THE BROOKINGS INSTITUTION

BUILDING A LONG-TERM NATIONAL STRATEGY ON GROWTH THROUGH INNOVATION

Washington, D.C.

Wednesday, January 12, 2011

PANEL 2: THE POTENTIAL OF GREEN ENERGY AND TECHNOLOGY

Moderator:

BRUCE KATZ
Vice President and Director, Metropolitan Policy Program
The Brookings Institution

Panelists:

JEFF IMMELT
Chairman of the Board and CEO
General Electric

STEVEN "MAC" HELLER
CEO
Coda Automotive

MICHAEL GREENSTONE
Senior Fellow and Director, The Hamilton Project
The Brookings Institution

* * * * * *

ANDERSON COURT REPORTING
706 Duke Street, Suite 100
Alexandria, VA 22314
Phone (703) 519-7180 Fax (703) 519-7190

P R O C E E D I N G S

MR. KATZ: So, we're going to start and people will begin to drift back in.

I'm Bruce Katz. I'm the vice president here, and I'm director of the Metropolitan Policy Program at Brookings.

And this panel is going to focus on the potential of the green economy to really transform the broader American economy at a time of intense global competition. And I think the order of the day, there is a method to the madness. It really makes sense to follow the prior panel on information technology because the shift to a low-carbon economy is going to be a market transformation really as profound as the information revolution. It is going to rely on technology, it's going to require smart public policy really at all levels of government, and it occurs within a period of intense global competition.

So, our perspective coming from the Metro Program, looking from the ground up is everything is about to change, and, frankly, everything is changing. The energy we use is migrating from an almost exclusive focus on carbon fuels to a more sustainable mix, wind and solar for sure, but also nuclear. The infrastructure we build is moving from outmoded transportation and energy to systems that are smarter, more technologically-enabled, more focused on market pricing, the products we buy are moving from high-carbon gas-guzzlers to obviously a basket of sustainable goods, and the homes we live in and the buildings and retail facilities we frequent are becoming more sustainable in

design, more efficient in their use of water and energy, and, frankly, better arrayed so that we can walk less, spend more, have higher quality of life.

Like the information revolution, this is a transformation that is ubiquitous, it affects everyone and every place, but it also concentrates in major cities and metro areas here in the U.S., Europe, Asia, Latin America because certain places are really going to leapfrog to the front of the line on idea generation, on production and deployment, on financing.

At the Metro Program, we're actually trying to map that sectoral and clustered differentiation within the United States compared to our competitors. This is a competition, and I think a lot of this conversation, I think, frankly, is going to be how does the U.S. play in this transition to low carbon when places like China and Germany ahead of us at embracing this as a market transformation. Obviously, there are very positive environmental consequences of this transition, but we see competitors abroad, particularly China, hell bent on out-investing us on renewables and other aspects of the green transition and out-competing us.

So, I think what we're going to try to do in this panel is really focus on three levels of conversation: Where does the U.S. fit in this transition to a global, low-carbon economy? What are our strengths? What are our assets? What are our attributes? How do we strengthen them? What should we be doing from a public policy perspective to catalyze markets and catalyze investments and grow jobs, and then, realpolitik, what can be done at a time of intense partisanship and polarization if the feds can't quite act to send the right

signals to the market, what can states do, what can cities do, what can metropolitan areas do? That's the genius of our system.

We've got three, great panelists to sort of walk us through this.

The first to my right is Jeff Immelt. He's the CEO of GE. Fourth on the *Fortune* 500 list; 300,000 workers, many countries across the world, so can give us both the domestic perspective, but also the global perspective.

Michael Greenstone is a colleague at Brookings. He's the director of our Hamilton Project, served in the Obama Administration, but also has real deep expertise in environmental economics, the economics of climate change.

And Mac Heller is the head of Coda Automotive, a small firm really at the sort of cutting-edge vanguard of electric vehicles based in that production engine, Santa Monica, California. So, that's going to be a special conversation with Mac.

But I'm going to start with Jeff because there's something that you wrote with John Doerr back in 2009, which I think really sets up this panel. You said, "The U.S. has no long-term market signal to tell companies and consumers that it values low-carbon energy. It has no policies to discourage sending hundreds of billions of dollars a year overseas for energy. It does not offer adequate, sustained R&D funding to be a serious competitor in this huge business."

So, like the information revolution, the green revolution really requires a platform of policy, smart policy to catalyze markets, innovation, and investment. What's your assessment today, 18 months or so after you wrote that

with John?

MR. IMMELT: It sounds more like John than me, but so, first, I would talk about it in terms of clean and not green. So, I'd broaden the definition to talk about energy productivity, energy security, pollution reduction in its broadest terms. It's a great business. It's not a good business, it's a great business. When you look at the consumption for electricity around the world between now and 2030, when you look at where the adoption cycle is in India and China on automotives, when you look at the amount of technology that's possible, when you look at a number of different emissions, this is going to be a great industry for somebody over the next 10 or 20 years. So, let's kind of start with that.

At GE, we are long in the space. We're about a $45 billion energy company, probably the biggest in the U.S., one of the biggest in the world, where in many places, we're the only American company that competes in these spaces. It's a business that's tripled over the last decade. So, this is going to be a big business for somebody.

