ARROWHEAD
BUSINESS AND INVESTMENT DECISIONS

Due Diligence and Valuation Report

Arrowhead Code:	48-01-01
Coverage initiated:	November 20, 2023
This document:	November 20, 2023
Fair share value bracket	AUD 0.09 – AUD 0.18
Share price (November 20, 2023):	0.059[i]

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Company:	BluGlass Limited
Ticker:	ASX: BLG
Headquarters:	Sydney, New South Wales
Non-Executive Chair:	Mr. James Walker
CEO:	Mr. Jim Haden
CFO:	Mr. Samuel Samhan
Website:	www.bluglass.com

Market Data

52-Week Range:	AUD 0.023 – 0.083[ii]
Average Daily Volume (3M Avg.):	2,062,342[iii]
Market Cap (November 20, 2023):	90.2 mn[iv]

Company Overview: BluGlass Limited (BLG or BluGlass) is a leading laser diode manufacturer based in Australia and the US. With over a decade of research & development (R&D) experience in light emitting diodes (LEDs), micro-LEDs and foundry work, BLG is well-positioned to manufacture high-performance gallium nitride (GaN) laser diodes.

The company's long-term goal is to be the 'Supplier of Choice' in the GaN laser diode market, by tapping into the rapidly growing industrial, quantum, biotech, defense, scientific and display markets, set to reach USD 3.9 billion by FY 2032. BLG has a unique business model that caters to the growing market by offering customizable and differentiated product offerings. The industry is currently constrained by a limited number of suppliers and lack of new product development and laser diode form factors, suggesting a large unmet need for a pure-play GaN laser diode supplier.

BLG's proprietary remote plasma chemical vapor deposition (RPCVD) technology uses low-temperature, low-hydrogen, and is intended to power tomorrow's smarter, cleaner, more efficient photonics. RPCVD is an important pillar of the company' unique business model, as this technology is ring-fenced by 53 internationally granted patents, 15 applications at the Patent Cooperation Treaty stage, 8 patent families, and 17 trademarks. BLG's product suite includes a range of laser diode products, from small-batch custom lasers to medium- and high-volume off-the-shelf products, making BLG one of a handful of end-to-end GaN laser manufacturers globally. The product roadmap encompasses a broad spectrum of wavelengths ranging from 395-525 nanometers (nm) in single and multi-mode options and flexible form factors.

Key Highlights: (1) BLG continues to invest in the development of its 405-450 nm products in both single- and multi-mode formats. The company aims to extend its wavelength range beyond blue 450 nm to the green wavelengths ranging from 500-525 nm and further into the UV down to 395 nm; **(2)** The company has dedicated state-of-the-art facilities in several locations including Sydney, Australia (laser design and wafer growth manufacturing), its recently acquired production facility in Fremont, California (downstream manufacturing steps to turn the wafers into laser chips or bars), and Nashua, New Hampshire (packaging and reliability testing processes) in the US; **(3)** BLG is committed to the continued development and commercialization of RPCVD as it launches its first commercial laser diodes, thereby expanding its laser portfolio and customer base. BLG has already acquired multiple orders from several industry-leading clients who are qualifying BLG-manufactured lasers in real-world applications. In October 2023, the company was named a member of the CLAWS Hub announced by the US Department of Defense; **4)** BLG's acquisition of a commercial Silicon Valley laser diode production facility lease and manufacturing equipment for USD 2.5 mn has started showing synergistic benefits. Management believes that a fully operational fabrication facility will boost BLG's top line capacity to c. USD 170 mn and gross margin by 15% to reach 45%; **(5)** BLG will look to invest in advanced capabilities, DFB technologies, and Photonic Integrated Circuits (PICs) as it transitions toward the quantum computing and quantum sensing markets that will help the company in attracting higher ASPs.

Key Risks: (a) BLG is currently in a pre-revenue stage, and any difficulties in raising adequate funds could delay the commercialization of its technology; **(b)** Any loss of key management personnel with extensive experience might adversely affect BLG's strategy, operations and future performance.

Valuation and Assumptions: Given our due diligence and valuation estimates, Arrowhead believes BLG's fair market value per share is AUD 0.09 to AUD 0.18, derived using Blended Valuation (DCF and Relative Valuation).

See important disclosures on page 52 of this report.

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1. Investment Thesis

Arrowhead is initiating its coverage of BluGlass Limited with a fair value of AUD 0.09 per share in the low-bracket scenario and AUD 0.18 per share in the high-bracket scenario, derived using Blended Valuation (DCF and Relative Valuation).

With the aim of helping customers and partners solve complex problems, BLG is set to become a leading pure-play supplier of GaN laser diodes worldwide. To power the smarter, cleaner, more efficient photonics of tomorrow, BLG has devised its proprietary RPCVD technology, which combines the best of traditional nitride growth techniques with its own unique low-temperature, low-resistivity nitride growth process – to enable brighter, higher-efficiency devices. This technology will enable the company to deliver cutting-edge, custom laser development across the industrial, defense, display and scientific markets. Leveraged by an extensive network of supply-chain partners, BLG offers a suite of laser diode products, from small-batch custom lasers to high-volume and off-the-shelf products, thereby strengthening its focus on becoming a "supplier of choice" for the industry. With strategic collaborations, the company is also well-placed to leverage its technological prowess to meet potentially surging demand in the future.

Burgeoning large addressable market may provide significant tailwinds in the future

Lasers form a key component of many products in everyday use. Consumer products such as Blu-Ray and DVD players rely on laser technology to read information from the disks. Barcode scanners employ lasers for information processing. Lasers are also used in many surgical procedures, as well as next generation medical diagnostics and treatments. In manufacturing, lasers are used for cutting, engraving, drilling, and marking a broad range of materials. Lasers are increasingly being adopted in the production of automobiles and aerospace manufacturing, not only in cutting and welding components, but also in implementing advanced technologies such as automatic driver assistance systems (ADAS). The rising adoption of high-tech applications globally, such as smartphones, smart TVs, 3D printing, electric vehicles, and renewable energy storage, as well as significant growth in industrial materials processing (automotive, aviation. and others), is likely to keep the laser technology market growing at a CAGR of c. 8.9% to reach c. USD 39.2 bn by 2032[v]. Within this market, approximately 10%[vi] is attributed to the GaN laser diode segment, which is projected to expand to around USD 3.0 bn by 2029 and USD 3.9 bn by 2032. Growth in this segment is largely driven by an increase in usage across a wide range of applications, covering both generic and specialized needs. Over the past few years, the importance of GaN laser diodes has been on the rise due to their ability to offer a significant edge over traditional IR lasers in terms of size, weight, absorption (particularly in metals), angle beam, as well as current consumption, voltage, and power requirements. Their unique advantages have made them the preferred choice for various applications, contributing to the growth of the GaN laser diode market.

RPCVD, BLG's Proprietary technology – a potential game changer

BLG's revolutionary RPCVD technology has firmly established the company as a global supplier of end-to-end GaN laser diodes. By combining traditional nitride growth techniques with its unique low-temperature, low-resistivity nitride growth process, BLG's RPCVD process solves complex technological challenges and delivers higher-efficiency, lower-cost devices. While BLG's initial focus is on offering violet and blue laser diodes using industry recognized MOCVD technology, the company's long-term ambition is to expand into green laser diodes using its proprietary RPCVD technology. An upgraded version of MOCVD, RPCVD addresses challenges such as high temperatures, low efficiency, and the usage of toxic carrier gases. The process combines the scalability potential of MOCVD with the unique benefits of a nitrogen plasma source to develop novel laser architectures. Leveraging its proprietary RPCVD and tunnel junction technology, BLG aims to develop longer wavelength devices and revolutionize the industry.

