

Center for Strategic and International Studies

TRANSCRIPT
Online Event

**“Supply Chain Resilience: Opportunities for U.S.-Korea
Cooperation”**

DATE

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FEATURING

Don Graves

Deputy Secretary, United States Department of Commerce

Denise Gray

President, LG Energy Solution Michigan Inc. Tech Center

John Neuffer

President & CEO, Semiconductor Industry Associate

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*Transcript By
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Matthew P.
Goodman:

Good morning and good evening to friends in Korea and other parts of Asia. Welcome to CSIS. My name is Matthew Goodman. I'm senior vice president for economics at the Center for Strategic and International Studies here in Washington and delighted to welcome you to this event on Supply Chain Resilience and Opportunities for U.S.-Korea Cooperation. An important topic for, I'm sure, everybody who's watching this conversation – either because you're interested in U.S.-Korea relations or in technology and the opportunities in a couple of important technologies, batteries and semiconductors, which we're going to focus on in this conversation.

Those were two of the four sectors that were studied by the Biden administration in their 100-day review that was released in June. And so they're very important, obviously, anyway, but they're a particular focus of policy interest in Washington these days. And we want to explore with some real experts what the risks are, what the opportunities are in those sectors. And so we've got a terrific group lined up here today. Let me start by thanking the Korea International Trade Association, which is making this event possible. We thank our sponsors for their support. We couldn't do what we do without their support. So thank you very much for that.

I now, I think with no further ado, have the distinct honor of introducing the Deputy Secretary of Commerce Don Graves. Mr. Graves is the 19th deputy secretary of commerce. The Commerce Department, as everyone knows, does a lot of things, but among others it's focused on jobs and innovation. And in that context, was responsible in particular for the semiconductor part of the supply chain review. But I'm pretty sure Deputy Secretary Graves is going to say, has an interest in all of this conversation about supply chains. And he's also served in the Obama administration and at Keynote Bank before this.

And importantly to me, as a native Washingtonian, his family has a kind of a storied history here in Washington, having run a horse and buggy business on the site where he's sitting. His great-grandfather ran that business, and then his grandfather ran a hotel around the corner and was one of the first Black patent holders in the United States. So I'm just thrilled, as a Washingtonian, to have this chance to turn now to Deputy Secretary Graves. So please, Deputy Secretary, welcome. Thank you.

Don Graves:

Well, thank you, Matthew. I appreciate that really kind introduction. And I'm glad that the experts will be on to follow up behind me, to really dig into these issues. I also want to thank CSIS for organizing what I think is

really a critically important event discussing a topic that I know all of us are paying a lot of attention to. As you all know, supply chain resiliency is a top priority for the Biden administration. And it's a key part of our build back better agenda. And as Matthew, as you said, Commerce is at the center of the efforts around supply chain resiliency.

Now, we all know the pandemic exposed just how vulnerable some of our supply chains truly are. And today we're continuing to see bottlenecks across the entire country and across the globe on things like home building materials, transportation delays in our ports, and supplier shortages for aluminum, electronics, pharmaceuticals, batteries – that I know we're going to hear a little bit more about – solar panels, and a whole lot more.

We're seeing it particularly as it relates to semiconductor chips. I know this is something that has been in the news a lot. And those chips, as we know, power our daily lives – from our smartphones to our cars, medical equipment in our doctor's office. They're really the building blocks that underpin our modern economy. And they're essential to our national security and our economic competitiveness.

Well, the U.S. faces two crises in the semiconductor industry, which I'm sure you all know about. First, there's an immediate shortage that's disrupting our critical industries, furloughing our workers, slowing our economic recovery. And then second – a second piece of that, and that's threatening our long-term leadership in the supply chain. We created the semiconductor chip industry 20 years ago. And back then – I mean, more than 20 years ago. And 20 years ago, we were producing about 37 percent of semiconductor chips. Today we account for only 12 percent of global production. And we produce zero of the most advanced chips.

Addressing back the immediate and the long-term challenges of the industry's been a priority of the administration from day one. We took some critical first steps, as Matthew mentioned, by completing a 100-day supply chain review on the semiconductor industry. As part of that review, we conducted an analysis of the risks for each segment of the semiconductor supply chain, from design to manufacturing, assembly, testing, packaging, materials, and equipment. We also provided recommendations to address those risks. And we've been working with industry and our international allies to foster better coordination among key supply chain participants.

But we can't simply react to today's shortage. What we need to do is to restore American leadership and competitiveness in the semiconductor industry to avoid future disruptions in the long term. We can do that by doubling down on our greatest assets – our innovation ecosystem, our workers, and our businesses. And we need Congress to fund the CHIPS Act, the supply chain resiliency program, and similar initiatives. All of those will help us work directly with semiconductor manufacturers to build more facilities and to expand our output here in America.

But in a globally integrated economy with global supply chains, the bright line between domestic and international doesn't exist anymore. And within that paradigm, over the last three to four decades the semiconductor sector has become one of the most globalized industries in the world. Companies in different countries have specialized knowledge of the semiconductor production equipment and processes. Chips can travel across oceans several times before they make it into your laptop, into your cellphone, into your car.

And this globalist specialization has facilitated more efficient designs and production for the most advanced chips. But it's also left the semiconductor supply chain vulnerable to the types of shocks that we've seen in the last year or two. As our 100-day review noted, it's critical that we work with our allies, like Korea, to make our supply chains for critical products, like semiconductors and advanced batteries, more resilient. According to the Semiconductor Industry Association, South Korea accounts for 16 percent of the global semiconductor value chain. Combined with our long history and our close friendship and deep commercial ties, this makes South Korea an absolutely vital partner on this issue.

Korea's our sixth-largest trading partner. In 2020, Korean firms invested over \$62 billion in the United States. And in the early stages of the COVID-19 pandemic, Korea shipped us personal protective equipment that helped save lives. In turn, President Biden announced in May that the United States would provide vaccinations for 550,000 South Korean soldiers. And as we recover from the pandemic, our countries will benefit from deepening that collaboration, particularly in sectors that are critical to the future of our economies, like semiconductors.

The cooperation is already underway at the business level. Two major Korean firms announced investments in the United States just this spring during President Moon's visit to Washington, D.C. SK Hynix, a memory

chip company, announced a billion-dollar investment into an R&D center in Silicon Valley. And Samsung unveiled its plans to build a \$17 billion semiconductor fab in the U.S. As both of our countries undertake policy measures to encourage the development of domestic supply – semiconductor supply chains, we hope to see investment flows in both directions.

It's imperative that we coordinate to avoid suboptimal market outcomes that weaken the competitiveness of our companies and the economic viability of our supply chains. The U.S. and Korea also have a shared interest in strong protections against countries that disrupt free and open competition. Both countries are home to technological leaders in the semiconductor market. We need to work together to coordinate our approach to protect intellectual property and prevent core technologies from being exported to bad actors.