So, who wins? I would say that basically everybody in this room is smart. If you basically do in your own mind kind of a little matrix, and on one side is market, how big is the market going to be over the next 10 years because markets accumulate practitioners, and practitioners decide who wins. So, how big is the market, who owns the innovation, how much R&D is being spent, where are the patents, things like that.

The third element is who's got a low-cost supply chain? Energy is

a scale business. If you took one thin film technology to commercial development, one, you will spend more on R&D than Google spent before it became a public company. So, a low-cost supply chain.

And then the fourth element is public policy. Who has public policy? You can have a small market, but if you have aggressive public policy, you can be a winner. And then plug in on the other side, China, United States, Germany, Australia, Canada, and things like that, and then you plug into that matrix solar energy, natural gas, coal gasification, every technology that's out there, and that's the clean energy future. It's going to be decided on technology, commercialization.

The U.S. doesn't win on many of them, if any of them. Fundamentally, China is kind of green on all of them, and Europe, because it uses public policy, is green on some, and the U.S. basically, in other words, GE is going to invest on coal sequestration, but we're going to do it in China because that's where the practitioners are. There are no real practitioners here.

And so, from a GE standpoint, we can kind of bob and weave and decide where we want to go, and we're a global company in that we can decide our own destiny. But if we decide as a country that we want to be a leader in the clean energy revolution, we've got to fill in this grid for ourselves and we have to decide where, and there are certain areas like natural gas we can still be the winner. So, that's kind of the state of play, big industry.

Our destiny right now has not really placed us to where we can lead in that destiny.

Now, I no longer talk about what I'd like to see. I'd rather talk about what we could see. I hate coming to any session and just whining about blah, blah, blah, right? Because there's plenty of ways you could do that. I'd say here's what we could maybe see. A focus on efficiency, you can use the tax code to encourage efficiency. Efficiency is a great thing. It helps consumers, it helps spawn industries. I think that would be really good.

Some kind of indication. What I'd say, clean energy standard, they didn't pick a technology or a fuel, but basically said look, let's get our carbon footprint to X by a certain date, maybe pick the utility industry, fuel agnostic. Coal could get there if it did certain technologies. Gas could get there. I think that might be possible, and in many ways what we have today is almost too many energy policies or none at all, but something like that would be helpful.

A way to nurture investment, kind of what RPE has done. I do believe that that helps some of the small companies get launched. And then a good export policy. In other words, our market here is not going to be that big. GE might make 120 heavy-duty gas turbines in Greenville, South Carolina, every year. Five go to the U.S., one hundred fifteen go outside the United States. So, a good export policy.

And the last thing I'd say, Bruce, is just words like green have killed this movement.

MR. KATZ: Right.

MR. IMMELT: It's so precious, it's become like such an elitist indication that I think we have to talk about energy security, energy efficiency, job

creation. This has to be reformulated and remarketed and repurposed because it's just become an elitist us versus them, and that's never what -- this has always been about technology, job creation, productivity, American leadership, and it all got lost, and so, I think that's how I'd end.

MR. KATZ: Okay, prefect beginning. You took it exactly where I wanted to go, to the practical what can we get done?

Mac, we're going from the large to the small, and you are at the cutting edge of a sector which I think actually has captured the American imagination. Electric vehicles, I mean, a completely different vision for mobility in the country. But, as we all know, has profound effects on place, the infrastructure necessary to support it. Where do you see the future moving, and really given Jeff's great matrix, where does policy fit in?

MR. HELLER: Thanks, Bruce. Let me zoom right down to ground level from the heights of policy.

Coda, as many of you know, is an electric car company and an electric battery storage company for vehicles and for grid storage, and so, we're a technology company, but we're also a consumer-facing company. And as we think about innovation and the United States and job creation, let me start with a couple of things that I think are working. First is privately-funded R&D. U.S. investors have created U.S. numbers that are higher than the private investment numbers for other countries around the world, and I'd like to go further and say that the U.S. R&D allocators have been shrewd stewards of capital and the returns or the discoveries per dollar, the patents per dollar have generally been

superior.

We discover in the United States many, many commercializable technologies, and so, that brings me to the second thing that I think is working well, which is the discovery itself. When you go through our area, if you want to look at a high-spec lithium-ion battery system, look in the Mars Rover, look in the B-1 Bomber. Everything, as we look forward from smart grid technologies to vehicle to grid technologies where electric cars will be distributed, storage for utility grid systems, and you may be selling power back into the grid as your car sits in the garage at night, a very high proportion of that discovery takes place in the United States. So, the two things working well, private funding and discovery.

Where we fall down, however, is the next two steps, and the first is creating -- Jeff mentioned this -- large and dependable home markets for these technologies. If you invent something here, you may well decide to market it first in the EU or in Asia.

Why would you do that? You would do that because governments in those places may well have created the sustained regulatory structures and the sustained price signals that are necessary for the successful and secure commercialization of new technologies. It will be a more secure market for your product somewhere else. This is a very big issue. And when you combine it with those other nations, generally higher or better rate of change public investment in R&D. The picture for U.S. innovation begins to get a little bit dark.

