

Remarks by the Honorable Ray Mabus
Secretary of the Navy
Energy Roundtable

Speakers:

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Moderator:

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PHYLLIS CUTTINO: Gentlemen? Well, good morning, and welcome to the Energy Roundtable. Our words for the day are “power” and “presence.” I’m Phyllis Cuttino. I direct the Energy Initiative at the Pew Charitable Trust.

So Pew is a nonpartisan, nonprofit research and advocacy organization that works to improve policy, educate the public, and invigorate civic life. I also direct something called the Pew Project on National Security, Energy and Climate, and we look at the intersection of those three issues and have spent a good deal of time of late really examining what not only the Navy but the other service branches are doing when it comes to energy challenges and opportunities. And it’s really in that capacity that I’m here today and going to act as your moderator.

So, a couple of things. When you came in, I hope you all had a note card on your seat. We’re going to have plenty of time for Q&A today. And so if you would, if you have a question at some point throughout the – throughout the conversation, please write down your question. And you can pass it to – down and we’ll have folks in the aisle who will bring them up and provide them to me.

We’re going to have a great conversation today. I’m very excited about it. And, you know, I think having the video was a great start because it really honed in on some of the really exciting innovations and purposes about the way we’re using energy and changing the way we’re thinking about energy.

I think, in reality, most Americans don’t think much about energy unless they’re filling up their tank or, frankly, the lights go out – something that Mr. Crane’s going to tell us a little bit about, probably – but energy is the third-largest industry in the United States. It is a global market that is \$6 trillion. And it enables nearly everything that we do, right? And it supports an ever more sophisticated and interconnected and, frankly, instantaneous economy.

And what's interesting is that it is a sector right now in the midst of a remarkable transformation. And that's really interesting because change is not easy in the energy sector. It's no easy task. And the sector has been notoriously stubborn when it comes to change. I mean, it has traditionally taken years for innovations to move from the lab into the marketplace.

And so, you know, frankly, we just kind of can't let another hundred years pass for the energy system to change because, really, our energy system, until just a little while ago, really looked like it did, frankly, almost a hundred years ago. But we have to force transformational change. We have to embrace change because our economic competitiveness, our national security and our environment all depend on accelerating this shift to clean energy sources and really pushing for innovation.

So today we're going to talk about how innovation and driving change in the energy sector is happening, and kind of what are the opportunities and challenges that are associated with that. And we're very lucky because our panelists today are all leaders. They're all game changers. And all of them are at the tip of the spear in their sectors.

So Secretary Ray Mabus needs no introduction. He is certainly a game changer for the Navy in the mold – of the mold of Teddy Roosevelt. Teddy Roosevelt ushered in the Great White Fleet in the early 20th century. And a hundred years later, from the earliest days of his tenure, Secretary Mabus has championed the great Green Fleet and challenged the Navy to obtain half of its energy from alternative sources. His vision for a Navy is a lot of what you saw —the result of which are a lot of what you saw just in this video. It's to make the Navy more secure, more independent, more effective and ever-more lethal – so his pioneering leadership on energy efficiency, biofuels, renewable energy, and increasing mission assurance on bases, and enhancing operational reach in the sea, in the air and in theater. So he's preparing the Navy for the 21st century. Welcome.

David Crane is a game changer in the utility industry. He's the CEO of NRG Energy, a company that's capable of powering one-third of the United States population. Many believe that he is the electric sector's most visionary leader. And he's really recognized that the 100-year-old model of a central power generation is yielding to a new, more distributed future that utilities can really access: solar and wind and energy efficiency, deploy microgrids and demand response instead of the kind of old, traditional, enormous coal-fired power plant. Energy's first-mover position is embracing competition and offering consumers a variety of choices.

And Mr. Crane's also been on the forefront of efforts to make the electric system more resilient to outages in severe weather, something we've all experienced. Remarkably, the United States suffers more outages than any other industrialized nation. And I've actually never forgotten a speech that Mr. Crane gave several years ago – and I hope he'll remember this; it made a real impression on me – in which he talked about the inherent vulnerability and even futility of an electric system that depends upon and is held up by 120 million wooden poles that are imported from Canada. (Laughter.)

So, finally, we're lucky to have with us Ira Ehrenpreis, and he's a game changer in the world of finance. Financing is the real fuel that drives change in the energy sector, and America has – and has always and continues to lead in terms of the innovation that is transforming the energy sector. And Mr. Ehrenpreis and others have been at the forefront of venture capital investments that are helping to not only incent but scale up pioneering energy innovations that David Crane and Secretary Mabus can really take advantage of. He's making the smart bets in companies that can achieve what he calls a double bottom line. That's a strong long-term financial success as well as positive social, environmental and economic impact on local communities.

And in addition to his day job, he is on a stunning array of advisory committees for institutions like the Department of Energy, the American Council of Renewable Energy, the Cleantech Venture Network. The list goes on and on. But perhaps most importantly in terms of advisory capacities, he is on the board of Tesla, which is the coolest car company in America and a game changer if there ever was one. So welcome, all, and welcome to our panelists. Thanks for joining us today.

So let me start – let me start the conversation with you, Mr. Secretary. You know, I've talked a little bit about the transformation that's going on in the energy sector. And of course there are global security developments; there are environmental developments that are – that are really going on. But, you know, since the day that you assumed your role, you've really made energy a priority. And how did you – you know, how did – why did you decide that we needed to do – the Navy needed to do things differently when it came to energy on bases, at sea, in the air? What was it?

SECRETARY RAY MABUS: Well, there are a whole bunch of reasons but the main one is that energy is a vulnerability. Energy can be used as a weapon. And if you need to have an example of that, look what Russia did in Crimea, look what Russia did in Ukraine, look what Russia is trying to do in Western Europe, and I didn't want that weapon used against us.

Navy ships are the most vulnerable when they're refueling. The Marines in Afghanistan lost a Marine – killed or wounded – for every 50 convoys of fuel we brought in. That's too high a price to pay. And so diversifying, number one, our sources of energy and making sure that we had some competition, making sure that we were not dependent on one single source of energy, was important so that it couldn't be used as a weapon.