As the world's governments continue to increase their focus on the supply of semiconductors, the U.S. and South Korea should promote market-driven developments of global industry. The recent shortage has demonstrated a need for government incentives to spur more private investment in the semiconductor industry, and to facilitate transparency and collaboration in the semiconductor supply chain. It's critical that we coordinate on efforts to facilitate transparency, research and development partnerships, export controls, and foreign investment reviews.

In closing, I'm really looking forward to continuing our engagement with all of you on this important issue and other issues in the future. It's clear that the partnership between American and South Korean businesses in the semiconductor industry, in health care, and electric vehicle batteries will continue to benefit both of our economies. Thank you all again and I'll turn it back to Matthew.

Mr. Goodman: Thank you so much, Mr. Deputy Secretary. Excellent start to this conversation. And really, you've laid down, I think, some of the key issues that we want to talk about in our expert panel to follow.

Let me, if you will allow us to ask a couple of questions, I'm going to start by bringing in John Neuffer. You mentioned the Semiconductor Industry Association. John is president and CEO of that organization that represents the semiconductor industry here in the United States. And I

want to ask John if he would like to ask the first question of Deputy Secretary Graves.

Go ahead, John

John Neuffer: That would be great. Thanks, Matt. And Deputy Secretary Graves, I'm not sure I need to be here after that wonderful scene setter on our industry. I think you hit all the data points exactly on the mark.

I think we're all in agreement that we absolutely need to have more manufacturing incentives in place so that we can plug a major vulnerability in our supply chain. You pointed out that in 1990 we produced about 37 percent of the world's semiconductors. Now it's down to about 12 percent. So the CHIPS Act, which includes \$52 billion dollars in funding, most of that of which is for manufacturing incentives, is, I think, a critical step in the right direction. And while it has moved by Washington standards at lightning speed through Congress, it really has been a kind of impressive legislative effort. And I know that Secretary Raimondo has been a big supporter of our industry, and of the CHIPS Act.

You know, we just want to make sure that this gets across the finish line in a timely fashion. And I know Congress tells you what to do, you don't tell Congress what to do. But do you have any sense yourself as to whether we're going to get this CHIPS funding through this year, and in a timely fashion?

Mr. Graves: Well, John, first off, it's great to see you again. Thank you for the great work that you and the association are doing in this area. It's a great question. I think that members of Congress, both the House and the Senate, have heard loud and clear, not just from businesses but from their constituents, that this has become a real issue that's sort of hitting at the core of our economy, but everyday lives of Americans. Their ability to get a car – get a new car, or buy that phone or a computer to be able to work from home, get their home set up while the pandemic is still going. That's really being constrained by the lack of movement on the CHIPS Act. And our ability to deal with both the short-term and long-term challenges is directly impacted by whether or not we're going to get that – the legislation passed.

So I think there's – I think even though there was some urgency before they started hearing from their constituents, I think they've started to really appreciate the urgency that we have around getting the legislation

passed. So my expectation is that we're going to get that legislation, that particular piece of legislation, passed, along with the broader infrastructure and budget deals done. Because the Senate and House know full well that if we don't do this, it's going to have a really big impact on our ability as a country to compete. It's not just your industry, for instance, but it's basically every industry in the country, because we're all connected as this point.

And I just came back from a trip to the West Coast to look at the – what was going on at our ports and some of our industries. And this is a challenge that everyone is facing. If we can't – if we can't make some fairly rapid improvement and investments this is going to be a really long slog in trying to get ourselves out from under the challenge of the semiconductor shortage.

Mr. Goodman: If I could jump in, Deputy Secretary Graves, and ask a question which actually I think John might also want to answer when he hears it, which is: So we want to promote cooperation with allies like Korea in ensuring resilient and secure supply chains. And that makes total sense given their sophistication and market power and all the rest of it, and the fact that they're allies and friends. But at the same time, part of the thrust of what we are doing or trying to do here in the U.S. is to enable our own manufacturing capability and supply here within the United States. And so I guess I want to ask about sort of two possible tensions.

One that, in other words, whether by emphasizing production here in the United States, you know, even, you know, policies like Buy American, which preference American suppliers, whether that's at tension with our interest in working with allies like Korea and others. So that's possible area. The other is that a lot of these companies that are going to be involved, that are involved in producing things like semiconductors, are competitors in the market themselves. And so, you know, whether it's Samsung, or Intel, or others that we could mention, you know, these are – these are companies that do compete in the marketplace. So that's a tension which potentially could get in the way of cooperation in this area. Or is that not the right way to think about it?

Deputy Secretary Graves, do you want to take a crack at that?

Mr. Graves: Well, thanks, Matthew. I'll take a first crack and then John, I'm sure, will clean up whatever I say.

Look, the – I should first say that what we’re doing on buy American – I know this has been something that folks have been – you know, there’s been angst around that. We’re just enforcing the rules and policies that are already on the books. We’re not doing anything beyond that. But there’s a lot that we can do to make sure that our own companies here in the U.S. are able to participate in the broad ecosystem, not just for semiconductors but for most of the technologies that we rely on. But to your broader point, I think that there’s no question that we can’t do this alone. The United States, one, doesn’t have the capacity. Even if – even if we move as quickly as we’d like on the CHIPS Act, and we make the types of wholesale investments across the ecosystem, building our supply chains, that’s not going to be enough to keep up with the demand of every one of the types of industries that I covered in my remarks.

So we need to partner with our allies across the globe. And frankly, that’s why – that’s how we build these resilient supply chains. Our friends in Korea have great technology and significant capacity themselves. And by partnering with them, we strengthen our own companies and we help to strengthen their companies. And, frankly, I think that we recognized that we can’t own everything. We have to make investments in sort of nearshoring or ally-shoring, if you will. Partnering with our friends in Korea to make sure that we’re able to keep up with the demand of just, as more and more devices become connected, as the Internet of Things grows, we need to make the types of investments both here and abroad with our allies to make sure that we have the resilient supply chain to keep up with that demand.

But I’m sure John has a better answer than I do.

Mr. Neuffer: Well, no clean up necessary. That was a spectacular answer. The reality is that, as Deputy Secretary Graves points out, is no one company or one country can effectively produce semiconductors. For better or for worse – and by far for better – it’s a global industry with global supply chains. And the last thing we should be doing is putting up barriers to innovation in our policies. Deputy Secretary Graves pointed out that East Asia produces the most sophisticated, most advanced semiconductors right now, below 10 nanometers. Ninety-two percent by Taiwan and 8 percent by South Korea. Do we want to put up barriers to that kind of innovation as we’re going forward with our manufacturing incentives or our other policies? No, I don’t think we do. So I feel that most folks in this town get that, and that at the end of the day we’re going to be able to have our cake and eat it too.

Mr. Goodman: OK. That's helpful from both of you. Let me just ask one more question and then we'll let you go, Deputy Secretary Graves. You know, we have a range of challenges in dealing with the competitive challenge of China. And the Biden administration has made clear that that's a – you know, that's a major focus of attention. Competition – as an economist, I'm not bothered by competition if it's fair, and open, and free, and everybody has a shot. So I don't see it as necessarily a bad thing. But there are elements of it that are – that are a little more challenging and difficult.