So, let me turn to the second area where I think that we need to

improve, and that is manufacturing. Would it upset you to learn that lithium-ion battery technology was actually invented in the United States back in the 70s, but in terms of manufacture, until very recently, there was no scale manufacturing of lithium-ion batteries in the U.S.? That was done in Korea, Japan, China. It should not be that way. So, we need to fix these two things: creation of large home markets and the establishment of domestic manufacturing because here's where I could become quite concerned as we move forward, and this is a very important point.

A number of people have mentioned the Consumer Electronic Show in Las Vegas. I was there on Friday. When you look at that show, you realize the following observation: If the center of manufacturing and of initial consumer adoption or industrial adoption of new, clean technologies is outside the United States, the locus of innovation will follow. In other words, as EVs and associated devices gain broad consumer adoption in the next few years, we will receive so much data about how consumers actually drive, how batteries actually charge and discharge, and how consumers will modify their vehicles, and that's what the CES was all about, that the next technologies will spring directly out of that consumer innovation feedback loop, and if you are not sitting in the geographies where that feedback is taking place, you will loose your innovation edge.

So, having made the picture a little bit dark, how do we solve this? I've got a couple of ideas, and, by the way, this doesn't necessarily have to involve government money. Outside clean technology, I will give you the

example, remind you of the example of seatbelts and airbags. This is decades ago that when they were two new technologies, initially, to some extent, opposed by the industry because they were said to be expensive and because consumers, it was said, would not favor them. What we did in this country is introduce a sustained federal policy and used that policy to drive volume and use that volume to drive costs down, and the result, as we all know, has been the saving of tens of thousands of lives.

So, putting issues, as Bruce has counseled us, to speak in the world of the real, putting possible federal clean tech subsidies aside and putting aside taxes on carbon, although I will note that other competitor countries have decided those policies are worthy of exploring, they've been enacted in various forms already by competitor nations, in the EU and Asia, and they are already having an effect in those nations of adjusting innovation and commercial behavior, consumer behavior toward a future more free from foreign oil than our future will be.

But putting those aside, let's talk about a couple of near-term things that could be done to foster innovation in the EV and battery area in this country. I won't go into these in great depth, Bruce, but Q and A may result.

Broad adoption of time of day electricity rate differentials, if you drive electricity usage from its concentration in the afternoon to spreading it more evenly over a 24-hour cycle, you foster renewable technologies and a whole series of smart grid devices, and you will learn in this country which innovations are most profitable.

Secondly, introduce a federal ZEV credit system. There are Zero Emission Vehicle credit regimes operating in California and about 13 other states. Those involve no tax dollars, and what they do is draw money from people producing only gasoline-burning cars and move that money through a series of calculations to those producing clean-energy cars. You could do that. There's also been discussion of a feebate ZEV credits applied to new cars, feebates are generally discussed for cars out in the vehicle fleet now.

Finally, acceleration of corporate average fuel economy standards. This has been something where the U.S. has made significant strides in the last few years in regulation.

We now include, for instance, the Lincoln Navigator as a car, but, as you know, the largest selling vehicles in the U.S. are the Ford F150 truck, et cetera. Those only recently have been included in this regime, and it's a good development, but on the numbers, all of our competitor nations are ahead of us. They are using that type of regulation to drive fuel economy and to drive clean technology transportation forward. We could do better there.

I'll stop, Bruce. There's a lot we can do.

MR. KATZ: So, Michael, you can talk about the full spectrum of this. Building on the last panel again, but I want you to focus on the effect of this transformation on American workers and families in this regard, and it really builds from what Jeff said before. When people hear green economy, what they generally hear is well, that's about the environment or potentially that's about tax. We're going to basically raise either specific taxes to lower consumption or we're

going to raise taxes to invest in certain kinds of infrastructure. What they don't hear are the benefits potentially from jobs created or for certain kinds of jobs created that pay certain wages and incomes. What is the fuller opportunity picture as we sort of talk about the transformation of the economy?

MR. GREENSTONE: Yes, I was going to pick up on Jeff's comment about green is too precious. I think that's right.

I think two of the most urgent problems that the country faces, although it's not the topic we've been tasked to talk about, the first is American competitiveness is at risk. And it's not at risk tomorrow, it's at risk today, and it's been at risk for the last three decades. There's a series of statistics that are familiar probably to most people in the room.

The median wages have stagnated for the last three decades. No real income growth for most families. Male labor force participation is down. Our share of high-tech exports in the world has declined from 20 percent to 12 percent, and I think all of that together kind of threatens in some sense the American dream in the following sense: At the core of this country, it's been that each generation does better than the previous one, and I think for the first time, we're seeing over a very extended period of time that that's not the case, and ultimately I think that can tear at the social fabric that holds the whole country together. So, I'd say that's problem number one.

And the second problem, which Jeff and Mac have alluded to, is kind of an energy problem at large, and you can see that in our dependence on fossil fuel, you can see it in our energy security, and then you can see it, lastly, in

climate change. And, again, these are not problems that are going to appear tomorrow, they're not problems that are going to appear in a decade, they're problems that are here today.

In the case of our fossil fuel dependence, there's no question that our foreign policy is constrained by a reliance on importing oil from the Persian Gulf, a region that is unstable at times and not always friendly to the United States. The warming of the planet is now unequivocal. Temperatures are rising, and they're doing so at a rate that the planet has never seen before. And the problem with that, of course, is that fossil fuels are the cheapest source of energy. That's why we don't have a climate policy, that's why we don't have a tax, that's why the world doesn't have a price on carbon.