BluGlass' differentiated offerings stand apart from those of its competitors

The market segment for ultraviolet and visible, or GaN lasers, is rapidly growing, establishing itself as a prominent part of the laser industry. It encompasses the portions of the near ultraviolet band, and violet to green wavelengths of the visible spectrum. GaN lasers offer several inherent advantages over traditional IR laser applications, opening new possibilities for various end-user industries, such as quantum sensing and computing, robotics, biotechnology, and medical therapies. Consequently, global original equipment manufacturers (OEMs), systems integrators, electronics manufacturers, defense contractors and research organizations rely on GaN lasers. Due to the complexity of laser diode manufacturing, new players face significant barriers to entry, resulting in a limited number of end-to-end GaN laser diode suppliers. Unfortunately, this often leads to unaddressed customer needs. The key problems faced by end-customers are constrained supply (a handful of captive global GaN laser suppliers), the focus on LEDs (most competitors have large, differentiated product portfolios focused on the LED and micro-LED markets), and a limited product mix (form factor flexibility, customization, and manufacturing agility). As a result, end customers are forced to undertake significant customization and expensive post-purchase packaging. However, BLG, one of the few GaN laser suppliers worldwide, has state-of-the-art facilities and a vertically integrated supply chain in Australia and the US, placing the company in an advantageous position to effectively address these unmet customer needs. Therefore, customers can confidently rely on BLG to provide flexibility, customization, and manufacturing agility, which are crucial in the GaN laser market.

Vertical integration marks a step-change

In FY 2022, BLG acquired a commercial Silicon Valley laser diode production facility lease and manufacturing equipment for a total of USD 2.5 mn. The 19,000 square feet (sq. ft) facility was strategically acquired to accelerate the company's long-term growth strategy. Acquisition of the fabrication facility is providing synergistic benefits by vertically integrating the downstream laser diode processing and packaging facility in-house, allowing BLG to turn laser diode wafers into customer-ready products. Management is confident that vertical integration will yield considerable technical and commercial benefits in both the short and long term, improving the quality and performance of the launched lasers, while accelerating learning cycles and development of new and next-generation products. This is providing enhanced operational control and manufacturing capability, critical in establishing BLG as a partner-of-choice and addressing key customer challenges, such as packaging flexibility and greater GaN laser availability. This strategic move has also allowed the company to significantly scale its manufacturing and revenue generation capacity, while reducing supply chain complexity and is on track-to halve wafer production costs, paving the way for higher margins and cash flow breakeven. This strategic move is expected to boost BLG's top line capacity to c. USD 170.0 mn, while scaling the gross margin to 45%.

DFB offerings provide BLG with multiple go-to-market options

DFB lasers are a highly promising laser technology commonly used in infrared non-visible wavelengths to enable single-frequency devices that provide narrow spectral width and high-spectral purity. Recently, BLG made substantial progress in its development of visible GaN DFB lasers using its proprietary RPCVD technology, demonstrating substantial performance improvements with collaboration partner University of California Santa Barbara (UCSB). In its latest development, the company demonstrated substantial performance improvements to its DFB laser, increasing the side-mode suppression ratio by more than 50% to deliver advanced single performance frequency at 450 nm and longer-wavelength blue devices up to 478 nm. Visible DFB lasers are not commercially available. However, there is a growing need for this highly promising laser technology to provide narrow spectral width and high spectral purity in more compact form factors to facilitate advanced quantum applications.

Won position as part of the CLAWS hub in the US Microelectronics (ME) Commons

In October 2023, BLG was named a member of the Commercial Leap Ahead for Wide Bandgap Semiconductors (CLAWS) Hub, led by North Carolina State University (NCSU). The US Department of Defense awarded USD 238 mn in CHIPS and Science Act funding in FY23 for the establishment of eight regional innovation hubs as part of the USD 2 bn allocated to the ME Commons Program from FY 23-27. The CLAWS hub which has been awarded USD 39.4 mn, is one of eight regional innovation hubs, and has the fewest members of all the hubs with only seven members, including BluGlass, Coherent Laser, General Electric, and Wolfspeed. The ME Commons is focused on bridging and accelerating the lab-to-fab transition and mitigating supply chain risks and will supercharge America's ability to develop, prototype, manufacture, and produce cutting-edge microelectronics at scale.

JV with a partner of sound reputation, presenting substantial innovation opportunities

BLG engaged with several highly respected partners, bolstering its earnings capability, and increasing its technological know-how. One notable collaboration is its partnership with Ganvix on the development of GaN vertical-cavity surface-emitting lasers (VCSELs) for green wavelengths (515 nm-525 nm) using a combination of MOCVD and RPCVD technologies. This partnership highlights BLG's ability to provide unique benefits and paves the way for the development of solutions for high-growth future markets. VCSEL laser diodes are the most rapidly expanding segment in the laser diode market. They are known for their high efficiency and cost-effectiveness. BLG was also recently recognized for its leading innovation in RPCVD epitaxy growth, novel architectures, and longer-wavelength devices by being invited to join the prestigious Solid-State Lighting & Energy Electronics Center (SSLEEC) Consortium at the UCSB. This invitation-only collaboration between industry leaders and pre-eminent GaN researchers is a testament to BLG's expertise in the field. With RPCVD technology offering key performance advantages, the company remains capable of delivering higher-power and efficient performances, thereby solidifying its position as a leading innovator in the industry.

Experienced management and board instill confidence in stakeholders

A strong and experienced management team is the foundation of any successful company. BLG has successfully built a team of industry experts with rich experience to power the smarter, cleaner and more efficient photonics of tomorrow. A case in point is the appointment of Mr. Jim Haden as chief executive officer. He has over 30 years of laser industry expertise with a proven record of transforming advanced technology businesses. Mr. Haden's experience includes his recent role at Soraa Laser Diode, where he guided the operations and development teams, thereby leading to an improvement and ramping-up production of high-power blue GaN lasers and associated packaging, as well as improving the manufacturing yields, later delivered to several customers. Prior to this, Jim was the Chief Operating Officer at nLIGHT, helping transform the business from early-stage revenue generation to its current market leadership position. Other senior roles include Director of Operations and Product Line Management at Coherent Incorporation, Director of Operations South Bay Operations at JDS Uniphase, and Director of Operations at Spectra Diode Lasers (acquired by JDS Uniphase for US$41B).

The board is further enriched by the presence of industry veteran Mr. Jean-Michel Pelaprat, who has over 30 years of experience in establishing, commercializing and scaling laser and semiconductor businesses. Jean-Michel was the co-founder of blue laser systems leader NUBURU. Other senior leadership positions include President and CEO of Vytran, and Director of NKT Photonics The company has recently appointed Mr. Samuel Samhan as the new Chief Financial Officer with more than 20 years of financial leadership and commercial operations experience which can prove to be pivotal in transforming the financial and commercial operations for the company thereby boosting its profitability.

Certain risks could impede growth plans

Development and commercialization of RPCVD technology is the key to success

BluGlass' long-term roadmaps rely on the successful development and commercialization of its RPCVD technology, which is in the alpha stage. If the technology fails to meet competitive specifications, BluGlass may need to allocate additional time and resources to rectify any outstanding issues, resulting in a delay in the commercialization of the company's advanced roadmaps. While RPCVD forms an important pillar, and will enable further differentiation, BluGlass could build a highly successful business with their MOCVD offerings due to the highly differentiated business model of manufacturing agility, customisation and form factor flexibility. Also, the qualification processes with larger clients may be time-consuming, potentially leading to further delays, resulting in delayed shareholder return.

Gallium export restrictions might lead to short-term headwinds

BLG's product heavily depends on gallium as its primary raw material. Any geopolitical instability could potentially cause a shortage of supply, boosting the price of the metal. This has already been observed with China's restriction on gallium export, which has caused a surge in the price since China controls a significant portion of the global supply (c. 80-90%). Although the company has been in contact with its primary gallium suppliers and has been assured of no short-term impact on supply, BLG is closely monitoring the situation with its suppliers. Any export-related restriction from China could lead to higher procurement costs for the company, potentially affecting its profitability in the short term. A lack of raw materials could also result in lost clients and business for the company.

BLG has yet to secure financing for the project

BLG is currently in an early-revenue stage and is generating modest revenues from customers, and through grants and tax rebates. It will have to raise significant funds to pursue its business strategy and planned capex. While it has raised the required financing in the past, it could potentially be unable to raise enough funds to meet its future requirements due to unpredictable circumstances, such as adverse market conditions and economic downturns, thereby leading to short-term headwinds.