And it seems like more broadly we are going to need to work even beyond, you know, the important area of semiconductors in working with allies on the challenges of dealing with a, you know, competitor like China. Both – and the administration has talked about both promoting and protecting critical technologies. And the ones that seem to keep circling around in addition to semiconductors are AI-related technologies, as well as batteries, which we're going to talk about here in a minute, telecommunications – 5 or 6G telecommunication systems, and then biotechnology is one that you hear a lot from the administration as a priority.

All of these areas I think Korea has, again, something to offer, both maybe on the promotion and the protection side, to make sure that we're not letting, you know, critical technologies leak into the wrong hands. So I just – it's an open-ended question, but just what else do you think – or how can we work with a country like Korea on that broader challenge. And, you know, are there constraints or problems, you know, given Korea's other interests, and particularly as – with a big trading partner of theirs, like China?

Mr. Graves: Well, it's a great question. And to be fair, you know, China is a big trading partner of ours as well. And many of our companies do a lot of business there. That said, they are a competitor. And you know, they and some other actors around the globe sometimes don't play by the same rules of the road that we play by, and don't utilize the international norms that I think the rest of us abide by. And so the point that you made, that there's the sort of promotion side and then there's the protection side, that's really what we do here at the Department of Commerce.

We have all of that in one department, from the International Trade Administration and our export promotion activities, the support for industries, the work that we do at – on protecting our intellectual

property with the Patent and Trademark Office, the work that we do at the National Institutes of Standards and Technology in the National Telecommunications Information Administration to develop standards and rules of the road for fair play and, like I said, the protection of our technologies.

And it's not just for U.S. companies, but it's for our allies. And that's why we work so closely with our friends in Korea and other countries. It's our Bureau of Industry and Security to – when we need to, to protect our technologies and use our export controls and, at times working with USTR and other agencies, a whole-of-government approach around sanctions to ensure that malign actors aren't stealing our technology or trying to find ways to get around the systems that are in place, the processes for sharing of technologies – appropriate sharing of technologies.

So we at Commerce have a whole-of-Commerce approach. And that really includes working very closely with our partners, our allies around the globe, because we're only going to be as effective as our allies are working in coordination and collaboration with us. So we spend a lot of time at all of those different bureaus that I mentioned trying to find ways to make sure that we're – that we're aligned, that we're taking the appropriate steps that we need to do to protect our businesses and our technology and intellectual property. And then, back to the – sort of the promotion side – it's making the types of investments that we can. It's making critical investment not just in support of the industry – semiconductor industry itself, but the whole ecosystem and the supply chain.

So you think about the Economic Development Administration here at Commerce. Making investments in local and regional economies that ensure that if a fab is being built, whether – or a fabless facility is being developed, that the entire ecosystem in that region is supporting that economic development, and that we're tied in with our partners around the globe. So it's really a whole of economy approach, and using all the tools that Commerce has at its disposal to support the industry, support our advancement and our competitiveness. But also, like I said, doing everything we can with our partners to ensure that they have what they need and that we're protecting all of our businesses and our intellectual property.

Mr. Goodman: OK, excellent. Well, we're at CSIS doing a lot of work on both the promotion and protection side of that story, and really happy to be

helpful, if we can, going forward. But for now, let me thank you, Deputy Secretary Graves, for spending time with us. I know you've got a lot else going on. You're welcome to stay and listen to the rest of the conversation, but understand you've got other important things to do. So let me – let me thank you so much for participating, joining us, and for your excellent comments, which really will help tee-up a great conversation among experts. Thank you so much.

Mr. Graves: Thank you, Matthew. And good to see you, John. And I look forward with the next chance to be with you all at CSIS.

Mr. Goodman: OK. Thanks so much.

OK, well, with that, John, you're going to stay on, and then we're going to bring two other people on who are just a terrific addition to this conversation.

First of all, Denise Gray, who is the president of LG Energy Solution Michigan, Inc. Tech Center, which is, as you'll find out, very focused on the battery side of this story. Denise spent 30 years at GM working on battery technology. She's an electrical engineer and, I think, will give us a great perspective on the – both the technical and the business side of this story, and particularly in batteries. So really looking forward to having Denise with us. Thank you, Denise, for joining us.

And then importantly we also have Naomi Wilson from ITI. She's vice president of policy for Asia at the Information Technology Industry Council. And Naomi's an old – actually, she's an alumna of CSIS. So a well-known figure here, and appears with us a lot on these issues, and delighted to have you with us as well, Naomi. OK, so – oh, I should have said, Naomi was at DHS and worked on – was acting director of the Asia-Pacific office there. So she's been in government doing this work as well.

OK. So let me – there's a lot to sort of follow up on there from Deputy Secretary Graves. But let me start first by bringing Denise into the conversation, because I think we need to get the batteries side of the story into the picture, and kind of understand a little bit more. First, Denise, could you just – because that is a really interesting background that you've spent 30 years at GM working on this, and now you're at a – you're at a Korean-affiliated company in Michigan continuing to work on this. So can you tell us how you kind of came into this work, and sort of the

trajectory of your experience with the battery development issues over 30 years?

Denise Gray:

Yes. Thank you so much, Matt, for having me to be a part of this forum. I did get a lot out of the deputy's information there. And it's all so germane to the task at hand. And the task at hand and how I started in this is, as you mentioned, I worked at General Motors for about 30 years – always on advanced technology and in pursuit of cleaner energy vehicles and energy solutions. And it's interesting because I started out on the internal combustion engine programs, and then I moved to some of the ethanol programs, and then I moved into batteries and fuel cells.

And my goal at all times was to bring the technology to General Motors, work with suppliers around the world, in order to bring that technology to bear. And my last assignment at General Motors was in charge of the battery technology. And we recognized, we didn't have a supply chain. We really needed to help develop the supply chain. And I was so fortunate to work under an organization that was very, very strong with develop the technology with partners who want to develop the technology with you, period. No matter where they are.

And so we really sought out worldwide. I put so many miles on my frequent flyer, really scouting different technologies, different companies, going through what the technology looked like, what their manufacturing looked like. And in partnership with my purchasing team, I was a part of engineering, and also our manufacturing team. And we partnered with United States Department of Energy under the USABC. It's a collaboration with General Motors, Ford, and Chrysler at that time. And we all were trying to find solutions that would allow us to have cleaner engine outs, we used to call it, whatever's coming out that tailpipe. We need to make it cleaner. And we also need to ensure that we have better fuel economy.

And as we search for those companies, LG Chem at the time, that was the name of the company, was one of those partners in South Korea that stepped up to the plate in support of that collaboration to bring technology to the globe, quite frankly. And that's how I started. And actually, we started out with Chevy Volt, with a V, earlier in with our first high-volume lithium-ion battery technology vehicle. And started out with a collaboration with, again at General Motors, but collaborating with LG Chem, collaborating with the federal government. There was lots of support from the federal government through the Recovery Act of 2009.

