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THE ROLE OF DISTRIBUTED POWER SYSTEMS IN THE U.S. ELECTRICITY SECTOR

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PANEL 3: SECURITY AND DISTRIBUTED POWER SYSTEMS:

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P R O C E E D I N G S

MR. SINGER: All right. Well, why don't we go ahead and begin? I'm Peter Singer. I direct the 21st Century Defense Initiative here at Brookings and it's a great honor to be moderating this panel on security and distributed power systems. In many ways this topic cuts to the heart of why we talk about the importance of "energy security." That is, it captures the essence of that phrase in both its meanings: in both the need for America to have a strategy that resources and uses energy in a more successful and efficient manner, but also in the second meaning, in ensuring the safe and secure availability of power.

And today we are greatly honored to be joined by a fantastic panel of both you could say experts, but as well as leaders to explore these issues. First we have Vice Admiral Dennis McGinn, retired, who is president of the American Council on Renewable Energy. He also serves as chairman and CEO of Remote Reality, a high-tech optical and software research firm. And he was previously with the Battelle Memorial Institute, where he led the Energy and Transportation and Environment Division. And his private sector work follows 35 years with the Navy, where he served as a naval aviator, test pilot, aircraft carrier commanding officer, and national security strategist.

To his left we have Sharon Burke, who is assistant secretary for Operational Energy Plans and Programs in the Department of Defense. She's the inaugural assistant secretary for that office, which was created to strengthen the energy security for U.S. military operations.

Prior to her appointment at DOD, she was a vice president and senior fellow at the Center for New American Security. And she brings an extensive background in other agencies, including Department of State and their Policy Planning Division, and DOD and Office of Near East and South Asian Affairs; and early career in the Energy and Materials Program of the Office of Technology Assessment.

And then to her left we have Rear Admiral Philip Cullom, who is director of Energy and Environmental Readiness Division in the Navy. He assumed this current position, I joked with him, after about a decade and a half of very, very busy times. He was previously the commander of the Eisenhower and George Washington Strike Groups.

His at-sea assignments included Southern Watch, Desert Storm. He was the

commander for the first Expeditionary Strike Group during Operations Iraqi Freedom and Enduring Freedom. And of course, ashore he's held a series of policy strategy and technical positions in both the Joint and the Navy environment.

And then to my left, we've got Henry Kenchington, who's deputy assistant secretary for research development in the Office of Electricity Delivery and Energy Reliability in the DOE. He's responsible for the strategic management of R&D to enhance reliability, security, and efficiency of the nation's electronic delivery system. He also directs the $3.4 billion Smart Grid Investment Grant Program, which is designed to upgrade the nation's power grid with advanced digital communications and control technologies.

And finally, we have a very large panel here, Bradley Schoener, who's energy portfolio manager at the MITRE Corporation where he directs the Energy Investment and Modeling Program. He also manages direct work programs at the DOE, as well as other federal agencies in the energy domain, and acts as a principle investigator managing a portfolio of research projects in energy infrastructure. And on top of that, he's taught at Johns Hopkins since 1995.

Now, my role as moderator, besides for giving lengthy introductions, is essentially to ask questions and get out of the way of these fantastic speakers. So the way this panel will flow is I'm going to steer one question towards each of them just to kick off the conversation and then very quickly we want to move into discussion between the panelists and then with you.

So actually, Sharon, I'd like to start with you. And the question I'd like to pose is, Defense Department, why does it even care about DPS?

MS. BURKE: Thank you, Peter. And thank you very much for holding this great panel because the department does care about this, and for two main reasons, and they have to do with how we use energy in the Department of Defense and we tend to divide it into two different kinds of energy used very broadly. One is in our facilities, in our fixed facilities, so just like we're using it here for heating, lighting, cooling; very close to the way that the commercial sector uses energy in its facilities. Then on the other side for our military operations to support our actual deployments, either forward in those deployments, whether they're on sea or in the air or on land, and also the readiness for those deployments, so all kinds of training and exercises and equipment readiness that we go through.

About 75 percent of our energy use is in the deployment, in the military operations category or operational energy, which is what I'm responsible for. And about 25 percent comes in fixed facilities.

The reason that we're interested in distributed energy for both of those is on the operational side, it's inherently distributed energy. Right now, for example in Afghanistan, all of the energy we're using is petroleum based or almost all of it. And it's, you know, whether it's electricity or it's going into the tank of some kind of mobility, it is diesel fuel, jet fuel, it's going to generators or it's going to mobility platforms and that's how we use energy; also battery use.

But it's inherently distributed. It's around the battlefield more distributed than it has been in the past because we're at a distributed style of warfare right now. So we are talking about tactical microgrids, we're talking about generators, we're talking about solar power, anything that gets us the power where we're operating.

On the other side in facilities, which I don't have primary responsibility for, but certainly do focus on some degree because we do support military operations directly out of our facilities and our fixed facilities, and we have something like half a million structures and buildings that the Department of Defense owns. Those fixed facilities are almost completely reliant on the civilian grid. So the strengths and the weaknesses of the American civilian grid and wherever we are where we may be using the grid are our strengths and weaknesses.

In all of our bases we tend to have diesel generation backup, which may or may not be in good shape, which may or may not be optimal. Increasingly, in some places we're looking at microgrids and other kinds of generations such as solar to supplement and to also improve our security of those missions because in a lot of cases we need backup and we need uninterrupted power for many of those missions. And you've written a great deal, for example, on UAVs, remotely piloted vehicles, which have become essential to the way that we conduct our business.

You can't have an interruption in your power, in your fixed facilities if you're going to have that kind of capability. So increasingly, we're looking at security of supply in that area as well. So those are the two main, broadly speaking, areas that we're interested in.

MR. SINGER: A quick side story to illustrate the importance of your last point. When I

was visiting our CAOC, our Combined Air Operations Center, that coordinates the air strikes and air operations for all of our forces in Iraq and Afghanistan, they had a power outage and then they said -- and lights go out in the command center, said don't worry, the generator will kick on. And the generator did kick on and then a big cloud of smoke came out of it. Apparently a cat was playing near the generator and so we actually went down for power for a short period.

Now fortunately, there was another third backup on top of it but it shows you how small factors, which I think we'll get to in a couple of the other conversations, can have major, major consequences because you had 36 different strikes going on, all of which went blind for a couple of seconds when our cat met its fate.

MS. BURKE: It's a great example because that low consequence/high probability event, like a cat in the generator, we don't necessarily prepare for and we should. We should be looking at that, too, so.

MR. SINGER: So Admiral Cullom, I'd like to turn to you to maybe bring in a different or somewhat related perspective from the Navy side of things. And in particular, there's often described to be a tension between technology and people. And in many ways that would seem to be something that might happen within this space and maybe you could speak to that on, you know, which matters more and how do we navigate between the two.

ADM. CULLOM: Certainly. Technology versus people, it often is the easiest thing to assume that you can solve all of the problems with technology. You'll come up with a solution and technology will set us free and energy will no longer be like air. But the reality is that you really can't solve all of the problems with the technology.

