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Session 4: “Short-Term Energy Prices — What Drivers Matter Most?”

Speakers:

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[Note: Recorders did not pick up introduction of panel (see biographies for details on the panelists) or introduction of session.]

Howard: And this presentation could not be more timely, given current developments in oil and natural gas markets and the start of the traditional summer driving season. In discussions of rapidly rising oil prices leading to a peak of \$147 per barrel in the summer of 2008, the factors that were traditionally the focus of EIA’s energy data and analysis program (such as levels of energy consumption, production, inventories, spare capacity and geopolitical risks) remain relevant. However, arguments addressing other influences such as: speculation, hedging, investments, exchange rates and developments across a wide spectrum of commodity markets, appear to become increasingly influential in the attempt to fully understand energy price movements.

In September of 2009, soon after being confirmed by the Senate as EIA’s Administrator, Dr. Richard Newell (whom you all met earlier today) launched an energy and financial markets initiative to improve, understand, and provide analysis of what drives energy prices, by incorporating greater consideration of these other factors into EIA’s work. This initiative aims to improve energy market transparency, support sound

policy and efficient markets, and increase public understanding — and those, of course, are the key parts of EIA's mission.

The initiative focuses on four main areas: collection of critical information on factors affecting energy prices, analysis through in-depth studies of energy market behavior, outreach to solicit feedback from a broad range of experts into the interrelationship of energy and financial markets, and coordination. Well, you know who I was: coordination with other federal and international agencies engaged in energy market information collection and analysis. EIA has already taking action under this initiative. For example, we now reflect the volatility and uncertainty surrounding our 12 to 24-month forecast of crude oil and natural gas prices by including quantitative measures of price uncertainty in the form of confidence intervals around crude oil and natural gas futures prices (based on information from futures and options markets). And I think Dr. Summers mentioned how (and why that range) in his remarks.

We're also initiating the collection of "crude oil and petroleum products" storage capacity data on a semiannual basis, beginning this year. In fact, in terms of outreach: the discussion that we're going to have today is one part of that effort, along with the recent federal registry notice formally soliciting public input on data gaps.

We have an excellent panel today, as evidenced by the size of the audience. So I'd like to move directly into the discussion. All of the speaker bios are in the program, so I'll keep my introduction short. I'm going to introduce everybody at the start, in the order that they will be speaking. It's not alphabetical, but it's not discrimination on my part. It was the order that we worked out, in a conference call last week, that made the most logical sense.

David Arseneau is a senior economist in the Division of International Finance at the Board of Governors of the Federal Reserve Board, with principal responsibility for monitoring and analysis of international energy markets. Ed Morse is Managing Director and head of Global Commodities Research at Credit Suisse in New York, where he has

previously held similar positions at other investment banks. Dr. Morse also has extensive governmental experience, having worked at the U.S. State Department as an advisor to the Departments of State, Defense, and Energy, as well as the International Energy Agency. Guy Caruso is a senior advisor in the Energy and National Security Program at the Center for Strategic and International Studies. He previously served as EIA's Administrator, and also as Director of the Office of Non-member Countries at the International Energy Agency, along with a host of other positions both domestic and international (although his bio doesn't say so, so I will mention this). He recently served as the Chair of a group assembled by the International Energy Forum to draft a white paper on energy price drivers and related topics, ahead of the recently concluded meeting of the International Energy Forum that took place in Mexico last week. Last but not least, Chris Ellsworth is in the division of Energy Markets Oversight at the Federal Energy Regulatory Commission. Mr. Ellsworth currently focuses on natural gas and liquefied natural gas market issues, including daily market monitoring. And again, this session is not just about oil. It's really about all energy prices, and certainly natural gas is of a great deal of interest, as evidenced by discussion at several panels this morning. I believe, although the schedule is tight, that questions from the audience and discussions among the panelists are really sometimes the most illuminating parts of sessions like this. So the panelists have all graciously agreed to limit their prepared remarks to about 10 to 12 minutes each; that will leave plenty of time for discussions among the panel and your questions from the floor. We will have our volunteers circulating among the audience to collect questions. It will help us if you provide them, not all at the end, but as they come up as each person speaks, so we can start to sort of organize them and get them together for the very interesting discussion that I hope we can have. So, without further ado and using less time than I have promised, I'd like to turn this over to David Arseneau of the Federal Reserve Board — David. That was the

other thing we agreed, to limit the number of slides. We figured that PowerPoint fatigue might be setting in.

David Arseneau: I agreed, kicking and screaming. Thanks. Just kidding. Okay. In fact, I'm going to walk around. Okay, so, I'm David Arseneau from the...I'm an economist at the Federal Reserve Board. So, I think I need to start by saying that the comments that I have here today are my own. They don't necessarily represent the views of the Federal Reserve Board, nor do they represent the Federal Reserve System in general.

So, that's out of the way. The other thing that I want to say is that my co-panelists here have a pretty impressive record for industry experience. So, I'm going to leave the gory details of market-specific developments, and sort of explaining the day-to-day movements in oil prices — I'm going to leave that to them, because I think their comparative advantage is much better than mine in that regard.

What I want to do is just, ultimately at the end of the day, I just want to make a really simple point. I think it's a simple point, and I think it's a noncontroversial point. I'm going to make it, and I think it's going to be a good starting point for the discussion for what we want to talk about here today (which is what drivers, not necessarily matter most, but what drivers matter at all for short term energy prices, okay).

So, before I get to the point that I want to make, I'm going to start with just sort of setting the stage, okay. So, it's easy to convince you that in recent years, we've seen unprecedented commodity price volatility, not just energy prices, but commodity prices in general — unprecedented volatility, okay. So this is a graph of commodity prices. I picked three out of the hat: copper, wheat and oil since 2000. It doesn't matter if the measurement is in nominal terms, what matters is the measurement in real terms. The bottom-line is in percentage terms, I mean that's insane volatility in a short period of time, okay.

Paul [*inaudible*] care about this, right? We care about energy price volatility. We care about commodity price volatility. So, why specifically?