Price was also in there, because you look at the price of oil, and it goes up and down but it's going, long term, in only one direction, and my first couple of years I was presented with several billion dollars in unbudgeted fuel prices because of the price of oil had increased. And it's a worldwide commodity and we cannot control it. And there are not many places even in the Pentagon to go get a couple of billion dollars.

MS. CUTTINO: So where does that money come from particularly?

SEC. MABUS: Well, it comes from – it comes from things like we have to take it out of training. We have to take it out of operations. So we fly less, we steam less, we train less. And if the bill gets too big, we buy fewer platforms. We buy fewer aircraft. We buy fewer ships because we cannot afford to fuel them. And neither one of those seems to me to be a really great option.

The third reason was that I'd been the ambassador to Saudi Arabia and I'd seen the world oil situation. And I keep remembering a quote from a former Saudi oil minister, Zaki Yamani, who said: The Stone Age didn't end because we ran out of stones; it ended because we invented something better. And the Navy has always been on the forefront of energy change: sail to coal, coal to oil. We pioneered the use of nuclear for transportation.

And every single time we did that there were folks that said, this is nuts; we can't do this. You know, in the case of wind: You're giving up something free for something that costs money. When we went to oil: You're giving up all these coaling stations around the world. What is wrong with you? In the case of nuclear: You will never get a nuclear plant small enough or safe enough to fit inside a submarine. Every time, they were wrong and the naysayers are wrong now too. We're on the front of energy change. And like you said, change isn't incremental. Systems tend to go along and then they just change. And because of people like the other two panelists, I think we're on that edge of that tipping point where the system just changes.

And the Navy is doing it for one reason, and you heard that on the video. We're doing it to be a better fighting force. Now, there's lots of inside effects. There's price, there's climate change, there's all sorts of being a better steward of the environment. But the main reason we're doing it is to be a better military force. And we're so big in the military – the Department of Defense is the largest user of fossil fuels on earth – we're so big that we can bring a market and can be – and then we turn to the private sector to provide that market.

MS. CUTTINO: So, wow. Well, I'm sure that NRG Energy is interested in being a partner, if they aren't already a partner of the Navy.

Now, energy is one of the largest solar developers. You have the largest electric vehicle charging system. You've really embraced distributed power and are providing greater choices in control, which is something as consumers we like. So why did you decide to drive that change within your company? Why did you seize that vision?

MR. CRANE: Well, as you said, within the private sector there's probably no sector that's been less innovative over time, over my career, 30 years, than the energy sector, and particularly the electricity sector. And that has to do with some ways in which it's structured as state-regulated monopolies where they won't pay for risk-taking or anything. But the historic mission of the electric industry in the United States was to provide safe, affordable and reliable electricity.

You know, 20 or 30 years ago people started to obviously worry about air quality, and particularly initially with acid rain and ozone depletion, SO_x and NO_x, and when the federal government passed the Clean Air Act amendments in 1990. And at that time the industry said, oh, we have – you know, we don't have the technology; we have no way of doing this; it could be ruinously expensive, and all these things. The government says, well, yeah, but you have to do it. And the industry, through embracing technology, found a way to deal with SO_x and NO_x.

And to this point, when I meet – you know, I spend time with college kids, high school kids. I'm like, how many of you – and these are environmental students. I'll say, well, how many of you think there's a problem with acid rain right now? And they're like, what's acid rain? And I'm like, well, in 1990 acid rain, that's all we talked about back then. Then we went through mercury and now we can deal with mercury. And so obviously the issue – the sort of existential issue now is dealing with carbon and greenhouse gas emissions, of which we are the largest emitter. The U.S. energy sector is the – well, second to China is the largest emitter.

And you said NRG is a big company. We emit 100 million tons of carbon into the atmosphere every year. And so we are embracing all those things because, you know, our board made a decision several years ago that there was going to – I'd like to say it was based on core values, and certainly that played a role in it, but it was also, you know, good to sort of say to the board, look, society is not going to let us do this, you know, that much longer, so we better get started. So ourselves and some other companies sort of thought, well, you know, this is coming, so since things don't happen overnight in the power sector we better get at it.

But the other thing – I mean, some things – I mean, like you say, electric vehicle charging, the thing that's – that has been the biggest change in my career in the American energy industry is – you know, the defining event when I was a young person was the two oil crises, the two oil shocks of the 1970s. And every energy executive in the United States – you know, in Silicon Valley, where Ira is from – you know, there are some 30-year-old CEOs and stuff like that, you know, but in the energy industry, if you're a CEO you're, you know, at least in your 50s, you know.

And so everyone grew up and spent their entire career in a period of perceived energy scarcity. And so the private sector in a capitalist society, you know, is driven by a very primitive supply/demand, but in our industry, unlike some other industries where people become experts at stimulating demand, everyone in the energy industry in the United States who's an executive spent their entire career worrying about nothing but supply. You know, whatever we can produce, whatever we can pull out of the ground, society will use and they'll pay us good money for it. Now, due to technological change, we actually live in a period of overabundance in this country, but it's uneven. You have to get it places and things like that.

And so there are other motivations going on. And to me, things like electric vehicle charging, from my perspective, yeah, I want to take market share away from oil, you know. And so some of the things we're doing, getting electric car charging – you know, I think a thing that's very important now in a period of changing climate is connecting renewable energy with water, fresh water production, you know, straight – you know, when California says, well, you know, I'm not sure we can handle 50 percent renewables – and they have this problem now. They have too much solar power at 3:00 in the afternoon. I said, well, then you also have a big water shortage. Why don't you actually make fresh water, you know, with all that extra zero marginal cost?

And so I think the military, and particularly the Navy, is in such a great position not only to – for your own mission but also to lead society not just with the scale of your purchasing but your ability to – because you're able to plan for the long term, which the private sector often is not, and because you have situations like what I would call true islands – you know, because they're true islands like Diego Garcia, where you can bring all the systems together and pioneer integrated technological solutions that then could find their way into private sector and to society generally, because to me that's the next step right now is all these technologies exist and are being deployed at scale, maybe not quickly enough, but they're in the siloed world that we've lived in. You know, power does power. You know, liquid transportation does liquid transportation. Water is produced by the water utility. And the idea is to bring these things all together because they're all synergistic with each other.

MS. CUTTINO: Better integration –

MR. CRANE: Yes, absolutely.

