

Vicor Corporation (NASDAQ:[VICR](#))

Q4 2018 Earnings Conference Call

February 26, 2019 5:00 PM ET

Company Participants

James A. Simms - Corporate VP, CFO, Treasurer, and Secretary

Patrizio Vinciarelli - Chairman, President and CEO

Richard J. Nagel - Corporate VP and Chief Accounting Officer

Conference Call Participants

Quinn Bolton - Needham & Company

Matthew Vigneau – Merus Global Investments

John Dillon - D&B Capital

Alan Hicks - Ainsley Capital Management

James Lieberman - –Revere Securities

Operator

Good day everyone and welcome to the Vicor Earnings Results for the Fourth Quarter and the Year-Ended December 31, 2018 which is hosted by James Simms and Dr. Patrizio Vinciarelli. My name is Shelley and I am your event manager. [Operator Instructions]. I would like to advise you all the conference is being recorded for training purposes and replay purposes. Now I would like to hand the call over to James Simms. Please go ahead.

James A. Simms

Thank you Shelley. Good afternoon everyone and welcome to Vicor Corporation's earnings call for the fourth quarter and year-ended December 31, 2018. I'm Jamie

Simms, CFO, and here with me in Andover are Patrizio Vinciarelli, Chief Executive Officer, and Dick Nagel, our Chief Accounting Officer.

After the markets closed today, we issued a press release summarizing our financial results for the three and twelve month period ended December 31st. This press release has been posted on the Investor Relations page of our website, www.vicorpower.com. We also filed a Form 8-K today related to the issuance of the press release. As always, I remind listeners this conference call is being recorded and is the copyrighted property of Vicor Corporation.

I also remind you various remarks we make during this call may constitute forward-looking statements for purposes of the Safe Harbor Provisions under the Private Securities Litigation Reform Act of 1995. Except for historical information contained in this call, the matters discussed on this call, including any statements regarding current and planned products, current and potential customers, potential market opportunities, expected events and announcements, construction plans, as well as forecast sales growth, spending, and profitability are forward-looking statements, involving risks and uncertainties.

In light of these risks and uncertainties, we can offer no assurance that any forward-looking statement will, in fact, prove to be correct. Actual results may differ materially from those explicitly set forth in or implied by any of our remarks today. The risks and uncertainties we face are discussed in Item 1A of our 2017 Form 10-K which was filed with the SEC on March 9, 2018. We will file, as required, our 2018 Form 10-K by this Friday, March 1, 2019. Please note the information provided during this conference call is accurate only as of today Tuesday, February 26, 2019. Vicor undertakes no obligation to update any statements, including forward-looking statements, made during this call and you should not rely upon such statements after the conclusion of the call.

A replay of the call will be available beginning at midnight tonight through March 13th. The replay dial in number is 888-286-8010 followed by the passcode 10247812. In addition a webcast replay of today's call will be available shortly on the Investor Relations page of our website. I will start this afternoon's discussion with a review of our financial performance for the fourth quarter and the full year, Dick will comment on tax

matters, and Patrizio will follow with his remarks, after which we will take your questions.

Beginning with consolidated results. As stated in today's press release, Vicor recorded total revenue for the fourth quarter of \$73.7 million representing a sequential quarterly decline of 5.5% from the \$78 million recorded for the third quarter and an increase of 25.4% over revenue recorded for the fourth quarter of 2017. On a full year basis, total revenue for the year was \$291.2 million, 27.8% higher than the total revenue for 2017.

As other companies have reported, December quarter results fell below expectations due to several factors, most notably weaker demand in China and softness in data center spending. For Vicor, Q4 bookings showed evidence of weakening demand. Fourth quarter revenues were influenced by upwards of \$5 million value of shipments rescheduled into 2019. In a moment Patrizio will address booking trends and specific circumstances influencing our outlook.

Last quarter we began providing a breakdown of revenue by Advanced and Legacy product categories. The Advanced products category represents the sum of the products of our Picor and VI chip operating segments, reflecting proprietary, patented advances in power -- factorized power distribution, power conversion topologies, control systems, power semiconductors, and advanced power packaging. Legacy products are those associated with our well-established Brick business unit operating segment, serving a broad range of classic distributed power applications with integrated converter modules, configurable standard product assemblies, and custom solutions. Going forward, we will be referring to these products simply as Brick products in our remarks and in our filings.

We will continue to report our operating segments in our 10-K and 10-Qs as we have for some time, as the BBU, VI Chip, and Picor operating segments, reflecting intersegment transactions, our financial reporting structure, and management oversight. But we believe the Advanced product and Brick product designations, net of intercompany and inter segment transactions, are appropriate for summarizing our progress in implementing our strategic transition from a relatively high-mix / low-volume model, serving a highly fragmented and diverse customer base largely in mature market

segments, to a relatively low-mix / high-volume model serving OEMs and their manufacturing partners, focusing on high growth opportunities with a portfolio of highly differentiated products.

For the fourth quarter, Advanced product revenue was flat sequentially, rising less than 1% over the third quarter, despite the program delivery rescheduling previously referenced. Advanced product revenue for the fourth quarter of 2018 rose 21.1% over the fourth quarter of 2017. As a percentage of total quarterly revenue, Advanced products contributed 36.7%, up from 34.6% of total revenue for the third quarter. For full year 2018, Advanced products revenue totaled \$104.6 million, a 36.8% increase over the total for 2017, and represented 35.9% of 2018 total revenue, versus 33.6% for 2017.

