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Session 9: "Energy Efficiency: Measuring Gains and Quantifying Opportunities"

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.]

Debbie: I'm the Acting Director of the Energy Resources and Environment Program at the Johns Hopkins School of Advanced International Studies. Many of you may know that I've been involved in energy efficiency for a long time prior to my tenure here at SAIS. We are going to be running a session that's going to cover a gamut of areas. So, I'd like to introduce each of the speakers briefly, and then talk to you about the format we're going to follow. In this session, each speaker will speak for no more than 10 minutes so that we have the opportunity to get a lot of input from the audience. Okay? So we will start with Steve Wade who is an Economist at EIA's Office of Integrated Analysis and Forecasting. And he specializes in buildings energy demand. Steve will focus specifically on how EIA makes assumptions and projections regarding energy efficiency. From there, we will move to Jeff Genzer and we're going to move to the state-wide level. Jeff is a partner in the firm of Duncan, Weinberg, Genzer and Pembroke, where he has practiced since 1983 and he has served as counsel for a

number of organizations that have to do with energy and also energy efficiency, including the National Association of State Energy Officials or NASEO, the National Association of Energy Service Companies, the National Energy Assistant Directors' Association, the Energy Programs Consortium, the Solar Energy Industries Association, the Solar Alliance, and the Geothermal Energy Association. And again Jeff will focus on both the opportunities and the barriers in energy efficiency from the point of view of states. We will then move back to the national level where we will first start with Hannah Granade who is a Principal in McKinsey's Stamford Office and she's a leader in McKinsey's Energy and Materials practice, focusing on issues of strategy regulation and climate change. She's also a leader in the Clean Technology Practice. And she is the principal author of the recent McKinsey report, which I think many of you are aware of, called unlocking energy efficiency in the U.S. economy. And finally we will move on to Steven Nadel who will principally also focus on the U.S. economy, but will at the end of his address also address the international market. And he is the Executive Director of the American Council for an Energy Efficient Economy known to most of us as ACEEE. It's a non-profit research organization that works on policies and programs to advance energy efficiency technologies and services. I will then follow-up at the end, and we'll focus particularly on energy efficiency in developing countries. So if we could start with Wade, please move ahead.

Steve: Thank you and good morning. I appreciate being a part of this distinguished panel. *[laughs]* So I'd like to cover some aspects of energy efficiency modeling and measurement in...for the 8th Annual Energy Outlook, using the National Energy Model-Modeling System or NEMS. In general, I'll describe the sources of energy efficiency in the projection, then I'll distinguish between energy efficiency and energy intensity and quantify the contribution of energy efficiency to the intensity of decline in the AEO. And finally, I'll present some efficiency results from the Integrated Technology

Scenarios that we do for the AEO and ultimately hazard an estimate of technical potential for buildings.

So energy efficiency stems from the evolution of projected stocks. There's considerable stock inertia in the economy, but normal turnover of energy consuming stocks increases energy efficiency and that the current technology is generally better than what's installed. NEMS includes projected improvements in technologies, both their cost and performance, and also has the technology learning for certain, what you might call, infant technologies, learning where cost improves as cumulative installations rise. Then things that affect installed technology include mandates and incentives. Under the mandates category, there are CAFE, fuel economy, regulations, plant sufficiency standards, for example, under NEPA, MECA and EPAC building codes, etc., you have renewable fill standards. Modeling efficiency standard is pretty easy in that you generally remove substandard equipment when the time comes from the models. In terms of incentives, recent examples under the Recovery Act include the investment — the availability of the investment tax credit for renewable generation, loan guarantees for renewable energy projects, as well as uncapping the tax credits for distributive wind and credits for ground source heat pumps, and other one two credits. Investment credits are modeled as targeting cost reductions for development technology. And then finally their volunteered programs which aim to enhance the transfer of information about energy efficiency for particular products such as Energy Star.

Okay, a couple of key concepts before moving on to results. Energy efficiency, energy efficiency is the relationship between the amount of energy input and the amount of service provided. And we calculated the NEMS as energy per unit of service to man even though that's kind of the inverse of what you will think of the efficiency. Normally you think, you know, output divided by input. But since intensities are measured in the same relationship, it makes the comparisons easier. So for example, efficiency in lighting would be obtaining more lumens for want of energy input, or in

heating, it would be more heat-up output for the same, for reduced input. Energy intensity is a broader more encompassing concept than energy efficiency, and this is the ratio of energy consumption in the U.S. economy per dollar of real GDP. So energy intensity includes efficiency and structural changes. And finally carbon intensity is just similar to intensity except the numerator is carbon emissions and it includes efficiency structural changes as well as the carbonization.

Okay now for some reference case results. We have energy efficiency contributing 5 tenths of a percent per year to the decline in energy intensity, which is coming in at 1.9% in the reference case; so that's about a quarter of the intensity of the decline would be attributable to energy efficiency. Decarbonization declines a couple of tenths faster than energy intensity, and that's primarily due to the power generation sector.

Since structure is such a big piece of this graph, I thought I'd quickly give some examples of structural changes and then move on to some of the results again for the reference case. One of the structural changes is conservation. And that's reducing energy consumption by reducing the services provided. Since nothing has changed in the relationship between energy input and energy services, that's not considered an efficiency gain. Although some people categorize conservation with efficiency, or I mean conservation with efficiency. So specifically, a response to an energy price could have both the structural and an efficiency component. In the short run, when people maybe mitigate their services by turning down a thermostat, that would be conservation in the structural basket. And the long-term if their response to a price causes you to purchase a different type of equipment then that would have a feedback to efficiency. Other structural changes include in the building sector, population migrations that tend to effect heating and cooling loads in buildings. There's a lot of *[inaudible]* in the building mix especially commercial sector, so the shifts in that mix would be structural changes. Same thing for industry, there's been shifts from energy intensive industries to less

intended...intensive industries over time. And growth of the service sector, even though it's not specifically industry, it's part of that compositional effect. And transportation, you've got vehicle type shifts within the light duty stock, for example, shifts between personal vans, SUVs, and light trucks. For a long time, the SUVs were growing the fastest and that's in the light truck category. And now there's kind of a shift back in the other direction. So the growth rate of some of these things in the AEO, we've got real GDP growing at 2.4% per year, and then we've got some of the other what we call non-structural drivers for the various sectors, and their growth rates range anywhere from just one-third of that of real GDP to two-thirds, and maybe just doing some rough math if you think of it as, on average, 50%. You'd expect structure to be contributing about 1.2% per year to the intensity decline. And if you compute it more precisely, it turns out to be 1.4%.

I'd like to now shift to some of our technology cases. Now the AEO has many different alternative cases that highlight particular aspects of the energy economy relationships but I'd like to talk about the low and high technology cases because they have direct feedbacks on technology and their sufficiency. So the low technology case, we call it an integrated because all of the models run together and surprises can change. We allow no technology advances essentially beyond 2009. You still have efficiency gains in the model though because you have the turnover over that based stock which is relatively inefficient. Now the reference case adds future projections of technology cost and improvement beyond the low-tech case. And in the building sector, the models are calibrated for kind of a base behavior, so the base are...purchases of energy efficient equipment, kind of a long line of historical parameters. And then in the high technology case, we have the same idea of future improvements and cost and performance. With these you're going to occur earlier in the model horizon or lower cost, something like that, and we use lower discount rates for consumers to make decisions. So there is a behavior shift in this case, too. Also we have some

improvement in building shales beyond the reference case. But there's no aggressive retrofitting in any of these cases, and so we just call it normal stock turnover.

