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CORPORATE PARTICIPANTS

Jeff Su *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Wendell Huang *Taiwan Semiconductor Manufacturing Co Ltd - Senior Vice President and Chief Financial Officer*

C.C. Wei *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

CONFERENCE CALL PARTICIPANTS

Gokul Hariharan *JPMorgan - Analyst*

Laura Chen *Citigroup Global Markets Taiwan Securities Co., Ltd - Analyst*

Charlie Chan *Morgan Stanley Asia Ltd. - Analyst*

Brett Simpson *Arete Research Services LLP - Analyst*

Bruce Lu *Goldman Sachs L.L.C. - Analyst*

Arthur Lai *Macquarie Research - Analyst*

Rick Hsu *Daiwa Securities Capital Markets - Analyst*

Robert Sanders *Deutsche Bank - Analyst*

Sunny Lin *UBS Equities - Analyst*

Brad Lin *BofA Global Research - Analyst*

PRESENTATION

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

(spoken in foreign language)

Good afternoon, everyone, and welcome to TSMC's fourth-quarter 2024 earnings conference and conference call. This is Jeff Su, TSMC's Director of Investor Relations and your host for today. Today's event is being webcast live through TSMC's website at www.tsmc.com where you can also download the earnings release materials. (Event Instructions)

The format for today's event will be as follows. First, TSMC's Senior Vice President and CFO, Mr. Wendell Huang, will summarize our operations in the fourth quarter, 2024 followed by our guidance for the first quarter, 2025. Afterwards, Mr. Huang; and TSMC's Chairman and CEO, Dr. C.C. Wei, will jointly provide the company's key messages. Then, we will open both the floor and the line for the question-and-answer session.

As usual, I would like to remind everybody that today's discussions may contain forward-looking statements that are subject to significant risk and uncertainties, which could cause actual results to differ materially from those contained in the forward-looking statements. Please refer to the Safe Harbor notice that appears in our press release. And now, I would like to turn the microphone over to TSMC's CFO, Mr. Wendell Huang, for the summary of operations and the current quarter guidance.

Wendell Huang - *Taiwan Semiconductor Manufacturing Co Ltd - Senior Vice President and Chief Financial Officer*

Thank you, Jeff. Good afternoon, everyone. Thank you for joining us today. My presentation will start with financial highlights for the fourth quarter of 2024. After that, I will provide the guidance for the first quarter of 2025.

Fourth-quarter revenue increased 14.3% sequentially in NT, supported by strong demand for our industry leading 3nm and 5nm technologies. Gross margin increased by 1.2 percentage points sequentially to 59%, mainly reflecting a higher-capacity utilization rate and productivity gains, partially offset by the dilution of 3nm ramp-up.

With operating leverage, total operating expenses accounted for 10% of net revenue. Thus, operating margin increased by 1.5 percentage points sequentially to 49%. Overall, our fourth-quarter EPS was TWD14.45 and ROE was 36.2%.

Now, let's move on to revenue by technology. 3nm process technology contributed 26% of wafer revenue in the fourth quarter. 5nm and 7nm accounted for 34% and 14% respectively. Advanced technologies, defined as 7nm and below, accounted for 74% of wafer revenue.

On a full-year basis, 3nm revenue accounted for 18% of 2024 wafer revenue; 5nm, 34%; 7nm, 17%. Advanced technologies accounted for 69% of total wafer revenue, up from 58% in 2023.

Moving on to revenue contribution by platform, HPC increased 19% quarter over quarter to account for 53% of our fourth-quarter revenue. Smartphone increased 17% to account for 35%. IoT decreased 15% to account for 5%. Automotive increased 6% to account for 4%. DCE decreased 6% to account for 1%.

On a full-year basis. HPC increased 58% year on year. Smartphone, IoT, automotive, DCE increased 23%, 2%, 4%, and 2% respectively in 2024. Overall, HPC accounted for 51% of our 2024 revenue. Smartphone accounted for 35%. IOT accounted for 6%. And automotive accounted for 5%.

Moving on to the balance sheet, we ended the fourth quarter with cash and marketable securities of TWD2.4 trillion or USD74 billion. On the liability side, current liabilities increased by TWD184 billion, mainly due to the increase of TWD71 billion in accounts payable and increase of TWD99 billion in accrued liabilities and others. In terms of financial ratios, accounts receivable turnover days declined by 1 day to 27 days, while inventory days decreased by 7 days to 80 days, primarily due to shipment of N3 and N5 wafers.

Regarding cash flow and CapEx, during the fourth quarter, we generated about TWD620 billion in cash from operations, spent TWD362 billion in CapEx, and distributed TWD104 billion for the first quarter '24 cash dividend. Overall, our cash balance increased TWD241 billion to TWD2.1 trillion at the end of the quarter. In US dollar terms, our fourth-quarter capital expenditures totaled USD11.2 billion.

Now, let me recap our performance in 2024. Due to the strong demand for our 3nm and 5nm process technologies, we continue to outperform the foundry industry in 2024. Our revenue increased 30% in US dollar terms to USD90 billion, or increased 33.9% in NT to TWD2.89 trillion.

Gross margin increased 1.7 percentage points to 56.1%, mainly reflecting improvements in overall capacity utilization, partially offset by 3nm dilution and higher electricity costs. With operating leverage, our operating margin increased 3.1 percentage points to 45.7%. Overall, full-year EPS increased 39.9% to TWD45.25 and ROE increased 4.1 percentage point to 30.3%.