Investment thesis conclusion

Through its distinctive offering, BluGlass plans to strategically position itself to answer the increasing demand from end-user industries. The company's partnerships with well-regarded names, for instance its inclusion in the ME Commons Commercial Leap Ahead Wide-Bandgap Semiconductor (CLAWS) Hub, recently awarded by the US Department of Defense, should help it in developing technical know-how and secure its financial position, paving the way for significant growth opportunities. However, on its way to becoming a reliable and preferred supplier, it must overcome several hurdles, including successful commercialization of its proprietary technology and the need to raise adequate funds for technological development.

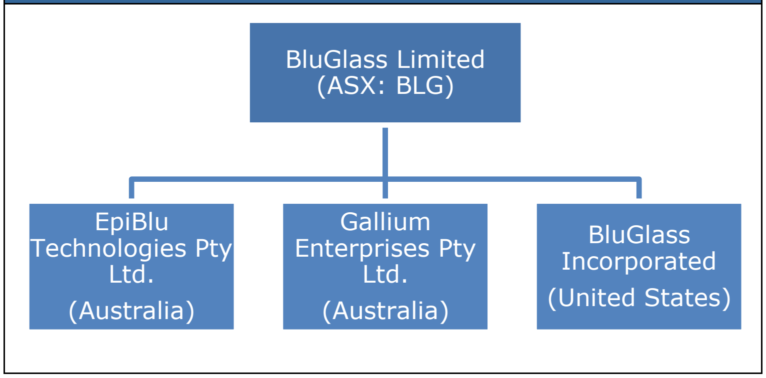
2. Business Overview

2.1 Introduction[vii]

Headquartered in New South Wales, Australia, BluGlass Limited is a leading supplier of GaN laser diode products to the global photonics industry. The company has been developing leading-edge semiconductor manufacturing technology and devices for more than a decade. It has developed and delivered innovative custom laser and LED technology to a plethora of end-user industries that span the industrial, defense, display and scientific markets.

BLG's offerings include a suite of laser diode products from small-batch custom lasers to medium- and high-volume off-the-shelf products, making it one of a handful of end-to-end GaN laser manufacturers globally. The product suite will encompass a broad spectrum of visible wavelengths ranging from 395 nm-525 nm in single and multi-mode options and flexible form factors, some of which are under development in BLG's dedicated state-of-the-art facilities in Sydney, New Hampshire, and its recently acquired production facility in Fremont, California in the US. Listed on the Australian Stock Exchange (ASX), BLG pioneered its proprietary RPCVD technology, which is low-temperature, low-hydrogen semiconductor manufacturing technology platform, established to power the smarter, cleaner, more efficient photonics of tomorrow. The company combines the best of both traditional nitride growth techniques, offering a range of standard laser diode products produced with the incumbent technology MOCVD, while applying its differentiated RPCVD technology in laser diodes with longer wavelengths. BluGlass' unique hardware and device technology is ring-fenced by 53 internationally granted patents in key semiconductor manufacturing jurisdictions, including Japan, Taiwan, China, the US, and Europe. There are 15 applications in the Patent Cooperation Treaty stage, eight patent families, and 17 trademarks.

Exhibit 1: BluGlass Holding Structure



BLG has already acquired multiple orders with several industry-leading customers who are qualifying BLG-manufactured lasers in real-world applications, thereby generating initial product revenues. The company's long-term aim is to build its core competencies, which revolve around solving customers' problems, thereby fast-tracking advanced product roadmaps to launch novel applications and next-generation lasers, which should, in turn, enhance BLG's industry competitiveness and ability to lead and influence the market.

BLG is the parent company with the following three wholly owned subsidiaries:

- EpiBlu Technologies Pty Ltd. (Australia)
- Gallium Enterprises Pty Ltd. (Australia)
- BluGlass Incorporated (A US Delaware Corporation)

2.1.1 BLG's History

BLG was formed via a spin-off from the Physics Department of Macquarie University in 2005, before being listed on the ASX in 2006. The company began with the goal of producing low-cost LEDs for general lighting by depositing GaN onto glass substrates. It developed a plasma deposition process that lowered costs and improved LED performance. The company opened a semiconductor deposition and demonstration plant in Sydney in 2008, and by 2018, it was commercializing RPCVD equipment for the LED, micro-LED and power electronics industries. In 2019, BLG pivoted to GaN laser diode manufacturing, offering bespoke solutions to the industrial, defense, display and scientific industries. The company commissioned the largest commercial-scale RPCVD manufacturing platform in 2020 in collaboration with AIXTRON, marking a significant milestone in its commercial-scale activities.

2.1.2 EpiBlu[viii]

EpiBlu is a service arm of BLG, offering highly specialized epitaxy, foundry and characterization services. Its state-of-the-art facility in Sydney, Australia, is home to experienced technical professionals. EpiBlu positions itself as a cost-effective partner for its customers by operating on a small scale, allowing for fast prototyping and product turnaround times. Its engineers and designers work closely with customers to co-develop custom solutions from concept development to product prototyping, optimization, intellectual property development and technology transfer. By working together, EpiBlu aims to bring new technology and innovation to life for its customers. Overall, EpiBlu offers the following:

Exhibit 2: EpiBlu's Epitaxy Services

Fast Prototyping	R&D	Customer Support
• Small-scale setup • Cost-effective partner for customers • Provides fast epitaxy prototyping and product turnaround times	• Offers contract R&D services for the manufacture of custom nitride templates and device wafers • State-of-the-art R&D capabilities	• Delivers solutions that provide customers with a competitive edge and assists them in solving their innovation problems • Works closely with customers to provide best support for the projects

- Full-suite epitaxy services
- Fast prototyping
- 405-525 nm wavelengths
- Custom nitrides with MOCVD & RPCVD capability

BluGlass is only applying its EpiBlu service arm strategically to augment its strategic position in the market and broaden its portfolio into non-edge-emitting laser diode. However, the focus remains on laser diode product portfolio.

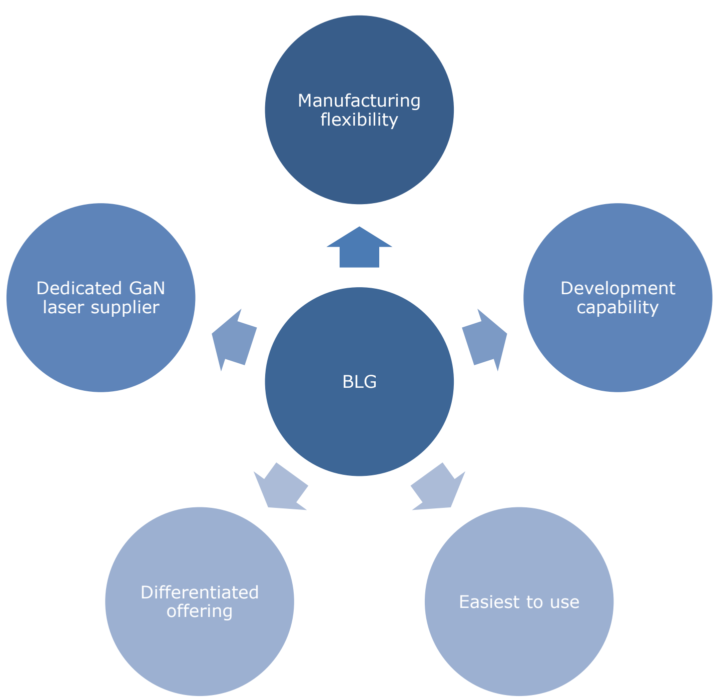
2.2 Why BluGlass?[x]

There are several industry challenges and economic drivers influencing the product development roadmap in the target markets.

The laser market demands more output power for less cost per unit. The need for more power per chip has been driving the industry since its inception. Efficiency is also a key metric for the company since power conversion is highly important, not just from an environmental perspective but as a way for customers to save money. Higher efficiency reduces the total cost of ownership for the customers, especially when they are running high-powered lasers.

As a result, customers are inclined to pay higher prices for brighter sources as they are easier to integrate and cost less, both of which are not readily available in the market at present. Customer integration ties into delivering the easiest-to-use light for customers by providing greater manufacturing flexibility and customization, which encompasses not just novel device architectures but integration designs, which reduces expensive post purchase integration and provides fit-for-purpose products. Customers have demonstrated

Exhibit 3: BLG's Competitive Position[ix]



willingness to pay more for high-brightness, high-efficiency, plug-and-play customized modules that provide not only a brighter solution but are easier and cheaper for customers to integrate and use in their systems.