MS. CUTTINO: – for multiple purposes, financial –

MR. CRANE: Yeah. And to your point, I do have to just say we're still based – we've still got a country, a 21st century country, that's dependent on 120 million wooden poles. You say they're from Canada. I actually thought they were mainly from Michigan, which is – at least it's part of the United States, so –

MS. CUTTINO: That would be – that would make me feel a little bit better, right.

MR. CRANE: Yeah. Well, I know in New Jersey, where I lived through Superstorm Sandy, that the biggest import – state-to-state import after Superstorm Sandy was, you know, wooden poles from Michigan into New Jersey. So that was – because that's what we do in this country is we rebuild the antiquated system when it gets torn down. (Laughter.)

MS. CUTTINO: Now, later we're going to – I want to come back to this notion of resilience and modernization, updating the grid, but let's get to Ira.

So, you know, we've talked about all these new technologies. So what really drove the technology revolution? I mean, you know, when it does take so long, why are we seeing all of this technology change happen so quickly? And the other thing is I want you – this is a group that has to look, you know, over the horizon all the time, so look over the horizon for us and tell us what's next.

IRA EHRENPREIS: Well, first of all, I think Secretary Mabus had it exactly right. We are at a tipping point. And oftentimes tipping points only are obviously to most after the fact, but we're right in the midst of it. This is a – we think of it as a renaissance time for energy innovation. The way we are producing, harnessing, consuming, storing energy is changing – as Secretary Mabus and David said, changing what we've had essentially as a desert of innovation for the last century.

Where we sit in Silicon Valley, what's interesting is, you know, we're used to the IT Moore's law pace of innovation. Every 18-month innovation cycle is focused on really making the last product line of 18 months ago obsolete. And that's the pace of innovation that Silicon Valley and entrepreneurship has tended to be focused on. And, yes, you know, the lights powering this room are a function of a grid that Edison would actually recognize, you know, which is really a very different industry compared to what venture capitalists and entrepreneurship has focused on historically.

When I made my first investment in energy now almost 20 years ago, Silicon Valley thought that was a bit crazy to focus on energy, and yet you rightly point out one of the largest markets in the world hasn't seen the light of day of innovation compared to other industries where large companies and entrepreneurship have focused. And so we looked at it and said this is an area ripe for opportunity. Now, it's taken a few years but there's actually been more innovation in energy in the last 10 years than the prior century. And we see it every day with entrepreneurs walking into our office with new ideas across the energy landscape.

And what it really comes down to in energy is cost. You know, when you compare something like solar – solar has had an unbelievable growth rate in the past few years. We've seen about two-thirds of all solar installations happen in the last three or so years. You've seen a 20X increase in solar installations over the last six or seven years. You've seen over 100X decrease in cost. We've gone from about \$75 a watt in the '70s to about 75 cents or less today.

You know, when you have that kind of cost curve – you know, think about – how many people here have cellphones? All right. How many of you had them in 1980? When the first cellphones came out they were thousands of dollars, and it was only when the cost curve – I mean, it's like any other innovations. When the costs came down you saw mass deployment. That's what we're seeing in energy. You saw it with LEDs. LEDs were about \$50 a lumen at the turn of the century. Now it's less than a penny a lumen. And we're seeing that across so many areas that for the 20th century didn't have that kind of innovation cycle. And it's happening today.

So what's really driving it? The most important barometer for me of optimism – the thing that actually, as a venture capitalist who backs entrepreneurs, it really comes down to human capital. As much as we talk about the financial capital driving it, in our world it's all about the human capital. It's, where are the best and the brightest focused? And we saw periods of time where the innovation cycles attracted entrepreneurs in the PC revolution. We saw a number of – the next generation of entrepreneurs focused on the telecom revolution. We've seen the Internet become an important area of innovation. But now we're seeing, for the first time ever, many of those entrepreneurs and top executives tackling energy.

You referenced Tesla. You know, Elon focused on PayPal a decade-plus ago. Today he focused on energy. Lyndon Rive, the CEO SolarCity, he was actually running an Enterprise software sold to Dell and now focused on energy. Tom Siebel, whose name is synonymous with Enterprise software for his work at Oracle and Siebel Systems, today running C3 Energy, which is really the intersection of big data and energy. Tom Werner runs SunPower, an ex-semiconductor executive. Amaja Tilla (ph), Syntetist (ph) – the list goes on. These are all people who a decade ago we didn't have in the energy ecosystem, and now we're seeing some of the great entrepreneurs of our time now tackling this industry.

We also were talking before the panel about where the next generation of best and brightest are focused. And you only have to walk into one of the great universities around the world to see this palpable change on the focus on energy. A few blocks from where I – from my office is Stanford. And literally a decade ago there were a very small handful of professors that self-identified as focused on energy, and today there are hundreds of professors that in some way, shape or form are tackling energy. And we have the former secretary of energy, the former head of ARPA-E, undersecretary – and the list goes on – on faculty.

And that's just one example of so many, as I travel around the country and world, where, when you talk to the students – again, a decade ago a lot of talk about the Internet, a lot of talk about other areas that my fellow brethren and venture capital have been focused on but have largely ignored energy. Today it's become an incredibly important focus. And as we look out to what's to come, you see just a range of areas that heretofore haven't even seen the light of day of entrepreneurship historically.

MS. CUTTINO: And so will the future look a lot, as an integration, as kind of the next thing that people are focusing on, or is it the marrying IT and energy and consumer control?

MR. EHRENPREIS: The good news is it's yes, yes and yes.

MS. CUTTINO: OK, great.

MR. EHRENPREIS: It's a little bit like the early days of any industry. You've got the picks and shovels that are now being implemented. And once those picks and

shovels and initial infrastructure gets deployed, there's an array of applications that then unfold as a result of that. And so today we're seeing, when you look at something like solar, a distributed infrastructure leads to personal choice, it leads to applications that you didn't have when you had a centralized plug-and-play infrastructure of old.

And so I think today – you know, one of the exciting things about being an entrepreneur and investor in this space is it is a white space. We don't have that historical range of innovation to build on. We're really tackling each and every part right now. And if you looked at our data log and just range of areas that are being focused on, it literally is across the landscape. I'm on the boards of solar, wind, storage, electric vehicle, energy efficiency, buildings, energy at the data center. I mean, the list goes on. These are all companies that we're part of right now and it's a small subset of things that we look at.