And also, in collaboration with the state of Michigan, which is where I am today.

And all of that allowed us to really push the technology, push the supply base to a point where we had some options for technology here in the United States. And so through that whole ordeal, we moved forward in bringing battery technology and the supply base to a point where we've got options and we can continue in that development. So my background is at an OEM working on advanced technology, how to bring it to the buying customer. And I've continued that quest here in my position here at president of LG Energy Solution here in Michigan.

Mr. Goodman: Excellent. Well, that's really interesting. And lots, again, to follow up on. And I'm going to circle back with you to ask a little bit more about the technology itself. But let me bring Naomi into the conversation. And ask Naomi if you can sort of tie some of this today. And it's maybe a pretty basic question, but how do we define what sort of is a critical technology? And how do you – I know the government is kind of struggling with that in the context of the various policy tools that we have – like export controls, as the deputy secretary mentioned, where there are emerging technologies, foundational technologies. And it's sort of difficult to actually define what those are, particularly emerging, because they're not here yet.

And so how do you – how do you kind of decide that these are the things that are the most important? What are the kind of criteria that make these particularly important, as opposed to other things that you could think of that have an influence on daily life and have supply chains associated with them? If that's not sort of too broad a question, I just – to help us kind of think about the broader context of this.

Naomi Wilson: Well, as you alluded to, the Department of Commerce has the lead here in crafting rules and regulations that identify what those key technologies are that should be protected for reasons of national security. When it comes to export controls, primarily, we have a number of foundational laws put in place over the past few years in the form, primarily, of ECRA, the Export Controls Reform Act, which gave Commerce a pretty significant boost in their, hopefully, staffing and authorities. But to get to the heart of your question, in terms of how to identify these technologies this is where the partnership between the private sector and the public sector is really key.

So, you know, to understand what technologies are currently under development and aren't already out there. You know, if it's already readily available, or at least somewhat available, then there's no need to protect it. It's accessible, it's used in the supply chain already. And so, you know, there's a little bit of a tension right now, I would say, when we talk about things like foundational technologies. And Commerce is clearly still working through that. Those rules have not been finalized. This is something that dates back to the previous administration. There was a call for feedback from industry, but we have not yet seen the emerging and the foundational rules released from Commerce.

So that's going to be a significant step. But really, you know, working through public-private partnerships, such as the ICT Supply Chain Risk Management Taskforce, which is co-chaired by DHS, are really important mechanisms to get the full picture, to understand the limitations of controlling certain pieces of the supply chain, and to preventing those unintended consequences.

Mr. Goodman: OK, terrific. Well, I want to dive more deeply than on some of that with you. But let me bring John back in, and ask you, John, I mean, you can – anything you want to say that sort of follows up on the conversation with Deputy Secretary Graves would be helpful. But let me – let me dive a little bit deeper into the actual technology itself, the semiconductors themselves. And ask you about, you know, the Korean role in particular in ensuring resilient supply chains for particularly the smaller and smaller nodes of – which I'm going to quickly get beyond my technical ability – but you have seven nanometer node semiconductors and we're trying to get down to five and three, or we are. And these are areas in which I think the Korean companies, particularly Samsung, are very, you know, cutting edge.

And so I guess the question is, you know, what is the – what is the role of – you know, of, A, those Korean companies in that more and more advanced sort of smaller and smaller nodes of chips? And, B, kind of the domestic U.S. capability in that space. Where do we – where should we be focusing our attention in terms of these investments that we're making at home?

Mr. Neuffer: Yeah. So great questions, Matt. Let me try to unpack some of that. As I mentioned before, South Korea, when it comes to the most advanced nodes – below 10 nanometers – it produces about 8 percent of those globally. The big producers of those very sophisticated nodes are in

Taiwan. TSMC is a big contract manufacturer of chips, called the Foundry. And it does most of that work. It does – it does contract manufacturing for many of our design firms here in the U.S., and design firms around the world.

So what we're trying to do is not on-shore everything. We're trying to diversify our supply chains and spread out our risk. And one of the things that we need to do is bring that advanced manufacturing back onto U.S. shores. And that's where the manufacturing incentives come into play. But something we've not talked about here yet is you can have all the manufacturing going on in the U.S., but unless you have innovation – which is powered by research – your industry is diminished. So there needs to be a big emphasis on R&D. And this applies to batteries, and AI, and every other – every other industry in tech.

Semiconductor industry invests about one-fifth of our sales back into R&D. And but there are some kinds of research we just need to have government involvement at the very basic, pre-competitive research, where the government can play a critical role. It's kind of – you know, we've had a long history of that in semiconductors, and other industries have enjoyed that kind of relationship. So we need to have – and part of the CHIPS Act funding is – a significant part of that is spending – government spending for R&D.

So, getting back to your kind of original question about rebalancing things, we do not want to create an environment where important players like Samsung, which is a massive investor in the U.S. And we heard that SK Hynix has just committed to another \$1 billion facility. We do not want to create an environment where those folks are staying offshore. We want to bring the innovation on shore, and that creates more competition here and helps us ensure that we can, as with U.S. headquartered companies, again, take the lead when it comes to the most advanced chips.

Mr. Goodman: OK. Thanks. I have been remiss in not encouraging the audience or reminding the audience that you are welcome to submit questions. We have gotten a couple early questions, but I would love to get some more from the audience. There should be a button on your screen there or somewhere within sight. You should be able to ask a question. And we will try to go through those as we get through my questions – after we get through my questions.

But let me – let me turn back to Denise. And I saw you nodding with some of the things John was saying about R&D and so forth. So I'd be interested in your sort of reaction to that in the battery sector, and how that applies, and sort of where that sort of dollar of federal support, you know, should be going. To that? Or is it to other potential spending that I could see on, you know, building infrastructure for charging stations, or just buying electric vehicles for the federal fleet to help stimulate demand for this technology.

I actually wasn't going to ask that question – I was going to ask that after, though. So if you could hold that for a second, I actually want to ask you about the technology itself. And sort of could you help us understand a little bit about the different sort of battery development – like, lithium-ion, sodium-ion batteries, and kind of the distinctions between these. And I think China has a different approach as well. And why these matter, and which of these is most promising going forward. And then talk about how the federal government can support that.

Ms. Gray:

OK. So I would say very simply, if you can think about battery technology and it's evolution, every vehicle has a 12-volt battery in it today that supports the starting and igniting of the engine. So technology – and that's been around forever, long before any of us were living that lead acid battery technology was there. When we really moved and tried to push the technology development so that that battery can perform more in the vehicle, we moved to a technology that most of you are familiar with, nickel metal hydride. And that was the next generation of rechargeable battery because, again, we need these batteries to live the life of the vehicle. And so the lead acid did not give us all of those qualities based on how we really wanted it to function. And moved to nickel metal hydride.