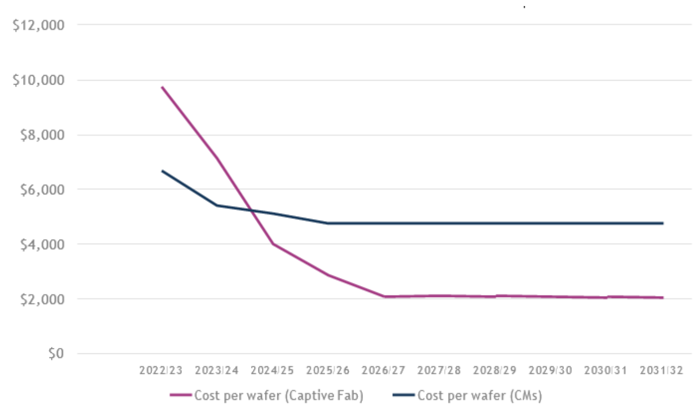
BluGlass' laser offerings address all the underserved markets with customized wavelengths and deliver solutions with flexible form factors. BLG is the only dedicated GaN laser supplier that targets a wide range of end-user markets with the added benefits of its proprietary RPCVD platform and Tunnel Junction technology, providing competitive advantages and enabling brighter and better-performing lasers.

2.3 Fremont Fab: A Gamechanger[xi]

In March 2022, BLG acquired a commercial Silicon Valley laser diode production facility lease and manufacturing equipment for USD 2.5 mn, a fraction of the ~ USD 40 million it would cost to build and fitout. The 19,000 sq. ft facility was acquired to accelerate the company's long-term growth strategy. It has allowed the company to significantly scale its manufacturing and revenue generation capacity, thereby improving the quality and repeatability of the laser diodes expected by customers, and fast-tracking development timelines for higher-value products at extended wavelengths. At the same time, in-sourcing manufacturing has helped eliminate supply chain complexity and halve wafer production costs, paving the way for higher margins and cash flow breakeven.

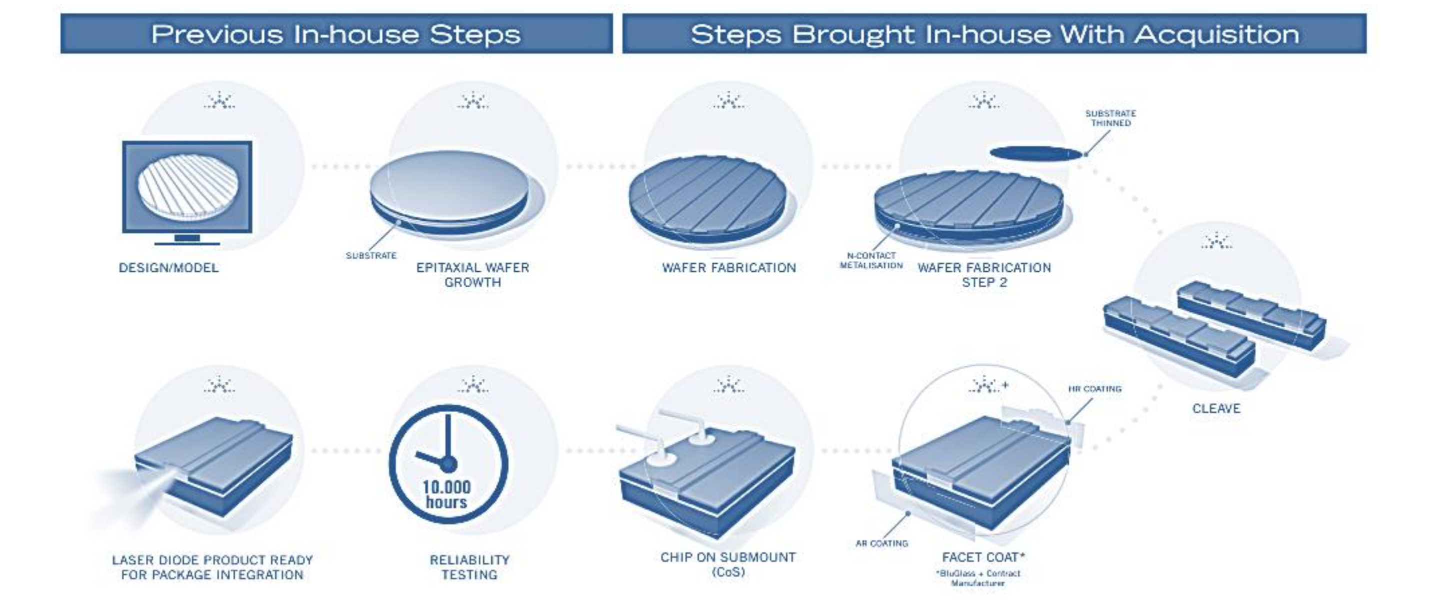
Exhibit 4: BluGlass Silicon Valley – Fremont[xii]

Exhibit 5: Wafer Fabrication Costs Front- And Back-End[xiii]



Prior to the acquisition, the company managed its downstream laser diode manufacturing steps using contract manufacturers from its laser diode test facility in Nashua, New Hampshire (US), which was opened in June 2020. This facility was used to manage its third-party fabrication and supply chain processes, including device packaging and reliability testing prior to shipping. With this acquisition, the company has benefitted by bringing the key manufacturing processes in-house. Faster wafer processing and reduced queue times at this fab have substantially accelerated full-loop and short-loop development cycles.

Exhibit 6: BluGlass' Laser Diode Manufacturing Process[xiv]



The acquisition of the fabrication facility has provided synergistic and quantifiable benefits, speeding development, allowing the company to launch better and more products by in-sourcing wafer processing where it converts laser diode wafers into laser components ready for packaging. This enabled the company to introduce more products than it had originally set out to release during the year.

Exhibit 7: BluGlass launched better products across more wavelengths

	Wavelength	Planned to launch	Launched
Violet	397nm		SM – 200mW ◆
Violet	405nm	MM – 1W SM – 100-200mW	MM – 1W MM – 3W ◆ SM – 250mW
Violet	420nm	MM – 1W SM – 100-200mW	MM – 1W MM – 3W ◆ SM – 250mW
Blue	450nm		MM – 1W SM – 100mW

Management believes that when fully operational the fabrication facility will boost BLG's top line to c. USD 170.0 mn, while the annual wafer capacity is likely to increase from c. 2,500 wafers to c. 10,000. With external contract manufacturers, the previous turn cycle was limited to 4-5 development iterations per year despite multiple contract manufacturers. Developing a new chip or enhanced product design often requires multiple iterations, while captive fabrication enables short loops to be turned in a week or less. This is resulting in full iterations (similar designs) with a significantly faster turnaround time of c. 3 weeks, allowing up to 48 development iterations per year.

Exhibit 8: Comparison Between Captive Fabrication and Contract Manufacturers[xv]

Particulars	Contract Manufacturing	Owned-Fab Capacity
Annual epitaxy wafer capacity (Silverwater)	c. 10,000 wafers	c. 10,000 wafers
Annual wafer fabrication capacity	c. 2,500 wafers	c. 10,000 wafers
Annual development iteration capacity	c. 4.5 (full iteration) & 10’s of short loop	Up to 48 (full iteration) & 100’s of short loop
Annual revenue capacity	c. USD 40 mn	c. USD 170 mn
Estimated gross margin	c. 30%	c. 45%
Cash flow	NA	Positive from 2025 onwards

2.4 RPCVD Technology

Before we can discuss the RPCVD technology, we need to understand the following:

2.4.1 Laser[xvi]

The word laser is an acronym for Light Amplification by Stimulated Emission of Radiation.

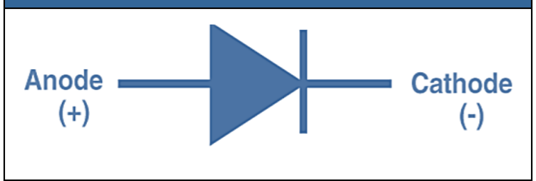
A laser is a device that releases light through optical amplification based on electromagnetic radiation's stimulated emission. Its coherence sets it apart from other light sources, allowing it to be focused on a tight spot for various applications such as laser cutting, lithography, laser pointers and light detection and ranging. Its narrow beam can travel great distances, making it useful in fields such as semiconductor chip manufacturing, laser surgery, skin treatments, cutting and welding materials and military and law enforcement devices. It has also found application in optical disc drives, laser printers, barcode scanners, DNA sequencing instruments, fiberoptics and free-space optical communications.