So the results, a lot of lines on this chart; the top 3 lines are energy efficiency results. And the bottom 3 lines are energy intensity results for the 3 cases. And the low technology case adds 2.4 quadrillion BTUs energy consumption in 2035, and you can see that causes its line to be just slightly above the reference case there. The high technology case has about twice the effect; it reduces energy consumption by 5.7 quads in 2035. And I guess the only comment about this graph is that you'll see the dispersion in the 3...between the 3 cases in the 2 concepts is similar and that's, I doubt, what you'd expect because we're directly impacting technology efficiency in these scenarios and that should feature the energy efficiency.

Okay, now moving on to buildings. There's the best technology case that we do for buildings, its buildings only and it's not integrated and in this case we take economics completely out of the picture. When a piece of equipment turns over or a building is constructed, we use only the state of the art there...or the best technology. Shales are...the shales that are available, especially in the commercial sector, are even better than in the high-tech case. And again it's normal stock turnover. So here's the results, so for the low-technology case, should say what it is, the result is of...Since this is buildings, we can put all the buildings on a per square foot basis. And, so this is delivered energy use per square foot, and in the low technology case there's a 15% decline in alcohol and energy intensity relative to 2009. So that's just the effects of normal stock turnover in today's technology. The AEO reference case was at number 2 about 20%. The high technology case just over 30% declines since 2009. And in best case, it's 38% less intensive in 2009. Okay, but that's not technical potential yet because in 2035 there are still buildings in the stock that haven't turned over yet. There are some technologies in NEMS that advance in the later part of the projection horizon and tend to have long lives that haven't turned over. And if you were...I did some rough

math on the back of an envelope and came up with additional 5%, so I would say the technical potential when these technologies fully penetrated would be 43% lower energy consumption per square foot than in 2009. And then the AEO is throughout this month and if you're interested in some of the particulars of how we model things in the energy bills, there's a nice report up on the web for the 2009 reference case where we dealt with E.R.A. or the stimulus bill. And if you're interested in the particulars of computing the efficiency index...indexes, there's a paper in the last, a citation there. Thank you.

Audience: *[Applause]*

Debbie: Thank you very much, Steve. So now we're going to shift to addressing both the potential and the barriers of the state-wide level and Jeff?

Jeff: Thank you Debbie. Sounds like everyone can hear me. I'll just sit here. I'm very pleased to be here with and Steve Nadel who I've known for many decades.

Debbie: *[Laughs]*.

Jeff: In fact, Steve and I have been on the same panel about the last 3 or 4 weeks, different speeches. So, if he starts to nap during my presentation, someone prod him. I will not go into the technical detail that either Steve's or Hannah and with that very, very good McKinsey study. I'm just a stupid lawyer, so I'll try to give you a sense as to what's going on at the state level, some of the barriers and some of the history, and where we see things down the road in the energy efficiency area. And Steve's done excellent work. Steve Nadel has done excellent work over the years. For example, in the appliance standards area which is a critical piece of the puzzle that I think is under-appreciated in terms of its contribution on a going forward basis to energy savings. I'm sure Steve will discuss that.

So in terms of the states, back in the 1970s...that is when we first started worrying about energy efficiency after the oil embargoes, we really were focused on traditional demand-side management programs. States took the lead, we had some Federal funding, some Federal legislation in the 1970s, but really the focus was utility

rate per funded programs, integrated resource planning, a concept that no one talked about for many years after the 80's but now is coming back into vogue. Some Federal funds and there was always, at least with respect to the energy efficiency programs, the dichotomy between what we call market transformation programs and direct...rebates, direct financing for specific energy efficiency projects. My own view is that there's an important role for both. There are barriers in both which we can certainly discuss during the Q & A.

States during the 1980s received several billions of dollars in what we called oil overcharge refunds which were recoveries from the oil companies as a result of oil price controls from 1973 to 1981. And that was a real jumpstart for a number of the energy efficiency programs that are operated at the state level. And we've seen acceleration now from, I would say, the late '70s through the '80s with the oil overcharge refunds into the early '90s, we saw really the hay day of demand side management. Once electric utility restructuring began to come into play in the 1993-1995 timeframe, we saw a dramatic reduction in spending for energy efficiency programs in the last few years. We've seen that really accelerate through the work of Steve and others focusing on state policies especially.

In Congress, we've had 3 major pieces of legislation that have impacted energy policy across the country. The 2005 Energy Policy Act, the 2007 Energy Act, and recently the Stimulus Package that was passed in early 2009.

So, I'm going skip a lot of the presentation in order to maximize the time, and I don't want to make Debbie mad.

Debbie: *[Laughs]*

Jeff: So, let me just skip now to some of the issues we're seeing in the Stimulus Package. There are a number of...$37 billion has been provided to and through the Department of Energy for a variety of Energy Programs through the Stimulus Act that was passed in February of 2009. That is a scale that, especially in the area of energy

efficiency that, we have not seen before. A few examples: the State Energy Program has historically received $50 million a year from the Federal Government; in the Stimulus Package it received 3.1 billion. In the Weatherization Assistance Program, historically would received anywhere from 200 million or 250 or 300 million; they received $5 billion in the Stimulus Package. A program that had not existed before called the Energy Efficiency and Conservation Block Grant, which primarily focus on local governments, received 3.2 billion. So no funding had been provided. In the early 1980s, we had a $5 million per year program dealing with local governments. This is 3.2 billion. Another 300 million for appliance rebates. Those are just some examples on the non-tax side where we'd seen a dramatic uptick in the amount of spending. So what we're beginning to see now is results on those programs. The spending has taken longer than I would have hoped; a lot of that is related to procurement issues and issues I can certainly go into in Q & A that I've spent an unfortunate amount of time on in the last year.

Jeff: But I think the bottom line is, we are seeing with this amount of money, that amount of money, over $11 billion, and what historically been programs that had been no more than 400 million. We're seeing major changes in the markets; we're seeing participation by industry, commercial folks, residential consumers, in programs that we never saw before. And there is a level of reporting both monthly and quarterly that is beginning to occur as a result of requirements by Congress, by OMB and-and the Department of Energy. So I think those results are beginning to come in. With the other thing we're seeing is significant leveraging of dollars. So in terms of whether it's a market transformation program or a direct acquisition program, we're seeing programs that you may put in 50 million but they're getting in one state 3.2 billion in projects as a result of that $50 million investment. The other thing we're beginning to see is a much greater concentration on revolving loans or other type of credit support mechanisms. So that the funds that had historically in the energy efficiency area been in a boom and bust

cycle, what we're hoping to see and what we are seeing is more of a flattening out of that so it could continue overtime. I think that's a major change.

So again, in the interest of time, I'd be happy to answer questions about the individual state programs, about the impact of potential future legislation on these activities, but I think suffice it to say, what we're seeing is significant leadership at the state level and we're seeing, I think, dramatic changes that will hopefully be reflected in the future annual energy outlook. Thank you.

Debbie: Thank you. All right, now we will switch to the national level and Hannah Granade will start.

Hannah: Thank you.