Fourth quarter revenue for Brick products declined 5.5% sequentially, but rose 28.1% over the fourth quarter of 2017. As a percentage of total quarterly revenue, Brick product sales represented 63.3%, in contrast to 65.4% for the preceding quarter. For full year 2018, Brick product revenue totaled \$186.6 million, a 23.3% increase over the total for 2017, and represented 64.1% of 2018 total revenue, versus 66.4% for 2017.

Quarterly international revenue declined 8.1% sequentially and represented 60.5% of total revenue. Advanced products exports rose 6.5% sequentially and represented 46% of exports for the fourth quarter, indications of the stability of our shipments of 48V to point of load programs with Asian ODMs and CMs. Brick products declined 17.8% sequentially and represented 53.9% of exports for the fourth quarter, down sequentially from 60.3%, reflecting bookings declines from our Chinese and European distributors, which largely serve industrial customers.

Geographically, total revenue for 2018 breaks down as follows: North America represented approximately 38%, China including Hong Kong represented approximately 37%, Asia Pacific excluding China represented approximately 13%, Europe and the Middle East represented 9.5%, and all other geographies sum to 2% of total revenue. For revenue across 2018, we recorded increases across all geographies, reflecting higher unit volumes and improved pricing. Exports to China of both Advanced products and Brick products accelerated early in 2018 and finished with year-over-year growth of approximately 34%. North American revenue increased approximately 32%, driven by

strength in aerospace and defense electronics, balanced between Advanced products and Brick products. Exports to Asia Pacific, excluding China, grew approximately 16% and exports to Europe increased by 15%.

For the fourth quarter and the full year, we had one 10% customer, NuPower Electronics, our largest authorized distributor in China. For the fourth quarter and the full year, our five largest customers including NuPower and two other distributors, represented 31.3% and 36%, respectively, of total revenue.

Recall that we report export volumes on the basis of ship-to address, so, as such, the 10% customer concept may not provide a complete view of customer concentration. Distributors obviously have many downstream customers with diversified applications. In contrast, an OEM using a relatively small number of our SKUs usually spreads a program's volumes across multiple contract manufacturers, and combined shipments for a given program for a given period may exceed 10% of revenue.

Turns volume, that is, orders recorded and shipped within the quarter, was approximately 20% of fourth quarter revenue, up from approximately 18% of third quarter revenue. Lower turns volumes throughout 2018 have been a reflection of extended lead times for certain raw materials which have resulted in extended scheduled delivery times for customer orders. However, given improved availability of some raw materials, we have been able to accommodate some customer requests for accelerated delivery, which is a sign of improved supply chain visibility.

As mentioned Patrizio will address bookings in his remarks, but I want to emphasize the following, which I have spoken to before. Bookings and shipment patterns can differ sometimes meaningfully for Advanced products and Brick products. Advanced products bookings and shipments thus far have reflected the low-mix / high-volume requirements of a concentrated customer base, with individual high volume orders scheduled for delivery over multiple quarters. Design wins for Advanced products can require upwards of a year of engagement with an OEM, and production volume orders from one or more contract manufacturers may not be placed for a similar period.

To illustrate, a hypothetical OEM program maybe planned for a three year life before a major redesign. Such a program typically involves multiple contract manufacturers,

which place orders with us based on the OEMs production schedules. In any year of the program, we might receive relatively few orders, but the orders are for high volumes, to be shipped over several quarters. Such shipments may be subject to rescheduling by the OEM based on revisions of its demand forecast or by the contract manufacturers based on their factory loading and supply chain visibility. As we seek to expand the number of OEMs and programs with which we are involved, we expect to smooth out the lumpiness of this cycle for Advanced products, but, until then, listeners should consider the relatively large impact of a program change, notably shipment rescheduling, on our results, as we experienced in the fourth quarter.

In contrast, Brick products generally are high-mix / low-volume, serving a statistical customer base of nearly 10,000 customers. Competition for design wins is less intense and generally of short length for Brick products, given our mass customization manufacturing model, which enables us to meet customer requirements that “catalog-based” competitors cannot. Many Brick products have been designed into customer end-products for a long time, and such customers typically are in relatively stable, mature markets with well-recognized demand patterns. While a few large customers place program (or blanket) orders, Brick product orders are generally smaller, averaging less than 100 units, and scheduled over weeks and months, contributing to a smoothed booking pattern across business cycles.

There are anomalies to booking patterns, as we believe we are currently experiencing. For example, in China, where the imposition in September of an additional 10% import tariff on U.S. manufactured goods made trading conditions challenging, the threat of another round of higher tariffs to be imposed if the current trade negotiations break down caused customers to postpone orders in the fourth quarter and, to date, in the first quarter of 2019. A definitive, positive resolution of the uncertainty about additional tariffs may result in a resumption of vigorous order flow.

I will now turn to product profitability. Consolidated fourth quarter gross profit margin, as a percentage of revenue, was 45.9%, largely reflecting lower product volumes and inefficiencies caused by shifting product mix. Advanced product volumes were flat, with increased VI Chip shipments offset by lower Picor shipments. Changing mix was a contributing factor for both product categories. While our third quarter consolidated

gross profit margin rose to 50%, stable mix was a strong contributor, as was relatively high volume. For the fourth quarter, manufacturing performed well under difficult conditions of changing demand, and we remain confident of the scalability of our business model.