Say I'm from a Central Bank, why do monetary authorities care about commodity price volatility? Well, it's simple; monetary authorities care about inflation, and commodity price volatility jerks around the CPI to the degree that the CPI jerks around — that means inflation is volatile. Volatile inflation means that it's hard to differentiate what's a *permanent* versus a *transitory* shock to inflation, and that makes it difficult to design an optimal policy response if your goal is to keep low and stable inflation and you can't parse out whether a shock is permanent versus transitory because you've got a lot of, for example, commodity price volatility, and your job is a lot harder. Your job would be easier if you had less commodity price volatility; that's one reason you care, right? But inflation is not the only thing that Central Banks care about. Central Banks also care about *real* activity, particularly in the FED when you do a mandate, right? We heard Dr. Summers today tell us that energy price volatility... commodity price volatility in general matters for investment positions on the part of firms. Apparently, that's Chairman Bernanke's dissertation which I actually didn't know; now, I do. I actually thought it was on the recession, but I was wrong.

So, you know firms care about commodity price volatility, but households do as well, right? If your income stream is uncertain, because gas prices move around a lot, that means that if you make decisions on a constrained budget (as most people do), and one of the most core goods that you buy in order to sort of do your daily business is really volatile, then it makes it harder for households to plan.

So the bottom line is that commodity price volatility matters for inflation, monetary authority cares about inflation and that is for *real* activity. Monetary authorities care about putting *output* near *potential* on a steady growth path, right? So, I think I'm probably beating a dead horse. Monetary authorities care about commodity price volatility, but so do other policy makers. And that's why we're here today.

The kicker is that what we want to do is understand what drives commodity price volatility. We want to say something about what drives volatility. If we understand what drives volatility, then we can think about reducing it. And my comments are centered around exactly that. So, you have to bear with me here. I want to show you the slide, and this has been beaten to death and I bet you everybody in this room is sick of it, but I'm going to show it to you anyways because it helps me make a point.

There's a real simple framework that you can think about to explain the crazy volatility that we've seen since 2000 in commodity prices, and the sort of relatively simple, over-simplified framework is couched in the lands of *fundamentals* versus *speculation*, okay. Yes, it's overused, but I'm going to use it anyway, okay?

So essentially, *fundamentals* say that if you want to explain relatively low frequency movements in oil prices, then we can look to fundamental developments in the oil market or *any* commodity market, for that matter. Say that broadly speaking, trend prices appear ... they're broadly interpretable through market-specific developments, okay? That's true at medium to low frequencies, but when we move to higher frequencies, the extreme volatility ... it's a little bit more difficult to tell that story, that the extreme volatility in higher frequencies is driven by fundamentals alone, okay?

So that sort of opens the door for these speculation arguments. Speculation is kind of nice because we think that it allows us to maybe explain a little bit about more high frequency volatility, and perhaps that filter is over into medium to ... I think it's case in part of the higher frequencies but perhaps medium frequencies, okay.

The issue here though, is that I may be speaking for myself here, but there are other people in the audience that feel the same way I do. In my opinion, we have yet to articulate a specific mechanism by which speculative activity influences oil prices or commodity prices in general. I don't think we can specifically articulate the mechanism. That means we don't understand it.

So, what I think is sort of surprising to me, is this distinction. However rudimentary it looks, it matters. It matters for policy that's on the table today.

So, what do we think about that? I mean it's policy is being made around this lens (that I'm not going to make a comment as to whether that's right or wrong). Frankly, I don't care. It's not relevant for the point that I want to make. Maybe making policy to limit speculation, to bring down oil price volatility is precisely the right thing to do. I don't know. I don't care.

The point that I want to make is that we're making policy, based on an assumption that I'm just not sure that we know is true, and that means there are parts of this market that we just don't get. We just don't understand, okay?

Okay. So, in reality, I think the line between *fundamentals* and *speculations* is quite blurry, okay? One way that you can describe why this line is blurred, is you can look at the monetary policy letter trend. There are monetary policies ... when we set policy, there are certain aspects of uncertainty that we sort of take into account when we think about setting monetary policy. Broadly speaking, you can classify them as *model uncertainty*, *parameter uncertainty* and *uncertainty regarding the true state of the economy*.

These same principles apply (probably in spades) to commodity markets. Very quickly, because I want to move it along. Model uncertainty: generally speaking, we just don't know how the dynamics of how the fundamentals of all the business cycle work in the first place. I think a prime example might be consumption dynamics. In particular, there's a lot of evidence out there that suggests that oil consumption over the business cycle is very different across countries. There's a tremendous amount of heterogeneity.

Do we have something that tells us specifically what drives that heterogeneity? I don't think we do. And because we don't, we don't have good models for those fundamentals. There's model uncertainty. You may have a model but it's not necessarily the right one. That leads to parameter uncertainty, right? One of the biggest issues I

think in commodity markets, is thinking about pinning down a parameter precisely, asking its elasticity (in particular, the price of income elasticity). If we had these guides and we knew what they were, none of this should be an issue. There's tremendous parameter uncertainty in commodity markets. Probably part of the reason is because there's also model uncertainty; they do feed on each other.

The last source among uncertainty is that there's uncertainty regarding the true state of the market. Here, the bottom-line is we have a lack of data transparency and in general, what data we do have is potentially mis-measured, okay? And here I'd say props to EIA, if you look across the world, they're leading the charge in rectifying this problem. I think where the principal problem lies is when you go to other countries. I would love to know what inventories in emerging Asian economies look like. I think that's really important. I think inventory stores for those economies in particular are really important. We just don't have the best data to tell us about that.

So, these three sources of uncertainty are really ... I think they are going to lead me to the point that I want to make here, which is actually very simple and I think is probably pretty uncontroversial and that's that. If we want to reduce commodity price volatility, I think a lot of that comes from: there's a lot of uncertainty about how commodity markets work. If we want to reduce uncertainty about how commodity prices work, we need more research to get at the "needy greedy." I don't think it's good enough to look at and expose volatility, and explain it after the fact. We need a sort of comprehensive view of how that volatility evolves, to say something *ex ante* as opposed to *ex post*. The ability to do that is going to be much, much more valuable to policy makers.

So, before I get into this (and I'll move through it quickly), I want to say at the get-go, I'm not naïve. I know this is really hard and I know we've been doing research and energy markets for a long, long time. I *do* understand that this is difficult. I *do* understand that the models are complicated. I *don't* think that should stop us. I think that

we need to ... in some sense, now is kind of the time to push on the research frontier about how commodity prices and how commodity markets work. I think there are big gains to learning more now. So, five years from now when we no longer have so much slack, and energy markets when the potential for price spikes come up again, we're going to be better prepared to understand it. Maybe not solve it, but at least understand it, okay?

