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PRESENTATION

Yeuk-Fai Mok - *Advanced Energy Industries, Inc. - VP of Strategic Marketing & IR*

Welcome, everyone, to Advanced Energy 2019 Analyst Day. I'm Edwin Mok, Vice President of Strategic Marketing and Investor Relations.

On behalf of the entire team, I'd like to thank you all for come here, both in -- either in person or joining us on our webcast. We're very excited to share with you the Advanced Energy story, and we really appreciate you taking time out of your busy day to come and join us.

Let me quickly start on the safe harbor statement. I'm going to read the whole thing. Any forward-looking statements we make today are subject to risks and uncertainties that can cause actual results to differ materially and are not guarantees for future performance. Information concerning these risks and uncertainties is in our filings with the SEC.

So today, we put together a strong line-up of presenters for you. Most of you know Yuval Wasserman, our President and CEO; and Paul Oldham, our Executive Vice President and CFO. In addition, we have 4 executives here to present to you our growth strategies, the 4 market verticals that we introduced at our third quarter earnings call as well as our products and operations. The slide presentation will be available on our website at ir.advanced-energy.com following today's presentation.

Now let me turn to agenda. Yuval will start with an overview, followed by Isabel talking about innovation. After that, Peter will talk about advanced power products as well as semiconductor before we go to a 10-minute break. After that, Dana will cover embedded power products, followed by Neil talk about integration and Paul talk -- finish with financials. We'll conclude with some closing remarks, and we will go to our Q&A session. We'll try to finish at 4:00 p.m. today.

Before I pass the meeting to Yuval, I want to talk on 2 housekeeping items. First of all, like most of these events, please hold on to your question until the end when we have the Q&A session. Second, since we are in our quiet period, any comment we make at our presentation or during today on the fourth quarter of 2019 are based on guidance that we provide during the third quarter 2019 earnings call on November 12 and there are not reiterations. We're not providing any near-term updates or comments on that, and our comment will solely focus on long-term growth and prospects for Advanced Energy.

With that, let me ask Yuval to come up. Thank you, Yuval.

Yuval Wasserman - *Advanced Energy Industries, Inc. - President, CEO & Director*

Hello, everyone. Thank you for joining us. I'm excited to be here today because we are now in the midst of serious transformation of our company. Over the last 5 years, we have grown Advanced Energy from $400 million revenue to $1.3 billion on a pro forma basis today. This is an exciting growth story, and we're more excited as we now transform the company in line and in lockstep with the major transformation the world is going through with the Fourth Industrial Revolution. I'll share with you our vision, strategy and plan as we're looking for the future to continue to grow our company and to provide value.

Over the last 5 years, we delivered on our strategic plans through innovation, focus on our customers, focus on operational excellence, expanded our presence and share in the markets we serve by focusing on future products and technology and innovating relentlessly to come to market with solutions that the market needs for the future. We are the market leader in all the markets we serve and maintained that leadership for very long time through innovation in power conversion, power -- I'm sorry, measurement, power control and the application of power for very sophisticated critical applications. We have expanded and grown our served markets and market presence, both organically and inorganically.

As we're looking to the future, we're transforming Advanced Energy right now to be a large-scale leader in the market of precision power conversion in the world. Electric power is everywhere. As we look at the future of Advanced Energy, we would like to continue to lead the world in the application of advanced electrical energy convention -- conversion to improve lives and to create value to our shareholders. We do that by focused innovation that is science-based, all the way from device physics, material science, the circuit, the system, the product and the application. We continue to delight our customers with support, engagement, intimacy and global presence that allow us to be close to our customer to continue to innovate with them, empower our employees to continue to innovate, support our communities and bring return to our shareholders.

Some of the key attributes that are unique to Advanced Energy. Number one, we are a pure play power company. That differentiates us from a lot of other viable supplier in our industry. We are a pure play company that focus on the technology related to power conversion, power measurement, power control and the application of power. We focus on developing highly engineered products. We call them highly engineered because we apply our core IP, innovation, trade secrets and innovative designs to our products that we take to market through collaborative agreements and relationship with our customers for critical applications, applications that depend on the performance of our power conversion solutions to be able to perform their specific products and applications. Doing that allow us to continue to deliver best-in-class technologies and to maintain the market share position we have had for years in many of the markets we serve.

Customer intimacy is part of the focus of the way we do business. We team up with our customers to ensure that we supply them with products and technologies not only for today, but for the long-term roadmaps for the future technology and applications.

Operational excellence is a competitive advantage at AE. We have demonstrated the ability to deliver products at quality, on-time, at target cost in an environment that continues to change demand volumes and mix on a regular basis. The ability to do that in a nimble and effective way is a competitive advantage. All these attributes are the reasons that we are continuing to deliver best-in-peer financial performance as we continue to grow the company.

We are in the midst of the Fourth Industrial Revolution. The ability to collect, compute, store and transmit data continues to impact our lives. Data and big data analytics impact health care, automation, manufacturing, security, safety, entertainment and education. This is enabled by the technologies that allow us and the world to perform these tasks, more specifically high-speed computing, data storage, broadband high-speed telecommunication and essential technologies that enable all the above to be realized and affecting every aspect of our lives.

We have a broad base of products, applications and solutions that go directly to the applications that enable the Fourth Industrial Revolution. Some of our most critical applications go to the drivers of the Fourth Industrial Revolution or the data economy. In the semiconductor industry, our power supplies enable most critical applications that are used for the manufacturing of semiconductor devices, microprocessors, memory devices and sensors. Our power supplies enable applications like deposition, etch, metrology, inspection, ion implantation, thermal applications, all critical for the manufacturing of semiconductor devices. In the industrial and medical field, the biggest content of revenue in our company right

now, our power supplies are being used in a very broad spectrum of applications, for material processing, for hard coating, optical coating, decorative coating. In fact, every product that we use every day is exposed to thin-film coating applications that are energized by our power supplies.

Medical applications continue to depend on critical applications that needs very uniquely designed power supplies that are either enabling the product or support the product. Applications that go beyond medical are motion control, automation, robotics and even high-tech horticulture applications.

Data center computing use AE power supplies for hyperscale, data centers, edge computing and edge -- I'm sorry, and connectivity. In the telecom area, our power supplies support the growing application space of telecom, radio towers, backhaul systems and enterprise communication. These markets are the key drivers behind the data economy, and we expect these markets to present to us opportunities for growth.

The semiconductor industry continues to drive more complex devices, new materials, new processing equipment, all need new form of power delivery systems. Power supplies are the energizer for a lot of the processes that takes place in the semiconductor industry. We expect the semi industry to continue to evolve and to grow as the new technology is being adopted for next-generation devices.

In industrial and medical, new power supplies that are connected, SmartPower enabled are required for the next-generation Internet of Things, next-generation automation and next-generation technologies where power supplies are expected to have predictive maintenance, predictive failure, self-diagnostics, self-calibration. The next generation of power supplies that go into these industries will generate tremendous opportunities for us to continue to serve these markets with next-generation devices.

The growing use of data around the world will continue to require investment in infrastructure. Data centers, hyperscale will continue to grow, and the adoption of artificial intelligence, machine learning will continue to drive very power-hungry applications. This trend will require a significant investment in innovation in power delivery because the cost of cooling and the cost of inefficiency of power usage become critical for the users of those data centers. Continuous investment in the power delivery solutions is required to reduce the total cost of ownership of data centers, hyperscale.

In the telecom and networking, we are now at the beginning of the investment in infrastructure of 5G. A lot of we hear about 5G devices ready, although the cellphones have 5G capability, that's the semiconductor part of the business which we benefit from. However, the infrastructure in the world to support 5G is just at the beginning of its investment cycle. We expect to see an increase in demand for macro cells and small cells for 5G as well as upgrades through existing systems and connectivity of enterprise connectivity -- communication.

We are excited about these trends because we have all the ingredients that are required to benefit from these trends and to take advantage of this migration that we call the Fourth Industrial Revolution. We have a culture of innovation, a culture of customer intimacy, a culture of desire to win that drives our company and support the reason why we are the market leader in the markets we serve. We have a clear strategy around applications, products and technology that focuses our R&D dollars on the right technologies and applications, focusing on the right markets where we believe we have the best opportunity for growth, the best opportunity to maintain and grow our share.

As I said earlier, customer intimacy is critical to our future. We have been successful in the markets we serve historically by working hand-in-hand with key customers, having our engineers and scientists working in our customers' labs together to develop their next-generation devices. That leads to technology and continuous investment in our technology. We are investing through the business cycles in innovations to ensure that we're ready for the next-generation technology with the right products that support our customers.

And lastly, as I mentioned earlier, our operation -- operational excellence is a competitive advantage. It's a source of pride and recognition at Advanced Energy. We have benefited from a tremendous amount of awards and recognitions for our ability to perform in our operations around the world.

What we basically do is take raw power from the grid and convert it to usable power. Our power supplies have a very broad range of power levels, types of power and shapes of power, all geared toward specific application. But we call our power precision power, simply because it has unique attributes that make our power supplies capable to solve difficult problems.

Precision power. Our power supplies that are configurable, reproducible, stable, controllable, clean power, reproducible power, predictable and, of course, safe and cost-effective. We apply these power supplies to very a broad range of application across multiple industries and usages. The way we do that, as I mentioned earlier, is continuing innovation together with our customers hand-in-hand to solve the most difficult problem. At the end of the day, this formula is the reason why we are the market leader.

Innovation is core in our culture, is an area of investment through the cycles, and we have a history of innovation and technology leadership from the inception of this company. From the early '90s when we went to market with power supplies that enabled deposition of thin films, both physical deposition and chemical deposition, through the invention of pulsed RF that allowed us to lead in the etch and deposition applications and multilevel pulsed RF that enabled us to continue to go into the next generation very-demanding etch processes and semi.

Our innovation and capability in the area of high power conversion efficiency and high power density are the key drivers behind a lot of the design wins that we have in data centers and hyperscale, and we'll talk about that later. As we look into the future, we look at SmartPower. SmartPower is our strategy to deliver new type of power supplies to the world, power supplies that deliver the right power to the right application with innovation in topology, innovation in metrology, innovation in control and innovation in connectivity so that we are compatible with the IIoT applications of the world. And you'll hear more about SmartPower from Isabel.

Being the grower than -- being growing at higher than the markets we serve is only one of the initiatives and aspiration of AE. Beyond that, we aspire to be the #1 or #2 supplier in every market we serve. And if you look at the markets we serve, we are indeed the #1 or #2 provider of solutions in those verticals. More importantly, we are now one of the largest power supply companies that have both advanced process power and embedded power solutions in the same company. We are also the largest power supply company in the markets served in North America. And if you look at the distribution of companies that serve the market, we are proud to be the leading American company in this business.

As we continue to grow and expand and add more content to the company, both organically and inorganically, and especially now after the acquisition of Artesyn, we've a very broad base of product portfolio. But in general, you can categorize our products in 2 groups. One is advanced power products.

Advanced power products are power supplies that are used for physical and chemical material processes. Naturally, these are the power supplies that serve our semi applications, the flat panel display applications, thin-film coating, optical coating, et cetera. The uniqueness about these power supplies or this technology, they rely on our unique core competency to deliver a very uniquely tailored power curve to our customers. Our power supplies allow our customers to perform physical and chemical processes by manipulating and moving atoms and ions. We move atoms. The ability to control, measure, deliver those power curves is unique advantage.

The other category is our embedded power products. It's a combination of historical AE products from previous acquisitions and the Artesyn product line that is the majority of the embedded product -- power products. The embedded power products are uniquely designed and configured based on our strength in power conversion efficiency, power density, designed for quality, reliability, stability and configurability. These power supplies, in many cases, going into very tight solutions in terms of space and areas where efficiency of power conversion is critical for performance.

These products go to a very broad base of applications around the world. Our way to go to market depends on our ability to continue to design our solutions into our customers' application. We do that through intimacy with our customers, either directly, using key accounts, working with our critical large accounts, or through our global network of R&D centers close to our customers, close to the markets we serve with the ability to work closely with them and design our solution into their applications. Our field application engineers work daily with our customers to ensure that we have solutions not for today's applications, but for the future.

To be able to serve these broad base of customers, and we hear more about the network in terms of how many customers we deal with, right, we rely on channel partners. Some of the leading, large channel companies in the world are our partners as we take our products to thousands of applications around the world. Some of our products are uniquely designed, customized for unique applications. Some of the products are derivatized for unique applications, and in some cases, we use standard platforms, configurable platforms that will go to the market and will be configured by our channel partners to address local applications, with very broad, diverse go-to-market system that support our products.

