WOOD & COMPANY

VIGO Photonics

Buy

Maintained

Price: PLN 449
Price target: PLN 593
(from PLN 629)

PIC(k) tech, made in Poland

We reiterate our BUY rating on VIGO Photonics and set our price target (PT) at PLN 593/share, implying 32% upside potential. In 2023, the company tackled the two main challenges (the reduced size of orders from Safran and supply chain issues) that harmed its results in the previous year, and recorded a results expansion, driven by strong demand for its military segment products, as well as the price hikes completed in 1Q23. From 2024E, we expect the growth to be driven by solid demand for both industrial and military detectors; while, from 2025E, we assume that VIGO develops a new revenue stream: infrared arrays, which should additionally boost its military segment sales growth. As a result, we forecast 2022-25E CAGRs of 39% and 51% in the adjusted EBITDA and net profit, respectively, for VIGO. The equity story is also spiced up with the EC's announcement to grant VIGO State aid of up to EUR 103m, to develop photonic integrated circuits under the HyperPIC – a project that can multiply its business size. On our forecasts, VIGO is trading at EV/EBITDAs of 13.1-10.2x for 2024-25E, at 6-18% discounts vs. its peers.

HyperPIC can multiply VIGO's business scale. In June 2023, the EC announced maximum State aid of EUR 103m (of the EUR 253m total qualified costs) for VIGO's development and commercialisation of mid-IR PICs. VIGO is the only Polish company included in the European Funds for Modern Economy programme. We do not include HyperPIC in our model yet, but estimate the NPV of the project at PLN 629m and treat it as upside.

Funding raised to realise development strategy. In November 2023, VIGO successfully completed a 145,799 series F shares issue, at PLN 430/share, through a private subscription. The shares were purchased by 54 investors, including major shareholder Warsaw Equity Management, which maintained its 14.27% stake in VIGO. The purpose of the share issue is to accelerate the sales growth of VIGO's core product lines, continue the development of infrared array technology, and finance the initial phase of the HyperPIC project.

Global infrared detectors market to expand at a 7-10% CAGR. According to five different market research sources, the global infrared detectors market's value is estimated at c.USD 0.5bn, while its long-term CAGR is expected at 7-10%. The market is niche: according to Fact.MR, the global sensors market value was USD 180bn in 2020, while the IR share accounted for only 0.23%.

21% 2022-25E sales CAGR. After the soft 2022, VIGO recorded an 11% yoy preliminary revenues rebound in 2023E, driven mainly by a strong rebound in military segment sales (up 47% yoy) and the industry segment. In 2024-25E, we expect VIGO's sales to expand by 24-29%, to PLN 94-121m, and its adjusted EBITDA by 51-39%, to PLN 32.8-45.4m, on an increase in industry segment demand, a military segment sales acceleration, price hikes and expansion into new geographies. From 2025E, we also expect the military industry revenues to be supported by the new infrared arrays initiative.

PLN 593/share PT. We reiterate our BUY rating on VIGO and set our PT at PLN 593/share (32% upside potential), on the average of our comparative and our DCF valuations. On our forecasts, VIGO trades at EV/EBITDAs of 13.1-10.2x for 2024-25E, at 6-18% discounts vs. its peers, while offering a stronger growth outlook: we expect VIGO to generate a 45% 2022-25E EBITDA CAGR vs. the 9% peers' median.

Expected events

4Q23 results	23 April
1Q24 results	28 May
2Q24 results	24 September
3Q24 results	26 November

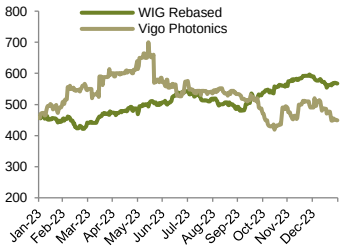
Key data

Market Cap	PLN 393m
3M ADTV	PLN 0.4m
Free float	66%
Shares outstanding	0.87m
Major Shareholder	Warsaw Equity Mgmt
Bloomberg Code	VGO PW
WIG Index	75,385

Price performance

52-w range	PLN 419-700
52-w performance	-1.5%
Relative performance	-26.0%

VIGO Photonics 12M share price performance



Year	Revenues PLNm	Adj. EBITDA PLNm	NI PLNm	Net debt PLN	Organic FCF PLNm	Organic FCF yield %	EV/adj. EBITDA x
2021	71.5	27.3	30.5	28.2	-12.9	-3%	15.4
2022	67.9	14.9	7.2	48.0	-16.5	-4%	29.5
2023E	75.6	21.8	9.8	-5.3	-3.0	-1%	17.8
2024E	93.8	32.8	19.2	37.5	-16.8	-4%	13.1
2025E	121.1	45.4	24.7	69.1	8.0	2%	10.2
2026E	159.7	65.9	37.0	35.3	33.8	9%	6.5

EQUITY RESEARCH

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Closing Prices as of 29 January 2024

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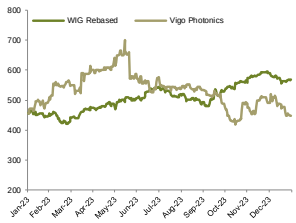
Company snapshot – BUY, PT PLN 593/share

VIGO Photonics

Bloomberg ticker	VGO PW
Closing price (PLN)	449
Price target (PLN)	593
Upside to PT	32%
Shares outstanding (m)	0.87
Market cap (PLNm)	393
Free float	66%
3M ADTV (PLNm)	0.4
52 Week performance	-1.5%
52 Week relative performance	-26.0%
52 Week Range (PLN)	419-700

SHARE PRICE PERFORMANCE



COMPANY DESCRIPTION

VIGO Photonics is a Poland-based company that specialises in the development and manufacturing of advanced photonics and infrared technologies. The company was founded in 1987 and has since grown into one of the leading global producers of uncooled, infrared photon detectors. VIGO's detectors have found applications in fields such as research and development, healthcare, security and defence, industry, transportation, and environmental protection. In 2022, the company sold 13,653 detectors and modules, and generated sales of PLN 67.9m, of which 94% was generated abroad (mainly in Europe). In 2022, the group employed c.215 people. The company has been listed on the WSE since December 2014.

RATIOS

PER SHARE RATIOS	2021	2022	2023E	2024E	2025E	2026E
No. shares (m)	0.73	0.73	0.87	0.87	0.87	0.87
EPS	41.85	9.90	11.20	22.00	28.27	42.33
BVPS	180.01	190.02	239.50	261.50	289.78	332.10
DPS	0.00	0.00	0.00	0.00	0.00	21.16
Organic FCFPS	-17.71	-22.57	-3.38	-19.18	9.09	38.58
FINANCIAL RATIOS	**2021**	**2022**	**2023E**	**2024E**	**2025E**	**2026E**
Adj. EBITDA margin	38%	22%	29%	35%	37%	41%
EBITDA margin	41%	27%	34%	42%	40%	43%
EBIT margin	32%	13%	17%	28%	28%	31%
Net margin	42.7%	10.6%	13.0%	20.5%	20.4%	23.2%
Net debt/ adj. EBITDA	1.0x	3.2x	-0.2x	1.1x	1.5x	0.5x
Net debt/equity	21%	35%	-3%	16%	27%	12%
Capex/Sales	68%	71%	52%	100%	64%	16%

DUPONT ANALYSIS	2021	2022	2023E	2024E	2025E	2026E
Net margin	42.7%	10.6%	13.0%	20.5%	20.4%	23.2%
Asset turnover	0.3x	0.3x	0.2x	0.2x	0.3x	0.4x
ROA	14.0%	2.8%	2.9%	4.8%	5.8%	8.4%
Leverage	1.7x	1.8x	1.6x	1.8x	1.7x	1.5x
ROE	23%	5%	5%	8%	10%	13%
ROIC	15%	5%	5%	7%	9%	12%
VALUATION RATIOS	**2021**	**2022**	**2023E**	**2024E**	**2025E**	**2026E**
EV/EBITDA	14.2x	24.4x	15.2x	11.0x	9.5x	6.3x
EV/adj. EBITDA	**15.4x**	**29.5x**	**17.8x**	**13.1x**	**10.2x**	**6.5x**
P/E	**12.9x**	**54.4x**	**40.1x**	**20.4x**	**15.9x**	**10.6x**
Adj. P/E	24.0x	107.0x	64.0x	27.8x	17.9x	11.2x
EV/sales	5.9x	6.5x	5.1x	4.6x	3.8x	2.7x
Dividend recorded yield	0.0%	0.0%	0.0%	0.0%	0.0%	4.7%
Organic FCF yield	-3.3%	-4.2%	-0.8%	-4.3%	2.0%	8.6%

COMPANY FINANCIALS

INCOME STATEMENT. PLNm	2021	2022	2023E	2024E	2025E	2026E
Net revenues	**71.5**	**67.9**	**75.6**	**93.8**	**121.1**	**159.7**
COGS	-25.7	-32.8	-38.9	-45.2	-54.4	-67.6
Gross profit (loss) on sales	**45.8**	**35.1**	**36.8**	**48.6**	**66.7**	**92.1**
Selling costs	-4.7	-10.4	-9.5	-9.8	-10.8	-15.4
General and administrative costs	-20.1	-20.7	-18.7	-22.5	-25.7	-29.2
Other operating revenues	5.9	8.3	7.8	13.1	7.0	4.8
Other operating expenses	-3.9	-3.6	-3.4	-3.4	-3.4	-3.4
Profit (loss) on operating activities	**22.9**	**8.7**	**13.0**	**26.1**	**33.8**	**48.9**
Financial revenues	0.5	0.4	0.6	2.0	1.2	0.1
Financial expenses	-0.9	-1.4	-2.4	-4.3	-4.6	-3.3
Gross profit (loss)	**22.6**	**7.7**	**11.3**	**23.8**	**30.5**	**45.7**
Income tax	7.9	-0.5	-1.5	-4.5	-5.8	-8.7
Net profit	**30.5**	**7.2**	**9.8**	**19.2**	**24.7**	**37.0**
Net profit adjusted for one-offs	16.4	3.7	6.1	14.1	22.0	35.2
EBIT	**22.9**	**8.7**	**13.0**	**26.1**	**33.8**	**48.9**
D&A	6.7	9.3	12.4	12.9	14.9	19.2
EBITDA	**29.6**	**18.1**	**25.5**	**39.0**	**48.7**	**68.1**
EBITDA adjusted	**27.3**	**14.9**	**21.8**	**32.8**	**45.4**	**65.9**

CASH FLOW STATEMENT. PLNm	2021	2022	2023E	2024E	2025E	2026E
Net cash flow from operations	**20.7**	**3.8**	**15.7**	**26.0**	**34.5**	**51.5**
Changes in WC	-8.8	-12.7	-9.8	-15.0	-15.5	-16.7
Cash flow from investing activities	**-30.3**	**-22.1**	**-21.9**	**-64.5**	**-61.5**	**-14.5**
Capex	-48.4	-47.9	-39.0	-93.5	-77.0	-25.0
CF from financing activities	**3.0**	**14.1**	**59.4**	**25.7**	**-12.6**	**-38.3**
Changes in debt	3.4	15.1	0.0	30.0	-8.0	-35.0
Dividends and other payments to owners	0.0	0.0	0.0	0.0	0.0	0.0
Total net cash flows	**-6.5**	**-4.2**	**53.2**	**-12.8**	**-39.6**	**-1.2**
Cash eop	**6.5**	**2.3**	**55.5**	**42.7**	**3.2**	**1.9**
FCF	**-9.9**	**-19.3**	**-8.0**	**-42.8**	**-31.6**	**33.8**
Organic FCF	**-12.9**	**-16.5**	**-3.0**	**-16.8**	**8.0**	**33.8**

BALANCE SHEET. PLNm	2021	2022	2023E	2024E	2025E	2026E
Tangible fixed assets	99.2	113.5	118.9	137.9	146.0	146.8
Intangible assets and expenditures on R&D	53.9	72.9	89.1	149.6	203.7	208.6
Deferred tax assets	22.4	22.0	20.5	16.0	10.2	1.5
Other	8.2	10.5	15.5	16.5	16.5	16.5
Fixed assets	**183.7**	**218.9**	**244.0**	**320.0**	**376.4**	**373.4**
Inventory	6.9	15.3	16.2	15.4	19.9	26.2
Trade and other receivables	14.4	14.3	15.9	19.7	25.4	33.5
Cash and cash equivalents	6.5	2.3	55.5	42.7	3.2	1.9
Other	6.6	3.3	3.3	3.3	3.3	3.3
Total current assets	**34.3**	**35.1**	**90.9**	**81.1**	**51.8**	**65.0**
Total assets	**218.0**	**254.0**	**334.9**	**401.2**	**428.2**	**438.4**
Equity	**131.2**	**138.5**	**209.5**	**228.8**	**253.5**	**290.5**
Long term debt	22.2	28.9	28.9	58.9	50.9	35.9
Deferred income	35.1	52.9	62.2	78.1	86.6	92.3
Other long-term liabilities	0.2	0.2	0.2	0.2	0.2	0.2
Long-term liabilities	**57.5**	**81.9**	**91.3**	**137.1**	**137.6**	**128.4**
Short term debt	12.5	21.4	21.4	21.4	21.4	1.4
Trade payables	8.1	4.4	4.9	6.1	7.9	10.4
Deferred income	2.4	2.6	2.6	2.6	2.6	2.6
Other current liabilities	6.4	5.2	5.2	5.2	5.2	5.2
Total current liabilities	29.3	33.6	34.1	35.3	37.1	19.6
Total equity and liabilities	**218.0**	**254.0**	**334.9**	**401.2**	**428.2**	**438.4**
Debt	**34.7**	**50.2**	**50.2**	**80.2**	**72.2**	**37.2**
Net debt	**28.2**	**48.0**	**-5.3**	**37.5**	**69.1**	**35.3**

OPERATIONS

SEGMENT RESULTS. PLNm	2021	2022	2023E	2024E	2025E	2026E
Detection modules sales	67.2	63.7	69.5	86.0	111.4	148.6
Volume (ths)	12.2	13.7	13.2	16.6	19.2	21.5
Average price (EURths)	1.3	1.1	1.3	1.3	1.4	1.7
Detection modules EBITDA	28.9	17.6	22.9	36.2	45.5	64.6
Semiconductor materials sales	4.3	4.1	6.1	7.7	9.7	11.1
Semiconductor materials EBITDA	0.8	0.5	2.6	2.9	3.3	3.6

REVENUE STRUCTURE BY INDUSTRY. PLNm	2021	2022	2023E	2024E	2025E	2026E
Science and medicine	4.0	7.2	4.7	5.3	5.8	6.4
Other	0.3	1.1	0.3	0.3	0.3	0.4
Industry	31.1	39.5	45.7	55.4	63.7	70.1
Transport	8.7	7.8	7.9	8.9	9.8	10.8
Military	23.2	8.1	11.9	16.1	31.8	60.9
Semiconductor materials	4.3	4.1	6.1	7.7	9.7	11.1

Investment summary

We reiterate our BUY rating on VIGO Photonics and set our price target (PT) at PLN 593/share, implying 32% upside potential. In 2023, the company tackled the two main challenges (the reduced size of orders from Safran and supply chain issues) that harmed its results in the previous year, and recorded a results expansion, driven by strong demand for its military segment products, as well as the price hikes completed in 1Q23. From 2024E, we expect the growth to be driven by solid demand for both industrial and military detectors; while, from 2025E, we assume that VIGO develops a new revenue stream: infrared arrays, which should additionally boost its military segment sales growth. As a result, we forecast 2022-25E CAGRs of 39% and 51% in the adjusted EBITDA and net profit, respectively, for VIGO. The equity story is also spiced up with the EC's announcement to grant VIGO State aid of up to EUR 103m, to develop photonic integrated circuits under the HyperPIC – a project that can multiply its business size. On our forecasts, VIGO is trading at EV/EBITDAs of 13.1-10.2x for 2024-25E, at 6-18% discounts vs. its peers.

The HyperPIC project can multiply VIGO's business scale. On 12 June, VIGO Photonics announced that the European Commission has approved the amount of State aid for the company's project, to develop and implement the technology of integrated photonic integrated circuits for detection in the mid-infrared range. The total value of eligible costs in the project is EUR 253.41m, and the maximum amount of State aid approved by the European Commission may amount to EUR 102.85m. The decision on granting the company co-financing and determining the final amount of co-financing will be made as part of the competition procedure under the European Funds for Modern Economy (FENG) programme. VIGO Photonics is the only Polish company included in the FENG programme.

A photonic integrated circuit (PIC) is a device that integrates multiple optical components functions on a single chip or substrate, similar to how electronic integrated circuits integrate various electronic components. Instead of manipulating electrical signals, PICs manipulate light signals to perform a wide range of optical functions. PICs technology is already commercialised in the short IR wavelength, which is used in the telecommunications industry. The PICs that VIGO aims to develop in the HyperPIC project should operate in the wavelength range of 2-12 micrometres, which covers mid- and longwave infrared (according to the classification used by VIGO) – the range used for gas sensing, chemical spectroscopy, environmental monitoring, and biomedical diagnostics. By targeting the mid-IR range, the PICs developed by VIGO can address these applications. We emphasise that the technology is not yet available in the market, so VIGO could be the first company in the world with such an IP.

Mid-IR PICs should have numerous advantages over current photonic systems, comprised of discrete components, such as: a compact size, scalability, cost efficiency, lower energy consumption, less heat emissions (no need for a cooling system or special shielding), and increased processing speeds.

The target market for HyperPIC is difficult to estimate, as this kind of solution for sensing based on the mid-IR spectrum has not been commercialised yet. In its presentations, VIGO approached the market value assessment by looking at the current market of non-PIC based sensor systems. By using this approach, the company estimates the market value at USD 1.5bn. P&S Intelligence (research from July 2022) estimates a global photonic integrated circuits market CAGR of 20.5% for 2021-30; while, according to Future Market Insights (July 2022), the 2022-32 PIC market CAGR should reach 21.5%.

In its presentations, VIGO assumes that mid-IR PICs target capacity production should exceed 10m sensors/annually, each priced at c.EUR 10. These assumptions might be too conservative as well, considering that the company published them before the announcement of the maximum State aid for the project. Nevertheless, VIGO's target annual PIC production value should reach a couple of hundred EURm, based on the publicly-known assumptions.

Our valuation (based on the residual income model) implies the current NPV of the HyperPIC project at PLN 629m. However, due to uncertainties related to the project's financing and commercialisation timing, we have not included HyperPIC in our model yet, and we see the project as potential upside for the equity story. Considering that the company has successfully raised funding through series F shares (aimed, among other things, at financing the initial phase of the HyperPIC project) and, in order to present the upcoming capex accurately, we have included PLN 25-40m of R&D outlays related to the project in 2024-25E. However, in order to be consistent in terms of valuation (as we do not include any potential income from the project in our model, at this stage), we exclude the capex from our DCF valuation.

The State aid for the HyperPIC project, approved by the EC, was part of the IPCEI ME/CT – the Project of Common European Interest in Microelectronics and Communication Technologies. The IPCEI ME/CT concerns research and development projects covering microelectronics and communication technologies across the whole value chain, from materials and tools, to the chip designs and manufacturing processes. The Member States will provide up to EUR 8.1bn in public funding, which is

expected to unlock an additional EUR 13.7bn in private investments. As part of this IPCEI, 56 companies, including small and medium-sized enterprises and start-ups, will undertake 68 projects.

We note that the global chip shortage, which started in 2020 during the COVID-19 lockdowns, has pushed Western economies towards considering supporting the development of local semiconductor supply chains, in order to avoid potential shortages in the future. We see this as an opportunity for VIGO to secure further financing for its production capacity development and R&D projects. In February 2023, the EU Parliament set its negotiating position on two draft bills: one on the "Chips Act", which aims to bolster technological capacity and innovation in EU chips; and the second on the Chips Joint Undertaking, to increase investments for developing this type of European presence. We describe the projects in the paragraph titled "Further R&D co-financing likely, due to supportive regulatory framework".

Global infrared detectors market to expand at a 7-10% CAGR. According to five different market research sources, the value of the global infrared detectors market is estimated at around USD 0.5bn, while its long-term CAGR is expected to reach 7-10%. All the research companies see increasing demand for motion- and people-sensing devices, smart home solutions, and IOT devices, as well as increasing product utilisation in the military industry, industrial plants and the automotive industry, as the main drivers of the market. The market is niche: according to Fact.MR, the global sensors market value stood at USD 180bn in 2020, while the IR detectors share accounted for only 0.23%. VIGO Photonics is focused on an even narrower niche of mid-wave infrared detectors, which contribute c.20-25% of the global IR detectors market. In its niche, VIGO competes with Teledyne Judson, Infrared Associates, and Hamamatsu.

IOT market should be one of the main drivers of demand for IR detectors. According to Statista's data (research published in July 2022), the number of Internet of Things (IOT) devices worldwide should almost triple, from 9.8bn in 2020 to more than 29bn in 2030E. According to Statista's research, the value of the global IOT market should expand from USD 181.5bn in 2020 to USD 621.6bn in 2030E (a 13% 2020-30E CAGR).

Levered military budgets should support the usage of IR detectors. According to the Polish army's modernisation plan for 2021-35, approved in 2019 and later updated by the Homeland Defence Act in 2022: from 2023, Poland is to spend at least 3% of its GDP on defence; in 2021-35, it plans to spend PLN 524bn on new military equipment, and it has set a target of doubling the size of the armed forces from 150,000 to 300,000 personnel. In 2023, Poland was about to spend a total of PLN 137bn (c.4.2% of the GDP, according to the government's estimates). We note that all the tanks and armoured vehicles can be equipped with the OBRA-3 Laser warning system, which utilises infrared detectors for the detection of vehicles and military objects' radiation from impulse rangefinders or laser illuminators. Apart from the demand from the Polish army, we expect VIGO to benefit from increased spending on army modernisation in Western countries.

M&A in the photonic industry: VIGO can be either an acquirer or a target. VIGO Photonics may be interested in potential acquisitions as, according to its strategy, this could accelerate its entry into new product segments: the company has noted, especially, the manufacturers of mid-infrared sources. We, however, also believe that VIGO Photonics could become an acquisition target, as it holds a unique, hard-to-copy technology, high-quality products and a global presence. Based on CERES data and our estimates, the average transaction EV/EBITDA in the broad photonics and related industries market stood at 13.4x in 2018-22 (based on 108 deals, in which the majority stake was acquired and the details regarding the financials and the transaction prices were known); while, in the pure photonics segment, 14.4x (based on 23 deals).

Solid 2023 results, after 2022 harmed by supply chain issues and reduced orders from Safran. In 2023, VIGO Photonics recorded preliminary sales of PLN 75.6m, up 11% yoy; while, in 2022, reported sales of PLN 67.9m, down 5% yoy. The 2022 weakness was driven by two main factors: 1) supply chain issues; and 2) a reduced orders size from its biggest client – Safran. Both issues, however, were temporary and, from 2023, the company recorded a results expansion, driven by strong demand for its military segment products, as well as the price hikes completed in 1Q23. Moreover in 2023, VIGO also reported a solid backlog of c.PLN 100m (vs. PLN 76.3m in 2022) and expects further strong demand from its European and US clients (especially on gas analysis solutions) – according to the CEO, the company believes that, within the next one-to-two years, the sales in the American market might reach the value of the European segment.

2022-25E adjusted EBITDA CAGR of 45%. After the soft 2022, harmed by reduced orders from Safran and supply chain issues, in 2023E, the company has recorded an 11% preliminary revenues rebound yoy, to PLN 75.6m, driven primarily by a strong rebound in its military segment sales (up 47% yoy, to PLN 11.9m) and the industry segment. In 2024-25E, we expect VIGO's sales to expand by 24-29%, to PLN 94-121m, and its adjusted EBITDA by 51-39%, to PLN 32.8-45.4m, on an increase in the industry segment demand, a military segment sales acceleration, price hikes and expansion into new

geographies. In our forecasts, we expect volumes of 100-300 in 2025-26E, respectively, and sales of PLN 13.2-39.6m.

Scenario analysis for the infrared arrays project. Out of the three new initiatives assumed in VIGO's strategy, we have pencilled only the infrared arrays project into our model, as we believe its realisation is the most probable. In our forecasts, we assume that VIGO will conclude an agreement with the Polish army and reach a target production volume of 300 infrared arrays/year from 2026E. In this scenario, the project adds PLN 145/share to our PT for VIGO – excluding the project, our PT for VIGO would reach PLN 448/share (i.e., 24% below our base-case scenario PT).

However, we note that our assumptions are conservative compared to the company's plans: VIGO estimates its annual production capacity of infrared arrays at 500 units, and volumes of 1,000 pieces/year in its strategy. If we pencil in volumes of 500 units/annually to our model, our PT would increase to PLN 659/share (11% above our base-case PT), while the annual contribution to sales would increase from the PLN 40m assumed in our base-case scenario, to PLN 66m.

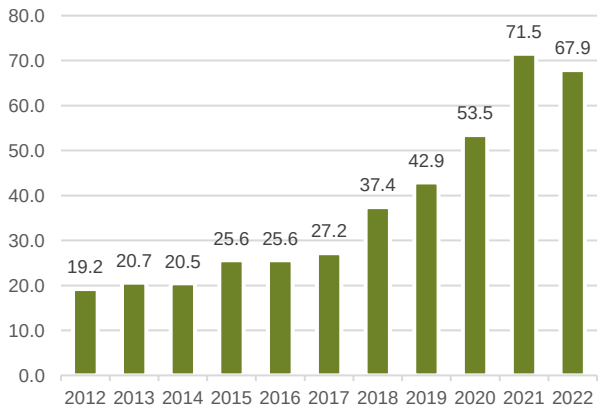
PLN 593/share PT. We reiterate our BUY rating for VIGO Photonics and set our price target (PT) at PLN 593/share, implying 32% upside potential. Our PT is the average of our comparative valuation and our DCF valuation. On our forecasts, VIGO trades at EV/EBITDAs of 13.1-10.2x for 2024-25E, at 6-18% discounts vs. its peers, while offering a stronger growth outlook: we expect VIGO to generate a 45% 2022-25E EBITDA CAGR vs. the 9% peers' median.

VIGO's LTM EV/EBITDA reached 17.7x, implying a 10% discount vs. its broad peers' group average of 19.8x (vs. the average 34% premium in the past two years).

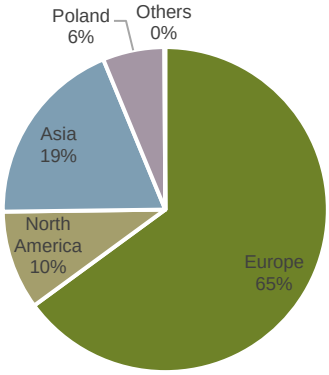
Company description

VIGO Photonics is Poland-based company that specialises in the development and manufacturing of advanced photonics and infrared technologies. The company was founded in 1987 and has since grown into one of the leading global producers of infrared photon detectors. VIGO produces IR detectors based on complex semiconductors that have applications in various areas, primarily in the industry, transport and military segments. In 2022, the company sold 13,653 detectors and modules, and generated sales of PLN 67.9m, out of which 94% was generated abroad (mainly in Europe). As of end-2022, VIGO cooperated with 25 distributors in 18 countries. In 2022, the group employed c.215 people. The company has been listed on the WSE since December 2014.

