding to help improve not only the rapidly growing set of best practices, but the next so they improve, and to help improve that, to actually know, you know, the seismic technologies: what to do, where to frac, how not to frac; to allay some of the concerns about fusion emissions; to, to minimize that; to, to figure out how to dispose of water, you know, in a much safer environmental place.

All of these things are certainly, I believe, solvable problems. But, they need more

work, and, and I think you agree that we do really want to develop these resources.

It's a tremendous burden, but it's a chance to develop them in an environmentally safe way. It was mentioned, DOE spent several months worrying about what kind of an oil leak; another month or two worried about the Fukushima accident.

And, it actually, when we were doing that, -- And this is not only about, you know, an hour or two a day. This is clear, like, all day and night.

It does realize that there are many things you can do to actually be very inexpensive mitigation procedures. And, that's, again, some of what we want to focus on.

Petroleum-base fuels are going to be part of our energy base, certainly for half a century, but three-quarters of a century. It, it's just, it's just a fact of life.

It's not only a fact of life. It, it's -- Petroleum-based fuels, especially got, very high-energy fuels that are used in diesels and in airplanes are something that we are still working

-- as was point out, using research and development to get next-generation biofuels that can achieve the performance and energy density of these fuels.

So, we see this as a very important part of the future. But, having said that, it's something where we want to, while we've got these resources, we want to use the resources in the most efficient way possible, looking at sites for the best benefit of our economy, our prosperity, and our environment.

Efficiency is something that was mentioned that both sides can debate efficiency. There you can read the report, because, you know, I, for the last five or six years, have been following this very closely, and the last three weeks, in writing the paper, were hooked very much into many of these aspects.

Vehicle efficiency, you can start with the internal-combustion engine, and cars. As was noted, that's going to be a mainstay for quite a while.

But, there can be things. A lot can happen to internal-combustion engines.

Many of you may know, Ford, for example, is producing a three-liter engine. Sorry, not three-liter engine; three-piston engine, one-liter engine with about 118 horsepower, 120 foot-pounds of torque.

Its footprint is on an eight-and-a-half-eleven-inch sheet of paper. It's about yea-big.

It, it, you know, will have 20-percent more horsepower than my two-liter-engine car of 20 years ago. It's amazing that you can produce an engine and it be -- And that's just the beginning.

Reduction -- Slightly higher octanes, just premium octanes. Good fuel injection.

A lot of other technologies that are happening. The 25-, 30-percent efficiency of internal-combustion gasoline engines can get very close to diesel engines for the 25-percent efficiency.

So, that's where it's at. Friction: The friction of the drive-, the friction, the actual friction of the engine and drivetrain can be decreased substantially.

And, these are all money-saving things that can actually make driving much less expensive, much more economical. There was a recent paper published where they estimate -- These are experts in tribology.

That's the engineering science of change in friction. They said just the normal friction things, you know, metal wear and that, were 20-percent reduction in near-term, and maybe up to 60 percent with, with different materials, hardening, in the 15-, 20-year term.

Aerodynamics with trucks. You know, you see these very sleek trucks now on the road.

The adoption was over a period of three years of the streamline of the cabs. A high-performance commuting simulation is optimizing that, but we're also discovering in the Department of Energy, if there's a little plastic insert placed on the back of these 18-wheelers just before the rear wheels, it can save another seven to ten percent of the 18-wheeler.

The buyer said, "Oops. It's too expensive. It's $5,000."

So, we redesigned it by the engineers and they got most of that savings with a $1,000 part that a single person can snap on. Five to eight percent.

That's a lot when these 18-wheelers go 100,000 miles, which is the average, per year; $80,000 diesel-fuel bill a year. And just say I get to five to eight percent for 1,000 bucks a pass.

Good. So, so, these are just examples of, of, of what we're doing at the Department of Energy.

Electrification: It's, it's a -- Right now the batteries are being, with Chevy Volt, a spectacular car, and some of these others. But, the price is higher, maybe by ten-, $12,000 from the conventional cars.

And what our part in the Department of Energy is is to improve the battery, battery system, electrical system, motor system of the car so that you can buy a, let's say, a hybrid at 20-, $25,000 with a 40-mile range, or an EV with a 150-mile range at the same price. And, if you get

to that price range without subsidy, same cars without subsidy, -- All of our targets are without-subsidy targets. That's very important. -- then, then, within three or four or five years at $3.50 a gallon, you're, you've paid for it, that vehicle.