As we look at our growth, there are basically 3 pillars for growth strategy:

The first one is continue to grow share and content. And we do that by innovating, designing ourselves into our customers' solutions and grow content and share.

The second pillar is to ensure that we have products for years out, and some of that investment in innovation ensure that some of the new technologies and new products we develop meet our customers' needs 5 years out. And that will ensure that we continue to maintain our market leadership position and we continue to benefit from revenue streams that will continue to come our way. Constant innovation extending in all the areas that we play today.

The third pillar is benefiting from the synergies, the infrastructure and recently the acquisitions that we have made. Here we talk about cross-selling, new market verticals, new applications and obviously continue to grow inorganically.

In the semiconductor equipment, power is an enabler. And you will hear later from Peter how critical the power supplies are for the manufacturing of semiconductor devices. Our customers use our power delivery architecture as a competitive advantage. Different OEMs will have different chamber architecture where they apply power, gas, gas load, temperature in a different way. In a way, our ability to tailor and customize our products to our customers' design allow us to continue to maintain our share and to secure future revenue.

The number of plasma processes in the semiconductor market continues to grow. The number of applications, the number of tools, materials continues to grow. And we believe that, that will continue to drive increase in our served available market. Our growth applications that we target continue to be advanced etch.

We're expanding to a new area, remote plasma source applications. This is an area we did not serve effectively over the years. We're now going to pursue this business. It's an incremental SAM that we did not have before, and you'll hear from Peter a little bit more about that.

There are new thin-film deposition techniques, materials and applications both in physical deposition, chemical deposition and the atomic layer deposition application we're going to pursue.

The electrostatic chuck technology. It's an area of growth for our high-voltage applications. And lastly, with the addition of Artesyn Embedded Power products, we are serving and we'll continue to grow in automated test equipment part of the semiconductor industry.

Industrial and medical. As I said earlier, advanced materials, highly engineered materials, are part of every product, every product you use today from your cellphone, your television, your eyeglasses, your car, your rearview mirror, every product you use today enjoys the benefit or the ability to be coated with either optical, decorative or functional films. This is a growing area. At the same time, the industry continues to demand power supplies and solutions that are IIoT capable that will drive new type of power supplies, new type of solutions.

The medical industry is growing with new applications, both diagnostics and therapeutic, that demand the new type of power supplies and new type of delivery of power. One example, a very fast-growing application in medical is RF ablation for very broad slew of therapeutic applications. Another area that we participate already in is laser surgery or laser for cosmetic applications that require uniquely designed power supply.

Industrial and medical is the largest revenue contributor to our business right now. We are going to focus our growth strategy around advanced materials processing, medical diagnostic and treatment, RF ablation is one area, for example, test and measurement in various industries, motion and control and robotics that is continuing to grow and evolve both for medical applications and industrial applications.

We talked about data center computing. We see opportunities in the data center hyperscale emerging for us. We see growing power consumption for new applications like artificial intelligence. These applications are heavy and they consume tremendous amounts of power. The cost of operation is becoming prohibitive as more power consumption is driven by very heavy computing and storage application. That drives the need for high-efficiency power supplies, which is exactly the strength of Advanced Energy, power supplies that have high efficiency of conversion, power supplies that have high density, which means they're small. Our target applications in the data center computing, hyperscale, rack and shelf power,

edge data centers, working with original design manufacturers that support the hyperscalers in partnership, high-performance computing and next-generation servers -- servers and storage systems.

As we talked about earlier, telecom and networking present a growth opportunity for Advanced Energy. 5G enables new opportunities to be -- new opportunities in new markets for Advanced Energy. We have very long-lasting deep relationship and partnership with some of the leading telecom companies in the world where our field application engineers, our scientists working hand-in-hand with some of the leaders of telecommunication. This will present a continuous opportunity for design wins and growth as the investment in the 5G infrastructure continues to grow. In addition to that, we have opportunities to go and do upgrades to backhaul and enterprise networks in an existing installed base. So our growth targets in this area, 5G cellular base stations, backhaul networks, enterprise networking, data centers networking and broadband infrastructure.

If I look at our company and you look at the key attributes I talked about the company, it's a pure play power. Focusing on core competencies across all our product lines, we have the unique opportunity to drive synergy through our organization as we continue to grow both organically and inorganically. We rely on making ourselves a one functional company. All the acquisitions we had in the past, all of them were folded into the company as one functional organization, which allows us to create support functions across all our product lines. We have global DNA, global sale, global marketing, global operations, support all product lines.

As we continue to integrate our acquisitions, we drive operational excellence. We optimize where we manufacture, we optimize where we buy raw material components, and we use our global footprint strategically to ensure that we have the manufacturing not only in the most economical sites around the world, but the most strategic sites around the world to address issues like trade wars, to address issues like IP wars, to address issues like government regulations and political issues that may come once in a while. We have the ability to move manufacturing between our factories in a more strategic and effective way.

Long term, we focus on developing the right products for the right applications in the right market, continuously optimizing our products, applications, customers and markets to ensure that we continue to climb on the ASP curve and continue to drive earnings growth by strategically choosing the right targets. This is the approach we've taken in all of the acquisitions we had, this is the approach we are taking with integrating Artesyn.

Over the last 6 years, we acquired 8 companies, and we deployed $568 million to add more than $750 million of revenue to our company on a pro forma basis. That also increased our SAM by 4x, right? As we continue and integrate Artesyn that was accretive from day 1, we expect this integration to result in increase of accretion, adding to our EPS within 18 to 24 months more than $0.80 per share on a non-GAAP basis and long term add more than $1.50 per share on a non-GAAP basis. Our success in acquiring, integrating, driving the acquisitions we made, with the opportunities that we see right now with the Artesyn integration, make us very bullish about the future. And we believe that we can continue and grow inorganically after we integrate Artesyn using our strong balance sheet.

The integration of Artesyn is exactly as I explained earlier. We're going to form one functional company, leveraging all the corporate infrastructure across all product lines. We're going to reduce the footprint by consolidating factories, consolidating sites, increasing revenue per square foot, increasing revenue per employee, driving synergy between our R&D centers to start developing new products and drive synergy in our supply chain because now we have significantly higher buying power. All that is part of our integration strategy and how we are going to create additional value, and Paul will give you more details about this plan.

The one thing that is really exciting about putting these 2 great companies together is the fact that we have complementary core competencies that can be translated to new products. Our advanced power teams are experts in RF, DC and plasma power. They are uniquely capable in the area of power measurement, power control for plasma applications, process applications, right, and very strong knowledge in topology of high power and high voltage, including liquid cold power supplies.

Our embedded power teams are extremely skilled and leading in the technology of power conversion efficiency, power density, design for X. They're expert in designing power supplies for reliability, quality, compliance with FDA, for example, automation, manufacturability and have unique operational excellence that Advanced Energy as a whole can leverage and benefit from. Both teams continue to collaborate already in

developing the next generation of technology that is required to be Industrial Internet of Things compliant, which means connectivity, artificial intelligence and machine learning-based algorithms and advanced controls. That will lead to additional revenue synergies and upside that will come from this collaboration of those 2 teams.

In the semiconductor -- just a few examples. In the semiconductor equipment industry, there is a whole space that was never served by either Advanced Energy or Artesyn before the acquisition. It's the auxiliary power, the nonprocess power of wafer fab equipment. These are power supplies that go to computing, connectivity, robotics, motion. With our access to semi, our global footprint, our connectivity to the semi leaders and the availability of off-the-shelf power supplies from the embedded power team, we can take these products and move them, cross sell them into the semi industry. And this is a sizable, incremental SAM of about $170 million.

In the medical equipment, just an example, as I said earlier, there is a growing demand for RF ablation equipment and power supply. RF ablation is becoming an enabling technology toward these multiple illnesses and issues. It's a growing and very large market segment. AE is a leader in RF. Our embedded power team are leaders in medical equipment capable and compliant power supplies at low voltage. The combination of these 2 skill sets and capabilities can result in RF ablation power supplies to serve this market.

And lastly, as I mentioned earlier, AE is very knowledgeable in liquid cooled high-power power supplies. Liquid cooled high-power power supplies are used in high computing applications like supercomputers, right, an area that none of us has served in the past.

All these examples, all these examples are upside revenue opportunities that we did not include in our current model that we put together. As we look at the future, as we look at the company, our increased SAM, our broad new market, new applications, especially with integration opportunities with Artesyn, the gains in efficiency can be -- that can be created through the integration, we're excited about the long-term future of Advanced Energy. And we restate our long-term aspirational goals to achieve revenue greater than $1.5 billion, EPS on a non-GAAP basis greater than $6.50 per share and deliver return on invested capital of more than 23%.

And with that, let me invite Isabel, our CTO, to talk about innovation. Isabel?

Isabel Yang - *Advanced Energy Industries, Inc. - Senior VP & CTO*

Good afternoon, everyone. I'm Isabel Yang. I'm actually relatively new to AE, about 1.5 years, and I'm their new CTO. So today, I'm going to talk about our innovation strategy as well as some of the initiatives that we're driving in innovation. So as Yuval alluded to earlier, there are some megatrends in the market. The mega confluence of these megatrends are actually demanding new innovation in power conversion. You have adoption of 5G. You have data economy. You have artificial intelligence. A whole bunch of these new megatrends that are impacting the market is coming back to us where our customers are demanding much higher requirements for new technology -- power technology.

So what does that mean? Moore's Law is slowing down. Everybody knows this, right? So novel materials need to be developed at the nanoscale atomic level, new deposition processes, new etch processes. They require fast response power supplies to deliver stable power to plasma. At the same time, by 2025, 1 zettabyte of data will be generated daily. Does anybody know how many zeros in a zettabyte? 21. 21 zeros. So data centers will be built, right? Additional storage, additional compute power, additional requirements for power supplies on the rack.

Now these power supplies have to be very efficient, as Yuval mentioned. So 0.5% improvement in efficiency increases millions and millions of dollars in savings in terms of total cost of ownership because the heat has to be removed. So we are at a point where we feel that these market-driven forces are forcing us to really take a back -- take a look at our innovation strategy.

So let me give you an example, more like an analogy, right? In a vehicle that requires the fastest acceleration, most of you know that the electric vehicle motor produces the most torque in a short amount of time, therefore, it gives you the fast acceleration versus internal combustion engine, more horsepower, more raw power, but it does not quite give you the acceleration you need. This is the same philosophy that we are applying to new innovative approach to power design, and we call it SmartPower.

So SmartPower, in essence, is a really transformative and holistic approach that we're taking the power delivery system design. So what does that mean, right? What are the specifics? It is advanced digital control system. It is innovation in new metrology. It is self-adapting algorithms that we will implement, advanced data analytics, machine learning algorithms in our control systems. And it is new topologies, all of this. All of these are part of SmartPower and much, much more as we innovate into the future.

So just to summarize, we have a broad portfolio of power content, but just more power is not enough anymore. It has to be the right power, that's what SmartPower is all about.

Okay. So let me just give some specific examples here. Now AE innovation. We have a long history of innovation in power delivery systems. For example, our RF power systems, they are dubbed the next-generation lithography, which Peter will go into much more detail about our capabilities. Why is that? Because Moore's Law is slowing down, you can't just shrink the dimensions anymore. You need new material, new etching, new deposition. Our ultrafast pulsing plus multiple frequency tuning allow our RF generators to couple the most stable power into the plasma for etching and deposition processes. This allows us to claim the market share, the dominant market share, in conductor etch for most OEMs, okay?

Advanced material innovation allow us actually to build the most stable, long chamber life remote plasma source systems. We can claim that. And in addition to the long chamber life, which is innovation in the material science of its own, the architecture of our RPS systems actually allow the longest association of precursors in applications such as remote chamber clean or surface clean for wafers.

And new innovations are on the horizon. We are developing technologies that allow us to actually control the ion energy. What that means is that the distribution of the ions compared to conventional systems is very narrow in terms of energy, that allow you to do very deep etches for a very straight wall. And you guys know that for semiconductors, the 3D NAND, you stack how many layers and you have to drill these big holes. This technology will greatly influence and enhance that. As well, atomic layer processes, atomic layer deposition, atomic layer etch, right, requires very dense, low energy plasma, and we're developing technologies for that as well. These are either -- we are testing with customers. It is right around the horizon.

And lastly, we are the users and consumers of the data economy as well ourselves. We are leveraging the information in our systems, combined with our engineering expertise and utilizing that to produce actionable insights for helping our customers to improve their process yield by giving them detections on anomalies in process. As well, through our own system, we can create a particular maintenance algorithm to help reduce the total cost of ownership for our customers.