VIGO Photonics: sales evolution (PLN m)



VIGO Photonics: sales structure by geography in 2022 (%)



Source: Company data, WOOD Research

Company history

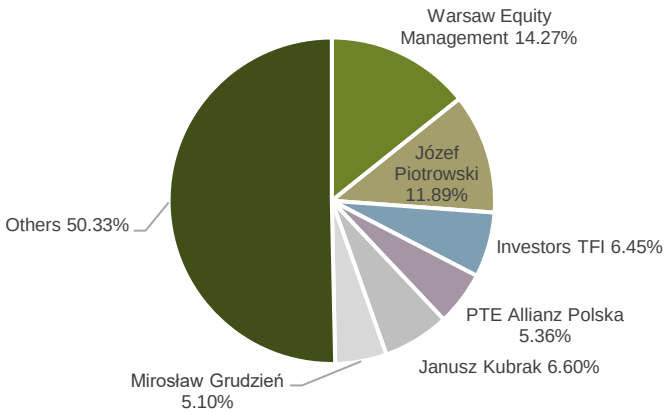
The history of VIGO dates back to the 1970s, when a team led by Professor Józef Piotrowski, PhD (one of the founders and still a shareholder of the company currently; author of 197 publications, 2,958 quotations, h-index: 27, link to the author's profile), developed at the Military University of Technology in Warsaw, Poland, using a special technique for manufacturing detectors operating without cryocooling, which was implemented subsequently at the company. The product was very good quality, and strong demand from the foreign markets prompted the creators of the technology to found their own production company in 1987, which was reformed as VIGO System in 1993. The founders of VIGO System were, Wieslaw Galus, PhD, Mirosław Grudzień, PhD, Janusz Kubrak, PhD, Andrzej Maciak, PhD, Andrzej Nowak, PhD, Professor Jozef Piotrowski, PhD, and Krzysztof Więcław.

VIGO Photonics: milestones

1987	• VIGO Photonics (previously VIGO System) foundation
2003	• Implementation of MOCVD technology
2007	• Relocation of the registered office to Ożarów Mazowiecki
2012	• VIGO detectors on Mars (Mars Curiosity Rover)
2013	• Construction of production facility
2014	• VIGO debut on the WSE main market
2015	• Implementation of MBE technology
2016	• VIGO detectors again on Mars as part of Exomars mission
2019	• New division at VIGO - epitaxy III-V
2020	• New production plant with 100,000 detectors annual capacity
2021	• First contract in North America – national intelligence organisation; establishing VIGO Photonics USA
2022	• New VIGO Photonics brand, cleanroom launch
2023	• VIGO Photonics included in European Funds for Modern Economy programme (the only Polish company)

Source: Company data, WOOD Research

VIGO Photonics: shareholders' structure as of 19 September 2023



Source: Company data, WOOD Research

The company's capital group is comprised of VIGO Photonics Inc. (a company established in 2021 as a sales representative in the North American region; a 100% stake) and VIGO Ventures ASI (as at 30 June 2023, VIGO Photonics S.A. held a 44.2% stake in VIGO Ventures ASI).

VIGO Ventures ASI is an investment incubator created by VIGO Photonics and Warsaw Equity Group (50:50 joint venture) in 2017 and transformed into an alternative investment company in September 2022. It aims to invest and develop technological projects (start-ups, spin-offs) with global potential in the production of high-tech devices and components in the areas of photonics, semiconductors, quantum technologies. The target companies should have developed solutions already pre-verified and/or with a working prototype. The projects should be profitable already and/or be potential support for VIGO Photonics. The fund's budget is planned at PLN 36m (PLN 18m to be contributed by each partner) and aims for single investments worth EUR 1-1.5m. The investment horizon reaches 2032 (or until all the investment projects are completed). In 2017-22, VIGO spent PLN 7.2m on investments within VIGO Ventures. As of end-2022, the value of the jointly controlled entities reported by VIGO stood at PLN 6.7m.

VIGO Ventures holds the following investments in its portfolio:

- **Fluence** – a company that develops environmentally stable and immune to shock femtosecond lasers for industrial applications.

- **QustomDot** – a company that created patented quantum dot(QD) technology for colour-conversion (InP) and IR sensing or imaging (InAs). The technology can address the challenge of colour conversion in future applications like microLEDs in various applications like: AR/VR goggles, smart watches, automotive displays, smartphones, etc.

- KSM Vision – a company providing smart machine vision systems for industrial in-line quality control. Pharmaceutical, food, construction or cosmetic industries can optimise their production processes and eliminate errors. The systems are based on a proprietary optics and software platform.

- Deep Detection – a company providing multispectral x-ray cameras for industrial inspection and material separation enabling simultaneous detection and characterisation real time, continuous inspection from production lines to recycling to security.

- ChipCraft – ASIC design house (Analog & Digital) with its own developed products. Its technology can also find applications in Photonic Integrated Circuits or Quantum Computing. Semiconductor IP cores' licenses provider.

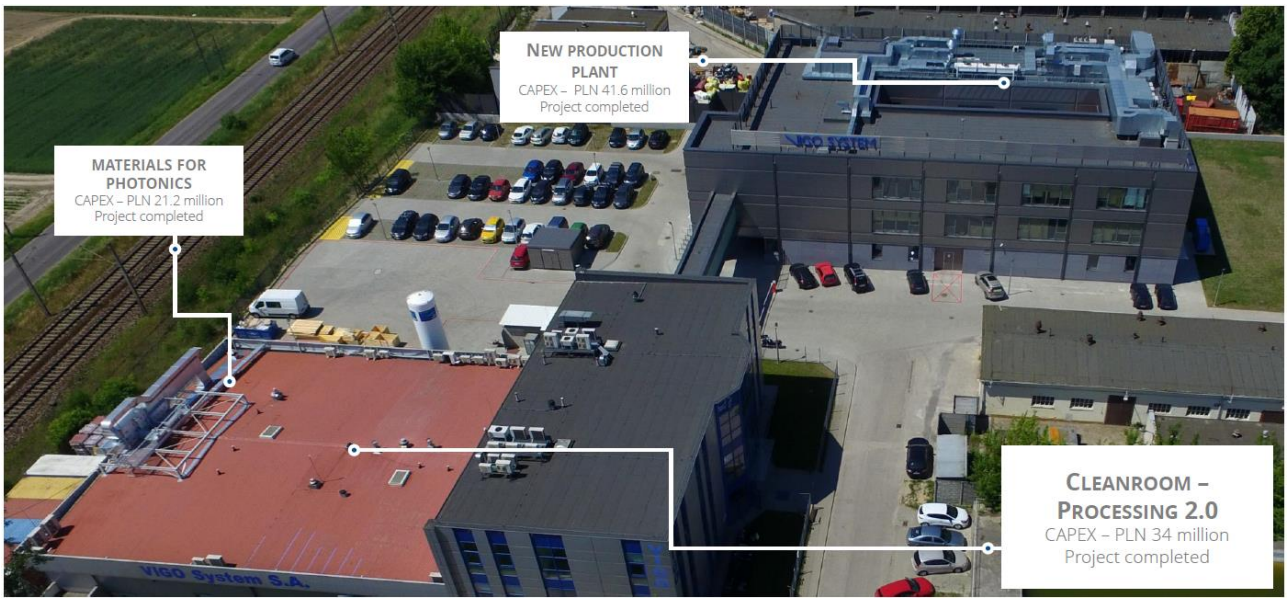
- PHOTON IP – a company developing technologies for advanced photonics applications. The company – together with leading industrial partners – is working towards providing solutions that will be used (among others) in the automotive industry and telecommunications, in the production of wearable electronics or in data centres.

- Quantune Technologies – a company developing a low-cost miniaturized quantum cascade laser (QCL) spectrometer for industrial and biomedical applications.

VIGO's technology and production capacity

VIGO Photonics has a complete front-end and back-end production line for semiconductor high-capacity instruments – from the epitaxy of II-IV (tellurium, cadmium, mercury) and III-V groups (indium, arsenic, gallium, antimony), through to detector chips, lasers, and their assembly and integration with electronics. The entire technological process, starting from epitaxial wafer growth, processing, assembly, and integration with electronics and measurements, takes place at VIGO Photonics' premises (the company is the owner of HQ and production facility buildings and all the machinery). The company also has its own modern measurement laboratories, which enable the fast and accurate measurements of products and semi-finished products at every stage of production. Throughout 2017-22, VIGO invested c.PLN 118m in the development of production capacity – thanks to the finalisation of the investments listed below, the current capacity of VIGO Photonics (considering its current sales mix) is c.100,000 detectors per year, thanks to which it is prepared for a rapid business scale-up.

VIGO Photonics: HQ and production facility in Ożarów Mazowiecki



Source: Company data, WOOD Research

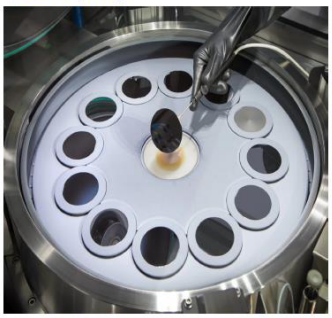
VIGO has four reactors for the production of semiconductor materials, the largest of which is a reactor manufactured by Aixtron. Since the beginning of 2023, VIGO has operated a new epitaxial reactor for the production of III-V semiconductor materials from Aixtron, which was supposed to double its semiconductors production capacity (the reactor of the same type and capacity was commissioned in 2019). In 2022, the company also finished the construction of its cleanroom, with a ISO 6/ISO 7 class dedicated to detection chips. The newly-built rooms meet the high standards of cleanliness, temperature and humidity control, and have the necessary protection against chemical hazards. A cleanroom enables the cost-effective and scalable production of detection chips to be used in InGaAs detectors and allow the company to enter the shortwave infrared (SWIR) market. At the same time, VIGO has been able to enter the mid-infrared (MWIR) market with detectors made of III-V materials, which meet the requirements of the new EU legislation on reducing the use of environmentally hazardous substances, introduced by the Restriction of Hazardous Substances (RoHS) Directive.

VIGO Photonics: reactors used by VIGO

MBE (InAs, InAsSb)

MOCVD (HgCdTe/ MCT)

MOCVD (III-V)



Source: Company data, WOOD Research

The techniques used for manufacturing photonics components are:

- MOCVD – for the production of HgCdTe MWIR and LWIR, as well as InGaAs SWIR detectors and detection modules.

The technique used for manufacturing HgCdTe detectors is the metalorganic chemical vapour deposition (MOCVD) method. As a result, multi-layer semiconductor heterostructures are obtained, consisting of more than 20 layers as a maximum, varying in terms of thickness, composition, doping and band gap broadening. They fulfil various functions: structural optical, photoelectric and electronic.

- MBEs – for production of InAs and InAsSb RoHS compliant MWIR LWIR detectors and detection modules.

The molecular beam epitaxy (MBE) growth technology is used for manufacturing bulk InAs, InAsSb and superlattice (SL) InAs/InAsSb detectors. SL detectors made of III-V materials have strong covalent bonds, which results in a higher temperature operating range, a better uniformity of the crystal, and better optical and electrical parameters.

- MOCVD epi III-V- for the production of III-V semiconductor materials for photonic and micro-electronic applications.

The company uses Planetary Reactor MOCVD for manufacturing GaAs or InP based high-quality III-V e and microelectronic devices (diodes, transistors) and others.

Products offered by VIGO

The mission of VIGO Photonics is to provide fast and convenient, easy-to-use IR detectors at any wavelength from 2 to 16 µm, reaching fundamental BLIP limits without cryocooling. The detectors manufactured by VIGO work in environment temperature or utilise thermoelectric coolers instead of cryocooling (used by most of VIGO's competition). Modules are available with different spectral response ranges, time response characteristics and gains. All the products are based on VIGO's proprietary, unique technology. The company provides ready-made and customised solutions, which allow it to create products dedicated to a given customer's application – c.90% of the company's sales are generated on customised products and 10% on standardised products.

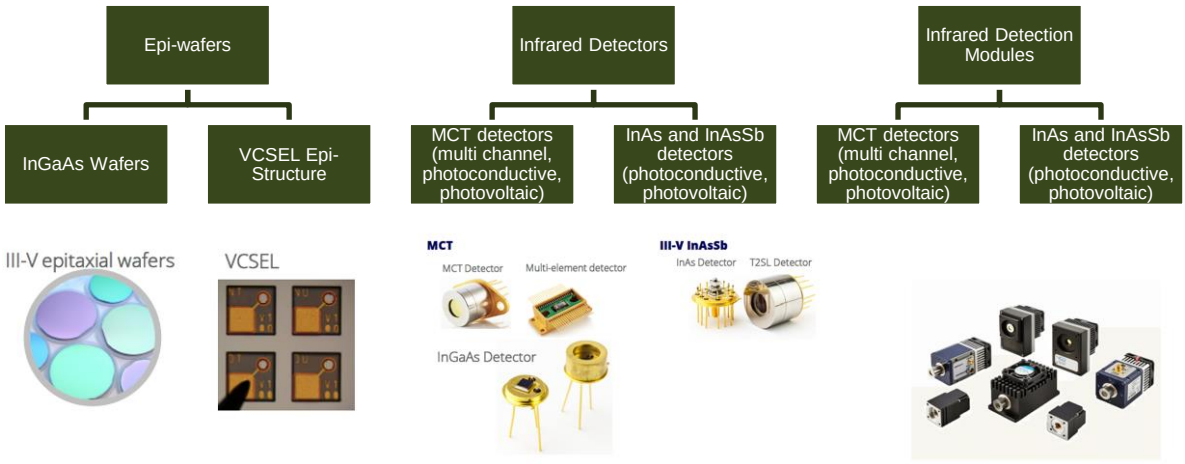
The company offers three main categories of product:

- Epi-wafers – an epitaxial wafer is a type of semiconductor wafer that has a layer of epitaxial material grown on top of a substrate wafer (a crystalline structure that can be made of silicon, gallium arsenide, sapphire, etc.). The company offers high-quality epitaxial structures of III-V semiconductor materials (InGaAs, InAsSb) directly to clients for the in-house production of detectors/chips and VCSEL lasers.

- Infrared detectors – a device that is capable of detecting and measuring the levels of infrared radiation emitted by objects. The company offers older types of detectors based on HgCdTe material, which offer the highest performance out of all the discovered materials suitable for infrared detection (suitable for industry and environmental protection), as well as detectors based on InAs, InAsSb and InGaAs, which are RoHS compliant and suitable for the consumer market.

- Infrared detection modules – infrared detectors integrated with electronics - complete and compact solution for detecting and measuring infrared radiation, with the added convenience of being ready to use out of the box. Detection modules offered by VIGO are characterized by high sensitivity in a wide spectral range from 1 to 16 µm, high speed in frequency bands up to 1 GHz, optimized amplification of the measured signal and operating temperatures in the range from 200 to 300 K. The company offers ready-made modules for applications such as gas analysis, temperature control in fast-moving objects, laser spectroscopy. The company also offers all the necessary electrical accessories for its products, such as thermoelectric cooler controllers and preamp power supplies and mechanical accessories, such as brackets for detectors and infrared modules, base mounting systems and cables.

VIGO Photonics: products



Source: Company data, WOOD Research

VIGO Photonics: current product portfolio

Product	Production method	Annual capacity	Price:	Applications	Sectors
MCT detectors and detection modules	MOCVD	20ths detectors and modules	average EUR 500-1,000/module	Gas analysis, examination of the spatial distribution of temperature, precise determination of the direction of the infrared radiation source, scanning of larger areas for the detection of substances, gases and temperature changes, sorters on production lines	Industrial, military and space technologies
III-V InAsSb detectors and detection modules	MBE	100ths detectors and modules, 1m chips	EUR 100-500/module, EUR 20-30/detection chip	Gas analysis, examination of the spatial distribution of temperature, precise determination of the direction of the infrared radiation source, scanning of larger areas for the detection of substances, gases and temperature changes, sorters on production lines	Environment protection, medicine, robotics, military industry, property protection, industry (automotive, manufacturing)
III-V InGaAs detectors and detection modules	MOCVD, Aixtron G4	1m chips	EUR 30-50/detection chip	Measurement of key parameters - glucose, lactic acid, alcohol, gas analysis, humidity measurement, leakage and emission control, breath analysis, applications in surgery and medical procedures, plastics analysis, food product analysis, health monitoring, next-gen lidar (especially automotive), direct optical communication; industry - non-invasive, verification of product quality	Industry (gas analysis), environment protection, military and space technologies, medicine, consumer market (wearable devices), quantum cryptography, IoT
III-V epitaxy: semiconductor materials	MOCVD, Aixtron G4	18ths wafers per year	EUR 800-4,500	Increasing data transmission efficiency, throughput in optical communications, gas detection, 3D scanning, access to energy sources without energy infrastructure, reduction of battery consumption in computer mice, elimination of microwave limitations for automotive radars, control of autonomous vehicles, electrical powering of satellites and strategic drones	Data transfer, 3D detection, microelectronics, imaging, telecommunications, automotive industry (LIDAR), medicine, quantum photonics

Source: Company data, WOOD Research

Advantages and high quality of VIGO's products

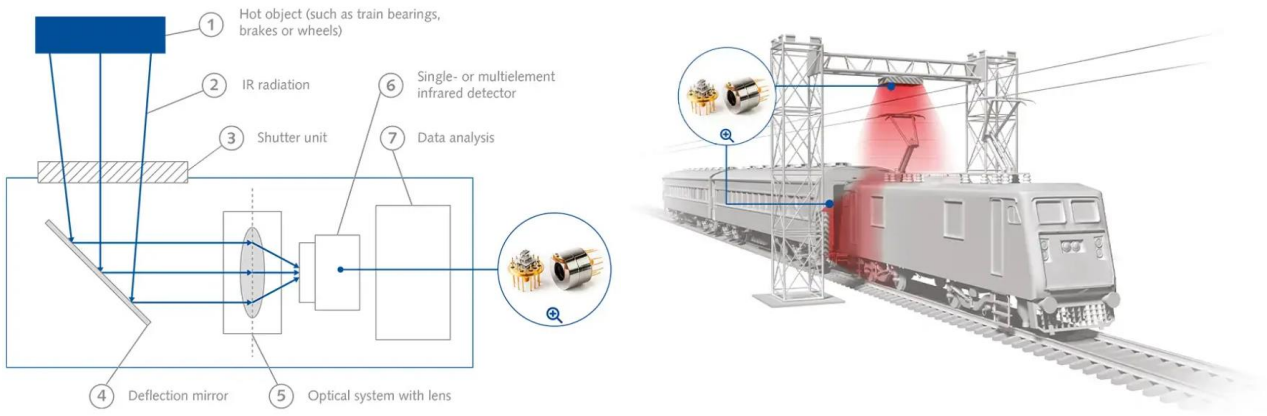
VIGO claims that, in the mid-wavelength spectrum, its detectors offer best-in-class quality in terms of the detectivity ratio compared to the competition. The proof of VIGO's products' quality is their use in the NASA and European Space Agency exploration programmes.

Applications of VIGO's products

The detectors manufactured by VIGO have a wide range of applications, such as:

- **Railway traffic safety:** failure detection systems in in the running gear of high-speed rail systems and fire detection systems. Thermal monitoring is a way to minimise the unscheduled breakdowns of all undercarriage elements, and prevent costly failures and downtime. The scanning system is integrated with a signalling system, enabling the automatic stopping of trains whenever hazardous defects are detected, without the intervention of the operator. The most efficient solutions for temperature measurement in the railway industry are infrared HgCdTe detectors.

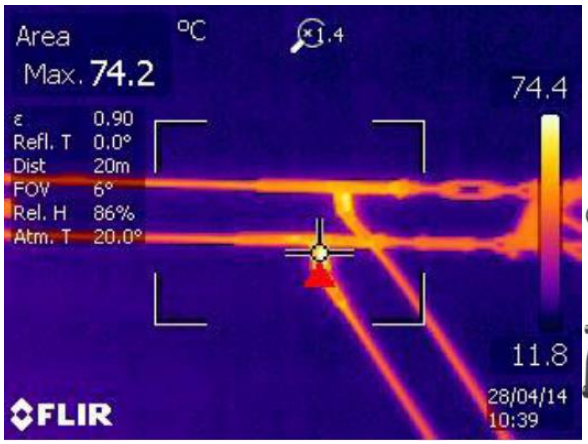
VIGO Photonics: thermal scanning system with VIGO's infrared detection modules



Source: Company data, WOOD Research

- **Environmental protection:** measurement of the threat to the environment posed by harmful chemical substances, the monitoring of emissions of hazardous substances into the air, air quality surveillance, and real-time water quality control.
- **Industrial applications:** industrial scanners for temperature distribution, industrial automation equipment, automotive sensors (analysis of temperature distribution in fast moving objects, engine emissions' monitoring and control, fuel quality assessment), industrial IR sensors (laser power control and calibration, mid-infrared spectroscopy, gas analysis), utilities (monitoring the technical condition of the transmission infrastructure).

Infrared thermography of transmission power lines using drones



Rosemount™ X-STREAM Enhanced XEFD Continuous Gas Analyzer

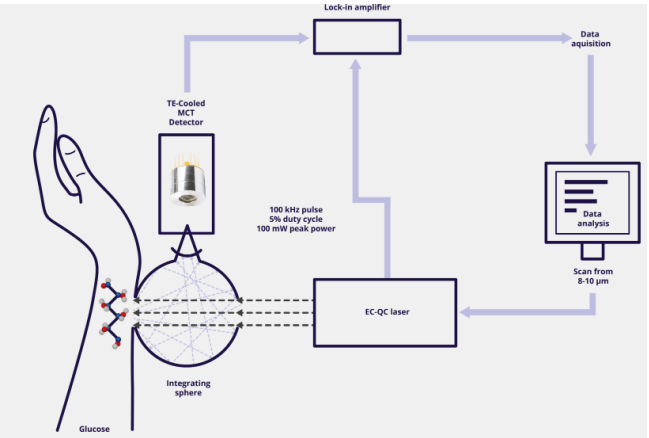
Source: scanpro.com.au, emerson.com

- **Research and science:** the measurement of high-temperature plasma parameters for thermonuclear fusion research, the measurement of ultra-short pulses of infrared radiation emitted by lasers and synchrotrons, and spectrometers for measuring extremely low concentrations of substances.
- **Medicine:** VIGO Photonics' infrared detectors and detection modules can be used in a wide variety of biological, biotechnological and medical applications, including human breath analysis, non-invasive blood tests, dentistry, pharmacy, and protein composition analysis. Exhaled breath contains more than 3,000 substances. The concentration of some of them may depend on health status. These substances, called biomarkers, may be used to diagnose some diseases or pathological processes in the human body. Other example of the IR detector application in medicine is a needle-free glucose-sensing device, which enables non-invasive blood sugar level measurement.

Breath biomarkers detected by IR detectors

Breath biomarker	Health condition	Selected absorption line, µm	Measurement technique
CH_3COH acetaldehyde	• after alcohol consumption • lung cancer	5.79 and 5.67	TDLAS
C_2H_6 ethane	• oxidative stress • Alzheimer's disease	3.33	TDLAS
C_3H_6O acetone	• type 1 diabetes	8.2	QCL-based infrared spectrometer
CH_4 methane	• oxidative stress • cancer	3.3916 and 3.3920	HWG-TLAS
NO nitrogen monoxide	• asthma • chronic bronchitis • allergic rhinitis	5.26296	ICOS
NH_3 ammonia	• renal diseases • asthma	10.341	pulsed QCL-based spectrometer
CH_2O formaldehyde	• lung and breast cancer	3.530	ICOS
HCN hydrogen cyanide	• cystic fibrosis	1.538	ICOS
CH_3SH methanethiol	• halitosis • hepatic cirrhosis • encephalopathy • coma	3.3565	WMS/TDLAS
C_2H_4 ethylene	• lipid peroxidation • ultraviolet radiation damage of skin	10.309	pulsed QCL-based spectrometer
OCS carbonyl sulfide	• hepatic failure • cystic fibrosis • rejected lung transplant	4.86	TDLAS

Principle of operation mid-IR non-invasive glucose measurements in skin using QCL spectroscopy



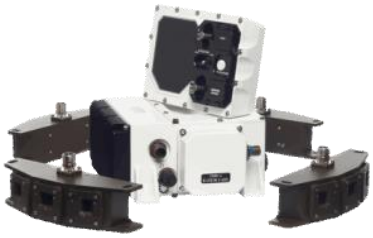
Source: https://vigophotonics.com/applications/medical-applications/

- **Security** (the detection of explosive and hazardous substances, prevention systems against terrorist activities, systems for checking the contents of passengers' luggage).
- **Space industry:** laser communications in open space, measurement equipment for space applications. Infrared detectors produced by VIGO were used in the Mars Curiosity Rover, which landed on the Red Planet on 6 August 2012 as part of the NASA programme, and the subsequent detection of traces of methane on Mars in December 2014 with the use of these detectors. The company's detectors were also used by the European Space Agency as part of the Exomars

mission. In October 2016, the Schiaparelli landing module, equipped with VIGO System's detectors, attempted a landing on Mars.

- **Military applications:** laser-beam vehicle-tracking alert systems, missile guidance systems. VIGO's biggest client in 2021 was Safran, which used VIGO's detectors in its smart munition products. An example of smart munitions systems utilising IR detectors is Bonus, a 155mm artillery shell designed for the in-depth engagement of enemy battle tanks produced by Nexter Munitions and BAE Systems (for more details, click here).

SSP-1 Obra-3 Vehicle Self-Shielding System **155mm BONUS Munition**

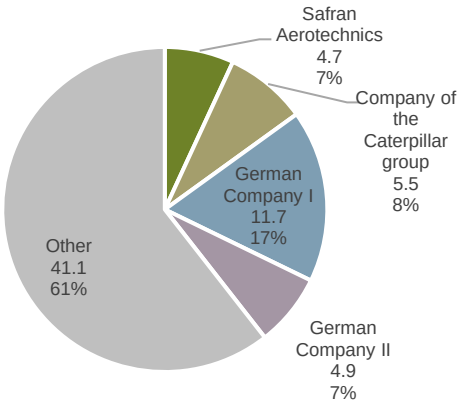


Source: pcosa.com.pl, baesystems.com

VIGO supplies global corporations and space agencies

VIGO's products are used by some global industry, security and defence systems manufacturers. The company lists the following clients among the biggest ones: Safran (VIGO's detectors are used in smart munitions production); Emerson (industrial gas analysers); Caterpillar (railway safety systems); and TRUMPF (industrial lasers). VIGO's detectors are also used by space agencies: NASA (VIGO's detectors were used in the Mars Curiosity Rover and the Orion spaceship); and the European Space Agency (Exomars mission). In 2022, Safran contributed PLN 4.7m to its sales (6.9% of total sales), Caterpillar PLN 5.5m (8.2% of sales), while the two other biggest clients (both German companies, not specified by VIGO) generated PLN 16.6m in revenue (24.4% of sales). In total, its four biggest clients generated 39.4% of VIGO's sales in 2022 (vs. 55.4% in 2021).