And Secretary Burke was correct, roughly 75 percent of our -- and it varies from service to service, but that's a perfect ratio, 75 percent of our energy is used as liquid in nature; 25 percent, generally speaking, comes from the grid because it supports the infrastructure. But let there be no mistake that whether it's in theater or out of theater today, they all end up supporting operations overall. And if you're going to enable your forces to be able to get to the fight back home, then you have to worry about critical infrastructure protection and that's where technology has to match up with behavioral changes, too. But on the battlefront, it's particularly important that the technology that we try to bring

there -- you know, like the Prius, if you drive your Prius like a sports car or try to drive it like a sports car, you're probably not going to get the 50 miles per gallon.

What we find with a lot of our technology measures is that they will get us a percent here, a percent there. Those are very important for us whether it's something like a hybrid electric drive. That's a great technology to put on a destroyer, but that's going to get you 8,500 barrels per ship per year. But now you have to match that with how are you going to drive that ship? How are you going to look at all of the systems that have to go together? So you need to lash another piece of technology up on the bridge and that technology up on the bridge would be a dashboard so that you operate differently.

On the battlefront, very forward, when you talk about Iraq or Afghanistan, you've got to talk about technology changes that will fundamentally change how often we actually run some of those generators. But then you have to talk about the behavioral things such as, well, gee, you know, if I run in my hooch, as they call it, you know, you run my AC so that it's nice and cold by the time I get back to my rack, my bed, then you're wasting energy on the battlefront. And think about how much it took to get that energy to that pointiest end of the sphere.

So changing personal behaviors can dramatically change how much we end up using out there. And we're trying to couple both of those together, for instance, with the SEAL Teams. We have a SEAL Team that will be deploying and their goal is net zero energy, net zero water. You're not going to get there just with technology. You're going to have to combine that with a lot of forward thinking by people's behaviors.

MR. SINGER: All right. Admiral McGinn, you bring an interesting perspective to this from both your experience on the DOD side of things, but also now on the civilian side. So maybe you could help us in essence sort of bridge the discussion, you know, outline your vision on how you see renewable sources affecting the stability of the grid system. But maybe more broadly, what's the link between DPS and the broader security of the civilian grid?

ADM. McGINN: I thought Secretary Shultz hit it out of the park this morning with his demonstration of a perfectly fine distributed power system. Phil Cullom just mentioned Navy SEALs, so I thought I'd bring a couple of toys with me. This is a smaller version of -- solar on this side; you can hide in the jungle on this side. Okay, that's the military side on the answer to your question.

First, folks who are in the business world get that anxiety, that Secretary Schultz mentioned Dave Slaton talking about. Imagine a pilot behind enemy lines. The only connection is, you know, two or three days of battery left of his survival radio.

Well, for us connected busy people in the civilian world, we have another one here; the same type of technology, different application. And if you think that it's really, really difficult to imagine what really is a microgrid, this is a microgrid -- power, generation, load -- in the form of the BlackBerry.

And finally, for those of you who may be fashion conscious, we have here the executive briefcase with solar. You know, I take these things out over at ACORE and my staff says, you know, Admiral, you don't just talk to the talk, you walk the walk here as far as renewable energy is concerned. But I think the question is exactly -- goes to the point of both technology, business, and culture.

What the military is doing right now is exercising absolutely superb leadership because it's good for mission effectiveness, it's good for the bottom line of taxpayer dollars that are devoted to national security. And when you think about the Marines in India Company, 3rd Battalion, 5th Marines over in the Helmand Province with devices like this and others that are saving energy from energy efficiency, as well as producing better capability on patrols and less trucks and convoys and exposure on the highways, that's a heck of an example for the rest of Americans about distributed power in the form of renewable energy, in the form of energy efficiency. Recycled energy or waste energy recovery, as Tom Casten pointed out, is really, really good for our bottom line.

It isn't necessarily mission effectiveness, maybe it's the business bottom line or the quality of life bottom line. But there's a huge place for microgrids, starting with this size and going up, and for distributed power systems across the civilian community.

MR. SINGER: And how about on the security side of things? Where do you see that weighing in in terms of looking at security and the second meaning of the term as I put it out there?

ADM. McGINN: Well, as Sharon pointed out, you know, there's a security aspect to it where we rely very much on the civilian grid for power. When you have a predator squadron that's operating out of Nevada that's controlling real life and death operations halfway around the world, you really want to have that power.

If you are operating a hospital, and all hospitals have some sort of a backup power

system, or you're operating a critical manufacturing technology that you can't afford the interruption of power because the big machines are going to get really, really fouled up, that is an economic security aspect and a health security aspect.

In terms of just plain old functionality or functional security, as we go more and more to smart grid, where we superimpose more information technology on top of existing and emerging grid systems, it becomes -- the good news is we can get a lot more granular in how we generate and how we manage load. The bad news is it creates a potential vulnerability for intrusion or cats in the -- I guess it would be bugs in your software, that can in fact bring down the right match between power generation and load. So when you go more distributed, you have a more resilient total system for electrical generation and electrical use.

MR. SINGER: Hank, that's actually a great segue to what you're working on because as the admiral said, as we move more and more towards this, we see a certain process happening and the military has been fairly aggressive in this. A number of states have started to move towards pretty aggressive deployment goals, but there is an opposite side of the coin that was touched on. There are some concerns over what intermittent generation -- how much the grid can handle. We've got some concerns about lack of transmission capacity between maybe where renewables are abundant, like you know, I've been out to Creech Air Force Base where they fly the predators from. The only things around it is a truck stop/casino that is smaller than this room and the Nevada State Penitentiary. And then you have to drive another hour before you get to any other humans. So how do we, you know, deal with that transmission problem as well?

MR. KENCHINGTON: Right. Thank you. Well, clearly I think distributed power systems is one of the answers to some of these trends and changes that we'll bring to the electric infrastructure. We see some other changes, too, that -- some of them were mentioned this morning, the growth of renewables with the variable power and how do we operate the system now with more and more variables on the system. We found that when you get above about 20 percent the operators start having a little bit of problems and we need to figure out how to do that.

Another trend we see is electric vehicles; electric vehicles bringing those on, the distribution system. And one of the things we don't want when people come home, say there's five

people in a neighborhood and they all plug in at 5 o'clock and they all turn on their cars and they blow out that transformer.

So we're looking forward the next, you know, 5, 10, 15, 20 years in developing an R&D portfolio to kind of address those issues so we have, as Andy Karsner was saying, a secure, reliable, affordable, clean grid in the future, right.

So one of the things we're also looking at is cybersecurity. Back in 2003 actually, we started a very robust program working with utilities and with vendors on some of the large control systems, SCADA systems, that control the power grid. And since then we've developed a roadmap forward and we're also making I would say considerable progress.