And I think what Jeff and Mac are trying to do is bring down that price differential, and I really think that finding a way to bring down the added costs of low-carbon energy is really central to solving these two problems that I think are two of the country's most urgent, if not the most urgent problems.

And just to put a fine point on it, I think the economy that innovates to reduce the cost of low-carbon energy will have effectively built the better mousetrap, and once that happens, the world will come and buy lots of mousetraps and nice cars, and the millions of things that Jeff's company builds.

And so, I think you want us to focus on policy. We can all say a prayer for a price on carbon, but that's not happening very soon, I think. I think there is a path forward that can solve these two problems that is available and is not quite so gut-wrenching as we seem to find the price on carbon, and that

would be to undertake a serious energy R&D program for the country and that it's focused on low-carbon energy. And it's very important that that be focused on the R&D not that private companies do, but the R&D that produces knowledge that private companies can take advantage of, and that's the kind of R&D that private companies can't do. Their investors wouldn't allow it.

And let me just give you a sense of the scope of the problem in that area. In 2009, we devoted 1-100th of 1 percentage point of GDP to basic energy R&D. Among the top 12 countries that spend the most in OECD on energy R&D, we're in 12th place. And, in general, we have a R&D policy in the energy sector as opposed to in health and other areas that's been focused on deployment of existing technologies rather than a program that is focused on developing the new ideas that can bring down the cost differential of low-carbon energy.

So, I guess my answer to your question is: The path forward that I see in the immediate future is a serious commitment to doing energy R&D and doing it in a way that this country has done in several other arenas. The NIH and the NSF are hallmarks of politics-free science, and we should do something like that in energy.

MR. KATZ: So, let me ask all three of you this question because I think it sort of connects together some of the initial responses. And it's something that Mac said that I think I'd like you to drill down on. I think there is a growing consensus, not the money on the table yet, that the U.S. needs to invest in advanced R&D on the public side to complement the private side. So, the question then becomes: Does the U.S. continue to be the place that generates

the ideas that cracks the code, but then sees production in deployment basically happen abroad?

And, Mac, what you said is that if we do not produce more at home, we will innovate less over time because of the interplay of innovation and the production cycle. So, how do we make this link better now in the United States, if not at the national scale, then at the subscale between idea generation, invention, and ultimately production and deployment?

It gets, Jeff, I think to your point of can we be a manufacturing base, but for what, and what has to change to make that happen? Anyone want to take a stab at that initially?

MR. IMMELT: Well, I have a slightly different spin, not that mine is right. I think markets -- practitioners generate ideas, and in that regard, we are not the biggest market. I think the first panel, we're kind of the biggest media market, we're kind of the biggest Internet market. When you look at the gigawatts China is going to build, their car market is bigger than ours, their aviation market will be bigger than ours by 2025. So, we don't have really the market that's going to generate practitioners anymore, and the way you compensate for that, or at least what Europe's done, is through public policy. If you want to win. If you decide solar energy, you pick it, nuclear, I don't want to be the one that picks it.

MR. KATZ: Right.

MR. IMMELT: But if you pick it, you have to either do one of those two things. Now, actually, look, we're not a bad manufacturing country. With

lien, manufacturing, with productivity, labor is a percentage of all these products, is relatively small. This is all about the science of manufacturing, workflow, work methods, IT, but if you're in a solar plant, labor is a pimple in terms of what the cost of the product is. So, we could make any of these we chose.

These are high-tech, low labor content, differentiated products. So, I think in the interim, while we're not sure which one we want to be, I think companies have to -- GE has got to do something with Exxon, Chevron's got to pick somebody else. We have to work as an industrial complex to say we're going to work together to make electric vehicles a reality. Whether or not there's public policy, what there is, because we think there's a chance this is a trillion-dollar market, and I want to be first.

And at the end of the day, I don't care what the government does. I'm not going to wait for that. I'm going to say we're going to buy 25,000 electric vehicles and we are going to have as good a chance of everybody of having the infrastructure associated with that because I don't think -- we're not going to be the biggest practitioners and I don't think anybody that wants to advance, anybody that's in that room betting on clarity in energy policy in the United States, man, you're not going to spend GE shareholder money on it. (Laughter)

MR. KATZ: Right.

MR. IMMELT: You can put your own money on it maybe, but that's a hard bet to make really.

MR. KATZ: Yes.

MR. HELLER: Bruce, if you're running a company, you have

trouble waiting for government policy in this country. You need to go forward. Having said that, consumers are extremely focused on this, not just in what they drive, but how their houses are, and, frankly, as we talked to consumers, they feel good about the environmentally-sensitive steps they've taken in every element of their lives from recycling to thermo-pane windows, and it is their transportation that remains frustrating to them.

And so, like Jeff, we believe that consumers in this country and others are more than ready for an EV revolution, and the reasons, they're not just green. Consumers talked to us about a desire to reduce our dependence on foreign oil because it is the single largest strategic weakness of our country. It is a matter of patriotism for them. They worry about our shipping billions of dollars, hundreds of billions of dollars every year overseas for oil, and that money is not coming back.