Also during the quarter, we were successful in meeting our needs for raw material inventories, as vendor lead times shortened.

Section 301 tariffs on our Chinese imports did not have a material impact on our procurement costs during the quarter. However, the costs going forward may not be inconsequential, given the volume of components currently sourced from China. When possible we are seeking alternate, non-Chinese vendors. As indicated last quarter, we filed requests with the U.S. government for exclusions from tariffs on a limited number of components for which no alternate vendor exists. However, we have not received any response yet. We continue to monitor the impact of tariffs on the cost of imports from China. If this impact becomes meaningful, we may add a tariff surcharge to the selling price of our products.

Turning to operating expenses, fourth quarter operating expenses rose 3.2% sequentially. For 2018, total OPEX rose 3.4% over 2017, in line with our expectations, with customary increases in compensation and outlier increases in audit and legal expenses, offset by a decline in R&D prototyping costs. On a relative basis, Q4 operating expenses reversed a seven quarter trend, actually rising as a percentage of quarterly revenue to 36.3% from 33.3% the prior quarter, but this is due in part to the unanticipated decline in revenue.

R&D expenses rose 3.5% sequentially and from 13.7% to 15% of quarterly revenue, with the only noteworthy spending variance being another decline in prototyping costs. Marketing and sales expenses rose 3.1% sequentially and from 13.6% to 14.9% of quarterly revenue, with no noteworthy spending variance. G&A expenses rose 2.6% sequentially and from 6% to 6.5% of revenue, also with no noteworthy spending variance.

Operating income declined sequentially to 9.5% of revenue, from 16.7% for the prior quarter. For the year 2018, operating income was 11.1% of revenue up from a

negligible operating loss for 2017. On an absolute basis, these results are in line with our recent statements regarding spending trends. We continue to expect operating expenses to decline as a percentage of revenue, while expanding at low single-digit percentage rates in absolute terms, largely driven by compensation costs. As stated before, our long-term model is to reduce total operating expenses to 30% of revenue.

I'll now turn to Dick for a quick overview of our tax position. Dick?

Richard J. Nagel

For the fourth quarter, our effective tax rate was 5%, and we recorded a net provision of \$363,000. For the full year, our effective tax rate was 3.3%, reflecting a cumulative provision of just under \$1.1 million, the majority of which consisted of state and foreign tax expense.

During prior conference calls, we have explained our perspective on the valuation allowance we maintain against the value of our domestic deferred tax assets. Under the assumption sequential quarters of improved profitability would allow us to conclude the release of the allowance would be appropriate. While our outlook remains positive for sustained profitability, the results of the third and fourth quarter, combined with generally poor near-term visibility, led us to conclude a release of the valuation allowance, which stood at approximately \$30 million as of December 31, 2018, would be premature. As such, pursuant to the requirements of ASC 740, we have left the full valuation allowance in place. We will continue to assess the potential release of the allowance later in 2019.

The composition of our deferred tax assets shifted further at year-end, as the company has been utilizing available net operating loss carry forwards and tax credits to offset taxes due on taxable income throughout the year, and consumed a major portion of its federal NOL balance in 2018, leaving federal and state R&D tax credits, along with other tax credits, reserves, and other accounts as the balance of our DTAs. As I previously mentioned, we believe it is more likely than not we will release some portion if not all of the valuation allowance later in 2019.

Jamie?

James A. Simms

Thank you, Dick. Returning to the P&L, we recorded fourth quarter net income after minority interest of \$6.9 million, down from the \$13 million recorded for the prior quarter, and up from the \$1.6 million recorded for the fourth quarter of the prior year. For 2018, net income, again after minority interest, totaled \$31.7 million, up from an essentially breakeven level for 2017.

Diluted EPS for the fourth quarter totaled \$0.17, down from the third quarter's \$0.32, and up from the \$0.04 per share recorded for the fourth quarter of the prior year. Full year diluted EPS was \$0.78, in contrast to last year's breakeven figure. Our diluted share counts for EPS calculations were 40,729,000 for the full-year EPS and 40,981,000 for the fourth quarter EPS.

Turning to the balance sheet, cash and cash equivalents sequentially increased \$2.4 million for the fourth quarter, ending at \$70.6 million. On a year-over-year basis, cash and cash equivalents increased by \$26.3 million, net of significant investments in equipment to expand manufacturing capacity made late in the year. The fourth quarter cash increase reflects operating cash flow of \$13.3 million for the quarter, a decline from the \$14.3 million recorded for the third quarter. A positive working capital swing offset the net income decline for the fourth quarter.

Capital expenditures rose to \$11.3 million from the prior quarter's \$3.3 million, reflecting the substantial amount of new production equipment installed, as well as certain facilities upgrades. Capital expenditures for 2018 totaled \$18.2 million, up from the prior year's \$12.5 million. I will return to capital spending and capacity in a moment.

Trade receivables, net of reserves, totaled \$42.8 million, down sequentially 2.6%, and DSOs rose to 44 days from 41 days. At year-end, the trade receivables portfolio was, and remains today, sound. Inventories net of reserved increased 9% sequentially to \$47.4 million, largely reflecting rising material and component purchases to ship our Advanced products backlog. Annualized inventory turns were stable at 3.6 times.