We've now worked with just about every major SCADA vendor -- GE, Areva, Siemens -- hand in hand. We've tested their systems in our national labs. They've built more robust systems and those systems today are now actually being deployed and installed in the system so we're making progress.

And getting to the smart grid issue, yes, technology is kind of a two-way sword here where we're going to get the benefits, but we've got to deploy it in a smart way, right. We want to be able to address those cybersecurity concerns and build it in up front, not build it on later.

And the distributed power systems, too. With the military we actually started working with the military on bases on doing assessments. We've done about 12 assessments at various DOD bases starting, well, about three or four years ago. We've now completed I think 12 and we'll be producing a report on best practices on how to -- we call them energy surety assessments: looking at how to make sure you get your energy needs as well as they're secure energy needs and energy renewable. So we're working hand in hand with the Department of Defense in that area.

MR. SINGER: I want to press you on the issue of "we're making progress" was the phrase that you utilized related to --

MR. KENCHINGTON: Mm-hmm.

MR. SINGER: -- in particular the vulnerabilities of SCADA systems.

MR. KENCHINGTON: Right.

MR. SINGER: Because what was interesting is the last time I was up on this stage was

about three weeks ago and it was a conference on cybersecurity.

MR. KENCHINGTON: Mm-hmm.

MR. SINGER: And one of the speakers sitting just about where you are was the German information security specialist, who essentially is the guy who figured out Stuxnet.

MR. KENCHINGTON: Okay.

MR. SINGER: And he --

MR. KENCHINGTON: Langner.

MR. SINGER: Yeah. And he talked about his frustration that we're now almost a year since we knew that Stuxnet was a piece of malware designed to go after SCADA systems and that as far as he could see, most of the companies were aware of the problem, but had not actually plugged key gaps. There hadn't been a kind of reaction and he was saying, you know, he was at the point of tearing his hair out over it.

MR. KENCHINGTON: Mm-hmm.

MR. SINGER: That, you know, there is a difference between making progress on awareness and making progress on action.

MR. KENCHINGTON: Mm-hmm. Well, I think in the cybersecurity world it's real easy to say the sky is falling. It's very difficult to say it's not. I can say that I've seen evidence that utilities, many utilities, have addressed the issue; at least they've looked at their systems. Do I have protections in place to protect myself against that vulnerability? So we have actively worked with utilities, with North American Electric Reliability Corporation and with FERC to ensure that those kinds of issues are addressed.

MR. SINGER: But there's no requirements? You said many have. That implies many have not.

MR. KENCHINGTON: No, there is no requirement to go tell a utility you shall do this. I think it's important to understand that the electric grid is run mainly by the private sector, owned by the private sector, and they're the ones who have to make the investments in that.

MR. SINGER: Mm-hmm.

MR. KENCHINGTON: So it's a line we have to walk.

MR. SINGER: Right. And this is a great time to bring in Bradley on this. Maybe you

could speak to how you see DPS and the risk of intentional disruptions to the grid, particularly as you move from maybe these more rural areas where we're tending to be generating more towards the urban zones.

And the background for why I'm particularly interested in this point is I was at a cybersecurity conference, not the one here, but a week ago, where a hacker described the smart grid as the dumb grid. And how would you push back on that perhaps?

MR. SCHOENER: Yeah, I certainly wouldn't call it the dumb grid. Let me first say thank you, Dr. Singer. Let me thank Dr. Charlie Ebinger and Secretary Schultz for having this conference to begin with. I can't think of a better topic for having a demonstration of a nonpartisan discussion as this one and I'm greatly pleased to sit on such a panel as this. I'm honored to be here.

Let me just begin by putting out a couple of facts. One is more than half of the U.S. population is packed into a few dozen metro areas. Distributed power systems have a real potential for impacting those areas. The Department of Energy's EIA found that 80 percent of the United States' energy consumption occurs in these urban areas.

As Charlie mentioned this morning, natural gas is clearly a dominant fuel for distributed power systems. Going forward it can be a midterm bridging fuel. It also might be a long-term solution.

In urban areas, there are some challenges around this. There is different sorts of disruptions, three I'll mention. One is caused by natural disasters, another accidents, and last I'd call intentional disruptions, attacks. And I'm going to focus in on attacks.

Peter, as you mentioned, we've all seen the news in the past few weeks of the Duqu Trojan, and it's eerily familiar to the Stuxnet and its authorship and we're all wondering what the impact of that might be. These sort of attacks are certainly more sophisticated and more complex as we move forward. And the movement towards distributed power systems certainly introduce some real advantages and some real disadvantages to security.

I'll name a few of each. Let me quickly do that just to put them up on the table. This morning we heard mentioned the idea of islanding, being able to pull out of the grid when there is some sort of attack or disruption. If we develop a resilient architecture, we can continue to deliver energy even when under a cyber attack.

Third, there is an absence of a single point of failure and that's enormous. Distributed power systems really present a more defused target. Fourth, we're generating energy close to where it is being utilized. So we don't have transmission lines and distribution lines to be concerned about, so it reduces the target area. It also changes the fuel and generation mix. And by changing that mix, it presents less opportunity for a disruption. One group doesn't hold sway over any particular sort of fuel. Finally, it puts the control in management of the generation at the point the power is consumed. I think these folks have all been a testament to that.

There are some downside risks that we've got to manage. First there is the challenge of incentivizing folks who actually own distributed power systems to adhere to any sort of standard of security that will have a normal distribution of folks that are actually putting security systems and measures in place and are not.

Distributed power systems really expand the attack surface. There's more points of entry and so the ability for bad actors to make interventions that we don't like goes up. Third, and this is a particular concern in the urban areas, oftentimes with natural gas power generation we're looking at having storage tanks of fuel in populated areas. Those two present a target.

Next I'll name is the oil pipeline is a target itself and so moving a natural gas through pipelines is a point A to point B scenario and it's difficult to reroute when a pipeline is disrupted. Where with the grid, you are able to move around points and it truly is a network.

Last I'll name is generators and storage technologies have a supply chain and we all know the risks of having foreign nations involved in our supply chain around things that have security concerns. The potential of putting in back doors to critical systems is always a concern. So generally, on balance I would say that there is a security improvement, but there are some real limitations to be addressed, particularly in urban areas.

MR. SINGER: Well, I want to give the rest of the folks on the panel an opportunity to either respond to what you've heard from the other speakers or maybe if you even would like to pose a question to one of the other speakers and then we'll turn it open to the broader audience here and I'll just go down the row.

ADM. McGINN: I was thinking about distributed power as I read reports of the

"Snowtober" that happened over the weekend. Folks up there in Connecticut especially, hardest hit, -- a foot of wet snow on trees with leaves and lots of falling branches. And I was reminded of, you know, what happened here. In Hurricane Irene there were the same kind of power outages, different natural cause. But more and more people are really starting to appreciate this idea of distributed or decentralized power generation and getting it closer to the load.