Blue to near-ultraviolet (near-UV) semiconductor lasers **perform roles that** both visible LEDs and invisible lasers cannot, as they possess a much greater radiance, avoiding the droop that can affect LEDs while permitting a much smaller emitting area and a focused beam of light.

2.4.2 Diode, Its Details and Types[xvii]

A diode is a semiconductor device that acts as a one-way switch for current. It allows current to flow easily in one direction, but severely restricts current from flowing in the opposite direction. In a diode, there are two terminals known as the ‘anode’ and ‘cathode’.

Exhibit 9: Diode Symbol



The arrowhead represents the direction of the conventional current flow. The other end is the cathode. Diodes can be made from many semiconductor materials, such as silicon, germanium, GaAs, or GaN.

Types of Diodes

There are many types of diodes, depending on the application. These include LED, laser diode, avalanche diode, Zener diode, Schottky diode, photodiode and PN junction diode. Of these diode types, we will discuss the following two:

- **LED:** A type of P-N junction diode that when an electric current between the electrodes passes through this diode fabricated from certain semiconductors, known as direct-bandgap semiconductors (GaAs, InP, GaN, for example), light is produced. In other words, light is generated when a sufficient amount of forwarding current passes through it. In many diodes, this light generated is not visible as there are frequency levels that do not allow visibility to the human eye. LEDs are available in different colors. There are tricolor LEDs that can emit three colors at a time. The color of the light depends on the energy gap of the semiconductor used.

- **Laser diode:** A type of P-N junction diode that produces coherent light. It is frequently used in CD drives, DVDs, and laser devices. It is costly when compared to LEDs and is cheaper when compared to other laser generators. Semi-conductor lasers are known to be more efficient (than gas lasers for instance) and can have extremely long operational life.

2.4.3 Laser Diode[xviii]

A laser diode is a semiconductor device similar to an LED in which a diode pumped directly with electrical current can create lasing conditions at the diode's junction. However, LED emits incoherent light in all directions, as compared to the light waves emitted from a laser diode, which have the same frequency and phase. A case in point, similar to the LED, is the light emitted by the Sun, in which the light is scattered in all directions, resulting in photons of multiple frequencies being emitted simultaneously, while the waves are not in phase. Because of this special characteristic, laser devices are used in a wide range of applications.

2.4.4 Methods of manufacture CVD[xix]

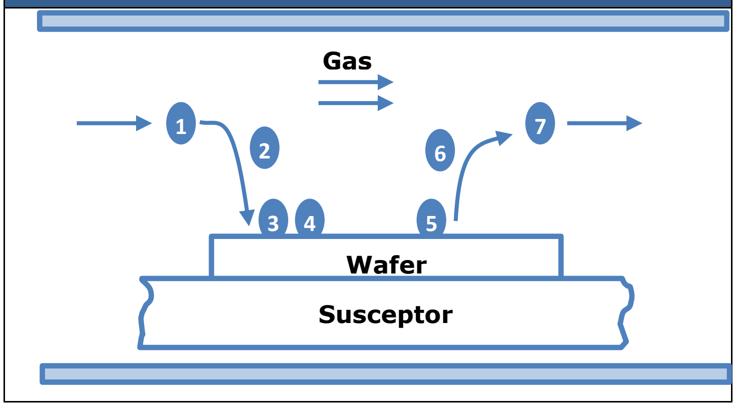
Chemical Vapour Deposition (CVD) is a thermochemical process, representing a highly efficient method for producing solid materials of exceptional quality and performance. This process involves using vacuum deposition, which is a group of techniques aimed at depositing material layers, atom-by-atom or molecule-by-molecule, onto a solid surface. The pressure required for conducting this operation is below the atmospheric level, i.e., in a vacuum environment. The resultant layers can vary in thickness from a single atom to several millimeters, forming freestanding structures. In the semiconductor industry, CVDs are widely used for producing thin films.

Steps involved in CVD

The CVD process involves the formation of non-volatile, thin solid film by the reaction of ions/species in a vapor state, resulting in subsequent deposition. This process is carried out in an "**electric furnace**" to maintain isothermal temperature. The electric furnace has an inlet, which carries "**carrier gas**" and a "**precursor**", while another outlet is connected to the "**exhaust**" for releasing toxic/non-toxic byproducts. This exhaust is connected to the "**exhaust scrubber,**" where the byproducts are treated by carrying out certain requisite treatment before disposal. The steps followed in CVD include:

1. Transport of precursor gases into an electric furnace through forced convection
2. Transport of reactants via diffusion to the wafer surface
3. Adsorption of reactants to the surface; this is where the actual reaction takes place, thereby forming the desired materials
4. Surface process, involving chemical decomposition, surface migration, site incorporation.
5. Desorption of byproducts from the surface
6. Transport of byproducts through the boundary layer
7. Transport of byproducts away from the deposition region

Exhibit 10: CVD Steps[xx]



2.4.5 Metal Organic Chemical Vapor Deposition (MOCVD)[xxi]

While CVD is practiced in a variety of formats, the industry incumbent manufacturing technology for the manufacture of gallium nitride semiconductors is Metal Organic Chemical Vapor Deposition. MOCVD is a reliable method of chemical vapor deposition that effectively produces high-quality single or polycrystalline thin films. This process is widely used for manufacturing complex semiconductor multilayer structures essential in electronic or optoelectronic components such as LEDs, lasers, high-speed transistors and solar cells. Unlike silicon, which is commonly used in computer chips, these semiconductors are composed of two or more elements, and thus referred to as "compound semiconductors". Such semiconductors include gallium arsenide (GaAs), indium phosphide (InP), gallium nitride (GaN) and related alloys, which are highly effective in electronic and optoelectronic applications. Compound semiconductors are also called "III-

V semiconductors," because they are made from metals of group III and hydrides/halides of group V of the periodic table and can interact to form crystalline compounds.

Why Are Compound Semiconductors Used?

Group III-V materials in compound semiconductors offer significant advantages over silicon. They allow for extremely fast electron movement, making them ideal for handling the high frequencies required in mobile phones, among other applications. Additionally, these semiconductors can operate at high temperatures and are highly efficient at converting light into electric power and vice versa, forming the basis for high-performance solar cells and LEDs.

Precursors and Carrier Gas

The following are the precursor materials used for gallium nitride deposition:

- Trimethylgallium (TMGa) or
- Triethylgallium (TEGa) or
- Trimethylindium (TMIn) or
- Trimethylaluminium (TMAl)

Gaseous ammonia (NH_3) is used as the source of nitrogen

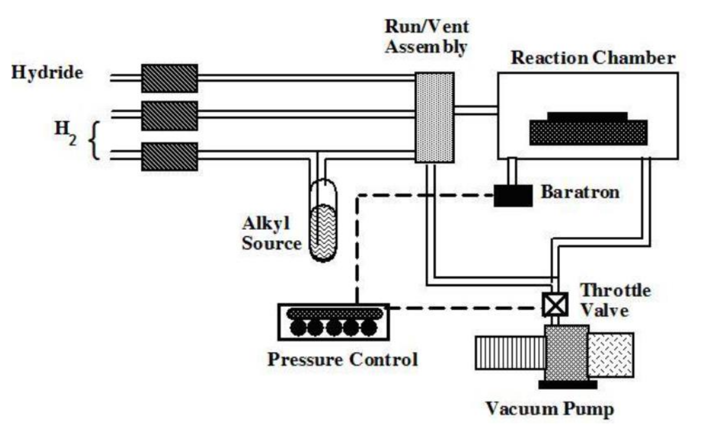
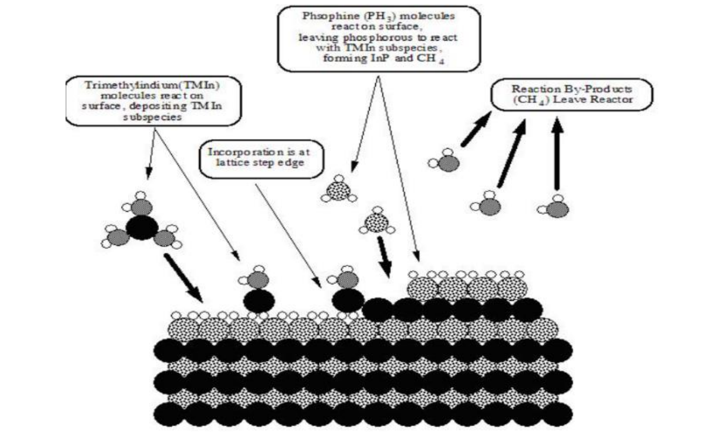
Working Principle (Formation of GaN on Substrate)