MS. CUTTINO: So there's something there for everyone to like.

MR. CRANE: Well, on that subject of integration and at the home level could I add – I mean, one of the things when I talk to young people I say, you know, what companies do you guys identify with? And you get the Apple, Amazon – I call it the four companies that will inherit the earth, right – Apple, Amazon, Facebook – Apple, Amazon –

MS. CUTTINO: Google?

MR. EHRENPREIS: Google.

MR. CRANE: – and Google, obviously, yes. And when you say to them, well, what about Microsoft, you know, and they'll say, well, that's a 1990s company, and I say, well, but will you – do you know that Microsoft is the second-most profitable company in the IT space? It makes \$20 billion a year, you know, second only to Apple. And that's because they're still mining the operating system that they sort of established as the definitive spot in the marketplace for PCs in the late '80s, early '90s.

That's what's out there right now for the person that comes with the operating system that controls all this at the house and then talks to the next house in a distributed grid and there are a lot of people after it. But the prize is that if you get – if you come up with the best operating system and everyone sort of rallies around that, then you're going to be printing that type of money, you know, for a generation to come.

MR. EHRENPREIS: I think there's something, though, very interesting about the four companies you mention, and it goes back to Secretary Mabus' point that change happens quickly. And when it happens, it happens in a big way. Three of the four companies you just mentioned didn't exist about 15, 20 years ago. And the fourth was not a very large market cap company 20 years ago, and today that's transformed.

And I think that goes to the point of just how quickly things can change, and that's what's happening here in energy. We can talk later about Tesla, but Tesla didn't exist a decade ago. And the kind of influence it's having on the automobile industry, transcending the cars it sells, is something that the industry has not seen, again, for a century.

MS. CUTTINO: So, you know, kind of talking about adoption and then marrying that with something you mentioned, which is human capital – so, you know, Secretary Mabus and David, you sit at large – atop large institutions. The Navy, you have a 900,000-person workforce, right? You talked about your, kind of, energy bill. And you've also mentioned the Navy's reputation for innovation, but you also are an institution steeped in tradition.

So how do you manage the kind of change when it comes to the culture of the Navy, because that's so important when – you know, you talk about kids and adoption and – not that the Navy is a bunch of kids but, you know, how do you manage that change? What are the opportunities and the challenges when it comes to energy change in the Navy?

SEC. MABUS: One of the things I've learned in a pretty long career in the public sector is change is the hardest thing you ever do. And I was governor of Mississippi, which I thought would be one of the easiest places to sell change because we were in dead, solid last place in everything – (laughter) – but –

MS. CUTTINO: Except in football. (Laughter.)

SEC. MABUS: Except in football. But I was governor a while ago. We weren't that good in football then. (Laughter.) And people – it doesn't matter how painful it is. It doesn't matter how obvious it is. People don't like to change. They don't like to get out of whatever is comfortable.

I mean, one of my favorite stories about being governor was I was trying to pass a big education act and there was a state senator named Pud Graham from New Albany, Mississippi who was voting against me every – just down the line. And I finally called him in and I said – you know, I made every argument I could to him. And I finally said, look, Senator, I don't know if this is going to work, but if it doesn't we haven't lost anything. We're in dead, solid last place in every educational achievement and measure there is and so we can't go any farther down but it might work. And if it does, we're going to move up pretty fast. And he looked at me and he said, Governor, we might be last but we're solid. (Laughter.) And I said, go vote against me, Pud, you know, that's fine.

But I think – I think there are some – there are some basic things that these guys understand very well. Number one, focus on a few things. Don't try to do everything. There are about a thousand things you can do every day that you go to work. If you try to do all thousand, you will fail, and at all thousand. So focusing on something like energy

– I picked four things to focus on, but energy was one of them to focus on. Give people a reason to change. Tell them why it's important. And this is not a top-down, a top-driven change. This is something that's going to help you be better at what you do. This is something that will improve your performance.

Reward success. Recognize the people who are out there taking chances. We just did that this week and recognized people who have come up with energy ideas. We've got a crowdsourcing site now to – about innovation across the Navy, but energy is part of it. And we just rewarded people who have done a great job on energy. And if you do those things and you're consistent and you do it over and over and over again – and I went on Makin Island, which is the Tesla of the seas, I guess. Well, it's the Prius of the seas. It's a hybrid. It's a big-deck amphib.

But on its first deployment it saved almost half its fuel budget, which translated into an additional 50 days steaming on the same fuel. They could be out three times as long without refueling. And I went on Makin Island and I was talking to the engineering officer who said, yeah, this equipment is great, we love it, but the real thing that helped us was that second-class seaman who was in charge of one piece of equipment who would say, I can do this better, and would come to his chief and say, let me try this; let's try something different.

We got a suggestion – you mentioned LEDs. We got a suggestion from a chief a decade ago saying, we want to change our lights to LEDs. We're doing it now. Every time we put a ship into the shipyard we change to LED lighting. We save about 3 percent of the total energy on that ship.

MS. CUTTINO: Wow.

SEC. MABUS: – just by changing the light bulbs. That's it.

MS. CUTTINO: That's a lot of light bulbs.

SEC. MABUS: And so, reward people who do take risk. And they're going to fail sometimes, but concentrate on a few things. Connect it to daily life to why it's important, why it will make you better. And then reward success. And, you know, once you start that change then it's pretty easy to keep going because you are proud of being on that cutting edge. I mean, entrepreneurs don't want to be the third adopter.

MS. CUTTINO: Right.

SEC. MABUS: And the military has a – has a tradition of being out there in front. I mean, you look at the Internet, GPS, flat-screen TVs, the list goes on and on of things that started out with military applications and then went into the private sector. And one of the things that we can do is, if it gives us an edge, we can pay a little bit more, early. And so that helps develop that market so that you can make the cost curve begin to come down.

MS. CUTTINO: So now, David, for you change is internal, but it's also with your customers, consumers, and so that's a lot of change to balance. What do you –

MR. CRANE: And investors.

MS. CUTTINO: And investors.