Jeff: I skip it all.

Hannah: Thank you very much. I'm delighted to be here to be able to share with you today the work that my firm did on the energy efficiency that was published last July. The full-length report is available for free public download on McKinsey.com. And what I'll do today is give you a little bit more of the Reader's Digest version for those of you who may be less interested in the full 150 pages or the longer methodology on the appendix on the methodology. I am also particularly delighted to be here today to be able to share with you a bit more about our methodology because often when I present at conferences that is the moment in my presentation when people go sort of glassy eyed and reach for their Blackberries. And so it's particularly enjoyable for me to be able to here today with an AIE and SAIS audience who I hope is more interested in the methodology. With that said though, I should also comment that the focus of our research was really to better understand the barriers affecting energy efficiency rather than the modeling per se although that's *[inaudible]* for this session. So our goal here was really to be able to build a detailed fact base and a model that will help us understand at a very detailed level where the energy efficiency opportunity in the U.S. actually was. But then to use that base, to really understand why it was that this

opportunity, that is economic, that has been known about for years, for decades, has not been captured in any really substantial amount relative to the amount of potential that's out there. That question that guided our research also affected many of the choices we made in our methodology for the modeling. And I'll get into that in a bit.

To begin with the punch line, there's substantial potential for energy savings. We consider just stationary energy consumptions, so not transportation. And we looked at the industrial, commercial, and residential segments and found that there's potential for savings that is NPV positive in investment at a 7% discount factor with $0 of carbon price assumed. To be able to save 23% by 2020 of our expected baseline case, this baseline is built on the AEO 2008 because of the time of our research but certainly could be updated as we go forward.

What you see here is that the potential is substantial in industrial, for instance, on an absolute basis. The relative amount of potential is actually far greater in commercial and in residential, indicated by the 2 shades of blue segments. The carbon emissions equivalent, when you blend this across field types, is 26% or 1.1 gigatons of savings that is possible. And again these savings are all possible at an NPV positive investment rate. So meaning if you spent the additional capital today for the up-front premium on the equipment or the installation and the maintenance cost, you would actually save over the life of the equipment more than enough to pay back that full investment.

If you take a look at this across field types, you'll also find that the savings is reasonably well distributed. There are quite a lot of the potentials in that first segment in electricity on our proportional basis when considering the use of heating fields as well. There's still an opportunity to save 23% in natural gas terms. So the amount is relatively well distributed and is enormous. 1,080 terawatt hours of potential electricity savings is actually more electricity than Russia uses on an absolute basis. The 2.9 trillion cubic feet of natural gas is more gas than Kennedy uses in stationary heating consumption. So the amount of energy we would actually be able to save on an absolute basis in NPV

positive investment is truly substantial. We modified our assumptions as well to be able to test how much potential could be out there on under a wider range of circumstances. Our base case uses a 7% discount factor and $0 of carbon price, and that gives us 9.1 quadrillion BTUs of end-use energy. I should also comment for those who delve deeply into these issues, we did this as well, primary energy terms. And so because it isn't an end-use focused energy efficiency potential report, we've reported a number of our charts in end-use terms. But as you go through the report you'll actually find them in duplicate throughout with the primary energy as well. If we alter the discount rate, since 7% is a suicidal cost of capital, has sometimes been cited as high. We use more like a 4% discount rate. We find that though the potential grows slightly, it actually does not grow all that substantially to 10 quadrillion BTUs. The reason for that as we delve more deeply into the types of investments that one might make or the energy efficient measures you might undertake is actually because the measures that we have today that are available to us tend to be deeply economic already. Then there is a large gap and wide a range of energy efficiency measures that are far from being energy efficient and NPV positive today. So there are very interesting emerging technologies but there are very few that are sort of chinning the bar to speak. There are very few, there are close to being positive that require a little bit of extra funding to get there. We have more of a barbell shape in our energy efficient measures.

Interestingly, we also alter the discount rate to 20% and 40% to think about this more of from a participant's lengths. And so from an end-user's perspective in making investment decisions and energy efficiency, how would you evaluate this investment where 20% is a little bit closer to a consumer class of capital and 40% is closer to what is often describe as the revealed discount factor or the need for about a 2 to 2 ½ year payback. Using those as metrics we find is that amount of energy efficient potential that is NPV positive does decline somewhat substantially. But interestingly, at even a 40% discount factor more than half of the opportunity remains and is NPV positive. This level

of savings, 5.2 quadrillion BTUs, is actually enough in 2020 to still be able to consume less on an absolute basis than we consumed as a nation in 2008. So then we've often heard about the revealed discount factors and major barriers to adopting energy efficiency or reasons why energy efficiency opportunities tend not to be as substantial. What we find here is actually that they are still quite substantial.

Lastly we take a look at carbon price. And the other question that has often come up is whether or not the introduction of a carbon price would actually help in the capture of substantially more energy efficiency potential. Bearing in mind that we modeled is actually the possibility for NPV positive energy efficiency., meaning we didn't attempt to rate this in any way by achievability or the likelihood that consumers would actually go out and invest in these measures. Instead, we just looked at what was practically available in the market, whether achievable in the sense of that the market can actually provide the technology that has been proven and tested and is well understood, and we look at the pure economics of the decisions. In that lengths when you add a carbon price to the energy efficiency investment, what you actually find is that there's, again, not much of a growth in the amount of total potential even at a $50 carbon price. And the reason, excuse me, the reason for that, again is because of this barbell shape in terms of the energy efficiency measures that are out there. It would take a dramatically higher price potentially combined with the change in the discount rate of investment that would actually allow it to happen to that next generation of energy efficient technologies and measures.

You may be familiar with seeing these charts from McKinsey already and despite the size of the screen I'm going to hazard a guess that you probably can't read most of the labels that are on there. What we've done here is we've actually aggregated the results around modeling into each of the energy efficient measures that you might undertake. And so to describe a couple of these for instance, computers here on the far left is the lowest cost up-front differential. Just pennies for MMBTU of energy saving.

The difference there would actually be to take a factory setting difference in the defaults to be able to save the energy when the computer is not in use or they change the way that a computer goes into standby mode. The incremental cost of undertaking such a measure would be fairly low. And we use an incremental cost base on a business as the usual adoption of these technologies. So a very conservative understanding of how much incremental cost there would be. As if you actually deployed these at scale you might find that the scale economist would bring the incremental up-front cost. As you get all the way out to the far right, you see that freezers are a very skinny extremely tall bar all the way out to the right. And as a reference we place here a dotted line that shows you the weighted average cost of all of the fields that we considered in our analysis. The freezers are substantially above the line, meaning that they cost much more to implement enough front terms than the average values of the energy save. The freezers actually are NPV positive still. And the reason is because we compared them against their regional energy rates, the regional electricity rates that you'd be able to use to be able to save that amount of energy. As a result you can see the amount of potential given by the width of the bar is actually quite thin as it relies on being in very high cost areas to be able to make that NPV positive. The basis for this chart is about a 20,000 micro-segment database of consumption. With the help of the Energy Information Administration, the National Energy Modeling System team as well as the *[inaudible]* and Max surveyors, as well drawing upon McKinsey's proprietary research in this area and our work with our clients. We put together a database that uses about 60 different features of demographic and usage base consumption. So, for instance, we look at factors like building size, building age, household size, household income, age of householder, factors along these lines broken by census division and by regional energy prices to be able to analyze from a bottom-up perspective how much consumption is out there against each of the end-uses in each of these 20,000 micro-segments that are demographically end-users *[inaudible].* Against that we run a

technology pick or model. They use the technology report out of the Department of Energy that also looks at about 675 or so end-use measures and gives their energy performance characteristics and their cost both in terms of installation, maintenance, as well as premium or the capital cost of the equipment, and round that against this model of micro-segment to be able to say for each end-use, what is actually the most NPV positive thing that the end-user in that segment might do for that end-use. We didn't actually ask the question, what is the most energy efficient thing that could be done. Because one of the barriers to energy efficiency and really to all more high cost alternative energy methods would be that the up-front economic premium is simply not justified to a lot of the end-users to be able to adopt this directly. So taking out that factor we actually said if you trusted the most economically rational thing, either at end of life replacement or an accelerated basis if the value encourages that. How much energy efficiency would we be able to get? And this is the result of that analysis.