And actually, there was some electric vehicles with that technology in it for a while. But then the breakthroughs in lithium happened. And here in the United States, that technology was worked on, researched – to John's point around research, so important. A lot of those inventions around lithium-ion technology was actually in the United States. And many companies have that technology, and many variants of it. Cathode technology, anode technology, electrolyte separators. Those are kind of the fundamentals of a battery. And that cathode material is where probably the broader differentiation occurs.

You've got battery – but, again, lithium has been the baseline for that technology. Whether you've got nickel and manganese or aluminum or iron phosphate, all of those are – if you can think of it as combinations – recipes that will give you varying functionality when it comes to a battery. But they don't all give you the same energy density. There's cobalt that really has a lot of energy in it. And so there's just many different types of recipes. You know, I think of my mother, who makes cakes. And she can make a cake and she can put different ingredients and it tastes a little bit differently. Some more potent than others. And so you can think about the lithium technology from that viewpoint.

But the most energy dense technology, because again most of my customers want to go – they want, you know, 500 miles range, and they want to be able to charge it in a very short time, and they want it to live long. And that is where the innovation continues to occur. And what is that recipe for that technology? So today, you know, lithium is the baseline. Sodium is a different type of material that can be used, but it's got some performance differences. Right now everyone's kind of grouped around lithium as the foundational technology that's used today for applications. But from the research perspective that John said, we can't rest on our laurels. We've got to continue to innovate for a better technology, less expensive technology, more available technology, more – a technology that gives you all of those combinations of the technology. So –

Mr. Goodman: Before – sorry to interrupt – but I just want to – before you get to the kind of support needed and so forth for all of this, just on the technology again, I mean, I have a lot of questions, but let me ask about kind of relative – this technology relative to other options that are being talked about, and that Korea, I think, has been a leader in, like, hydrogen fuel cell technology. Why is this battery approach – the lithium battery approach kind of one that's as or more promising vis-à-vis hydrogen fuel cells? Which, because my other question which I don't want to make this too complicated, but, I mean, hydrogen is in water.

And it sort of feels like, without being a scientist, you know, it's in sort of large supply, not so hard to extract, to get into these solutions. Whereas lithium and other materials, minerals that go into the electric technology, is dirty stuff. China, you know, either manufactures or finds a lot of this stuff. So that's complicated. So is there an advantage? Are we going down the wrong road here for a lot of reasons, and there's a sort of simpler, cleaner solution out there?

Excellent question, Matt. You know, as I mentioned, I worked on – and our team worked on alternative propulsion solutions. And one thing that I've learned in my 40 years in the industry is there's no one size fit all kind of solution. There's so many transportation, energy storage applications with different needs. And so hydrogen does have a play here. We worked on that. In fact, I had a vehicle fleet that had a hydrogen solution with a smaller battery to support storage and for immediate power. But I think there is a play for hydrogen in our humongous ecosystem of what's needed for so many different applications.

And it is progressing. I remember the hydrogen fuel stack being humongous. And as the years have gone on, great developments happen in that area where it's gotten smaller, more cost effective, more performance oriented. The supply and being able to refuel is still a topic that all of us have, be it hydrogen or be it batteries. How do you fill up, if you will? And so I do think that hydrogen will have a play and will continue to have a play in our solution set of technologies.

OK. Let me bring Naomi back in and ask about, you know, to give us some perspective on China's development of these technologies, and what sort of the – what the challenge is for us. I mean, can you kind of give us a sense of how China is working in these areas, and sort of what they're putting their money on, and why that's a particular problem of challenge for us in these two technologies and, if you want, beyond? Naomi.

Ms. Wilson:

Sure. Well, you know, as pretty well established, China makes strategic investments in areas that they think will be important to national security and economic security. One of the areas that they chose to make investments has been in semiconductors. But the important thing to note about the semiconductor story, is that it's a story of – more of failure than success. So you know, people tend to think of the Chinese government as a monolith, and as omnipotent. And, you know, when they come out with these grand plans, like Made in China 2025, the assumption is, if China wills it, it will happen.

But the semiconductor story is actually an example of how that didn't happen, how China poured, you know, tens of billions of dollars into semiconductors. And they certainly made progress. I don't want to discount that. But, you know, based on the amount that they invested, they still came out well behind the competitor companies in East Asia, in the West in terms of innovation, in terms of the ability to get the size of

those chips down. And so, you know, it's important to see where China is making investments. But we also shouldn't assume that because they have a plan they're going to succeed. And so, you know, I think that's a key takeaway in a lot of different areas.

The other element that I would note with respect to China is that, you know, in part through the pandemic, we have realized that there has been too much of a concentration in China, in other countries, and that really leads to some stove-piping and some potential friction points in the supply chain. So in terms of supply chain resiliency, I think there's been an important recognition that, you know, for a long time China was the center of all manufacturing and production. And it was important for, I think, all the stakeholders who manufacture in China – not just for geopolitical reasons but also environmental reasons – to step back and go, OK, where are weak points? Where are the potential areas that if we – if we lose this aspect of the supply chain, you know, the knock-on effects are really significant to the rest of our business?

Mr. Goodman: OK. Thanks.

John, let me bring you back in. And actually I'm going to start sort of pulling in a couple of the audience questions because they relate to things that I wanted to ask about. There were a couple of questions about –

Mr. Neuffer: Hey, Matt?

Mr. Goodman: Yes?

Mr. Neuffer: Matt, can I just jump in very quickly?

Mr. Goodman: Sure. Go ahead. Go ahead.

Mr. Neuffer: Great answers. Just a couple of things. Naomi gave a great response to kind of how successful China has been in terms of building out a semiconductor industry. I just want to put a little bit of a twist on there. Like China, the semiconductor industry is not monolithic. And there are pieces of it where China is specifically targeting and making some progress. And memory is one of them, but there are other pieces of it – where throwing just a tremendous amount of money at it and will see some success. And, you know, we've been down this road before in other industries. We get this nonmarket-drive overcapacity, and it can be

devastating to the global industry. So that's kind of one caveat I want to throw in there.

The other piece of it is about China. There has been a huge concentration of manufacturing in China for U.S. industry, particularly tech industry, but not the semiconductor industry. We manufacture virtually nothing in China. Couple of fabs there. Having said that, China does play a very big role in what's called backend assembly test packaging. Wafers are made and then they're sent out for cutting up and tested. And a lot of that testing does happen in China. And then finally, China is our biggest consumer. About 35 percent of our business is in China. About half of that goes to non-Chinese companies – the big electronics companies that have manufacturing in China. And the other half goes to indigenous Chinese companies. So I just wanted to throw that on top of what Naomi was offering. Thanks.

Mr. Goodman: That's helpful. No, let me – let me just say, following up on that, that I was going – because I was going to ask you about that. You know, it is a challenge, China, for you, because it is making those investments that are – that are going to be problematic. But it is a big customer as well. And, you know, I guess it's something that you have to, you know, strike a balance in the approach to these issues. And that's something that, you know, is that – is it as difficult as it sounds? I mean, it feels like it's difficult to walk that line of trying to be maintaining that customer base, but also, you know, you're dealing with potential competitors or existing competitors, in the future, you know, serious competitors in some of this supply chain, so.