- The ultrapure precursor gases are injected into an electric furnace/reactor with a non-reactive carrier gas (typically hydrogen or nitrogen). The precursor in MOCVD is a metal organic, which is a group III precursor and a hydride/halide for the group V precursor. For example, GaN can be grown with TMGa or TEGa as gallium precursors, and NH3 as a source of nitrogen.
- The metal organics are contained in **'bubblers'**. In a bubbler, a carrier gas (typically hydrogen or nitrogen) is bubbled through the metal organic liquid, which picks up some metal organic vapor and transports it to the reactor. The amount of metal organic vapor transported depends on the rate of carrier gas flow, the bubbler pressure, and the bubbler temperature.
- As the precursor gases reach the reactor, epitaxial vapor growth takes place inside the reactor in different conditions. The semiconductor wafer (placed on susceptors) undergoes pyrolysis, and the subspecies are absorbed onto the semiconductor wafer surface. Surface reaction of the precursor subspecies results in the incorporation of elements into a new epitaxial layer of the semiconductor crystal lattice. Solid layers of GaN on the substrate are formed by the following chemical reaction in vapor state with organometallic reactant species:

$$(C_2H_5)_3Ga\ (L) + NH_3\ (V) \longrightarrow 3C_2H_6\ (V) + GaN\ (S)$$

i.e., **TEG** + i.e., **Ammonia** → i.e., **Ethane Gas** + (on Substrate)

- Finally, toxic byproducts are released, which must be converted to liquid or solid wastes for recycling or disposal.

Exhibit 11: Schematic Diagram of MOCVD[xxii]	Exhibit 12: Deposition Process[xxiii]
	

Note: In the above deposition diagram, the example of trimethylindium and phosphine is used.

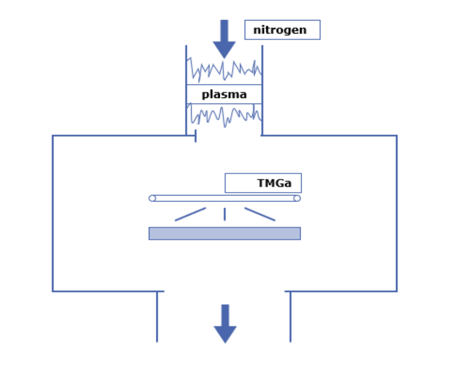
2.4.6 RPCVD

The new addition to the CVD process is BLG's proprietary RPCVD technology, which the company developed over the past decade, by solving complex technological problems. It combines traditional nitride growth techniques with its unique low-temperature, low-resistivity nitride growth process to enable novel and higher-efficiency, lower-cost devices.

The RPCVD process operates similarly to MOCVD, whereby chemicals are introduced into the reaction chamber for decomposition. However, instead of using toxic and expensive ammonia (NH3) as the source of nitrogen, RPCVD uses instead inert and cost-effective nitrogen gas (N2), which is passed through an electrical coil to generate a "**nitrogen plasma**". The nitrogen plasma source is kept in a remote place to avoid induced ionic damage to the film. The setup directly provides nitrogen for the deposition of GaN.

The process merges with the scalability potential of MOCVD with the unique benefits of a nitrogen plasma source to drive higher performance and enable novel laser diode, LED and micro-LED structures.

Exhibit 13: Schematic Diagram of RPCVD[xxiv]



2.4.7 How RPCVD is Superior to MOCVD

Although the RPCVD process operates similarly to MOCVD, the following are areas where the RPCVD process proved to be advantageous over MOCVD:

Exhibit 14: Difference between RPCVD and MOCVD[xxv]

Particulars	RPCVD	MOCVD
Operating Temp (°C)	500 – 850	>1,000
Nitrogen Precursor	Nitrogen	Ammonia
Deposition Area	Same as MOCVD	Large; highly scalable, offering substantial production efficiency
Capable of growing on thermally sensitive substrates or layers	Yes	No
Low hydrogen environment	Yes	No

Active as-grown p-type	Yes	No
Environmental Benefits	High	Low – due to the usage of ammonia

2.4.8 RPCVD Tunnel Junction

Limitation of GaN-Based Laser Diodes

The development of high brightness GaN-based laser diodes has paved the way for a multitude of exciting applications, ranging from industrial welding to biotech-flow cytometry, laser displays, general and automotive lighting. These applications require outstanding performance, and as a result, extensive efforts have been made to enhance the efficiency and brightness of GaN-based laser diodes to cater to the needs of these emerging markets.

However, despite these efforts, the **conversion efficiency** of the most state-of-the-art GaN-based laser diodes rarely reaches **40%**, in contrast to GaN-based LEDs, where conversion efficiencies are nearly **90%**. The low conversion efficiency of GaN-based laser diodes can be attributed to several factors and mechanisms, most of which stem from the **high activation energy of the magnesium** (Mg) acceptor in P-type Mg-doped GaN and AlGaN layers. Unlike the Si-donor in N-type GaN, where the lower activation energy leads to a direct relation between the atomic doping concentration and the free-carrier concentration, the high activation energy of Mg in GaN results in only a **small fraction** (c. 1%) of the Mg atoms contributing to the free-hole concentration.

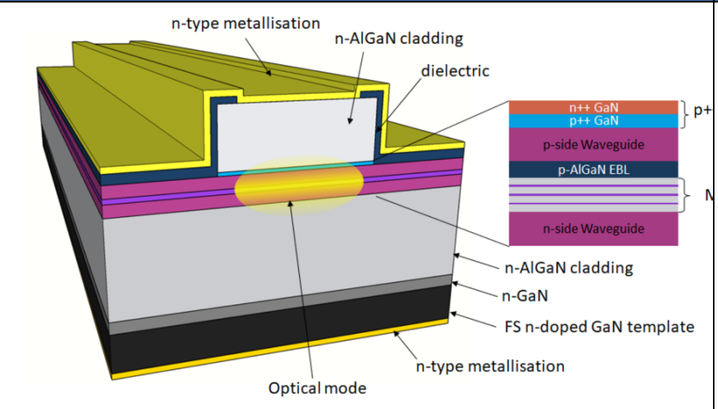
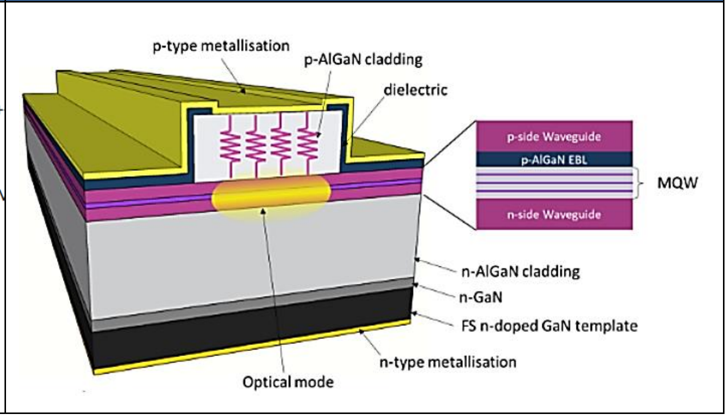
To achieve sufficiently high free hole concentrations to produce viable devices, the Mg doping level in the P-type layers is often increased by up to **100x** that of the silicon doping in the N-type layers, thereby resulting in low hole mobilities and high resistivities. This fundamental property of Mg-doped GaN and AlGaN has several consequences, each of which contributes to the overall low conversion efficiency of GaN-based laser diodes. Therefore, improving the performance of laser diodes necessitates advancements in **intrinsic material properties**, but more importantly, in the **structural design**.