Whether that load is your house and you've got a refrigerator to run and you've got -- and obviously a computer to run, and you have your Honda generator at the most basic level being able to produce 3 kilowatts of -- 3 kW of power, or whether it's one of these embedded gas-powered usually neighborhood type systems or a commercial system that people have said, hey, look, the interruptions have become so frequent that, because of severe weather events, that I'm just going to go ahead and make the investment because the loss of economic good or end quality of life just makes it so imperative that I insure myself.

I think as we see more and more opportunities come for beyond fossil fuel types of power generation systems and the kinds of storage systems that can really, really leverage those, I think we're going to see a lot more of this kind of a bottoms up demand for distributed power systems.

MS. BURKE: Well, a couple of observations. I mean, one, the great toy that Dennis McGinn brought. If you think about this is being used now by Army, the Marine Corps, and Navy special operators, it's why are they using it? They're using it because it has a mission benefit and a capability benefit, because it allows them to do something they need to be able to do in the theater of combat.

They want to get as much resilience to the supply line as possible, as much range and endurance, they want to minimize the number of people who are exposed to take risk moving things around the battlefield. Certainly we're interested in the fact that it saves money, too, but the primary reason is because it advances the mission.

So it all kind of comes back to that for us. And in some cases for domestic installations or for installations around the world that are fixed sites, there is going to be a number of different kinds of answers and it may be that sometimes improved generation on site or a microgrid that can do some load management are going to be extremely interesting and attractive, but there are also going to be circumstances in which better interdependence with the grid is going to be what's most resilient and

strongest.

And so we're going to want to look at what the possibilities are, what our needs are, what our mission is, and the whole range of opportunities there. But I would say, too, that the term "islanding" is one that I personally don't like to use in a DOD context for a couple of different reasons. One being that, you know, we have several different missions. We have the national security mission, but also support to civil authorities in a domestic emergency when so directed and it's not practical for us to talk in terms of isolating from the civilian community.

In those circumstances, we support the civilian community, and not only that but we're highly integrated with the civilian community. So it may be that our military members on that base live in the community, have day care in the community, their spouses have jobs in the community, there may be water, natural gas, and many other things other than just electricity.

So we tend not to think in terms of separating ourselves from the communities around us, but rather that interdependency as well. So islanding, I get what people mean by it and we're certainly interested in making sure that our missions are secure and can be continuous, but islanding is a term that, in general, for those reasons we try to avoid.

ADM. CULLOM: I would add onto both of the series of comments you have heard so far. I'll go back to what Admiral McGinn talked about when he talked about all of the different things that are out there in terms of alternatives. I think we all have gotten fliers in the mail, you know, whether it's the Honda generator or the solar bank that you can roll out and then be able to plug into your house so that you don't even have to have the Honda generator out there or the natural gas generators now that are able to convert directly to power. And of course we've seen a lot of the industry that's involved with data going to that approach to safeguard their ability to be resilient in case of earthquake or you name it.

What I would add on that is that to amplify on what Secretary Burke talked about, about islanding. Islanding, not really a smart idea for all of the reasons that she mentioned. But there is a way to be able to be resilient without actually having to be islanded from that.

And that's two goals that both Roughead, our last chief of Naval Operations, as well as Secretary Mavis, Secretary of the Navy, have put out there as to have 100 percent of our critical infrastructure to be able to be secure, and there are a lot of different ways to make it secure, and to have

50 percent of installations to be able to be net zero by 2020 time frame.

Now, those are challenging goals, but certainly very important if you're going to be able to enable all of the operations, whether it's operations that would happen at Creech Air Force Base or whether it be operations that happen in Norfolk, Virginia, when you're trying to get a Carrier Strike Group underway.

The other thing I would add is that the answer set is much broader overseas than it is in the continental United States because in a lot of places overseas, whether it be Guam, Hawaii, Guantanamo Bay, being able to have energy there that is, you know, like air, that you just accept is there, comes by barge. And just imagine how expensive it is to move that oil there. That allows you to be able to experiment with a lot more alternatives in places like that and it makes a good economic sense to be able to choose those alternatives.

So you can do ocean thermal energy conversion or solar or other types of alternative fuels and be able to use that as your resilience that you gain there while you're experimenting with it and while those costs continue to go down, while you're focusing on efficiency, efficiency, efficiency, because you can't neglect that piece of it. We've got to curb our appetite for just the profligate use of energy that we have in this country and all of those feed together to give you that resilience.

MR. SINGER: Just to add something. Since you grew up in the era of Goldwater-Nichols, you didn't point out, but I will, those kind of firm fixed goals that have been set in the Department of Navy have been incredibly evaluable. We have not seen them in the other departments on a joint level and that's something that I think could be great to see the other services set up the same kind of firm fixed goals.

MS. BURKE: Actually, all of the services do have firm fixed goals.

MR. SINGER: Of the same percentages?

MS. BURKE: Not of those percentages. But I think, you know, the challenge for all of the services -- and, you know, we're now forming a Defense Energy Board to figure out what the enterprise-wide performance target should be. Because one of the problems is that we don't have very good information or metrics on which to base these targets and we don't have very good analysis. And it's still useful to put a mark on the wall that you're aiming for, but we want to make sure that the department

knows more about the way it's using energy to support military operations and is setting metrics for the whole department that are going to get us where we need to be, which is making sure that we have the energy we need to support military operations.

So all of the services do have goals in this area and, you know, there are various ranges of ambitious and executable and various ranges of data analysis behind them. We are moving to a common effort on that.

MR. SINGER: All right.

MR. KENCHINGTON: I just wanted to kind of build on what Dennis was saying. He was saying there's kind of a grassroots kind of trend or drive or pushing up for distributed power systems, but we're also seeing a kind of top down from a transmission planning perspective that the ability to site new transmissions lines is becoming more and more difficult. We're looking at 5, 10 years if they get sited at all. So that's kind of a pusher towards more, more, more local energy.

Another common issue is in urban areas. There's no more space to put new transmission lines. So how do we make those systems more efficient and more effective, and that's -- to a more distributed and localized solutions.

MR. SINGER: Bradley.

MR. SCHOENER: Yeah, I guess I would make two comments adding to these. One of the things that I see is so useful that Department of Energy is just starting to do is gather data from a variety of the civilian agencies on energy. They're struggling to I think get consistent metrics in place, but they are moving down the path, is really pushing that along, and that's good to see.

One of the challenges I see, and one of the reasons I'm a real proponent for natural gas, certainly for the urban area, is you were talking about space. I look at solar and wind in urban and I say how would you do it? That if I have a 10-story building with a rooftop, it's not a very big rooftop comparatively to the space inside that building, and so the amount of offset you get isn't that great for the density. And so there are some real challenges. And so propane and natural gas suddenly look like a much better alternative to me.

MR. CHEN: Chow Chen, freelance correspondent, (inaudible). I just get in late on this panel three, but I heard a tree so I would like to talk about the tree. I did not know, as the panel two, you

know, (inaudible) mention tree or not. Every time there's a wind, rain, and snow, the tree always fell down and lots of people got affect, electricity disrupt. I think this is a real big issue.