VIGO Photonics: sales structure by clients in 2022 (PLN m, %) **VIGO Photonics: selected customers**



Source: Company data, WOOD Research

VIGO's 2026 strategy

In June 2021, VIGO Photonics adopted a new 2026 strategy, with the first stage being in 2021-23, for which the company has also presented financial guidance. The strategy assumes development in the market segments in which the company is present currently and the expansion of its operations to new areas.

In terms of financials, the company's ambition is to maintain the growth rate of revenues at 20-30% annually and high profitability of the core operating activities, including the gross margin on sales above 60% and EBITDA profitability above 40%. VIGO's financial targets include:

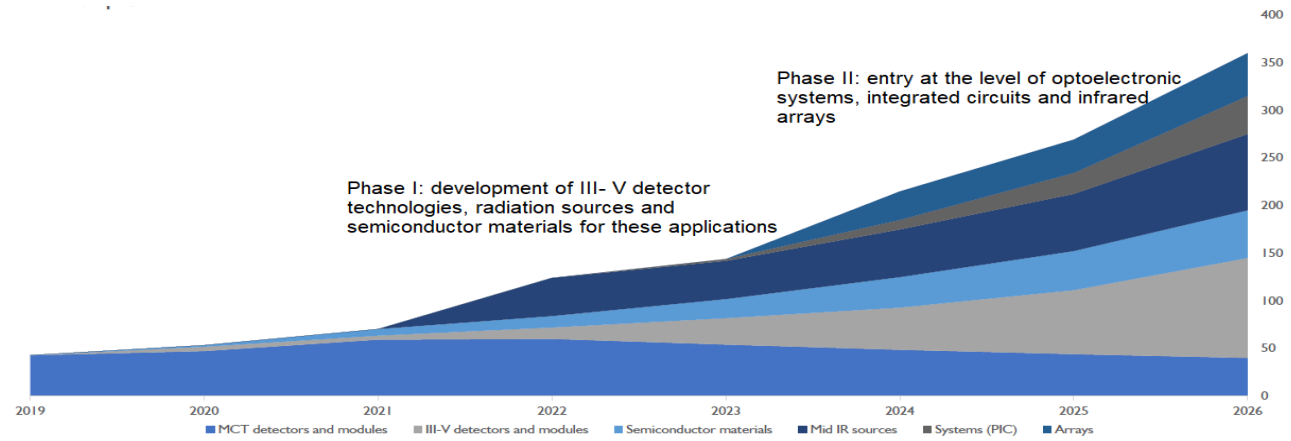
- PLN 67m in revenues and PLN 29.5m in EBITDA in 2021 (delivered).

- PLN 80m in revenues and PLN 33.5m in EBITDA in 2022 (not delivered: VIGO's sales reached PLN 67.3m in 2022).

- PLN 100m in revenues (not delivered: the preliminary sales in 2023E stand at PLN 75.6m) and PLN 40m in EBITDA in 2023E.

In order to achieve its goals, VIGO planned to spend PLN 30-40m in capex annually (both R&D and infrastructure) in 2021-23E, financed from own funds and public funding for R&D. In order to deliver on the growth rates assumed in the strategy, the management board has recommended no dividend payouts and the full reinvestment of the generated profits in the strategy period. The dividend policy will be subject to periodic review by the board.

VIGO Photonics: portfolio of growth initiatives – assumed development paths (PLN m)



Source: Company data

Strategy execution: financial goals not delivered in 2022-23E. The execution of VIGO's strategy is going as planned regarding the capex and R&D, as well as the geographic expansion, as the company is strengthening its presence outside Europe. However, it has failed in terms of the delivery of its financial targets in 2022-23E. The company reported sales of PLN 67.9m in 2022 (vs. the PLN 80m target), down 5% yoy, due to lower revenues from the military application, and lower than previously assumed revenues from applications for industry and transport, as a result of the lower availability of some components and the disrupted supply chains. In 2023E, the company has recorded sales of PLN 75.6m.

Despite the company not being able to deliver on its ambitious mid-term financial targets, assumed in the strategy, we believe in a strong long-term growth outlook, stemming from an increase in the demand for current products (especially in the industry and military segments) and new initiatives. We see potential especially in the infrared arrays project (considering the hike in the Polish army's budget) and believe that the project might cause some potential positive surprises for our forecasts: in our model, we conservatively assume 300 units sold annually from 2026E (vs. VIGO's current production capacity of 500 units and the volume of 1,000 units targeted by the company).

VIGO: guidance vs. WOOD's forecasts (PLN m, %)

	2021	2022	2023E
Guidance			
Sales	67.0	80.0	100.0
Adj. EBITDA	29.5	33.5	40.0
Actual/WOOD forecasts			
Sales	71.5	67.9	75.6
Adj. EBITDA	27.3	14.9	21.8
Difference (%)			
Sales	7%	-15%	-24%
Adj. EBITDA	-7%	-55%	-46%

Source: Company data, WOOD Research

Strategy details. The management board has identified a number of potential business opportunities for the company, considering the following initiatives the most promising ones:

1) Exploration of the MCT (HgCdTe) detector market, including expansion (geographical, segmental) in market areas not covered by regulations excluding the use of mercury and cadmium in detectors (RoHS).

2) The development of technology for detectors and infrared modules made of materials based on compounds from groups III and V of the periodic table, compliant with the Restriction of Hazardous Substances (RoHS) directive.

3) The development of the epitaxy of III-V semiconductor materials and the production of near-infrared sources (VCSEL lasers).

4) The development of the technology of infrared sources.

5) The development of the technology of optoelectronic systems and photonic integrated circuits for medium and short infrared.

6) The development of the technology of infrared detector arrays.

The implementation of the VIGO 2026 strategy is divided into two stages. In the first stage, covering 2021-23, the company intended to focus on: the continuation of the ongoing development projects, including the technology of photonic integrated circuits, detectors from III-V materials, epitaxy of semiconductor materials, infrared source technology, and the development of the technological base and technology, common to key pro-growth initiatives through investments in R&D and universal infrastructure, based on the effects of R&D projects, the analysis of the market situation, the selection of the most promising growth initiatives, and the preparation of the investment plan necessary for their implementation.

In the second stage, the company will focus on implementing the most promising growth initiatives.

VIGO also intends to continue its expansion into new geographic and product markets, including investing in the development of its own sales structures in key markets.

New initiatives: mid-infrared sources, PICs, infrared arrays

In its strategy, the company sees three new potential areas of growth:

- **Mid-infrared sources:** laser or diode chips and modules that provide infrared radiation sources, manufactured from III-V semiconductor materials. The company targets acquiring ICL, QCL and MIRLED technologies through the development of proprietary technology or the acquisition of an existing player. Mid-infrared sources can be applied to monitoring and measurement equipment manufacturers of high-performance sensory systems. In its strategy, VIGO is aiming for target volumes of over 1m chips/year.

- **Optoelectronic systems and photonic integrated circuits (PIC):** a miniaturised system consisting of multiple optical and electronic components with different functionalities integrated on a common substrate (usually semiconductor) – on a single chip. The development of PICs would mean moving up the value stream for VIGO, i.e., developing off-the-shelf sensory systems that can be integrated into everyday consumer devices. If VIGO develops the PIC technology, it would be the first manufacturer in the world of mid-infrared integrated circuits for sensors. On 12 June, VIGO Photonics announced that the European Commission had approved the amount of State aid (of EUR 103m) for the company's project to develop and implement the technology of integrated photonic integrated circuits for detection in the mid-infrared range, to build a complete production line for photonic integrated circuits in the mid-infrared range and to create a complete supply chain for these systems. VIGO Photonics is the only Polish company included in the European Funds for Modern Economy (FENG) programme.

We note that the company has experience in this matter as, since 2021, it has been working on the MIRPIC R&D project. The project, with a lead time of three years and a budget of PLN 29.3m (of which PLN 26.6m in co-financing), was realised in cooperation with the Warsaw University of Technology and the Institute of Microelectronics and Photonics. In its strategy, VIGO is aiming for target volumes of over 10m sensors/year. We elaborate on the HyperPIC project and the subsidy in a separate paragraph of this report.

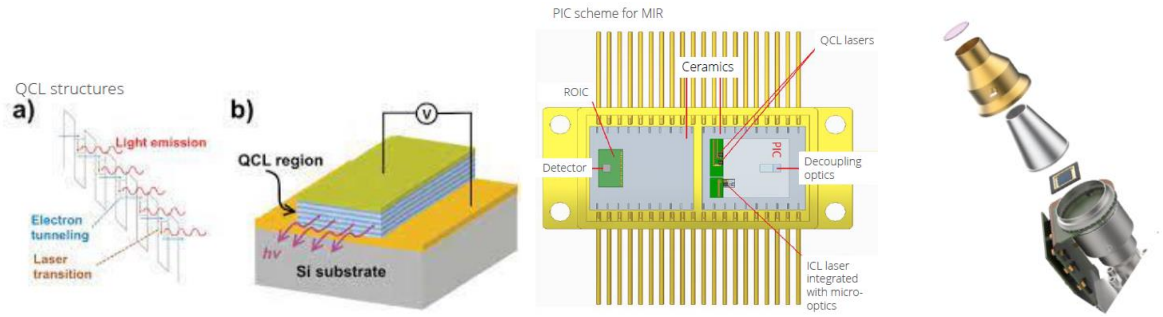
- **Infrared arrays:** infrared detector arrays containing hundreds of thousands or millions of active pixels used in the construction of thermal imaging cameras for space and military applications, and having a semiconductor layer made of III-V materials (InAsSb - MWIR, LWIR, or InGaAs - SWIR). Infrared arrays can be applied to imaging cameras for military and space applications. The company estimates that, after launching the new production line, from 2025E, its annual production capacity of infrared arrays should reach 500 units; while, in its strategy targets, volumes of 1,000 pieces/year.

VIGO Photonics: new initiatives

Product	Production method	Price:	Applications	Sectors
Mid-infrared sources	MOCVD or MBE	USD 6,000 - 9000/unit	Gas analysis, examination of the spatial distribution of temperature, precise determination of the direction of the infrared radiation source, scanning of larger areas for the detection of substances, gases and temperature changes, sorters on production lines	Environment protection, medicine, robotics, military industry, property protection, industry (automotive, manufacturing), consumer market (wearable devices)
Optoelectronic systems and photonic Integrated Circuits (PIC)	Different components made using different technologies	EUR 10/piece	Analyses of the chemical composition of gases, analysis of impurities in liquids, gas detection, FSO (free space communication), analyses related to medicine and telemedicine: blood analysis	Industry and transport, environment protection, food industry, biomedicine, telecom, protection and security, medicine, automotive, IOT, space industry
Infrared array	MBE (InAsSb) or MOCVD (InGaAs).	EUR 30,000/unit	Detectors for thermal imaging cameras	Military industry, space industry

Source: Company data, WOOD Research

VIGO Photonics: mid-infrared sources (QCL structures), PIC scheme, infrared array



Source: Company data

In our forecasts for VIGO, out of the new initiatives, we include only the infrared arrays as it is existing technology (unlike PIC, which has yet to be developed by VIGO) and does not require a potential acquisition. Moreover, VIGO Photonics announced, on 7 September 2023, that it has signed a letter of intent to cooperate with PCO (a subsidiary of PGZ – Polska Grupa Zbrojeniowa) to develop solutions tailored to the needs of the army, infrared arrays based on T2SL (Type II Superlattice) technology in particular. As stated, the new generation products will provide new capabilities in a wide spectral range to Polish and allied armed forces in the area of imaging and sensors. Implementation or production based on jointly developed technologies may only be undertaken by one of the parties or by another entity jointly determined by the parties.

We present our assumptions regarding the contribution of infrared arrays to VIGO's results in the forecasts section of this report.

Incentive scheme aligned with the strategy

In September 2021, VIGO adopted an incentive scheme for its managers and key employees, with the targets aligned with the financial goals assumed in the strategy. According to the scheme's rules, the company might distribute up to 29,160 warrants (40% to the management board, 60% to other key employees) in 2021-23 (20% annually in 2021-22, 60% in 2023), assuming that the company reaches adjusted EBITDA of PLN 29.5m in 2021 and PLN 33.5-40m in 2022-23E. Each 1% below the EBITDA target cuts the potential payout for incentive scheme participants by 4% of the warrants, with the condition that the realisation of less than 85% of the EBITDA target means no payout at all. On our forecasts, the warrants are unlikely to be issued, based on the 2023E results.

HyperPIC project can multiply VIGO's business scale

EC grants State aid of up to EUR 102.85m for development of HyperPIC

On 12 June, VIGO Photonics announced that the European Commission has approved the amount of State aid for the company's project, to develop and implement the technology of integrated photonic integrated circuits for detection in the mid-infrared range, to build a complete production line for photonic integrated circuits in the mid-infrared range and to create a complete supply chain for these systems. The project requires the development of new technologies, incurring significant investment and operational expenditures, as well as expenditures for the commercialisation of new products in a dynamic market.

The total value of eligible costs in the project is EUR 253.41m, and the maximum amount of State aid approved by the European Commission may amount to EUR 102.85m. Eligible costs in the project are expenditures on research and development works, expenditures on the construction of a new production line, and operating costs after launching a new production line.

The implementation of the project is planned for 2023-30 and consists of two phases:

- The R&D phase (2023-27) – the value of eligible costs in the R&D phase is EUR 34.19m.

- The first industrial deployment (FID) phase (2023-30), i.e., the first industrial implementation, including investments in a new production line and the implementation of new products for production, including financing part of the operating costs during implementation. The value of eligible costs in the FID phase is EUR 219.22m.

After the end of the FID phase, it is planned to start serial production (after 2030), under which no public funding will be provided for the project.

The company's management board anticipates that the eligible costs of the project, above the value of public funding, will be covered by the company's own funds and equity, from debt financing and/or, in particular in the FID phase, from other sources, such as strategic project partnership and/or off-balance sheet financing in the project finance formula.

Out of the financing sources listed by VIGO, we see equity raising and a strategic partnership as the two most probable. When it comes to a strategic partnership, we would see it as viable for VIGO to partner up with a potential buyer of the final product, as it might provide valuable feedback, develop its own products based on VIGO's PICs and, in the end, accelerate the commercialisation of the circuits.

The State aid was approved as part of the integrated European IPCEI ME/CT project (Important Projects of Common European Interest on Microelectronics and Communication Technologies). The decision on granting the company co-financing and determining the final amount of co-financing will be made as part of the competition procedure under the European Funds for Modern Economy (FENG) programme. Entities for which the European Commission has issued a positive decision, admitting aid, are able to apply for co-financing. The competition under the FENG programme was announced in 3Q23. The company submitted the documents at the local level at the end of November 2023. VIGO expects the final decision to be announced in the first months of 2024E. VIGO Photonics is the only Polish company included in the FENG programme.

Residual income model implies HyperPIC NPV of PLN 629m

In order to assess the impact of the HyperPIC project on VIGO Photonics' fair value, we estimate the NPV value of the project, in which the company has to spend a certain amount of capex in 2024-30 and, in the last year of the forecasts, gains an asset with a book value equal to the sum of the incurred investments and generating a certain ROE. Our valuation implies the NPV of the HyperPIC project at PLN 629m, as of 2023E. We emphasise the significance of the upside of the equity story that can be generated by the project – the NPV of PLN 629m materially exceeds VIGO's current market cap of PLN 393m and the 2023E fair value of the remaining business, which stands at PLN 455m, according to our DCF valuation.

In our analysis, we expect the total qualified costs assumed in the HyperPIC project to be spent by VIGO in the forecast period with 41/59% split between the State aid and own equity. We assume R&D costs to be incurred proportionately in the 2024-27 period, while the capex on the production line (First Industrial Deployment phase) to be concentrated around 2025-27.

We also conservatively assume that VIGO will use its own funds or strategic partnerships to provide financing for the project, so we use a cost of equity of 10.4% for discounting the cash flows related to the project. In order to estimate the HyperPIC project's present fair value, we use the residual income model, using the book value of the project based on the qualified costs, an adjusted ROE of 17.5%

(VIGO's average ROE in 2018-21, adjusted for the settlement of subsidies for grants and fixed assets and preferential income tax rate; we have skipped 2022 as the company's profitability was harmed temporarily by supply chain issues) and a 3% terminal growth rate for the project's income (in line with our terminal growth rate assumption for VIGO Photonics).

HyperPIC project capex assumptions (PLN m)

	2024E	2025E	2026E	2027E	2028E	2029E	2030E
R&D	37.6	37.6	37.6	37.6			
First Industrial Deployment	48.2	48.2	257.2	257.2	257.2	48.2	48.2
Total capex	**85.8**	**85.8**	**294.8**	**294.8**	**257.2**	**48.2**	**48.2**
Total state aid	34.8	34.8	119.7	119.7	104.4	19.6	19.6
Own capex	51.0	51.0	175.2	175.2	152.8	28.7	28.7
Discount factor	91%	82%	74%	67%	61%	55%	50%
PV of own capex	46.2	41.8	130.0	117.8	93.0	15.8	14.3
PV 2024-30E	**458.9**						

Source: WOOD Research

HyperPIC project NPV estimates (PLN m)

HyperPIC project final book value (PLNm)	**1,115.0**
PV final book value as of end-2023E (PLNm)	556.4
Assumed project's ROE (%)	17.5%
Terminal growth rate (%)	3.0%
Cost of equity (%)	10.4%
Residual income in terminal year (PLNm) = (ROE-COE)*final book value	79.2
Terminal value (PLNm) = Residual income in terminal year / (COE – Terminal growth rate)	1,064.0
PV TV as of end-2023E (PLNm)	531.0
PV TV and final book value as of end-2023E (PLNm)	1,087.4
PV of own capex as of end-2023E	-458.9
Fair value of HyperPIC as of end-2023E (PLNm)	**629**
Fair value of HyperPIC/share as of end-2023E (PLN)	**719**

Source: WOOD Research

As the ROE assumption in the residual income model is the most uncertain variable, we have checked our valuation and view on the project's value creation by applying the industry average ROE. According to our estimates, if we apply VIGO's broad peers' group average ROE of 12.5% in 2018-22 to our model, we would arrive at a HyperPIC project NPV of PLN 253m (PLN 289/share). A ROE of 12.1% (the average ROE of Hamamatsu and Teledyne, VIGO's closest peers) would imply an NPV of PLN 221m (PLN 252/share). We present our sensitivity estimates in the tables below. The application of the abovementioned ROEs results in an unimpressive NPV compared to the scale of the project, but we note that it means pairing an emerging market COE (with a constant risk free rate of 5.25%) with developed markets ROEs (VIGO's peers are based mainly in the US and Japan).

HyperPIC NPV sensitivity to ROE

	ROE	NPV 2023E (PLNm)	NPV 2023E/share (PLNm)
VIGO 2018-2021 adj. ROE	17.5%	629	719
2018-2022 avg. - Hamamatsu and Teledyne	12.1%	221	252
2018-2022 avg. - all photonic peers	12.5%	253	289

Source: WOOD Research

VIGO vs. photonic peers' ROE*

	2018	2019	2020	2021	2022	Average 5Y	Median 5Y
VIGO Photonics - adj. ROE**	**22.1%**	**18.4%**	**15.5%**	**14.1%**	**2.7%**	**14.6%**	**15.5%**
VIGO Photonics - reported ROE	**27.3%**	**22.7%**	**38.6%**	**26.3%**	**5.4%**	**24.1%**	**26.3%**
Hamamatsu Photonics	11.3%	10.1%	7.9%	11.1%	16.5%	11.4%	11.1%
Teledyne Technologies	16.0%	16.3%	13.5%	8.2%	10.0%	12.8%	13.5%
Visual Photonics Epitaxy	14.8%	19.2%	18.6%	27.7%	17.1%	19.5%	18.6%
Coherent	9.1%	10.0%	-4.2%	10.3%	5.4%	6.1%	9.1%
Ipg Photonics	19.1%	7.8%	6.4%	10.4%	4.3%	9.6%	7.8%
Optex Group	12.3%	6.8%	4.3%	11.1%	12.7%	9.4%	11.1%
Nippon Ceramic	5.8%	5.4%	4.4%	5.8%	10.3%	6.3%	5.8%
Focused Photonics Hangzhou	18.1%	1.2%	13.8%	-6.4%	-11.1%	3.1%	1.2%
Visual Photonics Epitaxy	14.8%	19.2%	18.6%	27.7%	17.1%	19.5%	18.6%
Amphenol	30.1%	27.0%	24.3%	27.2%	28.6%	27.4%	27.2%
Peers' average	15.1%	12.3%	10.7%	13.3%	11.1%		
Peers' median	14.8%	10.0%	10.7%	10.7%	11.5%		

*Source: Company data, Bloomberg, WOOD Research; *WOOD's estimates for VIGO, Hamamatsu and Teledyne and Bloomberg calculations for other peers; **VIGO's ROE based on net income adjusted for the settlement of subsidies for grants and fixed assets and the preferential income tax rate*

Residual income model NPV sensitivity analysis (PLN m)

		ROE						
		8.5%	11.5%	14.5%	**17.5%**	20.5%	23.5%	26.5%
Terminal growth rate (%)	1.50%	-21	166	353	539	726	913	1,100
	2.00%	-28	170	368	566	763	961	1,159
	2.50%	-36	175	385	595	805	1,016	1,226
	3.00%	-45	180	404	**629**	853	1,077	1,302
	3.50%	-55	186	426	667	907	1,148	1,389
	4.00%	-67	192	452	711	970	1,230	1,489
	4.50%	-81	200	482	763	1,044	1,325	1,606
		ROE						
		8.5%	11.5%	14.5%	**17.5%**	20.5%	23.5%	26.5%
Risk free rate (%)	6.75%	-124	46	216	386	556	726	896
	6.25%	-101	84	270	456	641	827	1,013
	5.75%	-75	128	332	536	739	943	1,147
	5.25%	-45	180	404	**629**	853	1,077	1,302
	4.75%	-8	240	489	737	985	1,234	1,482
	4.25%	36	312	588	865	1,141	1,417	1,694
	3.75%	89	398	707	1,017	1,326	1,635	1,945

Source: WOOD Research

We note that we have decided to keep the HyperPIC project results and impact on the valuation out of our model for now, for two main reasons:

- The uncertain financing of the project. We believe that the project should be financed primarily through equity raises and strategic partnerships. At this stage, it is difficult to assume the potential issue price and details of the profit-sharing conditions with potential partners. Considering that the company is also pursuing other opportunities (for instance, infrared arrays), and the profits in the HyperPIC project should be rather back-loaded, we do not see any significant opportunity for VIGO to finance the project with debt.

- The uncertain timing of the results. VIGO should start generating revenues on the PICs from 2028E, we believe, as we expect the majority of the production line related capex to be incurred by 2027E. The size of the potential market five years from now, as well as the pace of the PICs adoption is, however, difficult to estimate.

In view of the aforementioned issues, we see a simplistic residual income model, based on historical, photonic industry ROEs, as the optimal approach for an innovative venture-like project like HyperPIC. Simultaneously, we have tried to present a conservative approach to the valuation: we use a relatively high COE (with a constant risk free rate of 5.25%) and assume the HyperPIC segment becomes fully operational as late as in 2031E.

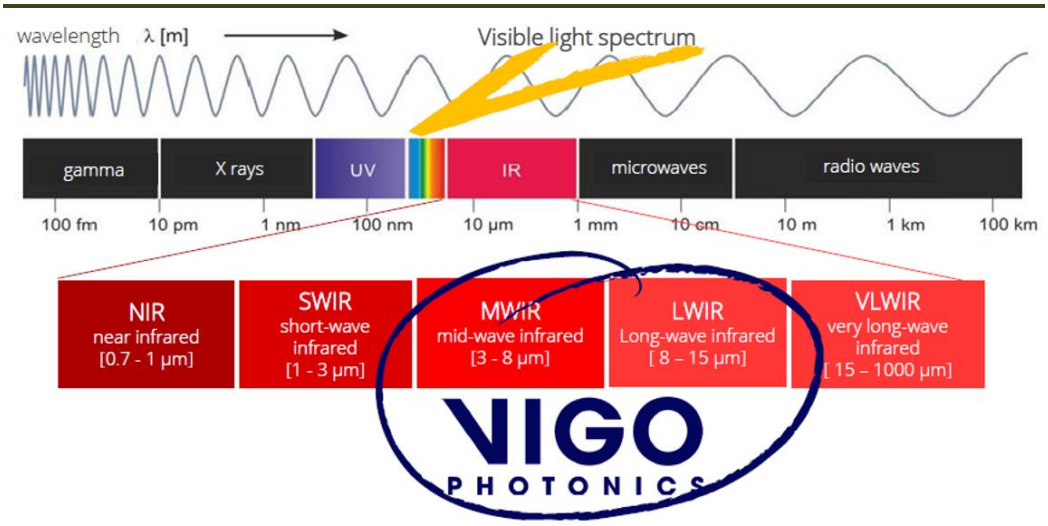
Considering that the company has successfully raised funding through series F shares (aimed, among other things, at financing the initial phase of the HyperPIC project) and, in order to accurately present the upcoming capex, we have included PLN 25-40m of R&D outlays related to the project in 2024-25E. However, in order to be consistent in terms of valuation (as we do not include any potential income from the project in our model, at this stage), we exclude the capex from our DCF valuation.

Sensors based on PICs will be smaller, cheaper and more efficient

A photonic integrated circuit (PIC) is a device that integrates multiple optical components (polarizers, phase shifters, waveguides) and functions on a single chip or substrate, similar to how electronic integrated circuits integrate various electronic components (resistors, inductors, transistors, capacitors). Instead of manipulating electrical signals, PICs manipulate light signals to perform a wide range of optical functions.

PICs technology has been commercialised already in the short IR wavelength, which is used in the telecommunications industry. The PICs that VIGO aims to develop in the HyperPIC project should operate in a wavelength range of 2-12 micrometres, which covers mid- and longwave infrared (according to the classification used by VIGO) – the range used for gas sensing, chemical spectroscopy, environmental monitoring, and biomedical diagnostics. By targeting the mid-IR range, the PICs developed by VIGO can address these applications. We emphasise that the technology is not yet available in the market, so VIGO could be the first company in the world with such an IP.

Optical radiation diagram



Source: VIGO Photonics

PICs will allow sensory systems that can be integrated into everyday consumer devices to be developed, i.e., smart sensors installed in wearable devices (i.e., smartwatches with health monitoring, including blood pressure, diabetes, etc.), advanced medical equipment (i.e., for blood testing), home appliances, monitoring pollution levels, detecting spoiled food, etc. The mid-IR PICs can also be applied to agriculture, autonomous driving (as replacement of LIDAR solutions), and sensing devices for aerospace and aeronautics.