Mr. Neuffer: Yeah. It's a genuine grown-up problem, no doubt about it. But the answer that we have is that while China certainly presents challenges for us as a nation, and an industry, it is a massive player. We and other industries need to be part of that market. And another piece of this is, as I mentioned earlier, about 20 percent of our sales goes back into R&D. And if you significantly curtail our ability to do business in China and other places around the world, then it puts a bit kind of kink in the R&D pipeline.

And that R&D is what keeps us ahead. We control about half of the global semiconductor market. And it's been that way for decades. And one of the key pieces to that, in addition to having very sophisticated supply chains that gives us great comparative advantages, is that we have just amazingly strong research agenda. And if that is somehow hurt, that

impacts our ability to pedal faster and stay ahead. And I'll just say, when it comes to competition around the world, the winner is going to be – in the semiconductor industry – the winner is going to be the one that can pedal the fastest and stay the farthest ahead.

Mr. Goodman: OK. And let me – the questions I was going to bring in, again, John, to you, are about, you know, why – sort of you touched on this, but just since a couple of questions have asked about it – you know, why are semiconductor supply chains largely concentrated in Taiwan, Korea, where they might be more vulnerable to disruption? And what are the challenges to moving that supply chain back to the U.S.?

And there's a related question about – yeah, well, it's the same, in a way, question – why is the semiconductor industry so dependent on such a small group of players, really? Why are there such few players in this business?

Mr. Neuffer: Yeah. So, yeah, great, great question. The reality is everyone's kind of dependent on everyone almost equally.

You know, Korea's very strong in memory. It controls about two-thirds of the memory chip market. You know, we're very strong in design, very strong in R&D. We have a fair amount of manufacturing, although it's flagging. Taiwan is very strong in the foundry business, contract manufacturing. So that is just – that is just the reality.

And so what we're trying to do is kind of – and what was really great about this supply chain review that the Biden administration undertook was it kind of put in bold relief where some of our vulnerabilities exist. We've all been kind of thinking about this and talking about this in the background, but now it's out in the open and up for public discussion and compelling Congress to kind of rethink, you know, how we do all this, and embracing the reality that when it comes to semiconductor manufacturing the federal government has really kind of not been in the business of incentivizing that. Other governments around the world – all around the world, kind of every other government that has a significant semiconductor manufacturing or design industry offers these massive manufacturing incentives. We do some of that at the state level, but it can't compete with what central governments are doing around the world.

So that is the biggest determinant behind why our manufacturing has been slipping in the last two or three – two or three decades. And fortunately, Congress, the administration, Secretary Raimondo, President Biden himself are very hip to this, and we have this CHIPS legislation that's getting closer to getting across the finish line to start kind of arresting the fall here and getting us heading in the right direction.

Mr. Goodman: OK. OK. Well, actually, I can't resist following up because I think you've answered this, but I – or, you know, but, you know, I've heard people ask the question of, you know, this industry is pretty profitable. I mean, you guys make a lot of money and you invest a lot – the companies invest a lot themselves in R&D. Why is that – I mean, again, you've touched on this, but why is that sort of additional support from government so critical, you know, when you've got, you know, a lot of your own R&D investment going on anyway among your membership?

Mr. Neuffer: So if you're a CEO at a big semiconductor company and it's going to cost you 40 percent more to build a fab in the U.S. versus building a fab in Singapore, what do you do with that? And without incentives in place to change the calculus there, the decision is going to be to build overseas.

And we're not – I don't – I don't think the U.S. has to – has to match the funding amounts, but it has to start coming close because there's a lot of other great things about manufacturing in the U.S. that make money not the only determinant. We have great talent here. We have great universities. We have great clean water. We have rule of law, a very predictable regulatory system. So all of these other things come together. But when the incentives variable is so out of balance, it's just very hard for companies to make the decision to increase manufacturing here.

Mr. Goodman: OK.

Denise, let me ask you a similar question about batteries. And we sort of – again, I didn't let you really answer that before, but I previewed it, that, you know, what is the kind of – what is the role for the federal government, or state governments for that matter, to support battery technology development? And you know, is it – is it largely in the R&D space? Is it – is it, as they say, in some of these other potential contributions? You know, consumer tax incentives I can think of. I could think – as they say, building charging-station infrastructure so that it then incentivizes people to have a battery-powered car because they know they can get it recharged out on the road, or, as they say, just buying cars.

If the federal government – I don't – forgotten the number, but the federal government has a lot of cars, and if they just bought battery cars would that – that costs money, but you know, would that – would that give a nudge to this? Or is there something else that the government ought to be thinking about as it supports this sector?

Ms. Gray:

So I was hoping I'd get back to that one because, it's amazing, I see so many parallels or needs in the semiconductor discussion that's in the battery discussion. It's just mindboggling how the parallels are there.

I have to say that the battery industry has been fortunate because almost 30 years ago, under the Department of Energy, there was a battery consortium created called the United States Advanced Battery Consortium – almost 30 years ago – for the clear purpose to continue to push forward with the development of battery technology. And it was a partnership with the U.S. government with GM, Ford, and Chrysler in order to come together and determine how much monies are needed and what projects are needed in order to fund R&D.

And our national labs have been working on these kinds of topics for 30 years – Argonne National Labs, NREL. There's been programs from – I saw someone asking a question about DARPA-E. And of these organizations have been coming together for a singular purpose: How can federal government; how can companies like GM, Ford, and Chrysler; and all the research labs determine what is the issue, put projects in place where there's a 50/50 cost share of – companies like LG Chem has participated in since 2002 – almost 20 years – and baselining where the technology is? How do we develop – we've been investing R&D dollars from the federal government; from GM, Ford, and Chrysler; and from the supply base like in LG Chem to how do we continue to push this technology.

And quite frankly, I would have to say because of that, I think, vision that whoever was in charge of the government at that point in time, us tax dollars – taxpayers, that entity was formed, USABC, in 1991-1992, and 20 years later we're reaping the rewards of that R&D. Argonne National Labs has many patents when it comes to battery technology. The technology that's in many of the vehicles today was created in Argonne National Labs. That's here, right here.

And also, through the DOE they've supported how do we get more manufacturing here in the United States. Since 2012 with that funding

that was a 50/50 cost share from the DOE, LG Chem stood up manufacturing in Holland, Michigan, the first high-volume lithium-ion battery manufacturing, which today we supply three – all three OEMs – GM, Chrysler, and Ford.

So it can happen. And I truly say there is a model that's already been created for 30 years here in this country on how a(n) advanced technology that wasn't even in production at the time called batteries for automotive applications – where the federal government, the state government, the local governments, the private and public sector, as well as universities creating programs to retrain engineers in this new field – all of that has happened. And I would say I think there is a page out of that book – maybe not the full book that can be used as an example for the semiconductor industry, but there's a couple of chapters that may be some examples on how we can solve this problem.