They talk about health reasons. They talk about wanting the U.S. to be a technology leader, and so, for many of our consumers, adoption of electric vehicles and broad-based EV technologies, including battery technologies, is a matter of patriotism.

I would also say that manufacturing in this country, I agree with Jeff, it's actually not about labor costs. You can do some simple math and instead of importing something from somewhere, if you thought Chinese labor rates were going to go up a little bit, if you thought the renminbi was going to appreciate against the dollar a little bit, if you thought over the next 10 years rising energy prices were going to increase shipping costs a little bit, very quickly,

the numbers on U.S. manufacturing begin to look relatively attractive. So, I agree.

It's not about labor costs, it's about where's the market. So, I think in retrospect, we need to look back at the last 20, 30 years in this country and wonder whether we, as a country, have put enough talent in the manufacturing.

Jeff and I grew up within 50 miles of each other in the same little corner of Ohio, and within a couple of years of each other. One of us went into manufacturing, the other into finance. Has too much talent in this country gone into finance and should manufacturing continue to be a skill in which we would aggressively compete in the world market?

MR. KATZ: Any thoughts on this, Michael?

MR. GREENSTONE: So, let me just say that let's just accept a couple of things that you all have said so far as a pragmatic set of things that we should focus on. More investment in R&D, some of the regulatory standard setting platform that has been discussed. I think your comment about where the U.S. market stands to some of our competitor markets is really the right setting here so we can compare and contrast with other sectors.

Let's talk about infrastructure for a second because if we're going to transition to a low-carbon economy, we do need to make certain kinds of investments in public infrastructure, whether completely financed by the public side or financed in a shared way with the private sector. The electric vehicle infrastructure, high-speed rail, if we're going to move in that direction. Metropolitan transit, the smart grid. Now, these are all shared kinds of

investments at the end of the day.

We've made some progress in this direction in the last two years, but, frankly, limited compared to our competitors, and we're in a fiscal environment right now where any new kinds of investments, whether they have high returns of the long run basically don't seem possible. So, given the broad market we're describing here, I mean, we're touching many different aspects of the transportation sector, the energy sector, and so forth. How do you think about the infrastructure conundrum? We are a first class economy, but every one of us who travels abroad comes back and says we have a third class infrastructure. How do you think about that?

MR. IMMELT: I always laugh, in the 2008 Olympics, if you went to terminal three in Beijing and then flew back to JFK, okay, now which is the emerging market and which is the developed market?

MR. GREENSTONE: Right, absolutely.

MR. IMMELT: Look, I think there's just no appetite for an infrastructure bank or high-speed rail or things like that, and so, I just don't see a tops-down solution. I think Mac hit part of it in that really one of the things that moves the needle in this country are consumers. I actually, before we made our investment in electric vehicles, went out and drove a couple of them. The Volt's a good car.

MR. GREENSTONE: Right.

MR. IMMELT: It's powerful, it's deadly quiet. I mean, I got out to do something. We've got a charging station at the office. When you plug it in,

you're empowered. There's a certain freedom about having control over your own -- you don't have to go to a gas station and stuff like that. It's in a consumer's fingertips.

MR. GREENSTONE: Yes.

MR. IMMELT: The same way if you know how much electricity your kitchen is using, you're empowered. You become smarter than your utility. You want that. I've had a utility CO that said consumers aren't asking for a smart grid. Well, in 1984, I was running a sales office for GE when they installed Microsoft Windows for the first time. I wasn't asking for Microsoft Windows, but it made my life better over the last 30 years or something.

MR. GREENSTONE: Right.

MR. IMMELT: So, I think getting the consumers to somehow taste demand, the power of a new energy future is probably, in the end, the only way -- it's either going to happen that way or you're going to have some disaster where a 70-year-old electricity grid in the Midwest craps out for 30 days and people say oh, my God, our electricity grid is 80-years-old.

MR. GREENSTONE: Yes.

MR. IMMELT: Maybe we ought to upgrade it. It's either going to be some kind of sudden disaster or consumer empowerment, but I just don't see the appetite with the deficits we're running and stuff like that for big investments and much of anything right now pragmatic.

MR. KATZ: No, no, that's what we want from this panel because I think one of the contrasts --

MR. IMMELT: I wish it wasn't true. I'd like to sell more stuff. (Laughter)

MR. KATZ: But one of the contrasts --

MR. IMMELT: But I'll sell it somewhere. I'll sell it in China, Turkey, or someplace else.

MR. KATZ: One of the contrasts in this area is the sense of possibility of the future and then this brutal reality of the kind of policy deficit we have here, which --

MR. IMMELT: I would just add but we need to reposition these things not as the burden you must face because of global warming is that you have to take this.

MR. KATZ: Yes, yes.

MR. IMMELT: That is a loser, right? What we have to say is these are great products, they're going to empower you, they're going to make you smarter, things like that have to be remarketed better.

MR. HELLER: If consumers were listening to this discussion, they'd say we've left you behind. We spent, a couple of years ago, a lot of time worrying about public charging networks and the capital required to do it and the federal-state interplay, et cetera, and then we started talking to consumers, and they said what are you worried about? I get home from work today, I plug in my phone. Today, they would go on and say I plug in my tablet, and when I get my EV, I'll plug in my car. It's not complicated. And so, consumers are way ahead of us in finding their way around these problems. Again, my message would be

we can't wait for a governmental policy in this country to solve these things. We need to solve it privately.