VIGO Photonics: PIC initiative key assumptions

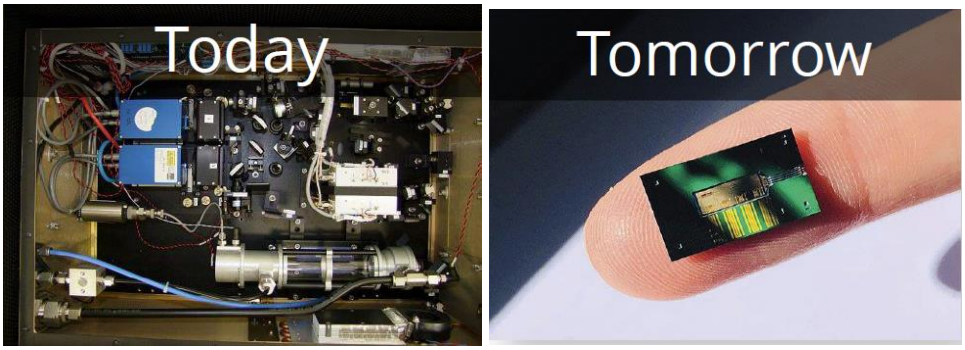
Product	Production method	Target volume	Price:	Applications	Sectors
Optoelectronic systems and photonic Integrated Circuits (PIC)	Different components made using different technologies	>10m sensors annually	EUR 10/piece	Analyses of the chemical composition of gases, analysis of impurities in liquids, gas detection, FSO (free space communication), analyses related to medicine and telemedicine: blood analysis	Industry and transport, environment protection, food industry, biomedicine, telecoms, protection and security, medicine, automotive, IOT, space industry

Source: Company data, WOOD Research

Mid-IR PICs should have numerous advantages over current photonic systems, comprised of discrete components, such as:

- Compact size – the integration of multiple components onto a single chip results in compact and miniaturised systems. Mid-IR PICs enable a reduction in size and weight compared to traditional components. This makes them suitable for portable, handheld, and low-power applications.

Gas sensor miniaturisation thanks to PIC application



Source: VIGO Photonics

- Scalability and cost-efficiency: photonic integration allows for the scalability and high-volume manufacturing of devices. Mid-IR PICs can be fabricated using established semiconductor manufacturing processes, making them compatible with mass production techniques. This scalability and manufacturability enable the cost-effective production and widespread adoption of mid-IR PIC-based devices, thanks to which their price for final customers can be materially lower than traditional integrated circuits.

- Lower energy consumption.

- Less heat emission (no need for a cooling system or special shielding).

- Increased processing speeds.

Target production value at a couple of hundred EURm

The target market for HyperPIC is difficult to estimate as this kind of solution for sensing based on mid-IR spectrum has not been commercialised yet. In its presentations, VIGO approached the market value assessment by looking at the current market of non-PIC based sensor systems (based on the following reports: Mid-Infrared Photodetectors And Systems: Market Study, 2018; Interband & Quantum Cascade Lasers Technologies, Market Trends And Application, Tematys, 2020). By using this approach, the company estimated a market value of USD 1.5bn and an expected CAGR of 12%.

The market reports on PIC might not properly reflect the opportunity for HyperPIC, as the vast majority of the market currently comprises solutions for telecommunications; however, we note that the growth drivers pointed out in the reports are similar to the applications of HyperPIC, like miniaturisation, application to sensors, the automotive industry, medicine, etc.:

- Based on P&S Intelligence research from July 2022, the global photonic integrated circuits market should expand from USD 7.6bn in 2021 to USD 41.0bn in 2030E (a 20.5% CAGR), driven by demand from telecommunications, biomedical, and data centre facilities, a shift towards automation in various industries and autonomous vehicles, and the miniaturisation of electronic devices.

- According to a Future Market Insights report from July 2022, the global PIC market should expand from USD 1.1-1.3bn in 2021-22 to USD 9.4bn in 2032E (a 21.5% 2022-32E CAGR), driven by the expansion of the optical communications segment, but also other photonic integration solutions, such as quantum, sensing, and medical optics.

In terms of the growth outlook, we have gathered market research for some of the potential applications for PICs, like IOT sensors and, more specifically, gas and wearables sensors, for which HyperPIC should be the most efficient solution:

- According to a research report by Market Research Future, from June 2023, the IoT sensor market should expand from USD 38.25bn in 2022 to USD 51.19b in 2023E and USD 141.8bn in 2030E (a 17.8% 2023-30E CAGR), due to miniaturisation (smaller sensors being applied to smartphones, drones, wearables, robotics), increasing demand from smart home solutions and building automation systems, expanding industrial applications (process control, asset tracking), and increasing the use of sensors in industries such as healthcare, manufacturing, and transportation.

- According to a Markets and Markets report, from September 2022, global gas sensors market should expand from USD 1.4bn to USD 2.1bn by 2027E (an 8.9% CAGR), driven by the implementation of various health and safety regulations across the world, the increased adoption of gas sensors in HVAC systems and air quality monitors, and increased air pollution levels and the need to monitor air quality in cities.

- A Straits Research report from 2022 estimates the global wearable sensors market value at USD 840m in 2021, and assumes its expansion to USD 3.7bn by 2030E (an 18.3% CAGR).

We note that, nominally, the total addressable market for HyperPIC should be smaller than the currently used solutions, considering that the technology should be significantly cheaper. However, the expected growth rates, especially considering the scalability and cost efficiency of PIC, should be achievable or even conservative.

In its presentations, VIGO assumes that mid-IR PICs target capacity production should exceed 10m sensors/annually, each priced at c.EUR 10. These assumptions may be too conservative as well, considering that the company published them before the announcement of the maximum State aid for the project. Nevertheless, VIGO's target annual PIC production value should reach a couple of hundred EURm, based on the publicly-known assumptions.

HyperPIC project risks: final efficiency and potential delays

According to VIGO Photonics, the development of HyperPIC technology is certain, and is a matter of time and financing. The main risk is, however, the timing of the technology development, its final efficiency and its commercialisation success.

We note that the company has experience in this matter as, since 2021, it has been working on the MIRPIC R&D project. The project, with a lead time of three years and a budget of PLN 29.3m (of which PLN 26.6m in co-financing), was realised in cooperation with the Warsaw University of Technology and the Institute of Microelectronics and Photonics.

M&A in the photonic industry: VIGO can be either an acquirer or a target

VIGO Photonics may be interested in potential acquisitions as, according to its strategy, this could accelerate its entry into new product segments: the company has noted especially manufacturers of mid-infrared sources. We, however, also believe that VIGO Photonics could become an acquisition target, as it holds a unique, hard to copy technology, high-quality products and a global presence. The company has noted that it observed levered investment activity in the photonics industry in 2018-22, in terms of both M&A and SPO/IPOs, driven by consolidation and vertical integration around market leaders – VIGO noted the trend of business investors (especially from the automotive industry) purchasing entities from photonics (biosensors and LIDARs producers). Moreover, we note that the recent crisis in the chip market shows the weakness of the semiconductor industry in the EU and the model, which is based on fabless manufacturing, i.e., outsourcing chip production to players in Asia. This can be especially risky, considering the current political tensions in the region; therefore, we believe that a need to move the production chain back to the Western markets might arise and drive demand for the local players. Due to a potential conflict between China and Taiwan, a country that now accounts for >50% of semiconductor production worldwide, Western governments want to build up their own production capacity in these key industries.

Based on the data from Mergermarket, we identified 55 M&A in the broad global photonics industry in 2018-22. In the table below, we present seven selected M&A, for which we have managed to find/calculate transaction multiples. In the selected group, the median transaction EV/sales stood at 2.5x, while the EV/EBITDA at 14.5x.

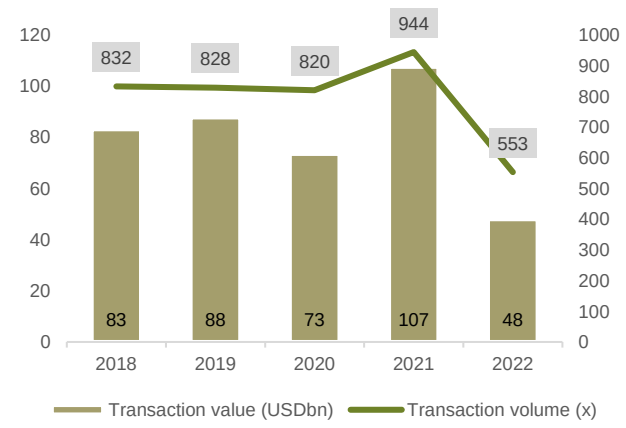
Selected M&A in photonics in 2018-22

Date	Bidder	Target	Implied EV (USDbn)	EV/sales	EV/EBITDA	Target description
Jul-22	II–VI Inc.	Coherent	6.6	4.4	n.a.	Laser manufacturer
May-21	Teledyne Technologies	FLIR Systems	8.2	4.3	19.9	Producer of infrared thermal imaging systems.
Jul-20	Materion	Optics Balzers	0.2	2.4	12.3	Liechtenstein-based provider of customised optical thin-film coatings and components for the photonics industry.
Jul-20	ams	Osram	4.9	1.2	27.7	Germany-based company engaged in the field of lighting fixtures.
Mar-20	TE Connectivity	First Sensor	0.3	2.0	14.5	Germany-based company manufacturing sensors, detectors and emitters.
Sep-19	II–VI Inc.	Finisar	3.2	2.5	n.a.	Manufacturer of optical communication components and subsystems.
Mar-18	Lumentum Holdings	Oclaro	1.8	3.0	12.9	Producer of optical components and modules for the long-haul, metro, and data centre markets.
Median				**2.5**	**14.5**	

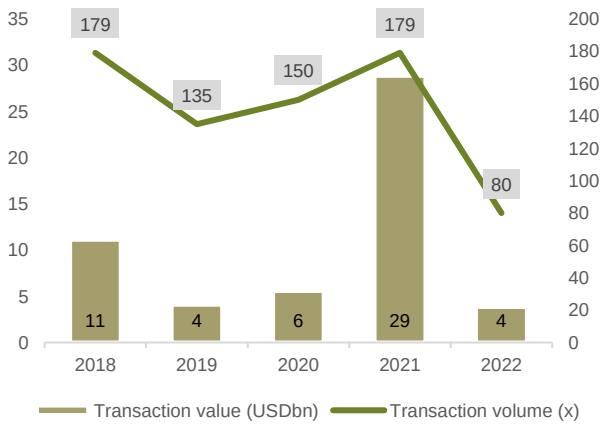
Source: Mergermarket, WOOD Research

According to CERES research, on M&A, the global photonics market saw a slowdown in 2022 vs. previous years due to macro uncertainty (inflation and rapid interest rate hikes), geopolitical instability in Europe and China, losses in both the equity and bond markets, supply chain risk and labour shortages. In the whole of the 2022 global M&A market, the company identified 49,633 announced transactions (down 14% yoy) worth USD 3.1trn (down 33% yoy). Of this, CERES identified 553 transactions (down 41% yoy), with a reported value of USD 48bn (down 55% yoy) in the photonics industry and vertical markets employing photonics technologies as core differentiators. In the pure photonics industry, according to CERES data, there were 80 transactions in 2022, worth USD 4bn.

M&A in photonics and related industries*



M&A in the photonics segment



*Source: Ceres "2022 Mergers & Acquisitions in Photonics", WOOD Research; *Photonics, IT, Energy, Defense Security and Sensing, Biophotonics, Advanced Manufacturing*

Based on CERES data and our estimates, the average transaction EV/EBITDA in the broad photonics and related industries market stood at 13.4x in 2018-22 (based on 108 deals, in which the majority stake was acquired and the details regarding the financials and the transaction prices were known); while, in the pure photonics segment, 14.4x (based on 23 deals).

The highest multiples for acquisitions of 100% shares in the broad photonics market were: Oxford Instruments (27.1x), provider of atomic force microscopy, optical imaging, spectrometer, nuclear magnetic resonance, scientific camera and x-ray source products (UK); CyberOptics Corporation (17.9x), supplier of high precision sensing technology metrology solutions (US); Yunex GmbH (17.6x), provider of hardware, software, Internet of Things devices and advanced modular traffic management solutions (Germany); Maxar Technologies Inc. (NYSE:MAXR) (14.2x), provider of earth intelligence and space infrastructure solutions (US); and Tower Semiconductor Ltd. (NasdaqGS:TSEM) (12.2x), an independent semiconductor foundry providing customisable process technologies, including CMOS image sensors (Israel).

Market outlook: infrared detectors global sales to expand at 7-10% CAGR

According to five different market research sources (detailed in the table below), the value of the global infrared detector market is estimated at around USD 0.5bn, while its long-term CAGR is expected to reach 7-10%. The market is a niche one: according to Fact.MR, the global sensors market value stood at USD 180bn in 2020, while the IR detectors share accounted for only 0.23%, but the company expects this share to increase going forward. VIGO Photonics is focused on an even narrower niche of mid-wave infrared detectors, which contribute c.20-25% of the global IR detectors market (based on the company's estimates and external research). In its niche, VIGO competes with three other main mid-infrared detectors providers: Teledyne Judson, Infrared Associates, and Hamamatsu (for details, please see Appendix 2 at the end of this report).

Global infrared detectors market value forecasts

Source	Research date	Forecast period	Current market value (USDm)	Target market value (USDm)	CAGR (%)
IMARC Group	Jan, 2023	2023-2028	483 (2022)	806 (2028)	8.90%
Knowledge Sourcing Intelligence	Aug, 2022	2021-2027	507 (2020)	837 (2027)	7.44%
Emergen Research	Jun, 2022	2022-2030	441 (2021)	785 (2030)	6.60%
Fact.MR	Jan, 2022	2022-2031	463 (2021)	968 (2031)	7.70%
Maximize Market Research (MMR)	Jan, 2023	2022-2029	422 (2021)	892 (2029)	9.80%

Source: WOOD Research

According to Transparency Market Research (publication from March 2023), the global mid-infrared laser market should record a CAGR of 9.6% from 2023 to 2031E, and reach USD 2.2bn by 2031E (from c.USD 1bn in 2022). The company sees demand for compact mid-infrared laser instruments with a broad spectral range in high-end IR applications, especially medical, defence and aerospace.

The global photonic integrated circuits market (based on P&S Intelligence research from July 2022) should expand from USD 7.6bn in 2021 to USD 41.0bn in 2030E (a 20.5% CAGR), driven by demand from telecommunications, biomedical, data centre facilities, a shift towards automation in various industries and autonomous vehicles, and the miniaturisation of electronic devices.

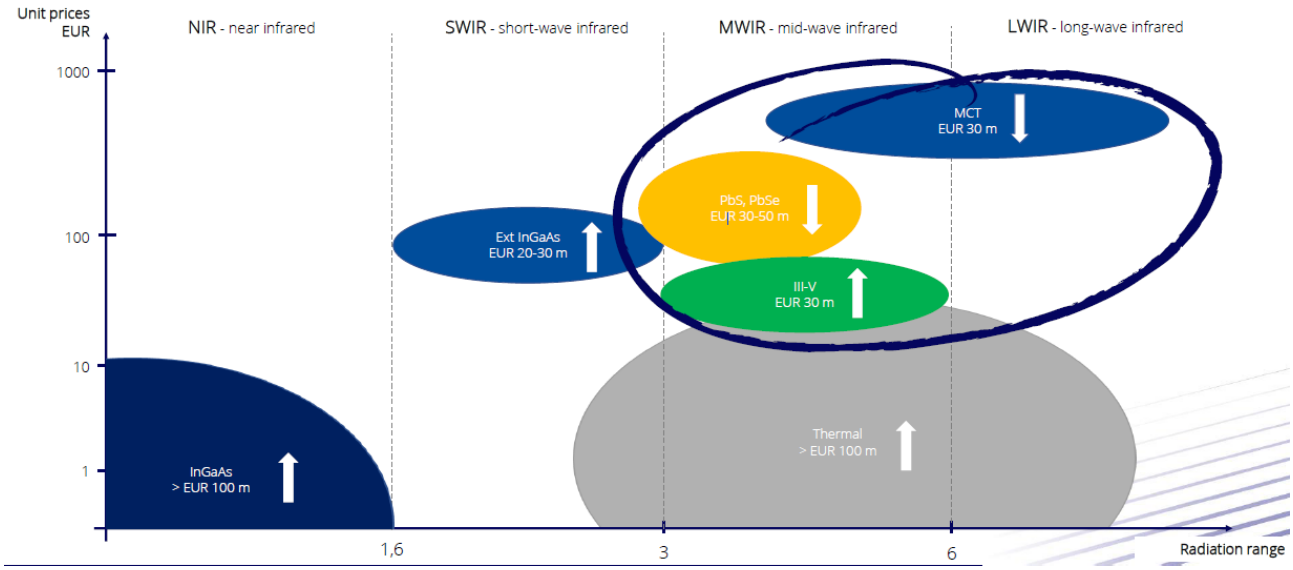
The expected long-term growth rates in the studied research pieces broadly match (or are slightly below) the growth rates quoted/estimated by the company for its specific product lines. We present the company's expectations in the table below.

VIGO Photonics: market size and competitive environment per segment (new initiatives highlighted with grey)

Product	Market value*	Market growth potential**	Competition
MCT detectors and detection modules	USD 40m	9% CAGR	Teledyne Judson, Infrared Associates, Hamamatsu
III-V InAsSb detectors and detection modules	USD 30m	>20% CAGR	Hamamatsu, Teledyne Judson, Asahi Kasei
III-V InGaAs detectors and detection modules	USD 150m whole market, USD 30m extended InGaAs market	>10% 2021-25E CAGR	Hamamatsu, Teledyne Judson, Laser Components, Thorlabs, OSI Optoelectronics
III-V epitaxy: semiconductor materials	USD 2.6bn	13% 2020-2027 CAGR	IQE, AMS, II-VI Inc., Intelli Epi
Mid-infrared sources	USD 61m	10% 2020-2026 CAGR	Hamamatsu, Thorlabs, Nanoplus, Daylight Solutions, Mirsense, Alpes Laser
Optoelectronic systems and photonic Integrated Circuits (PIC)	USD 1.5bn	12% CAGR	Redfinch, CEA-LETI, Picpair, Rockley, Brolis, NeoSpectra, Hamamatsu
Infrared array	EUR 15m (PL market)	n.d.	Lynred, Irnova, Hamamatsu, large armaments companies

*Source: Company data, WOOD Research; *Mid-Infrared Photodetectors and Systems: Market Study, 2018; Epitaxial Wafer Market For Compound Semiconductor, Allied Research, 2020; **Interband & Quantum Cascade Lasers Technologies, Market Trends And Application, Tematys, 2020, company estimates*

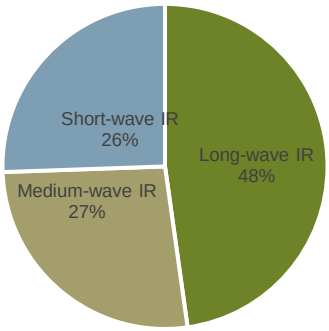
IR detectors global market structure



Source: VIGO Photonics

Based on the spectral range, the Infrared Detector Market is segmented into long-wave IR, medium-wave IR (in which VIGO Photonics is present), and short-wave IR. According to MMR, long-wave IR is expected to hold the maximum market share due to the high demand for long-wave IR from the defence and military industries for security and surveillance application. Moreover, the cost of long-wave IR products is lower than short-wave and medium-wave. According to an Allied Market Research report from December 2016, long-wave IR detectors dominated the global market, due to their ability to sense thermal signs and provide excellent detection capability in low-light-level conditions.

IR detectors market by spectral range, 2021 (%)

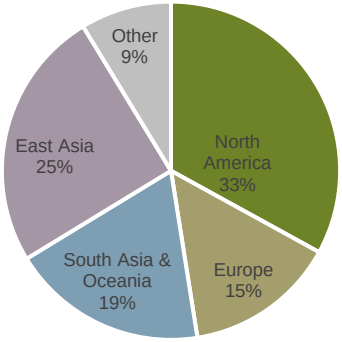


Source: WOOD Research, maximizemarketresearch.com (Infrared Detector Market – Global Industry Analysis and Forecast (2022-29))

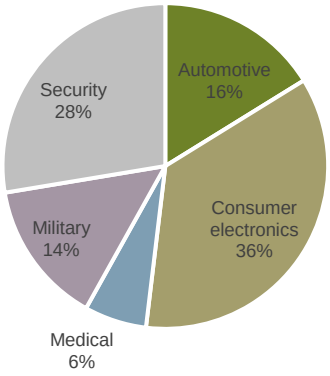
In terms of geographic split, Fact.MR estimates North America to be the largest IR detector segment (contributing to c.33% of the global market value), due to the rising demand in the US, followed by Asia (mainly China, which Fact.MR expects to dominate the global market in terms of the volume of exports, due to high production volumes and low pricing) and Europe.

In terms of industries, the biggest components of the global IR detectors market are consumer electronics (36%), followed by automotive (16%) and security (28%).

IR detectors market by region, 2021 (%)



IR detectors market by industry, 2021 (%)



Source: WOOD Research, maximizemarketresearch.com (Infrared Detector Market – Global Industry Analysis and Forecast (2022-2029))

All the research companies see increasing demand for motion- and people-sensing devices, smart home solutions, IOT devices, as well as increasing product utilisation in the military industry, industrial plants and the automotive industry as the main drivers of the market:

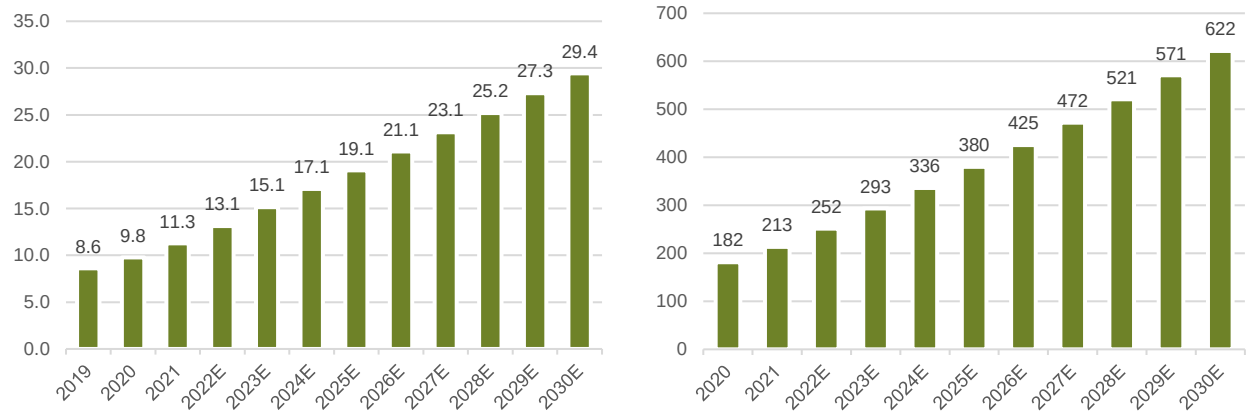
- **Wearable devices:** infrared motion sensors are being used in wearable devices, such as bands and smartwatches, to track heart rate, steps, and oxygen levels, to aid personal health monitoring. The company sees the development of wearable lab-on-chip (device able to measure glucose, lactic acid, and ethanol levels) as a potential driver for the infrared detectors market growth. The current solutions are based on the visible spectrum and short infrared; according to VIGO, the development of MIR PICs will boost the possibilities of the devices significantly.
- **Automotive:** the growing adoption of autonomous cars should drive demand for IR detectors, especially new generation LIDAR sensors, thermographic cameras, and in-cab sensors.
- **Defence:** the current geopolitical situation may influence the need for increased security in countries including those in Western Europe – the company expects growing interest in detectors from the defence sector.
- **IOT market:** IR detectors are used in various IoT devices for detecting the presence of objects, measuring temperature, and detecting motion. The growth of the IOT market should drive the demand for IR detectors.

IOT market growth outlook: 13% CAGR by 2030E

According to Statista's data (research published in July 2022), the number of Internet of Things devices worldwide should almost triple from 9.8bn in 2020 to more than 29bn in 2030E. According to Statista's research, the value of the global IOT market should expand from USD 181.5bn in 2020 to USD 621.6bn in 2030E (a 13% 2020-30E CAGR).

Major industry verticals, with currently more than 100m connected IoT devices, are electricity, gas, steam and A/C, water supply and waste management, retail and wholesale, transportation and storage, and government. The total number of IoT devices across all industry verticals is forecast by Statista to grow to more than 8bn by 2030E. The most important use case for IoT devices in the consumer segment is consumer internet and media devices, such as smartphones, where the number of IoT devices is forecast to grow to more than 17bn by 2030E. Other use cases with more than 1bn IoT devices by 2030E are connected (autonomous) vehicles, IT infrastructure, asset tracking and monitoring, and the smart grid. Statista expects the consumer segment value share in the global IOT market to expand from 35% in 2020 to 45% in 2030E.

Global IOT market forecasts by volume (lhs, bn units) and sales value (rhs, USD bn)



Source: Statista in cooperation with Transforma Insights (July 2022), WOOD Research

Polish army modernisation plan to drive demand for infrared detectors

According to the Polish army modernisation plan for 2021-35, approved in 2019 and later updated by the Homeland Defence Act in 2022: from 2023, Poland is to spend at least 3% of its GDP on defence; in 2021-35, it plans to spend PLN 524bn on new military equipment, and it has set a target of doubling the size of the armed forces from 150,000 to 300,000 personnel. In 2023, Poland was about to spend a total of PLN 137bn (c.4.2% of the GDP, according to the government's estimates).

In the plan, the Polish government assumes the purchase of 96 KRABs (a self-propelled tracked gun-howitzer), 672 K9s (a 155mm self-propelled tracked gun-howitzer), 1,400 BORSUK infantry fighting vehicles, 64 RAK self-propelled mortars, 1,000 K2 tanks, and 70 remotely controlled ZSSW-30 turret systems integrated with the SPIKE-LR anti-tank guided missile launcher for the purposes of integration with the ROSOMAK wheeled armoured personnel carriers.

The agreement regarding the purchase of equipment from Korea (the K2 tanks and the K9 gun-howitzers) includes the transfer of technology, as a result of which industrial capabilities will be established in the area of armoured technology, which will allow for the acquisition of service competences in the first stage and the final launch of the production of K2 tanks and K9 gun-howitzers in Poland, and thus the polonisation of the spare parts and supply chains.

We note that all the tanks and armoured vehicles can be equipped with the OBRA-3 Laser warning system, which utilises infrared detectors for the detection of vehicles and military objects' radiation from impulse rangefinders or laser illuminators.