So, concluding my review of the fourth quarter, total employee headcount as of December 31st declined to 1007, from 1018 for the prior quarter, but rose from the

December 31, 2017 total headcount of 980. Full time headcount was 976 at year-end up, two from the quarter and up six year-over-year.

I will now provide an update on our capacity expansion and planned capital expenditures. We have approximately \$7 million of production equipment scheduled to be placed in service in the first half of 2019, which is expected to complete the first phase of capacity expansion that began last year. Completion of this investment will add approximately 35% to our ChiP manufacturing capabilities.

We are into the permitting phase of an 85,000 square foot addition to our Andover manufacturing facility. We plan to break ground on this addition to our existing plant in 2019 and take occupancy in 2020. The planned addition of multiple manufacturing lines in this additional space, sequenced across 2020 and 2021, is planned to increase our Advanced products capacity by an additional 100%.

We are budgeting roughly \$17 million for the construction which will be paid through 2019 and conclude with occupancy. We are also budgeting an additional \$12 million for two phases of production equipment installation, the first beginning at occupancy. The second phase of capital equipment spending will be scheduled six months ahead of initial demand for that capacity.

Based on these budgets and our outlook for cash generation we anticipate internally funding both the building and the two phases of investment in automated manufacturing equipment. This sequenced approach to capacity expansion is designed to allow us to meet anticipated production scenarios by increasing our total Andover capacity to the \$750 million revenue level by the end of 2020, while deferring, to the extent possible, incremental capital commitments and equipment depreciation charges.

We also are exploring with potential licensees establishing an alternate source for Advanced products through a separate manufacturing facility outside of the United States. The licensee facility would complement Vicor's initiative to address global demand for 48V power system solutions in both automotive and artificial intelligence applications.

Turning to our outlook, Q1 revenue will be lower than Q4, while bookings are expected to increase sequentially, with a Q1 book-to-bill ratio slightly above 1. Bookings are forecast to increase at an accelerating pace as the year progresses, with revenues lagging one to two quarters. We expect to remain profitable and generate operating cash flow.

Having offered this limited guidance, I will remind listeners as I do each time I speak with you, our operating and financial forecasts are subject to unanticipated changes, many of which are caused by factors and influences outside of our control. With that, I will turn the call over to Patrizio.

Patrizio Vinciarelli

Thank you. Fourth quarter bookings for our products declined 34% sequentially. Bookings for Brick products declined approximately 15% sequentially with particular softness in Chinese industrial markets. Geopolitical uncertainty contributed to reduced expectations from Europe. Until this matter is solved our outlook for both Chinese and European industrial markets is cautious. However, confidence in U.S. markets remains relatively firm for both Brick products and Advanced products.

Overall bookings for Advanced products declined sequentially as orders for our Power-on-Package solution for high current AI applications did not follow through from the progression of prior quarters.

Near-term volume expectations for our first GPU Power-on-Package or power solution were reset by well-publicized forecast revisions from the lead customer for that solution.

Bookings for other 48V Direct-to-Point-of-Load programs were also slower than anticipated in Q4, reflecting temporary softness in data center spending, with new programs scheduled to wrap in the second half of 2019.

We remain confident of the opportunity before us in the rapidly developing Artificial Intelligence, supercomputer, and data center segments. A feverish pace of new program activity is setting the stage for substantial growth in bookings, revenues, and profitability.

For Power-on-Package, we have secured major design wins in the AI space and supercomputing, with production ramps expected in 2020. Our engagement with market participants continues to expand, as companies developing advanced GPUs, TPUs, and application specific integrated circuits specifically Artificial Intelligence ASICs, face fundamental power delivery challenges. With power delivery standing in the way of performance, Vicor's Power-on-Package has quickly established itself as the power system solution needed to overcome power conversion and power delivery challenges.

Our technology and leadership is expanding, as competition remains anchored by legacy 12V infrastructure, or variance in the team of the so-called intermediate bus architecture, known to be fundamentally handicapped after repeated, failed attempts at competing with 48V Factorized Power. Recognition of unrivaled technical leadership and enabling product capabilities are motivating broader adoption of Vicor's Power-on-Package solutions by leading developers of GPUs, TPUs, and every other high-current current AI ASIC.

Anticipating rising current requirements from hundreds of amperes to thousands of amperes to fuel smarter AI processors, Vicor has developed Power-on-Package solutions using proprietary vertical power delivery or "VPD" technology. AI design wins for higher performance VPD solutions evidence Vicor's ability, through fundamental innovation, to keep expanding the company's power leadership, causing competitors to play catch up with innovative products that require more than twice as much space in applications where there is no excess space to be had.

In space constrained applications, Power-on-Package design wins set the stage for complimentary front-end design wins with liquid cooled RFMs providing a nearly tenfold increase in power density to conventional AC to 48 DC front-ends, including front-ends using GaN FETs. Even though GaN FETs are capable of switching at high frequency, in high voltage power conversion applications, the switching frequency of GaN FETs is limited by losses in power conversion circuitry to less than 1/10th of the operating frequency of the RFM.

As such, because of a “speed limit” imposed on high voltage GaN FETs by power conversion circuitry, front-ends using GaN FETs take up nearly 10 times more space than the RFM, which is not constrained by similar “speed limits”.

