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PLUG-IN ELECTRIC VEHICLES 2008:

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PANEL 3: FEDERAL POLICY TOWARD PLUG-IN VEHICLES

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THE HONORABLE JAY INSLEE
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PANEL 3: FEDERAL POLICY TOWARD PLUG-IN VEHICLES

MR. SANDALOW: Ladies and gentlemen, it is my great honor to introduce this extraordinary panel.

Yesterday we heard two things. We heard lots of enthusiasm about plug-in electric vehicles, lots of belief that they have tremendous potential to change the world. We also heard a lot about the barriers. It's not going to be easy to puts tens of millions of plug-in electric vehicles on the road soon.

So, this panel is where it all comes together and we talk about the role that Washington can play to bottle up that enthusiasm in order to overcome those barriers. We have an extraordinary group of panelists here, starting with a man who certainly needs no introduction, Tom Friedman, a world-renown author, foreign affairs columnist for the New York Times, author, of course, of *The World is Flat,* and he told me moments ago author of the forthcoming book, which, as people here know about, I for one just heard the title, which is *Hot, Flat, and Crowded: Why We Need a Green Revolution and How it Can Renew America.*

In bookstores in September, Tom?

MR. FRIEDMAN: (Nods)

MR. SANDALOW: In bookstores in September.

We are also honored to have Jay Inslee, Congressman Jay Inslee, who you have already heard from, author of *Apollo's Fire* and a leader on this issue in the U.S. Congress.

We have Andy Karsner, assistant secretary of Energy Efficiency and Renewable Energy at the Department of Energy, who has been an extraordinary leader on this topic over the course of the past several years.

We have John Podesta, president of the Center for American Progress, who has built an extraordinary institution working on these issues, among many others, and who, of course, served as chief of staff for President Clinton, among many other roles in this town.

We have Sue Tierney, managing principal of Analysis Group, Inc., who has a distinguished career in federal government, in state government, and in business.

And we have Jon Wellinghoff, a commissioner of the Federal Energy Regulatory Commission, who has been a leader in this country and around the world on vehicle to grid applications and other issues.

We're going to start this panel with a short video, and, after that, we will go right to the panel.

Thank you very much.

(Video plays)

MR. FRIEDMAN: Well, David, thank you for inviting me here. This is a terrific panel.

I want to get right to the issue. I got briefed up a little bit on the discussions yesterday. Clearly, the big challenge we have around electric vehicles is to get down the cost volume curve as quickly as possible and make these truly scalable.

So, my question to the panel is this to begin with: How soon do you think we can get these cars made in China?

(Laughter)

MR. FRIEDMAN: Oh, we don't want them made in China. Sorry.

Andy, let me start with you. Underlying my question is a question. Is there not just a technology issue here, but a strategic manufacturing question? Is this going to be a strategic industry, and, as you've said to me, climate knows no boundaries, so, why should the manufacturing of electric cars know boundaries or should it?

MR. KARSNER: Well, sir, I think you framed it exactly right. If the twin major issues that have

magnitude and imperative to act are climate change and energy security, the truth is in this case, there's a tension between those two issues, and we've got to manage that tension, and you manage that tension through managing the diplomatic relationship with strategic partners globally. It wouldn't matter if we went to zero emissions in this country tomorrow and then had unabated growth in the amount of diffusion of vehicle technologies and business as usual in China for the next 10 years or 15 years. It would not be consequential to reducing our greenhouse gases in a matter that's relevant to the problem.

So, you need China to scale this and other technologies, getting in front of coal with carbon sequestration, et cetera. We need to have relative mechanisms of tech transfer and international collaboration. I penned an agreement with the vice minister on this, and we're continuing that dialogue next week with the strategic economic dialogue.

The other tension is that we have to retain technology advantage for our own energy security interests, and, of course, that is something that we have yet to focus on with the kind of poignancy that we did when we focused

on integrated circuits, computer chips, retaining a manufacturing base here for something that we viewed as strategic.

So, even as Taiwan and Japan and Korea and others move into the IT sector, the United States has been able to maintain a lead and agility in technology proliferation. I view the battery industry and storage for energy in general very much the same way. We have got to say that markets will ultimately perform, but markets don't make national strategy, and here we need a national strategy that incorporates a manufacturing base domestically for high technology energy storage.

MR. FRIEDMAN: Sue, let me ask you this, just to pick up on Andy's point because unlike the chip industry, we had the lead and it was really about retaining it. I'm not sure we have the lead in this technology. So, we first need a strategy for asserting leadership and then retaining it.

How do you see this?

MS. TIERNEY: It's a great question. This is an opportunity for the United States to lead on manufacturing jobs for technology. Jay talked about the importance of our intellectual resource. We have to deploy that, but we

can't get there without leadership. The reason I put it that way is we can't decide whether we're the chicken and the egg in this problem, and I think we have to choose whether we are going to respond to the public in its desires for low energy prices, continued low energy prices or lead by saying energy prices are high, they're here to say. Jay, you did say that, I think you said that in a sense.

(Laughter)

MS. TIERNEY: We have to de-carbonize the energy sector; we have to get off depending upon oil in the transportation sector. This is a major, major thing for leadership that we have to grab and lead.

MR. FRIEDMAN: Jon, let me ask you this from a labor standpoint: Should we look at electric cars the way we look at Wal-Mart or the way we look at Intel? That is, is it a Wal-Mart issue, let's get the cheapest car to the most Americans as quickly as possible and make them wherever that's necessary or is it an Intel issue, as Andy raised, a strategic issue in which we're going to have to retain this technology and have a strategy for that? How do you see it?

MR. WELLINGHOFF: Well, I think it's a little bit of both. There are a lot of cars made in North America still, and there's a reason for that, which is that we still have high levels of productivity in this country to manufacture technology of that sort.

I think that Andy raised the right issue though that the battery technology is largely, at this point, in current vehicles is made in Japan, Korea, other places. I think there's some promising aspects to innovation in the United States that could change that dynamic, but I think that we have to look at what are our kind of core national strengths, and innovation, the ability to have open capital markets, the ability to have a dynamic business enterprise are all strong aspects to the United States market, and, so, I think this is a very promising future for these advanced vehicles being actually not just invented in the United States but manufactured here, as well.