Apart from the demand from the Polish army, we expect VIGO to benefit from increased spending on army modernisation in Western countries. We note that, in its annual report, Safran, VIGO's biggest client, pointed out that 2022 brought sharp increases in defence and space budgets in Europe and internationally, against the backdrop of the war in Ukraine and the global geopolitical tensions: for example, the US, the largest defence spender, announced a budget of nearly USD 800bn for 2023 (up 8% yoy), and France a EUR 400bn budget for the French army for the 2024-30 period.

According to Jane's Defense (24 January 2023), Indonesia is in talks with Safran for the potential acquisition and domestic assembly of Hammer missiles (Indonesia ordered France 42 Rafale fighters in 2022, in a USD 8.1bn deal). In our view, future defence exports by the French Dassault and Safran groups may result in further sensor and detector orders for VIGO.

RoHS directive limits usage of MCT detectors in the EU

VIGO's performance and strategy is affected by regulations, especially the RoHS directive (Directive 2011/65/EU of 8 June 2011), who phases out certain uses of some hazardous substances in electrical and electronic equipment placed on the EU market. Among the hazardous substances are mercury and cadmium, which are contained in cadmium mercury telluride (HgCdTe), a basic semiconductor material for mid-infrared detectors.

In order to minimise the possible negative implications of the regulations, VIGO has diversified its portfolio with III-V infrared detectors that are RoHS compliant. Moreover, the company wants to keep developing sales of the old type MCT detectors in geographies (US, Asia) and industries (military, space) that are RoHS exempt.

Pursuant to the RoHS directive, mercury and cadmium in infrared detectors are exempt from the restrictions of the directive:

- Until 21 July 2021 for medical devices.

- Until 21 July 2023 for in vitro diagnostic medical devices.

- Until 21 July 2024 in the case of control and measuring equipment for industrial use.

The directive does not cover military or space applications.

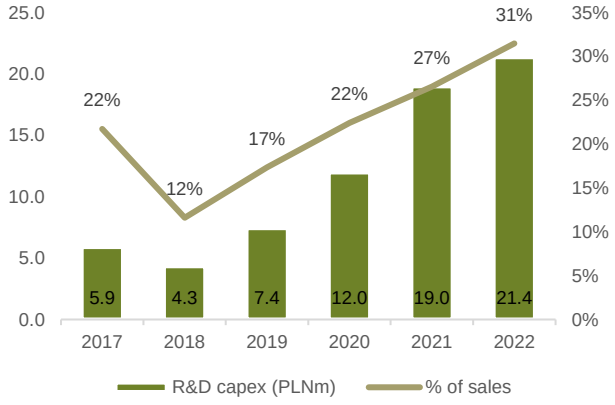
The directive provides for the possibility to apply to the European Commission for an extension of the above deadlines in the event that technical progress does not render it possible to find reliable substitutes for the above substances. VIGO has applied to the EC for an extension of the transition period for medical devices. Similar requests have also been made by other manufacturers of equipment using HgCdTe detectors. The applications are being examined currently. In March 2022, a report commissioned by the European Commission was published, assessing the applications submitted for extending the transition periods. According to this report, the consultant recommends extending the possibility of using HgCdTe detectors in all three of the above applications until 21 July 2028.

Further R&D co-financing likely, due to supportive regulatory framework

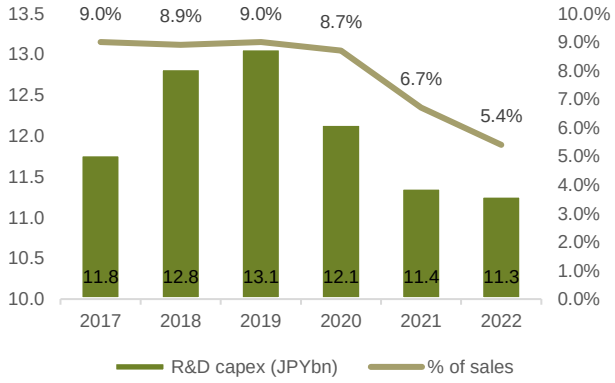
VIGO benefits materially from the subsidies/co-financing of R&D. As a technological company, VIGO invests a substantial share of its total capex in R&D: in 2022, the company spent PLN 21.4m on R&D, i.e., 31% of sales/45% of total capex. In 2022, VIGO's R&D department was the second-largest in the company – it employed a team of 63 scientists.

To compare, one of its closest peers, Hamamatsu, in the financial year ending September 2022, spent JPY 11.3bn, or c.PLN 0.4bn (5.4% of sales); while, according to its 2021 report, Hamamatsu employed 5,279 people, out of which the R&D personnel share stood at c.10% (i.e., over 500 people). A significant part of VIGO's R&D expenses are covered by subsidies: the co-financing contribution to the R&D capex stood at 93% in 2017-22.

VIGO Photonics: R&D capex evolution

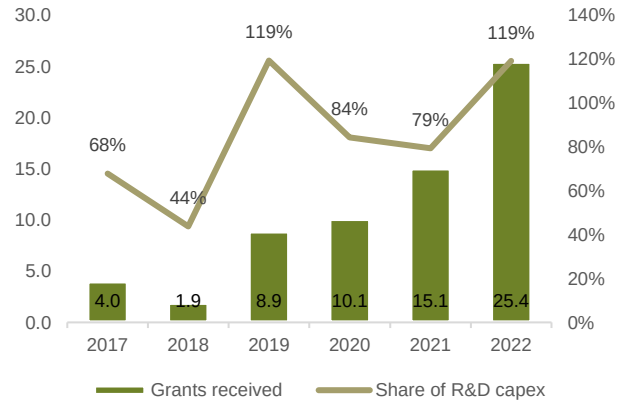


Hamamatsu: R&D capex evolution*

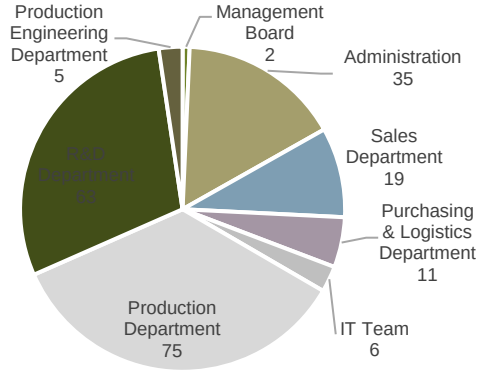


*Source: VIGO Photonics, Hamamatsu, WOOD Research; *financial years ending in September*

VIGO Photonics: grants received



VIGO Photonics: employment structure in 2022



Source: Company data, WOOD Research

Further R&D co-financing likely, due to the supportive regulatory framework. The global chip shortage, which started in 2020 during the COVID-19 lockdowns, has pushed Western economies towards considering supporting the development of local semiconductor supply chains in order to avoid potential shortages in the future. We see this as an opportunity for VIGO to secure further financing for its production capacity development and R&D projects.

In February 2023, the EU Parliament set its negotiating position on two draft bills: one on the "Chips Act", which aims to bolster technological capacity and innovation in EU chips; and a second on the Chips Joint Undertaking, to increase investments for developing this type of European presence. The next steps will consider negotiations with the Council on both acts.

Currently, according to EC data, on average, almost 80% of suppliers to European firms operating in the semiconductor industry are headquartered outside the EU, while only 10% of the global production capacity is located in Europe.

The main aim of the Chips Act is to double the European global market share in semiconductors from 10% currently to at least 20% by 2030E, in order to ensure the EU's future technological sovereignty.

The act also aims to strengthen Europe's research and technology leadership towards smaller and faster chips, build and reinforce capacity to innovate in the design, manufacturing and packaging of advanced chips, develop an in-depth understanding of the global semiconductor supply chains, address the skills shortage, attract new talent and support the emergence of a skilled workforce.

In order to achieve that, the act proposes:

- Investments in next-generation technologies.

- Providing access across Europe to design tools and pilot lines for the prototyping, testing and experimentation of cutting-edge chips.

- Certification procedures for energy-efficient and trusted chips to guarantee quality and security for critical applications.

- A more investor-friendly framework for establishing manufacturing facilities in Europe.

- Support for innovative start-ups, scale-ups and SMEs to access equity finance.

- Fostering skills, talent and innovation in microelectronics.

- Tools for anticipating and responding to semiconductors shortages and crises to ensure security of supply.

- Building semiconductor international partnerships with like-minded countries.

The Chips Act assumes the mobilisation of more than EUR 43bn of policy-driven investments, and setting measures to prepare, anticipate and swiftly respond to any future supply chain disruptions, together with Member States and international partners.

The Chips Act, according to the EC, should result in additional public and private investments of more than EUR 15bn, complementing existing programmes, and action in research and innovation in semiconductors, such as Horizon Europe and the Digital Europe programme, as well as announced support from Member States.

The semi-conductor industry is also supported by national investment plans in other geographies:

- In June 2021, the US administration approved a USD 52bn investment plan for domestic semiconductor manufacturing.

- South Korea has approved up to USD 65bn in support for the semiconductor supply chain by 2030E, with an ambition to attract more than USD 450bn of investment from the private chip sector. The support also includes tax incentives and relaxed regulations.

- China has increased its investments in semiconductors (in 2020, China's investments into semiconductor companies reached RMB 227.6bn, or c.USD 35.2bn, based on EC data).

IPCEI ME/CT. Another project that supports semi-conductor producers in Europe is IPCEI ME/CT – the Project of Common European Interest in Microelectronics and Communication Technologies. The project was jointly prepared and notified by 14 EU Member States: Austria, Czechia, Finland, France, Germany, Greece, Ireland, Italy, Malta, the Netherlands, Poland, Romania, Slovakia and Spain.

The IPCEI ME/CT concerns research and development projects covering microelectronics and communication technologies across the whole value chain, from materials and tools, to the chip designs and manufacturing processes. The Member States will provide up to EUR 8.1bn in public funding, which is expected to unlock an additional EUR 13.7bn in private investments. As part of this IPCEI, 56 companies, including small and medium-sized enterprises and start-ups, will undertake 68 projects.

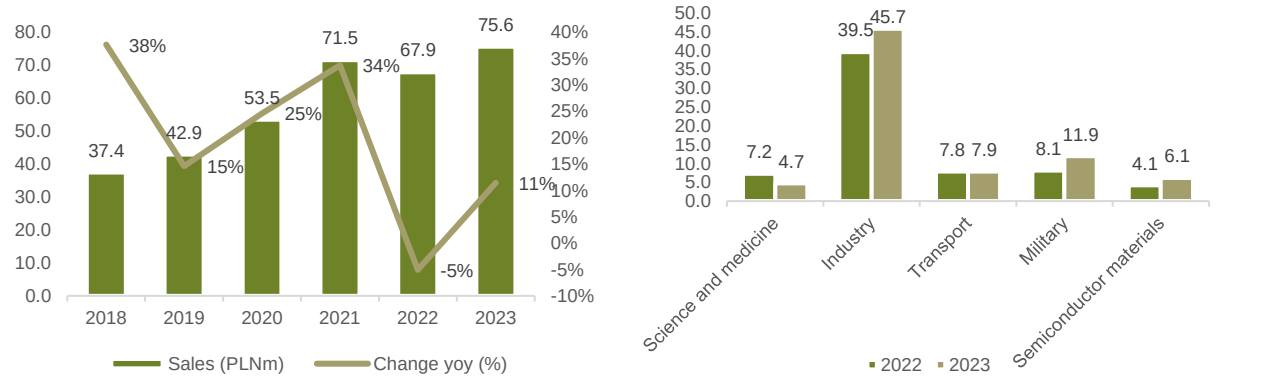
IPCEI ME/CT follows and complements the first IPCEI to support research and innovation in the field of microelectronics, approved by the Commission in December 2018.

We note that the State aid (of EUR 103m) for VIGO, approved by the EC (described in a separate paragraph, earlier in this report), was part of the IPCEI ME/CT project.

Solid 2023 results, after 2022 harmed by supply chain issues and reduced orders from Safran

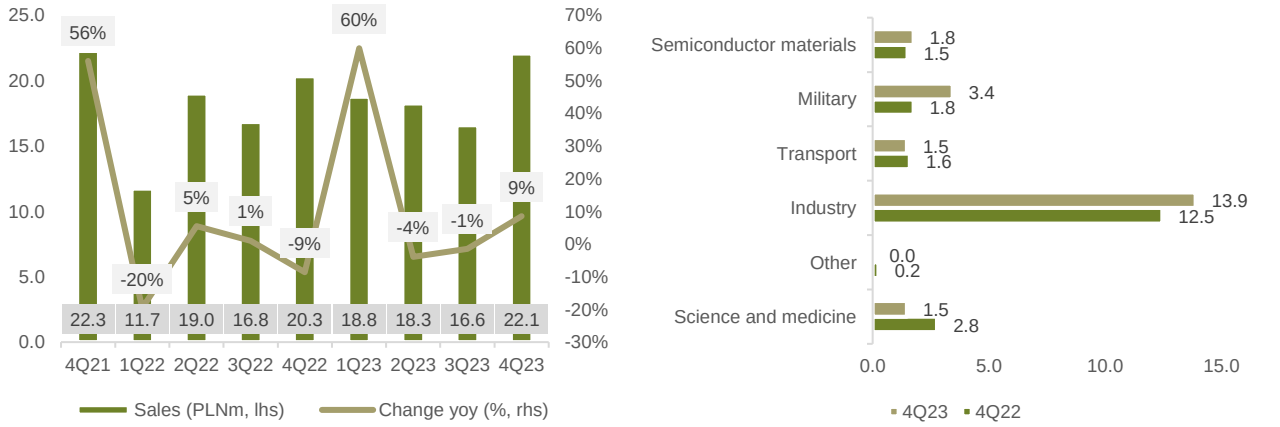
In 2023, VIGO Photonics recorded preliminary sales of PLN 75.6m, up 11% yoy; while, in 2022, reported sales of PLN 67.9m, down 5% yoy. The 2022 weakness was driven by two main factors: 1) supply chain issues; and 2) a reduced orders size from its biggest client – Safran. Both issues, however, were temporary and, from 2023, the company recorded a results expansion, driven by strong demand for military segment products, as well as the price hikes completed in 1Q23. Moreover in 2023, VIGO also reported a solid backlog of c.PLN 100m (vs. PLN 76.3m in 2022) and expects further strong demand from its European and US clients (especially on gas analysis solutions) – according to the CEO, the company believes that, within the next one-to-two years, sales in the American market might reach the value of the European segment.

VIGO Photonics: annual sales evolution* (PLN m, %)



*Source: Company data, WOOD Research; *preliminary 2023 results and actual data for other years*

VIGO Photonics: quarterly sales evolution* (PLN m, %)



*Source: Company data, WOOD Research; *preliminary 2023 results and actual data for other years*

We note that, since 2020, the global economy has faced a chip shortage crisis, as the demand for semiconductor chips has exceeded the supply materially. The crisis was driven by the upsurge in people working from home (demand for work-from-home technology increased dramatically), bottlenecks in the supply chains (particularly in South Asia), and strong demand from the automotive sector, which has been shifting towards electric vehicles and automation (and, as a result, required more chips).

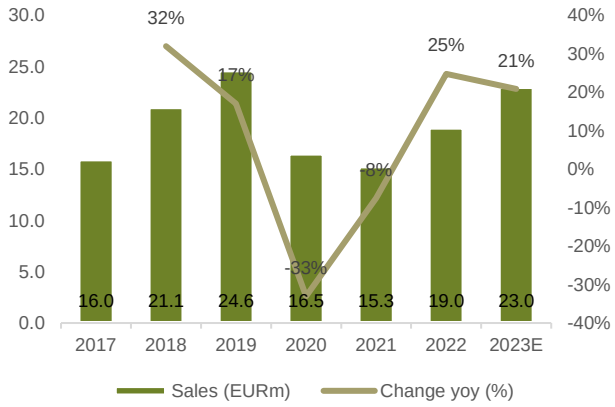
The supply chain issue risk materialised for VIGO in 2022. In October 2022, VIGO's CFO (as quoted by PAP) stated that the limited availability concerned c.10-20% of the electronic components, only for the production of detection modules for transport and industrial applications. According to the company's estimates (presented along with the 4Q22 sales results), the difficulties in the availability of certain electronic components reduced its full-year contracting in 2022 by approximately 5%.

The company has also faced issues with supply related to components manufactured in the Russian Federation. The value of components imported from Russia amounted to PLN 7.3m in 2021. The company has taken steps to find alternative suppliers and has completed the qualification of a new supplier successfully. In addition, the existing supplier has relocated its production outside of Russia.

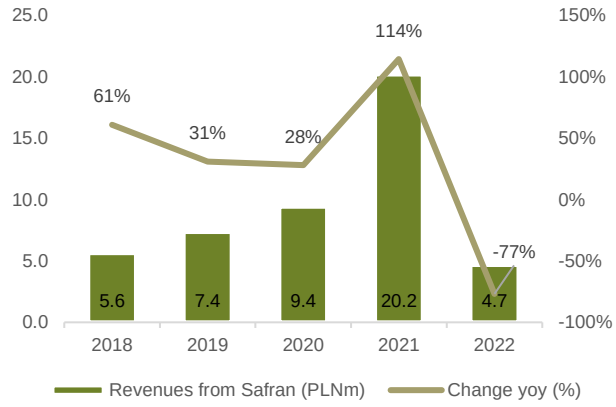
The company does not see any significant problems, at this stage, with the availability of components that were purchased previously from the Russian market.

In terms of the demand from Safran: VIGO's revenues from Safran fell by 77% yoy, to PLN 4.7m, in 2022 (from PLN 20.2m in 2021, then year when Safran was VIGO's biggest client). The 65% yoy drop in the military segment revenues in 2022 was driven mainly by a decline in the volume of orders from Safran. We believe that that the slowdown in revenues from Safran is temporary, and might be related to the strong stocking up in 2021: we note that, in 2021, VIGO generated PLN 20.2m of sales from Safran, more than double 2020 (PLN 9.4m) and almost triple 2019 (PLN 7.4m). Considering the solid outlook for Safran's defence segment, in which the company expects to benefit from levered Western countries' army budgets, we believe that the demand for VIGO's products should return soon. Already, in 2023, the company recorded a c.47% yoy increase in its military segment revenues (and 96% yoy in 4Q23), which was driven, to a large extent, by a rebound in sales to Safran.

Safran: revenues evolution (EUR bn, %)*

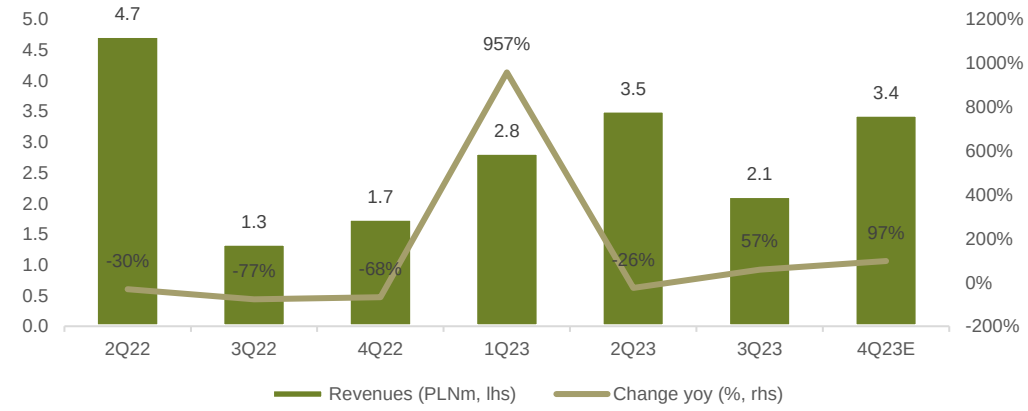


VIGO Photonics: revenues from Safran



*Source: Safran, VIGO Photonics, WOOD Research; *Safran outlook for 2023E assumes revenues of at least EUR 23.0bn*

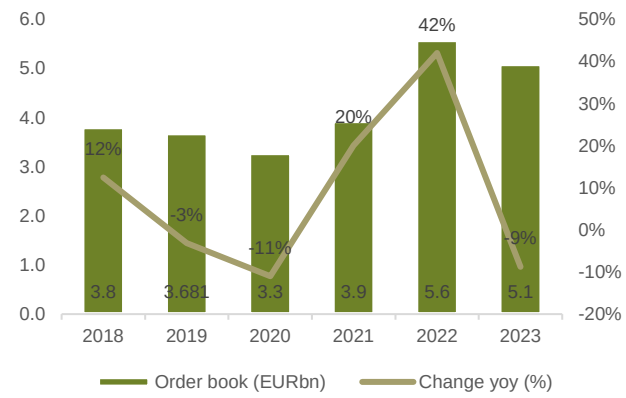
VIGO Photonics: military segment revenues* (PLN m, %)



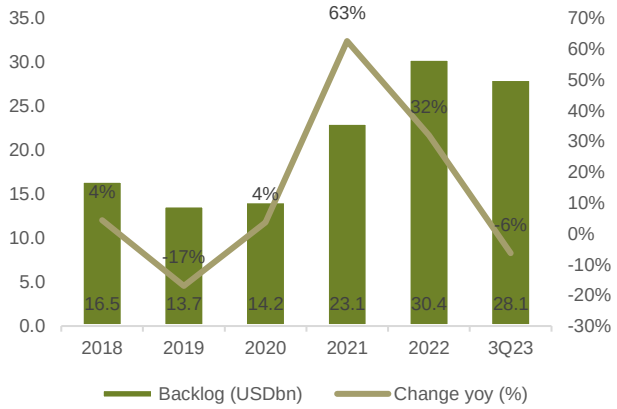
*Source: Company data, WOOD Research; *preliminary 4Q23 results and actual data for other quarters*

The performance outlook for VIGO's other key clients is mixed: Caterpillar (second-biggest client in 2021) recorded a backlog of USD 28.1bn as of end-3Q23 (down 6% yoy, down 8% vs. end-2022), while TRUMPF's order intake reached EUR 5.1bn as of the end of the financial year, ending in June 2023 (down 9% yoy). Moreover, the TRUMPF EUV (extreme ultraviolet) business order intake (most relevant for VIGO) declined by 23.5% yoy, to EUR 809m. This does not exclude the situation in which VIGO gains in importance among its key clients' suppliers: we note that, for instance, in July 2023, VIGO signed a new agreement with Caterpillar for the supply of the infrared detectors used for rail traffic safety measures, worth PLN 16.3m (vs. the EUR 3.02m/c.PLN 13.5m value of the previous agreement, signed in May 2020).

TRUMPF: order book evolution*



Caterpillar: backlog evolution



*Source: TRUMPF, Caterpillar, WOOD Research; *financial year ending in June*

VIGO successfully raised funding to realise its development strategy

In November 2023, VIGO Photonics successfully completed a 145,799 series F shares issue, at PLN 430/share, through a private subscription. The shares were purchased by 54 investors, including VIGO's major shareholder – Warsaw Equity Management. The shareholder acquired 20,800 shares, thanks to which it maintained its 14.27% stake in the company. The F series shares were introduced to exchange trading on 22 January 2024.

The purpose of the share issue is to support the company's development activities in accordance with the development strategy for 2021-26, adopted by VIGO's Management Board in June 2021. The proceeds from the issue will be used to:

- Accelerate the sales growth of VIGO's core product lines (infrared detectors, modules and semiconductors) by supporting operating activities in the entire value chain, including the development of own sales structures, and the development of technologies and new products.
- Continue with the development of the infrared array technology for civil and military applications, and the launch of the serial production of infrared arrays.
- Develop photonic integrated circuit technology and launch its serial production. The issue of shares is intended to finance the initial phase of the HyperPIC project, under the IPCEI programme, for which the company has obtained a decision from the EC, approving State aid of up to EUR 102.9m. The decision to grant the company co-financing and the determination of the final amount of co-financing will be made as part of the competition procedure under the European Funds for a Modern Economy (FENG) programme. Entities for which the European Commission has issued a positive decision, admitting aid, will be able to apply for co-financing. The company expects that the implementation of the HyperPIC project will allow it to scale up its business significantly, by becoming a leading supplier of integrated sensor solutions for mid-infrared technology.

Warsaw Equity Management has committed to a lock-up agreement lasting until 31 December 2024. On 25 October 2023, significant shareholders of the company, who are also the founders of VIGO, Józef Piotrowski, Mirosław Grudzień, Janusz Kubrak and Zbigniew Więcław, concluded lock-up agreements, under which each of them committed not to dispose of their shares in the company from the date of the conclusion of the lock-up agreements until the lapse of 365 days from the first day of the rights to series F shares or series F shares listing on the WSE (whichever of these events occurs earlier), without the prior consent of the joint bookrunners. In the case of Józef Piotrowski, the lock-up commitment relates to 80,200 of the 85,037 total shares owned; while, in the case of the three other founders, the lock-up commitment relates to all the shares held thereby.

Valuation – price target (PT) at PLN 593/share

We reiterate our BUY rating on VIGO Photonics and set our price target (PT) at PLN 593/share, implying 32% upside potential. Our PT is the average of our comparative valuation (implying a PT of PLN 603/share) and our DCF valuation (implying a PT of PLN 582/share). We assign equal 50% weights to both methods.

VIGO Photonics: valuation summary

Method	Valuation	Weight
Comparative valuation	603	50%
DCF	582	50%
Price target (PLN/share)	**593**	
Current price (PLN/share)	449	
Upside (%)	**32%**	

Source: WOOD Research

Scenario analysis for the infrared arrays project

Out of the three new initiatives assumed in VIGO's strategy, we have pencilled only the infrared arrays project into our model, as we believe its realisation is the most probable. In our forecasts, we assume that VIGO will conclude an agreement with the Polish army and reach target production volume of 300 infrared arrays/year from 2026E. In this scenario, the project adds PLN 145/share to our PT for VIGO; excluding the project, our PT for VIGO would reach PLN 448/share (i.e., 24% below our base-case scenario PT).

However, we note that our assumptions are conservative compared to the company's plans: VIGO estimates its annual production capacity of infrared arrays at 500 units, and volumes of 1,000 pieces/year in its strategy. If we pencil in volumes of 500 units/annually to our model, our PT would increase to PLN 659/share (11% above our base-case PT), while the annual contribution to sales would increase from the PLN 40m assumed in our base-case scenario, to PLN 66m.

VIGO Photonics: infrared arrays scenario analysis

	PT	Contribution to 2026E sales (PLN m)
Bull case	659	66
Base case	593	40
Bear case	448	0

Source: WOOD Research

DCF

We base our DCF valuation on the following assumptions:

- ✓ A risk free rate of 5.25%, as a proxy for the 10-year maturity Polish government bond yield.
- ✓ An unlevered beta of 1.2x, based on Damodaran's unlevered EM beta for electronics.
- ✓ An equity risk premium (ERP) of 4.5%.
- ✓ A debt risk premium of 2.0%, based on VIGO's effective cost of debt.
- ✓ A terminal growth rate of 3.0%.
- ✓ Considering that the company has successfully raised funding through series F shares (aimed, among other things, at financing the initial phase of the HyperPIC project) and, in order to accurately present the upcoming capex, we have included PLN 25-40m of R&D outlays related to the project in 2024-25E. However, in order to be consistent in terms of valuation (as we do not include any potential income from the project in our model, at this stage), we exclude the capex from our DCF valuation.