And, I think if you get that 20-, $25,000 -- Let's say about $23,000 hybrid at the same, you know, a Chevy Volt-type conformance, many Americans will just say, "Hey, done deal." You know, because the, the ability to have that stability, the ability to fill her up once every other month is, thrills them.

So, this is something. But, the -- But, you've got to have that technology development.

We do not have that battery today. The good news is over the last five, eight years, five years, especially, I've seen stuff that I hadn't seen 15 years ago.

Before I came to this job I was a scientist at a battery company. So, I knew a little bit about this stuff.

And, the, the stuff in the labs now is

startling. Battery/engine density was still being, the higher-temperature performance, so, so you don't have to be quite so concerned about the cooling aspects of it.

There's still more remarkable things. That's a doubling, we think, of the testing cycles for your test cycle in another couple of years.

It's already in the laboratories, and, and the battery system itself, -- Sorry I'm going on so long, but I'm a techie, so you'll have to bear with me. You know, we only use half the, half the battery for, to make it last 17 years.

We would really like them to last 15 years plus. Many discharge cycles.

That's the goal. But, weather is heavy because it's backed way off due to weather conservatism.

And so one of our goals is develop in-, in situ in battery, inside, not the outside, where you can sense these, the conformance of the battery, and then you can use a lot more of the battery, maybe two-thirds, three-quarters of the battery. And so we see technologies like that

being developed.

So, these are all great diversification of natural fuels. As mentioned, natural gas is, is, is doing great things.

Shauer's investing, I think it's $200 million in inner-city liquid natural-gas fueling stations for heavy-duty trucks. Another consortium is mostly targeting about a half-a-dozen, dozen cities, mostly liquid-nitrogen gas, again being the analysis already works out for long-haul trucks at 100,000 miles.

The added investment is a four-back, four-year payback period. And, and, as you get more manufacturers, you know, because it's a $100,000 truck, but some of the manufacturers are charging another 80-, $100,000 putting the liquid-nitrogen tanks and the fuel-handlings systems.

But, if you got a few competitors, we can get it brought down to 30-, $40,000. And, the payback period is a couple of years.

So, this is very big, because it diversifies our reliance on just a single source of

transportation energy, which is very important. In varied vehicles, other vehicles, not as clear, but we are doing a lot.

We're investing in new corridors of research to try to figure out how to, how to get inexpensive tanks that can store compressed natural gas, possibly hydrogen as well. It's -- Either the materials or absorbance, very important.

It is mentioned, biofuel cars. It might be in the consciousness of people, but you can have a, a, a vehicle, either a delivery vehicle or personal vehicle that has a small natural-gas compressed tank and a gasoline tank.

And, the same engine could run both if you flip a switch. And it turns out that Fiat was going to market this car a few years ago, but didn't do it.

I mean, so it is not only possible. It is something that's very, very -- It's, it's easier to make a bi-fuel car that runs on natural gas and gasoline than it is diesel and gasoline.

In fact, it's very hard to do that. So, it turns out that you can have the equivalent of a

plug-in hybrid, so you can fill up at home on natural gas for the first 40 miles, you don't have the road problems because you don't have the rapid -- you begin to build up the infrastructures.

So, that's a possibility. It, it's technically here today.

And, and so it's worth hearing about as to whether these bi-, so-called bi-fuel cars might be possible. Again, it's to diversify choice to the consumer, to industry; all very important.

So, -- But, these are, these are look-aheads. These are future technologies.

They have to be cost-compared. They have to be varied.

They have to build those things. I could go on for hours about bi-fuels.

None of these are -- You know, the, the battery I was talking about, I can't sit here or stand here and say we're going to have this in your automobile in five or ten years. I will be surprised if they won't be here in ten or 15 years, but it's still -- Hey, it's the future.

We don't know. And -- But, it is

rapidly developing.

That's very exciting. One last thing.

All the technologies I've talked about, from the fracking techs and shale technologies, to the commercial investing on methane hydrates, I'm guessing they may be recoverable instead of just clogging their lines, to vehicles, to advanced biofuels, to galvanated materials, to better internal-combustion engines, to better covered systems, these are technologies that the United States is well-poised to be a leader in the world in.