That's on the one hand. If you look on the other hand, we've kind of -- because of lack of policy, but, largely, if you look at the photovoltaic industry, we had I think about 45 percent of the market 10 years ago. We're now down to under 10. That's been picked up by the

Europeans and Japan because they, I think, invested in their own home markets and the production of -- and you had much more development in those home markets, and I think if we get the policy right, we can see the manufacturing follow.

MR. FRIEDMAN: Jon, you just came back from China. You e-mailed me from there about some of the exciting things you saw there.

Did you come back with a feeling of excitement, wow, here's a huge market that we can dive into if we achieve leadership on this electric car vehicle or did you come back with a little sense of dread, like these people are about to do for electric cars what they did for tennis shoes, they are going to clean our clock?

MR. WELLINGHOFF: No, I did have a little bit of dread, but I saw great potential. Number one, just the issue that we talked about yesterday of can we scale fast enough and can we do as Brazil has done and some of these other places and has China has done? In the last six years, they've been able to go from virtually zero electric vehicles to 40 million. They have 40 million electric vehicles on the road in China. Now --

MR. FRIEDMAN: 40 million?

MR. WELLINGHOFF: 40 million, yes.

Now, given that they are primarily scooters and mopeds, you know, they're not cars, but they still are electric vehicles that they plug in every night, that they plug into the grid, but I think our opportunity is to demonstrate to the Chinese the technology of how that grid integration can improve efficiency with the overall grid, lower the need to have coal plants on the grid, improve the ability to put in and integrate in wind power, for example, because we have to look at this as a system. As Congressman Inslee said in his speech, it's not just a transportation vehicle anymore, it is a grid appliance, and it's a grid appliance that we can demonstrate through our technology and help deliver that into China and make them more efficient, as well.

MR. FRIEDMAN: Jay, when I hear this discussion, and it's so exciting, but part of me wants to ask who are we kidding? Just a few blocks from here, our Congress has been debating now for well nigh a year whether and how to extend the production and investment tax credits for just wind and solar energy. You couldn't make that up.

(Laughter)

MR. FRIEDMAN: That we are still debating the production investment tax credits for wind and solar at a time when Germany has a 20-year feed-in tariff. You couldn't make that up.

Now, how can we be sitting here talking about taking the lead in what is clearly the next gen and we can't even catch up with old gen?

MR. INSLEE: Well, I think what Tom needs to understand is what Will Rogers understood, and they asked Will Rogers how do you come up with humor every single week, and he said it's easy when you got the whole U.S. Congress working for you.

(Laughter)

MR. INSLEE: So, you got to understand our role, semiotic relationship.

MR. FRIEDMAN: That's the ecosystem.

MR. INSLEE: That's the ecosystem, right. Look, I've been working on this for -- I was just talking to Dr. Frank -- for 13 years. In 1994, 1995, I started getting involved in this effort. How are we going to develop a clean energy system to stop global warming? And in 13 years, we have made a nanometers progress, in 13 years in public policy to do this. And I have to tell you that you

can ask my wife how angry I get about this coming home at night, not being able to solve this problem, not getting these portfolio scanners through, not getting our renewable tax credits through. If you think you're frustrated, come talk to me when I see it every morning on the House floor.

But I will just tell you this: I really believe, although I really didn't like the book *The Tipping Point* that much because the title was the whole book, frankly.

(Laughter)

MR. INSLEE: But I think we're there. I mean, I really believe we're there. I really believe this is one of those magic moments in American political history and technological history, and I'll tell you why. There are three things that are happening. Starting next January, there is a burst of technological innovation that is now becoming commercially available, and this and 20 other technologies.

So, right now, we are in the cusp of the commercialization of a whole suite of technologies that can get this job done all happening at the same time. I think that's a magic moment.

Second, the other scientific assessment is that the debate of global warming is over, in part because of

your advocacy, which all of us appreciate, and many others, so, the scientific certainty is there on the need to get this done. And I do believe this January you will see the largest political change since 1994, which, frankly, will create an environmental and political environment that will allow quantum leaps rather than just nanometers.

So, it's going to be all of the planets will be aligned next January, and I'm very excited about that happening, and it's going to be a moment where all of us are going to need to be engaged and make sure that happens.

So, I got to say, next year, I think 2009 is going to be 20 years of progress in one year.

MR. FRIEDMAN: Andy, I want to ask you and John a follow-up to Jay's point because, Andy, you're in the trenches right now, you know how hard it is to rewrite the rules, the enabling rules for this. And, John, you've been in the trenches.

So, let's just go back to this question, the point that Jay alluded to. Congress has been stuck on what should be a relatively easy thing, the extension of these critically important investment and production tax credits.

From your perspective as someone in the administration, John, from your perspective someone outside, why is it stuck?

MR. PODESTA: Do you want me to go first?

MR. KARSNER: Sure.

MR. KARSNER: I want to respond to Jay, but, first, I want to compliment him. He's on my energy committee; he's one of the great champions of our portfolios. So, that's the typical Washington technique. Compliment before the dagger.

But the answer is revealing because I don't believe that the problems that we just identified on energy, security, and climate change can remotely be aligned with biennial electoral processes in the election calendar, so, the very nature of waiting for the right number of votes for any one action to take place really answers this.

And, so, the true answer is it has got to be taken out of the hands of Congress, and that's a very painful thing for Congress to actually accept because Congress likes to be asked and they are the representatives of the people, et cetera, et cetera, but this is a multi-generational problem with myriad faces of a magnitude un-

previously faced, and when we have multi-generational problems in this country, typically we remove it from biennial election processes, from incremental, annual appropriation processes, and whether that's home ownership or whether that's student loans or whether that's putting a man on the moon or creating an atomic bomb, when we have a multi-generational process or problem to tackle, we organize ourselves and our institutions and our funding processes differently. We have not been doing that on energy.

So, policy cannot be reliant on the tax code as it was 15 years ago, and it cannot be reliant on choosing technological winners. Here's the policy for plug-ins, here's the one for wind, here's the one for nuclear, here's the one for coal. Instead, our policy has got to be permanent, it's got to be technology-neutral, it's got to be predictable for continuous and consistent capital formation, and it's got to be carbon-weighted and include externalities for our security.

In other words, we need policy that is attributes-based. What is it we want our energy portfolio and supply to look like, clean, affordable, domestic, secure, greenhouse gas reducing energy, and how do we get

there? That's not going to happen through this year's election or next or last year's; it's going to happen through government -- because that relies on government scoring and OMB and CBO, where the accountants aware managing the managers and the realities of institutional mechanisms that are too short-term to give us the solutions we want. So, we need an institutional and organizational revolution in how we phase down these things and then you will get the appropriate policies that can guide the marketplace to give us the results.