MR. CRANE: Yeah. Yeah. Well, our experience has been similar to what Secretary Mabus said. I just had a remarkable head-scratching moment because we are – we're sort of, for ownership purposes, dividing our company – partially dividing our company into the conventional side and the renewable side. And our chief administrative officer came to me just yesterday and said, people are reluctant – you know, because we're – we have a workforce of 11,500 people, so small by Navy standards but still –

MS. CUTTINO: Big.

MR. CRANE: – a good number of people –

MS. CUTTINO: Yes.

MR. CRANE: – and we have to separate them into these two companies. And the CEO says we have a problem. A lot of – many people, they don't want to go with the renewable company because they think it's too risky. And I said, let me – I mean, our home solar business grew 103 percent in terms of bookings through the first three quarters of this year, versus the overall electric grid in the – electricity demand in the United States in a good year grows at 1.5 percent, you know, these days. And –

MS. CUTTINO: And almost new – all new capacity is either natural gas or renewables, right?

MR. CRANE: Yes. Oh, yeah. Well, yeah. No, I mean – so I looked at our chief administrator and I said, let me get this straight: We have employees that work here – and, you know, we've been working the change message for many years, five or six years. And I said – people that – this is obviously the future and people are seeing that's risky. They would rather stay with thinking that a company that makes most of its money off 45-year-old coal plants, that that's the long-term future of it.

And I used to actually – you know, I, of course, have no idea what I'm talking about, but I sort of hearken back to the Navy and I say, well, that's like when the battleship officers – you know, the aircraft carrier was being developed and they're like, but I'll stick with the battleship, you know?

MS. CUTTINO: Right.

MR. CRANE: And so I use it – so –

SEC. MABUS: You actually do know what you're talking about. (Laughter.)

MR. CRANE: And so people are just scared of change even when it's so obvious. The past has just a greater constituency than it should. And so to me it starts, as Secretary Mabus says, with pounding into people's head the message that staying with the status quo is futile and it's the riskiest thing you could do. You know, our investors sometimes say, oh, you're doing these things; aren't they risky? I say, no, doing nothing is the riskiest thing we could do.

But then the other thing I would say is, as we look – if we look at the layers within our company, the biggest issue that we have is with the people that are sort of about to rise into the senior-most – so middle to, you know, lower senior management positions. In part, these people inherited me as the CEO. You know, I mean, they were there before I got there, and so they maybe bought into working for a boring electricity company and then I come along, you know, and shake things up. And some of them may not be happy about it, but I think they also have a lot at stake.

So one of the things we've done – and this is to Ira's point – is anyone who's come to work NRG in the last six or seven years came to change the world, because we're the energy company that actually, you know, believes in climate change and all of this – is you go around the middle level people and got to the younger people. And, you know, I'm not a home-gamer myself, but you do things to empower the lower people without disrupting the chain of command.

So we have these – we have these innovation labs and things that – one of the things we – if you go on the Apple store right now there's a – there's a game called Path to Luma, which has had 2 million downloads. It's developed by NRG. It's not for profit. You know, it's a game about how choices you make in the area we're talking about here would affect the world. And the graphics are fantastic. You know, it was developed by 20-somethings-type, you know, kids, to me, within the company that wanted to do this. And we gave them a little bit of money and they put it out there.

And it's not that you're trying to completely undermine the people in that middle, but if I'm pulling from the top and the younger people are pushing from below, you get everyone where you need them to be. At least that's my theory. Check back with me in a couple years to see if it worked. (Laughter.)

MS. CUTTINO: Well, before I go to Ira I want to ask you a yes-or-no question. Is this country going to build another coal-fired power plant, yes or no?

MR. CRANE: Me? No. I think any CEO in America that tried to build a coal-fired power plant right now would be out of their mind. There's no economic reason to do it. There's no environmental reason. And there's no way you can lay off the risk of future regulatory change.

MS. CUTTINO: That's big change, right?

MR. CRANE: Yeah.

MS. CUTTINO: OK, Ira, now you are investing in companies that are trying to have disruptive change –

MR. EHRENPREIS: Yeah.

MS. CUTTINO: – small companies trying to get into the market. I mean, Tesla is a good example of a company – of a company that has been unbelievably innovative not only in their product but also in the way they've entered the market. I mean, buying a car in a mall, right, ordering it online or over the phone is successful. So how has that happened?

MR. EHRENPREIS: So I'm actually struck at the parallels between startups and the Navy and the military more generally. When you think about the framework that Secretary Mabus just gave and you think about how is it that a small upstart, the David-Goliath story, how can this small, under-resourced company that often does start in the proverbial and sometimes actual garage, take on incumbency that is more resourced, that has a totally different balance sheet, that has history, that has processes?

And how do these startups – I mentioned it before where, in a very short period of time, these startups actually become what can be referred to as the companies that will own the world, that all started in the same way that some – that most of these young companies start. And it does start with focus.

In almost every startup it is a laser-like focus to solve a single problem. While it's true that today Google does many things, it started off maniacally focused on search. While it's true that Amazon has a range of things one can buy, they were maniacally focused on books and supply chain in those early days. And having that maniacal focus is so critical to a startup's success, and they're able to tackle something in a focused way compared to typically the incumbents that have a far broader reach. So that is one.

The second and, we think, probably most important – you referenced it in describing the kind of firm that we have – that we're part of, and that's this notion of impact investing, or double bottom-line. It's the notion that you can actually achieve financial success while changing the world. And it's this mission orientation that Secretary Mabus was describing when it's all about finding a purpose-driven mission-oriented approach.

And these are startups that are typically – I'll use the Tesla example – typically competing against industries where the employees of those industries have jobs. And these are people at startups who believe they are on a mission to change the world. These are people who are not clocking in a 9:00 and clocking out at 5:00. Typically when we go over to our startup companies at midnight you see a full parking lot of people who just

have that passion to change the world, which is how you can be a smaller and more under-resourced entity and tackle incumbency.

But it's also not just a double bottom line on the culture. It's also the product. And it goes back to that cost curve. For years we talked about trying to go green and do good for the environment. The problem was in doing so we had to pay more; we had to have an inferior product. And while a small percentage of the population might do that, that doesn't work for transformation.

That doesn't work to uproot an energy infrastructure. It only works when you actually remove this notion of tradeoff. And when you can actually take out the either environment or better product or cheaper product to this paradigm of "and" you can actually have a better, superior, cheaper product and in the process do some good things for the environment. That's when you have that kind of change.