We should be the leader, and are the leader leading the world to show other countries how to develop very positive resources in an environmentally responsible way. We should also be the leader for all these other technologies that the world will want and that we can exploit.

And, this, too, goes directly to what this is about. It's not only, only about energy and fuel.

It's all about the technologies, which show the best side of America, and will be the

foundation for our economic prosperity. And so, there, that, this is something I feel very strongly about.

Groups like this I see as -- I want to be -- I see as very strongly about you, and feel very strongly about you in this, in this discussion with all the so-called -- You know, some people might not believe what happened. Other people feel, they're convinced it's going to happen.

But, again, who knows? I'm an optimist.

But, again, I just want to say thank you, again, to NPC for all that you've done, especially all the hard work that you've done in, both in the reports. And, so, I will -- I've very appreciative of that, and will study it very closely.

So, thank you.

(Whereupon, applause was had.)

MR. O'REILLY: Senator Chu has agreed to take a, a few questions from Council members. If the Council members have any questions, this will be a good time to -- Are there any questions?

SECRETARY CHU: Don't be bashful.

MR. O'REILLY: I have -- Mr. Senator, I have one. This is not quite on topic, but the, the issue of battery development for energy storage, which would help with battery deployment of a vehicle --

SECRETARY CHU: Right.

MR. O'REILLY: -- energy, what are the prospects for that?

SECRETARY CHU: Very good. First, if you -- The grid -- People don't realize how our grid operates.

It, it -- Well, since many of you have come from technical backgrounds I think, the near-term -- I don't know where you went in college. How an electrical system works, well voltage is like pressure; current is like flow; and all those other things.

So, think about a plumbing system. You put water at the top and it flows downhill.

It's higher voltages to lower voltages. And you overfill the lines because you want the electricity to go way out in the distribution ends.

And, then you lose one or two percent.

That's okay, but, because you just want to make sure that people still have their voltage stability.

You treat it on a scale of not at the highest gigawatt hour, but at a megawatt. A megawatt you want it out there would help a lot in both the bow of the system, the robustness of the system.

So, what are the plans for those batteries? Well, it maybe in millions, because you have to have a fuel at a nonessential place.

They better be -- They're going to have to work in both low temperatures and high temperatures, and they've got be able to fix them, you know, the water hoses on them and all that sort of stuff. And, what's the likelihood of that?

It's getting better and better. Our batteries are now being tested that can switch on at temperatures, without cooling, up to 55, 60 degrees C that are being actually tested in Indonesia.

Prices are a little high, but, but, but the companies are saying you could come down, you

know, but, but it's about $50 per kilowatt hour, they'll go everywhere. And, as I say, they make the system much more robust, much more amenable to go out on the road, all of these other things that -- the variables.

They should provide a public standard. The amazing thing about this is this is going to be driven by the automobile industry because that battery, well, you know, that's a market, and the eternity market, well, they're very conservative.

And, and, so, it was kind of sitting around. But, all of a sudden, this young generation of, of the plug-in hybrid EV market, and they said, "Oops."

And then they were finding a cataclysm of the technologies that were all these inventions or, and sometimes universities where it looked to be exciting. Both the density, but also robustness, maintenance-free for a very long time, and not a, you know, okay.

So, that's a real possibility. You know, that's where I give you 50/50 odds.

Up to -- But, but, we really tested

those batteries, after that.

MR. O'REILLY: We have some microphones in the room now. Question here?

Microphone coming. Just identify yourself as you ask the question, please?

Thank you.

MR. JULANDER: Mr. Secretary, Fred Julander, Julander Energy in Denver.

On your watch our businesses were completely transformed. We've gone from a fear of recoil to a discovery of resources and the ability to extract them.

We, we just, we'll be around for much longer than anticipated a few years ago. This has a lot of ramifications.

I wonder, from your position and your vantage point, what's your take on this transformation? What's it mean for the country and the world, and what's it do for our industry?

What, what does it impose upon us?

SECRETARY CHU: Good question. All right.

Very good question. First of all, as

everybody in the room knows, it may be on my watch, but this was, seed was laid a long, long time ago.

I mean, the fracking stuff had, had, had people working at this in the '40s and '50s. The Department of Energy, '78 to '92, funded horizontal drilling and contract fracturing after the private sector didn't think it was -- You know, they were losing their appetite.