And to John, you know, I was saying – I was listening to John, and John is so right. We're not – we're not asking and no one's asking for all of the manufacturing to be done in the United States, but we need to have some so that we can secure supply for a number of reasons, and probably additionally that we can continue to learn.

When you develop and push technology, it's not you develop it in a lab, you throw it over the fence, and someone else manufactures it. I've been taught, you know, since the ripe age of 17 years old that it's the whole thing together from cradle to grave. And grave means recycling, by the way. It's not until it finishes its useful life. But engineering – the act of engineering that I was taught at universities here in the United States was you understand what the need is, you figure out how you're going to make – build it, manufacture it, and recycle it, all of that. And in order to be able to do that in the United States, you got to have some of the manufacturing here so it all feeds back together. All of us engineers learned about that.

And so what USABC under the DOE has done from an R&D through manufacturing here – not all of it, but manufacturing here – has allowed us to continue to learn and develop and push forward. So, from a United States perspective, that 100-day study was right on target, based on experiences we've had already here in the United States on how do you develop, you mature, and you continue to redevelop technology. It's stated right here in the hundred-day supply, and there's evidence that it can be positive and helpful.

And to Naomi's point, does it all pan out as – are you going to bet 1.000? No. There's going to be areas where it's not going to work. But if you don't even get in the game and try, then you'll never be in the game. And I think that's what many countries have done.

I've worked with suppliers in China. I've worked with suppliers in Japan. I've work with suppliers in Korea, all over the world. And one of the things that I do treasure from our government and examples of what their governments are, they see a technology that they know is still under development but is crucial to products that we want – be it consumer products, be it automotive products, be it grid-stability products – and that's what batteries are all about – it really bridges all of those – your cellphones, your computers, your backup generation, your grid stability, your automotive, your non-automotive. And we all recognize – and not just a government recognizing it, but companies – the automotive companies, the railroad companies, all of us have – all of us are pulling the same rope. And that's the genius of a collaborative consortium like USABC: We're all pulling the rope together, coming up with the solutions on what we need.

Mr. Goodman: OK. Really helpful. And there was a lot in there that I want to follow up on because I'm not as familiar with that consortium, as you mentioned. Semiconductors have had a similar history of consortium with government and private sector working on these issues for even longer than that, so it is a model that seems to be useful. There are probably big differences between the exact approaches there, but I think, you know, it's an interesting model for us to all look at and study.

Let me just quickly – because there are a couple of other questions coming in. I want to get to some of those. But let me ask Naomi just a kind of slightly more geopolitical question, I guess. But you know, it's been alluded to already, again, in this conversation, but you know, Korea is an ally and a partner, and there is a strong incentive for them to work with us on a lot of this. But you know, China's also South Korea's largest market and its – certainly for semiconductors I think it's only, like, 40 percent of their exports actually go to China. And so, you know, so there's a – they have a complicated relationship with China, and they're not the only ones. I mean, every ally one way or another, including the United States, has a relationship with China. How do we deal with that, I mean, in a sort of broad sense when we're trying to take on some of these supply chain resilience questions where we're all kind of, you know, one way or

another dependent on our relationship with China as a supplier or a market?

Ms. Wilson:

Right. Well, I think to a certain extent we have to accept that China is an integral part of the global market. They're an integral part of the supply chain and of manufacturing, and they're also a huge source of revenue. That doesn't mean that, you know, countries and allies don't work together to ensure that we're not taking appropriate steps to protect national security or to protect emerging technology. But you know, really the China piece in the semiconductor discussion, I think, gets a lot of attention, and understandably so, but when we look at an ally like South Korea – and you know, you referenced they have – they have trading relationships with other countries – but you know, what can we really do to work together with the South Koreans?

You know, we had – President Moon visited several months ago. He was one of the first presidents to visit with President Biden. And you know, they had this summit and outcomes. And there's always a lot of attention around semiconductors, but the next question is that, so what? How do we – how do we actually cooperate? And you know, to that point, I'd like to make a couple of points.

You know, first is with reviewing the global supply chain. Like, you know, we can't – not every conversation can be about China. So we have to sit down with our allies, look at where the strategic chokepoints are within the supply chain. And again, when you think of supply chain resilience, we're talking about backfilling not just for geopolitical reasons or national security, but natural disasters happen and the pandemic happens, and that disrupts train schedules and customs agencies and flights. And so there are all these other considerations when you think about, you know, what actually happens and what we need to be doing in order to make the supply chain more resilient.

The export-controls piece we've talked about. It is important to coordinate and to collaborate and to make sure that, you know, there is an international multistakeholder process to align and share information on those. But it's not the end all, be all.

And finally, I would say one of the major issues is the alignment of regulatory frameworks across the globe. And you know, Korea is an ally, they are certainly a leader when it comes to technology, but they are not aligned when it comes to digital regulatory frameworks with the U.S. and

there is still some protectionism going on in the Korean market. So one of the things that, you know, ITI would really like to see in terms of implementing how do we actually work together is to take a look at the regulatory frameworks and make sure that both markets are accessible to foreign and domestic companies equally.

You know, we touched on a little bit with the U.S. side the references to Buy American. What does that mean? And clearly, there's still some confusion even in the U.S. about what that means for companies. Is it a protectionist mechanism or, as the deputy secretary said, is it simply a compilation of preexisting authorities? But either way, companies need assurance that they can compete in other markets and be on a level playing field.

And you know, to a certain extent we still see those barriers in the South Korean market, particularly when it comes to cloud, which, you know, we're – I think when we talk about the hardware side of things, people look at them in kind of tunnel vision, but we're talking about an entire ecosystem here when it comes to technology. Semiconductors are part and parcel of pretty much every technology, and of the Internet of Things, and automobiles. All of those run on networks. And so, you know, you need cloud access and infrastructure that is fair and reciprocal.

And so that's – you know, one of the things that I think both governments really need to work on is: How do we ensure that our markets are open and accessible to the companies that we most want to compete, that we most want to help our economy and our allies' economies?

Mr. Goodman: OK. Boy, a lot there. Thank you for laying out some of those areas of cooperation. As you say, it's easy to say cooperate and collaborate, but harder to do. And so both on, you know, sort of seizing opportunities and addressing obstacles and challenges, it's a little more complicated than it sounds. And we're also trying to do some thinking on that, as I think you know, Naomi, because you've been helpful to us on that project.

But let me just go to the audience questions or some more of the audience questions. There's one specifically for you, John, which I think I'm going to sort of interpret a little more broadly. The specific question is about some of the Chinese semiconductor firms are being led by executives who have jumped from leadership at non-Chinese firms. Broadly speaking, what are the human resources challenges for American firms to increase production in the United States?

But let me sort of even broaden that and ask Denise a similar question, but John first maybe. You know, kind of talk about the human resources side of this story, because, you know, it has always been a historical strength of the United States that we've had great, you know, Americans like Denise who are electrical engineers and trained here in the United States. We've also depended on immigrants heavily in especially the high-tech sector. And that – you know, I always forget those statistics, but some significant portion of Silicon Valley firms were founded by non-Americans. And yet, we have challenges with immigration policy. We have challenges of concerns about, you know, the integrity of our research labs and so forth. And you have this sort of jumping back and forth to different, you know, home-based companies.