The third thing that Secretary Mabus – was incentives. The way that we have been able to attract some of the most extraordinary executives to take literally 20, 30 times pay cuts from the larger companies from which they were recruited to join startups that have very little cash to pay them is with the typical way startup compensation works, which is options, and folks forgo cash compensation in favor of getting stock. And in every company I'm on the board of, 100 percent of the employees have stock. That goes from the person who answers phones or who's greeting people at the door to the CEO, and everyone in between. And that's how wealth creation at the startup works. It's how you're able to take smaller balance sheets and compete against bigger balance sheets.

I had probably the most rewarding personal experience when I walked the halls of the Tesla manufacturing facility. And I was greeted by someone who knew I'd been on the board for a while and he came to thank me. And I didn't know him and I didn't know what he was thanking me for. And he said, well, I worked when this facility was a NUMMI facility. NUMMI was the joint venture owned by the large auto companies of old, and it got shut down in 2010. Tesla bought it, created the Tesla factory.

And he said, when I worked for 20 years I'd never had an option. I didn't really know what that was. And here I work at the Tesla factory and I was given options. I didn't really know what they were when I got them, but it's enabled me to send my kids to school, the first people in my family's history – first kids to ever go to college, that I was able to pay for. And we just bought our first home. And it's the first home in my family that we've ever purchased. And that's really the story of what option creation and the incentive scheme that Secretary Mabus was describing that defined startups.

MS. CUTTINO: OK. So I want to just remind everyone, if you have a question, please write it down and pass it up. And we're going to try and get to those – as many of those as we can in our remaining time.

And before I ask another question, I wanted to call on someone special in the audience. So this is also a person who probably needs no introduction to those of you

who are here in the audience. He's had a lot of titles – senator, secretary of the Navy, chairman of Armed Services – but I think the most important title to him is, or was, petty officer third class. Senator John Warner. (Applause.)

JOHN W. WARNER (former senator, R-VA): Thank you very much. I can tell you one thing: It's very dangerous to ever give an ex-senator a microphone. (Laughter.) But I shall try and resist that.

I've found this morning, thus far, fascinating. And the magical word is “change.” And I'm sitting here saying to myself, you've been a part of the workforce since January 1945, when I joined the Navy and I had a drill instructor. That was my first boss. I've worked for several presidents, I've worked for a lot of Senate leaders, and the biggest change in my life was the first woman boss I ever had, and that's Phyllis Cuttino. (Laughter.) So that was a whale of a change for me, lady, I've got to tell you. (Laughter.)

MS. CUTTINO: Hopefully a positive one.

MR. WARNER: And my good friend Ray Mabus, he's a modest fellow. I've told him many times – and we share this – we had the best job in the world because what better job than to serve the men and women of the armed forces of the United States and their families? And as I look back on my modest career in the Navy and the little bit of time in the Marine Corps – I had to go to boot camp twice, so I'm not too bright – (laughter) – what they did for me is far more than what I did for them. And I guarantee all those privileged to wear the uniform here today shall never forget it and always be indebted to their country. So we start with that.

I'm to ask a question. Is that correct?

MS. CUTTINO: Yes, sir.

MR. WARNER: All right, I'll ask it.

MS. CUTTINO: The first one.

MR. WARNER: Ray, you're about to finish, I think, the longest career as secretary of the Navy, I think, in history. You crossed me. I had five-and-a-half. And you can speak for yourself – you're so modest – but you've had a wonderful career. And you have spearheaded the effort of the federal government, really, to keep pushing the outer limits, particularly of the recyclables and energy, and there's testimony here to that effect.

But I have to pause for a moment to say – about that story, Teddy Roosevelt send the Great White Fleet around the world. He did do that and the Congress resisted him terrifically. They said, it's the dumbest idea that we've ever heard of. And Teddy said, we're going, and he shipped them halfway around the world. And the chairman of the

Appropriations Committee, who had been the fiercest critic, called him up and said, I read you're halfway around the world – and this is a true story – congratulations. Congratulations. Is there anything I can do for you? Roosevelt said calmly, yes, I'm out of money. I can't bring them home. (Laughter.) Well, Ray Mabus fought the battle time and time again to keep the money flowing.

But I say to my two distinguished colleagues over here today, you've mentioned solar, the extraordinary growth in it. We haven't talked much about when but we've had a parallel with wind. But we're coming up square and facing that the production of both is outpacing the ability to store. And my fear is Congress is going to get wind of that – to use a bad metaphor – and say we'd better pull back on this congressional support that we've given and that Ray has fought for so many years and just let solar and wind be on its own. Where are we on storage of these two valuable sources? With that, I yield the floor. (Applause.)

SEC. MABUS: John, I have a tradition as secretary. The first question at all-hands calls gets a coin. (Laughter, applause.)

MR. WARNER: (Off mic) – boot camp – (off mic). (Laughter.)

MS. CUTTINO: So do the senator's question about storage.

SEC. MABUS: Well, I'll do a very short thing and then turn it over to these guys who are actually working on the problem.

That's the big issue we're facing now. We're getting – we're at 50 percent. We will be – at the end of this year 50 percent of our power on our bases will come from alternative sources.

MS. CUTTINO: Wow.

SEC. MABUS: The issue that we have is storage; is how do you take solar, store it at night? How do you take wind, et cetera, et cetera? And how do you group those things together into microgrids so that you can pull yourself off the grid if there's an issue with those telephone poles or those wooden poles?

And we've got that issue on our bases. We've also got it in military terms. The F-18C, the Navy version, uses 60 percent more energy than – or the F-35 than the F-18. The Marine version, they use 110 percent more energy. Things like railguns, laser weapons, you have to be able to store huge amounts of energy very quickly and discharge them instantly, and then redo it because you don't – just one shot.

And so we're looking into the storage from a base situation but also from a purely military standpoint in terms of our weapons. That's what we're turning to the private sector for because we've got great Navy research labs, ARPA-E, all working on this, but a lot of these solutions are coming out of the private sector, the powerwall out of Tesla –

MR. EHRENPREIS: Yep.

SEC. MABUS: – which is giving part of that solution for homeowners. We have got to – that’s the next step. That’s the next thing that we’ve got to work on.