The challenge with a chart like this is...I'm sure you've thought if you've ever looked through a McKinsey report...is that you look at something like this and you think, what in the world do we do with that? It's very difficult to take you to these levels and to be able to put together a business model or a policy or a program that is going to help you go after, say, freezers without really any knowledge of where those freezers are going to be, who the owners of these freezers are, and what are some of their buying factors and their characteristics. So we did something a little bit different. We took that basis for consumption and for understanding of the potential, and we went back out and we conducted several hundred interviews to better understand what the barriers were to adoption of those measures. And we broke that across a wide range of characteristics to be able to better understand how the barriers actually impact each of these clusters of potential. We then took all of these micro-segments of consumption and we aggregated them on the basis of similarity of those barriers so that we can arrive at these hopefully more actionable clusters. And we've got here our 13 clusters of energy

efficiency potential plus combined heating powers of *[inaudible]* area. What you see in each of these clusters is that there's a reasonable similarity in how you might be able to go about designing an approach, whether a more market-driven approach or more policy-driven approach or a combination of those to be able to address the barriers that have prevented the capture of that manner of energy efficiency potential. And bear in mind again that, in this case, all these barriers are non-financial in nature in terms of the requirements of the investment. And so as you take a look through each of these, what you find is there's a substantial range of barriers that affect each of them. We map the barriers based on 3 characteristics and so we've put together a view on structural, behavior, and availability barriers. And for each of those clusters of potential, map out the types of barriers and how they specifically manifest. So on the far left of this chart what you see is that framework for the barriers that affects specific opportunities and then how that barriers specifically manifest in the cluster of opportunity describe. I won't take you through this chart now as I think both the time and your patience probably don't permit. But if you do work your way through the report, what you'll find is the summary against each of the clusters of the barriers that affect it and approaches that can be use.

One final word on the quantification of the barriers which is something that we had set out for ourselves at the outset of this project as an aspiration to be able to come back and say how much exactly of the potential does each of these barriers affect. We discovered something about the overall barrier approach and the solution strategies that we thought was interesting, which is that some of these barriers can be quantified and some of them are actually much smaller than one might think. So for instance the landlord-tenant problem only affects about 8% of the residential energy efficiency potential, much smaller than is often described to be. But what we find is actually that when we look at solutions that had been tried over the years that the effectiveness rate was less dependent on any linear relationship to the number of barriers that they had

had. But they tended to be confounded if any single barrier had been left in place. So the weighting of these barriers is very fluctuating and is dependent on what the total relationship is between them.

So with that as context, if there are questions for others, we're happy to address them. Thank you.

Audience: *[Applause]*

Debbie: Thank you very, Hannah. We'll now move on to Steven Nadel who will also touch on domestic issues and will end his discussion talking about international challenges.

Steven: Okay. Thank you. I'm very happy to be here, and I'm going to try to compliment what the other speakers had said and also maybe try to put what I'm going to say into that context. I just have a relatively limited number of slides to share and hopefully that will give us plenty time for discussion. First I was asked to say what is the energy efficiency opportunity? And this is a slide from a recent study we did for the State of Maryland wherein the State of Maryland the Governor had set a goal of reducing energy intensity by 15% by 2015 and asked whether that was achievable. We look at it...look at specific policies. We tend to combine both the technology and the policy perspective to achieve that and we found out, yes, it could be achieved if they really let out all the stops. And ultimately in Maryland, this was for electricity and get to a 29% reduction by 2025. That's roughly similar to what Hannah found. We had an extra 5 years to do it and therefore we have a slightly higher number is to oversimplify many different things but they, I think they, are consistent. Going into a longer term, this is only some preliminary work now, gee, if you could save 29 -30% by 2025 or so, what can you save by 2050 or longer. We've just started doing some work in this as some very preliminary and we plan to refine them. It's also subject to create uncertainly looking with the future. Our crystal ball is very foggy. I don't know if any of you has better crystal balls. But this shows that if you look at the existing efficiency opportunities,

which is the light blue here, roughly 30% savings, in this case we modeled it by 2030. If you did that, energy is...will decline but then eventually it will start increasing again. There are new opportunities and very roughly we're estimating these at another 30%. Advanced technologies, advanced practices, we are trying to get a handle on them that could roughly double that efficiency potential by 2050. So maybe in total between the 2, you can cut relative to predictions maybe as much as 60%. Still the green shows what we need to do if we're trying to get an 80% reduction in our greenhouse gas submissions. There's a lot more that would need to be done. We can probably get some of that with energy conservation doing with less, somewhat, renewables, but definitely we need low carbon energy sources and other strategies, so even as much of a proponent as I am of energy efficiency, we need to do more than just energy efficiency. It won't do it all.

Proceeding some to the policies, one of the leading policies to help promote energy efficiency has been adopted. The State level's called energy efficiency resource standards basically setting energy saving targets for utilities, certain of savings they must do. We're now up to 23 states on this graph...I just found out Florida has just set their target, so up to 23 states, which is good. But one of the key barriers is that there are a lot of differences among the states. We have this whole band across the middle of the country that hasn't done as much. There are some significant exceptions, you know, Oregon, Idaho, Montana, up Maine, New Hampshire, they've been doing quite a bit of efficiency without an energy efficiency resource standard. But that middle and south are examples, states that just haven't done as much. They've done some, some are promising. I'm actually off tonight to Arkansas working on a project. In Oklahoma, Missouri, the Carolinas, they're working on some things but definitely we need some of these lacking states to catch up a little.

Another key barrier, if we're looking for utilities, whether selecting gas to be a key vehicle of implementation in addition to the Federal Government to the states, I think

utilities have been a key. Most of these are investor-bound; they're responsible to their shareholder. The shareholders are expecting return on their investment. They're not, you know, investing your pension, for example, out of the goodness of their heart. They want to have enough money to pay you when you retire. If the utilities promote energy efficiency, that reduces their sales and obviously reduces their revenues; there are a lot of different effects going there, but bottom line often does hurt their bottom line if they promote efficiency unless we make some adjustments. We're now up to roughly half the states. This is a map put together by the Institute for Energy Efficiency to associate it with the Edison Electric Institute which are recognizing this problem and are starting to figure out various ways to share the savings between the repairs and the stockholders. You know most typical things you figure the savings, 90% of the savings, go to the repairs, but 10% go to the shareholders to give them an incentive to do a good job in pursuing these programs. So we need to get the market signals right if we're really going to be implementing a lot of this.