In our embedded power space, if I think about what I said earlier about just 0.5% improvement in efficiency, increase millions of dollars, and if you think about it, the efficiency and density actually goes hand-in-hand, right? There is competition for rack space, especially with big data coming on with the zettabytes of data per day, you need more compute powers. You need more storage. And then, of course, you need power.

The power supply is always squeezed for space in order to maintain or improve the efficiency, you have to take the heat out. So I think our history has proven with our embedded power systems that we have the most aggressive road map for improving power density as well as power efficiency. And of course, serving the medical and industrial markets, there is no one-size-fits-all power supply. So the design philosophy has to be a platform that allow you to do thousands of configurations through connectivity and the software. This allowed us to go to market very fast.

And lastly, in the telecom vertical, right, our power supplies has to work in the desert as well as in the Arctic because everybody has to have their cellphones. And we have advanced the technology in such a way that they work everywhere, and Dana will go into much more detail about this.

So we believe that innovation shouldn't happen in the vacuum. We need to leverage our extended ecosystem as much as possible, which means leveraging academia, leveraging commercial partnerships with startups. Now this allow us to really take the full advantage of the scientific talents out there as well as the external funding sources. Now we have 13 global design centers. So pretty extensive footprint. So that allow us to really engage internationally with universities and companies.

So let me give you some examples of the work that we're doing. We are working with a university on advanced topology that basically will generate any type of waveform you need from a power supply purely configured by software. One topology, multiple waveforms. Another example is, to

enable IIoT, we are working on wireless connectivity of our products. So you can imagine, for the simple products, the operator can go and scan a barcode. It will tell you the entire health of that product, the maintenance cycle, everything. For more sophisticated products, eventually, all of this will be part of the digital trend that you can remote monitor the health and the maintenance, enable our customers to determine when they should be doing maintenance so they could optimize their total cost of ownership.

And lastly, software-defined. Software-defined is sort of the last pillar in the data center space, right, software-defined network, software-defined compute, the last one is software-defined power. And we are partnering with a small company that basically utilizes the foundational techniques, such as peak shaving and load balancing for software-defined power in data centers. So these are just examples that we are engaging in with partners.

And finally, our -- we take our IP very seriously, and we protect this seriously through our engagements because we know that we need to protect our IP to enable our businesses to have the freedom of action to offer it anywhere.

So I'm going to just change the topic just slightly because I want to dive a little bit deeper into the big data analytics solution that we introduced about 1.5 months ago, and that solution is called PowerInsight.

PowerInsight is really a set of solutions that utilizes the data that's already coming out of our systems. The way you can think about PowerInsight is that our subsystems are essentially the smart node as part of a larger system. So that larger system could be the OEM tool or actually could be the factory itself, right? So we have all these smart nodes that have inherently collecting data. So now we're going to leverage that data. We're going to leverage that data, but the value that we produce is not in the data itself. The value we produce for the customers is combining our decades of engineering expertise in how to interpret that data with the most advanced data science techniques to produce actionable insights so that they can act on it.

I'm going to go into a couple of examples to actually see what we have done with customers. The first example is micro-arcing detection. This is something very common in deposition processes, in particular. This is real data from a PVD process. So in this particular case actually, there are no additional sensors put on the system. This data actually comes from our generator. And what you see on the middle top is the raw data, right? So you can't really make that much sense out of the raw data. So we have taken this, we have automated the big data enhancing and the data science behind it to produce what you see at the middle, sort of the bottom half section.

So what you see is that you could automatically detect signatures in the process without actually knowing what's happening. You can detect the preprocessing, you can detect that they're using different recipes. And in this case, it shows you that for recipe X on the third wafer, an arcing event has occurred. So how do you -- what do you do with this data? You can actually alert the operator or the process engineer that this has happened. They could either continue to process or they can take this data, combine it with their metrology data to look at the yield impact. So this is one example, it has been installed in the fab.

The next example is predictive maintenance. So predictive maintenance, this is applied to actually one of our RPS products. In this particular case is an abatement system. What happens is that this chamber that basically breaks down the gas, right, dissociates the gas, but that material gets coated on the chambers with time, with prolonged use. And when this is so heavily coated to a point that essentially the plasma will not ignite, so that will incur downtime.

And what happens with this particular case is that, usually, the end-user have a time to maintenance cycle. Sometimes, they may get off too early, there's still life left. That costs you money. Sometimes they take it off too late because the tool already went down. So then that also costs us money. So this is all based on actually data collected from a subfab. And what you see here is that we create an algorithm on their system where the data is ingested and the algorithm learns on its own in real-time and adapts and predicts down to the hour when they should do maintenance. So on the top, you see a dashboard, right? When you're in the yellow zone, maybe you have 10, 15 hours left. By the time you get to the red zone, do maintenance, tool is going to go down. So this is an example of predictive maintenance to reduce the total cost of ownership.

So in both cases, like I said, there were no additional sensors needed. The data came from our system, and we just have to leverage and utilize it to produce value for our customers.

So PowerInsight, the way we see it is that it is relatively new. We're still learning through the process. There is true value differentiation when we combine our expertise with big data analytics, machine learning and provide those actionable insights to our customers. We see a lot of pull from them in terms of helping them to solve problems. The engagement is through our services organization, and it's a problem-solution approach. So when we do have the solution for them, it tends to be very sticky. They come back when they have a problem that need to be solved. So in the long run, we see that this could be an incremental recurring revenue driver for our services organization and, of course, in light of the bigger picture, a key enabler for the Industrial IoT for 4IR.

All right. So let me wrap up. Essentially, we want to make sure that you understand AE truly is a leader in power innovation. It is rooted in our history. It is going to be part of our DNA moving forward. And also, we have seen the market forces driving us into shifting the way we design. It's a new paradigm shift, and we call that SmartPower. We truly believe SmartPower will be a game changer in the coming decade.

And lastly, we do have a pipeline of very healthy technologies, either organically done by ourselves. And I have shown you the engagements we have externally with partners, academia and commercial partners, and, of course, these are getting us ready to embrace Industry 4.0.

So that's my presentation. Thank you all. And I'm going to introduce Peter.

Peter Gillespie - *Advanced Energy Industries, Inc. - VP & GM Semiconductor Customer Solutions*

Okay. Great. Thanks. Hi, I'm Peter Gillespie. I'm the Vice President of Semiconductor Solutions, and I'm really -- oops, kind of put us on the right slide. Are you okay with the sound? I'm really excited to be here today to talk about AE SmartPower and how it's leading advanced power forward. I'm going to talk broadly about the advanced power applications first and briefly. And then, I'm going to go into the specifics of semiconductor for the majority of the presentation.

Semiconductor is always a dynamic industry. It's always changing. But there have been some really fundamental changes, some big changes that transformed the significance, the place, the role and the benefits of process power. So there's some big changes that really affect our marketplace, which is great news for Advanced Energy because it gives us opportunities to both extend our lead in the marketplace and also drive new growth.

So just a little bit about where we fit into the supply chain of the data economy in the Fourth Industrial Revolution, as Yuval mentioned. We're actually here in 2 places. You can see, process power is the fundamental, all the way on the left. This is a $1.7 billion area, where we provide the process power that powers semiconductor equipment such as etch, deposition, ion implant, automated test equipment and electron beam inspection. And that powers the $50 billion semiconductor equipment TAM, which goes to the fabs. The fabs produce about $500 billion in chips that goes into electronics. In electronics, there are about $1.5 trillion. And then the data economy is about $4 trillion. So they all build on each other.

We also in advanced power do a lot in the electronics area, of course, and so I'll pick up that on the next slide. There are some of the leading players in each one of the spaces there. I'm just going to talk a little bit about our customers. We're super grateful that we have really deep relationships with our customers. It's fundamental to our development and everything we do. We work very closely with them, and we also hold their information very safe. So I won't be talking about any specific customer engagement, so I'll be talking generally across the marketplace.

Okay. Generally about advanced power, sort of zooming out to the full SAM. We kind of hit it before, but thin film processing is in a wide variety of industrial and medical applications. It's used in patterning mobile phone interface. Those are thin films. It's used in even low-emissivity glass. It's used on just a wide range of things, even decorative coatings and virtually every electronic that you touch. The back side of the cellphone, for instance, is just 1 [used on] cellphones. These applications are continuing to grow and spread as this technology is being used to add value to more and more products and in the medical industry and the industrial area for tooling.

AE has a great portfolio for this with RF for both etch and deposition, DC, remote plasma source for chamber clean, high voltage for the decorative coatings and products for photonics and controllers for controlling thermal properties. So this is a great area where AE serves the market worldwide and is continuing to find new applications and areas for growth.

Okay, now, I'm going to zoom into semiconductors, and I'm going to try to thread the needle, and that's going to be little bit difficult. I know there are some people here that have actually worked at some of my customers and know this back to front and there are some people where semiconductor is a little bit less front of mind. So I'm going to try and provide a mix, but it's a really great story.

AE is really the right player in the right place at the -- with the right product at the right time. This is about as good as it gets. Our power SAM -- right now, our power SAM is growing faster than the WFE market, so we are actually adding content, adding value ahead of our target market. AE is the market leader, so we have the #1 position there. AE is expanding our share, and this is an exciting area that I'm going to talk to you about some strategies that we are driving, get specific on some things, and it's really cool what we are doing here.

AE is also expanding its SAM. We are taking on new whole segments to go after, newer whole product areas to go after. And AE SmartPower is giving us innovations for now to win and also setting up our wins in the future.

So just a little bit more about our market leadership. So AE is different from almost all our competitors, actually, all our competitors. We live and die by power, and so that's really stood us well, and we have a long history of firsts because of this. We are able to build the confidence and power that gives us the innovations and gives us more chance to build our confidence, and we have this virtuous cycle where we've been able to out-innovate our competitors.

We also really to that engage deeply with our customers, as Yuval said. To the point where we are at all points of our customers' processes and had deep technology knowledge with our applications, engineers and scientists, and this gets us the chance to solve our customers' toughest problems, which gives us view to the high-value problems that we can then design enabling products for.

AE is the market share leader, so this is being rewarded in the marketplace, and we're almost, -- we're approximately 2 times bigger than the next closest competitor. AE is also -- our products are balanced to really take advantage of DRAM, NAND, foundry and logic, so despite which one of the capital cycles and their capital cycles in semiconductor is going on, we are able to benefit.

Okay. So that was kind of just the scene setting and orientation on us a little bit. I'm going to do a couple of pages on market challenges for the big picture and then get into some of the strategies where we're winning to take advantage of these market challenges. So the big area that is really changing is, I guess, in 2 dimensions.

Semiconductor manufacturers are doing a lot more different kinds of products and also they're turning on capital a lot more abruptly. Shorter lead times for new fab projects and also a lot more different types of products that require a lot more different kinds of semiconductor equipment. So our semiconductor equipment customers need to build products faster, they need to develop more optimization for different kinds of processes. And for -- what does that mean for us is that we're much more closely linked to our customers, but also power is no longer one size fits all. In the old days, you could have fairly generic products. But now we really have to design a range of frequencies and power and optimization in terms of enabling capabilities.

A lot of people thought that just the evolution of power over time would be more power, just keep adding power, keep adding power. But we're hitting a threshold, but that doesn't make sense anymore. Adding more power is starting to damage the chamber. It's making the environment hard to work in. It's also having unintended process impact. So what you need is not more power, you need smart power, and this is where AE SmartPower is. When you want to just deliver the energy to exactly the target of making the process work, and we'll talk about it specifically. It sounds a little bit different notion of power when you think about plugging in a plug, but you can actually target what makes a process work. And right now most products that bring power -- bringing a lot of power that's never used, it's wasted and doesn't do any useful work.

So just another thing to be successful in the marketplace, we have to have the development jobs to work closely with our customers. That means we have to invest. And in the difficult times, as the first half of this year, when the market was down, we continued to invest. And that led us to win, and we win, and that led us to continue to invest. So this is a cycle that we've been very strong on.

I'll go lightly here, but I did want to explain the comment Yuval made earlier about new lithography. I'm going to ask to take this water. Power is becoming much more of an enabler. Moore's Law used to be led by lithography. Had the cadence of Moore's Law, everything was successful, then lithography started to run out in terms of capability.

So innovation for applications went in a couple of different directions. One is it went 3D. So you see in this cartoon, a 3D stack, and that sets up a lot of different processing challenges. But actually to fully form the device, we need etch and deposition to complete and draw the circuit that the lithography started. That's a completely different paradigm, and it drives a lot of different process requirements. And those process requirements are all fundamentally enabled by power.