I think Department of Defense and Department Energy and also a local community and the electrical utility should form a team trying to inspect the tree, particularly those tree -- big tree next to the house or next to the power line. I think if there's a potential risk, I think we should try to take it out. Thank you.

MR. SINGER: Does anyone want to tackle the issue of natural disaster? And, I mean, you touched on it a little bit earlier in terms of the impact and maybe where DPS comes into this, and maybe I'll pose it in this way. From the policy perspective, how can we do a better job in the combination of DPS as a response to natural disaster? What's missing right now?

ADM. McGINN: I think Admiral Cullom really hit on it earlier when he -- I believe the word he used was "resiliency." I would use another phrase that goes with resiliency, "graceful degradation," so that you try to take a systems-wide approach: where and how you're generating power, or energy in the case of gas or liquid, where are you using it, and how do you get it between the two points and how you can eliminate single point failures. Whether if I've got a line going from my home to the electrical distribution pole and I've got a tree that is threatening it, that's a single point of failure, that I want to try to mitigate the risk. Maybe it's a good strong tree and I think it's going to be able to withstand the ravages of Mother Nature. However, if it really is important for me never to lose that power, if I have a business or something like that, then I'm going to be talking about putting the lines underground or doing something with the tree.

I will make kind of an allusion to literature. I think that poem "I think I shall never see another thing as beautiful as a tree" must have been written before electricity.

MS. BURKE: Well, I want to clarify that the Department of Defense is not against trees. We like trees. But what we are for is partnerships, and a lot of our bases in particular will have very strong relationships or will seek to have strong relationships with the utilities that serve them. They are often significant consumers for those utilities. We do work together and we work a great deal with our partners in DOE, which I think this is really -- this is probably Hank's personal nightmare.

MR. KENCHINGTON: Well, I'll just get back to the trees for just a second. The utilities

do have responsibility to trim the trees. Unfortunately, they come up against some aggressive homeowners sometimes that don't want the trees taken down, but it is really their responsibility to take that. They spend a lot of money on actually what they call vegetation management. So that policy is in place.

MR. SINGER: The person right here.

MR. CASTEN: Tom Casten. Peter, your panel has done a great job of talking about the security problems of a central grid and yet when we went to Iraq, the policy was to rebuild a central grid. Now we're in Afghanistan and we're doing the same thing all over again where there is no grid and it's horribly vulnerable. How do we take the knowledge that's coming out of this panel and translate it into our policies and nation building?

MS. BURKE: Yeah, I think we're agreeing that's a great question and would say that we need to do a better job and that's certainly -- the Department now has an operational energy strategy and that's one element of it, is that we need to integrate these kinds of concerns, the way that energy affects not just our tactics and our ability to operate, and our strategic interests and where we have our missions, but that place in between, our operational and our strategic goals. When we are deploying we need to incorporate energy considerations into that from the very beginning. However, in Iraq, of course, the security of energy supply continues to be an issue for the Iraqis and an issue in civil unrest. That's true in many countries around the world.

In Afghanistan, it's both. You know, again, you're talking about countries that don't have much in the way of electricity -- well, in Afghanistan at any rate -- and it has to be part of the answer. But we also have a Village Stability Operations Program which is looking at a decentralized generation and how there are areas of Afghanistan that are not going to be on the grid and they don't necessarily need to be in order to get the kind of energy they need. So we are looking at both right now. Those are being integrated at a strategic level at U.S. Forces Afghanistan Headquarters and also within ISAF.

MR. SINGER: Go ahead.

ADM. CULLOM: And I would add that from not just a strategic, but also from a tactical perspective, what we're looking at doing in some of those with the Village Stability Operations Group is to have simple leave-behinds, things that will allow that community to have power, but not something that is

so complex that two months later after we're gone it can't be operable. And there's a lot of really interesting things going on out there in academia, at universities all around the country, that can help people that are dedicated to trying to bring a leapfrog, in essence, leapfrog the grid that we created and have people not make the same mistake as we try to help nations be able to come into the 21st century in a different way.

ADM. McGINN: You'll recall that after the Wall came down in 1989, the countries of Eastern Europe wanted to have world-class telecommunications system and instead of importing lots and lots of telegraph and telephone poles and wires they leapfrogged and went to wireless.

And I think that this concept of leapfrogging has applicability in nation building, certainly as you posed the question, Tom. And it also has, I think, some applicability in how we recover after natural disasters here in the United States. There's a couple of communities that have really taken this seriously, one in Kansas years ago after a tornado.

And there's tremendous opportunity for us to not exactly use them as test beds, nobody wants to live in a test bed community, but to take a look at what the possibilities are for gaining much, much greater energy efficiency, energy redundancy or resiliency, energy choice, and to do it in a way that actually enhances the economic vitality and a quality of life of those communities when they're rebuilt by leapfrogging over just having to rebuild it the way it's always been done, starting back with Thomas Edison.

MR. SCHOENER: So I'm appreciating the design of the morning of stepping through both the economic aspects and environmental aspects prior to the security aspects because taken alone, if we just focus on one, we come to the wrong conclusions I think.

I was part of a group sponsored by the Department of State and the Department of Energy to work with a coalition of the Iraqi Oil Ministry about four years ago. They came over with the question of rebuilding their infrastructure to figure out how to pay for roads and hospitals and schools and so forth. And we were working with folks that were pipelined and refinery folks, different engineers. As we were having dinner one evening, I was talking with them about what life was like in different cities and they all talked about the fact that there was a grid that was on for a few hours a day, but if you wanted quality power you had to pay for it and it came from a diesel generator on the corner. And none of them

wanted to pay the diesel generator all of the time because it was very expensive. But when they needed it, they wanted it available. And so I think choice is a matter here and economics has a big sway in this.

MR. SINGER: I would just add there's an additional advantage to the decentralized approach that hasn't been brought up, which is you're talking about conflict environments and the role of the enemy matters most, and at least the experience in Afghanistan has been that the Taliban targets power infrastructure that's highly centralized, but when the local village owns it, they don't target it because they know that means losing hearts and minds there.

Now the problem is the contradiction of that necessary factor and a counterinsurgency versus our broader counterinsurgency strategy, which is focused on centralized state building. So the independence of that village having its own power source makes them less vulnerable to Taliban targeting, but it also means they don't need Kabul as much. And we have a problem set there.

Let alone, it means there is not as much money to peel off of large infrastructure projects. And when I say "peel off of," notice I didn't identify whether it was an Afghan contract or an American contract are doing the peeling off of the money on the infrastructure construction. All right, over here.

MR. BECK: I'm Chris Beck with the Electric Infrastructure Security Council. We're a nonprofit organization focused on security of the electric grid and most specifically security from high-impact, low-frequency events, like solar storms or nuclear EMP, some other kind of radio frequency jamming. Before I was here I worked on the Hill, the House Communittee on Homeland Security for a number of years, and I focused on science and technology and infrastructure protection issues.