So, I'm actually going to move along a little bit. I have some suggestions on broad sorts of themes. One broad theme is: so I'm kind of a theory nerd and I'd like to see a little bit more theoretical guidance sort of pushing us towards...sort of guiding the empirics more, okay? I think one of the key problems is that our models just aren't really very good at all. And I think with better models, we might get better parameter identification that will help us to understand what is *fundamental volatility* versus *volatility that we can explain*.

So that's one sort of broad area. Another broad area (I think this is sort of less tacky and maybe a little bit more policy-oriented, which is I think one of the things that we've really suffered from over the last two or three years) is the unanchoring of expectations regarding long term oil prices. I think that ... we know this from monetary policy, right? You know Central Bankers think, you know they stay out late at night thinking about *inflation expectations*. Are they anchored or are they not anchored, right? The reason is because, when inflation expectations become unanchored, inflation rises. As inflation rises, it correlates with higher volatility. There's good reason to think that when expectations become unanchored, you have rising inflation and more volatility. My suspicion is that the same thing is happening in commodity markets when you look at views on a "long run" oil price. When the market ... when you have level shifts in the futures curve like you did in 2008, the markets are thrown in their view on what the "long run" price is. What we need is something that coordinates traders' expectations or market *[inaudible]* and expectations to help anchor that. I think that would be really

important, really valuable for reducing volatility. I also understand that it's really hard to do, because nobody is willing to go put their neck on the line (like we saw today at lunch) and forecast future oil prices. I mean, it's a good way to shoot your credibility. Maybe we should get past that; maybe we should have a more open dialogue about what the "long run" price of oil is.

So, I'm going to move really quickly now. This is a big room. Normally, I don't have a problem with self-serving slides promoting my own research, but this is a big room so I'm probably going to skip the slide. I have some research. I don't want to come across just preaching to you. I'm trying to *walk the walk*, as well. I've got some research that tries to sort out why we see so much heterogeneity in oil consumption across countries, and I like to think that I'm making some modest progress on that.

So, in conclusion I'm going to wrap it up and let this guy go on. I'm probably over [time]. Understand that volatility in the commodity market is crucial. In my opinion, the current level of understanding is insufficient. We need more research. I think having a better understanding will help to reduce the uncertainty, and that ought to reduce the volatility as well. Maybe that's a tall order, but I don't know that I'm so concerned by that. I'm willing to try.

Male Speaker: Thank you very much.

David Arseneau: You're welcome.

Male Speaker: David did help to anchor expectations about *[inaudible]* presentation so we'll help with that more.

David Arseneau: That's why I went first.

Male Speaker: I know. Here we go.

Ed Morse: I started life as an academic. My professional life started as an academic and there is a saying that people in academia have: "it's no trick to review a book you've never read." So, I had prepared remarks, but I didn't know I was going to have a target starting in front of me with David. So, I think I'll just take off from some of

his comments because, well, I think he's absolutely right that we need better research, better model research. I think we've been a lot more knowledgeable about this business that he went on about than we knew.

And one of the things we know about volatility is that there are two clear factors that are readily understood that could rise to volatility in markets. And one is shortages gave rise to price spikes; there's no doubt that once demand bumps into a supply constraint, what *has* to give is price. It's the only way to ration demand, and we have it on small markets. We have them in big markets. We certainly have had it in the mid-west of the United States for many years in the summer time; when there was not enough gasoline around to meet some driving demand and gasoline prices spike, that's what happens. You get volatility as a release.

We have gone through a decade in which that happened across a whole range of commodities. The range of commodities included agricultural commodities, included metal commodities, and included energy commodities. All of them (for accidental rather than supercycle reasons) seem to have run into supply constraints more or less at the same time, at the beginning of the last decade or in the second and third year of the decade. And that was a factor, not because of demand necessarily, so much that we know, but because of under-investment, under investment over a long period of time. And the ... my favorite example of under-investment is the global refining system, which gives you a sense of lead times in this business.

In 1981, according to — and there are enough of you in this room — the VP Annual Statistical Review of World Energy, the world had 82 million barrels a day of refining capacity, and demand which was growing at 8% per annum for a couple of decades. All of a sudden, this came through not only a halt, but petroleum product demand dropped by 10% or 12% in a five-year period of time and refining became an oversupplied industry. Now, it took 20 years for that oversupply to be worked off; and if you look at global refining capacity in 1981 or 2001 (with some differences in terms of

the structure of the machinery) it was the same capacity. When you have 20 years, in which 17 are not profitable for an industry, you don't get investment. And then, all of a sudden you have ... and here's another issue that David talked about where we know significantly more than he would lead us to believe we know ... there was significant growth and demand for not *all* petroleum products, but for distillates in particular. Distillates include: diesel, heating oil, and jet fuel. And demand for distillates really is different in the emerging markets from what it is in developed country markets and the industrial world; In the OECD, oil products are essentially used for transportation but in emerging markets, they are used for a lot more than just transportation. And one of the things they are used for, that they are handy for, is power generation. And when you have emerging markets that have double digit demand growth, the power generation and the handiest of all fuel sources to use is not coal, not natural gas, but distillate fuel oil. You get demand rising for it at a different rate than you do within developed countries where oil is only a transportation fuel, or is essentially a transportation fuel. As margins exploded, refining became profitable and a lot of capital went into developing new plants and equipment.

There's a lead time in the refining arena. That lead time is about five years. The tightness in the market started around 2002 to 2003; accelerated by a couple of hurricane seasons on the US Gulf Coast and five years later, a lot more refining capacity was coming online than demand for petroleum products. And now, we have a refinery [*inaudible*] that's likely to last for long period of time, competition in the market, and an impact on those prices.

So, I think that's one of the sources of volatility that we know a lot about; and that has to do with shortfalls. The other has to do with something that really *is* new in the commodity markets: as Ogden Nash states, "Here's a good rule of thumb; too clever, is dumb." We really do know a lot about something that's new in the market, and we know a lot about its impact on volatility. What's new in the market is that, with the growth of

liquid instruments, commodities could be a target of investor opportunity. They could be a source of investment because the commoditization of the financial markets, or financialization of commodity markets, allowed people to gain direct access to commodities without the inconvenience of holding it in storage. Without putting a lot of working capital into holding deteriorating grain, or holding deteriorating jet fuel, or simply holding a lot of oil in inventory, you could do it through a liquid instrument. And commercial markets exploded in terms of the amount of liquidity in them after 2002–2003. It accidentally happened at the same time that a lot of commodity markets (virtually all of them) became tight because supply constraints emerged from a couple of decades of under-investment.