GaN FETs also fail to add value, either in terms of performance or cost, to low voltage applications, specifically with the emerging 48 volt standard in automotive applications. In automotive, Vicor is getting significant traction with OEMs and Tier 1 suppliers challenged by electrification, the advent of the 48V bus, and autonomous driving. Our value proposition includes high power density and modular flexibility. As recently reported, deployment of the most advanced Level 5 autonomous driving system will ramp substantially, starting in 2020. Based on this and the trajectory of other early engagements, we expect that our growth in the automotive segment will, before too long, be comparable to the growth we're now experiencing powering Artificial Intelligence and servers in data centers.

Across key growth markets, we are addressing major opportunities and scaling up capacity to support forecast production requirements.

Let's now turn to questions. Operator, Shelley?

Question-and-Answer Session

Operator

[Operator Instructions]. And your first question comes from the line of Quinn Bolton. Please go ahead.

Quinn Bolton

Hi Patrizio, hi Jamie.

Jamie, just wanted to start, I guess first, on a couple of business questions. It sounds like you mentioned there was some rescheduling of \$5 million of orders from 2018 to sometime in 2019 from, I think, your largest Power-on-Package customer. Have those reschedulings... or have you seen any additional reschedulings quarter to date, here in March, or has that forecast now stabilized?

James A. Simms

I will let Patrizio take it.

Patrizio Vinciarelli

So, time will tell whether that vortex has stabilized, but I think exposure from a revenue and backlog perspective is limited and fundamentally tied to the \$5 million to be shipping later this quarter.

Quinn Bolton

Although it [ph] will actually ship here in Q1?

Patrizio Vinciarelli

Q1 and very beginning of Q2, yes.

Quinn Bolton

Okay, okay, great. And I know you referenced a couple of times in your prepared comments that visibility is low, but you did say you thought bookings and revenue would grow into the second half? I'm trying to understand, are you sort of anticipating that the March quarter would be at the bottom? Or do you really just not yet have enough visibility to call the bottom of this cycle?

Patrizio Vinciarelli

So, we expect to see a nearly 15% growth in bookings in Q1 and progression with higher bookings levels in Q2-Q3 and ending the year in Q4, nearly \$100 million.

Quinn Bolton

Okay, and revenue you said typically follows that booking trend by one to two quarters?

Patrizio Vinciarelli

This will follow the bookings by nearly two quarters, more than one quarter, closer to two quarters.

James A. Simms

Quinn I also want to take exception with the use of the word cycle, because what happened with the rescheduling was very specific to a circumstance, and, in general, it's very difficult for anyone to separate the events that are largely categorized as macroeconomic, when, in fact, it's our point of view, notably in China, that the slowdown is most fundamentally associated with customers waiting for more certainty about tariffs. So, does that help?

Quinn Bolton

It does. And then, just last a sort of business question, you've mentioned now on a couple of conference calls that you source a fair number of components in China and that you're trying to find sources outside of China, just wondering if you could give us an update on that initiative?

Patrizio Vinciarelli

Well, we are realigning our supply chain in view of a number of considerations. Obviously the dependency on Chinese suppliers being one of them, it is not the only one. So, we believe that we're well positioned going forward to ensure that we have continued supply and, importantly, continued supply, at cost competitive levels that support our expanding business model.

Quinn Bolton

Great, and then the last one for me for you Patrizio, just you mentioned the vertical power delivery or the geared MCMs give you the capability now to deliver more than a 1000 amps of current. Can you just sort of give us a quick overview what is it about the geared MCMs or vertical power that allow you to get into that 1500 amp or higher range with that technology? Thank you.

Patrizio Vinciarelli

So, this technology essentially cuts, by nearly a factor of 10, the interconnect resistance between the current multipliers and the XPU being powered by the current multipliers.

So, for instance, for our well-advertised GPU application, the current multipliers are located on the sides of the GPU. There are tens of volts of power loss that take place in the current travelling sideways to the sides of the XPU. By moving to the bottom of the XPU in vertical power delivery, the current multiplier or current multipliers (so, we have an application, for instance, with four current multipliers). The four current multipliers reside under the XPU, and that allows the current to travel a much shorter distance to feed the XPU in a much more efficient and uniform way.

Now, this may sound relatively obvious, but the reality is quite complex because there are obstacles standing in the way of providing vertical power delivery. I'm not going to go into those technicalities, but suffice to say that it's not easy to do. It's being viewed as a complex task, and we've overcome the fundamental challenges with proprietary developments that enable this capability.

Now, to be clear, lateral power delivery is not coming to a screeching halt. In fact, we have new applications with more advanced GPUs that will take current up to as much as 1,500 to 2,000 amps, still with lateral power delivery. But we've also recently won, virtually without any effective competition, the first vertical power delivery opportunities where, again, the value proposition is one of much more efficient power delivery, one where, in effect, the level of AI capabilities is not gated by gating the current to the XPU.

Quinn Bolton

Thank you.

Operator

Thank you. Your next question comes from the line of Matthew Vigneau. Please go ahead.

Matthew Vigneau

Hello, this is a similar question to Quinn's. In the past, management has mentioned that a robust economy wasn't needed to deliver growth. And so my question is what really leads to confidence that this is mostly tariff related and temporary, versus the potential

for a push out of the data center upgrade cycles and a push out that could potentially last for a longer period of time? Thank you.