Another thing I want to talk out is the role of national policy. This is from various analyses that ACEEE has successfully done over the years looking at different energy policy, bills that Congress is either enacted or is considering. The first Energy Policy Act of 2005, the Energy Independence and Security Act of 2007, and the Stimulus Bill...these are all things that the AIE forecast now shows. They've been enacted; they show that. These save anywhere from, you know, the Stimulus Bill's probably good for almost a quad of energy. The other bill because it's longer term that does many things overtime is probably 4½ quads. That's all well and good, but we use roughly 100 quads. If we're going to get 30% savings and more, we need much higher numbers. The orange bars are pending bills, at least the first 2 are. The lower one is the Senate Bill. This has been reported at the Senate Energy Committee, ACELA...roughly the energy saving goes similar to the 2005 law. The House Energy and Climate Bill that was passed. It has more savings; some of the efficiency provisions such as the Appliance

Standards Buildings Codes are more aggressive, but the big difference is it has cap and trade and therefore has money to spend in all the efficiency programs that are established. The Senate Bill establishes program and hadn't fund them; it's hard to give it much credit unless there's money there. So the key thing is, regardless of what bill, if there's funding source, we can do a lot more. And then the last bar is the House Bill with some additional enhancements that we and many other efficiency supporters are recommending such as a National Energy Efficiency Resource Standard to raise some of the laggard states to a level of a typical state, if you will, such as in...on the energy efficiency funding using the cap and trade revenues. They started out at a relatively high level; 10% of the proceeds go to the states, but then it declines overtime to 4%. We're saying why not keep it at 10%? If you do that, you start getting up to, you know, almost 8 quads. We're starting to make a significant difference. I'm not saying, even with the enhancements, that we're going to get where we need to go. The policy process is always trying to drive toward a lower common denominator so there's going to be plenty more work to do and we need to. I see that as a barrier; we need to help overcome some of the problems in the inertia and the policy process if we're going to get to where we really need to go.

A few other issues I would note. Workforce is a key one. This is from a chart that Lawrence Berkley Lab and Research Into Action did. Looking at the ramp up in energy efficiency spending as a result, particularly, of a lot of the state actions, and how many person years we're going to need in different fields. But, as you could see, the employment needs to more than triple in this efficiency related field. Given that we're in a recession, there are a lot of people looking for work, this is a major opportunity. But it's not just snapping our fingers; we need to get these people trained to do this work. That means both classroom training but particularly on the job, in the field experience, practical experience. So that's another barrier. How do we get these people trained?

And then, finally, just to help reinforce how much we can and should do. This chart which you cannot read the details of, but is meant to show you, in China, these are all policies, a list that they have adopted in recent years. They have a goal established by their cabinet in a regular report, on an annual basis to the prime minister, bonuses, promotions, depending on hitting this goal of reducing energy intensity in the Chinese economy by 20% over 5 years. So their economy is growing, but they want to significantly reduce the road of energy as it grows. So here are about 20 different policies that they've already adopted. They're working on many more. And this shows, I think, that a country like China certainly recognizes this problem, and they are seeing this as an opportunity. In order for them to stay competitive, they need to, as they grow their economy, do it efficiently. I hope that we can perhaps even learn from them and do the same 'cause frankly we're competing with them on world markets. And if they're going to be that much more efficient than us, we're going to be at a competitive disadvantage.

So that concludes my remarks, and let me turn it over to Debbie, who I believe wanted to build a little bit on the international front. So, thank you.

Audience: *[Applause]*

Debbie: Okay, I'd like to just make a few comments about the developing world which we've heard a lot about particularly since Copenhagen. As many of you know, the developing world has already superseded the developed world in its greenhouse gas emissions, and, within the next few years, it will supersede the developed in terms of its overall energy demand. Energy is growing very rapidly in developing countries. Obviously a lot of wealth creation is yet to take place in these countries, so we expect their economies to grow on average much more rapidly than those in the developed world and that also means that their energy growth is necessarily going to grow particularly as a middle class emerges and starts inhabiting buildings with more and more energy services and starts using more and more transportation services. We've

heard a lot about barriers and clearly a lot of these barriers exist in developing countries as well, but one of the questions is what do we do? How do we address both the potential and the barriers? I want to know, first of all, the developing are meeting a variety of barriers just to maintain their current growth in the current energy services, not the least of which is having the capital investment particularly in the electricity sector to make the type of investments that will provide them with the energy services they need. Also, the type of energy that they're currently developing has produced a tremendous problem within a tremendous environmental problem, particularly air pollution, and in many cases the process of wealth creation and the associated energy services is widening the gap between rich and poor with the rural communities the most displaced in this process. One could argue that, and I do argue that, energy efficiency has a lot of potential to address a lot of these. Certainly, if you sort of, quote, build it right from the beginning, your investment cost in the electricity sector would proportionately drop. The same thing can be said for environmental problems and in many cases also for many of the social strains. The advantage that the...the potential that developing countries...is that they're on the growth phase, so their infrastructure is not mature like ours, so we're not talking about implementing energy efficiency on a replacement basis. We're really talking about building anew, and that offers a lot of potential. So we talked a lot about these barriers. Many of these are apparent in developing countries, but I wanted to bring another one, and that is that these technologies...many of the technologies, in particular that Hannah delineated, are just not available in these countries. And it is not simply a matter of saying to all the producers of these technologies, go ship them to developing countries. In many cases, they're not applicable. And, for example, many of them will not operate well in a fluctuating voltage market that is characteristic of developing countries. Now this is not insurmountable, you can do applied research. There had been some cases of already adopting these technologies for the fluctuating voltages. So that's a relatively easy solution in theory. But there are lots of other barriers

including the fact that many of the industries that are on the ascent in developing countries are really on the descent in the developed world. They're the infrastructure building industries like steel, like cement, etc., and so the innovation is yet to come. The innovation that will occur with these industries is more likely to come in developing countries than in developed countries, and the question is how do you adopt or stimulate that kind of innovation when the innovation creation historically has been in the developed world? Now, much of this issue of...sort of technology transfer was discussed in Copenhagen. We didn't make a lot of progress in that. And what see now on the international scene is that we don't really have a very good answer. What we have is a lot of bilateral agreements including with the United States primarily aimed at the most developed...at the developing countries like China. But that doesn't cover a very large fraction of the rest of the developing world. And we have a mechanism that was created originally in the first UN framework convention on climate change called the clean development mechanism which has also touched very few and primarily in the wealthier countries, and one could argue has not live up to its potential of really transferring technology. So again, the point that I'm making is, as we look at the challenge of improving energy efficiency, whether it's from the point of view of energy security or from the point of view of greenhouse gas emissions control, the challenge of energy efficiency in developing countries is as central to the concerns in developed countries as developing countries.

So, with that said, I see there any questions, and we can start answering them? We had a lot of questions about the Stimulus Bill. And I'm going to sort of summarize them. Jeff, this is a story of an unsuccessful program or one that has had lots of growing pains. So I'll read it to you. I have recently issued rebates for new appliances and it was "a disaster." Website went down, phones got overlogged, rebates were probably too high for the appliances. What is ensuring that these programs implemented at the state

level are wisely designed and effectively implemented? And if others want to comment after Jeff *[laughs]*...