On cash flow, we spent USD29.8 billion or TWD956 billion in CapEx, generated TWD1.8 trillion in operating cash flow and TWD870 billion in free cash flow. We paid TWD363 billion in cash dividends in 2024, up 24.5% year over year.

I have finished my financial summary. Now, let's turn to our current quarter guidance. We expect our business in the first quarter to be impacted by smartphone seasonality, partially offset by continued growth in AI-related demand.

Based on the current business outlook, we expect our first-quarter revenue to be between USD25 billion and USD25.8 billion, which represents a 5.5% sequential decline or a 34.7% year-over-year increase at the midpoint. Based on the exchange rate assumption of USD1 to TWD32.8, gross margin is expected to be between 57% and 59% operating margin between 46.5% and 48.5%.

Regarding tax rate, our effective tax rate was 16.7% in 2024. For 2025, we expect our effective tax rate to be between 16% and 17%. This concludes my financial presentation.

Now, let me turn to our key messages. I will start by talking about our fourth quarter '24, and first quarter '25 profitability. Compared to third quarter, our fourth-quarter gross margin increased by 120 basis points sequentially to 59%, primarily due to a higher capacity utilization rate and productivity gains, partially offset by dilution from the continued ramp up of our 3nm technology.

We have just guided our first-quarter gross margin to decrease by 100 basis points to 58% at the midpoint. This is primarily due to ramp costs associated with N2 and CoWoS expansion, and the start of dilution from our overseas fabs. As a reminder, six factors determine TSMC's profitability: leadership technology development and ramp-up, pricing, cost reduction, technology mix, capacity utilization and foreign exchange rate.

Looking at full-year 2025, given the six factors, there are a few puts and takes I would like to share. On the one hand, we are working hard to increase our value. The dilution impact from our N3 ramp is expected to gradually reduce and we expect our overall utilization rate to moderately increase in 2025.

On the other hand, as we have said before, we forecast 2% to 3% margin dilution impact from the ramp-up of our overseas fabs. The impact is less than 100 basis points in the first quarter of '25, but we expect it to grow more pronounced throughout the year as our fabs in Kumamoto and Arizona ramp up.

We also expect inflationary costs, including higher electricity prices in Taiwan, to impact our gross margin by at least 1% in 2025. In addition, there are some ramp-up costs associated with N2 and further conversion of N5 to N3 capacity, which, together, we expect to impact our gross margin by about 1%.

Finally, we have no control over the foreign exchange rate, but that may be another factor in 2025. Longer term, excluding the impact of foreign exchange rate and considering our global manufacturing footprint expansion plans, we continue to forecast a long-term growth margin of 53% and higher is achievable.

Next, let me talk about our 2025 capital budget and depreciation. Every year, our CapEx is spent in anticipation of the growth that will follow in the future years. And our CapEX and capacity planning is based on the long-term market demand profile.

At TSMC, a higher level of capital expenditures is always correlated with higher growth opportunities in the following years. In 2024, we spent USD29.8 billion as we continue to invest to support our customers' growth. With our strong technology leadership and differentiation, we are well positioned to capture the multiyear structure demand from the industry megatrends of 5G, AI, and HPC.

In 2025, we expect our capital budget to be between USD38 billion and USD42 billion, as we invest to capture the future growth. Out of the USD38 billion and USD42 billion CapEx for 2025, about 70% of the capital budget will be allocated for advanced process technologies. About 10% to 20% will be spent for specialty technologies. And about 10% to 20% will be spent for advanced packaging testing, mask-making, and others. Our depreciation expense is expected to increase by high single-digit percentage year over year in 2025 as newly incurred depreciation will be partially offset by other nodes rolling off depreciation.

Even as we invest for the future growth with this level of CapEx spending in 2025, we remain committed to delivering profitable growth to our shareholders. We also remain committed to a sustainable and steadily increasing cash dividend per share on both an annual and quarterly basis. Now, let me turn the microphone over to C.C.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Thank you. Wendell. Good afternoon, everyone. First, let me start with the conclusion of 2024 and our 2025 outlook. 2024 was a mixed year of recovery for the global semiconductor industry. AI-related demand was strong, while other applications saw only a very mild recovery, as macroeconomics condition weighed on consumer sentiment and the end-market demand.

Concluding 2024, the Foundry 2.0 industry, which we define as all logical wafer manufacturing, packaging, testing, mask-making, and others increased 6% year over year, slightly lower than our previous forecast. Supported by strong demand for our leading-edge process technologies, TSMC's revenue increased 30% year over year in US dollar term, outperforming the foundry industry growth.

Entering 2025, we expect fabless semiconductor inventory to have returned to a healthier level exiting 2024. We forecast the Foundry 2.0 industry to grow 10% year over year in 2025, supported by robust AI-related demand and a mild recovery in other end market segments.

Supported by our technology leadership and broad customer base, we are confident we can continue to outperform the industry growth. We expect 2025 to be another strong growth year for TSMC, and forecast our full-year revenue to increase by close to mid-20s% in US dollar term.

Now, I will talk about the AI demand and TSMC's long-term growth outlook. We observed robust AI-related demand from our customers throughout 2024. Revenue from AI accelerators, which we now define as AI GPU, AI ASIC, and HBM controller for AI training and inference in the data center, accounted for close to mid-teens percent our total revenue in 2024.