MR. FRIEDMAN: John?

MR. PODESTA: I guess I'm tempted to say I like Andy.

(Laughter)

MR. PODESTA: And I think he does a terrific job.

MR. FRIEDMAN: We all do.

MR. PODESTA: But he left one thing out. It's going to take presidential leadership, and I think that that's really what Jay was talking about.

I think at least we have two candidates -- I think they have different positions on this question, and Senator Obama leans out further, but at least they've embraced the challenge of climate change and need to cap

carbon in an extremely serious way, and I think that will change the dynamic, and I think this election will be a significant election. I don't think this just something that ebbs and flows in which politics doesn't matter.

And I think the particular example that you raise is, in fact, an example of that, where, as I think Jay noted in his opening remarks, there was a one vote margin in the Senate that filibustered a bill that could have gotten this job done, and I think that what we see now is a kind of crippling politics in Washington that needs to break apart, we need a realignment.

As I said, I think the good news is that there is a -- Jay talked about -- *Tipping Point*. I'm glad he didn't read *Collapse*.

(Laughter)

MR. INSLEE: I did read *Collapse*.

MR. KARSNER: But I think there is I think, at least in Washington, I think amongst the public more generally, there's a sense that we got to get on with this, we really need that conversion from a high carbon base to a low carbon base. That's going to take policy that's going to be formed in Congress, they have a role to play, but

what it's going to really take is leadership from the White House driving this process forward, and I think that can get done.

MR. FRIEDMAN: Let me just do a quick follow-up on that because I always kind of wonder when the leadership moment, when that tipping point is going to happen. I mean, we're just fresh from a primary campaign where two of the three candidates proposed a rollback on the federal gasoline tax, a summer holiday, which everyone knew was a completely fatuous solution. It's like when do we get to that point where we really tell the truth? It's like I've been thinking for a long time I want to write a column, it'd be called the Only 100 Days. You know that we used to say that first 100 days, but it feels like more and more that it's just 100 days now at every administration. After that 100 days, you're getting ready for the by-election. After the by-election, it's for the next presidential election. So, the first 100 days is like the only 100 days.

Has all this shrunk? When do we actually tell the truth?

(Laughter)

MS. TIERNEY: Right now.

MR. FRIEDMAN: Okay. Let's hear from you.

MR. INSLEE: Yes, right now.

MS. TIERNEY: Can I ask how many people in this audience are from outside Beltway? Put up your hands, please. Okay. Where is the action on all of these issues taking place? It's taking place outside the beltway, people are understanding that energy is expensive, that it's expensive at the gasoline pump, electricity pump. People have to lead from outside the beltway in, unfortunately. I was in the beltway for awhile, and guess where I fled, to the hinterlands.

(Laughter)

MS. TIERNEY: There is leadership in the state governors, there is leadership in state legislatures, there is leadership in state regulatory commissions. This is about being real about sending price signals to consumers about real electricity and real gasoline prices, getting over the fact that they're not going to go down. Okay, so, I said I'd be honest, right? And I'm not running for anything, so, I can. And that's where leadership has to press into Washington, unfortunately.

MR. FRIEDMAN: Jay, do you think that'll happen?

MR. INSLEE: Yes, I think, as I said, I really believe 2009, you're going to see an explosion of both policy and technology, and as far as when it'll happen, what I would suggest is it will happen when people in leadership positions understand how to talk about this issue, connecting it to inspirational higher values in the American character. A lot of people -- and one of the reasons I think this became a partisan issue, which I think is most unfortunate and very unnecessary -- is that we got off somehow thinking of this as calling for a deprivation living in just a 50 degree house, wearing just sweaters, and having a reduced American vision of what America is about, and it became associated with a reduction of American ability rather than an expansion on it.

MR. FRIEDMAN: Your book talks about that.

MR. INSLEE: Yes, and because people got in that sort of mindset, they were afraid to "tell the truth" because telling the truth was equated as the un-American view of pessimism, lack of expansion. It just became associated with defeat, and I think you can tell the truth with the American people, and I kind of think I've told as much as I can get through.

MR. FRIEDMAN: Got you.

MR. INSLEE: Is that this is associated with the higher values of America, and it's baseball, apple pie, and innovation, and, by the way, I really appreciate you've been right on the money on this. So, I think you can tell the truth to the American people, which is gas is going to be ungodly expensive, and that is something that is not going to change until the basic American character of courage, vision, and innovation gives Americans an alternative to gasoline. And, so, it's an expansive view, rather than a contractual, and then you can tell the truth to the American people, and I think you're going to start to hear that January 20, 2009.

(Laughter)

MR. FRIEDMAN: Tom -- oh, go ahead.

MR. KARSNER: I want to get in this because as the token republican on the panel, I know Wellinghoff's independent, and most of these folks are pretty independent-minded.

MR. FRIEDMAN: Please.

MR. KARSNER: But being the one who gets to defend the administration, I'd like to take a crack at it.

MR. FRIEDMAN: Go for it.

MR. KARSNER: Now, I'm no match for the well-versed political pros up here, and I'm not a campaign giant, but I do know a little bit about the portfolio and how it's progressed and where's it come and where it started, et cetera. So, let's lay a little bit of facts on the table because leadership is more than being able to talk about a good game. It also requires a capacity to listen, and that's actually what's not happening very well in this town.

So, if you start with what needed to happen in this town at first, it was definition of a problem, and that's why the president came out and said we are addicted to oil in unequivocal terms so that we would know in the starkest reality that which we face. Carbon-based fossil fuels have to be eroded from all sources, and in the following year from the same platform, when the president called for the most ambitious metrics of measurable reduction with enforcement by law with a mandate to reduce that oil and the first time elevation of vehicular efficiency, and then managed to pass that law within a year, it should be noted that the law that was sent to Congress was ecumenical and inclusive of all sources.

I personally fought and testified on more than 20

occasions to include electricity in that mandate, and the mandate that came back from Congress was a biofuels only mandate, and biofuels and liquid alternative fuels have a role to play, but Congress also has to listen to the leadership, whether they agree with it. I think it was you that said the quote that some things are perfectly right, even if George Bush says them. Okay.