So these challenges, I won't go in great detail, but making deep holes in filling those, making straight lines on complex structures, having a stack of 128 layers and making them so that each layer doesn't potato chip a little bit and throw off the whole thing. These are the challenges, and all those are enabled by power.

So I'll give you a couple examples. I said I'll try to thread the needle and give you a -- people that aren't expert in this a sense of things. When we say a narrow deep hole, I can tell you how many nanometers it is and nobody is going to know what that means. I don't even know, what a nanometer really feels like, but you get a sense of how the shape is by looking at the aspect ratio.

So toothpick is the aspect ratio, length to diameter of about 30:1. And the holes that they are now doing for advanced memory stacks are 50:1 or 70:1. So it's like having 2 toothpicks end to end at that same diameter. That has to be etched and removed perfectly all the way down with straight lines. You can imagine the challenge, right? And you see it in this cartoon. You have trouble sometimes getting that etch all the way down to the target or you can have troubles with the profile of it and control, and all these are big issues that result in power trans for us.

So for etch, it's about tuning while pulsing. I'll introduce pulsing in greater detail in a minute, but pulsing is what you're really trying to do is, get all the way -- the reactants all the way to the bottom of the hole. And to do that, you have to change the charge to try and get ions to go all the way down there. And so it turns out pulsing, turning on the power on and off extremely rapidly has the capability to do that. But to do that with the process transitions, you have to tune very quickly in the power. So that's a big etch process driver, also adding more ion energy to make it faster. Not more power, but the targeted energy is critical.

In deposition, people are shifting from 13 megahertz to 27 and higher. And so they are doing this to get better control of no potato chipping. It tends to have less thrust and faster processing. And other applications in MRAM, PCRAM are requiring lower frequencies, higher power control of lower power. So what you see is there is this whole spread of different requirements that's coming in, and this is where you use SmartPower as that's our tool box that we are really reaching in to integrate topology, metrology, control, connectivity to make this happen. This is what we are winning with today. And then we are going beyond our efforts, I'll introduce later, to win tomorrow.

So back to kind of how Yuval set things up. We are growing share. Our strategy is growing share, innovation and new opportunity. I will illustrate a few of these.

So in share, what we're talking about is, really taking our RF products and extending leadership positions in etch, deposition and other target applications. In match, the match is a great area for us to gain market share. So those are growth strategies. In innovation, we are using SmartPower to extend our RF capabilities and also to lead with RF beyond RF power. And new opportunities are 2 big new SAM opportunities for us that I'll talk about.

So I won't spend a lot of time on this, but this sort of fills out the next level of detail of the chart that you saw from Yuval. And this shows our firsts along the [wave]. We've been able to bring products to the market that have fundamentally changed how people use power all the [waves] in our 30-year history. And it's a good illustration of why we'll be successful in the strategies we're pursuing now.

On these first, I won't spend a lot of time on it, instead I'll look at what our products are today. Primary products are the Paramount and Paramount+ platforms and Navigator Match. These 2 together are the strongest combination of a generator and a matching network in the market today. And

they are the workhorse for a broad swath of applications, but they're also the most capable products for the high precision advanced processing. So that's what we are winning with today.

And then we have the next step, which is Navigator FastCap, which has a 1,000-time faster tuning time, which is really important when you talk about matching processes I'll talk about and the new EVoS, which I'll go into in detail.

So here I'll talk about a specific strategy, and this is really exciting. This is where we're winning in growth by increasing our match position. And AE has been ahead in high precision, high demanding applications for matches. And matches are growing. This is a fastest-growing product category. It's growing at 15% CAGR according to VLSI compared to Power, which is growing at 10%, which both are growing faster than WFE. And the reason it's growing is because people are increasingly adopting multi-frequency generators, and they're also using higher value matches to replace dumb matches because they need it for the advanced processing capability.

Here maybe it's worth taking a minute to kind of explain generator and match interaction. So if you use an analogue, if we think of an automobile, a car, generator is like the engine. It provides the power. The matches like the transmission, car transmission, when you start to pump the gas, the motor runs, and then the transmission uses gears to make that engine speed match the wheels, so you can go forward smoothly.

Matches do the same. Matches take the power of generators, and it matches it to the process that's there and it does it with -- instead of gears, of course, uses capacitors and switches. And so AE's Navigator II match is the optimum product for high-precision, high-processed matching. And just 2 reasons why this is going on is, first it is superfast, and with really quick process steps that are going on today in today's recipe, you have to be able to switch at an incredible speed and tune to incredible speeds. Second is, we have a metrology part of our SmartPower -- metrology advantage that we're able to measure at the output, which is very tricky, and measure the power as it's going into the process chamber. And you're really then looking at what is impacting your customer's process. This has been a huge differentiator and is really valued by our customers.

So what it means bottom line for us in our growth strategy is the segment or the product category is growing very quickly. AE is ahead, and AE is having advantage as more people go from dumb matches to smart matches and going from single frequencies, multi-frequency. This is an area that really is a big growth area for us.

Now kind of on the same theme, but it really does merit its own description is, AE does have the best match in the industry. We also have the best generator in the industry. And when you put them together, you can get much better results than 2 boxes on their own that don't work together. So it's kind of one of these -- the sum is, the -- it's more than the sum of the parts or 1 plus 1 equals 11. And it's really required because you have to now with these processes be very fast and if you have a match that doesn't understand the generator it will have a pause in being able to regulate that power and send that message back. And what that creates is a dropout in the plasma itself and then you have that process result.

In the past that was -- didn't happen. You had enough time. But now things have gotten fast enough that you need the enabling capability of having these products integrated together. So AE has an enormous advantage here. And AE's competition isn't set up well to compete because you have some competitors that have some strengths in generators and some competitors that have some strength in matches, but there is nobody that has strength in both. So this is an area where our experience is really helping us, and we are solving the toughest problems, and we are relied on more and more to provide these integrated solutions.

Beyond that we've actually integrated solutions into a single box for target applications, and we're continuing to find more. And this even has the advantage of making a smaller volume product at a lower cost because you are saving parts and providing that enabling speed. So this is an example of AE being able to provide a power solution that just simply assembling 2 different boxes from different competitors can't do. And this is a great growth strategy that we are executing on right now.

Now kind of taking a look at the future, this is super exciting. This is changing power and how power is delivered to our customers, and it's a whole different product and philosophy. And this is what SmartPower is able to do, is come up with these whole new different ways to put together holistic solution for power.

So a little science-y first then I'll tell you what this means. So multi -- we used multi-frequency before in the examples I gave you to come up with ion energy distribution that looks like that complex squiggle over there. It turns out that gives you more energy in the places as you want it, but as you can kind of guess from that line all the way across, it gives you some energy in places that's not doing any work. And also, it has some disadvantages and that if you want to increase the power you're increasing a lot of that power that you don't want at the save time.

So it's good for today's processes. It's working a lot well, but you can see that the extension where it's going to run out of gas. And so what customers have really been asking for is, I only want to put in energy that's going to activate the ions I want. I want to control ion energy directly. And there's been no means with RF to do that.

So AE came up with an entirely new power concept, and we're able to tune the power, the ion energy. Tune the ion energy to specifically where you want to associate -- it's effectively just a knob that actually ionizes the -- makes the ions that you want to do the work. And you can see at that little peak, it's just exactly what you would want, and you can shape that peak. You can do pulsing with it, and it's a huge differentiation that is coming up. It's something that our customers are really excited. This is what they wanted. Now it's very different. So now they're trying to figure out how best to take advantage and use it, and we are engaging with our customers, and this is going to be a very super interesting and super great story as we go forward.

We've heard a little bit about RPS. It's a new -- another growth strategy for a new incremental market area. We are going after $150 million incremental SAM that we are going after. Sorry, I'm losing some of my voice. Right now, the market is not satisfied with the solutions or there isn't a sufficient product set out there that takes care of it.

The dissatisfiers are the products don't last long enough. They don't have a good enough chamber life. They don't make enough of the reactants that you want to really clean off the stuff that builds up on the side wall. That's what remote plasma clean does is you take the [wave form] out and you're using this to actually clean off the gunk that builds up through processes. The other thing is it doesn't -- the products out there don't consistently strike plasma, and so you have different results. And so people are conservative. They use a lot of overprocessing to do this. It's very expensive, and it takes a huge toll on tool productivity.

So this is where we're bringing the Xstream and the MAXStream to this application. This is like a really bulletproof plasma strike. It's proven that it strikes every time. We also have a whole new cluster design and material selection that we've proven chamber life is much longer than alternatives. So COO is much better. Performance is much better. This is a market that really needs a new product, and we have the products that are going to really make a difference in this marketplace.

The last growth strategy I will talk about is, really looking about just more power in the process. So here you can see the different products that interact with our process chamber, and in gray you can see the kind of core products, largely bringing process in DC and RF. In blue are the acquisitions that we have made in the last 5 years. And besides high voltage products for ion implants and e-beam, they are largely focused on new sensing and control of the electrostatic chuck that holds the wafer. So that's a very exciting complement to have to our processing. And then the green brings incremental SAM, and that's the RPS that we talked about, but also the low voltage support power that we are adding with Artesyn.

And altogether you can see we are focused on power, so each piece of the power that we have there helps us understand more about the other pieces of power, and we can see how to improve our products just on a single level, but also how to potentially add value through integration.

So just to sum up here, AE is in a really great position and has a tremendous opportunity ahead of it. And one that's already taking advantage with several -- and executing on -- with several strategies. So the SAM is -- power SAM is growing. Really 10% is a good healthy CAGR.

We are the power leader. We're expanding etch and target deposition and other wins. We're also expanding our share with these new RF solutions that primarily with the match, and the match is pulling additional generators and multi-frequency. We are expanding our SAM. The RPS is addressing $150 million SAM. And in the last 5 years, acquisitions bring another $450 million in SAM.

And lastly, our AE SmartPower is bringing us a set of innovations that are helping us win now, but also making sure that we continue to win in the future.

So I think that's a quick boil through, but now I think you've earned a break.

We have a 10-minute break. So we look forward to talking to you about our other products and operations as we go forward.

(Break)

Dana Huth - *Advanced Energy Industries, Inc. - Chief Revenue Officer of Embedded Power*

Well, good afternoon. I hope you've enjoyed your break. Thanks, again, for being with us here today. Allow me to introduce myself. My name is Dana Huth, and I am the new guy at Advanced Energy. I came over to Advanced Energy as part of the Artesyn Embedded Power acquisition on September 12th. I've been in the technology industry for about 35 years and have been in the embedded computing and power space for about the last 15 years with both Motorola and Emerson Electric. I've been leading the advanced -- excuse me, I have been leading the Artesyn team and the integration into Advanced Energy. And I can tell you our team is really excited to have become Advanced Energy employees and to help AE lead the power conversion industry.

As you heard earlier today a few times, the acquisition of Artesyn expands the addressable market and Advanced Energy's participation in the daily economy. I'm going to spend about the next 20 minutes or so, not only educating you on the history of embedded power, but how we fit into each one of the markets that we serve. And I'll also talk about the longstanding value-based relationships that we've built with industry-leading customers from around the world. I will talk about our strategies to win and why we win in each one of the markets that we serve.

You'll see here we are well positioned in each one of these 4 markets, and all of these play a key role in serving the daily economy. Starting on the left, you've heard quite a bit already about Advanced Energy's position in the semiconductor equipment market. I know many of you know that market well. We certainly have a play there, where we plan to take existing embedded power products and cross-sell into the customer set that AE already has intimate relationships with, and I'll talk a little bit more about how we're going to do that later.

As we move across the chart here, you see in the industrial medical space that both Advanced Energy and Artesyn play in this space. This is a very diverse market set of customers, and we have now a wider range of products to sell into these markets. As we move further to the right, in the telecommunications and networking space, we play with industry leaders in the traditional networking space. An example is Cisco, one of our large customers. In the telecom infrastructure space, one example is Nokia. We have longstanding relationships with many of the industry leaders in this space as well as in the data center space. If you look across to the right, this is another new market for Advanced Energy based on the acquisition. We've served this market with traditional enterprise computing and storage customers like Dell as well as the new hyper-scale customers, an example is Microsoft.

Our embedded power products and solutions serve a very diverse set of verticals and applications. We address these applications through a set of engineered platform-based custom products for our Tier 1 or larger customers and a robust set of standard products for our Tier 2 and broader markets. Most of our products fall in the 100-watt to 3,000-watt range, and these are often typical devices that you would see plugged into a wall. We call these AC to DC devices and systems. We also have DC to DC or board-mounted power products, which help power semiconductor devices right on the customer circuits -- circuit board. Our products are differentiated from others by leading with efficiency, density and flexibility.