VIGO Photonics: DCF valuation (PLN m)

	2024E	2025E	2026E	2027E	2028E	2029E	2030E	2031E	2032E	>2032E
Revenues	93.8	121.1	159.7	169.9	180.6	190.9	201.9	213.7	224.9	224.9
EBITDA	39.0	48.7	68.1	73.0	76.0	80.3	84.9	89.9	94.3	94.3
EBITDA margin	*41.6%*	*40.3%*	*42.7%*	*43.0%*	*42.1%*	*42.1%*	*42.1%*	*42.1%*	*41.9%*	*41.9%*
EBIT	26.1	33.8	48.9	53.0	55.9	60.3	65.0	70.1	74.8	74.8
EBIT margin	*27.8%*	*28.0%*	*30.6%*	*31.2%*	*31.0%*	*31.6%*	*32.2%*	*32.8%*	*33.3%*	*33.3%*
Cash tax on EBIT	-5.0	-6.4	-9.3	-10.1	-10.6	-11.4	-12.4	-13.3	-14.2	-14.2
NOPAT	21.1	27.4	39.6	42.9	45.3	48.8	52.7	56.8	60.6	60.6
D&A	12.9	14.9	19.2	20.1	20.1	20.0	19.9	19.8	19.5	19.5
Change in WC	-15.0	-15.5	-16.7	-7.9	-6.5	-6.4	-6.6	-6.8	-6.6	
Capex*	-38.5	-22.0	-14.5	-14.5	-13.0	-13.0	-13.0	-13.0	-13.0	-31.1
FCFF	**-19.4**	**4.8**	**27.6**	**40.5**	**45.9**	**49.5**	**53.0**	**56.7**	**60.5**	**49.0**
Discount factor (%)	91%	82%	74%	67%	61%	55%	50%	45%	41%	
PV	-18	4	21	27	28	27	27	26	25	
PV 2024-32E	167									
TV growth rate (%)	3.0%									
PV TV	272									
EV 2023E	**438**									
Minorities 2023E	0									
Net debt 2023E	-5									
Equity-accounted investees and other LT financial assets 2023E	12									
Equity value end-2023E (PLN m)	**455**									
Number of shares, m	0.87									
Fair value per share as of end-2023E (PLN)	**521**									
12-month price target (PLN)	**582**									

*Source: WOOD Research; *capex including grants received and excluding the capex on financial investments and the HyperPIC project*

DCF sensitivity analysis (PLN m)

		Unlevered Beta						
		1.5x	1.4x	1.3x	**1.2x**	1.1x	1.0x	0.9x
Terminal growth rate (%)	1.50%	479	503	529	558	590	626	666
	2.00%	482	507	535	565	599	637	679
	2.50%	486	513	541	573	609	649	695
	3.00%	491	518	549	**582**	621	664	713
	3.50%	496	525	557	593	634	681	735
	4.00%	502	532	566	605	649	701	761
	4.50%	508	540	577	619	668	725	792
		Equity risk premium						
		5.25%	5.00%	4.75%	**4.50%**	4.25%	4.00%	3.75%
Risk free rate (%)	6.75%	438	452	466	482	498	516	535
	6.25%	463	478	494	511	530	550	571
	5.75%	490	507	525	545	566	588	613
	5.25%	520	540	560	**582**	606	632	660
	4.75%	555	577	600	625	653	683	715
	4.25%	594	619	646	675	707	742	780
	3.75%	639	667	698	733	770	812	858

Source: WOOD Research

Comparative valuation

We base our comparative approach on the 2024-25E EV/EBITDA and P/E multiples, using our forecasts for VIGO Photonics and the Bloomberg consensus median multiples for its peers. Our comparative valuation implies a PT of PLN 603/share for VIGO, and we assign a 50% weighting to this in our final PT for the company.

We see VIGO's valuation as relatively attractive as, on our forecasts, it trades at EV/EBITDAs of 13.1-10.2x for 2024-25E, at 6-18% discounts vs. its peers, while offering a stronger growth outlook – we expect VIGO to generate a 45% 2022-25E EBITDA CAGR vs. the 9% peers' median. In the 2021-25E period (2022 is not representative due to a temporary issue with the supply chain), we estimate VIGO's adjusted EBITDA CAGR at 14%, still above the peers' median.

Comparative valuation (PLN m)*

	P/E (x)			EV/EBITDA (x)		
	2023E	2024E	2025E	2023E	2024E	2025E
VIGO multiple	40.1	20.4	15.9	17.8	13.1	10.2
Peers median	22.2	25.8	19.7	14.4	14.0	12.4
VIGO premium (discount)	81%	-21%	-19%	23%	-6%	-18%
Company results	9.8	19.2	24.7	21.8	32.8	45.4
EV implied		533.4	556.9		459.9	563.7
Net debt	-5.3	37.5	69.1	-5.3	37.5	69.1
Minorities	0.0	0.0	0.0	0.0	0.0	0.0
Equity value implied		496	488		422	495
Multiple weight		25%	25%		25%	25%
Equity value (PLNm)	**475**					
Fair value/share (PLN)	**543**					
12M PT (PLN)	**603**					

*Source: WOOD Research; *the current multiples calculations are based on WOOD's forecasts for VIGO Photonics and the Bloomberg consensus for its other peers*

VIGO Photonics: peer multiples*

	Country	MCap (USDm)	P/E (x)			EV/EBITDA (x)		
			2023E	2024E	2025E	2023E	2024E	2025E
VIGO Photonics	**Poland**	**97**	**40.1**	**20.4**	**15.9**	**17.8**	**13.1**	**10.2**
Hamamatsu Photonics	Japan	6,619	22.1	24.2	22.1	12.2	13.1	11.5
Teledyne Technologies	USA	20,250	22.2	20.9	19.3	16.6	15.0	13.3
Visual Photonics Epitaxy	Taiwan	796	56.9	31.9	25.1	31.2	20.1	16.8
Coherent	USA	7,412	16.6	36.8	17.3	8.8	11.3	8.4
Ipg Photonics	USA	4,688	21.3	20.1	15.9	10.9	9.5	9.4
Optex Group	Japan	467	14.2	12.5	10.8	7.6	6.2	5.4
Nippon Ceramic	Japan	500	16.4	15.3	13.9	n.a.	n.a.	n.a.
Focused Photonics Hangzhou	China	847	903.3	27.4	20.1	n.a.	n.a.	n.a.
Visual Photonics Epitaxy	Taiwan	796	56.9	31.9	25.1	31.2	20.1	16.8
Amphenol	USA	60,699	34.2	30.9	27.8	21.5	19.5	17.5
Median			**22.2**	**25.8**	**19.7**	**14.4**	**14.0**	**12.4**
VIGO premium (discount)			**81%**	**-21%**	**-19%**	**23%**	**-6%**	**-18%**

*Source: Bloomberg, WOOD Research; *the current multiples calculations are based on WOOD's forecasts for VIGO Photonics and the Bloomberg consensus for its other peers*

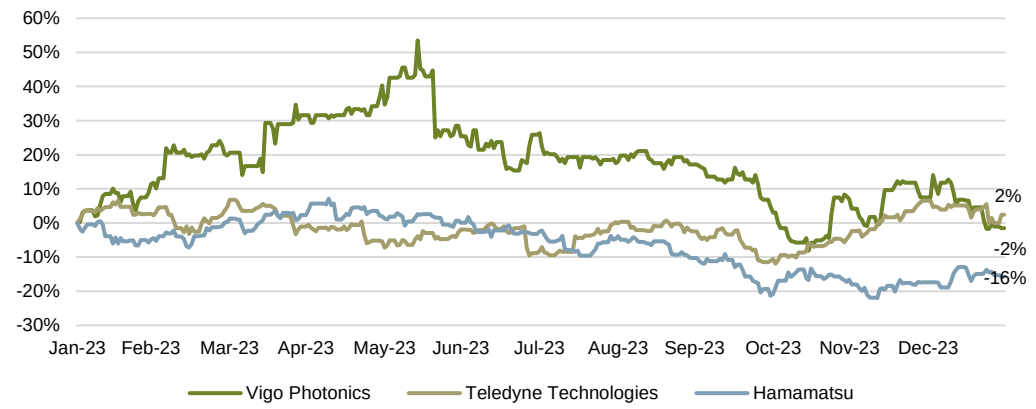
VIGO Photonics: peers' key indicators*

	CAGR 2022-25E		ND/EBITDA	FCF yield		Dividend yield		EBITDA margin		NI margin	
	NI	EBITDA	2023E	2023E	2024E	2023E	2024E	2023E	2024E	2023E	2024E
VIGO Photonics	**51%**	**45%**	**-0.2**	**-1%**	**-4%**	**0.0%**	**0.0%**	**29%**	**35%**	**13%**	**21%**
Hamamatsu Photonics	1%	5%	-1.7	2%	2%	1.3%	1.3%	32%	29%	19%	17%
Teledyne Technologies	8%	7%	1.9	4%	5%	n.a.	n.a.	24%	25%	16%	17%
Visual Photonics Epitaxy	19%	17%	-0.1	2%	2%	1.6%	2.1%	30%	33%	17%	21%
Coherent	0%	14%	2.6	2%	-1%	0.0%	0.1%	25%	22%	11%	5%
Ipg Photonics	6%	2%	-3.4	3%	4%	0.0%	0.0%	26%	27%	17%	18%
Optex Group	1%	n.a.	-1.3	7%	9%	2.2%	2.4%	14%	15%	8%	9%
Nippon Ceramic	-10%	9%	n.a.	n.a.	n.a.	3.9%	4.2%	25%	25%	16%	15%
Focused Photonics Hangzhou	-7%	55%	n.a.	-4%	2%	n.a.	n.a.	0%	7%	-6%	2%
Visual Photonics Epitaxy	19%	17%	-0.1	2%	2%	1.6%	2.1%	30%	33%	17%	21%
Amphenol	7%	6%	0.8	3%	3%	0.8%	0.9%	24%	24%	15%	15%
Median	**3%**	**9%**	**-0.1**	**2%**	**2%**	**1.4%**	**1.7%**	**25%**	**25%**	**16%**	**16%**

*Source: Company data, Bloomberg, WOOD Research; *estimates based on our forecasts for VIGO and Bloomberg consensus for its peers*

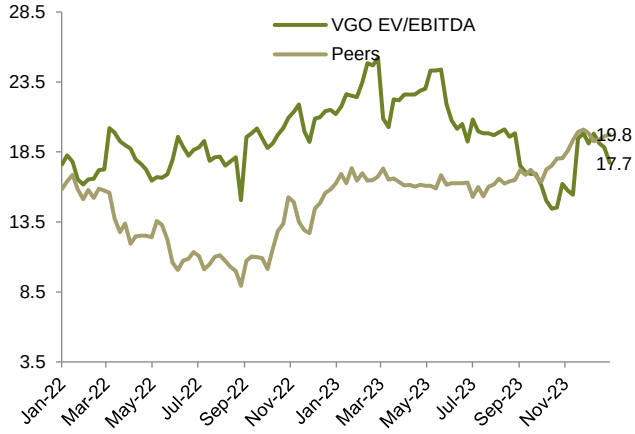
VIGO's share price has outperformed Hamamatsu and has been broadly in line with Teledyne in the past 12 months: it has fallen 2% vs. Teledyne's 2% increase and Hamamatsu's 16% depreciation. VIGO's LTM EV/EBITDA reached 17.7x, implying a 10% discount vs. its broad peers' group average of 19.8x (vs. the average 34% premium in the past two years).

VIGO Photonics vs. peers' share price performance

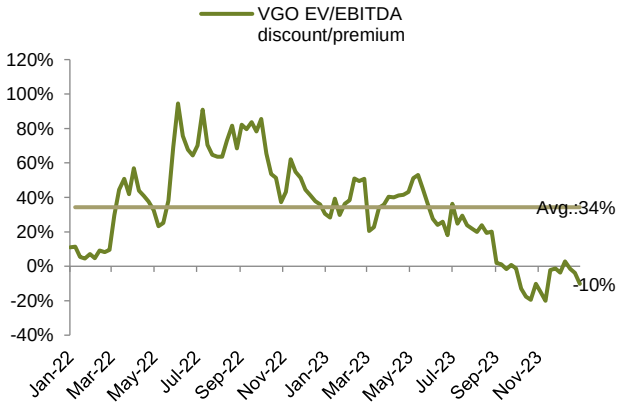


Source: Bloomberg, WOOD Research

VIGO Photonics vs. peers
Average LTM EV/EBITDA



LTM EV/EBITDA discount/premium



Source: Bloomberg, WOOD Research

Financial forecasts

2022-25E sales CAGR of 21%. In 2022, VIGO recorded total sales of PLN 67.9m, down 5% yoy. A yoy drop was recorded in both the detection modules (5% yoy) and semiconductor materials segments (down 3% yoy). The decline was driven by weakness in demand from the military industry (due to a 77% yoy drop in the value of orders from Safran) and supply chain issues, related to the limited availability of c.10-20% of the electronic components used for the production of detection modules for transport and industrial applications. According to the company's estimates (presented along with the 4Q22 sales results), the difficulties in the availability of certain electronic components reduced its full-year contracting by approximately 5% in 2022.

In 2023E, the company recorded preliminary revenues of PLN 75.6m, up c.11% yoy, driven primarily by a strong rebound in military segment sales (up 47% yoy, to PLN 11.9m) and the industry segment (up 11% yoy, to PLN 45.7m). We also note that, in 2023E, VIGO's sales were supported by the price hikes completed in 1Q23 (by 25-30%). We have reflected the price hikes in 19-2% increases in the average prices in 2023-24E in our model.

In 2024E, we expect sales to expand by 24%, to PLN 93.8m, driven by an increase in demand from the industry sub-segment (21% yoy growth in 2024E, with an acceleration vs. 2022 related to the improving macro environment) and a military segment sales acceleration due to orders from Safran and demand stemming from the Polish army's programme of modernisation (described in a separate paragraph in this report). The sales volumes should also be supported by VIGO's geographical expansion, especially in the US and Asia, which recorded a strong performance in 2023E already. We note that, along with the 3Q23 preliminary sales results, VIGO's CEO stated that the company expects further strong demand from its European and US clients, especially on gas analysis solutions, and believes that, within the next one-to-two years, sales in the American market might reach the value of the European segment.

From 2025E, we also expect the revenues from the military industry to be supported by the launch of VIGO's new initiative – infrared arrays. In our forecasts, we expect volumes of 100-300 in 2025-26E, respectively, and sales of PLN 13.2-39.6m.

VIGO Photonics: sales forecasts

	2018	2019	2020	2021	2022	2023E	2024E	2025E	2026E	2027E
Science and medicine	2.8	3.1	7.8	4.0	7.2	4.7	5.3	5.8	6.4	6.9
Other	0.4	0.4	0.4	0.3	1.1	0.3	0.3	0.3	0.4	0.4
Industry	20.3	25.4	23.6	31.1	39.5	45.7	55.4	63.7	70.1	75.7
Transport	5.8	5.8	6.2	8.7	7.8	7.9	8.9	9.8	10.8	11.7
Military	8.1	8.1	13.4	23.2	8.1	11.9	16.1	31.8	60.9	63.1
Semiconductor materials	0.0	0.2	1.9	4.3	4.1	6.1	7.7	9.7	11.1	12.2
Revenues (PLN m)	**37.4**	**42.9**	**53.5**	**71.5**	**67.9**	**75.6**	**93.8**	**121.1**	**159.7**	**169.9**
Change yoy										
Science and medicine	12%	11%	153%	-50%	82%	-35%	11%	10%	10%	8%
Other	-43%	-1%	8%	-35%	296%	-74%	11%	10%	10%	8%
Industry	30%	25%	-7%	31%	27%	16%	21%	15%	10%	8%
Transport	66%	0%	7%	41%	-10%	1%	13%	10%	10%	8%
Military	69%	-1%	67%	73%	-65%	47%	36%	97%	92%	4%
Semiconductor materials	n.a.	n.a.	1101%	124%	-3%	48%	26%	25%	15%	10%
Revenues (PLNm)	38%	15%	25%	34%	-5%	11%	24%	29%	32%	6%
EUR/PLN average	**4.3**	**4.3**	**4.4**	**4.6**	**4.7**	**4.5**	**4.4**	**4.4**	**4.4**	**4.4**
Revenues (EUR m)	**8.8**	**10.0**	**12.0**	**15.7**	**14.5**	**16.7**	**21.3**	**27.5**	**36.3**	**38.6**
Change yoy	38%	14%	21%	30%	-8%	15%	28%	29%	32%	6%
Sales volume of detector modules ('000s)	**7.6**	**7.2**	**8.4**	**12.2**	**13.7**	**13.2**	**16.6**	**19.2**	**21.5**	**23.3**
Change yoy	40%	-6%	16%	46%	12%	-3%	25%	16%	12%	8%
Average price (EUR 000s)	**1.1**	**1.4**	**1.4**	**1.3**	**1.1**	**1.3**	**1.3**	**1.4**	**1.7**	**1.7**
Change yoy	-1%	21%	4%	-11%	-17%	19%	2%	12%	17%	-2%

Source: WOOD Research

Adjusted EBITDA margin to expand from 22% in 2022 to 37% in 2025E. We expect VIGO's adjusted EBITDA to rebound from PLN 14.9m in 2022 to PLN 21.8m in 2023E and PLN 32.8-45.4m in 2024-25E, implying an adjusted EBITDA margin expansion from 22% in 2022 to 29% in 2023E and 35-37% in 2024-25E. We note that the profitability contraction faced by VIGO in 2022 was driven by a decline in the top line, paired with a hike in the costs of materials and energy, as well as increasing employee-related expenses, due to the team expansion (including the development of VIGO's branches abroad) and pressure on salaries. From 2023E, we expect the adjusted EBITDA margin to rebound, due to the price hikes implemented by VIGO, and the assumed stabilisation of components (due to the partially solved supply chain issues) and energy prices in Poland. Assuming adjustments related to the settlement of

grants of PLN 3.7m in 2023E and PLN 6.3-3.3m in 2024-25E, we expect the reported EBITDA to reach PLN 25.5m in 2023E and PLN 39.0-48.7m in 2024-25E.

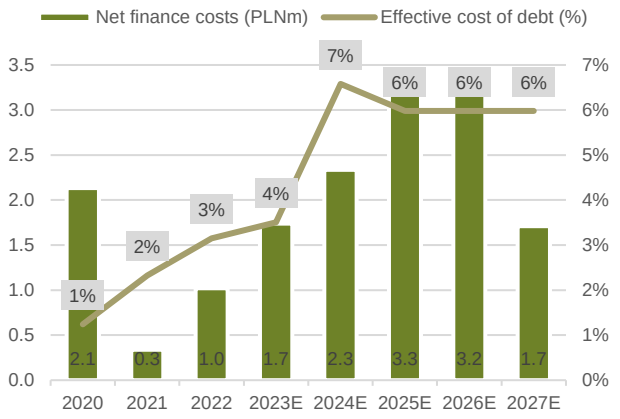
VIGO Photonics: operating profitability forecasts

	2018	2019	2020	2021	2022	2023E	2024E	2025E	2026E	2027E
Depreciation	-3.5	-4.6	-6.2	-6.7	-9.3	-12.4	-12.9	-14.9	-19.2	-20.1
Consumption of materials and energy	-6.4	-8.5	-9.4	-12.8	-13.5	-18.2	-20.6	-24.2	-30.7	-32.3
Third-party services	-2.2	-3.0	-4.1	-5.9	-9.8	-14.5	-18.8	-24.2	-31.9	-34.0
Taxes and charges	-0.2	-0.2	-0.2	-0.3	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4
Employee-related expenses	-9.6	-10.5	-12.5	-16.4	-16.4	-20.5	-23.7	-26.1	-28.8	-30.5
Other costs by type	-0.4	-0.5	-0.3	-0.4	-1.0	-1.0	-1.0	-1.1	-1.1	-1.1
Total costs by type. of which:	-26.8	-32.5	-39.0	-49.7	-67.1	-67.0	-77.4	-90.9	-112.2	-118.4
Change in products	0.0	2.1	2.0	-0.9	3.2	0.0	0.0	0.0	0.0	0.0
Selling costs (negative figure)	2.2	2.4	3.4	4.7	10.4	9.5	9.8	10.8	15.4	18.4
General administrative expenses (negative figure)	7.7	12.2	15.9	20.1	20.7	18.7	22.5	25.7	29.2	31.0
Cost of products and services sold	-16.9	-15.9	-17.8	-25.7	-32.8	-38.9	-45.2	-54.4	-67.6	-68.9
Gross profit (loss) on sales	**20.5**	**27.0**	**35.6**	**45.8**	**35.1**	**36.8**	**48.6**	**66.7**	**92.1**	**101.0**
EBIT	**12.8**	**14.0**	**20.2**	**22.9**	**8.7**	**13.0**	**26.1**	**33.8**	**48.9**	**53.0**
EBITDA	**16.2**	**18.6**	**26.5**	**29.6**	**18.1**	**25.5**	**39.0**	**48.7**	**68.1**	**73.0**
One-offs	0.0	0.0	-2.0	-2.3	-3.1	-3.7	-6.3	-3.3	-2.3	-2.3
EBITDA adjusted	**16.2**	**18.6**	**24.5**	**27.3**	**14.9**	**21.8**	**32.8**	**45.4**	**65.9**	**70.7**
Margins (%)										
Gross profit (loss) on sales	55%	63%	67%	64%	52%	49%	52%	55%	58%	59%
EBIT	34%	33%	38%	32%	13%	17%	28%	28%	31%	31%
EBITDA	43%	43%	50%	41%	27%	34%	42%	40%	43%	43%
EBITDA adjusted	43%	43%	46%	38%	22%	29%	35%	37%	41%	42%

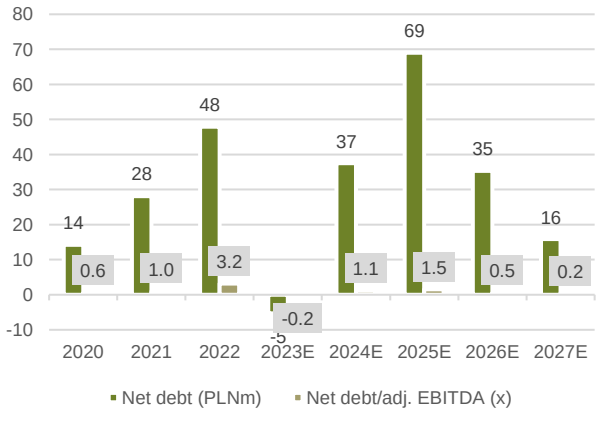
Source: Company data, WOOD Research

2022-25E net profit CAGR of 51%. We expect VIGO's net finance costs to expand from PLN 1.0m in 2022 to PLN 2.3-3.3m in 2024-25E. Apart from a hike in the EURIBOR (on which most of the company's interest on debt is based), we expect an increase in VIGO's leverage due to the capex outlays related to the infrared arrays R&D and production line, R&D related to the HyperPIC project and other organic capex that we expect. We expect VIGO to record negative FCF in 2023-25E and return to cash generation in 2026E. From 2024E, we also assume that VIGO's effective income tax rate stands at 19% (vs. 15% in 2023E and 0%, or a positive result related to the deferred tax asset creation in previous years). We expect VIGO's net profit adjusted for one-offs (related mainly to gains on subsidies and tax assets creation) to rebound from PLN 3.7m in 2022 to PLN 6.1m in 2023E and PLN 14.1-22.0m in 2024-25E, while the reported net profit to hike from PLN 7.2m in 2022 to PLN 9.8m in 2023E and PLN 19.2-24.7m in 2024-25E.