(Laughter)

MR. KARSNER: And that has certainly been the case on the addiction to oil and deploying the technologies that are consequential. I inherited a portfolio with zero for a budget on plug-in hybrids and zero for plug-in technology, and that's boosted up from zero and you can say it's infinite X, but up to almost $100 million this year.

Today, we're going to be announcing $30 million from not just retrofitters, but the OEM manufacturers, great companies like GE and GM and Ford and Chrysler, aligned with EPRI and the University of Michigan, A123, Johnson-Saft. Most of the people in this room -- that's my shameless plug for a press avail after this event.

(Laughter)

MR. KARSNER: But for an additional $30 million, to put out demonstration cars like the one I drove in here today that I like to call the electro-flex, to use any kind of biofuel in any blend and plugs in and won't use more than 75 gallons of gasoline over the course of an average driver's year, produced from a major manufacturer here in the United States. I don't have to tell you how sexy the Volt is. The Japanese and Chinese couldn't possibly put out something that appealing to Middle America.

So, we've got real issues on certification, integration, testing, validation, a holistic program that the next administration will inherit, so, it will be inaccurate when people look back at the facts and say did this administration act on this issue? We did.

MR. FRIEDMAN: Andy, I've been through a lot of these sessions before and until you've heard Andy debate Al Gore, you haven't lived. Okay, I've got to tell you. All right.

(Laughter)

MR. FRIEDMAN: Jon, I want to go to you.

A lot of the kind of simple assumption here is that -- I don't mean simple as simplistic, but just as part of the formula is that it's all going to work great,

everyone will have an electric plug-in car, everyone plugs in at night when the grid has the most capacity and electrons are cheapest, and it works out just perfect, everything fits together wonderful.

Is our grid really ready for that many cars plugging in at night, and if it's not, what do we have to do?

MR. WELLINGHOFF: Well, first of all, it is ready. There have been two studies done that have been talked about in this proceeding, one at PNNL and one by EPRI that indicates that we can have somewhere between 70 and 80 percent of our current fleet turn over to plug-in fleet and not increase generation or increase grid capacity. In fact, it is ready from that standpoint.

I think it is also ready from a standpoint of markets. We have organized wholesale markets in this country that, right now, are taking demand response from providers in individual institutions like business and industries that are providing services to the grid. Those services are being done through tariffs that FERC approves that allow payments beamed back to those demand response providers that you could do the same thing with a car, with a plug-in car.

In fact, I've got a chart in my pocket that shows the car out in the hallway there providing a signal back to PGM that ultimately can provide regulation service to the grid while it's charging. So, it's getting paid while it's charging. So, our grid is ready, we can make it ready for larger numbers of cars scale up very quickly, I think quicker than the automobile manufacturers can crank out these cars. I think we can scale up the grid to make it ready for what we need to do.

MR. FRIEDMAN: I don't know who wants to take this question, but it's one that's been on my mind for a long time, and it goes back to the batteries point because over and over we hear that the battery is really the problem, but so much VC money is going into batteries, and it really has led me to ask: Is this simply kind of VC technology scale problem, just enough VC money into battery is going to give us the solution, or are we up against the laws of thermodynamics here?

Jump in on that.

MS. TIERNEY: I was going to talk about policy, not thermodynamics.

MR. FRIEDMAN: Please. Okay, all right.

(Laughter)

MR. FRIEDMAN: Anyone want to jump in on that? Andy, what have you seen at DoE? You've had to fund some of these.

MR. KARSNER: Yes. And, so, one of the other things we inherited was too much of a technology-specific approach, and, so, we were all hydrogen all the time, and hydrogen and biofuels and all these things have their place in keeping our eyes on the prize and reducing the oil, but we viewed it as a race between protons and electrons.

Okay, so, yes, of course, thermodynamics and physics and science all have a role to play here, but the question is: Is there a preferential role for electrons based on their efficiency of delivering and storing and releasing that energy, and I think we're leaning at least on the scalable production side as to saying yes, there absolutely is. So, we measure that in, reducing the costs, extending miles, extending cycles and durability of that battery. I mean, those are your fundamental metrics that surround this question, and all of those metrics are working our way.

And, so, specifically, we think we get down to where we need to be, about $300 per kilowatt hour by 2014. And now you also have interrupted miles. That's the

government in static thinking saying well, this is the car industry today, and the battery needs to last 17 years or 18 years or the life of the car because no one wants to mess with the car. Along comes Agassi and his group and they start saying well, actually, you don't need a battery to last that long if your price signal's high enough in select markets where the problem is acute enough. You could switch out the battery and we could go back to something we all grew up with, which was a battery that said 24 months or 36 months or maybe we don't have to fill it with water and the assumption is we don't know, how will consumers react to that?

But so, you have disruptive commercial paradigms meeting disruptive technology and we don't know where that's going to end up. What we do know is that we have to elevate our game in collaborating between government, utilities, and the vehicle industry, domestic manufacturing to get a net outcome at an accelerated rate. And, so, that's going to be our goal.

MR. FRIEDMAN: Well, I propose that.

Sue, what would you like to see a President John McCain, a President Barack Obama, whichever it is, include

in his inaugural speech that would truly empower this industry policy-wise?

MS. TIERNEY: Great question.

That I will meet my commitments to doing everything I can to have the nation pass as soon as possible a mandatory cap on carbon, do it in a way that is workable politically, and, therefore, we get a framework in place fast and that will allow less to work in international forum in saying America is at the table right now.

Two, I would say that we will use the money from the cap program either through options for technology deployment or circle that back into the United States as a way to provide investment in. I would encourage continuation of tax credits to get these vehicles out there. Tax credits for manufacturing, for purchase, and then I would do everything I could from the bully pulpit to ask the states to get their job right on the grid.

I think we have -- I think Jon is totally right that the grid is ready from a physical point of view. I don't think we're ready from a policy for pricing use of the grid so that consumers -- let's say all those vehicles get out there and customers plug them in, these residential customers who see average rates across the month, they plug

them in all day in the middle of the day and suck out the juice, that grid is not ready. So, we have a train wreck happening if the president doesn't say the job is at the states to get the pricing to retail consumers right on this.

MR. FRIEDMAN: John, what would you like to hear?

MR. PODESTA: Well, I think we're finally in agreement up here on this panel, but I'd add a couple of other items.

One, on day one, grant the California waive around the Clean Air act.

MS. TIERNEY: Yes. Wait, not wait. Let's have that already. Go ahead.

MR. PODESTA: You need a new president to do that, so, it has to be on day one. I apologize.