Even after more than tripling in 2024, we forecast our revenue from AI accelerator to double in 2025, as the strong surge in AI-related demand continues. As a key enabler of AI applications, the value of our technology platform is increasing, as customers rely on TSMC to provide the most advanced process and packaging technologies at scale in the most efficient and cost-effective way. To address the structural increase in the long-term market demand profile, TSMC is working closely with our customer to plan our capacity and investing in leading-edge specialty and advanced packaging technologies to support the growth.

As we have said before, TSMC employs a disciplined and a throughout capacity planning system to evaluate and judge the market demand to determine the appropriate capacity to build. This is especially important when we have such high forecasted demand from AI-related business. At the same time, we are committed to earning a sustainable and healthy return that enables us to continue to invest to support our customers' growth, while delivering profitable growth for our shareholders. Underpinned by our technology leadership and broad customer base, we now forecast the revenue growth from AI accelerators to approach a mid-40% CAGR for the five-year period starting off the already higher base of 2024. We expect AI accelerators to be the strongest driver of our HPC platform growth and the largest contributor in terms of our overall incremental revenue growth in the next several years.

Looking ahead, as the world's most reliable and effective capacity provider, TSMC is playing a critical and integral role in the global semiconductor industry. With our technology leadership, manufacturing excellence and customer trust, we are well positioned to address the growth from the industry megatrend of 5G, AI, and HPC with our differentiated technologies.

For the five-year period starting from 2024, we expect our long-term revenue growth to approach a 20% CAGR in US dollar term, fueled by all four of our growth platforms, which are smartphone, HPC, IoT and automotive.

Next, let me talk about our global manufacturing footprint update. All our overseas decisions are based on our customers' needs, as they value some geographic flexibilities, and the necessary level of government support. This is also to maximize the value for our shareholders.

In the US, we have a long-standing, good relationship with the US government, dating back to even before our Arizona fab project announcement in May 2020. We have received a strong commitment and support from the US customers and the US Federal, state, and city government, and are making substantial progress.

Building on the successful result of our earlier engineering wafer production, we were able to pull ahead the production schedule of our first fab in Arizona. Our first fab has already entered the high-volume production in 4Q '24, utilizing N4 process technology with a yield comparable to our fabs in Taiwan. We expect a smooth ramp-up process. And with our strong manufacturing capability and execution, we are confident to deliver the same level of manufacturing quality and reliability from our fab in Arizona as from our fabs in Taiwan.

Our plans for the second fab and third fab in Arizona are also on track. These fabs will utilize even more advanced technologies such as our N3, N2 and A16, based on our customers' needs. Thus, TSMC will continue to play a critical and integral role in enabling our customers' success while remaining a key partner and enabler of the US semiconductor industry.

Next, in Japan, thanks to the strong support from the Japanese Central, prefectural, and local government, our progress is also very good. Our first specialty technology fab in Kumamoto has started volume production at the end of 2024, with very good yield. Construction of our second specialty fab is scheduled to begin this year.

In Europe, we have received strong commitment from the European Commission, and the German Federal, state, and city government. We are progressing smoothly with our plans to build a specialty technology fab in Dresden, Germany, focusing on automotive and industrial application. In Taiwan, we continue to receive support from Taiwan government, and we are investing in and expanding our advanced technology and packaging capacities.

Given the robust multi-year demand for our 3nm technology, we continue to expand our 3nm capacity in Tainan Science Park. We are also preparing for multiple phases of 2nm fabs in both Hsinchu and Kaohsiung Science Parks to support the strong structural demand from our customers. We are also expanding our advanced packaging facilities across several locations in Taiwan.

As we have said before, under today's fragmented globalization environment, overseas fab costs are higher for everyone, including TSMC and all other semiconductor manufacturers. We will leverage our fundamental competitive advantages of manufacturing technology leadership and large-scale manufacturing base to be the most efficient and cost-effective manufacturer in the regions that we operate, while supporting our customers' growth.

Finally, I will talk about the N2 and A16 introduction. Our 2nm and A16 technologies lead the industry in addressing the insatiable need for energy-efficient computing, and almost all the innovators are working with TSMC. We expect the number of the new tape-outs for 2nm technology in the first 2 years to be higher than both 3nm and 5nm in their first two years, fueled by both smartphone and HPC applications. N2 will deliver full-node performance and power benefits, with 10 to 15 percent speed improvement at the same power, or [25%] (corrected by company after the call) to 30% power improvement at the same speed, and more than 15% chip density increase, as compared with N3E. N2 is well on track for volume production in second half of 2025 as scheduled, with a ramp profile similar to N3.

With our strategy of continuous enhancement, we also introduced N2P as an extension of N2 family. N2P features further performance and power benefits on top of N2. N2P will support both smartphone and HPC applications, and volume production is scheduled for second half 2026.

We also introduced A16 featuring Super Power Rail, or SPR, as a separate offering. TSMC's SPR is an innovative, best-in-class backside power delivery solution that is first in the industry to incorporate a novel backside metal scheme that preserves gate density and device width flexibility to maximize the product benefits.

Compared with the N2P, A16 provide a further 8% to 10% speed improvement at the same power, or 15% to 20% power improvement at the same speed and additional 7% to 10% chip density gain. A16 is the best suitable for specific HPC product with complex signal route and dense power delivery network. Volume production is scheduled for second half 2026.

We believe N2, N2P, A16 and its derivative will further extend our technology leadership position and enable TSMC to capture the growth opportunity going into the future. This concludes our key messages, and thank you for your attention.

QUESTIONS AND ANSWERS

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Thank you, C.C. This concludes our prepared statements. Before we begin the Q&A session, I would like to remind everybody to please limit your questions to two at a time to allow all the participants an opportunity to ask their questions. Questions will be taken from both the floor and from the call. Should you wish to raise your question in Chinese, I will translate it to English before our management answers your question.