In the markets we serve, Advanced Energy is now the #2 player in the power conversion industry and is now at the center of many powerful brands that you see here on the bottom right in this chart. These brands have over 50 years of history, and with these brands and these acquisitions, we developed a deep market and application-specific expertise. And the customers in these markets value us as a trusted adviser and preferred supplier. We have over 700 engineers with over 300 patents, and we've really built a brand reputation around innovation, reliability, and certainly, something you've heard today, operational excellence. These are all things that we believe are going to help Advanced Energy move forward to serve the data economy.

Our customers. We've built customer relationships all over the world. You heard Yuval talk about customer intimacy a few times. One of the really cool things that we discovered very quickly in the integration process is that both companies have a very strong passion for customers. We aim to serve our customers. And we found in both companies, if we serve our customers well, we get a nice return, okay?

And so for our team, we've had customer relationships on average that are over 20 years long. They place a high value on leveraging our expertise and our engineering capabilities from the 7 design centers as well as our field application engineers that we have out on the street close to our customers. As a matter of fact, many of our FAEs visit customers daily. Some of our customers have the FAEs as part of their internal team and extension of their internal teams.

There's a high value based on the engineering capability we bring and the product sets that we build. This puts us in a great position to not only leverage our direct selling effort, but utilize as you've heard Yuval talk about our channel partner program and our distribution network around the world to take our standard products and our modified standard products and basically sell them into broad markets around the world, great position to scale our business.

One of the key differentiators for us is Design for X. It is a set of design practices that helps us increase the value we deliver to our customers while optimizing our own investments. The first is design re-use. And we develop platforms of products, and rarely is a product or an application so completely unique that you have to have a ground-up design. And what we found is through this platform strategy is that we can get ahead of the product development cycle by having a base platform to start with and that helps the customers get to market faster, which is of value to them.

On the theme of time to market, our ability to make modifications through software, that you've also heard about a few times today, allows us to tailor the standard off-the-shelf products into the environment for the customers. Our design engineers are also very involved in the manufacturing process, so design for manufacturability becomes important. We've been able to use automation strategies and magnetics integration to increase the density of our products and design that from the beginning into the manufacturing process. And what that produces is a high quality level of -- a high level of quality in our product at the best cost, obviously, things that are very important to our customers and very important for us in the bottom line. A number of the processes that we put in place are also patented in this area for embedded power.

Our growth strategy. Our growth strategy has 3 dimensions. And the first is to grow share across mission-critical, precision power and vertical markets, and this includes the hyper-scale data center applications and in the industrial medical space as well as taking advantage of the migration to 5G in the telecom and networking space.

Our increased scale allows us to expand further into complementary markets like semiconductor. And I'm going to touch on each one of the 4 -- each one of the 4 markets that we serve and give you an example, much like Peter did, of the growth strategies that we have in each one.

For the semiconductor market, as you've heard, it continues to grow, and our play here is pretty straightforward. Our play is to take existing embedded power products and take them to the customers that AE already knows really well. And we've identified this $170 million market that we can go after in the auxiliary power market that we were not addressing. We typically only played in the test equipment vendors, very few of those. So this is a market we believe our products are a great fit. We've already started some engagements with these customers, and we are looking forward to take an advantage of this area of growth within the semiconductor space.

The Fourth Industrial Revolution or Industry 4.0 and the growth of electronics and medical devices aligns well with the portfolio I described of all of our standard products. And our products have the ability to start with the base platform and quickly adapt into the market segment that we serve.

The industrial edge applications themselves leverage some of the same technology that we used in the data centers. So the products that we built for data centers over many years for companies like Dell and HP and IBM, et cetera, have leveraged that and put us into a position to build standard products that actually can now be configured to address the industrial-medical market space. We'll do that through a lot more software, and as we've developed those programs, we have found unique opportunities in the market space.

Let me give you an example here. The industrial-medical market is very diverse. And what I can describe is that it would be virtually impossible to have a portfolio of standard commercial off-the-shelf products to serve every application that you need. At the same time, it would be cost prohibitive to have a custom product built for every one of those. So what we have done to address that is we have developed a configurable power supply. That's a highly flexible platform that allows customers to take this off-the-shelf module and create nearly a custom solution. We further enable the products with advanced monitoring and communications so customers can more easily integrate these products right into their end system. Our

Artesyn and Excelsys brands have been shipping configurable products for decades. As a matter of fact, thousands of different configurations bet -- built on a small set of building blocks.

As we move into the data center and hyperscale space, we are focusing our efforts in this growing part of the market in hyperscale. It's certainly a rapid growing market and that is driven by companies moving their IT spend to the cloud. And our growth strategy really addresses 3 trends: the drive towards the need for higher efficiencies, and I'll go into a little bit more on the efficiencies on the next slide; the need for decreased time-to-market and increasing our engagement with the ODMs or the original design manufacturers we talked about.

I mentioned we have a long history in serving some of those companies in the data center arena. We still serve some of those companies. What's interesting is many of them went to work at the hyperscalers. So we have longstanding relationships even within new clients like the hyperscalers with engagements and people that have known us as power conversion experts for many years. As we work with the ODMs, we'll also be developing them as another channel to market because they're not only an influencer today to the hyperscalers, but they are developing their own products to go out to the broad market.

Let me touch on a couple of pieces of technology. Efficiency is a measure of how effectively energy is being converted. And what really matters here is the total cost of ownership. In an ideal world, you'd like to be able to convert 100%, and in reality, the mainstream for efficiency is about 94%. This is especially true with the hyperscalers. We have customers that are spending tens of millions to hundreds of millions in operational expense for electricity.

So a fraction of improvement in efficiency can have a material financial impact with the hyperscaler. This is the relentless drive for efficiency. And as you can see on this chart, although hundreds of companies claim to be experts in power conversion, there is only a few that have really been able to get to efficiencies that are used in today's data center. And there is only 2, of which Advanced Energy is one of them, that actually have products that are ready for next generation to get us to 98% efficiency. This is a big deal for the hyperscalers, and it's a big advantage for Advanced Energy.

Power density. Across the entire technology industry, there's been this relentless drive to shrink form factors and/or increase the existing capability of packaging. And this oftentimes, there's a -- means that we are trying to put more into a smaller space, which creates more heat, and you heard Isabel talk about the issue with heat.

The embedded power team has a longstanding expertise, in not just driving for more efficiencies, but taking advantage of densities. And you can see here that we try to put all these components together, and we've actually reached and secured and are shipping 75 watts per cubic inch. So we're today in a great position compared to the competition about -- around the size of the power supply and how efficient it is in this market space.

As we move now into the strategies around telecom and networking. Over the next years -- over the next few years, we actually see growth returning to the telecom and networking market space, as 5G becomes more mainstream. This will not only drive the wireless infrastructure market, but also the broader communications market that supports it.

Our strategy is pretty straightforward, win next generation 5G designs for both the macro cell or the big cell towers as well as a number of key design wins in this space with leading network companies like Cisco, okay, for the communications.

Quality of service is one of the most important and key metrics in the communications provider space. So keeping these networks powered is central to delivering on the metrics that they have. And we deliver today rugged, highly reliable product, built on a foundation of experience that we gained through the businesses that we acquired from companies like Ericsson and Huawei, where we've built that application and market-specific expertise that I talked about.

Here is an example for you of a highly reliable power supply in one of the harshest environments. So it doesn't matter whether you are in the frozen tundra of Alaska or you're in the desert in the Middle East with extreme heat, our telecom customers and their end customers, and ultimately, their end customers, who are all of us using our cellphones, really rely on our products to power their radios, the base stations and their core networks.

I've shown this -- this is one example, but I can tell you that our customers entrust these products to only a few companies that actually build the products for these towers. There is a really good chance that an AE power supply is powering most of the communications that all of us use on a daily basis.

We have deep expertise in mechanical design and that allows us to meet stringent, thermal and packaging requirements that these applications demand. This is completed by some of the magnetics and integration designs that I noted earlier around our design process, and our ability to deliver here is really built on that foundation of customer intimacy. If you don't know the application and what really happens with that telecom infrastructure provider, it's really tough to build products for them. So we are in a great position in the telecom and networking space.

So with that, in closing, I hope that you now have a better understanding of how the embedded power acquisition -- the embedded power team and the acquisition of Artesyn, now becoming part of Advanced Energy, helps us expand our platform for growth. We're truly excited about the positive impact that we will have by taking these industry-leading products to the world class customers that we have in our portfolio, using our channels to market, to scale this business and drive strong earnings per share for Advanced Energy.

I thank you for taking the time today. And at this point, I'd like to bring up our Chief Operating Officer, Neil Brinker.

Neil D. Brinker - *Advanced Energy Industries, Inc. - Executive VP & COO*

I appreciate it. What I can say, every time I watch one of your presentations, I get more and more excited about this acquisition. Thinking about the technologies, the products, the markets that we have with Artesyn and the combined efforts with Advanced Energy, we're going to be in a really good place, and it's very exciting.

My name is Neil Brinker. I am the Chief Operating Officer for the Advanced Energy. I've been with Advanced Energy for approximately 18 months, and it's been a long time since I've seen this level of an explosion of opportunities, and being part of that is really great. I am very, very excited about that.

We've heard a lot today about markets. We've heard a lot today about technologies. We've heard a lot today around innovation, particularly with the combined businesses. I'd like to discuss the integration, and what we're going to start with the integration.

First we're going to focus our integration on functional integrations across the companies and across the platforms. We're going to do this with a maniacal focus on scalable processes. We have some scalable processes that we've developed that are centered around the Advanced Energy operating model. The operating model runs in tandem with the business model and if they align perfectly.

With our operating model, we'll deploy this across the entire enterprise, and we'll focus on optimizing our footprint, our global footprint. There's a real advantage and a real opportunity with the additional factories that we have through the Artesyn acquisition. There's a real differentiator in terms of optimizing our factories across the globe. Operational service and excellence behind this will also be critical in terms of the integration as we move forward.

Vertical integration within our factories will also be a differentiator. Integrated R&D, you've heard a lot in terms of where we compliment one another in terms of R&D and how we can leverage our integrated R&D across the functions, and we can advance our innovation, we can advance our products into the marketplace.

Supply chain consolidation, this is very exciting. There's a real opportunity in supply chain consolidation, and we see it immediately. We're seeing the impact of it immediately. This is real cost savings that go to the bottom line.

And of course, distribution and channel alignment. As we lever up and we move these businesses together, we see real opportunity to get extensions of ourselves across the channel and through distribution. These create a competitive advantage now and in the future. In the short-term defined by 18 to 24 months, we expect to see roughly $20 million in synergies. In the long term, we expect to see $40 million in synergies based on the functional integration across the organization.

So the processes, the structure, the tool set, how we're going to deploy it, will be around the AE operating model. We standardize, we innovate, we execute and we simplify through complexity reduction. These are a collection of best practices that we put together at Advanced Energy. This isn't claimed and renamed or a framework from different companies or industries. This is something we developed with the leadership team over time. We're very proud of this. We've got the buy-in and the consensus of the leadership group to deploy these best practices across the organization, and this is part of our integration methodology.

We have proven this with our operating model over the last few years with integrating some of our recent acquisitions. With some of our recent acquisitions, we've moved them from single-digit to double-digit profitability, from tools like 80-20 complexity reduction, daily management, the execution of our first year in our strategic initiatives and our strategic goals.

This also allows for us to establish a common business language across the organization. This is particularly important when we want to deploy our leadership and make sure that we have our best people working on our greatest opportunities. We have to have a common language, especially when we are dispersed across the entire world and many different cultures and in many different regions and time zones. It keeps us in sync, it keeps us aligned and it keeps our eye on the prize. This is a scalable structure that supports growth even in times of volume and mix shift. it allows us to be very agile as we move in and out of the tool set. It's standardized, it's scalable and, again, it's proven results. And we've seen it in the bottom line.

So let's start with integration of the -- and optimizing our global footprint. We have 6 facilities, major manufacturing hubs today. We're going to move towards 3. We'll have 3 hubs by 2020. We're going to optimize, and we're going to invest around these manufacturing capabilities, around centers of excellence and vertical integration.

This would create flexibility, flexibility with these manufacturing hubs in different regions in different countries. Having our manufacturing hubs in different countries will allow us to stay connected with our customers and allow us to move and shift production as we see fit. We all know that there is extreme challenges with the geopolitical environment. We all know that we have to make choices where we want to manufacture, and this will maintain business continuity for the long term, having 3 facilities, major hubs in 3 different regions.