Now, if we look at who is involved in these markets from a financial perspective in 2003 (when there were roughly 700,000 contracts available in futures markets to trade petroleum), there were like three different kinds of actors, each representing a better third of the market. A third of the market were *bona fide* corporate hedgers. The third of the market were speculators — what we call speculators or investors in the commodities. And the last third of the market were basically banks (like the one I work for) which were providing liquidity, both to what we call speculators and what we call *bona fide* hedgers.

As the markets exploded (those 700,000 contracts in total), open interest in crude oil grew to 3.5 million contracts in five years, going from representing 700 million barrels to 3.5 billion barrels (not including over-the-counter markets and not including options, which make it an even bigger market than what I am saying). Two new kinds of investors got into the market and then, the third one was added to it.

So we had (here's where transparency is important because we don't yet know quite what the size of these actors are, because we don't know what they do) in the over-the-counter markets but we have new institutional investors and long-only products called index funds. We now have ETF investors (also basically long-only, although you

can short them too) that were also not in the market beforehand (also based on these instruments). And thirdly, we have black-box, algorithmic traders who will become like day traders — in and out of the market. We don't have an exact view, with precision, of how much of the market these three new enterprises that didn't exist in 2003 constitute, but it's probably fair to say it's about 30% to 35% of the market, in terms of who owns total open interest.

So, a third of the market is now comprised of three new kinds of economic animals. And we know that one of them, the algorithmic traders, thrive on volatility. They trade based on candle sticks. They trade based on resistance levels, and support levels, and to argue that they have no role to play in volatility is really a little bit silly. We know they have a role. We know what that role is. We can measure it in fact, in terms of the movement of prices within a day and across days.

So we know (I think) a significant amount about volatility, and what we know is that one of the sources of volatility is likely to decline significantly once supply constraints are removed. And in fact, one of the extraordinary things about commodity markets is: on the left side, we look at prices in a range of commodities between 2006 and 2008, the middle of 2008 and by and large, they tended to rise ... a lot of them rising together in price, reflecting (by and large) shortages on the supply side. We had a tremendous drop in commodity prices in the second half of 2008, and the distinguishing factor that we now have is that the commodities are not all the same. They're behaving very differently toward one another, and that's largely because the ones that are still going up are the ones that are in structural supply constraint territory. And the ones who's prices have either gone down, or have moderated, are the ones that can identifiably be seen as ones for which the supply response is shorter than it is for oil and copper. And we have it, and if I did this chart across each quarter of the period 2003 to 2010, you'd see that in much of the time span between 2003 and 2010, all commodity prices went up and then, they started differentiating. And of course, the first quarter of

this year, they're highly differentiated with some strong winners and some strong losers (most know we're on the losing side of sugar and natural gas). And the natural gas story is one that has been talked about a lot in the past few hours, but it's one in which the supply response has been dramatic, where technology has been applied and one part of the commodity *[inaudible]* United States with a significant response.

I want to just make one other set of observations in terms of drivers. We think a lot about the relationship between the dollar and commodities. Most commodity economic textbooks use silver as the example of the commodity, to argue that when the dollar depreciates against basket of currencies, silver prices go up and vice versa. But actual historical analysis shows a very random relationship between the dollar and virtually all commodities. The dollar and oil over time have been a random walk (until about 2007 when we started seeing emerge a pronounced negative correlation between the dollar and oil, the dollar and copper, the dollar and a bunch of other commodities). Remarkably, what people had thought of as a permanent (now negative) correlation between the two, became very positively correlated after the third quarter of last year and into the first quarter of this year. And where we've been in the last month has been back to a random walk. Something to be explained. But you no longer can go into an office in the morning and think that if the dollar goes down against the best of the currencies, commodity prices are going to rise; and it's not just because traders aren't trading it, but because the perceived impact of the dollar and of inflation as a result of some macro things and commodities seems to have disappeared.

Investment flows in to commodity indices, and this is an ETP, so they're something that we all know have to be measured. We all know that they have a certain impact on prices. We all know that they have an impact on volatility. We all know that the initial index funds had a five-day trading range between the 15th and 9th business days of the month. And we all know that funds trade around, the funds that are invested in them creating a certain amount of volatility.

So, I suggest that we know a lot more about some of these things than we think we do. If, I went through the end of this slide, I would start where Richard started and give you sort of the Adam Sieminski spiel, saying that the fine print at the very end of the presentation tells you not to believe a word I said. And certainly don't make any investments on it, and I'm not responsible for anything I said. So, thanks very much.

Howard: I think Adam Sieminski gets to give the Adam Sieminski spiel in the next set of break out session. But Guy, please.

Guy Caruso: Thank you Howard. And I want to thank Howard for inviting me to join this panel, and it's great to be part of the EIA conference once again and see so many long-time friends and former colleagues. And it's really great to again, participate and to really try to answer some of the questions that Howard had posed to use last week. And I'm going to focus mostly on the drivers on oil prices, but I'll mention a little bit about the study that Howard referred to at the International Energy Forum, which was instrumental and leading to some decisions that were taken or at least agreed to amongst the ministers last week in Cancun. And then a couple of points about the relationship between oil and natural gas prices.

The ... we spent a lot of time in my last year or so as Administrator of EIA in 2008, trying to explain this issue that David teed up very clearly in his presentation, and Ed commented on: that of *fundamentals* versus *speculation*, to put it simplistically. And frankly, we ... I think our conclusion in , that ... our analysis in EIA and other organizations came to, was really very much in line with what both David and Ed had said, and that is we really didn't have enough information to really disaggregate the fundamentals from this new asset class that Ed described of commodity investors. And I think we're seeing that playing out even now, as we saw a rapid decline in the oil prices in the second half of '08 and then recovery in middle of '09, and then relatively narrow trading range. And now, we're seeing (as recently as this week) prices approaching

\$87. It's very difficult to explain using the old model of inventories, spare capacity and other supply-demand fundamentals.