(Event Instructions) Now, we will begin the Q&A session. We'll take the first few questions here from the floor and then go to online. I think, maybe left, middle, right. So why don't we start?

Gokul Hariharan, JPMorgan.

Gokul Hariharan - *JPMorgan - Analyst*

Thanks, Jeff. Happy New Year, management team. My first question is on the TSMC's US future strategy. There has been a lot of changes recently. Taiwan relaxed the N-1 restriction. There was a news about that a week back. C. C., you met Elon Musk as well recently. So you said there are a lot of developments that you've discussed. Your key IDM competitor seems to be struggling as well, while your Arizona fab seems to be ramping up quite well.

So in light of all these, I just wanted to understand the longer-term strategy. Would you start -- would you consider investing in latest node in the US? Because so far, it has been N-1. Now you don't have the restriction from the Taiwan government to go and invest in the latest node. What has been your feedback in whatever discussions you have had with the incoming President Trump administration because they have talked a lot about CHIPS Act and everything, but they're also supportive. Your original investment was during President Trump first term.

And lastly, I think, Wendell, I think last time you had mentioned you're not very keen on taking over any IDM fabs. Has that thinking changed, especially given TSMC has the potential to become even more stronger partner for the US in terms of bringing up US local manufacturing? Sorry, long question.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Yes. Okay. Thank you, Gokul. Indeed, a very long question. I think Gokul's question is looking at TSMC and our strategies in terms of global expansion, particularly in the US.

He notes that Taiwan has recently relaxed or said they relaxed the N-1 rule. And C. C. has met several -- many of our large customers in the US And our Arizona fab is ramping quite well.

So his question really is on the longer-term strategy, I believe, three parts, number one, what is the feedback or sort of discussions ongoing with the next administration in the US? Secondly, would we consider taking over IDM's fabs? Has that thinking changed? And last on the new node, maybe we'll go one by one.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

I almost forgot your question already. Okay. First one, the technology node. Actually, it's not that we don't want to ramp up the same technology as in Taiwan. But if you look at the -- when we're ramping up, introduce a new technology into manufacturing, the fab is -- the process is so complicated.

So it has to be very close to the R&D people. So the initial phase of the ramping up always come from the fab close to R&D. So in that sense, we want to ramp up the same kind of technology in the US, but that practically is a little bit difficult. So Taiwan will always be first. Did that answer your question? It's not because of N-1 or N's limitation. No. It's practically, we just have to ramp up a new node in Taiwan.

And the second, do we change our strategy to expand faster or something? Again, this is -- we always say that we build the capacity overseas is due to customers' need. If my customer has a very high demand, what should I do? I build more fabs, right, with the necessary government support, by the way, okay?

Talking about the government. Let me assure you that we have a very frank and open communication with the current government and with the future one also. I cannot say anything more than that. Okay. What --

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Gokul Hariharan - *JPMorgan - Analyst*

IDM fab.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

That's my customer. And now we -- again, our strategy is not based on my IDM competitors' status. They are very good customers. I like them, and they are very important to TSMC's business also. That's all I can say. Thank you.

Gokul Hariharan - *JPMorgan - Analyst*

Okay. Maybe my next question, going to gross margins. So Wendell, we are almost approaching 60% gross margin. Last cycle, we peaked at about 60% towards the peak of the cycle. You are expecting the cycle to even strengthen based on guidance that C.C. provided for both AI as well as some improvement in non-AI. So how should we think about gross margins in this cycle? Is it realistic that we can get to more than 60% gross margin in this cycle?

And related to that, could you help us understand the US -- especially the US fab, overseas fabs, but especially US fab dilution. What are the key factors there? Because as you mentioned, yield is already approaching or almost close to Taiwan yield. So is it basically cycle time is longer? Or is it that some other costs are much higher in the US fab because new fab depreciation is probably fairly similar compared to the Taiwan fab.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. So Gokul's second question is on gross margin. Again, two parts, he noted gross margin is almost approaching 60%. In 2022, the last cycle, it was also around this type of level.

We have said that this year is another very strong growth year for TSMC. So this question is how should we think about gross margins in this current cycle? Can we approach or get to 60% or low 60s type of again?

And then the second part is more specific to the US in terms of the cost gap. What are the US cost factors leading to the dilution impact?

Wendell Huang - *Taiwan Semiconductor Manufacturing Co Ltd - Senior Vice President and Chief Financial Officer*

Gokul, first question on the gross margin. As we said, there are six factors affecting the profitability. Every year, different factors play different roles. But for example, if the utilization is extremely high, like last cycle, it is not impossible for us to reach what you just said.

And secondly, the US fab cost, it is more expensive in the US, mainly because of several reasons. Number one, the smaller scale, right? Now number two, the higher price in the supply chain; and number three, the very early stage of the ecosystem. So if you add all these up, as we said, 2% to 3% dilution from our overseas fabs every year in the next 5 years.

Gokul Hariharan - *JPMorgan - Analyst*

If I use the 2% to 3% and do some math, it feels like the overseas fab is starting at, I don't know, 10% gross margin or 5% gross margin. Just adding factors, obviously, it's not how it works, but I'm just doing outside in. Is that right? Is that the right kind of ballpark in terms of thinking about margin?

Wendell Huang - *Taiwan Semiconductor Manufacturing Co Ltd - Senior Vice President and Chief Financial Officer*

All we can share is the 2% to 3%. Yes.