Jeff: That person should give me their name and then I'll have them move to another state.

All: *[Laughs]*

Jeff: The $300 million, I think I joked, that we would have spent a whole lot more time on the statute back in 2005 when we developed the authorization language, if we thought it was actually going to get funded. But the problem is with $300 million spread across the entire United States and no specificity with what could be the limit of the appliances addressed in individual state, it was up to the state to make a determination as to what appliances to cover. So states made the determination within the category of Energy Star appliances. And frankly, there's just not enough money to go around with that 300 million spread across all Energy Star appliances in every state. It's made it difficult. That said, what we've seen in a lot of the jurisdictions, maybe not the jurisdiction for the questionnaire, is a pretty successful roll-out of the program and states that are targeting individual appliances that are making a meaningful difference. It's also bringing the eyeballs into the stores to focus more on Energy Star products. The other thing that's going on now which I applaud the Administration foron is actually focusing on the value of the Energy Star label. They're revisiting that to make sure the appliance manufacturers are actually meeting the Energy Star label. So I would say that your example is an anomaly; I think the program is generally a very positive program but I'd be happy to meet you outside afterwards.

All: *[Laughs]*

Debbie: Steve or Hannah, do you have any comments? No?

Steve: No.

Debbie: Okay. I'm taking some liberty here but one of the questions that has been asked, one of which is aimed at AIE and one is aimed at regulators, is how do you

track the savings? How do you track this huge expenditure not only from the movement out into the states but also in the tax credits? How is AIE tracking it and how can regulators track? Okay let's start with Steve.

Steve: Good questions. To my knowledge, we don't really track the savings. We try to model the savings and project the savings forward in the model and that could be quite different from what might be advertised as a potential savings or what someone who's actually, you know, making a calculation based on more information might have.

Steven: Right. In terms of the regulators, whenever you have a utility-funded program that's subject to regulatory oversight, I'd say virtually all, if not every one of the states is requiring that evaluations be conducted. They're typically done by university experts, private consulting firms, and residential. It might be a statistical analysis comparing participants and non-participants to aggression analysis, tease out what else is going on with the weather and other things, and what the savings are from a participant group to a control group. Somewhat similar for commercial. By the time you get to industrial, it tends to be very process-specific, so it tends to be more engineering based often with sub-metering because you do have very large uses, a particular process and through this process they can estimate, you know, with a fair degree of precision about what the energy savings have been. And I know we, ACEEE, often try...to the state level figures and add them up. So there are methods and quite a bit of oversight to crack it at that. I know there's been some discussion on the Stimulus Bill on trying to conduct some evaluations, I believe, where we spend, preparing an evaluation plan. I haven't heard the latest, but I do believe they'll be some analysis in terms of how much is actually being saved. The evaluations give us a better idea of how much is being saved, also teaches us a lot of lessons. I challenge anyone to operate a program doing anything and that make a few mistakes and the evaluation helps show you how you could do better. In the case of this, Iowa, yeah, maybe, they did some of the

incentives a little too high, so you learn that type of thing through evaluation. You have more modest incentives going forward.

Debbie: Jeff, yours?

Jeff: Right. I agree with Steve on that, the states are required under, I think, at section 1512 of the Stimulus Act under OMB guidance to provide not only quarterly reporting but monthly reporting on things like energy savings and job creation, etc. So that's actually a requirement, not only at the Federal level but it's a requirement that is being insisted on by state legislatures, by state regulators, by governor's offices to try to prove that it's working.

Debbie: Great.

Jeff: So.

Debbie: Do you have any comments, Hannah?

Hannah: One observation, just on tracking. It's a question that comes up somewhat constantly and I do tend to think there's in...some *[sic]* of it in session would actually counting every single kilowatt hour that has been and trying to measure it very meticulously. I think we do, after recognizing that fundamentally we're trying to measure something that did not occur against the baseline that we don't know. And so methodologies that attempt to do this at a tremendous level of detail are likely to be flooded and to be somewhat burdensome. If you take this back to the analogy of how businesses think about cost, every time you do a cost reduction program in a business, and this is probably particularly timely, you are taking a bit of a leap of faith. You don't know what your cost trajectory would have been, you don't actually know if you save all these dollars or if these dollars are redeployed into other areas, but you do it all the time anyway 'cause it's fundamental to competitiveness. I think the analogy really does apply in energy efficiency as well.

Debbie: Great.

Jeff: There is one additional piece that Hannah you reminded me of. What we're seeing in a lot of the projects under the Stimulus package is projects that are related to commercial, industrial, institutional buildings. And they tend to be conducted...the states are doing bidding processes to bring in energy service companies to do the work. Those kinds of activities are done under contracts that identified shared savings. So there are metering and sub-metering requirements, and there are penalties for failure to meet those; so in those instances, there's requirement and there are incentives built into the contracts. So we're seeing again an acceleration of those kinds of activities.

Steve: To just chip in one other about the AEO. We modeled the Stimulus Bill under the AEO of 2009. It's still going to receive a lot of visibility in this year's publication, so it's out in a couple of weeks, and we've got a lot of the assumptions as how things are modeled in the back of the publication and so I point you to that.

Debbie: Great. There was a question that I'm going to build on, Jeff, what you just said, which is what are the remaining challenges in financing, in private sector and commercial financing, of energy efficiency, and so I'd like to take this back to your comments about ESCO, Energy Service Companies and Shared Savings. And everybody can comment on sort of the gap there.

Jeff: Well, I think the obvious problem is that the credit markets tightened at about the same time. And one of the reasons for the Stimulus package was to get money into the economy. So there are significant problems with getting access to credit. Now one of the advantages of the energy portion that's running through the states is, again, these revolving loan programs. So again, while you still have to convince someone to take the loan, which is not an insignificant barrier, to the extent that you have reduced interest, you can do the technical assistance and the handholding to work with the business or an institution that makes the difference. The other thing we're working on is credit support mechanisms and other things that will make the money go further. And that is a significant problem, but it's one that we finally got guidance on the

couple of the programs within the last 2 weeks that I think will allow it to go forward. In the residential market, we have $800 million, for example, targeted to residential retrofits through these programs. The non-weatherization programs, we have significant amounts of dollars in the hundreds of millions, that have been targeted through revolving loan programs. So I'm very hopeful in that area, but the credit market has been a major problem, and on the business side, those businesses that are making decisions in this area, you know, when they make those judgments, what we're hearing more even than before is, if you don't have something that's going to give me a payback in under a year, I don't want to talk to you. So that's required the states and the local governments and others to add more incentives than they would otherwise do.

Steven: Okay, I had a couple of comments. Yes, the credit markets are somewhat frozen now, particularly here for the commercial industrial sectors, still a major problem. I think assuming it will loosen up in the coming months, a couple of issues there. One, applying for financing is time consuming and can be quite a hassling process. So a lot of people really try to avoid that process; we need to make the finance even more user-friendly where possible. For example, one thing I think is promising is on bill finance. You have electric and gas utilization. They have your credit history, they know who pays and who doesn't, and they could help finance these energy-saving investments on your bill, and, as long as the savings in energy cause are greater than the monthly loan payments, you come out ahead, and, you know, the bill is the same or slightly less, but you've gotten all these improvements. So I think we need to develop these and other types of creative approaches more. But the other thing is to recognize that there are limits of financing. There are people who just don't want to do these measures, and no amount of finance will make it possible. And that's where incentives come in. They can be very useful to help get our attention and get over that hump. I know there have been a variety of studies; one from Wisconsin a few years ago comes to mind where they gave customers a choice between a financial incentive, I think they

pay like a third of the cost of the measure, or a loan subsidy exactly the same cost. 90% of the people took the up-front rebate, only 10% of the people wanted the subsidized loan. You know it's easier and so you need to mix and match these strategies.