So, what most of the traditional analysts are saying is, how you can explain this? We've got these fundamental conditions of weak demand still, despite some evidence of global economic recovery in 2010 as Dr. Summers pointed out. But we have, depending on whose numbers we use, 4-5 million (maybe even 6 million) barrels a day of unused crude oil productive capacity which, by historical standards, means a *down* pressure on price. Yet we're seeing prices continue to go up. We have a very strong inventory position in OECD countries and yet, as I said — \$87 oil.

So, how do you ... how can you explain this (and I think David pointed out) this issue of data. And I think that's also part of what came out very clearly in the international reform meeting of 66 countries (many of whom were represented by their ministers, including all the major producers and consumers), there is still a great lack of data, especially in nine OECD countries. And I don't ... and I think the decisions that were made were that to improve the data systems, both in the truly so-called "Joint Oil Data Initiative" in this International Energy Forum, as well as the International Energy Agency and OPEC (represented there), both pledged to improve the efforts of data collection and understanding the relationship between financial and physical markets. I think that's got to be the number one take-away from the Cancun meeting; that of at least a political commitment by the ministers and other representatives including, you know, our deputy secretary and Richard Newell. I'm very happy to say he was there, because of how important it is that EIA played a role in this. And we continued to be the leaders among IEA members around the world for first class data collection and analysis. And, thanks to Richard's leadership and Howard's leadership and the many hardworking people in EIA, I think we can really play an important role in sort of expanding "Best Practices" around the world and I think that's probably the most

important result that came out at Cancun: if we really do get political and financial support from the many of these, in particular non-OECD countries.

When you look at some of the other issues, *clearly the fundamentals* that I had mentioned, and investment ... lack of investment in the '80s and into the '90s were part of this boom and bust cycle that led us to a very rapidly increasing oil and natural gas prices. In fact, commodity prices have both *[inaudible]* as the chart shows. So, it was the boom and bust, not only for energy, but for many commodities. And now, we're seeing that perhaps going back to a more stable relationship. But Ed talked about one other factor that we look at in EIA, and others have looked at in the international financial institutions: impact of the dollar and other currencies on commodity prices.

Our conclusion was, and I think still is, that it's more likely to be a random walk when it comes to linkages between currencies (and especially the dollar) and the oil prices. The other one that we've tried to look at more closely at the CSIS and a number of financial institutions is the relationship between the finding and development cost for oil and for gas, and the price. And clearly, it was hard to explain \$150 oil based on finding and development costs which probably were in the \$20 to \$30 range. Maybe they've gone up a bit, given the price of commodities that they use to find and develop oil. But again, the \$60 to \$80 seems to be what those costs right now would indicate as a price range, and yet we're now pushing well above that. So clearly, there are other things at play and the initiatives instituted at EIA by Richard to look into that is definitely laudable. And I think the CFTC's decision to acquire more data on over-the-counter and other data systems that we were not really getting adequately during the last five years or so will help, and that will take time. And I think Dave's point about "we'll need time to gather that data, do the research" is correct. So, it's not going to be overnight, but clearly another point that came out of Cancun was the need for improved data systems around the world. And obviously, in those countries that have well-developed financial markets (such as ours, but also others), they will be necessary. And again, it's

important, now that the ministers who are at Cancun will take that decision ... commitment I should say, as opposed to decision, back to their countries and actually provide the resources to their governments to do that.

This slide I owe to Adam Sieminski, who you'll hear from the next session about "are we in sort of new ... is there a new relationship between the fundamentals and price of oil." And certainly, it would seem that way when you look at data on this particular chart which focuses on inventories in the historical period in the so-called "good old days" of the 90s and early part of the previous decade. The model that used inventories and spare capacity did a pretty good job of projecting oil prices, but that relationship certainly became much more difficult in the period of price run up until now.

So, what we're ... what I think we need to do and again, this just probably repeating a bit about what Dave said and what was agreed to in Cancun, is we need to improve the data information systems that link financial markets with physical markets as well as a better understanding of that in the EIA, OPEC and IEF. And secretaries have all agreed to do more research and provide more information to their leaders ... of their member countries.

Finally, just a couple points on the ... we've looked very closely at CSIS, at the natural gas market in the last year or so, seven or eight different workshops and seminars, particularly because of the new focus on unconventional gas particularly from shale source rock. And the relationship that has ... what it means for gas prices, and I think it's clear at least to those we've had come and speak to us as well as through our own work, that the relationship between natural gas prices and oil will continue to be decoupled in the United States because of the lack, the virtually negligible competition between natural gas and oil, whereas the linkage in other regional markets like Europe and Asia continues to persist given the long term contracts that both of those regions have instituted in terms of, in particular, Asian O&G contracts (with linkages to crude oil) and within Europe (linkages to both crude and product prices).

So, I think it's ... the initiative that Glen Sweetnam and others at EIA has started approximately five years ago, to come up with a global gas market, is now facing even greater challenges with the robustness of the shale gas supply in the United States which you know, make modeling global gas market and global gas prices even more difficult. But the news is that Chris Ellsworth is going to speak next, and he'll focus mostly on natural gas. And I'll just segue into Chris's remarks by saying I think that we still don't have a global gas price, and in all likelihood that we aren't going to at EIA but sure there will be a global gas market, at least in the near term (in my definition, that is three to five years).

So with that, once again, thank you all very much for your time and attention.

Chris Ellsworth: Thank you for that segue, Guy. Indeed, I'm going to talk about natural gas prices today, which we haven't touched on and what's been going on in that market.

But first of all, I'd like to thank Howard and EIA for inviting me to participate in this forum. And so I'm going to change topics to the drivers on natural gas prices. One of the questions that we struggle with daily in our work at the Federal Energy Regulation Commission, is do market prices reflect underlying physical fundamentals, and (as we saw in 2008 and in other times in 2009) are other forces at work? The office I work in, the Energy Markets Oversight office, is particularly interested in price manipulation and fraud by market participants.

However, we need to understand markets and what is driving them at any given time to understand price movements. We have a particular focus on short term price loop formation; unlike EIA, we don't make any forecasts. We don't pretend to make any forecast. But we are also interested in what's driving prices, kind of in the more medium term. I'm really talking over you know, a few months period.

So, we look at all the physical fundamentals that are driving gas — markets and prices. I'm sure you're familiar with them all, you know, whether how that translates into

gas demand production, imports, the level of storage, flows in and out of storage, flows along pipelines, pipeline capacity availability and other factors like that *[inaudible]* for some of those important ones.