And I’ll give you another very practical example. When we put solar blankets, solar panels with Marines in Afghanistan, we save the average company of Marines 700 pounds in batteries. The packs that Marines carry today weigh more than a hundred pounds. About 20 pounds of that are batteries.

MS. CUTTINO: To power all that equipment, sophisticated equipment.

SEC. MABUS: To power all the stuff. If we could get a different source of storage –

MR. EHRENPREIS: That’s right.

SEC. MABUS: – a different source of power – sun, wind, whatever – we would – we’d cut way down on what Marines have to be resupplied with and on how much Marines have to carry into the fight.

MR. EHRENPREIS: Well, by definition a venture capitalist is an optimist because in every investment we typically do – to hearken back to the Roosevelt story – we’re told we’re crazy when we make those investments.

But on the storage front I’m actually extraordinarily optimistic. Right now there’s – I’ll give you – I’ll give you some stats on storage. Storage is an area that essentially as a country we ceded and most of our batteries right now do not come from domestic manufacturing. Today the largest construction project on planet Earth is going on in Sparks, Nevada. It’s to build what’s called the gigafactory. And it’s to create lithium – domestic lithium-ion battery manufacturing capacity that will not just go for electric vehicles for storage but also, as Secretary Mabus described, for applications at the home and at the utility.

The combined – the manufacturing capacity that is being planned in that single facility will exceed the entire battery manufacturing capacity on planet Earth today. So it’s an extraordinary project. That, along with a number of other initiatives, are driving down cost per kilowatt hour, because that’s what this really comes down to. It’s not that there’s not technology that can satisfy the storage problem. It’s, how do you actually have that technology at a cost that can make sense for when David is doing solar implementations he can combine it with storage in an economic way?

And the same way we describe solar itself – LEDs, wind and others driving that cost curve down – it comes – solar is following that same cycle but it’s going to come with manufacturing scale and innovation. Beyond lithium-ion we see innovations in the

area of flow batteries, which have the ability to bifurcate power and storage, and doing so from a kilowatt to megawatt scale we see new chemistries that are being developed targeting power applications as opposed to what lithium-ion does, which is energy applications.

We're just seeing a range of storage opportunities right now. Again, as much as there's been work in the labs historically, there haven't been the kind of commercial efforts to develop new kinds of battery manufacturing and scale opportunities. Today we're seeing that. There's a lot of entrepreneurship focused on it. I think we're going to see a lot of new things over the next few years. Again, much more reason to be optimistic.

MR. CRANE: OK, well, I actually have a slightly different and more pessimistic view than Ira because –

MR. EHRENPREIS: A Silicon Valley venture capitalist, utility –

MR. CRANE: Yeah, yeah. Well, or the old guy versus the young guy – (laughter) – because apart from the bit about the new factory, the speech about battery technologies and it's just around the corner, I heard that back in 1990 when I started in the industry: It's two to three years away.

MR. EHRENPREIS: Yeah.

MR. CRANE: It's always two to three years away when it comes to energy storage. And what makes the electricity industry interesting – because, you know, you're – you know, if you're in this industry you're sort of in the most boring industry in America, right? You're producing a product that you can't see, you know, you can't conceptualize, and if you happen to touch it you die. (Laughter.) So the thing that keeps people motivated in the industry is that it's very intellectually interesting because it's the one commodity that can't be stored in large scale.

And, you know, the breakthrough hopefully is around the corner because it's important. But what I would say is, again, if we think about it creatively – and, again, a key role for the military – the problem with batteries is no matter how much the expense comes – and first of all, it has to be done at such large scale, whatever chemistry you put in there the materials become very expensive, because if you're going to do it at scale suddenly this thing, you know, becomes very expensive.

And also, batteries kill their own market because batteries, they even out the price of electricity because basically electricity is effectively free at night and it's expensive in the middle of the afternoon. And if you equalize that, you've killed your own market. So what I would say is I hope that the large-scale energy storage is around the corner. And I think there's a big role for the Navy in particular because, you know, the missions that you have, but I think there are a couple of things that we have to look at.

First of all is secondary – what I call secondary energy storage, which in most cases is vehicle to grid. If you pay for the battery to move your vehicle – the average American passenger car is in use one hour and 27 minutes a day. That means 22 hours and 33 minutes a day it's available to do something else. And it's sitting there with a battery that you pay for to move the vehicle. It can be connected to the grid. And think about school buses, for instance. What are school buses doing all summer? You know, a depot of school buses is a – it's an energy storage power plant if it's correctly wired.

And the second thing I would say is as we think about household consumption of electricity – first of all, in the average American household, roughly 20 to 30 percent of the electricity used is wasted.

MS. CUTTINO: In this country we waste enough power to power the entire country of Japan for a year.

MR. CRANE: Yes. By our estimate there's another 15 to 20 percent of household use which I would call discretionary – time discretionary load. So when we think about load shifting we usually think about trying to take load away from the middle of the day to middle of the night. But if you have a bunch of solar panels on your roof and they're properly – you know, and their smart solar power is connected to your dryer, which is timed – you know, which – you don't run your dryer in the middle of the night. You actually run your dryer when the sun is shining. And you also then have the dryer as a direct current dryer so you don't lose the 20 percent in inverting direct current to alternate current.

So, you know, software, appliances that are tied to the solar – so I think there's a lot you can do –

MR. EHRENPREIS: Yeah.

MR. CRANE: – because energy storage is definitely coming, but it's always going to be expensive. So you want to – you want to use the minimum amount of batteries that you – (laughter) –

MR. EHRENPREIS: So David is one of the –

MS. CUTTINO: So kind of pessimistic but a little optimistic too.

MR. EHRENPREIS: I would just say David is one of the most progressive, visionary –

MS. CUTTINO: Right.

MR. EHRENPREIS: – utility CEOs.

MR. CRANE: But? (Laughter.)

MR. EHRENPREIS: If we were to have 10 others –

MS. CUTTINO: Right.

MR. EHRENPREIS: – you would have an even more pessimistic view.

MR. CRANE: Yeah.

MR. EHRENPREIS: And therein lies the opportunity, because I think the facts actually speak for themselves in terms of where we've seen cost per kilowatt hour go over about a three-year period compared to the last 30-year period.