And so I have this kind of general question that seems one of the last comments, your comments, sir, about how we talked about the environmental, we talked about the economic, we got to the security. And I want to ask this kind of high-level question that's always been a difficult one for me to figure out, which is how do we make an economic and security connection? How is it that we can best make the business case for security?

We had some examples here about -- Mr. Singer brought up the fact that he was at an operations base and the power flickered and they said no worries, we've got a backup generator. Well, that's something that the military can usually do because they're not very cost-sensitive on that. The mission is always -- usually wins the day and the ultimate trump card is the life of the service member. So

if you can say this equipment is needed because, you know, less Marines are going to die, most people are willing to put up the money for that.

In a private sector business, that generator is an asset which is not generating income. It's a redundant -- and that's good for security, but it's bad for standard economic thought. And so there's always this tension and so I'm wondering what are those things that can be done that make a financial incentive out of having security, redundancy, distributed power, hardening, whatever the solution is, how does the CEO view that? Because you have situations usually where the chief security officer says, hey, we really need to do that, the CEO says you've got to make the business case for it before we expend, you know, capital assets on this kind of thing. And it's always been a challenge for me and I'd like to just take advantage of the brain power here and ask that sort of high-level question. Thank you.

MR. SINGER: That's a great question. And I'll maybe make it more pointed. If we're looking in the realm of infrastructure, the last two speakers talked about cybersecurity risks and yet among major infrastructure companies over the last year we haven't seen spending on cybersecurity increase. So how do we, whether it's on cybersecurity or more broadly on infrastructure, how do we make a better business case for security? And why don't we just -- it seems a topic a lot of people would be interested in, so let's just start with Bradley and move on down.

MR. SCHOENER: A couple of examples. I think really the Holy Grail is how do I make something more secure and have and ROI, right? How do I put it in a process procedure technology where I can make it more secure, but also save money? Okay.

I can give you a couple of examples where we've actually done something like that. One is a technology that we developed. It was actually developed at a national lab in an inoperable -- interoperable kind of a shell, operating system shell, that we then commercialized actually through Schweitzer Engineering. They built an interoperable communications box that they could put in a substation where they can interoperate with other vendors' equipment and they improve the security for a couple of reasons.

They built an encryption into the one box and so they can put in serial communications, they can put in routable communications, but the box also controls the passwords, okay, to other devices in that substation where before you had to have a guy come in one at a time and change all of those

passwords per the NERC regulations every six months. Now you had one control and you can control all of those. You can do it in one centralized process. So that's an example of where we did that one. We actually reduced the cost and improved the security.

Another one was that we developed a security profile that a company could use to put on their control system, their network, and check to see are their settings in the proper position, okay. If I've got 2,000, like your PC, you know, do I have all of the ports open, closed, those kinds of things, and it automatically tells them whether they're on or off and that helps them meet another NERC requirement. So they reduced the compliance cost and increased their security.

ADM. McGINN: I guess my initial reaction is that something -- it's impossible to secure these sorts of systems. With enough time and money almost anything is penetrable. Generally what I learned in the counterintelligence world is really that the name of the game is making it so expensive that it's prohibitive to your adversary. And so one way we can start to look at it is saying who is it that's trying to penetrate and how deep are their pockets, and starting to cost it that way rather than based on the consequences, pay attention to your adversary.

MR. SINGER: I want to take the same question and frame it more towards the DOD side and looking at research and development, which is often -- you know, while the point was made that maybe the Defense Department at the end of the day isn't cost-sensitive, although I think you're probably feeling differently particularly these days and moving forward, but in tough budgetary environments, the experience has been -- and it held true in last year's budget -- that research and development is cut by a greater salami slice than the rest of the budget, and yet R&D is that part of investment that your seed corn for the future and we can look at it in sort of the same way of security versus investment. So what's your sense of this in terms of how do you make the case in the R&D side for the value of that investment being paying off even though you don't get the fruits of it until a longer term in the future?

ADM. McGINN: I would start by saying that Hank made a good case and provided a good example that security and costs aren't necessarily a zero sum game; that you can, in fact, make some pretty good investments that enhance your security at a lower cost.

I think in terms of Department of Defense R&D, or DOERE R&D, it comes down to the classics of cost-benefit risk analysis. And risk has two components. It has probability and consequence

of failure. So depending on what the end use for whatever technology you're trying to develop, and earlier in the stage research on it, I think it is going to be driven by what are the direct costs and the indirect costs to the extent you can include externalities.

What are the direct and indirect benefits of -- in a case of DOD? Certainly one great indirect benefit is the kind of technology that brought us the Internet, GPS, all of the other things that we've benefited from DOD research.

And finally, what are the risks, the risks of failure in a particular mission, and what are the probabilities and what are the consequences? Is it something that you can, in fact, accept a certain amount of failure or is this something that it's got to work the first time every time? Apollo mission type of approach to R&D there.

MS. BURKE: I just want to clarify, DOD likes trees and we also like a positive return on investment. We're not against ROI. And, in fact, for us we're not that different from any other business when you get down to it, which is whatever we are purchasing or doing there has to be a return on investment. The closer you get to the fight, the more that some of those returns may be nonmonetary. But in general, you know, a lot of our activities, you know, $500 billion, 2 million person organization, more when you start counting Guard and Reserves and veterans and families, and we still need a return on investment, a monetary one, too. And that's even before the current budget environment.

Now, however, it's a really good question which is, yes, we're having to find $450 billion at least in budget cuts over the next 10 years and Secretary Panetta and the new chief, General Dempsey, have made it very clear that we're not going to sacrifice the strategic interest of the United States or the military capabilities we need in order to answer them, in order to comply with that. But it's still the reality that we're going to have to find how to do business in a more effective and efficient way and we will do that.

Research and development is one of the places that traditionally comes in for cuts in those circumstances. One of the other places where we tend to take risk is in infrastructure. So, you know, we're going to be watching closely to make sure that those investments keep the longer term interests of the Department of Defense at, you know, and on the table and in consideration. I think we're very committed to making sure that we continue those investments.

The other thing I would point out is that how the department gets innovation isn't just the R&D that we sponsor directly. Our acquisition budget is hundreds of billions of dollars a year and that's where the big money is. And if we start putting requirements in our acquisitions for better energy performance, that's also an R&D draw and that is one place where we're going to improve no matter what our budget cuts look like. We are going to make those requirements and that will stimulate R&D as well. So there's more than one way that we engage with the innovation sector.

ADM. CULLOM: The one thing I would add on that is that 10 years ago you would probably not have thought that Google or Groupon or companies like that would have gone through a calculation to figure out how they make their systems more resilient. They just came off of the grid and, voila, that was it.