And, so, I think that would be quite important. And then I think on the other side, I think we've got -- I think Jay raised this in his earlier comments. I think you have to think about this simultaneously with production of clean, alternative energy so that I'd like to see in addition to what we're talking about on the vehicle side and on the carbon side, a requirement that there's a renewable electricity portfolio standard, and then he's got

to do -- now I can say he. He's got to do more on efficiency, in driving efficiency into the system, decouple it, trying to do as much as you can to decouple electricity rates to bring down demand on the electricity side, as well.

MS. TIERNEY: John, to get this grid to be as efficient as it needs to be, and not only to have the scale, do we need to have a truly national grid? Someone said to me that our electric grid, if it were a highway system, it would be like driving from Maine to Los Angeles using only local and state roads. We don't have a national grid. I don't have to tell you. Do we need one or can this work -- Sue alluded to this -- without a truly integrated national grid?

MR. WELLINGHOFF: I get developers coming into my office almost every week proposing a new transmission line. A transmission line, interestingly enough, in many instances for wind only, but they are dispirit and they're not integrated and they're not looking at a total system, so, I think Congressman Inslee's congressional proposal, as well as one that Senator Reid has, are ones that we absolutely have to look at.

We have to look at, first of all, our national

energy plan as much as Andy's talked about that's attribute-based. But, from that plan, we then have to develop from those attributes things like a national grid, and I think we absolutely do need a national grid.

It doesn't mean we can't start putting in plug-in vehicles prior to that, but I will tell you one thing, putting in plug-in vehicles will facilitate that national grid because to do wind energy, you need to have regulation services. The State of California is going to put in 7,000 more megawatts of wind by 2012. In doing that, they'll need 1,000 megawatts more of regulation services. These vehicles, as demonstrated by the car out there by the MAGIC Consortium, can do that now.

So, ultimately, we can put the two together and marry that national grid with these vehicles in a way that can provide services for the grid and also have the vehicles available to reduce our dependence on oil.

MR. INSLEE: Can I add a couple of --

MR. FRIEDMAN: Sure, go ahead, Jay. Please.

MR. INSLEE: Yes, there's a couple of other things. Two procedural, one non-procedural to the grid. We talked about the superhighways bill that I've

introduced, but we have to go to some more federal mandates on interconnection standards, we need a federal metering bill if we're going to make sure we can plug these things in and use this storage capacity, there has to be a federal requirement that we do this, and I have to tell you we're still fighting like the Civil War when it comes to transmission issues. Every time we try to do something on a federal basis to make this industry spring forth, people are talking about this is the Civil War and we can't trample on some states' rights. We have to get some federal interconnection standards to make sure that Don Guhl or Felix Kramer can actually plug in and we can really interconnect this system.

Second, we have to have a system of decoupling where utilities are required to decouple the revenues from their sales of electricity. We have to turn utilities into exclusively sellers of electrons to restart sellers of efficiency in the electrical system, in the hybrid system as part of that. When you decouple, you give an incentive from utility to use these batteries in a more efficient way, and you can actually make revenue on that. That gives an incentive to act on this. Those are the two procedural

issues, but the question was what to see in the inaugural address?

MR. FRIEDMAN: Yes, please.

MR. INSLEE: I actually believe the single most important thing in the inaugural address is to engage the emotional component of this clean energy revolution to this American vision. These are sort of policy things that may be lost on the American public and the million people on the Mall, but really calling forth a true visionary statement, I believe is the single most fundamental thinking to engage this country on a grander scheme. We think of this as sort of just a business opportunity or just a public policy here and there. This has to become a national cause. The scale of this demands a national cause rather than tinkering on the edges, and that's why we're going to need a very inspirational message.

MR. FRIEDMAN: I want to open it. We have a little time to open up to the floor. I know there's so many knowledgeable people out there. Let's try two questions.

Please. Could you identify yourself?

MR. TAYLOR: I'm David Taylor. I'm with Taylor Automotive. My video was shown last night before dinner.

And I would just like to say that I come from an automotive repair facility, so, I've felt the crunch with the gas prices going up. Our service business goes down, so, I've kind of seen the writing on the wall that eventually my business has to change if I'm going to survive. And I think this is kind of going on all over the nation.

MR. FRIEDMAN: I don't quite understand. I'm just kind of curious. You're in the automotive repair business.

MR. TAYLOR: Repair and service.

MR. FRIEDMAN: And how has your business been affected by what's going on, just so --

MR. TAYLOR: Every time the gas prices go up, whether it's 5 cents, 10 cents, consumers, if they're being crunched with their budget, groceries are more expensive, the gasoline, if they've got a choice of putting gasoline in their tank or come in and getting their oil changed, they're going to put gas in their tank.

MR. FRIEDMAN: Got you.

MR. TAYLOR: So, I understand --

MR. FRIEDMAN: So, people delaying everything else?

MR. TAYLOR: Right.

MR. FRIEDMAN: Got you.

MR. TAYLOR: So, our business is down probably 40 percent this year in the service aspect, but I'm going to take my business into the conversion business, and this is something that can be done today. I can start converting cars tomorrow. Based on technology that is already out there, it's not perfect, it's not going to get you 300 miles on a charge, but it's inexpensive, it's something that people can do right now until the technology is there.

MR. FRIEDMAN: That's true.

MR. TAYLOR: So, my question is -- and I know this is selfish.

MR. FRIEDMAN: Please.

MR. TAYLOR: But I've not had anyone come up to me today saying hey, how can we help you to duplicate this? Do you need funding? So, how do we address that?

MR. FRIEDMAN: Sir, to elaborate, is there an enabling legislation or system to get this going before we get to big companies doing it that would enable this kind of ground up conversion industry to take off?

MR. INSLEE: Well, we do have a proposal. We passed it out of the House, could not get it through the

Senate, for a $3,000 tax credit which creates a demand for the conversion right there. That's, obviously, first step. We hope to get that done fall of 2009.

MR. FRIEDMAN: Andy?

MR. KARSNER: And, first of all, David, you're both my hero and my greatest concern. And you're a hero because you're an entrepreneur, you want to do the right thing, and there ought to be a policy environment that gives you predictable pathways as a small business person to do that, and I want to meet you and see what we can do.