MS. CUTTINO: So we have questions that are great, and so I'm going to – let's do these rapid fire so we can get to these questions.

So following up on pessimism – (laughter) – you know, we've talked a lot about the opportunities –

MR. EHRENPREIS: This must be going to you. (Laughter.)

MS. CUTTINO: And again, quickly, so we can get through these, we've talked a lot about the opportunities, but kind of what are the risks and threats that you see from moving in a distributed energy generation? Some people talk about cyber.

SEC. MABUS: Well, number one is the issue we just talked about, is the storage, and is – but you see more opportunities.

One of the things that David mentioned that's a risk in distributive energy is just the fact that energy is regulated by the states. It's not a national thing. And state utilities have a – have a business model. And they're monopolies. They're paid in most states based on how much energy they sell. That's what their return comes to.

MR. EHRENPREIS: Or how much stuff they build.

SEC. MABUS: Or how much stuff they build that they can put into the – into the rate base. And you're seeing that happening now with distributive energy because more people are putting solar panels on their – on their roofs. Once we get a little bit more storage they can pull themselves off the grid. That's a threat.

MS. CUTTINO: Right.

SEC. MABUS: And you're seeing some of that with access costs, utilities trying to persuade local public service commissions to do that. I think that's a risk. That's a governmental risk and that's sort of a nationwide risk. And that's part of the change

argument because this is, I think, a rear guard action that will ultimately be unsuccessful, but it could slow things down for people like David, to some extent.

MS. CUTTINO: Quickly.

MR. EHRENPREIS: You mentioned the physical security. Currently we have models where we go from centralized to distributed. We've seen it in computing. We've seen it in telecom. And while there is more nodes on the network that can be vulnerable, it also has a more fault-tolerant system that there's a not a single point – a more single point of failure. And I think therein lies the opportunity if we can deal with the cyber issues.

MS. CUTTINO: So instead of a whole grid going down or something –

MR. EHRENPREIS: That's right.

MS. CUTTINO: – just a piece of the grid goes down. So instead of 8 million people being without power in Hurricane Sandy –

MR. EHRENPREIS: That's right.

MS. CUTTINO: – it would be a smaller number.

MR. CRANE: I mean, to me to that's completely it. Look, I've got no national security clearance. And the Navy's role is not internal security but, you know, three middle-grade electrical engineers, one in the Eastern Interconnect, one in the Western Interconnect and one in Texas, could bring this country to their knees, you know, with very low-grade – I mean, the system we have is impossibly risky. So, you know, from a systemic point of view, there's nothing we're talking about that's more risky –

MS. CUTTINO: Yeah.

MR. CRANE: – than staying with the status quo.

MR. EHRENPREIS: Exactly.

MS. CUTTINO: Right. Well, we did a report that looked at – one of the things it looked at was power outages, and there were 67 power outages on military bases alone of more than seven hours that cost more than 6 (million dollars) or \$7 million. And that's just the cost in terms of financial. It's not the cost to mission.

OK, so what happened to net zero efforts? Is that still a goal?

SEC. MABUS: Yeah, we're – and I'll give you very small examples on this, but we've got SEAL teams in the field now that are really close to net zero in both fuel and water that they're using alternative energy to produce fresh water at the same time.

In terms of Marines making power where they are instead of – instead of importing power using solar, using wind, using the things that they can use there, and using some storage capabilities, one of the sort of unanticipated consequences of this is when you turn the generator off you can hear.

MR. EHRENPREIS: Yeah.

SEC. MABUS: And you're also not putting a big target on yourself.

MS. CUTTINO: Right.

SEC. MABUS: But the net zero on our bases, we still have that target. And we're making a good bit of progress toward it because we want to – we want to produce as much power on those bases and in those microgrids as we use so that – net zero.

MS. CUTTINO: So we are out of time, unfortunately. This has clearly been a fantastic conversation and panel. But before we go, before a round of applause, this is an audience that is going to be all the future leaders – current and future leaders of America. So when it comes to energy, do you have any kind of words of wisdom before we close down, the three of you, on kind of what to look for, how to move forward?

SEC. MABUS: Well, for the Navy and Marines, which are a lot of this audience, you are going to be the leaders. And I think the risk is to embrace the status quo too much. We don't want a zero-defect force. We want a force that's willing to take risk, willing to see what comes next. And we've got to make sure, at my level, that we reward those risk-takers even when they fail, that we're trying to get away from check-the-box career paths and give those risk-takers a reward.

I'll tell one final story. Gary Roughead, when he was chief of Naval Operations, kept a fitness report outside his office. It was of a young officer who had run a ship aground and he had been court martialed for it. His defense was: You told me to take risk. It was pounded into me that a destroyer skipper should get in close to shore to support our ground troops. That was what I was doing. I ran the ship aground on an uncharted obstacle and I was doing what you want me to do. I was taking risk. He was exonerated. His name was Chester Nimitz.

MS. CUTTINO: Oh.

SEC. MABUS: And if he hadn't taken that risk, and if we hadn't exonerated him, if we had cashiered him for that, who knows how the war in the Pacific would have turned out?

MS. CUTTINO: Any final words, David?

MR. CRANE: Well, I'd just say, as future leaders – I mean, we live in a society where leadership has become decentralized, disaggregated. Empowerment at lower levels is what the 21st century is about. And I would say my experience from the private sector, not being in the military, it's amazing to me the number of people that strive throughout their career to get into a leadership position, and then when they get into the leadership position they don't leave.

So I would just say to you, to all of the military officers and other people in the room that have their career ahead of them, as was me mainly behind me, is, you know, strive for that leadership position but be prepared to lead when you get there, I mean, because I think there's more than ever a responsibility to lead that comes with inhabiting leadership positions.

MS. CUTTINO: Quickly?

MR. EHRENPREIS: I'd say let history be a guide. To the Stone Age comment, we've seen it in every great transformation in industry. We've seen it from the horse and buggy to the automobile transformation. We've seen it with flight. We've seen it with the advent of the television, cellphones, Internet. And we're here with energy right now. As leaders, don't look in the rearview mirror to figure out where we're heading in the 21st century energy economy.

MS. CUTTINO: So with that, I'd like to thank our panelists very much, and thank our audience for coming and participating. (Applause.) Thank you, sir. It was great. Thank you.