We've seen pull from our customers. I've spent a lot of time collecting VOC with our customers over the 1.5 years at AE. It's been one of my primary jobs. And one of those areas is speed, flexibility, how we can stay connected to the customer and how we have vertically integrated facilities so that we can control our destiny.

Operational excellence through vertical integration. This is a really unique opportunity, sometimes the once-in-a-lifetime opportunity. Where you have the AE model of manufacturing, which was primarily based on late-stage assembly and test, and in the Artesyn manufacturing methodology, which is more vertical integration. Taking these 2 methodologies and combining them together to create a strategic differentiator in a hybrid model. Neither one is right or wrong, but being able to optimize, being able to leverage upon these skill sets, being able to leverage upon these factories so that we can move quicker and we can control our costs and we can have speed. Speed is the new king in terms of factories, efficiencies, optimization and getting products from the innovative design cycles that we have through our facilities now. This will accelerate our time to market and it will optimize cost.

Along with our operational excellence, we also think of this in terms of our world-class global service solutions, leveraging the global service footprint across the globe. This is, again, another differentiator we have with our service organization. We've operationalized our service organization.

We provide innovative custom solutions for our customers upon demand. We have high quality repair centers, and we've launched some new products into the industry today to satisfy customer needs where, honestly, they can't -- they don't have the need for a new product development at this time. They're looking for custom solutions through our service organization, and we do this through a dedicated service organization that has a dedicated engineering team that can react to the customer demands and has a dedicated sales force.

Now we've invested heavily in our service organization over the last few years. And we've done this as we have seen shifts in terms of where we can manufacture and we can optimize our landed costs. And through that investment in our service centers, that's given us the ability to provide service and provide high-quality repairs and custom solutions in-region, not within specific hubs, but within region. We have 10 service centers

across 8 countries that we're going to be able to leverage those experiences and the operationalization of service with Artesyn. Now we have a much broader product portfolio that we can bring to the customer, and we have these service centers in place across the globe.

Integrating our R&D and accelerating new product introduction. This is going to be key to our success. That's what we are. We're a highly innovative technical company. And being able to do this and leveraging the 2 companies and integrating these functionally allows us to now have 1,600 total people on our technical staff, with over 600 combined patents. It's impressive. That's a real opportunity to leverage.

And you can see from the earlier presentation from Dana around the expertise that we have in R&D, Design for X. It was an excellent overview that Dana gave in terms of Design for X of Artesyn. Artesyn's ability to have high-efficiency, high-technology topology. AE's ability and focus on RF/DC plasma and technologies, that's what we do; controls in metrology, being one of the leaders in the industry; high voltage and high power; combining all these together to provide something that's new and unique in the industry today. Common development with data analytics, connectivity, advanced controls and software, that's what we have shared experiences, shared skill sets. We'll work on these together in the combined R&D function.

Now you take these new technologies, you set this with our -- you set this up with our NPI teams, which is now global, New Product Introduction, and now we can move rapidly. We've reduced the complexity and we shortened the lead time to the customer. We have design engineering hubs in-region that are near the facilities. We have our sales organizations within regions, which are near our facilities. So you've reduced that lead time from sales, marketing, innovation into our designs centers, into our design hubs right into the factory. This will continue to help us drive new product solutions as we drive towards the Fourth Industrial Revolution.

Supply chain consolidation where our spend has doubled. We've got a different seat at the table now, and that's important for 2 reasons. One, cost. Two, as we get the mind share of our supply chain so that we can work on the next level of technologies and the next-generation products from our supply chain so we can advance our product development. There is real opportunities in supply chain consolidation. We're going to align our own common device suppliers. We're going to rationalize our supply chain, both with components as well as with our commodities and we're going to create strategic partnerships with some of our suppliers and that's intentional because we do want to partner with our supply chains, while we get the best COGS.

We recognize that through our joint and combined spend that we should realize roughly $7 million in savings and we're going to leverage that across both AE and Artesyn. We're actively working on it today. We're going to improve our COGS.

Distribution and channel alignment, again, leveraging the 2 businesses together, having additional feet on the street, having extensions of ourselves outside in the market. With the combination of the 2 businesses, we now have scale and design opportunities of well over 150,000 OEMs. This is well over 2 million targeted design engineers throughout our distribution worldwide. And having training and incentives and programs in place so that we can handle those extensions of ourselves, provide our products and allows us to be in positions that we currently don't have today.

Now we do a great job with key account sales. We were born on key account sales. We do a wonderful job with key account management. We know where to focus and we know where our primary customers are, but through our distribution and our channel allows us a lever even beyond that and that's important especially with the broad breadth of products that we have in our portfolio today. This will continue to improve access to our customers and we'll be able to continue to design in new technologies and innovative solutions into the marketplace.

So in summary, the functional integration and the operational excellence that we provide will be a competitive advantage. We have the deployment and the execution through the AE operating model, which is led by the leadership and created by the leadership. We're going to optimize our global footprint. We're going to continue to drive vertical integration through operational and service excellence. We're going to integrate R&D. We're going to supply -- we're going to consolidate our supply chain and we're going to leverage all that and move it through our channel and we're going to do that with our strategic partners. It's a lot of work. It's worth it. We're investing in the future. Sign me up.

I'd like to introduce our Chief Financial Officer, Paul Oldham.

Paul R. Oldham - *Advanced Energy Industries, Inc. - Executive VP & CFO*

Great. Thank you, Neil. Yes, sign me up, too. That sounds like a lot of fun. Actually, I think it's rare that you get a chance in your carrier to join a company that's at an inflection point in its growth. And I know many of you in the room, we've met before in previous roles that you know I've only been at AE for about 18 months as well and that's what was exciting for me when I started at AE because I saw this opportunity that of a company that was at an inflection point in its growth and a chance to be a much larger company, all while focusing on its core competencies. And I think that's the opportunity that we have ahead of us today.

So thank you very much for being here. I look forward to talking with you a little bit today as we execute our strategy to focus on delivering precision power conversion, measurement and control in a new broader set of diversified and technology market and create a platform for not just growth but accelerated earnings growth. And as you see, hopefully, today, a platform that also delivers top-tier financial performance, especially when you compare us with diversified technology companies.

Now hopefully, as I go through this, I'm able to tie everything that you've heard about from the other members of the executive team regarding our market, regarding our innovation, strategies for growth, operational excellence and the synergies we think we can deliver, tie that altogether and describe how we will drive value creation.

So our strategy to win, as you heard from Yuval is not new. It's been in place for the last 5 years. And as we put our energy and went through the first transformation as a company to focus on our core competencies of power of conversion, it also built for us a very strong foundation, which we are utilizing today.

During this time, we grew as a leader for power, for semiconductor equipment enabling critical process steps in deposition and etch. We added power content and capability along that wave, which allowed us to grow share. We also began to invest and expand into new addressable markets and we began to build a position both organically and inorganically in industrial technology products.

During that time, we built the best-in-class financial model, and we generated a lot of cash and we deployed that cash. Part of that cash we deployed to grow and part of that we returned to shareholders and you will hear a little bit more about that. This strong foundation that we built from 2014 to 2018 enabled us to basically weather the semi downturn that we've seen over the last year or so. And not just weather it, but invest for growth during that time and set ourselves up in a position to grow faster as our markets begin to recover, but also position ourselves to make a transformative acquisition like the one we just made and closed in September. I'm going to describe a little bit about each of those steps as I go forward.

In previous Analyst Days, we described how we would focus on being a pure play power company and we would grow along with the semi industry and at the same time begin to add content in other areas. Well, from 2014 to 2018, we grew our semi revenues by 17% CAGR, which is almost 150% of the growth in wafer fab equipment.

In addition, we began to diversify and extend into industrial applications, as you heard from Peter, both in thin film deposition for advanced materials, but also inorganically by acquiring other embedded power applications in things like medical, life sciences, analytical equipment. That allowed us to grow and expand our presence in industrial technology markets with a CAGR of about 20%, which exceeded our target of 15% or mid-teens, both organically and inorganically. And finally, we were able to add on to this by acquiring scope over this period of time through a series of 7 companies that we bought that added about $160 million of annualized revenue, both a little bit in semi, but also heavily in industrial products and applications.

Financially, we also performed well. Overall, we grew revenues that is about 18% CAGR from 2014 to 2018, and we grew earnings faster than revenues at just over 20%. We delivered operating income in the mid-25% -- 20% to 25% to high 20% range and we generated over $600 million in operating cash flow. As a result, we exceeded our aspirational goals every year up through 2018.

We deployed the cash that we generated during this time to both grow the company and to return value to our shareholders. We invested $168 million, as I mentioned, to acquire $160 million of annualized revenue. And not only did we acquire the companies, but we've helped them to be successful. Each of them has grown, each of them is profitable and plays a key part in our product portfolio.

In addition, we took advantage of buying opportunities to buyback our own stock particularly in the early part of this time in 2014 and 2015 and also in 2018. And the result of that is, we were able to buy back 5.2 million shares for about $200 million, which is an average price of $38 per share. Now this is roughly 12% of the company, and again, has demonstrated our ability to both grow the company and be a good stewards of the cash and deploy it in a smart way.

The financial model and this proven strategy has enabled us to continue to strengthen the company, building on this foundation, but also strengthen it through the downturn that we've seen over the last year or so. Now despite a significant decline in our semiconductor revenues from their peak, our industrial revenues, our investments we've made in acquisitions and the growth we've seen in services have helped to buffer that decline and to cushion the overall impact to the semi downturn.

Now revenue down about 30% from our peak quarter in Q2 of '18 through the trough of Q2 '19, our resilient business model enabled us to remain solidly profitable on a non-GAAP basis, generating double-digit operating income, generating positive earnings per share and positive cash flow, each quarter.

Now we also generated cash during this time and added about $150 million of operating cash flow from the beginning of '18 through the end of the third quarter. As our business begins to recover, we expect to be able to see the same leverage we've seen historically on our organic business and that will help earnings increase as the markets improve.

Finally, the addition of Artesyn, which you see as a projection in the final bar in each of these areas, expands our ability to diversify our results and not rely just on the semi market during up cycles and down cycles, and not only just revenues, but expand our ability to grow profits as well.

Now I will note that in Q4 of 2019, we expect to see negative cash flow, largely driven by the timing of payment related to deal cost for the transaction and nonembedded power-based payables, which we acquired as part of the transaction. So if you exclude those items, we would still expect on a base ongoing business that we would see positive cash flow in Q4 and I've tried to illustrate that in the chart here.

Now good companies are able to make money in both good times and bad companies (sic) [times] but we believe great companies are able to not just make money in bad times, but also invest for the future and that's exactly what we've done. As you can see from the chart on the right, we have increased R&D both organically and inorganically for the last 8 quarters. These investments have allowed us to keep up with our customers' accelerated product development cycles, to develop some of the smart power innovations you've heard about today and to achieve critical design wins in both current and next-generation etch and deposition processes.

Now we also invested in capital during this time and you heard a little bit about, from Neil, about our manufacturing strategy. But we're able to invest capital to move from a single-source to a dual-source manufacturing strategy during this time frame, which we think is very important because of business continuity, diversifying geopolitical risk and ultimately lowering cost. Now you'll hear more from the acquisition of Artesyn, you'll see some quantification, but now that we have an even broader footprint, it gives us a chance to continue to shrink that footprint and maintain some of this diversification. And our investment in our new factory in Malaysia will be one of our key sites going forward.

We also invested during this time to strengthen the management team. Many of the people that you heard today are new to AE in the last 1.5 years and come with the experience and the ability to help the company enable at this scale going forward. Now at the same time we invested, we didn't sit on our hands.

We streamlined the company. We simplified things. We focused on operational excellence. We focused on reducing waste and we used this time to further integrate some of the acquisitions that we've already made.

As a result, we were able to achieve a cumulative cost savings over the last 7 quarters of almost $20 million. And if you look underneath that, we've reduced annualized SG&A costs by 12% from our from exit rate in Q4 a year ago to today. And that's on pre-Artesyn basis, obviously, Artesyn is going to add in, but if you look at the underlying run rate, it's down 12%. We've reduced our headcount by 8%. We consolidated 3 existing sites that we had and we reduced our square footage by about 10%. So we have an ability and what we have proven is that we can during tough times, continue to strengthen and optimize the company, while allocating resources to grow in the future.

These investments that we made in scale and capability and process, combined with this resilient financial model is really what set us up to be able to make a transformative acquisition like Artesyn right in the heart of what would be a pretty big market downturn in our primary market and it sets us up with this platform to create accelerated earnings growth and to drive top tier overall performance as a more diversified technology company.