We coordinate pretty closely with our power generation group, since power generation demand and gas prices are often closely interlinked. And we look both domestically and globally. Domestically of course, shale gases have taken on a greater role, and helped reduce prices recently and also O&G imports. So, you know, we're looking at imports into the U.S. but we're also looking at the drivers of O&G imports.

However, at times, we do see events on the market that are difficult to explain through pure fundamentals alone, or physical fundamentals alone. So, we also look at the other side of the equation. Financial variables influence financial product prices. For example, trader activities on commodity exchanges, the level of investments and exchange rate funds. Those were mentioned by Ed a little bit earlier. Trading activity at key natural gas hubs. A lot of the trading activity at key hubs around the country is of more of a financial nature than of a physical nature. We look at other things, such as exchange rates, returns and alternative investments to commodities, equity indexes and things like that.

So, a lot of what of the speakers are looking at, we also look at. And this kind of leads me to the extra ... and what I'm already focused on today is what happened in gas markets in 2008. So, this leads me to an extraordinary round up in gas prices in the first half of 2008, and then, that sudden collapse in the latter half of the year. And if you want more information on this topic, it was discussed quite extensively in *[inaudible]* 2008 State of the Markets before, which is downloadable from our website.

And this, perhaps ... this 2008, perhaps provides the best recent example of a time when non-physical factors appear to be driving natural gas prices, regardless of prevailing fundamentals. I've got to do a little of a bit *[inaudible]* here, but over the past seven or eight years, we have developed the state of the art market monetary center

that allows to look at literally thousands of streams of physical and financial data on a daily, hourly or in some cases (as you will see later) on a second by second basis. And the more information we saw, during this period of 2008, I think the less convinced we became that prices correspond to purely physical drivers or physical fundamental drivers.

I'll go to the first graph here. This shows ... this graph here shows how far gas prices have moved beyond that five-year average in the first half of 2008. The blue line there is 2008; the red line below is 2009. The green shaded area is from the five-year average, and that yellow area there is what prices did during the fall of 2005 after hurricanes Katrina and Rita. And you could look at this and say "well, yeah they went up to \$13 in July, which is unusual for summer, for natural gas users go to peaking price. But you know, you saw prices like that in the fall of 2005, so events do happen in natural gas markets that can pull us up." But what you've got to remember about the prices in the fall of 2005, was that the U.S. lost about 18% of its U.S. productive capacity due to Katrina and Rita, and as that capacity restored (you can see as we entered into 2006), gas prices returned back to the five-year average.

Well, in 2008, the U.S. had not lost 18% of productive capacity. And in fact, supply during the first half of 2008 (based on EIA figures) grows at 4%; gas use during the first six months of 2008 was up slightly less than 4%, with growth concentrated mainly in January and March due to colder than normal weather during that period. So that kind of explains perhaps, why you had \$8 gas, or so, in January or March. But markets returned very quickly to normal as we exited March and went into summer, and yet prices continued to go on up almost \$13 million BTU, actually over \$13 a million BTU and I think it's around ... July 2nd or July 3rd.

So gas prices peaked and then, began plummeting early July. Even though, as I said there was kind of no large event on the supply side which would have caused price to hit \$13; well likewise, there was no large event on the downside that should have

caused prices to plummet. There was no sudden loss of supply, and there was no sudden loss of demand. Markets were behaving as you'd expect a typical summer market to behave. And in fact, the downward pressure on prices was so great that in September, Hurricanes Gustav and Ike actually did take about *[inaudible]* per day about 12% of U.S. production up to market and prices continue to fall. So, we kind of have to ask ourselves, what was that all about? We got a 12% reduction in supply and prices continue to fall.

So, I now turn to some of this non-physical and I call them *financial influences* on gas prices during that period. And here, I think as David was saying, it gets more theoretical. It gets more conjectural; given the data that we have, this is a hard case necessarily to prove. But I still think it's a compelling story. Going to the next graphic here, which I think is a version of the graphic Ed showed ... and it shows that commodity prices started trending up in unison in late 2007 and peaked in early July 2008. From January 1st 2007 until July 6th 2008, prices of crude oil and corn grew 237% and 191% respectively. Gold increased about 150% and natural gas prices rose to 215% over that period. Some of the strength in commodity prices probably has much to do with developments (and this is again conjecture), but some of this strength may have to do with developments at global financial markets perhaps perceiving superior returns that commodities offered over asset classes and have as much to do with that, as with any fundamental shortages, particularly in the natural gas market. Interestingly, the collapse in commodity prices predates the collapse in equity by about a couple of month or so.

So, natural gas prices in 2008 were likely influenced (and again, this is kind of, I think agreeing with most of what I'm saying) by large influxes of passive investments into commodities, and technical trading strategies based on trading around prevailing market momentum. The past few years, we've seen a large influx of passive money,

primarily from institutional investors into commodities. By institutional investors, I mean: large banks, hedge funds, pension funds, and exchanged traded funds.

Beginning ... in the second half of 2007, the fall in equity values ... remember we started entering the recession, I think in 2007 ... a decline in the dollar and a rise in commodity prices, we think, helped pull investors into commodities in search of high returns. Some in the market though, expose you to exchange traded funds such as AIG (Dow Jones commodity index fund and the Golden Sachs commodity index fund, to name but two). Many of the investments took place in unregulated, over-the-counter markets, using financial instruments that mimic regulated exchange traded features options and swaps that are traded on *[inaudible]*

Perhaps a year later, there was a growing sense of financial instability as we approached the fall of 2008; a rapid deterioration in credit conditions, and growing losses on asset-backed securities created the conditions that required commodity investors to liquidate those commodity positions. And we saw a big drop around that time of open interest, particularly by the non-commercials and particularly in the natural gas market.

And this probably placed tremendous downward pressure on gas prices. But physical and financial markets weren't in isolation during 2008, but probably influenced one another and were influenced by the expectations and perceptions of market participants. This interaction between physical and financial markets likely occurs most of the time.

However, during 2008, the end result of this interaction resulted in prices that were substantially out of balance with the underlying physical fundamentals (particularly in natural gas), and were going to touch other markets.

Following the roller coaster ride of 2008, gas prices seem to have settled back into a range that more closely reflected market fundamentals. Consumption was down 2% in 2009, while production was up 4% due to growth in shale gas. Gas prices briefly

fell below \$2 in million BTU last year. However, there are still movements in gas prices that are hard to explain with fundamentals alone, but nothing on the scale we saw in 2008. For example, gas prices react to the release of EIA's weekly storage number almost weekly; they do a little jump, you know anywhere from 5 cents to 15 cents immediately after its release, even though it reflects a state of the market that is already old by a week.