VIGO Photonics: net finance costs forecasts (PLN m, %)

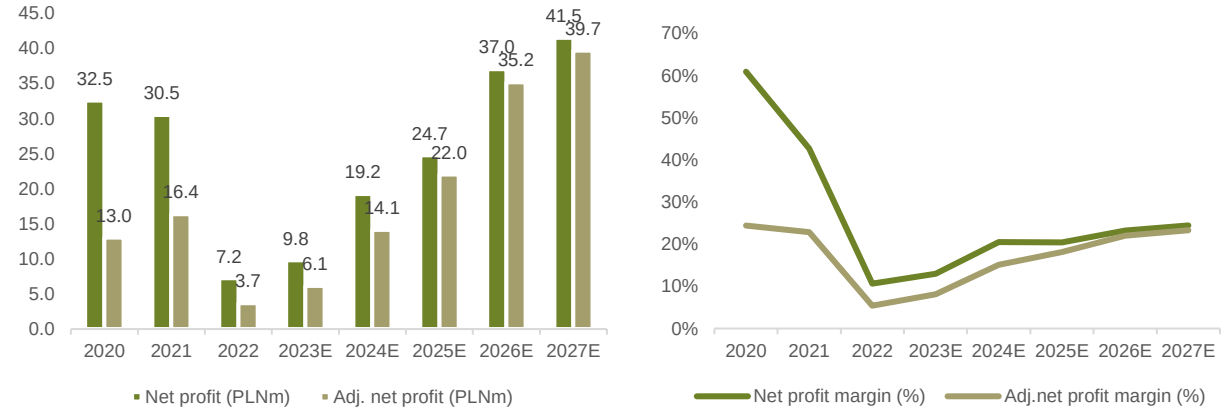


VIGO Photonics: indebtedness forecasts (PLN m, %)



Source: Company data, WOOD Research

VIGO Photonics: net profit forecasts (PLN m, %)



Source: Company data, WOOD Research

VIGO Photonics: P&L forecasts (PLN m)

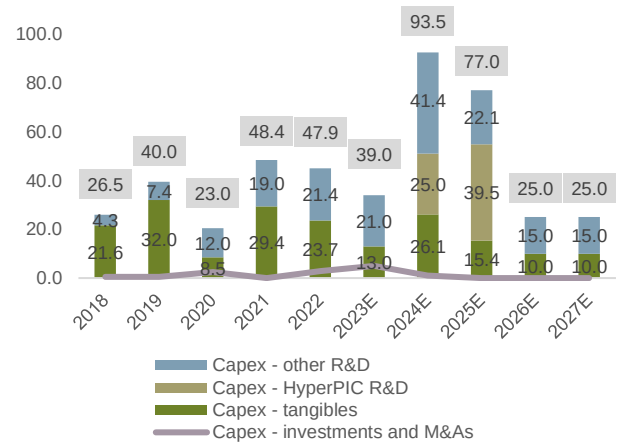
	2018	2019	2020	2021	2022	2023E	2024E	2025E	2026E	2027E
Net revenues	**37.4**	**42.9**	**53.5**	**71.5**	**67.9**	**75.6**	**93.8**	**121.1**	**159.7**	**169.9**
COGS	-16.9	-15.9	-17.8	-25.7	-32.8	-38.9	-45.2	-54.4	-67.6	-68.9
Gross profit (loss) on sales	**20.5**	**27.0**	**35.6**	**45.8**	**35.1**	**36.8**	**48.6**	**66.7**	**92.1**	**101.0**
Selling costs	-2.2	-2.4	-3.4	-4.7	-10.4	-9.5	-9.8	-10.8	-15.4	-18.4
General and administrative costs	-7.7	-12.2	-15.9	-20.1	-20.7	-18.7	-22.5	-25.7	-29.2	-31.0
Other operating revenues	2.8	2.7	4.4	5.9	8.3	7.8	13.1	7.0	4.8	4.8
Other operating expenses	-0.7	-1.1	-0.6	-3.9	-3.6	-3.4	-3.4	-3.4	-3.4	-3.4
Profit (loss) on operating activities	**12.8**	**14.0**	**20.2**	**22.9**	**8.7**	**13.0**	**26.1**	**33.8**	**48.9**	**53.0**
Financial revenues	0.3	0.1	0.0	0.5	0.4	0.6	2.0	1.2	0.1	0.1
Financial expenses	-0.1	-0.3	-2.2	-0.9	-1.4	-2.4	-4.3	-4.6	-3.3	-1.8
Gross profit (loss)	**13.0**	**13.9**	**18.1**	**22.6**	**7.7**	**11.3**	**23.8**	**30.5**	**45.7**	**51.2**
Income tax	0.0	0.0	14.5	7.9	-0.5	-1.5	-4.5	-5.8	-8.7	-9.7
Net profit	**13.0**	**13.9**	**32.5**	**30.5**	**7.2**	**9.8**	**19.2**	**24.7**	**37.0**	**41.5**
EBIT	**12.8**	**14.0**	**20.2**	**22.9**	**8.7**	**13.0**	**26.1**	**33.8**	**48.9**	**53.0**
EBITDA	**16.2**	**18.6**	**26.5**	**29.6**	**18.1**	**25.5**	**39.0**	**48.7**	**68.1**	**73.0**
EBITDA adjusted	**16.2**	**18.6**	**24.5**	**27.3**	**14.9**	**21.8**	**32.8**	**45.4**	**65.9**	**70.7**
Net profit (loss) adjusted for tax gains	**13.0**	**13.9**	**18.1**	**22.6**	**7.6**	**9.8**	**19.2**	**24.7**	**37.0**	**41.5**
Net profit adjusted for one-offs	**10.6**	**11.3**	**13.0**	**16.4**	**3.7**	**6.1**	**14.1**	**22.0**	**35.2**	**39.7**

Source: Company data, WOOD Research

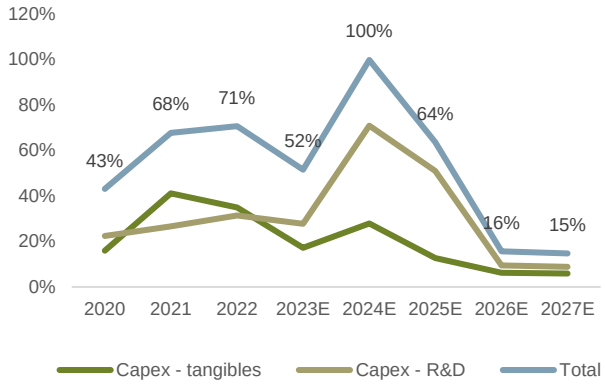
Capex to reach its peak in 2024E, dividends on hold. We expect VIGO's capex to decline from PLN 47.9m in 2022 to PLN 39.0m in 2023E, expand to PLN 93.5m in 2024E, and then fall to PLN 77.0m in 2025E. We expect the increase in the total capex level in 2024E to be driven mainly by the development of the infrared arrays initiative that we assume, i.e., R&D expenses and investments in the production line (which should be fully operational by end-2024E, on our assumptions), as well as R&D expenses related to the HyperPIC project (which we assume at PLN 25-40m in 2024-25E). We also pencil in an investment of another PLN 5m in VIGO Ventures in 2023E. Due to the expected levered capex outlays, we expect the company to record negative FCF in 2023-24E. As a result, we see no space for dividend payouts; however, this is in line with the company's strategy, which assumes no dividend payouts and the full reinvestment of earnings until the end of 2026E. In 2025E, we assume a drop in the capex, due to the end of the capex related to the infrared arrays project.

In our forecasts, we assume that a significant part of the R&D expenses will be supported by subsidies – the average co-financing contribution to the R&D capex in 2017-22 stood at 93%; while, in our forecasts, we conservatively expect the share to fall to 70% from 4Q23E. We note that, at this stage, we pencil in the R&D capex related to the HyperPIC project that has to be incurred by VIGO only; therefore, the forecast grants are related to other projects, excluding HyperPIC.

VIGO Photonics: capex forecasts (PLN m)

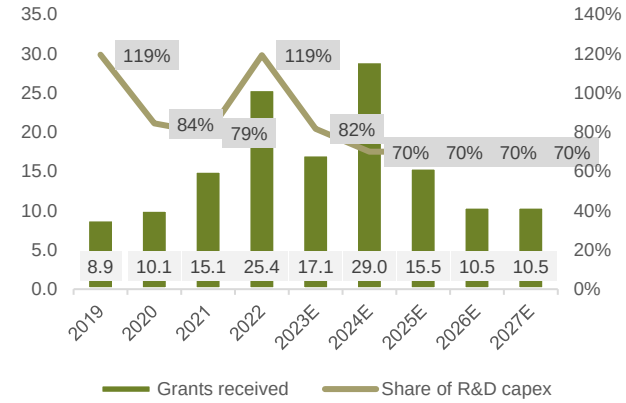


VIGO Photonics: capex/sales forecasts (%)

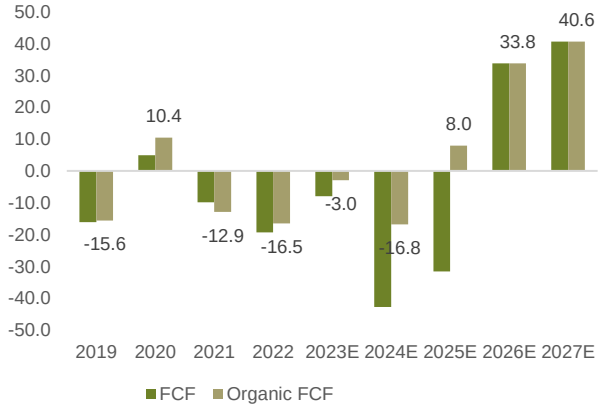


Source: Company data, WOOD Research

VIGO Photonics: subsidies forecasts (PLN m, %)



VIGO Photonics: FCF forecasts (PLN m)



Source: Company data, WOOD Research

VIGO Photonics: FCF reconciliation (PLN m)

	2018	2019	2020	2021	2022	2023E	2024E	2025E	2026E	2027E
Net cash flows from operating activities	9.1	15.4	21.2	20.7	3.8	15.7	26.0	34.5	51.5	56.9
Net cash flows from investing activities	-24.6	-31.1	-15.9	-30.3	-22.1	-21.9	-64.5	-61.5	-14.5	-14.5
Interest and commissions	-0.1	-0.4	-0.4	-0.3	-1.0	-1.8	-4.3	-4.6	-3.3	-1.8
FCF	**-15.6**	**-16.1**	**4.9**	**-9.9**	**-19.3**	**-8.0**	**-42.8**	**-31.6**	**33.8**	**40.6**
Investments and M&As	0.5	0.6	5.5	-3.1	2.9	5.0	1.0	0.0	0.0	0.0
Organic FCF	**-15.1**	**-15.6**	**10.4**	**-12.9**	**-16.5**	**-3.0**	**-16.8**	**8.0**	**33.8**	**40.6**
FCF yield	**-5%**	**-5%**	**1%**	**-3%**	**-6%**	**-2%**	**-11%**	**-8%**	**9%**	**10%**
Organic FCF yield	**-5%**	**-5%**	**3%**	**-4%**	**-5%**	**-1%**	**-4%**	**2%**	**9%**	**10%**

Source: Company data, WOOD Research

Forecasts changes (PLN m)

	2022	2023E				2024E				2025E			
	Actual	Old	New	Chg.	New yoy	Old	New	Chg.	New yoy	Old	New	Chg.	New yoy
Revenues	67.9	87.5	75.6	-14%	11%	107.2	93.8	-13%	24%	134.7	121.1	-10%	29%
Adj. EBITDA	14.9	28.2	21.8	-23%	46%	39.4	32.8	-17%	51%	54.3	45.4	-16%	39%
EBITDA	18.1	31.5	25.5	-19%	41%	43.4	39.0	-10%	53%	56.3	48.7	-13%	25%
EBIT	8.7	19.3	13.0	-32%	50%	29.5	26.1	-12%	100%	40.8	33.8	-17%	30%
Net profit	7.2	13.0	9.8	-25%	36%	20.4	19.2	-6%	96%	29.5	24.7	-16%	29%
Capex	47.9	63.3	39.0	-38%	-19%	77.7	93.5	20%	140%	20.0	77.0	285%	-18%
FCF	-19.3	-25.2	-8.0	n.a.	-59%	-25.0	-42.8	n.a.	n.a.	25.3	-31.6	n.a.	n.a.
Organic FCF	-16.5	-20.2	-3.0	n.a.	-82%	-24.0	-16.8	n.a.	n.a.	25.3	8.0	-69%	n.a.
ND/adj. EBITDA	3.2	2.9	-0.2	n.a.	-108%	2.7	1.1	-57%	n.a.	1.5	1.5	2%	33%

*Source: Company data, WOOD Research; *capex excluding the grants impact*

4Q23E preview

VIGO Photonics is due to report its 4Q23E results on 23 April. We expect decent results, with the adjusted EBITDA up 20% yoy, to PLN 6.5m, the EBIT up 14% yoy, to PLN 4.3m, and net profit of PLN 2.7m (vs. the PLN 2.0m net loss in 4Q22). We note that our net profit forecasts consider the recurring result excluding the one-off cost impact of the share issue, which might harm the 4Q23E finance costs.

The company reported its preliminary sales results on 15 January. VIGO recorded revenues of PLN 22.1m (up 9% yoy) driven by the expansion of detection modules sales in the industry segment (up 12% yoy, to PLN 13.9m), the military segment (up 96%, yoy to PLN 3.4m) and semiconductor materials sales (up 18% yoy, to PLN 1.8m). In the transport segment, the company recorded an 8% yoy decline, to PLN 1.5m; while, in the science and medicine segment, a 47% yoy sales drop, to PLN 1.5m. In terms of the geographic structure of sales, VIGO emphasised that the best performance was recorded in the US market (up 26% yoy, to PLN 2.7m) and the European market (up 37% yoy, to PLN 15.6m).

VIGO Photonics: 4Q23E results preview

	3Q22	4Q22	1Q23	2Q23	3Q23	4Q23E	qoq	yoy
Net revenues	**16.8**	**20.3**	**18.8**	**18.3**	**16.6**	**22.1**	**33%**	**9%**
COGS	-8.8	-11.9	-9.4	-9.8	-7.9	-11.7	47%	-2%
Gross profit (loss) on sales	**8.0**	**8.4**	**9.3**	**8.4**	**8.6**	**10.4**	**20%**	**23%**
SG&A	-7.8	-5.8	-7.2	-6.1	-7.4	-7.4	0%	29%
Other operating income&costs	1.3	1.1	1.6	0.6	0.8	1.4	64%	23%
Adj. EBITDA	**3.3**	**5.5**	**5.6**	**4.9**	**4.7**	**6.5**	**39%**	**20%**
EBITDA	**4.2**	**6.5**	**6.5**	**5.9**	**5.3**	**7.7**	**44%**	**19%**
EBIT	**1.6**	**3.8**	**3.7**	**2.9**	**2.1**	**4.3**	**111%**	**14%**
Net finance costs	-1.3	0.9	-0.7	1.7	-2.0	-0.7	-65%	n.a.
Pre-tax profit (loss)	**0.3**	**4.7**	**3.0**	**4.7**	**0.0**	**3.6**	**n.a.**	**-23%**
Income tax	2.8	-6.7	-0.5	-0.3	0.2	-0.9	n.a.	-86%
Net profit (loss)	**3.0**	**-2.0**	**2.5**	**4.3**	**0.2**	**2.7**	**1028%**	**n.a.**
Margins								
Gross profit (loss) on sales	47.8%	41.5%	49.7%	46.2%	52.1%	47.1%	-5.0pp.	5.6pp.
Adj. EBITDA	19.8%	26.9%	29.9%	26.9%	28.4%	29.6%	1.3pp.	2.8pp.
EBITDA	24.9%	31.9%	34.8%	32.1%	32.2%	35.0%	2.7pp.	3.1pp.
EBIT	9.7%	18.6%	19.8%	16.2%	12.4%	19.6%	7.2pp.	1.0pp.
Net profit (loss)	18.1%	-9.6%	13.3%	23.8%	1.4%	12.3%	10.8pp.	21.9pp.

Source: Company data, WOOD Research

Risks

Competition. Despite being one of the global leaders in terms of product quality, the company is up against competition with a similar global reach, which are improving their offers constantly. We also note that, in such a specialised market niche as the one in which VIGO is operating, the sale process starts along with the process of the development of a new product on the client's side. As the project of the product is created based on specific components, the loyalty of customers is relatively high, so it might be difficult for VIGO to win market share from the competition. We also note the high barriers (technology, R&D process length and cost, capex on production facility) to entry and the relatively low number of competitors in VIGO's niche of mid-infrared detectors.

New initiatives failure. Out of the three new initiatives assumed in VIGO's strategy, we have pencilled only the infrared arrays project into our model, as we believe its realisation is the most probable. In our forecasts, we assume that VIGO will conclude an agreement with the Polish army and reach a target production volume of 300 infrared arrays/year from 2026E. In this scenario, the project adds PLN 145/share to our PT for VIGO. We believe our assumptions are conservative (as VIGO sees annual production capacity of 500 units from 2025E and target production volumes of 1,000 units), but we see a risk of failure in terms of concluding the contract with the Polish army (it might decide to use foreign components).

Macro risks. A macro slowdown might limit the demand for VIGO's products. On the other hand, the current inflationary trends might put pressure on the company's profitability (in terms of energy costs, salaries, production resources and equipment prices).

High concentration of sales. VIGO's four biggest clients generated as much as 39% of the company's sales in 2022. Losing one of its key clients is a risk for VIGO's future results development. However, we note the high quality of VIGO's products and that the switching process for its clients is a difficult one, so customer loyalty is relatively high.

Lack of new orders from Safran. VIGO's 2022 sales weakness was, to a large extent, caused by limited demand from Safran, its biggest military client – VIGO's revenues from Safran fell by 77% yoy in 2022. We believe that that the slowdown in revenues from Safran is temporary and might have been related to strong stocking up in 2021: we note that, in 2021, VIGO generated PLN 20.2m in sales on Safran, more than double 2020 (PLN 9.4m) and almost triple 2019 (PLN 7.4m). In our forecasts, we expect a rebound in military revenues, driven mainly by a return of demand from Safran, which we believe is likely, considering the strong outlook for Safran's defence segment. However, if orders from Safran are limited again, or if Safran decides to change its supplier, we would see it as a major risk for our forecasts.

We note that, in 2023, the company recorded a c.47% yoy increase in its military segment revenues (and 96% yoy in 4Q23), which was driven, to a large extent, by a rebound in sales to Safran, , which mitigates the risk somewhat.

New technology replacing IR detectors. We see a risk of new technology emerging, which could be cheaper or perform better than IR detectors.

Risk related to key staff members. Experienced managers and employees are one of the company's key strengths and competitive advantages. The loss of key employees is a risk for VIGO.

Lack of skilled labour force. VIGO needs high-skilled specialists for its R&D and production departments. There is a risk that a lack of these in the Polish labour market could limit the company's growth pace, or it might have to look abroad for specialists, implying higher labour force costs in the future.

Potential share issue. Recently, the company secured financing for its development strategy, through a series F shares issue. We would exclude the risk of a further share issue aimed at financing the capex-intensive projects, especially HyperPIC and infrared arrays. The company has also flagged that it might enter the mid-infrared sources segment through M&A.

Supply chain issues. For the purpose of the detector production, the company purchases thermoelectric cooler, substrates, electronic circuits and some amounts of chemical elements (including cadmium, mercury, tellurium, antimony, arsenic, and indium).

We note that, since 2020, the global economy has faced a chip shortage crisis, as the demand for semiconductor chips exceeded the supply materially. The crisis was driven by the upsurge in people working from home (demand for work-from-home technology increased dramatically), bottlenecks in the supply chains (particularly in South Asia), and strong demand from the automotive sector, which has been shifting towards electric vehicles and automation (and, as a result, required more chips).

The supply chain issue risk materialised for VIGO in 2022. In October 2022, VIGO's CFO (as quoted by PAP) stated that the limited availability concerned c.10-20% of the electronic components, only for the production of detection modules for transport and industrial applications. According to the company's

estimates (presented along with the 4Q22 sales results), the difficulties in the availability of certain electronic components reduced its full-year contracting in 2022 by approximately 5%.

The company has also faced issues with supply related to components manufactured in the Russian Federation. The value of components imported from Russia amounted to PLN 7.3m in 2021. The company has taken steps to find alternative suppliers and has completed the qualification of a new supplier successfully. In addition, the existing supplier has relocated its production outside of Russia. The company does not see any significant problems, at this stage, with the availability of components that were purchased previously from the Russian market. However, due to disruptions in global supply chains in the electronic components market, this risk cannot be excluded completely.

China limiting exports of gallium and germanium. In July 2023, China unveiled restrictions on exports of eight gallium and six germanium products, starting on 1 August, escalating the tensions between China and the US over access to the materials used in making high-tech microchips. These elements are used by VIGO: if the supply is materially limited, we would see either an impact on VIGO's profitability (due to price hikes), or a negative impact on the volumes produced by VIGO, due to supply chain disruption.

FX risk. The company generates the vast majority of its revenues in EUR, while it incurs a large part of its opex in PLN (labour force costs, which are mostly PLN denominated, contributed 49% of the opex in 2022). To some extent, VIGO hedges the FX through debt: all of the company's bank loans were EUR-denominated as of end-2022.

Risk of lower co-financing amount. In our forecasts, we assume that VIGO's R&D expenses will be supported by public subsidies. In 2017-22, the support reached as much as 93% of the R&D expenses (on our estimates); while, in our model, we conservatively assume a 70% rate. However, we see a risk of a lower subsidies level in the future, which could either mean higher capex for VIGO financed from own sources, or limited R&D activity, and the risk of losing its technological advantage over the competition.

Financials

Sales forecasts

	2018	2019	2020	2021	2022	2023E	2024E	2025E	2026E	2027E
Science and medicine	2.8	3.1	7.8	4.0	7.2	4.7	5.3	5.8	6.4	6.9
Other	0.4	0.4	0.4	0.3	1.1	0.3	0.3	0.3	0.4	0.4
Industry	20.3	25.4	23.6	31.1	39.5	45.7	55.4	63.7	70.1	75.7
Transport	5.8	5.8	6.2	8.7	7.8	7.9	8.9	9.8	10.8	11.7
Military	8.1	8.1	13.4	23.2	8.1	11.9	16.1	31.8	60.9	63.1
Semiconductor materials	0.0	0.2	1.9	4.3	4.1	6.1	7.7	9.7	11.1	12.2
Revenues (PLN m)	**37.4**	**42.9**	**53.5**	**71.5**	**67.9**	**75.6**	**93.8**	**121.1**	**159.7**	**169.9**
Change yoy										
Science and medicine	12%	11%	153%	-50%	82%	-35%	11%	10%	10%	8%
Other	-43%	-1%	8%	-35%	296%	-74%	11%	10%	10%	8%
Industry	30%	25%	-7%	31%	27%	16%	21%	15%	10%	8%
Transport	66%	0%	7%	41%	-10%	1%	13%	10%	10%	8%
Military	69%	-1%	67%	73%	-65%	47%	36%	97%	92%	4%
Semiconductor materials	n.a.	n.a.	1101%	124%	-3%	48%	26%	25%	15%	10%
Revenues (PLN m)	38%	15%	25%	34%	-5%	11%	24%	29%	32%	6%
EUR/PLN average	**4.3**	**4.3**	**4.4**	**4.6**	**4.7**	**4.5**	**4.4**	**4.4**	**4.4**	**4.4**
Revenues (EUR m)	**8.8**	**10.0**	**12.0**	**15.7**	**14.5**	**16.7**	**21.3**	**27.5**	**36.3**	**38.6**
Change yoy	38%	14%	21%	30%	-8%	15%	28%	29%	32%	6%
Sales volume of detector modules ('000s)	**7.6**	**7.2**	**8.4**	**12.2**	**13.7**	**13.2**	**16.6**	**19.2**	**21.5**	**23.3**
Change yoy	40%	-6%	16%	46%	12%	-3%	25%	16%	12%	8%
Average price (EUR 000s)	**1.1**	**1.4**	**1.4**	**1.3**	**1.1**	**1.3**	**1.3**	**1.4**	**1.7**	**1.7**
Change yoy	-1%	21%	4%	-11%	-17%	19%	2%	12%	17%	-2%

Source: Company data, WOOD Research

Operating profitability forecasts

	2018	2019	2020	2021	2022	2023E	2024E	2025E	2026E	2027E
Depreciation	-3.5	-4.6	-6.2	-6.7	-9.3	-12.4	-12.9	-14.9	-19.2	-20.1
Consumption of materials and energy	-6.4	-8.5	-9.4	-12.8	-13.5	-18.2	-20.6	-24.2	-30.7	-32.3
Third-party services	-2.2	-3.0	-4.1	-5.9	-9.8	-14.5	-18.8	-24.2	-31.9	-34.0
Taxes and charges	-0.2	-0.2	-0.2	-0.3	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4
Employee-related expenses	-9.6	-10.5	-12.5	-16.4	-16.4	-20.5	-23.7	-26.1	-28.8	-30.5
Other costs by type	-0.4	-0.5	-0.3	-0.4	-1.0	-1.0	-1.0	-1.1	-1.1	-1.1
Total costs by type. of which:	-26.8	-32.5	-39.0	-49.7	-67.1	-67.0	-77.4	-90.9	-112.2	-118.4
Change in products	0.0	2.1	2.0	-0.9	3.2	0.0	0.0	0.0	0.0	0.0
Selling costs (negative figure)	2.2	2.4	3.4	4.7	10.4	9.5	9.8	10.8	15.4	18.4
General administrative expenses (negative figure)	7.7	12.2	15.9	20.1	20.7	18.7	22.5	25.7	29.2	31.0
Cost of products and services sold	-16.9	-15.9	-17.8	-25.7	-32.8	-38.9	-45.2	-54.4	-67.6	-68.9
Gross profit (loss) on sales	**20.5**	**27.0**	**35.6**	**45.8**	**35.1**	**36.8**	**48.6**	**66.7**	**92.1**	**101.0**
EBIT	**12.8**	**14.0**	**20.2**	**22.9**	**8.7**	**13.0**	**26.1**	**33.8**	**48.9**	**53.0**
EBITDA	**16.2**	**18.6**	**26.5**	**29.6**	**18.1**	**25.5**	**39.0**	**48.7**	**68.1**	**73.0**
One-offs*	0.0	0.0	-2.0	-2.3	-3.1	-3.7	-6.3	-3.3	-2.3	-2.3
EBITDA adjusted	**16.2**	**18.6**	**24.5**	**27.3**	**14.9**	**21.8**	**32.8**	**45.4**	**65.9**	**70.7**
Margins (%)										
Gross profit (loss) on sales	55%	63%	67%	64%	52%	49%	52%	55%	58%	59%
EBIT	34%	33%	38%	32%	13%	17%	28%	28%	31%	31%
EBITDA	43%	43%	50%	41%	27%	34%	42%	40%	43%	43%
EBITDA adjusted	43%	43%	46%	38%	22%	29%	35%	37%	41%	42%

Source: Company data, WOOD Research

Segment results forecasts (PLN m)

	2018	2019	2020	2021	2022	2023E	2024E	2025E	2026E	2027E
Sales revenue	**37.4**	**42.9**	**53.5**	**71.5**	**67.9**	**75.6**	**93.8**	**121.1**	**159.7**	**169.9**
Detection modules	37.4	42.7	51.5	67.2	63.7	69.5	86.0	111.4	148.6	157.7
Semiconductor materials	0.0	0.2	1.9	4.3	4.1	6.1	7.7	9.7	11.1	12.2
Gross profit on sales	**20.5**	**27.0**	**35.6**	**45.8**	**35.1**	**36.8**	**48.6**	**66.7**	**92.1**	**101.0**
Detection modules	20.5	26.9	34.8	44.0	34.0	34.8	46.0	63.5	88.4	97.0
Semiconductor materials	0.0	0.1	0.8	1.8	1.1	2.0	2.6	3.2	3.7	4.0
Profit (loss) on operating activities	**12.8**	**14.0**	**20.2**	**22.9**	**8.7**	**13.0**	**26.1**	**33.8**	**48.9**	**53.0**
Detection modules	12.8	14.3	19.6	22.4	8.6	11.3	24.2	31.8	46.8	50.7
Semiconductor materials	0.0	-0.3	0.7	0.5	0.1	1.8	1.9	2.0	2.1	2.2
Net profit/ (loss)	**13.0**	**13.9**	**32.5**	**30.5**	**7.2**	**9.8**	**19.2**	**24.7**	**37.0**	**41.5**
Detection modules	13.0	14.1	34.1	29.9	7.3	7.1	18.0	23.4	35.6	40.0
Semiconductor materials	0.0	-0.2	-1.6	0.6	0.0	2.7	1.2	1.3	1.4	1.5
EBITDA	**16.2**	**18.6**	**26.5**	**29.6**	**18.1**	**25.5**	**39.0**	**48.7**	**68.1**	**73.0**
Detection modules	16.2	18.8	25.5	28.9	17.6	22.9	36.2	45.5	64.6	69.2
Semiconductor materials	0.0	-0.3	1.0	0.8	0.5	2.6	2.9	3.3	3.6	3.8

Source: Company data, WOOD Research

P&L forecasts (PLN m)