In terms of the conversions, there's one word that penetrates the whole conference here that's the most important to consider: warrantee. Warrantee. Okay, and the idea of avoiding a warrantee on your largest hardware purchase that's critical to the transportation and for your livelihood for most people in America is not a realistic option. It may be if we're going to keep this into a select luxury green niche to wear a green badge of courage, but, actually, as a national vision, we want electrification of drive trains to be ubiquitous across the fleet, first for hybridization across all sources, and then to plug into our homes, and then vehicle to home and vehicle to grid.

So, we've got to crawl before we walk, walk before we run, run before we get to the decathlon, and my big concern here is, as a guy who was once a diesel engine guy, that we don't lose three decades like we lost when we prematurely went into diesel, encountered flaws, had pushback, and it's taken us three decades to recover dieselization of the fleet.

So, certification, validation, testing with warranted batteries that people don't have to worry about from a perspective of safety and security is going to be fundamental, so, we want to work with the retrofitters, but we don't want to lose the idea that ultimately it's got to be consistent with what the automakers are putting out.

MR. FRIEDMAN: Jim Woolsey?

MR. WOOLSEY: Jim Woolsey, *Vantage Point*.

A couple of weeks ago, there was a very thoughtful, rather lengthy article in the *National Journal* called *China's Cyber Militia*, and that story lead with the assertion based on discussions with people supposedly in the know in the executive branch that not only the outage in 2003 in the Northeastern part of the United States and Eastern Canada previously attributed to tree branches falling in Cleveland on power lines, not only was that done

by Chinese para-governmental hackers, but the outage in eastern Florida in February was also from the same source.

This morning's papers talk about Chinese hacking into Capitol Hill office.

MR. FRIEDMAN: Jay's office?

(Laughter)

MR. WOOLSEY: Not his yet as far as we know from the press. But Congressman Wolf's office.

With the noble exception of the two executive branch officials on this panel, and I think John's chairman, who is seeking legislative authority to deal with some of these problems, I would say in the executive branch of the United States and in the state public utility commissions and the utilities the vulnerabilities of our grid to hacking and intentional interference have been met by absolutely full-bodied ignorance and lack of willingness even to consider or talk about the issue.

Now, I'm as big a fan as anybody of going electric with vehicles, but can any of you tell us something about somebody somewhere who is trying to take some action to keep the grid from being taken down by foreign governments, by terrorists, by whoever, let's say

12-year-old hackers? The existing system has probably protected us pretty well against 9-year-old hackers.

(Laughter)

MR. WOOLSEY: But let's go with the 12-year-old hacker.

MR. FRIEDMAN: Jon, you're closest to that. Let's start with Jon.

MR. WELLINGHOFF: And Jim did allude to the fact that Chairman Kelliher has testified before a House committee indicating that FERC needs additional authority, as some of you may know, FERC was given the authority in the 2005 EPAct for responsibility, for reliability of the grid. That wasn't necessarily security, but, certainty, security should be subsumed in reliability, and, as such, we have developed or actually the entity under that Act, act as our organization reliable organization, the NERC has developed standards, cyber security standards that we, in fact, have adopted, FERC has adopted.

Now, that doesn't close all the loopholes, and that's ultimately why Chairman Kelliher asked for this additional authority from Congress, and I understand the legislation is being drafted, and, hopefully, that will be expeditiously processed and will get these closed up, but

Jim is correct. I mean, we need the authority to ultimately direct the utilities from FERC to do certain things with respect to cyber security. We don't have that authority yet; we need it.

MR. FRIEDMAN: Andy, and then we'll go to you, Sue. Andy, from the government point of view?

MR. KARSNER: Yes, Jim successfully scared the hell out of me last time he and Jay and I were together in California and courteously recommended that I get a classified briefing on this, and, so, the declass part that we can speak to is this isn't the cyber hacking that you think of just for passwords, this is the capacity to destroy hardware in your home, at airports, at military bases, your car if connected through the grid, and I see that the undersecretary of homeland security for technology development is in the second row here, this is what he does 100 percent of the time, and I think that's why he's here.

But the main point, Jim, that you leave us with is security cannot be less of a concern than environment in the current context of immediacy as we plan out energy transformation, and that is absolutely true if we're talking about clean energy superhighways, which I would like to see. We have got to integrate all of our thinking

about security if we want the appropriate on and off ramps at our homes, at commercial facilities, at military infrastructures.

MR. FRIEDMAN: Sue?

MS. TIERNEY: I sit on a National Academy of Science Panel with the lovely title of essentially terrorism in the grid, and we've been waiting with a finished paper on this to get it out to the public. The gist of it might say if it were ever released that, in fact, there's a lot of work going on in security, there are significant efforts underway by utilities in advance of, in addition to getting additional authorities on this. Because of the way that our grid is designed, it would be very, very unlikely to be able to take out the grid.

MR. FRIEDMAN: It's too inefficient.

(Laughter)

MS. TIERNEY: It's too inefficient, and it's too different. There are bigger threats to the grid and to the modernization of it, and it's the aging infrastructure, it's what you all talked about before, which is these little pieces all out there. In fact, having the plug-in hybrid system designed right would actually decentralize the grid and make it more robust.

So, Jim, with all due respect, I wouldn't want to leave it out there that nobody's doing anything on this topic.

MR. FRIEDMAN: Yes.

MS. TIERNEY: I think that's not true.

MR. FRIEDMAN: John, real quickly. I want to get more questions.

MR. PODESTA: I think I wanted to make the distribution point, but I think the other thing, as Jim raises and scares us with the thought of moving to a system of transportation based more on electricity, the very real security threats from doing nothing are intense, like mass migration, weak and failing states, scarce water resources, the capacity of the United States to kind of cope with doing nothing will soon swamp even the kind of nightmare scenarios that Jim's talking about.

So, I think we've got to get on with it and we've got to move down this track.

MR. FRIEDMAN: Please.

MR. KARSNER: The point is they're not one or the other.

MR. PODESTA: Right.

MR. KARSNER: They're not one or the other. You have to incorporate the security --

MR. PODESTA: Right.

MR. KARSNER: -- as you move to the clean energy electrons.

MR. FRIEDMAN: Please. Could you identify yourself?

MS. STEVENS: My name is Pamela Stevens with *Envision Solar*. I'm a Californian. And my question pertains -- first of all, thank you for mentioning the renewable tax credit. We need that. *Envision Solar,* we need that.

My question pertains to distributed generation, and it's a good segue from the previous question about national security.