Financial markets have played a growing role in price discovery since futures markets for natural gas were established in the early 1990s, and the volume and range of financial instrument has expanded. Trading on electronic exchanges now takes place around the clock, as physical traders look for guidance from financial markets to help determine that opening bid for the trading day. This is similar to the way stock traders seem to look at European and Asian markets or the stock future market before the stock market in the U.S. opens, in terms of setting an initial price.

I'd like to go on to this graphic here. And this graphic is a period in 2009: you'll see in it three days of May 2009. And what you see in there is Nimex, and Nimex is essentially or the *[inaudible]* futures contract is essentially traded now 24 hours a day on *[inaudible]* while the stock market is traded kind of during normal business hours, so to speak. But what we saw during *that* period was a 77% move up in gas prices over the three-day period. It's really nothing fundamental going in the market that we could see, but the stock market seem to be given guidance by the futures market in that move up because as you see, the futures market moves up, and spot stops trading, say on May 6th around about 3:00. The futures continues trading up and the spot the next day opens up where the stock market closed, the futures continues to trade up and it seems to give guidance to prices that next day.

So, to conclude, investments and commodities with ... one of our goals is to try and ferret out manipulation and fraud, but investment in commodities is not manipulation, nor is it ultimately bad for market outcomes. Passive investors and active

market participants may enhance the price signals to producers and consumers that energy market are tied to by beating up prices, in effect magnifying the impact on prices of underlying fundamentals.

We could also say that the commodity price instability in 2008 was perhaps being seen by some investors as a precursor, and a valuable indicator of the turbulence that was going to come in broader *[inaudible]* markets. I know I've read kind of several kinds of Joe *[inaudible]* articles on that and that seems to be the view that the run-up in commodity prices really was an indicator of what was to come in broader markets.

So, I'm going to conclude, because I know we're running out of time. But most of my remarks today do come from the State of the Markets report that you can download. And also, the views expressed did not necessarily represent the views of the Commission. And thank you, for your attention today. Thank you.

Howard: Thank you to all of our speakers. I have quite a deck of cards here. I don't want to be easy on EIA or easy on the panelists, so let me start out. There were three of the cards ... I guess several of the speakers talk about the need for better data and better data quality, and I think three of the cards spoke to, I guess, a story that ran yesterday about natural gas data in the Wall Street Journal. And I guess it was ... it's not fair to stick the panelists with that, but let me talk to it in our efforts to provide high quality transparent natural gas data and then, I'll turn to the other questions that are equally tough for the panelists.

I think EIA has been completely upfront and transparent regarding its effort to address anomalies in natural gas data. Again, some of this was identified in March 2009. We identified them publicly on our website. We published papers in July, and in September of 2009. We started issuing a monthly comparison of our data with other sources that we publish each month on the web. We post them, we've announced the change in the EIA 914, which is the monthly gas methodology report, effective next month, which apparently led to the story in the Journal. It's really the latest part of our

effort to keep the markets informed, and avoid any surprises. So, I guess there's a Washington lesson "no good deed goes unpunished" and you know, we've been being very public about natural gas data issues for over a year in that context of open discourse. The opinion expressed by one source, that overstated EIA data maybe keeping prices down, is somewhat difficult for me to understand. And furthermore, as noted in the article, although certain states will see significant revisions, there's no indication of a big overall change.

The article also talks of the discussion with the production data. It raised questions related to the imbalanced item in the natural gas monthly report; certainly production data issues can have some effect on the size of the imbalance, but it does not appear it would be the primary driver, as suggested by another party cited in the article. And EIA is doing a lot of work in that area as well. We've recently received approval from OMB to add a question to our survey of local distribution companies, and we think that will help a lot in addressing some seasonal aspects of the natural gas imbalance item.

I guess the bottom line is, I'm thinking of David's call for better data and better analysis you know, EIA is working for better data on a variety of long-standing statistical issues, consistent with stronger funding that we received starting in 2009. Further work is still going to be needed but again, the improvements and methodology on the production side, and our work with the survey of local distribution companies should make EIA's data stronger than it has been in the past. We still have to keep up with changes in the industry. Things like the shale gas revolution, and the way our production samples were put together reflect that.

But in the case of natural gas production data, at least in my view (which is immediately biased because I do work at EIA, EIA is being very transparent about what's going on and we're working to improve the data, and we're providing as much

context to our users as possible. So, I appreciate the question, but now I will turn ...
yes, Ed.

Ed Morse: I'd just like to make one comment. And that is that no level of rated transparency can overcompensate for incompetent reports in the nation's largest and most important business press.

Howard: Well, I probably said too much. Now, let me turn to the panel. I just didn't want the three people out there to think that somehow we were ducking the issues, or selecting only the questions we would like to answer.

So now, I will treat the panelist with the same degree of disdain for their comfort. And for our panelists: volatility increased not only in most primary commodities but at other assets as well. It would appear that the source of volatility in all asset prices would originate in instability and volatility in monetary policy. See, this is one David wanted to answer. In related demand management policies, one that maybe Larry Summers would want to answer if he was here. Why is that not the case?

So again, the question about demand management policy throughout the world, which presumably ties to economic growth and monetary policy ... David and others?

David Arseneau: The question is, did monetary policy contribute to general asset price volatility? I think (so obviously, this is a tough question to answer), I think it's ... let me put it in the context of monetary policy and commodity markets. That's a link at one specific asset that people would point it to. People will say that having low interest rates for long periods of time is one of the reasons that commodity prices, we kind of bubble in commodity prices.

Well, I guess my response is going to reflect the presentation. I'm willing to buy that story, if you tell me specifically half. You know, I'm willing to buy that perhaps there is a channel between low near-term interest rates, and aggregate interest rates and commodity prices, if you tell me how, in one potential mechanism (or something that was pointed out earlier, which is commodity markets or rather the physical storage

markets). Physical storage markets, I think; if you want to look for a role for monetary policy and commodity prices as an asset, that's a place you've got to look. In a general equilibrium, a framework takes into account the entire end working in the economy, which is what monetary policy is about. I'm not aware of any research that looked at that. That's an area to look at. Maybe it's the case; we just have to discover it.