Do I worry about transmission insufficiencies? Do I worry about grid issues? Yes, I do, but EV adoption broadly, nationally, will take some period of time. There may be concentrated neighborhoods or cities in states like California, where it actually happens relatively quickly, but good news, the investor-owned utilities, the publicly-owned utilities, especially in California, but nationwide, are in front of this, on top of this. They've communicated with their customers. They're aware, down to the street, where EV adoption. We have a lot of demographic data. So, the private market is, to a great extent, taking care of this high-speed rail, absolutely for it. High-voltage transmission lines from wind farms, who can oppose it? But who can wait for it?

MR. IMMELT: Yes, it strikes me that if you compare this to the last panel, right, electric vehicles are like the iPhone of the clean tech transformation. I mean, and there may be a few other products that fit there. I mean, I've been to sort of Microsoft's imagining lab sort of looking towards the homes of the future, which talk to us. I'm not sure I want to talk to my utility directly, but I want mine talking to my home occasionally.

MR. GREENSTONE: As Jeff was saying, if you can make money selling power to your utility, you'll warm up in a hurry.

MR. IMMELT: But I think it gets to this question of the consumer end of this. With products being sexy and constantly evolving and with brands sort of emerging from that, both in the company and the products so that people

are anticipating the next thing, that has a transformative effect in markets. It ultimately should be complemented with smart policy, but you're right, we can only wait so long.

For some of these other things, they are large, collective investments, and maybe the consumer revolution is efficient enough to drive more political palatability for it or maybe we are waiting for that shutdown of the grid. I don't know.

Michael?

MR. GREENSTONE: Yes, I think both Jeff and Mac make an excellent point. Consumers will lead the economy in particular directions. It is also important to keep in mind, I think, the current fiscal situation, and really think hard about what we're trying to achieve with policy and electric vehicles certainly will be an important component of reducing our dependence on foreign oil, and the smart grid may potentially be useful in reducing energy consumption. I think the jury's out on that. But without some direction from government, these changes in consumer behavior are unlikely, I think, to make a significant dent in carbon emissions.

And so, the degree that the problem that we're aiming it is climate change, there really is no substitute for finding cheaper ways to produce low-carbon energy and for price in carbon at end of the day. And, I mean, the electric vehicle will be great for reducing foreign oil dependence, but right now, we're going to plug it into a coal plant.

MR. KATZ: Right, absolutely. So, last point before I open it up,

which is we are not Britain. We're not waiting for someone in White Hall to make a bunch of rules. If the federal government does get polarized to the point where they can't move on some of these platform setting things, as Michael describes, how do you all think about the next level down, the states, and what they potentially can do with California obviously being a leader, New England being a leader in some respects, and how do you think even a level further down, cities and even metropolitan areas deciding to leap to the head of the line?

MR. HELLER: Let me go through the list, and it's a long list, and there's a lot of creativity. States and cities are already doing day versus night electricity rates. They're already allowing single driver EVs into the HOV lanes, the High Occupancy Vehicle lanes. They're creating charging posts in state office buildings. They're accelerating permitting process to put a GVEVSE in your garage. They're creating a whole series of amenities. When you drive up to any parking structure, there are a certain number of handicap spaces. Maybe there should be a certain number of EV-only spaces.

So, there are a whole series of consumer facing and grid facing innovations that are going on at the state and local level, and the ZEV credit regime that I mentioned earlier is a very significant one.

MR. IMMELT: And some of those seem completely aligned with the fiscal moment. They are low cost, high impact, market transforming.

MR. GREENSTONE: Correct. States have no more money than the federal government, obviously, so, they generally involve no expenditure of state dollars.

SPEAKER: I agree. I think it can only be positive.

I'd take the other end of the spectrum, the State of Georgia, that probably the only nuclear power plant that'll be built in the United States let's say this decade will be Southern Company in the State of Georgia, and this is specifically driven by the PUC in Georgia and the rate base Supporting Southern, who's a great utility, and that's on completely the other end if there's going to be any kind of renaissance in nuclear energy, they're actually doing something about it.

MR. IMMELT: Right.

MR. KATZ: And, specifically, a company and a state and a PUC that's taking that action.

MR. IMMELT: Right, and it sort of brings into focus these public utility commissions and the utilities themselves, almost like the FCC in the info conversation, which generally are not thought of as the lead --

MR. KATZ: In cabinet agencies.

MR. IMMELT: Cabinet agencies.

MR. GREENSTONE: In California, the day-night charging, the California PUC calls it the EV tariff. So, local and state regulatory authorities are farther ahead than you may think.

MR. HELLER: I actually go back. I basically agree with you. In other words, if you're ever going to move the needle, you are going to have to have a price for carbon or something like that. I guess what I try to think about is what do we all work on in the interim because the biggest mistake the U.S. could

make is just not doing anything right now on the clean energy future, and there's a danger of that. So, what are two or three constructive steps that could be taken while there's not going to be anything more significant that happens?