So just that's a sort of open-ended question. Talk about this, because it's really important in this – in this story about securing supply chains, how we're going to get the people to do the work. So, John?

Mr. Neuffer:

The workforce question is enormous for our industry, no doubt about it. Right now, about three out of four graduate students emerging with electrical engineer degrees, like Denise has, and computer science degrees are foreign-born. So that has been steadily going upward in the last 20 years. So that says that we are not cultivating enough native talent here in the U.S. K through 12, all of that is in need of much improvement. Companies do a lot of work to put programs in place to try to help fund STEM education and generate more of that, but there just needs to be much more work at the federal level.

So we don't do a great job when it comes to cultivating our own talent, so we have a lot of amazing talent that comes from overseas. It comes to our amazing universities, and they get great educations there, and then our immigration system – which is fundamentally broken – chases most of that talent home to work for competitors because they can't get a visa status to stay and work.

So it's two kind of fundamental problems that are interwoven that need much attention if we're going to stay at the tip of the spear in technology. We have to get this workforce problem sorted out.

Mr. Goodman:

OK.

Denise, do you want to offer thoughts on that?

Ms. Gray:

No, I love John. (Laughs.) He said it – he said it perfectly. And I would also say that we cannot be a country that limits our ability to develop based on where a person was born or lived. We will not succeed, period. Technology development should have – should be global citizens, in my mind, because that's how our world will be better. And so that's my philosophy, and I'm trying to do the – and we are so bad at telling our children in the K through 12 – we're so bad at talking about the great innovation in these areas and what they can do and how they can contribute to society in this area from a STEM perspective. So we are awful at it and we need to be a lot better at doing just that.

But again, I think for our world to be successful in reaching our full potential of innovation, innovation should have no nationality because it's what's in your mind. And in your mind has to be allowed to be – to develop and to allow that to be used wherever that may be so that we can truly reach our full potential. And if that is the underlying foundation of what we as humans should be doing, then I think we can be further along.

Now, there's a business side to this as well. And you know, I grew up in the Motor City, here in the Detroit area, and I'm second-generation automotive. And believe me, we all drive cars and we drive what we make because we're proud of what we make. And so there is some ecosystem that can be created.

I remember growing up and saying – and seeing the beautiful vehicles at GM, Ford, and Chrysler, and I said, number one, I want to contribute to that company when I grow up; and number two, I want to drive some of those best products because I see them. So it doesn't have to be a forceful kind of thing if it's the right product because people will want it no matter what.

So I think there's some inherent, fundamental principles that sometimes it feels like we're politicizing that don't need to be politicized. They're just natural gravitations. Innovation is a natural, natural thing to do, to buy the product that you make because you're so proud of it. Every vehicle I worked on I felt like I birthed it. It's my child, and therefore – but having that pride of what you do and the pride of what you contribute, that's a natural, you know, organic nature of us as beings. And I think if we dwell on those things, it becomes a natural thing to do.

Just like I said, the USABC activity – batteries, securing supply, innovation – it was a natural thing to do. Maybe not in the beginning, but it's become a natural thing to do. And therefore LG Chem, a foreign company from Korea, 20 years ago invested in the United States to continue to work in partnership with the United States to develop the technology, and has not faltered – in fact, will continue to increase investment in the United States because of organically where the United States want to be, which is alternative fuels, propulsion systems, battery electric, stability of grid. All of those things naturally happens, and South Korea and the United States are joining forces – have joined forces for 20 years in doing just that.

So there's just some fundamental things that I think if we dwell on those natural fundamental things like innovation and pride of what you do and pride in the product and wanting to continue to support the environment that you live in, that some of those things become natural and not so forced, if you will.

Mr. Goodman: OK. Terrific answer and lots of interesting points you make there.

Naomi, we're almost out of time so let me sort of just ask everybody – or, really, Naomi – to comment on the human resources if you want or on anything else that's been discussed and sort of any final thoughts before we – before we close. So go ahead, Naomi.

Ms. Wilson: Sure. So just in terms of some final thoughts, there's a lot of potential with cooperation between the U.S. and Korea at this point. But I would really like to see both administrations get down to the nitty gritty, and that means having the discussion about regulatory environments and making sure that our companies can effectively work together, can support each other, can be business to business not only competitors but also cooperators, and have that client-, you know, -consumer relationship. And that's going to require some difficult discussions about the lay of the land and what has to happen in each country's regulatory environments, and an emphasis on, you know, making sure that we're aligned, and really setting the tone for other countries.

You know, the U.S. and Korea often set the trends, set the tone. So they need to be leaders here, and right now we're kind of falling behind on the aspirations set by the presidents' summit.

Mr. Goodman: OK. Terrific. We have a little bit of audio problem there, but we got, I think, most of your point there, which is great. So thanks, Naomi.

Denise, any final words? And then John, and then we'll – or do you think you've covered the ground, Denise?

Ms. Gray: I probably said enough. Thank you so much for having me.

Mr. Goodman: There's, I know, lots else to say, but appreciate that.

John, any final thoughts?

Ms. Neuffer: Yeah. Just adding to what Naomi said about cooperating with South Korea, in the semiconductor space this CHIPS legislation funding manufacturing incentives is available to U.S. and foreign companies, so we hope the Koreans reciprocate. They have this big new strategy called K-Belt Semiconductor Strategy. We hope there's equal access to that strategy and participation by the foreign players.

And then also, adding to Naomi's earlier comments about export control on the protect side, clearly there's an area where there needs to be more collaboration. We've had some bad experiences with unilateral export control on our side in the semiconductor space, where we basically moved our market share to other overseas players and didn't get our national security objectives met vis-à-vis China. And so we need to have collaboration with Korea and others if we're – have any hope of having effective and targeted controls that apply to national security matters. Just have to have collaboration in that space.

Mr. Goodman: Excellent.

Well, a great way – note to end on. I know there are a lot of Korean friends, including government officials, listening to this, and I hope some of that advice and recommendations are helpful to both governments as we move forward here. It's a critical opportunity, I think, for both of these great allies to work together on just an, obviously, shared set of interests around supply chains of these critical technologies.

So really appreciate the panelists joining us: John Neuffer, Denise Gray, Naomi Wilson. You guys were each and all terrific, and you really gave us a lot of insight and food for thought – and a lot of your time, which I really do appreciate – to help us understand this and our listeners.

Thanks to all of you for joining us. I know there were some questions we couldn't get to, but we're – sort of the line is always open. We're happy to have a dialogue and continue, and I'm guessing that our panelists would be happy to keep the dialogue going as well.

So, with that, I'm going to wish you a good morning or a good night and thank you for joining us here today.

Mr. Neuffer: Thank you, Matt. Great job.

(END)