One of the concepts that was written about this past week is something that our company does, is we recover space in parking lots with solar infrastructure that protects against -- it can abate storm water, produce clean electricity, provide shade for customers, and also create a very intense utility scale distributed generation and electric vehicle charging infrastructure, and I just wanted to get some thoughts on distributed generation and that

role that that plays in electric vehicles and national security.

MR. FRIEDMAN: Who would like to take that?

Go ahead.

MR. KARSNER: It's very much the same as the last question, I mean, as Jim's. In other words, he's telling you the problem, you're telling the solution, which is redundancy, resiliency, agility, and power that we're not going to be able to deal with sequentially we just have so much and just in time delivery. That's where we've been, and then throw on top of that an aging infrastructure; we're in a world of hurt.

So, we need to modernize the superhighways, the conductivity of the nation that Jay has talked to, but, at the same time, in parallel, we've got to accept and encourage and incentivize redundancy and resiliency from distribution, in addition empowering your customers to feed in and make a difference.

MR. PODESTA: The additional advantage if you think of the Internet is that also drives innovation, you've pushed innovation out to the edge of the cloud rather than in sort of the main power producers of the country, and I think that creates its own virtuous cycle,

which is also, I think, an important aspect of what you're talking about.

MS. TIERNEY: Tom, and this --

MR. FRIEDMAN: I want to get to more questions, if we could.

MS. TIERNEY: Okay, sure.

MR. FRIEDMAN: So we can get as many people as we can. We only have five more minutes, so, real quick.

MR. BROWN: Hi, my name is Carter Brown. I'm with Boulder Electric Vehicle. We build 6,000-pound electric delivery trucks.

There's one point that I feel everybody in this room is missing with the vehicle to grid idea, which is that every time you charge and discharge a set of batteries, no matter how good they are, even if they're A123s, you shorten their cycle life. So, if you're going to take a consumer product that the consumer takes a lot -- pays a lot of money for and you're going to shorten the lifespan of the car that they drive by 50 percent or even 60 or 70 percent by charging and discharging it on the grid every single day, there needs to be a significant either payback for the consumer or tax break or pay in from the utility company or something to

benefit the consumer by killing their batteries in 3 years instead of 10 years.

I'm wondering if any of you up there have considered that or if any of you have solutions for that.

MR. FRIEDMAN: Jon and then Jay.

MR. WELLINGHOFF: Actually, this is a myth, and let me dispel the myth, and here's the chart if we can see the chart.

This chart basically shows this car out here providing regulation services to the PGM grid. It's providing them following with this red line underneath the blue line, which is the signal from PGM. The green line is charging. You can provide grid services without ever interrupting charging at all, especially regulation services. You do not have to charge and discharge necessarily to provide those. You can, in fact, do this without affecting the charge whatsoever.

MR. KARSNER: I think, Jon, his point is making up for capital cost --

MR. BROWN: Where can I get a copy of that chart?

MR. KARSNER: I'm sorry, what did you say?

MR. KARSNER: I think his point was making up for the capital cost difference in the battery up front if want

to integrate them in the vehicles today. Wasn't that your main point?

MR. BROWN: Yes, the capitalization of it.

MR. KARSNER: Yes, right.

MR. BROWN: And the consumer payback from the utility company.

MR. WELLINGHOFF: But his point though, Andy, was ultimately by doing vehicle to grid, you're going to decrease the life of the battery, and I'm saying you don't. You don't at all.

MR. INSLEE: One idea, I think eventually we need to go to a financing system to finance acquisition and maintenance of the battery separate from the car possibly, and when you do that, you give a lot more flexibility. We look at Shai Agassi's model, which because they can shift batteries around to higher and lower mileage needs a day, they can maximize efficiency to battery.

MR. FRIEDMAN: Yes.

MR. INSLEE: So, if we go to a GMAC that can finance your battery and manage your battery, it'll be much more efficient. I think that's one step.

MR. FRIEDMAN: Because there are four people left in line, if you'd each just quickly ask your question, and

then we'll let everybody just bite off whichever one they want, and that'll close it.

MR. STEVENS: Bob Stevens, General Motors.

The transition from petroleum power to grid power vehicles represents a significant improvement in greenhouse gas emissions; however, the grid is still 50 percent coal. Long-term solutions are to go to solar thermal, geothermal, or wind, and just in case the audience doesn't realize it, those are technologically and economically feasible. I point to the MIT hot rock study about geothermal potential, which is enormous in this country, and the DoE's recent report on wind.

In the meantime until we get there, have you all considered how are we going to do the tradeoff between the movement of CO2 emissions from the automotive side to the utility side and who's going to get the credit and burden for that?

MR. FRIEDMAN: Quickly.

MR. KLINE: Stan Kline.

The Congressman talked in his comments about the Europeans being ahead of us in certain activities. I just wanted to point out that our electric grid has a lot of legacy information technology in there, and I'm not talking

about the interface to the home, I'm talking about the devices in the substation and so forth.

There's an advanced automation system where the technology was developed at EPRI, but it isn't being taken up as well in North America, in the U.S., as it is being taken up in Europe, and that's somewhat of an artifact of how the Europeans buy their substations and so froth. I think one thing that's going to be needed is some relief.

I know that I was at a meeting having to do with the security aspect, and there was one gentleman from one major utility that's got 400 substations, it's going to cost $200,000 a substation at minimum to upgrade the security there, so, a lot of this, some of the state regulators are going to need to loosen up their -- or something's going to have to happen to enable utilities to spend that kind of money to upgrade those facilities.

MR. FRIEDMAN: Good point, actually.

Go ahead, please.

MS. GOLD: Hi. Caitlin Gold, American Council on Renewable Energy, and I was just wondering if you could elaborate on how you'd propose nationwide RPSs?

MR. FRIEDMAN: A nationwide RPS?

MS. GOLD: Mm-hmm.

MR. FRIEDMAN: Last one. Make it good.

MR. ABRAMSON: Hello, Tedd Abramson, Electrorides, California.

There's one underlying market issue that I'm sure you might be aware of, but it has to do with the distribution of electric cars mainstream. You have dealerships that are making roughly 5 percent margin on the sale of the vehicle, 35 percent on parts, and roughly 65 percent on service. That will pretty much be cut way down if we introduce large-scale electric vehicles, so, that's an issue just from the distribution point that has to be addressed economically at the local dealer level, state by state, city by city. So --

MR. FRIEDMAN: Why doesn't everybody take a minute and bite off any question you want. And, Jon, we'll start with you and we'll just work right down.