SPEAKER: Yes, I think the state and local governments are playing a role. The State of California has been a leader at basically every significant environmental policy we have, it started in the State of California. But it's a big ask, and I think we shouldn't underestimate that. Because if you cut through all of it, basically we're asking a small set of citizens to pay a higher price for something.

SPEAKER: Absolutely.

SPEAKER: And to the benefit for the rest of the country, and in economics, we would say that's not an equilibrium. People aren't willing to do that forever. And I think this can help provide some signals that will be important for corporations and companies, but at the end of the day, it's not going to solve the problem.

MR. KATZ: Transition point for a comment. So, Bill, do you have a question? Perfect.

MR. ANTHOLIS: Bill Antholis from Brookings.

The question is to Jeff. You sell things everywhere, you make things lots of places, but not everywhere. The places where you're making very high-tech, efficient, clean energy things, have you noticed a change since you've invested in those places in their own attitudes about buying these things? In other words, does Greenville, South Carolina, suddenly become much energy

conscious consuming as metropolitan areas in terms of the kinds of things they purchase back from you or others? Or does it not make much of a difference?

MR. IMMELT: Look, I think it's always up to us to connect to dots, but it does. I think our employees' awareness about what they do and what impact it has and the fact that the company has had a big clean energy initiative since 2004. So, we basically decided in 2004, as part of our clean energy initiative, that we were going to run GE under the guidelines of the protocol, that we basically had a specific carbon footprint reduction. And since that time, we've done like 6,000 employee projects that have been from the factory floor on up. We save $100 million a year. Because it's a knee-jerk to say if we have to do all this clean energy crap, our costs are going to go up, that all this stuff means it's higher costs.

And I try to explain, like Wal-Mart's the lowest cost. I mean, I've made a living selling stuff in Wal-Mart purchasing rooms, right. These are hard-nosed guys. If they're driving a waste reduction clean tech revolution in Wal-Mart or GE is, this isn't really about high-cost, fancy stuff in the end. It's about waste reduction, productivity, energy savings, and things like that. So, I'd say our employee base, not just in the U.S., but everywhere around the world is quite in tune with clean tech because we've kind of educated them on it over a long period of time.

MR. KATZ: I've got questions back here. And I know there's some media in the back, reporters have particular questions.

SPEAKER: I have a question for Chairman of the Board of General

Electric, Jeff Immelt. I have a particular question for you. Maybe you know there was a Russian-U.S. agreement on civil nuclear preparation and it was (inaudible) in December, and if I'm not mistaken, your company, General Electric, commented on it on federal register.

What is your position on this agreement? Thank you. If you are aware of this.

MR. IMMELT: I don't know how to comment specifically on that specific agreement. I think the nuclear industry is kind of a sovereign industry. It's really a country-to-country business today, and we'll see how it evolves over time, but it is a sovereign industry today.

MR. KATZ: One back here, yes, and then in the back. Yes. And then we'll move back up again. Thanks.

MR. FELLER: Gordon Feller with Cisco Systems.

I'm interested in the apparent death of the debate in Washington about the National Infrastructure Bank and other initiatives designed to finance both infrastructure and provide the kind of project finance that will help companies in the clean tech space with their Valley of Death problems, and I wonder, Jeff, especially, if you could talk about GE's view on this and where perhaps Coda might differ with your views, given their position in the ecosystem.

MR. GREENSTONE: Again, we think the National Infrastructure Bank is a good idea, providing access for these long tail projects. It gets scored, if you're talking about deficit reduction and things like that, the infrastructure bank gets scored in a particularly negative way, which makes it quite problematic in

the debate on deficits and things like that. Now, but we're in a world now that's got a lot of equity. So, I would say it's different today than it was two years ago.

MR. IMMELT: Right.

MR. GREENSTONE: Where there's actually excess liquidity and good financing projects that have outside the U.S. (inaudible) and tariffs and things like that or getting capital today in ways that they didn't get two years ago.

MR. IMMELT: Excellent point.

MR. HELLER: I have little to add to that. Coda was born and grew up during the financial crisis in this country. We'll be hungry our whole lives, and it's not a horrible discipline, and every company would like a proliferation of government policies to aide it, but every company needs to calculate ways to survive on its own.

MR. KATZ: That's great. Good. I've got one back there. There's a gentleman in the middle, and then we'll come over here. Thanks. And then move to the side.

SPEAKER: Thank you. My name is Umay Yama from (inaudible) company, Washington, D.C., office.

The innovation should be eventually eroded by market share of the products, and as Mr. Immelt said, U.S. market is not necessarily the number one market. Now global market is important. To dominate the global market, probably de facto standard for specification for EV probably battery charging stations specification, whatever, may be important, but also to promote the culture of how to use EV may be important. My point is how do you think you

would strategically pursue the market share, global market share? Of course, government may be able to help on the policy and the international export initiative, but myself, I think partnership is very important, international partnership is very important to have the dominant share. What do you think about that?

MR. IMMELT: The whole electrical vehicle market is in its inception. So, it'd be like we're getting dressed for the game in the locker room. The game really hasn't started yet. So, this is all out there to be decided. We are convinced that we think it's a good market and one to invest in. We don't know what we don't know, so, we want to try things.