But, then, after '91, Schlumberger picked it up and right after that it, it started going. And, that was in the last decade.

So, so that's a good thing. Not everybody might say that's a good thing, but I say it's a good thing.

It's a good thing because it doesn't mean, you know, "Oh, energy problem over? Oh, you know, we don't have to worry anymore."

No. The, the, the answer to the problem is a very complex problem.

But, it does mean -- Actually, looking now, I, I didn't think -- Before this, I didn't think there would be a peak. I thought there would be a plateau, and then the price-lifting cost

would, would adjust.

And now, within the past, you know, within in the past, I think it can be stable for a long time, and still you can, you can meet supplies. We still have a volatility issue, but it's tricky because of the time developing.

But, I think it's -- But, well, having said all these things, I still worry about greenhouse emissions, greenhouse gas emissions. But, -- So, that's why I'm talking about energy efficiency.

I'm talking about all those other things, but, but it does not -- But, but, it means you can have a moderate price to make the transition, but the planes don't crash, things like that. It does change the whole geopolitical spectrum.

Well, there for a while, though, it was looking like there's a chance it could be swinging drastically by the -- But, it could actually be oil-neutral, okay? So, for the first time people were saying, "My gosh. If you developed the resources responsibly now, you could be, North

America might be oil-neutral for a couple decades."

So, we shouldn't take our eye off the ball. We probably -- I -- There are considerable risks.

The uncertainty is large, but there are considerable risks. So, we have to -- Sure, there are greenhouse gas emissions we have to bring down, but it's not as though we are on an economic cliff for, let's say, 50 years, and the run on the price of gas goes to $400 a gallon.

I don't see that happening, you know, right now. But, we shouldn't say, "Oh, that means we can just stop thinking about these issues."

So, you know, it's -- It looks bad, but it's, but, but, you know, but it's a good thing to know that it means the United States is exporting less money. It's -- We're using more of our own resources, but we should use our own resources wisely.

And, we should -- Well, natural gas, especially, is, someone said here in this room, natural gas is now the, cheaper than coal. All natural gas is definitely cheaper than coal; half

the carbon.

But, it doesn't mean that storing carbon is bad, but it's, it's a mutual position because you can build natural-gas generators. And, you talk about going zero to 60.

You can go from zero to about 400 megawatts in ten to 15 minutes. That means the design of the jet engines can go up and down, which means that's the time they need to, to, you know, with all the wind's upwind, so all the wind's dying.

So, you don't have to have hot spot reserves. And so those are the kind of things that conserve on fuel, but the, the ballast has a transition mode.

So, these are opportunities I think we should consider in the future. So, that's half-century, two-thirds century.

MR. O'REILLY: Question from here. We'll take one more question, and then --

MR. HOFMEISTER: Mr. Secretary, John Hofmeister, Citizens for Affordable Energy.

Infrastructure is always the bugaboo of

alternative fuels because of the economic issues. And, and whether it's something like hydrogen, or whether it's other alternative fuels, does the Department of Energy ever consider a regional strategy where we live in a country where we love ubiquity and we want the whole country to adopt instantaneously so many products.

But, what's your mindset when it comes to regionalizing infrastructure for the economic opportunity in, in a shorter timeframe?

SECRETARY CHU: I'm with you. If you want to -- For example, this is my thinking.

Why not get our hydrogen from natural-gas reforming and certain technologies that are, you know, the target would be first $2.00 a kilogram, then down to $1.00 a kilogram. A dollar a kilogram would be a very exciting price.

But, then, we don't have an infrastructure. But, you're -- Where you use natural gas, you use some modifiers to, to, you know, redo the mix for our higher-value products.

There are technologies you can burn natural gas in partial hemispheres where you get

hydrogen, you get a lot of the, where you shift it to hydrogen-CRO, you shift that process to more hydrogen-CO2. You get more CO2.

If you're anywhere near an oilfield, that's good. Okay?

You're recovering the content in the reforming process generating electricity. That's good.

And, you have some hydrogen. So, then it makes economic sense.

If you have all three of those, this looks very, very good. And, then you have the vehicles, you have a local hydrogen source.

That is going to make good sense. It doesn't mean government subsidy.

It's just going to make good business sense. So, then you build out.