MR. WELLINGHOFF: Sure.

MR. FRIEDMAN: And, Jay, you can wrap it.

MR. WELLINGHOFF: With respect to the issue of security and cost on substations of $200,000 per

substation, I've already seen technology that can do it at $10,000 per node. So, ultimately, there is technology --

MR. FRIEDMAN: $10,000 per node?

MR. WELLINGHOFF: Per node, right. So, it'd be $10,000 per substation, for example, in that particular example. So, it takes it down by a factor of 20. That ultimately can be done. And the issue of moving the CO2 to the grid, again, even with a 50 percent coal, we're reducing the CO2, and that's with --

MR. FRIEDMAN: On a wheels to wheels basis.

MR. WELLINGHOFF: Yes, on a wheels to wheels basis, we're reducing the CO2, and the grid's only going to get cleaner, we're only going to put more wind on the grid, more solar, more geothermal on the grid, so, ultimately, I don't think that's really an issue. Those are the two I --

MR. FRIEDMAN: As Felix Kramer always says, electric car is the only one that gets cleaner the more you use it.

MR. WELLINGHOFF: That's right, absolutely.

MR. FRIEDMAN: Sue?

MS. TIERNEY: I would have everybody take a look at what California is doing to connect the dots between decoupling sales of electricity from profits, throwing

financial incentives to get utilities on the same wavelength as distributed generation, efficient solutions, clean energy. There's a whole long list of other things which I will not say, but there's great lessons learned there to be followed.

MR. FRIEDMAN: John?

MR. PODESTA: Well, I think that we've talked about a lot of different things. I think the House and Senate have both passed renewable electricity standards, they just can't seem to pass them together nationally, that also take account of savings on the efficiency side.

The federal government has enormous power beyond things that are new that Congress can enact the power to procure, the power for advanced sales, et cetera, but what this is going to really take when you think about all these moving parts is, again, a real plan, leadership coming from the White House driving this solution and driving the transformation of the economy, and I think Jay raised earlier the industrial scale of World War II. It's not far off.

MR. FRIEDMAN: Andy?

MR. KARSNER: I'm so glad I'm not part of a campaign this year.

(Laughter)

MR. PODESTA: There's room on the Obama --

MR. KARSNER: Oh God. I'm going where Sue goes, out of the beltway.

Let me talk about the things that aren't included. I thought it was a very important point the gentleman made about transformation of the economy and unintended consequences. This is where government has a role to lead, but not necessarily be a cheerleader. There are more mundane things that a government will have to do in terms of certification, testing, validation, advancing in the R&D.

One of the things you've just said, when you heard about leaving off the revenue from the service and the repair shop and the automotive industry, people forget that we get all of our road taxes from gasoline. So, what happens is we begin alleviating gasoline at a rate that we find consequential; Congress is going to have to deal with these realities.

There are more complex components that have got to be put in here because we're not just going to let the roads and highways go to hell as we do it. These things aren't insurmountable, but they've got to be computed in

every bit as much as security and environment and the other things that we're talking about today.

I want to thank the guy for the plug on the studies that our office funded at MIT for a vision beyond incrementalism for geothermal and for wind at 20 percent and for the built environment by 2015, so, that's what the new administration with all their vaunted leadership will inherit.

(Laughter)

MR. KARSNER: Is a Department of Energy that's gone beyond incrementalism and redesigning the way the portfolio has to go, and Republican or Democrat are going to work with the same civil servants that are dedicated to Dan Ryker and me and my successor. And, so, you've got to have a reality measure on this and say what needs to be done for the hard, multi-generational lifting. That's not going to be sloganeering; it's not going to be the tired, old policies that we bicker back and forth with every election cycle. It's going to be two things, a price signal that is carbon-weighted and includes security externalities that is technology-neutral and it has to be incorporated across the board in an institutional

revolution that scales capital formation to fund these industries and turn over the capital stock at a timeframe and at a scale that is of the magnitude of the challenge. Anything less is sloganeering of the past, a superficial nod to green power as a good thing.

You know, Tom, this is your deal. If it's done in scale, it's just a hobby. You need the money to scale it, not just R&D, but the things that scale capital markets. That's going to mean new institutions of the type that you and John Deutsch have been talking about, but it's also going to mean a price signal that's clean, technology-neutral, and not subject to the erratic, unreliable whims of Congress.

MR. FRIEDMAN: I repeat, until you've heard Andy debate Al Gore, you haven't lived. Okay.

(Applause)

MR. FRIEDMAN: Jay?

MR. INSLEE: I spent a week in Europe looking at their experience last summer, and what they told us, one lesson from Europe is the price signal. I totally agree with Andy, the necessity of a price signal to dry the scale of the capital into these industries, but a lesson from Europe is very clear that a price signal is not sufficient

alone. There are a whole suite of these things that we have to do. I'll just mention two of them in answer to the lady's question.

One, we need to have a price signal to distributed energy that you will have a product to sell at a fixed price, at a guaranteed price. A feed-in tariff in Germany allowed them to leapfrog us. We led in solar energy for a decade. We're number four or five. Germany has shot way in front of us because of a feed-in tariff.

I'll be introducing a bill in the next week or so to create basically a performance-based guarantee to distribute energy for a price for 20 years. That's a price signal that will attract the financial capital Andy is talking about.

Second is R&D. We've skirted around it, but I just want to say our R&D budget in the federal government is pathetic. Microsoft's research and development budget is two and a half times the entire United States' R&D budget for energy. Apollo energy R&D was 8 times our budget and it's 55 times higher in Iraq than clean energy. We've got to scale up.

Last, I just want to leave with one comment and plead to all of us in this room. There are about three dozen members of the United States Congress, about 535 of the United States Congress who have some basic understanding of the potential of electrifying the United States' transportation system. That has to get up to well over 60 percent to make what we have to have happen in Washington, D.C.

I hope that each of you will join Tom's leadership, Andy's leadership, the rest of us in educating your member of the United States Congress of the potential of this technology. If they understand the potential, we will get this job done. You are tremendous advocates. Go have a teaching day to your member of the U.S. Congress and tell them what you're up to and we'll get this job done.

Thank you.

MR. FRIEDMAN: Just a great way to end it. David, thank you so much. It's been a wonderful panel. Please give them all applause.

(Applause)

MR. REICHER: What breadth on plug-ins from national cause to warranted batteries to cyber security to weak and failing states, we heard it all. That was really fantastic.