Challenges That Limit GaN Laser Diode Performance

- **Optical Loss:** A major obstacle that hampers the performance of GaN laser diodes is the optical losses in the P-side, particularly in the P-AlGaN cladding layer. The P-AlGaN cladding layer has a lower refractive index than the MQW and waveguide layers to confine the optical mode within the MQW and waveguide region. Yet, some fraction of the mode unavoidably overlaps with the P-AlGaN cladding layer, owing to the high levels of Mg in the layer that result in very high absorption coefficients. Although waveguide design can attempt to reduce the modal overlap with the P-side cladding, a significant proportion of the total optical loss in GaN laser diodes is due to absorption in the P-AlGaN layer. The P-side waveguide (P-WG) layer also contributes to the optical loss. The Mg doping concentration can be reduced in the P-WG compared to the P-AlGaN cladding layer to minimize the optical absorption coefficient, but the modal overlap with the P-WG is usually large, given the proximity of the P-WG layer to the MQWs and peak of the mode. Hence, the optical loss in this layer can be significant. Lowering the Mg doping in the P-WG or inserting a thick undoped upper WG layer, while reducing the optical loss, may also come at the expense of reduced hole injection efficiency and lead to higher device resistance.
- **Resistive loss:** In addition to the optical loss, the P-side layers also present a source of significant resistive loss. The low hole mobility of the P-AlGaN layer leads to high series resistance. Also, there is a significant contribution to the resistive losses in laser diodes from the P-side metal contact as a result of the lack of available metal with suitably large work function to match the P-type Mg-GaN. The combination of the series resistance in the P-AlGaN cladding layers and the high P-side contact resistance can account for up to 50% of the power consumption of the laser diodes in the form of Joule heating when operated at high current densities above the lasing threshold.

Solution: GaN-Based Tunnel Junction (TJ)

One promising solution to the issue of high P-side contact resistance is to replace the P-metal Ohmic contact with a GaN-based TJ for conversion between N-type and P-type regions. The GaN-based TJ facilitates efficient tunnelling of electrons from the valence band (VB) of the P-type layer into the conduction band (CB) of the N-type layer, which allows the top P-type Ohmic contact to be replaced with an N-type contact that has much lower contact resistance. However, this approach may not fully address the issue, as the P-AlGaN cladding layer still experiences optical and resistive losses. Alternatively, positioning the TJ deeper in the structure, either within or even below the P-AlGaN cladding layer, would enable the replacement of some or all of the highly resistive and loss-prone P-AlGaN layer with much lower resistance N-AlGaN, which also has the advantage of a lower optical absorption coefficient due to the lower Si-doping requirements.

Exhibit 15 (a): Structure of Tunnel Junction Laser Diode[xxvi]	Exhibit 15 (b): Structure of Conventional laser diode manufactured using MOCVD Technology[xxvii]
	

The positioning of TJ is critical. It must be placed so that any increase in optical losses associated with its addition is offset by a comparable reduction in losses that come from the replacement of P-type layers with those that are N-type. In addition, it is crucial to ensure that the resistance in the TJ is low enough to be offset by the reduction in series and contact resistance. It is only by meeting both of these criteria that the TJ laser diode can offer a viable solution to increasing the conversion efficiency of GaN-based lasers. Results from the simulation of various laser diode structures show that a large proportion (c. 80%) of the total optical loss is associated with the P-side of the device. Losses are high in the electron N-blocking layer, the P-WG, and the P-cladding layers.

BLG repeated the simulation for a laser diode incorporating a TJ with the same base structure, but with a TJ at the top of the P-WG; rather than a P-type AlGaN cladding, followed by a heavily P-type doped contact layer, an N-type AlGaN cladding and a heavily doped N-type contact layer. One of BLG's simulations observed that greater losses come from thicker, more heavily doped junctions.

How RPCVD is changing the landscape

BluGlass, with its extensive experience in applying RPCVD to grow active-as-grown TJ for cascade LEDs, has used this technology to tackle the limitations of laser diodes. Post-simulation, the results indicated that laser diodes featuring a TJ grown by RPCVD and optimized to have the lowest increase in the drive voltage can yield a net **reduction in total optical loss**. This paved the way for improved devices with reduced series and contact resistance, due to the replacement of P-type cladding and P-type contact layers with N-type cladding and N-type contact layers.

In April 2021, BluGlass achieved a proof-of-concept milestone by growing lasers with TJ through the combination of MOCVD and RPCVD, using c-plane free-standing GaN (**FS GaN**) as a foundation. The company has successfully grown layers up to the heavily P-type TJ layer by MOCVD, before adding the remaining layers by RPCVD. BluGlass has demonstrated world-first RPCVD TJ laser diodes, showcasing their confidence in this innovative technology, enabled by the unique benefits of low temperature, low hydrogen, which can eliminate the need for these highly resistive and performance detracting P-type layers. The low temperature, low hydrogen growth enables BluGlass to replace the P-type cladding layer with an RPCVD TJ and second N-type cladding layer, called a "**dual N-wave"** laser diode, paving the way to significantly improve laser diode performance in the future. Going forward, the company will continue to optimize its RPCVD TJ laser diode design, epitaxy and fabrication to maximize laser performance.

2.5 Opportunities

With technology advancing at an exponential rate, the demand for new devices rises accordingly. This has made miniaturized high-tech application systems increasingly important. For example, microelectronics has changed the way electricity is manipulated, enabling sophisticated electronic products that are now an essential part of daily life. Similarly, integrated photonics are revolutionizing the way light is controlled for applications such as data communications, imaging, sensing and biomedical devices. So, by using micro and nanoscale components to route and shape light, integrated photonics can shrink full optical systems into tiny chips.

Despite its success, integrated photonics has been missing a key component for complete miniaturization: high-performance chip-scale lasers. While some progress has been made on near-IR lasers, visible-light lasers are capturing a significant portion of the market. As visible light is essential for a wide range of applications, including quantum optics, displays and bioimaging, there is a need for tunable and narrow-line-width chip-scale lasers that can emit light of different colors.

2.5.1 Visible Lasers: A Step-Up on Traditional Infrared Laser Applications[xxviii]

The visible or GaN laser market is rapidly growing and becoming a prominent segment in the laser industry. It covers the visible spectrum from ultraviolet to green wavelengths. GaN lasers have numerous inherent advantages over traditional IR laser applications, including superior brightness and higher energy absorption in metals.

They also provide more accurate, cleaner and faster material processing, which is vital for today's increasingly miniaturized high-tech applications. GaN lasers' unique performance properties are also enabling new applications in a wide range of end-user industries such as quantum sensing and computing, robotics, biotechnology and medical therapies.

Exhibit 16: Advantages of GaN Diodes over Traditional IR Laser[xxix]

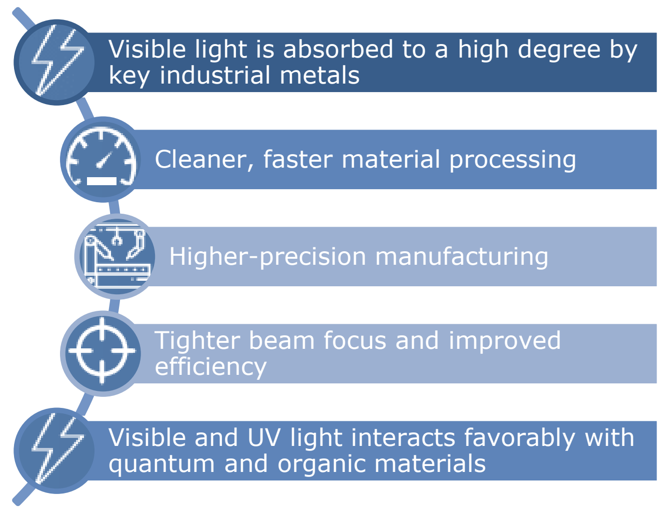


Exhibit 17: Blue Laser Superiority over IR Laser[xxx]

Key metals	Improvement of energy absorbtion in metals
Gold	66x
Silver	17x
Copper	13x
Aluminium	3x
Nickel	1.5x
Steel	1.5x

2.5.2 Requirement of New Suppliers[xxxi]

Global OEMs, systems integrators, electronics manufacturers, defense contractors and research organizations rely on GaN lasers. Due to the complexity of laser diode manufacturing, there are significant barriers to entry for new players, resulting in a limited number of end-to-end GaN laser diode suppliers. Unfortunately, this often leaves customers' needs unaddressed. They require greater flexibility, faster development, enhanced performance and lower-cost solutions, which the existing large suppliers cannot provide due to the following:

- Limited availability of form factor flexibility
- Limited supply of a wide range of wavelengths

As a result, the end customers are forced to undertake significant customization and post-purchase packaging. However, BLG, one of the few GaN laser suppliers worldwide, has the potential to address these unmet customer needs with its state-of-the-art facilities and vertically integrated supply chain in Australia and the US. The company's focus is on wavelengths that are in demand for use in the industrial, display, defense and scientific application sectors.