Patrizio Vinciarelli

So, to be clear, the issue or the headwinds as we refer to the circumstances of the fourth quarter had to do with more than the situation with the tariffs on imports into China. They had to do, as mentioned in our prepared remarks, with one of our major applications for GPUs suffering setbacks that had nothing to do with China, and, more generally, with some level of softness in data center infrastructure spending. We believe based on a variety of inputs we have received that that softness is very temporary. There are new programs that are starting to ramp in the middle of the year.

And going back to your fundamental question of how do we ensure that we can deliver growth in good times but also in not so good times, obviously not necessarily at the same level, the answer to that question is very simple: by having kickass products that beat the competition dead, and that's what we are doing in point-of-load applications, that's what we're doing in supercomputing applications, and before too long, that is what we are going to be doing in front-end applications.

It's the reality that essentially every -- take as an example the Artificial Intelligence chip market, right? So that's a market we understand has a value of around \$1 billion. Everybody of significance in that market has come to Vicor for their solution. We're the only game in town. So that's how we ensure long-term growth, and that's one market. There are other opportunities in other markets that we're also pursuing, because we believe in our differentiated business model, one that is not predicated on one particular end-market. So we are building presence in automotive, we are building presence in other kinds of applications, before too long, as mentioned earlier. We're going to have a strong presence with front-ends that are going to complement our superior point-of-load capability.

James A. Simms

Do you have a follow-up Matthew?

Matthew VigneauNo, thank you so much.

James A. Simms

Thank you.

Operator

Thank you. Your next call -- your next question comes from the line of John Dillon.
Please go ahead John.

John Dillon

Hi Patrizio, you mentioned a \$100 million bookings level. I wasn't quite sure, are you talking about the second or third or fourth quarter for that level?

Patrizio Vinciarelli

Fourth quarter.

John Dillon

Okay, so it'll ramp from where we are, so you expect 15% increase in bookings up in the first quarter and they will ramp up to the \$100 million level is that correct?

Patrizio Vinciarelli

Yes, that's our expectation at this point.

John Dillon

Okay, and the 15% increase in bookings, I guess you're pretty far into the quarter so I would imagine you have a pretty good feel for that, is that pretty good...?

Patrizio Vinciarelli

Well the quarter is not over, as we've seen in the fourth quarter, surprises can happen and do happen. But that's our forecast and I got confirmation this morning that that forecast is still good as of today.

John Dillon

Good, okay. On your vertical power delivery products, this kind of brings me back to the IBM days, I believe on the start of the VI Chips you provided the power supply run underneath the processor of the IBM supercomputer, and, if I remember correctly, you actually enabled IBM to have a higher performance computer back then. Is that correct?

Patrizio Vinciarelli

Yes, but it's really not vertical power delivery, as enabled with the technology for which we recently got initial design wins. The problem we're solving with vertical power delivery is quite a bit more complex than in the early going of Factorized Power. It involves a changing of gears, so to speak, which is necessary in order to adapt from the cell pitch of our converter cells, which is around 3 mm or 3.5 mm, to the pitch within an XPU or the power feed within XPU, which in one instance is 1 mm pitch. The other instance it is down to 0.45 mm pitch. That change of pitch presents certain challenges.

Also, not to get too technical, and just to give you a flavor of another challenge, the area under the XPU has historically being consumed by hundreds of bypass capacitors that are required in order to ensure that as the XPU undergoes rapid changes in current draw, which now are getting to really 1,000 amp changes on time scales of nano-seconds, that the XPU voltage node is kept within a tight -- very tight -- control range. So the bank of capacitors has historically populated the area under the XPU and precluded power converters, current multipliers in particular, from occupying that same area. We also solved that problem.

So fundamentally, with the geared MCM or "GCM," we are enabling a complete solution that delivers current in potentially the thousands of amperes, with very high bandwidth, in effect occupying the same space historically that has been taken up by bypass capacitors.

John Dillon

Now you're obviously, like you mentioned before, you're saving a lot of power by doing this -- by a factor of 10 I think reducing the resistance by a factor of 10...

Patrizio Vinciarelli

Yes. So, interconnect resistance in a lateral power delivery application would typically be, let's say, 70 micro ohms. That may sound like a very small number, but when you are passing through that 1,000 amps, that's 70 watts worth of heat, which is a light bulb, in and of itself.

With vertical power delivery, that 70 micro ohms get turned into eight micro ohms. So you are essentially cutting that power loss by an order of magnitude. And therein lie 60 to 70 watts of peak power dissipation savings that can be, in effect, utilized to not just provide more power to the XPU, but also to provide more controlled power to the XPU, because, as voltage nodes on 7 nanometer technology get to lower and lower levels -- we have applications now down to 0.4 volts, so the processor is run nearly sub threshold of 0.4 volts. That's a very low voltage and literally millivolts make a difference with respect to a performance and operations, and so the headroom allowed in the power delivery path for drops associated with current delivery gets further and further reduced. And that's why vertical power delivery is an enabling technology that ultimately results in higher performance AI processors, and, needless to say, our performance is what this is all about. And that's why, you name it, every one of the major contenders for opportunity in that space comes to the place that has the technology.

John Dillon

I mean that's incredible. I mean you're saving 60 or 70 watts and you must play that by the number of processors in the supercomputer or data center, you're talking about some serious power savings.