And what they have found since then is that they really do need to do that. They clearly have done that. Now their metrics are probably a little bit clearer than some of ours are because we span that distance between the pointiest end of the sphere and a place like Afghanistan or even in Iraq, as well as back home here right next to the community alongside us. So there are differences with regard to probability and consequence which are that measure of risk. And we do have to sit there and balance what is that risk and find a relative risk mitigation that will allow us to be able to continue the mission, what that mission is, in a reasonable way.

We generally try to look at portfolios of things, where we mitigate the risk down here. There are other portfolios that we may pick in the upper quadrants that have greater risk but less probability of happening, but yet are so potentially catastrophic we do need to make an important investment there.

Secretary Burke mentioned the issue about procurement and what we go out there and go buy, and that is a critical thing because unless we actually put it into writing and say this is an RP that will -- a requirement for the next type of weapon system, it's not going to make it through that process. And we are in the process of doing exactly that.

And in the Navy we've got some paper out there on the street that actually helps us in that regard. There are big new systems out there that are going to be made more energy efficient as a result of that and those contribute directly to a different kind of resiliency. And also when we pick those

new ideas out there that have maybe a R&D that has a very small chance of success, it's also important for us though to pick a few of those, the shots on goal, as Mr. Cosler would say when he looks at his venture capital of things he invests in.

Well, we have to do some of those kinds of things ourselves, too, in the Navy or the Air Force or the Army. We have to make some well-placed bets out there, but we also have to have milestone points where we look at it again and go if this isn't panning out well, then let's stop that investment so we make a good prudent use. But we do have to be able to think 10 and 20 years out because I think that's what you demand of us as taxpayers and you should demand that of us.

SPEAKER: I just wanted to follow my question earlier quickly and say thank you for the great answer and just to thank Brookings and the Hoover Institute for coming together on this.

And the impressive part about it is that there are people that are coming to this from -- people like myself that are interested in security, people that are interested in consumer, you know, prices being lower, and people that are more for going at it for the environmental aspect and looking for solutions where there are partners that you don't normally think about and finding them and saying, well, we can find some common cause here and we can all benefit even if it wasn't any one person's particular focus, but finding areas like this where there is such a broad series of drivers. I really want to credit everybody --

MR. SINGER: Thank you.

SPEAKER: -- and thank everybody for being --

MR. SINGER: Okay. Any other questions? Right in the way back there.

MR. COLORINA: Thank you. Rob Colorina, AIC Investments. And the question is with respect to if you're seeing technological progress amongst these different service areas, the culture of sharing them amongst the different branches. And then also, too, with the DHS, Department of Homeland Security, I'd be interested particularly in Admiral McGinn's -- now that you're in private sector, what could be improved amongst that?

ADM. McGINN: I know on the first question, that's one for Secretary Burke. She has purview over all of the services and her equivalent in terms of installations, Dorothy Robyn, does that as well, to try to blend together. And then the uniformed area, the Joint Staff does it.

So I come from a time when about half of my career was before Goldwater-Nichols and the other half was after it. And we definitely benefited from that legislation and we came maybe kicking and screaming to that realization, but it really is -- it's the way it works. It's the way we fight, it's the way in many cases we train, and it's the way in which we increasingly procure things. Not a perfect world by any measure.

But on the Homeland Security thing, I know that FEMA in particular has been looking at ways of responding in the immediate with more solutions for sustainable energy, for example, or alternative energies. And looking a little bit further ahead to the recovery from a natural disaster for example, that tends to be more on the State side of things.

What I am working to try to do is to get a better dialogue going about how you can best use whether it's public money for emergency disaster relief or private money coming from insurance companies or investment companies, to use that money to create a better outcome than what the status quo was before the event.

MS. BURKE: Well, my office is fairly new. It's only a little over a year old and it was created specifically to improve coordination within the department across military departments, military services, and the Joint Staff, and other relevant agencies in recognition that we could do better in that area, particularly when it came to the operational energy side of the House.

And you have to remember that that hasn't really been a separate category for all intents and purposes. You know, Admiral Cullom has said a couple of times, compared energy to air. It's been an assumption in our military planning. It's just it's the part of it that's been carefully planned for a very long time is the movement of energy and the movement of fuel to the fight and we have, you know, a cadre of -- who are brilliant at that.

But in terms of managing that energy and using it better and differently, it's a fairly new practice, so even accounting for it is new for us. As I said, we don't have a lot of data in that area, but we're moving forward on that. And just recently, just two weeks ago I guess, the chairman designated a lead on his staff on this issue. There has not been a lead in the Joint Staff when it comes to energy and operational energy and now there has formally been designated someone. So we're definitely moving forward to do that.

Now, to be fair, and Admiral Cullom can say a lot more about this, the services do share a lot of data, particularly on things like fuel certification, things like that. And they do work jointly when it comes to the logistics of energy. There's a great deal of collaboration. It hasn't been formalized necessarily.

The same with DHS in that we have a formal new MOU with DOE that's heightened our collaboration. I know that there has been some discussion about a three-way collaboration on siting of renewables and whether or not DHS is going to formally collaborate on the MOU. I think also there's my colleague Paul Stockton, who is the assistant secretary in Homeland Defense. We run together with our colleague Dorothy Robyn, an electric grid security group that includes DHS. So we do talk. We do collaborate extensively on that issue. And of course, on the Homeland Defense side, they work very closely with DHS on a whole range of critical infrastructure and homeland defense issues. So there are definitely formal and informal collaborative networks on all of the things you mentioned.

MR. SINGER: Any other questions?

ADM. McGINN: I would just, by the way, add that the collaboration that we have undertaken with the other services is pretty far-reaching. Now, clearly for the Navy, we're buttoned up with the Marine Corps all of the time because that's Department of Navy, so that collaboration is probably the easiest of all.

And clearly the efforts that India 3/5 did last year, we've been able to work very closely with the Marine Corps on not only just some of the projects that we had very early on with Recovery Act money, that are seeing their way to fruition, not only in India 3/5 and the expeditionary forward-operating base concept, but now also leveraging to the next level with the SEAL Teams.

But the other collaboration with other services is also very good as well and we're talking all of the time to the other energy offices within the other secretariats. And collaboration with other departments has -- it's a challenging thing because our cultures are very different and we sometimes run into some stumbling blocks that are just a matter of how we relate to each other, but we broke it through a lot of those barriers, too.

And I'd tell you, one of the easiest ones has actually been with Department of Energy with RPE. And RPE has a mission set and, interestingly enough, it's pretty complementary in many ways

with ours because they look at some very early S&T to R&D. But then we can serve as kind of a catcher's mitt on the other end if we do early collaboration. And that's what we're in the process of doing with Dr. Meshram Darr and -- his deputy there, as well as with other departments -- USDA, Agriculture -- we have an MOU and we're working those issues, that's for alternative fuels, and also with NASA.

MR. SINGER: Charlie.

MR. EBINGER: Charlie Ebinger from Brookings. Do any of you see any evidence of any other countries that are seeing DPS systems from a security standpoint, thinking particularly Russia, China, or anywhere else?