The acquisition of Artesyn culminated a many months process, I've talked to a few of you about this, to identify, assess, diligence, and ultimately acquire what we believe is a highly synergistic and strategic company. And it's part of our strategy to remain a pure play powerhouse. So we didn't go off into some adjacent unknown area to grow just for growth's sake. We believe there's a tremendous opportunity to continue to focus our efforts and resources in the area of power and continue to grow.

At the same time, the acquisition increases our presence across global markets, roughly doubling our presence in industrial and medical markets, introducing us to some new semi applications and giving us the whole new exposure to the telecom and data center markets, which we didn't have before. It almost quadruples our addressable markets overall and gives us a more diversified footprint. And even though, as you heard from both Dana and Neil, we have a lot of still marquee customers that are very critical and whose names you recognize, none of those now is greater than 10%, except 1. So it gives us a much broader footprint.

Dana described a little bit how Embedded Power and Artesyn is highly complementary in terms of the capabilities they bring, the strong organization, which they have and the demonstrated capability in operational excellence, which I think puts AE going forward in a unique position to leverage that capability relative to our peers. And we executed well during the transaction process. We were able to acquire Artesyn for roughly 5x synergy adjusted EBITDA and we were able to utilize low-cost debt, which we believe gives us a wide runway to create value going forward. All of this will help us drive faster earnings growth and we've talked about this acquisition being able to yield $0.80 of accretion in the first 18 to 24 months and over $1.50 beyond that.

Now one of the significant benefits of the transaction is it continues to diversify our revenue base. Rather than just being primarily a semiconductor equipment company that's kind of trapped in the rising and lowering tides or as Yuval likes to describe being a big fish in a little pond, we're now a smaller fish in a much bigger pond with a lot more irons in the fire, a lot more opportunities to grow and a more diversified footprint.

If you look forward, semi, which wasn't the vast majority of our business, is now about 30% of our business. Industrial and medical is about the same size or maybe even a little bit bigger, and we have nice exposure to telecom and network and to the data center markets. And if you look from the types of products we sell, it's about an even split between Advanced Power products, which you heard about from Peter, and Embedded Power products, which you heard about from Dana, with Embedded Power probably being slightly lower -- larger over time.

Now in order to better describe the dynamics of the markets that we address, we have provided information at this meeting and in your charts that shows the impact of Artesyn revenues on a pro forma basis going back by quarter through 2018. That was a pro forma impact. One thing I will note is that the Q4 numbers that you see here or the bar chart are intended to be an illustration of the guidance or the directional guidance that we talked about in our Q3 call, not as some new market guidance or something you should try to look at exactly, but more -- much more directional.

Now when you take a look at the trends, what you see is in our semiconductor market, things appeared to have bottomed. And back in the summer, we talked about we felt like things were bottoming and we were seeing some things begin to improve and other areas that were still struggling. Since that time, as you heard on our call, we've seen strength in foundry and logic. And the beginning of some maybe small capacity adds in NAND and in China, which are helping our business to improve. We guided back in the third quarter that we thought we would see our semiconductor revenues up in the low to mid-teens for this coming quarter. And so it seems like the semiconductor market is beginning to recover.

If you look at industrial and medical, on a combined basis, you can see that, that market for us and also our results have steadily grown over time. This has been a function of not only pretty steady growth drivers in those markets, but also the impact of design wins by both companies over this period of time.

Within data center, you can see the impact of early wins in hyperscale that Dana talked about that are fueling our results in the near term. And those are partially offsetting softer market overall -- market conditions overall as data center is coming off a strong year in 2018.

And finally, in telecom networking, we expect that to be a little lower in the near term because of the impact of China tariffs, some market uncertainty related to the combination of Sprint and T-Mobile in the near term. But we believe that in the long run, the investments in 5G will continue to fuel our growth in that market.

Now if you take a look at the long-term market growth and the trends there, we are not counting on achieving our aspirational growth just through market growth. In fact, if you look at the average -- the aggregate growth from 2018, which was a peak year in semi and a good year in both telecom and in data center, we are just projecting just 2% market growth on a CAGR basis between now or between 2018 and 2022.

Our basic assumptions basically call for semiconductor equipment to get back to the levels it was in 2018 over this period of time. Now if overall WFE returns to those levels faster or it's higher, then we will do better, but that's our base operating assumption. If you look at telecom and networking and data center, while those aren't fast growth markets, we believe that we're attached and have exposure to the fast growth trends within those areas. And finally within industrial and medical, this market overall is growing at almost 4%, and it's an area where we're expanding our footprint and want to take advantage of the growth in the market.

Having said all that, if you look at the aggregate growth in the market, we believe this could yield about $100 million in revenue growth over this period of time from market growth. Now we're not just relying just on market growth, we think growing our position through the investments we're making is critical to executing our strategy and you heard about those strategies today. We want to grow share, we want to innovate and bring out new products and we want to continue to increase our SAM. Within share, you heard now our investments in semi and in advanced etch. We're already seeing momentum on RF match and we believe we'll benefit from integrated products between the generator and the match, as you heard from Peter.

We also continue to win individual programs in industrial and medical, and we're already seeing the benefits as you've seen from growth in wins in hyperscale. Within innovation, there's a number of new opportunities related to SmartPower that you heard from Peter and eV Source, PowerInsight and some of the next-generation products that we're bringing out beyond RF.

And from a SAM perspective, we are reentering the RPS market. We have a new content in semi that we'll be bringing to market from both Embedded Power and Advanced Power areas and we think there's opportunities to enter some of the high-performance computing areas in data center. There's additional opportunities from synergy of new products that Yuval talked a little bit about. Those aren't in our synergy model right now, but would represent upside.

Now we expect to leverage that revenue growth into faster earnings growth not only through continued operational excellence, which we've demonstrated over time, but driving synergies as you heard from Neil. We expect to be able to gain over $40 million of synergies over the long run, with just over half of those coming from gross margin improvements and the other half coming from improvements in operating expenses. The combination of supply chain optimization, changes to our product portfolio, consolidating our global footprint, as you heard from 6 large factories down to 3, all of those things will help raise the underlying margins of our Artesyn Group from the low 20s up into the high 20s or very close to 30%.

We also expect to realize expense synergies by consolidating our global infrastructure, by leveraging shared services, integrating our sales channel and by reducing corporate costs for our compliance and other administrative activities. In fact, if you take a look at that, we believe that we will have identified and completed the actions to deliver about $8 million of annualized synergies by the end of Q4. So we're well on our way to achieving these goals.

In addition, as you heard from Neil, a lot of the building blocks to gain -- to achieve the synergies in the supply chains are already well underway, and we would expect to achieve more than half of those synergies in the first phase of our integration plans.

Finally, if you look at the 2 areas on the right, we've not included in our model the benefits that we think we can get over time from revenue synergies both by increasing our coverage and our footprint through leveraging of the new sales channel as well as by expanding our SAM through new products, which we can introduce over time as a combined company.

The results of this as we see a clear path to grow earnings from 2019 levels of $2.25, which is roughly the midpoint of our guidance back in Q3 to over $6.50 per share at revenues of $1.5 billion. This growth will come from a combination of market growth, innovation driving new products, share growth, SAM expansion, the underlying intrinsic earnings that comes with Artesyn as well as the synergies which we can drive through the integration. All of these are reflective on an after-tax basis.

These investments yield a new business model for Advanced Energy as more of a diversified technology company that can deliver top-tier financial performance. We start with a baseline of Q4 guidance, which we've annualized to give a sense of what the combined company looks like. This already yields a higher earnings number than what we would deliver for 2019 on a stand-alone basis. We then modeled the impact of revenues between $1.3 billion up to $1.5 billion and the associated impact of the synergies at those level. The result is that at $1.5 billion, gross margins are over 40%, operating margins are around 20% and we can generate greater than $6.50 per share. In addition, we'll continue to generate over $100 million per year at these levels in cash flow.

Now we also believe we can develop -- we can deliver top-tier financial performance overall, and we're introducing a new metric at this Analyst Day of return on invested capital. As the starting point, our lean operations and focus on efficiency delivers a return on invested capital on a pro forma basis for 2018 of over 12%. Now that's about 1.75x our weighted average cost of capital, which is just over 7% on our new capital structure.

Over time, as we grow revenues and grow earnings with the leverage we've discussed, we believe we can almost double this up to about 23%. Now we believe that the -- this financial performance, when you look at it relative to peers, you can see that this puts us in a top quartile position. If you look at return on invested capital and you look at 4 peer groups which we looked at, the first is, semiconductor equipment suppliers, which are largely our customers; semiconductor equipment subsystem and component peers; power equipment peers; and diversified industrial technology companies, people like Danaher and IDEX and Emerson and others, you can see that our current run rate of over 12% return on invested capital always puts us -- already puts us near the top of our peer group in every category. However, if you look at our long-term target, as we're able to grow from $1.250 billion roughly up to $1.5 billion, we would see our return on invested capital arguably be best-in-class on a pure company basis.

Turning now to the balance sheet and capital allocation. Our overall strategy remains the same. Invest in growth and return value to shareholders on a smart opportunistic basis. In the near term, we're highly focused on executing the Artesyn acquisition and making sure that we get the efficiencies and the gain in the value that we believe exists on a combined company basis. During this time, we'll direct most of our growth funding towards debt reduction to build credibility with our constituents but also to bring our gross debt down to our target levels, which are 1 to 1.5x of EBITDA. We think this can be achieved over the next 12 to 18 months in part on better EBITDA but also on modest reduction of the debt. We expect to maintain our opportunistic share repurchase program to both offset dilution and selectively reduce share count over time, and we'll continue to evaluate other strategies to return value to shareholders or optimize shareholder value over time.

In summary, we're at an exciting time in the phase of the company. We have taken steps to build a strong foundation, to invest in the downturn and create a platform for growth, that will enable us to achieve our revenue targets of $1.5 billion. But more importantly, it will enable us to accelerate earnings growth, to deliver top-tier return on invested capital and to continue to generate over $100 million of operating cash flow per year. In addition, as a more diversified technology company serving a variety of end markets, we'll have more stable -- we'll be in a more stable revenue environment and have a more resilient financial model, while still enjoying the upside of the semiconductor capital equipment market.

So let me reiterate, as we look forward, our long-term goals are to achieve revenues of $1.5 billion, non-GAAP EPS of $6.50 and return on invested capital of 23%. We expect to be able to deliver these goals in the next 3 to 4 years, depending on the timing of the semiconductor recovery. As I mentioned earlier, if that happens faster, we could achieve them more quickly. There are other several factors could help us -- that could help us achieve these goals, which you've heard today. One is synergies from new products that we've not included in our revenue and another is the potential to add additional acquisitions as we go forward. Our strategy of adding scale or adding scope and applying scale to that in this large highly fragmented precise power market continues to be the same. If we're able to deliver these results, we believe that arguably, we have delivered one of the best returns of our peer companies.

So let me wrap up by returning to some of the key points that you've heard today. This is a very exciting time for Advanced Energy. We're on our second major transformation in 5 years. The first was the focus of the company in the power market and the second is now to continue to take that same focus and extend it into a broader set of end markets, which allow us to become a more diversified technology company rather than just a

semi equipment company only. Let me reiterate, we keep all the benefits of being in semi going forward, but we get to now add on to that with additional capability, additional diversification and additional earning power.

We expect to continue to grow our position as a leader in pure play power, and this focus will give us the competency, the capability and the resources we believe to outperform our peers. And we'll continue to grow share and content in a diversified set of markets, both organically and inorganically. And all of this will help us to drive accelerated earnings growth and deliver top-tier financial performance for a diversified technology company.

So with that, I'd like to invite you all to come back up, and we'll take some of your questions. Now as you have questions, a couple of things. One is, if you would wait a moment until we can bring you the mic so that people on the webcast can hear your questions. And secondly, if you'll please state your name and company when you give your questions. Yuval and I are here to answer, but we also have the executive team is available to provide additional information as well.

So Yuval, I will turn the time back to you.

Yuval Wasserman - *Advanced Energy Industries, Inc. - President, CEO & Director*

Well, thanks very much for joining us today. It's been an exciting time for us to share with you our vision, strategy, goals and also to introduce a new management team for the new company. I'm excited about the team. We have fantastic culture and we expect to see an acceleration in everything you heard from us today over time.

So with that, I'll open the floor for questions.

QUESTIONS AND ANSWERS

Yuval Wasserman - *Advanced Energy Industries, Inc. - President, CEO & Director*

Amanda?

Amanda Marie Scarnati - *Citigroup Inc, Research Division - Semiconductor Consumable Analyst*

Thanks for taking the question. I just would like to go back to the revenue synergy opportunities, the 3 that you specifically pointed out. Can you just talk about why those opportunities hadn't been explored individually as individual companies? And what the competitive environment looks like in the likelihood of being able to actually attack those markets?