Patrizio Vinciarelli

Now to be clear, those are peak power draws, not necessarily the average power draws, but the system has got to operate also under instantaneous peak power draws. So, these are complex issues, and it's easy to trivialize them, but I think we've taken a very holistic view of the entire problem at the point-of-load and solved it. And the solution comes back to 48V. Some people say 48V is going to take a long time to take root in the data center space, absolutely not. 48V is being brought about, not just

because of the benefits of more efficient power delivery. I think, ultimately, the real driver is enabling the level of high performance that makes the solutions, our customers' solutions, more competitive relative to their own competition. That's what will drive 48V adoption in data centers. And ultimately, the automotive market is also very powerful driver and that's a market in which conversion to 48V is happening. There is no question about it.

John Dillon

Along the same lines of vertical, don't you also -- you have said many times you free up pins, and doesn't that also enable a higher performance compute, because you have more IO, and can't you place supporting chips closer to the processor, so that the time that electrons go from the processors to the memory or another processor are shorter, so doesn't that also make a faster, higher performance computer?

Patrizio Vinciarelli

Yes, because, generally speaking, with lateral power delivery, you are confining the address for the signal IOs that, to your point, provide the needed bandwidth for communication with other devices. So by going to the back, and obviously going there requires solving all the problems that stand in the way of vertical power delivery, by going to the back, essentially the impacted perimeter of the XPU is freed up, and we have applications where these capabilities are going to be taken to new orders of magnitude of performance. So they are going to literally blow away the level of performance of the best GPU today.

John Dillon

That's the point I'm excited about that because I don't think the average person, I don't think the average engineer understands that a power supply can be an enabling technology, and to me that's what I get really excited about. So, I've taken up a lot of time, so I will get back in the queue. Thank you very much.

James A. Simms

Any other questions?

Operator

The next question is coming from the line of Alan Hicks. Please go ahead sir, your line is open now.

Alan Hicks

Yeah, good afternoon. You've been talking about the opportunity with ASICs, the high ampere ASICs, what kind of opportunity do you have there and what kind of applications are those?

Patrizio Vinciarelli

So, we're not going to name customers. As I suggested earlier, we have essentially every high current application that we know of and that is generally been identified. So, for instance the recent Barron's story on AI projecting growth of 50% per year level over the next five years to, I think, a \$34 billion market five years from now. There are a lot of names in this story, and we are doing business with virtually every one of them. And that's because, again, in this applications what's needed is a level of current delivery and performance that cannot be supported otherwise. What has happened over the last few years is something that I think many of us would have had a hard time predicting. It wasn't that long ago that an Intel processor could be fed with less than a 100 amps and could have provided all the performance that applications required. Only in a matter of few years we've gone from less than a 100 amps to a few hundred amps to 500 to 600 amps with peaks of 1000 amps, to our highest current application as of few weeks ago is going to be pretty close to 1,000 amps, and this is coming in 2020.

So, this escalation clearly is being driven by a need, and that is the need to, as suggested in the prepared remarks, fuel these devices that are running on finer and finer lithography with very, very large currents and lower and lower voltages. And that is a compounded problem, because, as suggested earlier, by going to a lower voltage, you run out of headroom for voltage error. You are enabling more current delivery with acceptable levels of power dissipation. Obviously if you kept the voltage enough, you can feed it with double the current for the same power consumption within the ASIC. But ultimately, all these applications are driven not by considerations of power savings, they

are really driven by considerations of computing capability. And fundamentally, every competitor is looking to feed their ASIC with the most current that they can deliver and thermally manage.

Now, thermal management is very capable, particularly with liquid cooling, so the headroom made possible by advanced thermal management techniques has allowed this exponential rise in current consumption, which ultimately is a proxy for computing capacity.

Alan Hicks

So this main opportunity in AI area or supercomputing and how does it compare to the GPU opportunity?

Patrizio Vinciarelli

Well it seems both, I think we are in all the above. We're going to be in all of the above.

Alan Hicks

So it's as big an opportunity as GPUs or CPUs?

Patrizio Vinciarelli

Well, they all have a common denominator need, which we are, I believe, uniquely equipped to address. Their common denominator need is voltage delivery of less than 1 volt of typically 0.8, 0.7, 0.6, 0.5 volts. Our currents, as suggested earlier are rising, they have risen by an order of magnitude in the last few years, and for the time being there is none in sight, as long as they can be terminally managed. So, with advanced thermal management techniques, you can easily get to applications that may consume, in one device, literally a few tens of thousands of amperes. And there is a value proposition there. It is a supercomputer in a very small space that can do all kinds of wonderful things.

Alan Hicks

And whether supercomputer market, in general, I know you get the huge projects, but do you have -- do you expect many wins this year?

Patrizio Vinciarelli

We are engaged, again, with every significant competitor. They're all coming to Vicor for good reason, which is we can deliver a level of power density, current capability, power distribution efficiency that nobody else can. And this is enabling, as suggested in an answer to an earlier question, it is an enabling technology. We are not a supplier of commodity solutions. We are a partner that enables much higher level of performance than can be otherwise achieved.

Alan Hicks

I know you had the PEZY win about a year or so ago, it was about \$8 million order if I remember right, how big are these orders big for big supercomputers?

Patrizio Vinciarelli

So there are many opportunities that are in the tens of millions of dollars per year range.

Alan Hicks

Okay, thank you very much.

Patrizio Vinciarelli

You're welcome.

Operator

The next question is coming from the line of James Lieberman. Please go ahead sir, your line is open.

James Lieberman

Thank you and greetings. Can you give any further color or timing on automotive adoption and could the adoption happen independent of the timing of autonomous vehicle rollout? In other words, would it just happen because you got multiple supercomputers onboard more and more cars, is that going to be as equally a motivating factor?