ADM. McGINN: I would say more likely the UK and Australia.

MR. SINGER: Frame it a different -- well, I was going to put it in this way. The U.S., while we've talked about that we joint -- Goldwater-Nichols and we say we fight jointly and we train jointly, we buy jointly, kind of, but we actually don't. We fight in coalitions, we train in coalitions.

Do we see what's been the interface with colleagues, maybe perhaps within NATO, or are -- you said maybe Australia? But are we seeing it institutionalized within our alliance systems and, if not, how can we do that better?

ADM. McGINN: I'll give a personal example. The United Kingdom envoy for climate and energy security, Admiral Neil Morisetti, active duty admiral just like Phil is here, is a frequent visitor to Washington and throughout the United States. We've traveled to places as far flung as Austin, Texas; New York; Miami, Florida, over the past couple of years, basically comparing the approaches of both nations from a Navy perspective -- in my case retired and his active -- about how we are viewing things like energy security and what we're doing about it.

So I'm sure Phil could talk quite a lot more about the specifics of this sharing of perspectives from a very, very high national level, strategic view, on down to the tactical. And as you've rightly pointed out, we fight as coalitions and I know that there's a lot of collaboration going on at that level.

ADM. CULLOM: And my personal example is just from a couple of weeks ago. We had an International Sea Partisan Symposium held up in Newport, Rhode Island, where over 100 leaders of navies came together to talk about issues. And as you can well imagine being addressed by not only our

chief of naval operations, but the chiefs of naval operations from many other countries, there were panels and you name it.

Secretary of the Navy also addressed one group. Actually it was the kick-off and very early on in his speech he talked a great deal about energy and about coming to solutions together on this. And I found myself engaged with an awful lot of staffs of the chiefs of naval operations all interested in solving this energy issue. And it's not just the UK, it's not just Europe, South America. It's Asia, it's the Middle East. Everybody is interested in this issue.

SPEAKER: Thank you for bringing up the recent conference that you just had with all of the international navies. Would you, and also Secretary Chu, talk about the necessity of the ratifications of a United Nations conventions on the law of the sea? Because I sit in one of the conference and Senator Murkowski talked about energy and she said one of the concerns that we need to have is to have Congress ratify that (inaudible). So I'd like to hear your views on that. Thank you.

ADM. McGINN: It's long past due for our Congress to ratify the law of the Sea Treaty. I mean, every service, every national security organization, whether it's a department or an agency, has endorsed the benefits of that. The risks are not completely gone, but they're minimal compared to the tremendous benefits so long past due. I'm disappointed that it's taken us, our elected officials, so long to recognize the goodness that can be gotten for the United States and for our allies by ratification.

MR. SINGER: I believe if I have my history right, every president since Reagan has endorsed it from both parties, which is very hard to get every president since Reagan to agree on one thing.

MS. BURKE: I think we have an expert in the front row.

MR. SINGER: But before we invite you to come -- actually, do you want to weigh in on that?

SPEAKER: (inaudible) comment on that.

MR. SINGER: Sure, go for it.

SPEAKER: (inaudible) since Reagan. When the law of the Sea Treaty was as proposed in the Reagan Administration, it had an absolutely terrible mining provision in it. It was completely unacceptable and the President said so. And it got changed, and now it's really a very good mining thing.

As a matter of fact, as a result of our not now ratifying it, our mining companies are at a disadvantage because they don't have access to the regime that is established by the law of the Sea Treaty as properly amended at the urging of President Reagan.

So now I think the case is compelling to get it ratified and it's stirring again. And I've had -- personally, Jim Baker and I wrote an op-ed favoring the ratification of Law of the Sea in the second Bush Administration. And I think we are well on our way to having all of the former Republican secretaries of state ready to pitch in, and as I understand that maybe next spring sometime is when this would go.

But I think it needs unequivocal, unhedged support, particularly from the Navy because you know the most about it. But there are also a great energy interest here in protecting our continental shelf up in the Arctic for instance. I mean, the Chinese are on our continental shelf as I understand it, but they shouldn't be there. So now that President Reagan got it straightened out right, we should ratify it.

ADM. CULLOM: And that was a topic of discussion at great length and centering mostly around the issues associated with the Arctic as we look ahead 20, 30, 40 years, that the imperative for that was pretty overwhelming for many chiefs of naval operations from around the world, most of those that were interested in the Arctic.

MR. SINGER: So the only thing that needs to happen is for Congress to act in a mature and wise manner, which seems to apply to many more problems beyond the Law of the Sea. We're getting to witching hour here, so I'd like to give each of our panelists an opportunity to make any final comments that you'd like to raise. Why don't we just start from right?

ADM. McGINN: I'd just like to wish everybody a Happy Halloween.

MS. BURKE: I would add for the Department of Defense sort of a reminder that we're -- not to forget the power of the unglamorous acts; that for the Department, as we're interested in distribution and distributed powers for the two reasons I mentioned, for our fixed installations and for our deployed locations, that we are, you know, one of the first steps in capturing the benefits of that is getting our demand down and controlling the volume of fuel that we consume. Because as long as we consume the volume that we consume, other solutions become more difficult.

And that secondly, when you're looking at resilience at home, even though we have to be

worried, concerned about the high-consequence, low-probability events such as you mentioned, we also need to think about the, you know, the frequent events, the angry water pipes and the tree branches. Because in the time that I've been in office there have been a number of outages at military bases and they have inevitably been maintenance shortfalls or human error.

So we need to also -- you know, our first line of activity or defense when it comes to resilience at home is to do those things. So I would just, you know, urge that we are looking across the whole scale, but we shouldn't neglect the things that don't sound quite as exciting, like demand management and just maintenance of our systems. So that's my plea there.

ADM. CULLOM: I'd say what the secretary said, but I'd add to that a couple of things. The first is that, at the end of the day, the barrel that you don't burn, the MBT that you don't consume are the most important ones to go after first. And I think that's -- in this era of fiscal restraint, we have a responsibility to go do that first.

And at the end of the day, every investment that we make somehow needs to add to three things: combat capability, combat capability, and combat capability for the military. Otherwise it's an investment we probably shouldn't be making.

MR. KENCHINGTON: Well, I think the -- having been involved in the energy, I'll just call energy space, for about 15 years, it's pretty complex. We try to put it in like a triangle of the technology, a combination of technology and markets and policy. And it can be very complex, but I think at the heart of that, the way that we can solve some of these problems is through innovation. And if we focus on innovation and putting our heads together, I mean, we could invent an iPhone and all of these kinds of things and put solar -- now we've got it down to where you can wear it, right. We can get our way out of this I think. Thanks.

MR. SCHOENER: Yeah, so I'd say the security improvements offered by distributed power systems are immense and they have some real complexities to them, some technical challenges to them, but I believe the policymakers could tip that balance and introduce them in the U.S. to our advantage.

MR. SINGER: Well, with that, why don't you please join me in a round of applause for our fantastic panel? (Applause)