Yuval Wasserman - *Advanced Energy Industries, Inc. - President, CEO & Director*

Sure. So it's really interesting. So AE, historically, was focused on process power. That was an area of expertise, that was an area that we focus on. That was an area that we manage to continue to create differentiating solutions. And we did not have the process to take on the auxiliary power. So these products were provided by a broad base of suppliers, some of them really small. Some of them localized. Some of them large, but aim for enhancements, right?

Artesyn, although they have the products and the design and the capability to deliver on the auxiliary power, they don't have the [capability] and the access for semi. The semi business that Artesyn had, historically, was not to mean to provide equipment. They were in the ATE side of the business, the automated test equipment and did not have the channel and the approach and the relationship to take this to the semiconductor industry.

The benefit of putting these 2 teams together is that we become almost like a one-stop shop for power solution not only process power, but auxiliary power as well.

Amanda Marie Scarnati - *Citigroup Inc, Research Division - Semiconductor Consumable Analyst*

And then just the competitive environments in those industries, is it -- does it seem like it's something that would be easy to attack or is it going to be something that's very difficult?

Yuval Wasserman - *Advanced Energy Industries, Inc. - President, CEO & Director*

We expect like any design win in the semiconductor industry, we expect that the -- that these design wins to take the course of evaluation, testing, quantification, copying exactly so similar trajectory of sales cycle that can be 18 to 24 months. So this is something that won't happen tomorrow morning. This is something that was built over time. But there are a few companies, some of them small in U.S., some of them in Europe, some of them in Asia, that provide -- in those applications.

Amanda Marie Scarnati - *Citigroup Inc, Research Division - Semiconductor Consumable Analyst*

And then just following up on the medical side, is that going to be similar as well? That seems like it's a bigger opportunity, about $600 million SAM?

Yuval Wasserman - *Advanced Energy Industries, Inc. - President, CEO & Director*

So in the medical equipment, this is an area that both teams already made their presence. So the Advanced Energy team through the acquisition of Excelsys, we already are a supplier of power supplies that build the surgical lasers, cosmetic lasers, some surgical tools that buy AE, namely the AE power supplies, right?

Obviously, Artesyn bring in experience from their broad portfolio of products as a supplier to medical applications, not competing by the way. The opportunity in this new application space, the RF ablation, emerges from the combination of core competencies of both the teams. AE's capabilities and expertise in RF power are geared towards process power. Very high power. Very high power, this is not suitable for medical applications, right? Artesyn engineering team has the ability to provide low power, SDA-capable, highly reliable, cost effective to small footprint fan-less because in the medical equipment and surgical room, you do not have fan that starts blowing particles. The combination of these capabilities may result in a low-power RF power supplies, fanless SDA-capable or certified for the RF ablation market. That's an example.

Paul R. Oldham - *Advanced Energy Industries, Inc. - Executive VP & CFO*

Thank you. Your mic is down. This is Paul. I'm not sure, they we go. Great. Next question.

Quinn Bolton - *Needham & Company, LLC, Research Division - Senior Analyst*

All right. Quinn Bolton from Needham & Company. Thank you for hosting the day. Three questions. One on the PowerInsight, it sounds like you'll be selling this more through the services business. Can you talk about how -- what's the selling strategy? How does it -- how do you price it? Is that an annual contract? And then I've got 2 follow-ups.

Yuval Wasserman - *Advanced Energy Industries, Inc. - President, CEO & Director*

There are some things we can share about this and some that we couldn't, but maybe I'll ask Isabel to talk about that initiative.

Isabel Yang - *Advanced Energy Industries, Inc. - Senior VP & CTO*

Okay. So our initial strategy is to penetrate through our services organization because we have a huge installed base. And through that installed base, we learn about what the customer really want, what their real problems are and we created analytics solutions. Moving forward, with our new platform, we're actually defaulting with the embedded. It will just be part of our power supply and will be offered as options to customers.

Quinn Bolton - *Needham & Company, LLC, Research Division - Senior Analyst*

So starts off in sort of an additional service, but longer term gets built into the pricing of the power supply?

Isabel Yang - *Advanced Energy Industries, Inc. - Senior VP & CTO*

Absolutely.

Yuval Wasserman - *Advanced Energy Industries, Inc. - President, CEO & Director*

Yes.

Isabel Yang - *Advanced Energy Industries, Inc. - Senior VP & CTO*

Absolutely. It will be across the board.

Yuval Wasserman - *Advanced Energy Industries, Inc. - President, CEO & Director*

Yes.

Paul R. Oldham - *Advanced Energy Industries, Inc. - Executive VP & CFO*

You should probably think about this plan as an additional differentiator to our product, which will allow us to command more value in the market. Obviously, there'll be some recurring revenue over time, but it's really a differentiator for us.

Quinn Bolton - *Needham & Company, LLC, Research Division - Senior Analyst*

Okay. Great. And then for Peter, Peter, you talked about moving into the RPS market, I think about $150 million SAM. I think that's largely dominated today by one competitor. Do you have any internal targets as to what percent of that market you think you might be able to achieve in terms of share over time?

Peter Gillespie - *Advanced Energy Industries, Inc. - VP & GM Semiconductor Customer Solutions*

Yes, I don't think today we're talking about the targets, it's an area that we're confident that we're going to enter into. But we are -- yes, not talking about any targets right now.

Quinn Bolton - *Needham & Company, LLC, Research Division - Senior Analyst*

Great. And then lastly for Dana. You talked about the increasing efficiency of telecom and server power supplies and limited or decreasing number of commentators that can hit these higher efficiencies. I assume but I'll ask, do you get -- are you seeing a trend where your gross margins increase as the power efficiency goes from 92% to 94% to 96% and ultimately, to 98%. I mean, I think power supplies historically have been a cost-first market and so driving higher margins has proved elusive for a number of companies.

Dana Huth - *Advanced Energy Industries, Inc. - Chief Revenue Officer of Embedded Power*

I think I've described it some. I'll describe it as the value goes up, obviously, we see an increase in profitability. And at this point, our plan is certainly around developing more efficient products with more density, put us into a position to add more value to our customers.

Paul R. Oldham - *Advanced Energy Industries, Inc. - Executive VP & CFO*

If I can add, Quinn, our strategy in this specific area is to go-to-market first with the highest efficiency. In this specific market, time to market is critical, going to market first with the highest efficiency will allow us to get designed in earlier, which may translate to better margins.

Krish Sankar - *Cowen and Company, LLC, Research Division - MD & Senior Research Analyst*

It's Krish Sankar from Cowen and Company. I have 2 questions. One is to follow-up on the RPS question. Is your product going to have the same, I guess, flavor as you'll call them so such like oxygen, nitrogen, water vapor remote plasma? Or do you plan to do a focused slot? And then I have a follow-up question.

Yuval Wasserman - *Advanced Energy Industries, Inc. - President, CEO & Director*

So right now if you look at our RPS strategy, we start with approaching existing applications with better performance. We have higher chamber lifetime, significantly longer, lower cost of ownership. We have the ability to strike plasma almost without failure and just better performance.

The next step in our expansion in the RPS would be more of radical processing for wafer processing. This is a little bit more, I would say, more challenging and more lucrative as you go into application like hydrogen plasma for a surface treatment or even soft etch applications. So we're going to grow gradually. We believe that right now the lowest barrier to entry is in the chamber clean market. The market needs a better solution and we're being pulled by the market to provide that solution.

Krish Sankar - *Cowen and Company, LLC, Research Division - MD & Senior Research Analyst*

Got it. Got it. That's very helpful. And then a follow-up on the data center computing market. You guys give a number of $1.9 billion SAM in 2022. My understanding is this, from a power supply standpoint, it's pretty lumpy for you guys. So I'm just trying to figure out how do you size the market? Is there a way of saying each server needs so many watts or kilowatts of power times 20 million servers? I'm just trying to figure out how do you size that market?

Yuval Wasserman - *Advanced Energy Industries, Inc. - President, CEO & Director*

Edwin, do you want to talk about that?

Yeuk-Fai Mok - *Advanced Energy Industries, Inc. - VP of Strategic Marketing & IR*

Actually, let me take the market sizing data, right? So 2 -- 3 things that we can offer you. First, we use a third-party source as you see on our data point there, right? Second thing, obviously, that we triangulate with the data that we can collect ourselves, okay?

In terms of the market, it's separated into few areas. Hyperscale being one big area that is priced roughly only right around 20% of the market, but it's growing in the teens versus the overall market is kind of flattish. That's the area that we are targeting for growth. That's the area where we already have significant design wins that actually on the third quarter earnings call, we talked about potentially contributing to fourth quarter and we expect that to drive substantially faster growth in that market.

Thomas Robert Diffely - *D.A. Davidson & Co., Research Division - MD & Senior Research Analyst*

Tom Diffely, D.A. Davidson. Couple of questions on the embedded side. When you look at the growth plan, where it was in the last couple of years, has it changed under the AE leadership or is it the same plan essentially?

Paul R. Oldham - *Advanced Energy Industries, Inc. - Executive VP & CFO*

Well, I would say it, it has certainly changed and that it's a way more focused. Now one of the challenges that we had prior to the acquisition is that we served not only these 4 markets, but we served other broad markets like the consumer space and the embedded computing space. So what this acquisition has done has helped us to provide a laser focus on being a pure play power conversion player in each one of these markets with specific focuses, with products and technologies in each space. So I'd say we're well aligned with AE and in a way better position to execute on that strategy.

Thomas Robert Diffely - *D.A. Davidson & Co., Research Division - MD & Senior Research Analyst*

Okay. And then when it comes to your largest competitor, Delta, what's the relative size of the 2 companies? And what is it that you think you're going to use to gain share over time?

Yeuk-Fai Mok - *Advanced Energy Industries, Inc. - VP of Strategic Marketing & IR*

Yes. So in terms of absolute company, Delta is actually a multi-billion dollar company, all right? In terms of our relative size, as we said, we are #2 in the market right now. Delta is bigger than us, right, but it's not by an extreme far margin. And if you look at the other 3 companies in the list, they are quite a bit smaller than us actually in the SAM that we're targeting.

Yuval Wasserman - *Advanced Energy Industries, Inc. - President, CEO & Director*

If I may add to that, Tom. We focus on a very specific set of niche applications. We're not trying to compete with all the power supply companies around the world that provide power supplies to charge your shaver or power supply to charge your laptop and there are simple commodity off-the-shelf power supplies that we don't call them precision power. We continue to focus on precision power conversion solutions for high-end applications where a failure means significant damage to yield, property, profitability, et cetera. And that will continue.

So if you look at the world of power supplies, which is huge, we serve a niche of that world. And we will continue to focus on that because this is where we can deploy our innovation, core competency, capabilities. Going into a commodity market of consumer product, power supplies, it's a different domain where you basically compete on the lowest cost possible. We would like to compete on the highest value possible.

Yeuk-Fai Mok - *Advanced Energy Industries, Inc. - VP of Strategic Marketing & IR*

Just to support Yuval's comment, if you look at IHS data, for example, third-party. The overall power supply market is in the high $20 billion, but we're only targeting the $9 billion of the $20 billion because of the uniqueness of the customers that we're targeting.

Thomas Robert Diffely - *D.A. Davidson & Co., Research Division - MD & Senior Research Analyst*

Okay, thanks. And then finally, Paul, when you look at the target model, it looks like it's essentially the same as it was when you first announced the deal. But having looked under the hood for a little bit here what's changed in your mind?

Paul R. Oldham - *Advanced Energy Industries, Inc. - Executive VP & CFO*

Well, as you know, Tom, we did a tremendous amount of due diligence leading up to this deal because it was a carve-out under various circumstances. I think we feel very pleased that we've validated as we've gotten to know it more deeply, the initial assumptions that we made.

If anything, I think we believe there could be upside to this model over time. And you've heard about a few of those areas today or we can execute faster as the teams come together. But at this point, we feel like we have good line of sight to the synergies we've talked about and we're focused on executing those.

Yuval Wasserman - *Advanced Energy Industries, Inc. - President, CEO & Director*

Thanks, everyone. It was great to see you here today. Thanks for joining us. As you can see, we're extremely excited about the future of the company. We're fully energized with this acquisition, and we have a strong, strong confidence that we can deliver on the plan, just like we delivered on our strategic plan over the last 5 years. Thank you so much.

Paul R. Oldham - *Advanced Energy Industries, Inc. - Executive VP & CFO*

Thank you, everyone.