So, there, there are pockets in the United States that are just -- okay? So, it makes a lot of sense to build out to see if this is really going to fly as we're, as we're busy with technologies with fuel cells, you know, the price, the reliability -- Reliability is really one of our

best fuel cells.

If we can put them in buses, some of these will go, like, ten or 15 years, but the price is high. So, you get the price and reliability in the right place, and there's a choice.

So, that looks awesome. Natural gas similarly makes a lot of sense in this mix, you know.

The one natural-gas thing that I was delighted and surprised by is the interstate trucking, because, because you only need a fueling station every 100, 150 miles. The trucks go five- to 600 miles, and so it turns out that one every 100 miles gives you enough comfort.

So -- And, that's why -- That's forming that business strategy. And, heavy-duty trucking is 20 percent of transportation records, all right?

So, that one could be, more or less. But, then I'm with you on the other ones.

You know, start where it makes good sense, where it's, you know, economically viable, and then see how it grows. Electricity, a different point.

We have electricity, okay? And, that would -- You need the inexpensive battery.

Yep. So, --.

MR. O'REILLY: All right. Thank you very much.

I want to again thank you.

(Whereupon, applause was had.)

MR. O'REILLY: All right. Mr. Secretary, on behalf of the Council I'd like to thank you for being with us today, and for your remarks, and also for the time you spent with us answering our questions.

So, appreciate it very much. Thank you.

(Whereupon, the Secretary left the meeting.)

MR. O'REILLY: Before addressing some of the administrative matters on the, on the morning's Agenda, I'd like to again repeat my thanks to everybody involved in this study; Clarence, you in particular, and your team.

MR. CAZALOT: Thank you.

MR. O'REILLY: And, the wonderful people here on my, on my left. Linda, here, and her team

did a good job at, at generating the study represented here this morning.

We do have a couple of administrative matters, and before that I have two announcements. The first is for the benefit of the members of the press here today.

Five minutes following the meeting's adjournment, we will have the study leaders available up here at the podium to answer your questions.

The second is for our on-line audience. The webcast will pause for now and resume with the press conference, which should start in about 15 minutes or so.

So, I'm now going to turn to the reports of the administrative committees of the Council. First report this morning will be from NPC Finance Committee Chair Chuck Davidson.

Chuck?

REPORT OF THE NPC FINANCE COMMITTEE:

MR. DAVIDSON: Thank you, Mr. Chairman.

The Finance Committee met earlier today to review the financial condition of the Council.

We had representatives there from Johnson and Behr, our independent outside auditors who reviewed the draft of the 2011 calendar-year audit.

And, based on this review I'm pleased to report that our accounting procedures and our controls received high marks. I'm also pleased to report that the Council's contingency funds at year end remained at approximately five months' of our expenditures, and this is no small part to all of your's response to the contribution request, which exceeded 95 percent for Year 2011.

Committee also discussed the proposed 2012 Budget. The Committee is recommending to the Council a calendar-year budget for 2012 in the amount of $4,960,000, and member contributions in the same amount to fully fund this budget.

This budget is the same as last year's, and supports the Council's ongoing operations, including a very significant requirement to complete and print the Future Transportation and Fuels report that we discussed this morning. So, subject to your approval of the Budget and contribution recommendation, the Council will be

sending out the individual 2012 member contribution requests in the very near future.

And, of course, we encourage you to respond quickly on that.

Finally, the Committee would be our Charter which recognizes our finance, audit, and investment responsibilities, and reaffirm that Charter.

Thank you, Mr. Chairman. This concludes my report, and move that it be adopted by the Council.

MR. O'REILLY: Thank you.

Is there a second?

A MEMBER: Second.

MR. O'REILLY: Are there questions for Chuck?

(Whereupon, no response was had.)

MR. O'REILLY: Okay. Hearing none, all in favor?

(Whereupon, a response was had.)

MR. O'REILLY: Opposed?

(Whereupon, no response was had.)

MR. O'REILLY: Thank you, Chuck.

As Chuck noted, the request for the 2012 contributions will go out shortly, and as we're already well into the year, I hope you'll give the requests, when they come, your prompt attention.

Our other administrative report this morning is from the Nominating Committee. Ray Hunt's Chair of the committee, but was not able to be with us this morning, although he had a meeting last week.

Rob Catell, a member of the committee, will now present the Committee's report.