Patrizio Vinciarelli

So, we have been working with the company in that space, which we believe has the highest and most capable autonomous driving system, Level 5 driving system. And that the scale-up of that should happen independently of other initiatives that we have been pursuing of late, with the hiring of a VP for global automotive initiatives.

But before too long that opportunity is going to be complemented by a number of other opportunities that are not necessarily related to autonomous driving. They are related to the electrification of vehicles, the 48V system, hybrid systems that have dual, 12V and 48V busses. A conversion between those busses, 48 to 12, 12 to 48.

There is a plethora of requirements and opportunities where very high density, light weight, efficiency and modularity, scalability, and cost effectiveness play a role with respect to creating opportunities. You know, our team has been visiting OEMs in Japan, in Europe, in the U.S., and the universal response from all of these companies is they are blown away by the capability of our technology. They actually want us to be a Tier 1 to them with respect to our capabilities. And we are pursuing a combination of initiatives to make that happen as quickly as possible. Word of caution here, nothing moves very quickly in automotive, and that's mitigated to some degree in today's automotive industry, which as we know is challenged to adapt to changing competitive landscapes. So, it is not moving at the glacial speed of earlier times, but it is still for a variety of reasons progressing in terms of the cycle of initial evaluation, designing for validation and scale-up for production. It is still moving at a slower pace than some of the market opportunities that we referenced earlier, which can turn from planting a seed to volume production in nine months or a year. I think of the time scale that we should all be thinking of with respect to our presence in automotive in a meaningful way of the scale

of comparable to some of these other markets, that time scale is beyond three to four years, it is not short-term.

James Lieberman

Thank you very much, it was quite helpful.

James A. Simms

Thank you. If there is one more question.

Operator

Yes, there is a question left and it is coming from the line of John Dillon. Please go ahead. Your line is open.

John Dillon

Hi Patrizio, can you give us some more color on the front-end products, in particular, when do you think you will start seeing a revenue pickup on those and any kind of significant revenue from those products?

Patrizio Vinciarelli

So we are seeing more instances of combined opportunities with point-of-load, so, a recent example of customer we have been working with for a very advanced point-of-load solution, wanting to incorporate a RFM front-end. With the RFMs as we currently have it we have a solution that is based on earlier generation control. We are progressing rapidly to what we call 4G control. We are rolling out 4G in a variety of products, including a more advanced RFM that will be even denser and even more cost effective. So we see these front-end opportunities beginning to play out in scale over the next year. Initially, with the existing RFM, which is based on older generation control, but once we introduce 4G-based solutions, we see, because of their cost attributes and even higher performance attributes, we see opportunities for bigger up-take.

John Dillon

When you say over the next year I mean like for example when do you expect to get like maybe let's say \$10 million in revenue, would that be a year from today or could that be six months from today?

Patrizio Vinciarelli

I think it would be closer to a year from today.

John Dillon

And like six months could you expect a couple of million or 5 million or...?

Patrizio Vinciarelli

Well I think it's on the scale -- it doesn't really move the needle. So I think the way we should be thinking about these, to avoid losing the forest for the trees, is what moves the needle in the short-term is broad penetration of AI applications, supercomputing applications, that's moving the needle. I think front-ends complementing these point-of-load applications will provide another wave of opportunities. Because as we discussed in the past that can literally at every one account, in every application, it doubled the revenue opportunity. And then, as I suggested earlier, the automotive initiative, that's even further into the future, but in the short term, we're working our major opportunities which are still in the data center space, they are still with AI, GPUs, XPU's, CPU's of the latest kinds. Those are the near term opportunities.

John Dillon

Okay, great, and the NBMs, when do you think you'll start seeing some kind of significant revenue from those?

Patrizio Vinciarelli

We have a lot of design wins. By the way, automotive is another opportunity for the NBM, but we have quite a few wins in a variety of other end applications. I mean, that too is a device we're now upgrading to 4G and that would make it even more efficient

and more capable and even more cost effective. So, we are moving across all of these opportunities from a product development perspective, being about next generation control technology that provides for more flexibility, more performance, lower cost, lower part count. And we see these initiatives as bearing fruit in the order that I outlined a little while ago.

John Dillon

So it's similar to the front-end type stuff maybe it hit a \$10 million run in a year from now or so?

Patrizio Vinciarelli

I think the opportunity for NBM's is quite significant. It's another example of a product capability without equal. It is far smaller than anything else out there, and there have been many tries, including some failed tries, of that -- not from us.

John Dillon

Jamie, you mentioned that if tariff stuff goes away you might see an acceleration of bookings, does that mean we could possibly and I don't know you are not going to commit to this, but we could possibly see numbers better than we talked about earlier if the tariffs go away?

Patrizio Vinciarelli

Let's not speculate about what it might happen if the tariffs go away, in terms of the impact on near-term bookings. I don't know what the lag would be, but I don't think there would be a large lag, and certainly this would be a very beneficial development in terms of our penetration of the Chinese market, which is a very substantial market.

John Dillon

Great. Thank you very much guys. Appreciate it.

Patrizio Vinciarelli

Thank you. We'll be talking to you in a few months.

Operator

Everyone, that concludes our conference call for today. You may now disconnect.
Thank you so much for joining and have a lovely day. Goodbye.