Jeff: Phase is the other one, Steve, right?

Steven: Right.

Jeff: Additional on bill financial.

Steven: Yup.

Jeff: Where the benefits show through the payments through the property tax. And that's expanding across the country pretty dramatically.

Debbie: Great.

Steve: I don't have answer, sorry.

Debbie: Go ahead.

Steve: An answer, but just to post an interesting question, more heat rates had been below 7% for a number of years now and you got to wonder these things don't happen. As I just read in the paper the other day, kind of an interesting story about in the District, it's now a nickel a bag at the store if you take a bag out. And they reduced the amount of bags that customers receive by something like 75%. And if you go to most stores and bring your own bag, they'll credit you maybe not a nickel but 3¢ so there's a symmetry involved too. So understanding the consumer behaviors is not necessarily straightforward, and, working for Energy Information Administration, it's always better to try to understand that and get the information as to what's going on there.

Hannah: Great, good. To pick on something else that Jeff and Steve said, one of my favorite quotes from the interviews we did on barriers was, "Why would I want to borrow money to pay something I didn't want to buy?" And I think that is still the central challenge with energy efficiency financing.

Steve: It's not a flat screen TV, is it?

Hannah: That's right, exactly. And so the challenge with energy efficiency financing is still is the highlighter that you need to get the end-user to actually be willing to take on the financing. It is a major advancement that with phase bonds and other structures you are able to attach the energy efficiency debt to the asset where the benefits actually attaches well, rather than have to carry that on with the consumer who then can't clearly carry the benefits along with them. But to still overcome that adoption barrier, I think will be a big challenge if we continue to focus directly just on end-users. There's not a lot of scale in the end-user in learning how to file for incentives and to go through the financing. Businesses don't go out and find special purpose financing for energy efficiency. It's not how they think about their balance sheets. And so making the financing available to companies, to energy services companies, to load aggregators, to direct load control companies, to those who are really in the business of selling the customers these benefits and who developed the sales engine and the paperwork engine to be able to overcome these issues, I think, will be much more effective and a better leverage point.

Debbie: Just a quick comment to pick up on that. One of the lessons learned from a long time ago, was at end of the Carter Administration, something very short-lived called the Solar Energy and Energy Conservation Bank was created where money flowed through the states to basically offer a variety of options to reduce the cost of borrowing money to invest in energy efficient equipment and it was somewhat of a competitive process. And what's interesting is that one of the states, the one who had one of the most successful uptakes of these monies was one who invested in what they called project packagers. People who went door-by-door and said I'm going to offer you a sort of a one-stop-shop of getting access to these loans and, in that case, rather than writing down the interest rate or writing down the principal, they had much more success in getting those loans even though they were no longer subsidized.

Jeff: I think that's an excellent point because we have been relearning those lessons consumer by consumer, business by business, school by school, year after year. The advantage that I guess people like Steve and you and I have, Debbie, is that no one remembers that, other than the 3 of us.

Debbie: *[laughs]*…and us.

Steve: *[Laughs]*

Jeff: Yeah, you know, it's always a new thing. But what we found in a number of these programs is that...and this is, you know, to get to the high-end delivery under the potential study, there is so much more technical assistance and handholding that are required with especially on relatively unsophisticated consumers in the energy efficiency area. And what we're always trying to do is work on best practices to make it easier to do that. So we have done that solar banking sample across the country in a number of areas. New York has run a program for industrial folks called a FlexTech Program where they actually send people out to work on process efficiency, graduate students and others to come up with the study. And then New York is able to package the cost to the audit into the measures if it's adopted. Iowa, starting in the mid 1980s running through today, set up a school facilities energy efficiency program where the state went out got the bond council, got the program council, prequalified the engineers, got the auditors, essentially did all the forms, went and got the bank *[laughs]* through a bidding process. So all the school superintendents in those 436 school districts had to do was sign their name. They made it easy 'cause they know that 99% of the time for the school superintendents, they have to worry about schools and not about energy cost. What they found with that program was they had a I think the total investment was in terms of the measures using private capital was $300 million and they had a 6-year NPV payback built into the statute and they hit a 108% of projected savings. But the key to that program and there are myriad examples throughout the country, was that they made it easy for the people to make the decision to do it.

Debbie: Great, good. I'm going to take some liberty with one of these...with 2 of these questions, because I think there's been some frustration on the part of some of the participants that there hasn't been an integration of looking at the innovations in smart grid and decentralized generation with energy efficiency. And so the question that's posed is, "What interactive potential positive effects could happen as a result of both smart grid and decentralized generation?"

Jeff: Do you want to take that on?

Steven: Sure, I'm happy to start. There's certainly a lot integration that are positive. Just to mention a few for distributed generation, combined heat and power. Industrial plants or large commercial facilities, you can much more efficiently generate the heat and power at the same site as opposed to you have a boiler in your building, in your factory, and a power plant 10 miles away generates the power. You can get inappropriate applications, you know, 60-70-80% efficiency compared to a power plant which is 30 to best, you know, 45 or something percent efficient, so enormous opportunities there. In terms of smart grid, one of the very promising things about a smart grid is you have this information that you can provide to the consumer in ways that maybe is actionable. But how do you provide that information on what their energy use is perhaps relative to what they did last year, perhaps relative to a typical neighbor. Break it down into pieces so that they can act upon it so that's a very promising technique. I would say that smart grid applications, a few people are doing that, most of them are concentrating on *[inaudible]* metric reading on other, you know, demand response or shifting load off of a peak period. So there are a lot opportunities to integrate the energy efficiency aspects with smart grid, but I said the majority of smart grid applications aren't yet taking advantage of that, and I hope that will increase in the future.

Jeff: What we're seeing smart grid *[sic],* about $4½ billion was provided through combination of equipment purchases and demonstration projects through the Stimulus

package. It was held up for a while because of a tax issue that has now been resolved, but the $4½ billion, the number of projects that came in seeking the 50% maximum federal contribution were far in excess. I think a multiple of 10 beyond the 4½ billion. So we're seeing a lot of creativity in that area as Steve mentioned. The basic smart meters are one thing, but one thing we need to be very careful about is on the residential side, the overselling of it. It's something that's very important we're working with the state energy officials and the demand response community very closely to try to educate the public. What we need to be very careful about is that it not be seen as something that's going to help 20-somethings who, you know, take their "crackberry" out and will sit there at their office when they're supposed to be working and turning on and off their appliances when they get their price signals from the PGM grid on their screen. Now that's great.

Steven: That's supposed to be all automatic.