Rob?

REPORT OF THE NPC NOMINATING COMMITTEE:

MR. CATELL: Thank you, Mr. Chairman.

As the Chairman indicated, the Nominating Committee met last week, was chaired by Ray Hunt, who, unfortunately, couldn't be here today, so I was asked to give the Committee Report. The Nominating Committee has agreed on its recommendations for NPC officers and chairs, and members of the Agenda and other committees of the Council, as well as five at-large members of the NPC Co-Chairs Coordinating Committee.

Accordingly, on behalf of the Committee, I'm pleased to recommend the following for nominations:

For NPC Chair, Jim Hackett.

For NPC Vice-Chair, Jim Davidson.

For the Agenda Committee we recommend the following as members: Bob Catell, John Coch-, John Varne (phonetic), Ray Hunt, Jim G. Ramsbey (phonetic), Dave Lesar, Andrew Liveris, Rex Tillerson, John Watson, and Dan Yergin, with Larry Nichols serving as Chair.

For the Approval Committee we recommend the following as members: George Alcorn, Bill Fisher, John Hess, Mike Linn, Aubrey McClendon, Lamar McKay, Mark Papa, Jim Rogers, David Scanlon and David Seaton, and John Walker, and Bob Pullman (phonetic), serving as the Chair.

In addition, we recommend the following as the at-large members of the Co-Chairs Coordinating Committee: Georgia Bell, Jim McManus, Marvin Odum, Phil Sharp, and Sue Chebby (phonetic).

Mr. Chairman, this completes the report of the Nominating Committee, and once again I move

that the above slate be elected until the next organizational meeting of the Council. Thank you.

MR. O'REILLY: Thank you, Bob.

I've got a Motion. Do I have a second?

A MEMBER: Second.

A MEMBER: Second.

MR. O'REILLY: Thank you.

Are there any fur-, further nominations from the floor?

(Whereupon, no response was had.)

MR. O'REILLY: Okay. So, now, all those in favor, "Aye."

(Whereupon, a response was had.)

MR. O'REILLY: Any, "No"?

(Whereupon, no response was had.)

MR. O'REILLY: Okay. The Report is adopted.

Thank you, again, Bob, for your -- And, and also to Ray Hunt, who does a, a great job at chairing our Nominating Committee.

Just a, before I wind up here, I'd like to just thank all of you for serving Chair of the NPC for the, for the last two years. It's been,

it's been a, a very interesting period to be involved with the NPC with two reports going on concurrently, and I'm especially grateful to, to the NPC staff, of course, led very ably by the gentleman to my far right, as well as to the leaders of the two studies, Clarence Cazalot and Jim Hackett, and, and the folks that supported them during this period of time.

And, obviously, I wish Jim and Chuck every success of the, of their leadership of the Council during the next two years.

Ladies and gentlemen, before the final item on our formal Agenda, was there any other issue that any Council member wants to raise at this time?

(Whereupon, no response was had.)

MR. O'REILLY: Does any nonmember wish to be recognized at that time?

(Whereupon, no response was had.)

MR. O'REILLY: Okay. Do I have a Motion for Adjournment?

A MEMBER: So moved.

MR. O'REILLY: We have it moved. Do I

have a second?

A MEMBER: Yes.

MR. O'REILLY: Thank you.

All in favor, --

(Whereupon, a response was had.)

MR. O'REILLY: -- say, "Aye."

(Whereupon, a response was had.)

MR. O'REILLY: The one hundred and twenty-second meeting of the National Petroleum Council is hereby adjourned, and in about five minutes, at the top here, we will have that press conference.

(Whereupon, the above meeting was concluded.)

I certify the foregoing to be a true transcript from my notes.

E-signature: D. I. Bunn

CSR CP RPR

CERTIFICATION

I, D. I. Bunn, a Registered Professional Reporter, Certified Conference Reporter, and Notary Public, do hereby certify that the foregoing testimony was duly taken and reduced

to writing before me at the place and time therein mentioned. I further certify that I am neither related to any of the parties by blood or marriage, nor do I have any interest in the outcome of the above matter.

In witness whereof, I have hereunto set my hand and affixed my official seal, at Lusk, Wyoming, USA, this 6th day of August, 2012.

E-signature: D. I. Bunn

Notary Public

My Commission expires January 5, 2016.