So I guess I'd answer the question by saying that the linkage ... perhaps there is a linkage, but I'm not sure specifically what it is, and I'm not willing to say "yeah, you're right you know, working on bad monetary policy asset price volatility" until I know more about it.

Howard: Any other comments? Ed?

Ed Morse: Just an observation on it. The two types of commodities that Central Banks and governments are more sensitive to are: energy price changes of volatility and food prices. And I think it just so happens, that in global commodity markets, these are the two largest sectors of the global economy in terms of level of the volume and value of traded goods, and in terms of the value of international investment clubs. They also are two areas where governments are very sensitive, because of what David talked about earlier (headline inflation and corn inflation). And these are the two areas in which I would argue it's almost certainly the case. It's more subject to government intervention and other commodity markets. So, certainly more than base-metals are. And government intervention and the pricing of food substances and energy (particularly in emerging markets, but not only the emerging markets) are certainly two of the factors that feed into price volatility, because of the imperfections they lead to. I would just like to make another observation on volatility, and that is: whether you look at gold or oil or copper or wheat, and look at technically-defined levels of volatility, there's virtually no volatility in the markets today as compare to what transpired in 2008. Yeah, we talked a lot about price movements as though that were volatility, but these markets have become really stable, much less volatile than they were. And even at the height of

volatility, if you look at certain kinds of options. So, if you look at the structure of puts on the crude oil market, once oil prices started to go up and market participants realize that OPEC was going to support and have a higher price level, the level of volatility on the *[inaudible]* diminish, sometimes disappear completely because the market recognized that Saudi Arabia or OPEC was giving market participants a free put on the downside. And that, I think arguably ... and I think if one looks at the data carefully, it would show why the investors cued the investment floats to call actions on the upside because you could buy ... if you look at the risk reward between the free put that Saudi Arabia was giving the investor, versus the opportunity for gain on and out of the money call, the market reflected what looked like a bias toward the upside. But it was really reflecting what the risk reward was for the individual investment.

Howard: This is a question about the oil gas multiple ratio of oil prices to natural gas prices, and the question is: do you all agree that the ratio has changed in tremendous amount? Do you think we'll see a return to a more stable trading multiple between oil and natural gas? And if not, why? I guess this is a question about divergent movements in the oil and natural gas crisis, and what's driving them. Chris, would you like to start or should I?

Chris Ellsworth: Yeah. It's certainly true that the oil price is now a multiple of what the gas price was just a few years ago. And a lot of that seems to be not really a gas ... that gas got cheap ... and its perhaps more reflective, I think right now, it's fundamental. But I think it's a question of where all of this is right now. Is it overpriced, or is it priced fairly? Well, I want to say overpriced. Are there still financial fundamentals within oil markets that have helped lead that divergence, because certainly it's an unusual event and I would expect it over the longer run to find a new level. I'm not sure where that's going to be though.

Howard: I think in North America, markets were not going to see a great deal of convergence, mainly because it's going to take time for demand for natural gas to catch up with this new supply development, which is the unconventional gas availability at ...

[BREAK IN RECORDING]

...relatively debate about what the cost are but it certainly in the \$4 to \$6 range is what most analyst are saying for unconventional gas.

Okay. At the top end of that you're still talking about on a BTU equipment of \$36 a barrel of oil equipment and so I still see at least two to one ratio and as Chris pointed out depending on what your view. It could even be higher or lower but I think...I don't see convergence in a near term mainly because it takes time for demand to catch up with the new supply development.

Ed Moors: But Guy you really said in your opening remarks or your formal remarks namely that there is no or very limited substitution between the two. One is a source of input mostly for the power generated sector. The other is a transportation fuel and why should there be convergence.

Guy Caruso: Exactly.

Ed Moors: And the only place there is convergence is where there's force convergence as an OMB contracts that are linked to crude oil prices or to fuel oil price.

Howard: I guess we will have to be.

Guy Caruso: I agree with my remark.

Howard: This will have to be the last question unfortunately 'cause there are really pile of cards here. But in hindsight, do we understand the 2008 oil price hike?

Male Speaker: No.

Male Speaker: Yes, it was a bubble.

Howard: A rational bubble or bubble, bubble? David?

David Arseneau: I mean, I think we understand aspects of it or did we think we understand the aspects of it, but I mean certainly there's been an unexplained

component as well I mean I think the comments that I had with you know low spec capacity and tight inventories, you know, we know from storage models that that generates big non-price linearity so we can get a lot of nonlinearity and volatility out of that but, you know, I don't know. What we saw was pretty severe and maybe it doesn't explain it all. So, explain component...unexplained component.

Howard: All right. I think we can get one more in because you guys chose to be short on that. And this relates to the long run commodity investment, long run index investment. Does long run index investment in oil put a floor under oil prices? Inclusion of commodities in the portfolios of institutional investors so I think this is the discussion of the index investment that was mentioned in several of the presentations. Does that serve to put a floor under oil prices?

Male Speaker: You know, it's really much more complicated than that. A lot of people talk about...many of us on the panel talked about the presumed negative correlation between commodities and other asset classes particularly equities and we you know, the commodity as an asset class phenomenon that going through long only index funds and look at the level of divergence of commodity prices after the winter of 2008–2009 probably reflecting fundamentals. And I think if you look at the new generation of index funds provided to institutional investors, they differ from the original generation and that they're not long only. There is some that are long short. There is some that have particular commodity baskets in there. There are some that look algorithmically at the commodity investment component versus an equivalent equity investment component like the move between all...one or all the other. There are others that are based on algorithmic traders, quantitative analysis that provide for momentum and volatility and some drivers of the basket of industry. So, I think if one more bias to argue that one only index funds might have had in effect, an impact of putting a floor on the commodity prices that arguably was or wasn't true. But it's certainly the case now

that we have these different kinds of index once created that I think it's very hard to make the argument that they put on the gas prices.

Howard: Anybody else, Chris? You were nodding.

Chris Ellsworth: No, I tend to agree with that certainly on the gas side, we still see a lot of activity in index loans but it didn't seem to put a floor on gas prices in particularly so.

Howard: All right. Well, please join me in thanking our panelists. And again, we're delaying the entire schedule by about 15 to 20 minutes so, the next session instead of beginning at 3:30 which would be in the past. We'll begin at 3:50.

END OF RECORDING