Gokul Hariharan - *JPMorgan - Analyst*

I don't think TSMC has ever started a fab at 10% gross margin.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Gokul, we are working hard to improve it.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Laura Chen, Citigroup -- Citibank.

Laura Chen - *Citigroup Global Markets Taiwan Securities Co., Ltd - Analyst*

Congratulations for the good results. I just want to have more details about your review. I mean I think people are kind of looking for your updated long-term CAGR growth. So I believe that 20% starting from a very -- already very high base in 2024 is a really good long-term objective. But just wondering that aside from the strong AI demand, what's your view on the traditional applications like PC and the smartphone growth and particularly for this year?

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. So Laura's first question is looking -- she notes that we have updated our long-term CAGR to be approaching 20%, revenue growth in US dollars, starting off even the high base of 2024. So her question is, of course, AI demand is part of that, but what about smartphone and PC. And I think your question is specific to this year, C.C., 2025.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

This year is still mild growth for PC and smartphone. But everything is AI related. So you can start to see why we have confidence to give you close to 20% CAGR in the next five years. AI, you look at a smartphone, they will put the AI functionality inside. And not only that, so the silicon content will be increased.

In addition to that, actually, the replacement cycle will be shortened. And also they need to go into the very advanced technology because if you want to put a lot of functionality inside a small chip, you need a much more advanced technology to put silicons in. Put it all together that even smartphone, the unit growth is almost low single digit, but then the silicon and the replacement cycle and the technology migration that give us more growth than the just unit growth, similar reason for PC.

Laura Chen - *Citigroup Global Markets Taiwan Securities Co., Ltd - Analyst*

So we can kind of expect those AI edge devices, they were all based on 2nm next year, perhaps second half?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Leading edge technology, that's what I say.

Laura Chen - *Citigroup Global Markets Taiwan Securities Co., Ltd - Analyst*

Okay. And also my next question is about AI. I noted that these times, you include the HBM controller into your AI business revenues definition. So can you provide us more update about what the HBM based business opportunities could be?

And previously, TSMC kind of announced cooperation with the key memory suppliers globally. Can you give us more details or updates on the progress of this business engagement?

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. Thank you, Laura. So Laura's second question is on HBM controllers. She notes that our definition of AI accelerators includes memory controllers or HBM controllers. So her question is, well, how do we see this opportunity?

Or what is the opportunity for TSMC? And what is the progress of this working with our memory partners?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

We are working with all the memory suppliers, all of them. And that's because TSMC's logic chip or logic technology is more advanced, and that meets our customers' requirement. So all of them are working with TSMC.

Now we start to see some of the products coming out. But the high volume, probably you need to wait for another half or one year to see the high volume and big contribution to TSMC's revenue.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. Thank you. We'll move to this side of the room. I guess we have Charlie Chan from Morgan Stanley.

Charlie Chan - *Morgan Stanley Asia Ltd. - Analyst*

C. C., Wendell, and Jeff, first of all, happy New Year. I think it's going to be a very exciting year, given your bullish outlook and also lots of news going on, right?

So let me start with overnights that US seems to put the new framework on restricting China's AI business, right? So I'm wondering whether that will create some business impact to your China business and how are you going to manage that?

And also, for some chips in the middle, high performance like crypto mining, autonomous driving chip, do you think they're counted as cloud AI? And would TSMC be able to continue to service your China customers?

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. Thank you, Charlie. So Charlie's first question, if I may, sort of extrapolate or summarize is about the announcements of different types of US export restrictions this week pertaining to China and AI-related chips. So his question is, what is the impact to TSMC. How does it impact our business?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

So far, we look at -- we don't have all analysis yet, but the first look is not significant, it's manageable. So that meaning that my customers, who are being restricted or something, we are applying for the special permit for them. And we believe that we have a confidence that they will get some permission so long as it's not in the AI area, okay, especially automotive, industry or even you talk about the crypto mining, yes.

Charlie Chan - *Morgan Stanley Asia Ltd. - Analyst*

This is super helpful. And my second question is actually a very hot topic recently as well, the CPO. I think your main partner, Jensen, come to Taiwan, this time probably -- besides meeting you, right, probably also want to enable this supply chain. So based on your recent technology symposium, right, you already get ready for your COUPE optical engine, but do you think Taiwan supply chain can really facilitate this CPO? Because without these key components, the next-generation Rubin's schedule could have some issues. So I think this is part of the first part of the question about how we are going to facilitate the CPO supply chain?

And secondly, to TSMC, your foundry service, right, do you see significant upside with optical networking migrating to CPO? Because -- I ask this because there are some conventional product like optical transceiver, DSP could be replaced.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Well, Charlie's second question is a very specific topic. He wants to know, well, if I can generalize because we certainly don't comment on customers or their products. But in terms of our progress on silicon photonics and CPO, how are we working with customers, how we're preparing as part of our advanced packaging solutions, and what are the opportunities for TSMC as optical moves to silicon photonics and other type of solutions on a general basis.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Charlie, that's a very technical question. Silicon photonics, we are working on it, as you said, and we got a good result also. However, a big volume, I don't think it will be in this year or probably we'll wait for 1 or 1.5 years till you can see that the contribution or the volume production. The initial results are quite good, no doubt about it. And so my customers are quite happy.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay, thank you, C.C. Operator, we will now move to the questions online. We'll take the first call from the online participant, please.

Operator

Brett Simpson, Arete Research.