Jeff: That's right. But it's not going –

All: *[Laughs]*

Jeff: But the problem is what we're seeing is, having that conversation with a 65 year old retiree without a computer is a very difficult thing to have. So I think it has great potential. And also the interaction with the transport-electric transportation and plug-in hybrids is another one that has great potential but we need to be very careful not to oversell it because there's certainly been a history in the energy efficiency area...I don't *[inaudible]* those area but we're overselling.

Debbie: Great.

Steve: The smart grid kind of illustrates as a model that's sometimes difficult to figure out how to incorporate these things into your model, because one smart grid isn't a necessarily well defined concept when it's ruled out in a legislation and it's evolving and there are some great presentations here today on that. But the way we model it in NEMS was to higher peak elasticity is where electricity demands basically into model.

So there are savings in terms of generation cost, but in terms of just energy savings not so much. And then one thing under Stimulus was — it was really under the previous bill — that's like was the 30% credits for distributed buildings generation type technologies and in our model that's stimulated quite a bit. Now there's been somewhat of a bust in the economy simultaneously with that. So maybe these things pick up, we'll see how that performs but we've got some pretty robust results for distributed generation right now.

Debbie: Hannah?

Hannah: I think the potential for smart grid integrated with distributed generation is enormous. If you think about being able to free the power system from the demands of real-time production in use, being able to actually distribute some of the load, and produce in an effective way at an expected and controllable loading factor on plants. The efficiency potential in the generation and in the distribution in transmission will be tremendous. I think we are very long way from that world, and that's in part because of the demands of the developed consumer and the requirements for instant gratification. And frankly, the somewhat lack of price sensitivity, that you've had to send a price signal so enormous to make somebody on a regular basis be willing to interrupt their usage of power which is relatively low cost particularly in this country and, you know, very small certainly relative to the benefits that we perceive out of it. So I think the opportunity is tremendous, but to be able to bring the cost effectiveness to a reasonable point, the automation to a point that this doesn't interfere with the users' life and to be able to make the benefits actually worthwhile to an end-user to change behavior in that way, I think, are still decades away.

[BREAK IN RECORDING]

Debbie: There are 2 themes that are coming from the audience. Should the Federal government do more, that's the first one. And the second one has to do with this peak and valley characteristic associated with energy efficiency and renewables

funding, and that one of the questions came from somebody who is talking about RGGI funds being reallocated in some states. So again, when these resources are available without ties, they go to other resources, so sort of combining both: How do you deal with the *[inaudible]* of a lot of these allocations at and also what is the role, the next step for the Federal government to take?

Jeff: We don't have enough time.

All: *[Laughter]*

Jeff: Let's see. Where do we start? On the peaks and valleys issue, again alternative financing, the revolving loans, the pace model, the on-bill financing are all things that I think will help. You have the defined asset, you have something, I think that makes sense. The thing about energy efficiency at least is if you think there's one silver bullet out there that's going to solve all your problems, you are going to be wrong. So I think the idea is that we need to have a myriad of programs and projects and policies in place that will help flatten that out. In terms of going forward, what types of policies? Well Steve and I have spent an inordinate amount of time working on the climate and energy legislation, Steve's chart that showed the different potential. And Congress now is moving away from the Cap and Trade Program at least for all sectors of the economy, and our fear right now is we had hope that if that legislation were to pass in some form, that the revenue through Cap and Trade would be contributed to a number of these areas, energy efficiency resource standards, funding of up to 10% of available allowances for state and local energy efficiency programs, maybe up to a third of funding for utility efficiency programs and that would have been persistent and overtime and would have helped us a lot. We're not sure where we are right now. We'll see when Kerry and Graham and Lieberman do their bill on the 22nd or the week of the 22nd. But the big concern we have is that that will not provide necessary revenue to keep a lot of these programs going and that will be a big problem. There's a talk about a Jobs Bill which would have specific incentives in it, for one thing that is called Home Star which

could be $6 billion, 50% rebates for consumers. Building Star is a program that would help multifamily and commercial through a combination of rebates and tax incentives. There's an industrial energy efficiency activity that Steve is taking the lead on. That could be a big benefit in the industrial sector. There's a program for manufactured housing that would provide $7500 rebates to help mostly poor people change out old pre-1976 manufactured housing limits with energy manufactured housing limits. That Jobs Bill, those options for potential Jobs Bill, are very positive, but we don't know what's going to happen with any of those things.

Debbie: Good. Steve, do you have something to add?

Steven: Okay, I've to add a few things and just to summarize. So, as the Jobs Bill with significant energy efficiency components, and Jeff just described some of those; passing energy and hopefully a climate bill with these additional provisions *[inaudible]* developed this new provision because as I said this is just a down payment. I think a real key is coming up with stable sources of funding, and so whether it's allowances, carbon tax revenues, oil import fees, or something, many of the developed countries in the world have these various taxes that are devoted to energy-efficiency programs and we don't. So how do you stabilize the funding? I'd also say don't just wait for Washington because Washington goes through cycles, and you know the states really need to be taking a lot of the lead on their own. And many of them are and doing things at the state level, typically through utility programs that are funded through rates, sometimes through state taxes. But just to mention the utility programs, back in, I think it was, 1994 utility spending on energy efficiency programs, it was about $800. That was right after electric utility restructuring was all the rage, and everybody cut their elective expenses down at the bone. This year we're probably talking an excess of $4 billion of utility funding, and if we can keep that up, you work steadily at it. You know the Stimulus Bill is great, but, you know, that is coming and then it's going to go. So what can we do

that's steady, whether it's utility funding, whether it's something through carbon revenues in the future, I think is very important.

Jeff: We've preferred to call those rate pair of funds.

Steven: Okay.

Debbie: Hannah?

Hannah: I think the central issue is really certainty to pick up on something that Dr. Summers said yesterday at the lunch. And the issue here is being able to put together an energy vision that is consistent over time. We still want the flexibility to be able to innovate not just in technology but also in policy, and so as programs work or don't work you want the flexibility to continuously fund or not fund them. I think that is the central tension between providing business certainty, to be able to go after opportunities versus making sure you don't invest in things that are proven not to work over time, just for the sake of certainty. That tension I think can better be solved if we do have a clearer energy vision. At the moment I think we know who the country who wants to be cleaner is, and we want to be greener, and we want to use less. We want to be safer. We need something more beyond that of what is the rule that the federal government intends to play against those dimensions. How does that play out, at least at the high level against each of the initiatives we could pursue? And then what is the general governing philosophy within each of those for how grants will be given or how incentives will be distributed? I think that is a reasonable compact then for business and Government to have. To say as long as it works, the funding will continue until it becomes market adopted on its own. If it doesn't work, the funding will go away and that's a reasonable level of certainty.

Debbie: Good. Steve, do you...?

Steve: Well, we're not a policy advocacy shop. In an urge, it's supposed to be policy neutral. But as an economist, I'm not agnostic on the subject and I think if you get energy prices wrong, you set the economy up for just long-term welfare losses that are

very difficult to correct, and I think that's where we're at today. And so it was good that I guess we heard that in Copenhagen, there's some commitment by countries to quit subsidizing fossil field production. I think you need to go beyond that and recognize extra nullities that go along with energy consumption, and if you do that then there are some planning sources for some of these other corrections to the past, you know, century of energy pricing.

Debbie: With that said, thank you very much to all the panelists. I'm sure that they'll be available if you have any intelligent questions including the question about Iowa to Jeff *[laughs]*. And thank you very much.

END OF RECORDING