	2018	2019	2020	2021	2022	2023E	2024E	2025E	2026E	2027E
Net revenues	**37.4**	**42.9**	**53.5**	**71.5**	**67.9**	**75.6**	**93.8**	**121.1**	**159.7**	**169.9**
COGS	-16.9	-15.9	-17.8	-25.7	-32.8	-38.9	-45.2	-54.4	-67.6	-68.9
Gross profit (loss) on sales	**20.5**	**27.0**	**35.6**	**45.8**	**35.1**	**36.8**	**48.6**	**66.7**	**92.1**	**101.0**
Selling costs	-2.2	-2.4	-3.4	-4.7	-10.4	-9.5	-9.8	-10.8	-15.4	-18.4
General and administrative costs	-7.7	-12.2	-15.9	-20.1	-20.7	-18.7	-22.5	-25.7	-29.2	-31.0
Other operating revenues	2.8	2.7	4.4	5.9	8.3	7.8	13.1	7.0	4.8	4.8
Other operating expenses	-0.7	-1.1	-0.6	-3.9	-3.6	-3.4	-3.4	-3.4	-3.4	-3.4
Profit (loss) on operating activities	**12.8**	**14.0**	**20.2**	**22.9**	**8.7**	**13.0**	**26.1**	**33.8**	**48.9**	**53.0**
Financial revenues	0.3	0.1	0.0	0.5	0.4	0.6	2.0	1.2	0.1	0.1
Financial expenses	-0.1	-0.3	-2.2	-0.9	-1.4	-2.4	-4.3	-4.6	-3.3	-1.8
Gross profit (loss)	**13.0**	**13.9**	**18.1**	**22.6**	**7.7**	**11.3**	**23.8**	**30.5**	**45.7**	**51.2**
Income tax	0.0	0.0	14.5	7.9	-0.5	-1.5	-4.5	-5.8	-8.7	-9.7
Net profit	**13.0**	**13.9**	**32.5**	**30.5**	**7.2**	**9.8**	**19.2**	**24.7**	**37.0**	**41.5**
EBIT	**12.8**	**14.0**	**20.2**	**22.9**	**8.7**	**13.0**	**26.1**	**33.8**	**48.9**	**53.0**
EBITDA	**16.2**	**18.6**	**26.5**	**29.6**	**18.1**	**25.5**	**39.0**	**48.7**	**68.1**	**73.0**
EBITDA adjusted	**16.2**	**18.6**	**24.5**	**27.3**	**14.9**	**21.8**	**32.8**	**45.4**	**65.9**	**70.7**
Net profit (loss) adjusted for tax gains	**13.0**	**13.9**	**18.1**	**22.6**	**7.6**	**9.8**	**19.2**	**24.7**	**37.0**	**41.5**
Net profit adjusted for one-offs	**10.6**	**11.3**	**13.0**	**16.4**	**3.7**	**6.1**	**14.1**	**22.0**	**35.2**	**39.7**

Source: Company data, WOOD Research

Balance sheet forecasts (PLN m)

	2018	2019	2020	2021	2022	2023E	2024E	2025E	2026E	2027E
Tangible fixed assets	45.0	67.5	70.7	99.2	113.5	118.9	137.9	146.0	146.8	147.5
Intangible assets and expenditures on development projects	21.1	29.0	39.6	53.9	72.9	89.1	149.6	203.7	208.6	212.9
Deferred tax assets	0.0	0.0	14.5	22.4	22.0	20.5	16.0	10.2	1.5	0.0
Other	1.3	2.3	4.3	8.2	10.5	15.5	16.5	16.5	16.5	16.5
Fixed assets	**67.4**	**98.8**	**129.1**	**183.7**	**218.9**	**244.0**	**320.0**	**376.4**	**373.4**	**376.9**
Inventory	4.1	6.9	9.2	6.9	15.3	16.2	15.4	19.9	26.2	27.9
Trade and other receivables	5.6	7.1	9.9	14.4	14.3	15.9	19.7	25.4	33.5	35.7
Cash and cash equivalents	9.3	12.8	13.2	6.5	2.3	55.5	42.7	3.2	1.9	6.0
Other	3.7	2.1	5.6	6.6	3.3	3.3	3.3	3.3	3.3	3.3
Total current assets	**22.8**	**28.9**	**38.0**	**34.3**	**35.1**	**90.9**	**81.1**	**51.8**	**65.0**	**73.0**
Total assets	**90.2**	**127.7**	**167.1**	**218.0**	**254.0**	**334.9**	**401.2**	**428.2**	**438.4**	**449.9**
Equity	**54.2**	**68.1**	**100.6**	**131.2**	**138.5**	**209.5**	**228.8**	**253.5**	**290.5**	**310.9**
Long term debt	5.5	26.8	24.1	22.2	28.9	28.9	58.9	50.9	35.9	21.9
Deferred income	12.0	19.6	25.3	35.1	52.9	62.2	78.1	86.6	92.3	98.1
Other long-term liabilities	0.4	0.7	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Long-term liabilities	**17.9**	**47.1**	**49.6**	**57.5**	**81.9**	**91.3**	**137.1**	**137.6**	**128.4**	**120.1**
Short term debt	7.9	6.5	6.4	12.5	21.4	21.4	21.4	21.4	1.4	0.0
Trade payables	7.0	1.6	1.7	8.1	4.4	4.9	6.1	7.9	10.4	11.0
Deferred income	1.3	1.4	2.9	2.4	2.6	2.6	2.6	2.6	2.6	2.6
Other current liabilities	1.9	3.1	5.7	6.4	5.2	5.2	5.2	5.2	5.2	5.2
Total current liabilities	**18.1**	**12.5**	**16.9**	**29.3**	**33.6**	**34.1**	**35.3**	**37.1**	**19.6**	**18.9**
Total equity and liabilities	**90.2**	**127.7**	**167.1**	**218.0**	**254.0**	**334.9**	**401.2**	**428.2**	**438.4**	**449.9**

Source: Company data, WOOD Research

Cash flow forecasts (PLN m)

	2018	2019	2020	2021	2022	2023E	2024E	2025E	2026E	2027E
Gross profit (loss)	**13.0**	**13.9**	**18.1**	**22.6**	**7.7**	**11.3**	**23.8**	**30.5**	**45.7**	**51.2**
Depreciation	3.5	4.6	6.2	6.8	9.4	12.4	12.9	14.9	19.2	20.1
Exchange gains (losses)	-0.2	-0.2	2.2	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Interest and share in profits (dividends)	0.0	0.0	0.4	0.3	1.7	1.8	4.3	4.6	3.3	1.8
Change in accruals	0.8	0.7	2.2	0.4	-0.6	0.0	0.0	0.0	0.0	0.0
Change in inventories	-0.7	-2.8	-2.3	2.3	-8.4	-0.9	0.8	-4.5	-6.3	-1.7
Change in receivables	-5.8	0.8	-3.1	-8.6	3.6	-1.6	-3.8	-5.7	-8.1	-2.2
Change in liabilities. except credit and loans	0.5	0.4	0.3	2.9	0.5	0.5	1.2	1.8	2.5	0.7
Change in prepayments	-0.1	0.0	0.7	-0.4	-0.3	0.0	0.0	0.0	0.0	0.0
Change in deferred revenue	-1.5	-1.3	-3.6	-5.4	-7.5	-7.8	-13.1	-7.0	-4.8	-4.8
Result of entities accounted for using the equity method	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Income tax (paid)/received	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	-8.2
Other adjustments	-0.5	-0.7	0.0	-0.1	-3.1	0.0	0.0	0.0	0.0	0.0
Net cash flows from operating activities	**9.1**	**15.4**	**21.2**	**20.7**	**3.8**	**15.7**	**26.0**	**34.5**	**51.5**	**56.9**
Grants received	1.9	8.9	10.1	15.1	25.4	17.1	29.0	15.5	10.5	10.5
Purchase of intangible assets and tangible assets	-21.6	-32.0	-8.5	-29.4	-23.7	-13.0	-26.1	-15.4	-10.0	-10.0
Expenses for the purchase of shares	-0.5	-0.6	-2.5	0.0	-2.9	-5.0	-1.0	0.0	0.0	0.0
Investment Funds	0.0	0.0	-3.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Expenditure on unfinished research&development projects	-4.3	-7.4	-12.0	-19.0	-21.4	-21.0	-66.4	-61.7	-15.0	-15.0
Loans granted	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Net cash flows from investing activities	**-24.6**	**-31.1**	**-15.9**	**-30.3**	**-22.1**	**-21.9**	**-64.5**	**-61.5**	**-14.5**	**-14.5**
Changes in debt	13.3	19.7	-4.7	3.4	15.1	0.0	30.0	-8.0	-35.0	-15.3
Dividends and other payments to owners	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-21.2
Interest and commissions	-0.1	-0.4	-0.4	-0.3	-1.0	-1.8	-4.3	-4.6	-3.3	-1.8
Other	0.0	0.0	0.0	-0.1	0.0	-1.5	0.0	0.0	0.0	0.0
Net cash flows from financing activities	**13.3**	**19.2**	**-5.1**	**3.0**	**14.1**	**59.4**	**25.7**	**-12.6**	**-38.3**	**-38.3**
Total net cash flows	-2.2	3.5	0.2	-6.5	-4.2	53.2	-12.8	-39.6	-1.2	4.1
Cash opening balance	**11.6**	**9.3**	**12.9**	**13.2**	**6.5**	**2.3**	**55.5**	**42.7**	**3.2**	**1.9**
Cash closing balance	**9.3**	**12.9**	**13.0**	**6.5**	**2.3**	**55.5**	**42.7**	**3.2**	**1.9**	**6.0**

Source: Company data, WOOD Research

FCF reconciliation (PLN m)

	2018	2019	2020	2021	2022	2023E	2024E	2025E	2026E	2027E
Net cash flows from operating activities	9.1	15.4	21.2	20.7	3.8	15.7	26.0	34.5	51.5	56.9
Net cash flows from investing activities	-24.6	-31.1	-15.9	-30.3	-22.1	-21.9	-64.5	-61.5	-14.5	-14.5
Interest and commissions	-0.1	-0.4	-0.4	-0.3	-1.0	-1.8	-4.3	-4.6	-3.3	-1.8
FCF	**-15.6**	**-16.1**	**4.9**	**-9.9**	**-19.3**	**-8.0**	**-42.8**	**-31.6**	**33.8**	**40.6**
Investments and M&As	0.5	0.6	5.5	-3.1	2.9	5.0	1.0	0.0	0.0	0.0
Organic FCF	**-15.1**	**-15.6**	**10.4**	**-12.9**	**-16.5**	**-3.0**	**-16.8**	**8.0**	**33.8**	**40.6**
FCF yield	**-5%**	**-5%**	**1%**	**-3%**	**-6%**	**-2%**	**-11%**	**-8%**	**9%**	**10%**
Organic FCF yield	**-5%**	**-5%**	**3%**	**-4%**	**-5%**	**-1%**	**-4%**	**2%**	**9%**	**10%**

Source: Company data, WOOD Research

Appendix 1: glossary

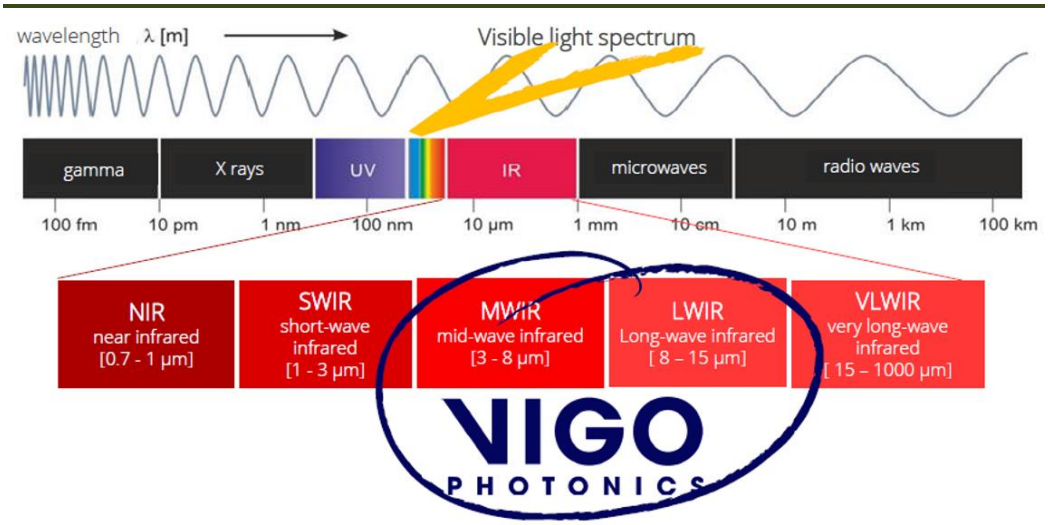
Photonics: photonics is a field of science and engineering that deals with the study and application of light. It involves the use of light (photons) to manipulate, transmit, and store information. Photonics is a multidisciplinary field that draws upon various areas of physics, materials science, electrical engineering, and optics. Photonics has a wide range of applications, including telecommunications, information processing, sensing, imaging, lighting, agriculture, medicine, manufacturing, transportation, and aerospace. Examples of photonics devices include fibre optic cables, lasers, LED lights, photodetectors, and optical filters.

Infrared radiation (IR): a type of electromagnetic radiation, with wavelengths longer than those of visible light, but shorter than those of radio waves. It is invisible to the human eye, but can be detected by specialised sensors and cameras. Infrared radiation is generated by thermal radiation from objects that are at a temperature above absolute zero, which means that almost all objects emit some level of infrared radiation. Infrared radiation is often referred to as "heat radiation", because it is associated with the sensation of warmth. It is used in a variety of applications, including thermal imaging cameras, remote controls, and some types of medical imaging.

Infrared radiation is divided into five categories: near infrared (700 nanometers to 1000 nanometers), short-wave infrared (1-3 micrometers), mid-wave infrared (3-8 micrometers), long-wave infrared (8-15 micrometers) and very long-wave infrared (15-1000 micrometers), based on the range. Near infrared and short-wave infrared radiation are the closest to visible light and are often used in applications such as fibre-optic communication, spectroscopy, and imaging. Mid-infrared radiation is used in applications such as chemical sensing and thermal imaging. Long-wave infrared radiation is associated with thermal radiation from objects at low temperatures and is used in applications such as astronomy and materials science.

VIGO Photonics is focused on IR detectors operating in any wavelength from 2 to 16 µm.

Optical radiation diagram



Source: VIGO Photonics

Infrared detector: an electronic component made up of semiconductors that allows the conversion of infrared radiation energy into an electrical signal. The device is capable of detecting and measuring the levels of infrared radiation emitted by objects in its field of view. Infrared detectors are used in a variety of applications, including remote sensing, thermal imaging, and non-contact temperature sensing.

Simplified general operating diagram of the infrared detector

Source: VIGO Photonics

There are two main infrared detectors categories: thermal, whose operation is based on the use of changes in resistance or voltage as a result of the thermal effect of radiation; and photon, operating as a result of the conversion of radiant energy into thermal energy.

Thermal detectors are typically used for applications that require high sensitivity and low cost, such as non-contact temperature measurement, motion detection, and TV remote controls. Photon detectors are typically used for applications that require high speed and a wide range of detectable wavelengths, such as telecommunications and imaging.

The key differences between thermal and photon infrared detectors are the following:

- **Sensitivity:** thermal detectors typically have higher sensitivity than photon detectors. They can detect very small changes in temperature, which can translate into very small changes in the amount of IR radiation detected. Photon detectors are less sensitive to small changes in radiation, but they can detect a wider range of wavelengths.
- **Response time:** thermal detectors typically have slower response times than photon detectors. This is because it takes time for the detector material to heat up or cool down in response to changes in radiation. Photon detectors can respond more quickly because the interaction of photons with the detector material is faster.
- **Temperature range:** thermal detectors can operate over a wider temperature range than photon detectors. This is because thermal detectors are based on temperature changes, which can occur at very high or very low temperatures. Photon detectors are typically limited to a narrower temperature range.
- **Cost:** thermal detectors are generally less expensive than photon detectors. This is because they are simpler in design and use less complex materials.

Semiconductor materials: materials with a crystalline structure whose electrical conductivity is between conductors (usually metals) and insulators (most ceramic materials). They have the unique property of being able to conduct electricity under certain conditions, such as when exposed to light or heat. Semiconductors are used extensively in electronic devices such as transistors, diodes, and integrated circuits. They are also used in solar cells, light-emitting diodes (LEDs), and other optoelectronic devices. The most commonly used semiconductors are silicon (Si) and germanium (Ge), which are both elements in the periodic table. Other semiconductors, such as gallium arsenide (GaAs) and indium phosphide (InP), are compound semiconductors made from combinations of different elements.

Infrared module: an integrated system containing an infrared photodetector, signal processing electronics, optics, heat dissipation systems and other components. The infrared module provides a complete and compact solution for detecting and measuring infrared radiation, with the added convenience of being ready to use out of the box. An infrared detector is a component that detects infrared radiation, while an infrared module is a packaged assembly of components that includes an infrared detector, along with other components, to provide a complete and convenient solution for detecting and measuring infrared radiation.

Substrates: the crystalline structure on which the proper layers are then grown. In the context of electronics and semiconductor technology, substrates are commonly used as the foundation or base layer for the fabrication of electronic devices. Substrates can be made from a wide range of materials, depending on the specific application. Commonly used substrate materials include silicon, gallium arsenide, sapphire, and various types of glass. In the semiconductor industry, substrates are used to grow thin films of semiconductor materials, such as silicon or gallium arsenide, through a process called epitaxy. The substrate acts as a template or seed for the growth of the semiconductor material. The properties of the substrate, such as its crystal structure and surface finish, can have a significant impact on the quality and properties of the grown semiconductor material.

Epitaxy: a process in which a thin layer of crystalline material is deposited on top of another crystalline material with a matching lattice structure, such that the deposited material takes on the same crystal orientation as the underlying material. In other words, epitaxy is a method for growing a crystal film with a specific crystallographic orientation on a substrate. The process of epitaxy is used extensively in the semiconductor industry to create thin films of materials such as silicon, gallium arsenide, and other compound semiconductors. These films are used in a variety of applications, such as in the production of computer chips, solar cells, and light-emitting diodes (LEDs). During the epitaxy process, the crystal structure of the deposited material aligns with that of the substrate, creating a single crystal structure.

There are several types of epitaxy, including molecular beam epitaxy (MBE), chemical vapor deposition (CVD), and metal-organic chemical vapor deposition (MOCVD). The choice of epitaxy technique depends on the specific material being grown and the desired properties of the resulting thin film.

Epitaxy III-V: epitaxy III-V refers to a process of growing thin layers of materials from the III-V group of elements (such as gallium arsenide, indium phosphide, or aluminium gallium arsenide) on top of a

substrate using a technique called epitaxy compared to I-II group elements (such as zinc sulfide or cadmium selenide).

Epitaxy III-V is commonly used in the semiconductor industry to create high-performance electronic and optoelectronic devices such as transistors, solar cells, LEDs, and laser diodes. The III-V materials offer several advantages over traditional silicon-based devices, including higher electron mobility, higher carrier concentration, and a wider bandgap, which allows them to operate at higher frequencies and temperatures.

By controlling the thickness and composition of the epitaxial layers, engineers can create complex structures with precise electrical and optical properties, which are essential for many advanced electronic and optoelectronic devices. Epitaxy III-V has enabled the development of many technologies, including high-efficiency solar cells, high-speed transistors, and high-brightness LEDs.

MCT detectors: MCT stands for Mercury Cadmium Telluride, which is a compound semiconductor material that is commonly used in the fabrication of infrared detectors. MCT detectors are a type of photoconductive detector that operates by converting incident infrared radiation into electrical current. MCT detectors have several advantages over other types of infrared detectors, such as high sensitivity, fast response time, and wide spectral range. They can detect radiation in the mid-wave infrared (MWIR) and long-wave infrared (LWIR) regions of the spectrum, which makes them suitable for a wide range of applications, such as thermal imaging, remote sensing, and spectroscopy.

RoHS: the Restriction of Hazardous Substances (RoHS) regulations restrict the use of certain hazardous substances in electronic products, including semiconductor devices. The substances covered by RoHS include lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBBs), and polybrominated diphenyl ethers (PBDEs). The goal of RoHS is to reduce the environmental and health hazards associated with these substances. The impact of RoHS on the semiconductor market has been significant. The regulations have forced semiconductor manufacturers to find alternative materials and manufacturing processes that are free from the restricted substances. This has led to the development of new materials and processes that are more environmentally friendly and less hazardous to human health.

Infrared array: an infrared array is a type of infrared detector that consists of an array of individual detector elements, each of which can detect infrared radiation in a specific wavelength range. The individual detector elements are typically arranged in a regular pattern, such as a square or rectangular grid, and are often fabricated using semiconductor manufacturing techniques.

Infrared arrays can be used in a variety of applications, including thermal imaging, gas detection, and spectroscopy. By detecting the infrared radiation emitted or absorbed by a sample, infrared arrays can provide information about its temperature, chemical composition, and other properties.

The performance of an infrared array is typically characterised by parameters such as its sensitivity, spatial resolution, and spectral range. In recent years, advances in infrared array technology have led to the development of high-performance detectors that are capable of detecting infrared radiation with high sensitivity and resolution, opening up new possibilities for applications such as medical imaging, environmental monitoring, and industrial process control.

VCSEL: Vertical-Cavity Surface-Emitting Laser. It is a type of semiconductor laser diode that emits light perpendicular to the surface of the wafer, as opposed to edge-emitting lasers that emit light parallel to the surface. VCSELs are commonly used in applications such as optical communication networks, sensing, and computer mice. They offer advantages such as low power consumption, high modulation rates, and ease of fabrication. They also have a circular output beam, which makes them easier to couple with optical fibres or other optical components.

Laser spectroscopy: a field of science that uses lasers to study the properties of matter. It involves using laser light to excite atoms, molecules, or solid-state materials and then analysing the resulting light emitted or absorbed by the sample. By studying the interaction between light and matter, laser spectroscopy provides information on the structure, composition, and dynamics of materials at the atomic and molecular level. Laser spectroscopy has applications in such as chemistry, physics, materials science, and biology.

ICL: Interband Cascade Laser technology, which is a type of semiconductor laser used in the mid-infrared wavelength range. ICL technology is based on a unique cascading design of multiple quantum wells, which allows for efficient and low-threshold operation in the mid-infrared region. This technology enables the development of compact, high-performance mid-infrared sources that can be used in a wide range of applications, such as sensing, spectroscopy, and medical diagnostics. The mid-infrared wavelength range is particularly useful for sensing and imaging applications because it can provide information about the chemical composition of materials, including gases and liquids.

QCL: Quantum Cascade Laser technology, a type of semiconductor laser used in the mid-infrared wavelength range. QCLs are made up of multiple layers of semiconductor materials, each layer only a few nanometers thick. The layers are carefully engineered to allow for the efficient and controllable movement of electrons through the structure, resulting in the emission of mid-infrared light. QCL technology has several advantages over other mid-infrared sources, such as ICLs. QCLs can be designed to emit at a wide range of wavelengths in the mid-infrared region, providing access to a broad range of chemical information. They also have high power output and can be operated at room temperature, making them more practical for many applications. QCLs have many potential applications, including trace gas sensing, medical diagnostics, and defence and security.

MIRLED: Mid-Infrared Light Emitting Diode, a type of semiconductor technology that allows for the efficient emission of mid-infrared (MIR) light from a light-emitting diode (LED). Traditionally, LEDs have been limited to emitting light in the visible or near-infrared (NIR) regions of the electromagnetic spectrum. However, MIRLED technology has been developed to extend the emission of LEDs into the MIR region. This is achieved by using new semiconductor materials and device structures that can efficiently emit light in the MIR region. MIRLED technology has several advantages over other MIR sources, such as QCLs and ICLs. MIRLEDs are compact and low-cost, making them suitable for portable and handheld devices. They are also more energy-efficient than other MIR sources, which can help to extend battery life in portable devices. On the other hand, MIRLED's output power and wavelength coverage are currently more limited than QCLs and ICLs. MIRLEDs have many potential applications, including chemical sensing, biomedical imaging, and environmental monitoring.

Appendix 2: peers descriptions

Hamamatsu Photonics is a leading global manufacturer of advanced photonic devices and systems, founded in 1953 in Hamamatsu, Japan. It offers devices for the generation and measurement of visible, infrared, and ultraviolet light. These devices include photomultipliers, photodiodes, infrared detectors, image sensors, scientific cameras, and light sources. The company also manufactures x-ray detectors and sources, as well as specialised photometric systems for semiconductor manufacturing, pharmaceutical development, non-destructive inspection, and academic research. Hamamatsu Photonics serves customers in more than 100 countries worldwide. In 2022, it generated revenues of almost USD 1,676m.

Teledyne Technologies was founded in 1960 and is headquartered in Thousand Oaks, California, providing electronic subsystems and instrumentation. Its products include digital imaging sensors, cameras and systems within the visible, infrared and X-ray spectra, monitoring and control instrumentation for marine and environmental applications, harsh environment interconnects, electronic test and measurement equipment, aircraft information management systems, and defence electronics and satellite communication subsystems. It also supplies engineered systems for defence, space, environmental and energy applications. In 2022, it generated revenues of almost USD 5,459m.

Coherent Corp is a global leader in materials, networking, and lasers for the industrial, communications, electronics, and instrumentation markets. The company is headquartered in Saxonburg, Pennsylvania. It was founded in 1971, to manufacture high-quality materials and optics for industrial lasers. Today, the company operates in more than 20 countries around the world.

IPG Photonics, founded in 1991, is a developer and manufacturer of high-performance fibre lasers and amplifiers, used in materials processing, communications, entertainment, medical, biotechnology, scientific and advanced applications, with many new products displacing traditional technologies. IPG operates globally, with manufacturing facilities in the US, Germany, Russia and Italy, and regional sales offices in China, Japan, Korea, Taiwan, India, Turkey, Brazil, Mexico, Singapore, Spain, Poland, the Czech Republic, Canada, and the United Kingdom.

OPTEX, founded in 1979, manufactures and markets infrared sensors used for security system, automatic doors, industrial automation, factory automation and environmental control. The company's products include passive infrared sensors, photoelectric sensors, and automatic transparency measurement systems.

NIPPON CERAMIC develops, manufactures, and sells various types of ultrasonic sensors and pyroelectric infrared sensors. The company also produces ferrite cores and gas sensors. Nippon Ceramic operates production facilities in Japan, the UK, and China, and markets its products in China, the UK, and the US.

Focused Photonics Hangzhou Incorporation develops, produces and sells instrumentations for environmental monitoring, industrial process analysis and safety monitoring. The company's main products are environmental monitoring systems, digital environmental protection information systems, industrial process analysis systems and security monitoring systems.

Visual Photonics Epitaxy, founded in 1996, with its HQ in Taiwan, develops, produces, and markets semiconductor epitaxy wafers, LEDs, photodetectors, and other optoelectronic devices, which are used in a variety of industries, including automotive, telecommunications, and consumer electronics.

Amphenol Corporation designs, manufactures, and markets electrical, electronic and fibre optic connectors, interconnect systems, and coaxial and flat-ribbon cable. The company's products are used in a variety of industries, including telephone, wireless, and data communications systems, cable television systems, and commercial and military aerospace electronics.

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04/12/23	EME Macro/Strategy: Hungary	Heading into a brighter 2024E	Raffaella Tenconi, Alessio Chiesa
04/12/23	Romanian Banks	Banking in the land of Dracula	Miguel Dias, Marta Jezewska-Wasilewska
01/12/23	EME Macro/Strategy: CIS plus	Top growth in our markets, again	Alessio Chiesa, Raffaella Tenconi
01/12/23	Magyar Telekom	Fastest-growing EMEA telecom	Piotr Raciborski, Atinc Ozkan