Brett Simpson - *Arete Research Services LLP - Analyst*

Yeah, thanks very much. And can I just say congratulations on reaching 100 billion in annual sales in Q4. It's quite a milestone.

So my first question is in Arizona. I think, Wendell, you mentioned that we need to see some higher scale. So can you update us on the status of Phase 2? It looks like the conduction of this shell is nearly complete, but it would be great to understand more about how you see P2 developing over the course of 2025.

And in terms of pricing US wafers, how are you planning to do this? Will you have a US price and a Taiwan price or are you more likely to have a global price regardless of where you make the wafers?

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. So Brett's question -- first question is on Arizona, maybe split into two parts. First is in terms of -- we have already started the volume production of the first fab. So Brett would like an update on the progress of the second fab in terms of the construction of the buildings and the shells, et cetera.

And then the second part would be on the pricing of overseas. As we say there's value to our customers. He wants to know do we charge a separate price? Or is it part of the overall pricing, et cetera, et cetera.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Let me answer the second question first. Do we charge a little bit higher? Yes, we did, because we have a value of geographic flexibility, right? And you guys know Made in USA is a premium product. Yes, we discussed with our customers, and they all agreed and happy to work with TSMC so that we can -- because of the cost structure over there, so it's a little bit higher price over there.

The progress of the first fab is right now in volume production. Second fab we almost finished all the building and start to put the facility, et cetera, et cetera. And we expect that we move the tools [in 2H26] (corrected by company after the call) also. And we have a plan that our third fab probably will start very soon, and we will announce it in the later days, okay?

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. Thank you, C.C. Brett, does that answer your first question? And do you have a second one?

Brett Simpson - *Arete Research Services LLP - Analyst*

Yes, very clear. And the second question, I wanted to get your perspective. Broadcom's CEO recently laid out a large SAM for AI hyperscalers building out custom silicon. I think he was talking about a million accelerated clusters from each of the customers he has in the next two or three years. What's TSMC's perspective on all this?

I'm sure you've spent a lot of time verifying what hyperscalers are applying over the years to come? And how comfortable are you with the scale of what's being implied here?

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. So Brett's second question is looking at AI, I guess, specifically AI custom chips or ASICs. He notes that one of our customers recently laid out a very strong or large addressable SAM market for AI hyperscalers using custom silicon. Lots of them talking about clusters of 1 million chips. So he wants to know what is TSMC's view, how do we see this trend in terms of AI ASICs as part of the AI demand megatrend?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Brett, I'm not going to answer the question of the specific number, but let me assure you that - whether it's an ASIC or it's a graphic, they all need the very leading-edge technology, and they're all working with TSMC, okay?

So -- and the second one is, is the demand real as a number that my customers said. I will say that the demand is very strong. Is that enough to answer your question, Brett?

Brett Simpson - *Arete Research Services LLP - Analyst*

That's great.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. Thank you, Brett. Operator, do we have anyone else on the line? It seems not.

Operator

We don't.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. Thank you, Brett. Operator, do we have anyone else on the line? It seems not. Then let's -- okay, we don't. Then let's go back to the floor.

Bruce Lu, Goldman Sachs.

Bruce Lu - *Goldman Sachs L.L.C. - Analyst*

To be honest, I'm a bit surprised that the long-term gross margin target doesn't really change it. I believe TSMC's value is definitely more than selling the -- pass on the cost. I believe that TSMC needs to invest a lot more in R&D to maintain the leadership. TSMC suggested to raise the gross margin target in 2022 with higher R&D requirement, with higher profitable target, right? So I asked the same question 2 quarters ago, which is in the process of pricing negotiation, which is understandable.

But I think the price negotiation is pretty much done. What's the discrepancy here? Why TSMC cannot raise the profitability target?

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. So Bruce's first question, he wants to know, again, our long-term gross margin. Why are we not changing the target of 53% and higher, okay? He correctly notes that certainly TSMC's value is increasing. And certainly, TSMC would need to invest a lot of money in R&D and capacity to support our customers' growth.

So we have always had a focus on earning the right return. He also notes in 2022, while our gross margin used to be about 50%, then we raised it to 53% and higher. So the question is, why is it not and higher, I guess?

Wendell Huang - *Taiwan Semiconductor Manufacturing Co Ltd - Senior Vice President and Chief Financial Officer*

Bruce, as we said, six factors affecting the profitability. Every year, different factors have different weight. Now 2 things to note. Number one, starting from this year, overseas fab expansion, 2 to 3 percentage point impact every year for the next 5 years.

The other thing to note, macro environment uncertainty, which may lead to impacting the global economy, which may lead to end market demand.

Now, having said that, we are in a capital-intensive industry. So we will need to have to earn a healthy return to continue to invest to support our customer, support their growth and also deliver a profitable growth to our shareholders.

And you mentioned about the raising of long-term gross margins back in 2022 to 53% and higher. And we have been able to deliver that "and higher" part since then. So given all the above, we continue to think that 53% and higher gross margin is achievable, and we work very hard to achieve on the "higher" part.

Bruce Lu - *Goldman Sachs L.L.C. - Analyst*

Okay. I'll try next two quarters. For the CoWoS capacity, TSMC has been very aggressive in expanding the capacity. However, the application is highly concentrated in AI at the current stage, which there are certain noise around it. When can we see non-AI application such as servers, smartphone or anything else can be -- can start to adopt CoWoS capacity in case there is any fluctuation in the AI demand?