One of the advantages in GE is we've got a big balance sheet and we can try things. So, we decided that we're going to put half our sales force in electric vehicles. We made the biggest commercial purchase in history. We're going to try to put our own charging technology to play in this endeavor, and we're going to let it go as it goes, and then we're going to have some partnerships, and we'll probably try six different things about how if the electric vehicle business structure works. We're not going to marry one technology. And so, if we do enough experiments right now, they're not all going to be successful, but one or two will be, and this market will play out over the next 10 or 15 years. But we have all these long debates like about nuclear power. In this country, there's never been so much discussed for so little activity. (Laughter) The main product of the industry right now are press releases. (Laughter) It's not actually building plants and things like that. So, I think the key

--

MR. KATZ: Those are American jobs. (Laughter)

MR. IMMELT: The key to energy, I think, is you never know the endgame, you have to try things because what gets down to learning curve, it may not always be best in breed that wins. We're in the health care business, best in breed almost always wins in health care. in energy, like the third best idea, well executed, usually wins. Because it's all about cost and access and all those things, and so, that's why I want us to be engaged in a half dozen EV experiments with partners.

MR. KATZ: That's right. How about three questions? I'm going to move to the right. Not a political statement. And then we'll have rapid fire response because I know we have the next panel.

MR. GRIFFITH: Hi, my name is Scott Griffith. I'm CEO of a company called Zipcar based in Boston.

I want to follow Gordon's question. Infrastructure banks sort of went for a whiff, I guess. Something that is probably coming up this year is the highway bill, the reauthorization bill. Do you have any specific thoughts on what can be done or should be done that would be smart policy to move us in a direction on either transportation or energy or just smarter urban living that ought to be in that and considered? Interested in your thoughts on that.

MR. KATZ: Okay, hold that thought. Next question. Just a few more, and then we'll go to rapid fire.

MS. HUDSON: I'm Florence Hudson with IBM, and I totally agree

with your ideas of partnerships and ecosystems to derive and deliver new value in this green economy. You mentioned GE and Exxon. We're involved in smarter building coalitions between building management system companies and IT companies to elaborate the data and help people reduce energy use in buildings. There are grid coalitions.

What are some of the areas you wish we would all help to create ecosystems and partnerships to deliver real value for this green economy?

MR. HELLER: There's a substantial need for information on how will people really drive, how will people really charge? A surprising number of cities in this country are actually transportation islands. You tend not to drive. Texas is not that way. California, to a great extent, is that way. Why is that? So, there's a lot of information about how do people drive, how will they drive?

This is Jeff's point, you can't sit here and decide that consumers require 100 miles of range, require 150 miles of range, et cetera. You need to learn about that as you go. If you decided for sure right now, you'll certainly be making a mistake. How will consumers want to integrate their E V with their other electronic devices, be it a nav system, a dashboard of performance of the car, where a telematic is telling me where is the nearest charging station, et cetera. Will people charge at home, will they charge at work, will they charge in front of a 7-11 or a Wal-Mart, or will they charge on the I-5 on a charging station? All these are information gathering functions, and we look forward to working with IT companies to do that.

MR. KATZ: Any response on the transport bill or on this particular -

-

MR. GREENSTONE: Yes, on the transport bill, we are in this period of fiscal distress, and I think it provides an opportunity for the government to think about problems in the way business people think about problems. And the way we've historically done transport is kind of let it seep out to the political system, let the political system do whatever it wants to do with it. There are no measurements of return, there's no measurement of which projects have high payoffs and which projects have low payoffs. And this transport bill is a real opportunity to use kind of like very low-level cost benefit analysis and the kind of things that these guys do on a day-to-day basis, and that could be a model for how the government should invest in many other areas. But there's a real opportunity.

MR. KATZ: Any thoughts on that particular piece of --

MR. IMMELT: No, I think the highway bill is good answers I'd give.

On the IBM question, I actually think commercial real estate is a great one. The one you brought up. I actually think the more pragmatic energy conservation, the low-hanging fruit, those are places we ought to just be all over right now, and commercial real estate is a perfect example of one where there are big opportunities, very economically-driven.

SPEAKER: Can I jump on that?

MR. KATZ: Yes.

SPEAKER: In this whole drive to reduce energy consumption, there are a lot of myths out there, and what I think we really kind of have to do is

separate the wheat from the chaff, and it may be in commercial real estate, there's great returns to energy efficient investments, but, frankly, like there's not a body of evidence to point to. I mean, there are some companies that are able to do it, but in the residential sector, as far as I can tell, there are a lot of claims, but there's not a lot of evidence. If I were in charge, I would set out to try and understand where the returns are high and where they're not.

MR. KATZ: So, we have to move to the next panel. I would just say the sum up of this is that we are going to transition to the low-carbon economy, the clean tech economy in a different way than just about everyone else in the world. It will be consumer-led, it will be company-driven, it will be market evolution, and policy will come in and out of the focus, whether at the national state or local level. So, this is going to be the grand experiment really, and we'll come back in five years and we'll see where we are, vis-à-vis China and Germany and a whole bunch of our other competitors.

But excellent panel, and now we're going to turn it to Peter Singer. Oh, everyone should stay in their seats because we're going to move directly to the next panel. Thank you. (Applause)