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. Thank you, Bruce. So Bruce's second question is on CoWoS capacity. In his words, we have been very aggressive to expand the capacity, but his concern is highly concentrated with AI-related demand. So his question is, when do we expect or -- to see more non-AI application adoption of CoWoS solutions?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Well, yes, today is all AI focused, and we have very tight capacity and cannot even meet customers' need. But whether other products will adopt this kind of CoWoS approach? They will. It's coming, and we know that it's coming. So that's all I can say.

Bruce Lu - *Goldman Sachs L.L.C. - Analyst*

When?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

It's coming.

Bruce Lu - *Goldman Sachs L.L.C. - Analyst*

Okay. I will try next quarter.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Non-CPU and non-server chip. Let me give you a hint.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Arthur Lai, Macquarie.

Arthur Lai - *Macquarie Research - Analyst*

Hi, C.C. and Wendell and Jeff, Arthur Lai from Macquarie. So first of all, congrats on the strong gross margin. I just have a very quick follow-up on the US and JP expansion as this is important. My client keeps asking me.

So do you have operational strategy to mitigate the cost gap between the overseas fab and Taiwan fab? Yes, I think, C. C., you hint like you'll work on it and improve the gross margin. But during the Chinese New Year, I read Morris Chang's autobiography, and he mentioned that the strategy is "copy exactly from the Taiwan mother fab." So I want to understand how we maintain the high yield and also drive the cost down.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. So other question is about our overseas expansion. His question is related to the cost gap and what is our operational strategies to mitigate the cost gap. How are we doing this internally in our fab operations and strategies to do so?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

You mentioned my boss's book. That's meaning that you really read it. What he said as copy exactly is whatever Taiwan's improvement, the US will copy over there. It doesn't mean that this year, next year and the following year will be the same. We continue to improve.

That improved the cost structure, both in Taiwan and in the US. And we also try very hard to find out new methodology or whatever that I cannot share with you right now. But it will give Arizona fab some benefit. And so we will improve -- what minimize the gap between the cost structure between US and Taiwan.

And we are working on that. But no matter what I said, we will be the best fab over there.

Arthur Lai - *Macquarie Research - Analyst*

Second follow-up question probably is on Wendell. You just mentioned that there's 200 bps or 300 bps margin dilution, right? So can you give us a 1 level down, like the variable cost and the fixed cost? Maybe half? Or maybe which one is higher?

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. So Arthur's second question is on the overseas dilution of 2% to 3%. He is asking if we can provide a further breakdown in terms of how much of that is composed from variable costs, how much of that is from the fixed cost, et cetera.

Wendell Huang - *Taiwan Semiconductor Manufacturing Co Ltd - Senior Vice President and Chief Financial Officer*

Arthur, we really don't give breakdown on these numbers, but both of them are higher. That's all I can share with you.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Rick Hsu, Daiwa Securities.

Rick Hsu - *Daiwa Securities Capital Markets - Analyst*

So the first one, C. C., can you share with us your view on this year's global semiconductor revenue forecast ex-memory? Or any driver by applications in priority across the main application?

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. So Rick's first question, he's asking for our forecast of the semiconductor industry, what we used to provide as semi ex-Mem. But of course, we have already given Foundry 2.0. Then he would like the outlook by end market application in terms of ranking. Maybe just a comment on the overall end markets as a whole.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Rick, I think the memory business will grow this year also. But all I can say is that HBM, will grow very fast. And I don't comment on other memories because of it's not Logic.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

And we have already provided Foundry 2.0 to grow 10% year-over-year. That's our industry forecast for 2025.

Rick Hsu - *Daiwa Securities Capital Markets - Analyst*

Just a quick follow-up. Can I use your Foundry 2.0 market growth as a proxy of the global semi ex-memory?

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

So his question is, can we use Foundry 2.0 as a proxy for semiconductor ex-memory?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Yes.

Rick Hsu - *Daiwa Securities Capital Markets - Analyst*

And the second one is very quick. About your CoWoS and SoIC capacity ramp, can you give us more color this year? Because recently, there seems to be a lot of market noise - some add orders, some cut orders. So I would like to see your view on the CoWoS ramp.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. So the second question is lots of market rumors here. So he would like to know any comment we can provide on CoWoS ramp in 2025.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Rick, as you said, there's a lot of rumor. That's a rumor. I assure you. We are working very hard to meet the requirement of my customers' demand. So cut the order, that won't happen.

I actually continue to increase. So we are -- again, I will say that we are working very hard to increase the capacity.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay, well, thank you. Okay, let's move back to operator. Is there anyone online?

Operator

Robert Sanders, Deutsche Bank.

Robert Sanders - *Deutsche Bank - Analyst*

I just had a question on AI demand. Is there a scenario where HBM is more of a constraint on the demand rather than CoWoS, which seems to be the biggest constraint at the moment? And I have a follow-up.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. So Rob is asking us to comment on AI demand and HBM status constraint? Or what is the bigger constraint in AI demand?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

I don't have other suppliers, but I know that we have a very tight capacity to support the AI demand. I don't want to say I'm the bottleneck. TSMC always working very hard with customers to meet their requirement. That's all I can say.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

You have a second question?

Robert Sanders - *Deutsche Bank - Analyst*

Yes. Just on SoIC, there's been more discussion in the market around your smartphone customers adopting SoIC. Can you just discuss if there's any kind of inflection point here, whether it's in the PC domain or the smartphone domain? Or is this still more of a data center story?

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. Well, Rob's second question is on SoIC adoption. His question basically in a nutshell is when do we see an inflection point for smartphone application to adopt SoIC?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Today, SoIC's demand is still focused on AI applications, okay. For PC or for other area, it's coming, but not right now.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Sunny Lin, UBS.

Sunny Lin - *UBS Equities - Analyst*

And so my first question is to try to get a bit clarity on the cloud growth for 2025. I think longer term, without a doubt, the technology definitely has lots of potential for demand opportunities. But I think if we look at 2025 and 2026, I think there could be increasing uncertainties coming from maybe CSPs' spending, macro, or even some of the supply chain challenges.

And so our management just provided a pretty good guidance for this year for sales to double. And so if you look at that number, do you think there is still more upside than downside as we go through 2025 or how should we think about the demand profile for this year and next year?

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. Well, Sunny's question is about the AI-related demand. We have said that even after -- more than tripling last year, it will double again in 2025. She wants to know is there upside or downside to this? And also for us to provide an outlook on the 2026 AI growth.

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Sunny, I certainly hope there is an upside, but I hope I get -- my team can supply enough capacity to support it. Does that give you enough hint? Okay, and we also forecast based on the 2024 high number. We also forecast of mid-40s CAGR for the five years. That gives you some kind of estimate that you can calculate.

Sunny Lin - *UBS Equities - Analyst*

Yes. Also, mid-40% is the long-term expectation in terms of growth by next few years. But how should we think about the trajectory of the growth? For sure, this year, it's still pretty strong growth, but do you see a point maybe we see a moderation of growth temporarily and then followed by another ramp.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Well, I think Sunny's question, again, is asking us to comment on 2026 outlook, which is a little bit early, or is that -- how do we see the trajectory of the growth?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

I already said, it's a little bit too early.

Sunny Lin - *UBS Equities - Analyst*

Sure. No problem. So I will follow up maybe next quarter as well. And so my second question is on edge AI. And so last year, management thinks by mid-2025 to be the inflection point for it to see more content related to edge AI. So based your current visibility, are you seeing clients ramping for this year for the edge AI products, maybe into second half?

And before, you also mentioned edge AI could potentially drive 5% to 10% die size increase. Will that be a one-time increase or do you think beyond the 5% to 10% increase for the maybe first gen product, there should be sustainable increase going forward?

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. So Sunny, second question is related to edge AI. She'd like some more detail or color. Do we see customers ramping edge or what we call on-device AI products in the second half of this year?

And the second part, in terms of the content increase, 5% to 10% increase is a one-time thing? Is this an ongoing thing? How do we estimate the content benefit from on-device AI?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Okay. On the edge AI, our observation - we found out that our customers start to put more neuro processing inside. And so we estimate a 5% to 10% more silicon being used. Can it be every year 5% to 10%? Definitely it's no, right? So they will move to next node, the technology migration.

That's also to TSMC's advantage. Not only that, I also say that the replacement cycle, I think it will be shortened, because of when you have a new toy that with AI functionality inside, everybody wants replacement, replace their smartphone, replace their PCs, and I count that one much more than near 5% increase. Did I answer your question?

Sunny Lin - *UBS Equities - Analyst*

Yeah. Thank you very much.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Thank you operator. I think there's one more participant online. So we'll take the last question from online participant, please.

Operator

But I think the last caller just dropped the line. Thank you.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Brad Lin, Bank of America.

Brad Lin - *BofA Global Research - Analyst*

Thank you for squeezing me in. So Happy New Year and taking my questions. I would like to answer two questions. First question would be on the CoWoS as well. So we have observed an increasing margin of advanced packaging. Could you remind us the CoWoS contribution of last year? And do you expect the margin to kind of approach the corporate average or even exceed it, after the so-called value reflection this year? That would be my first question.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. So Brad's first question is very specific to CoWoS. Basically, he wants to know what is the revenue contribution from CoWoS last year? And what is the margin profile? Maybe we can talk about advanced packaging.

Wendell Huang - *Taiwan Semiconductor Manufacturing Co Ltd - Senior Vice President and Chief Financial Officer*

Brad, we don't break down in different segments of the advanced packaging. But overall speaking, advanced packaging and testing accounted for over 8% of revenue last year, and it will account for over 10% this year. In terms of gross margins, it is better. It is better than before, but still below the corporate average.

Brad Lin - *BofA Global Research - Analyst*

Thank you, Wendell. That's very helpful. And then my second question will be on the IDM. So we have seen IDMs increasingly rely on TSMC. And then do we still expect the IDM to support our long-term growth?

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. So Brad's second question, I think, is on IDM and IDM outsourcing. He does note that we do see more IDM outsourcing business. So is this part of our long-term growth outlook CAGR?

C.C. Wei - *Taiwan Semiconductor Manufacturing Co Ltd - Chairman and Chief Executive Officer*

Again, let me repeat again. They are our very good customers. And we work together. I don't say they rely on TSMC. We are partners. And I really hope that's a long-term relationship will be there, for sure.

Jeff Su - *Taiwan Semiconductor Manufacturing Co Ltd - Director of Investor Relation*

Okay. Thank you, C.C. Thank you, Brad. Thank you, everyone. This concludes our Q&A session. Before we conclude today's conference, please be advised that the replay of the conference will be accessible within 30 minutes from now. The transcript will become available 24 hours from now, and certainly, both will be available through TSMC's website at www.tsmc.com.

So thank you, everyone, for joining us today online and in person. We'd like to wish everyone a Happy New Year, and hope everyone continues to stay well, and I hope you'll join us again next quarter. Good-bye, and thank you. Have a good day.