Exhibit 18: Key Challenges Faced by End-Customers

Constrained supply

- Only a handful of captive global GaN laser suppliers
- An emerging market which is set to expand to USD 2.5 bn by 2025

Focus on LEDs

- The majority of competitors are not dedicated GaN laser suppliers
- Large differentiated product portfolios focused on LED and micro-LED markets

Limited product mix

- Limited form factor flexibility, customisation and manufacturing agility in current business models
- Significant unmet needs in quantum, scientific defense and biotech verticals

High barriers to market entry

- Complexity of laser diode manufacturing - creates significant barriers to entry

2.6 Products and Their Details

2.6.1 Laser Portfolio[xxxii]

BLG intends to offer a range of laser diode products, including MOCVD and RPCVD-manufactured laser diodes across a broad spectrum of wavelengths, in both single and multi-mode.

Exhibit 19: Laser Diode Specifications[xxxiii]

Mode	Color	Product	Wavelength (nm)	Optical Output Power	Current	Voltage (V)	Form Factors	Available for Purchase
SM	Ultraviolet	BLV-397 200	392-400	200 mW	200 mA	4.5	TO cans, C-mounts and F-mounts, chip-on sub-mounts	Prototype
SM	Ultraviolet	BLV-405 250	400-410	250 mW	200 mA	4.5		Yes
SM	Violet	BLV-420 250	415-425	250 mW	230 mA	5.4		Yes
SM	Blue	BLV-450 250	445-455	250 mW	230 mA	5.4		Yes
MM	Violet	BLV-405 1W	400-410	1 W	1 A	4.5		Yes
MM	Violet	BLV-405 3W	400-410	3 W	2.8 A	4.5		Prototype
MM	Violet	BLV-420 1W	415-425	1 W	1 A	4.5		Yes
MM	Violet	BLV-420 3W	415-425	3 W	3 A	4.5		Prototype
MM	Navy	BLV-450 1W	445-455	1W	1	5.4		Yes

 See important disclosures on page 52 of this report.

Exhibit 20: BLG's Laser Portfolio[xxxiv]

		Available for Purchase	Higher-Value Products in Development	Next-gen (Premium value/margin) Products in Development
Violet	397nm	SM – 200mW ◆		
	405nm	MM – 1W MM – 3W ◆ SM – 250mW	SM – 300mW-400mW	SM – 500mW
	420nm	MM – 1W MM – 3W ◆ SM – 250mW	SM – 300mW-400mW	SM – 500mW
Blue	450nm	MM – 1W SM – 100mW	MM – 1.6W MM – 2.2W MM – 3.5W SM – 250mW	MM – 5W
	470nm		MM – 2W SM – 100-250mW	
	488nm		SM – 100-200mW	MM – 1.5-2W
Green	525nm		MM – 0.5-2W SM – 80-100mW	

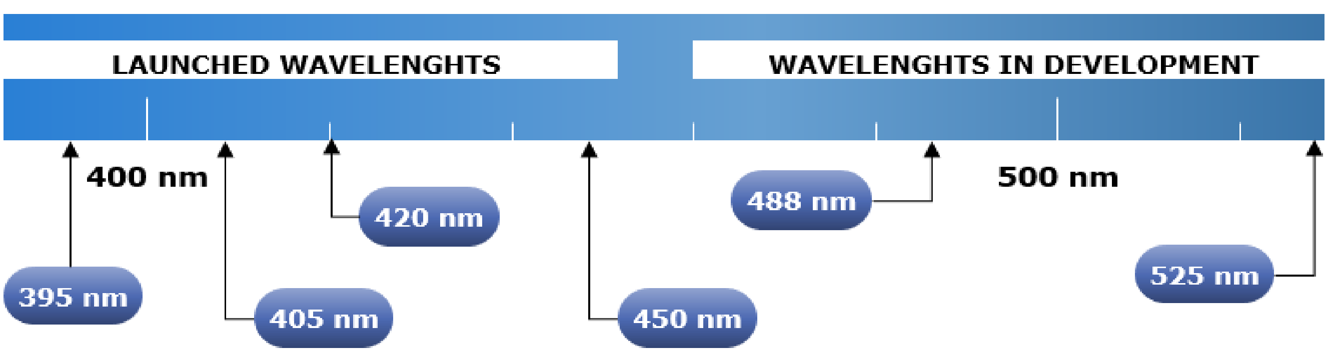
MM: Multi Mode SM: Single Mode ◆: Prototype

2.6.2 Wavelength[xxxv]

BLG is working on achieving its technical and commercial milestones through technologies such as MOCVD and its patented RPCVD, thereby manufacturing higher-performance, lower-cost GaN laser diodes. The company intends to offer a range of laser diode products across a broad spectrum of wavelengths, ranging from 405-450 nm in single and multi-mode versions. The company leverages over a decade of experience in GaN semiconductors and is progressing its product development, including transitioning to longer wavelengths at a more rapid pace than its competitors have in the past. As a case in point, the company significantly improved light emission, power conversion efficiencies and voltage across its violet (405 nm and 420 nm) and blue (450 nm) wavelengths. In particular, BluGlass's 450 nm lasers had breakthrough improvements with power conversion efficiencies for single-mode and multi-mode devices up more than 55% and 42%, respectively, from initial product launches at Photonics West in January 2023 to Laser World of Photonics in June 2023. In that period, the demonstrated lasing wavelengths of BLG lasers increased from 450 nm to 488 nm and down to 395 nm (UV).

In the future, the company aims to extend its wavelength range, moving beyond the blue 450 nm to the green wavelengths ranging from 500-525 nm and further into the UV down to 395 nm.

Exhibit 21: BLG's Laser Wavelengths[xxxvi]



2.6.3 Form Factors[xxxvii]

Whether customers are looking for individual chips, bars, chip-on sub-mounts or volume-manufactured multi-chip modules, BLG's world-class team with state-of-the-art facilities in the US and Australia has the capability and expertise to deliver the products they need. BLG has expertise in the following form factors:

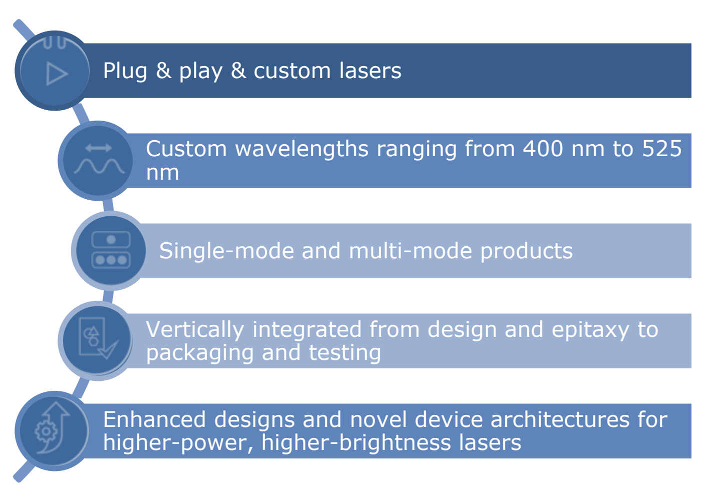
- Single emitters
- LD bars
- Chip-on sub-mounts (CoS)
- TO cans
- C-mounts, f-mounts and butterfly pins
- Multi-chip modules

2.6.4 BLG's Offerings: In a Nutshell[xxxviii]

BluGlass' vertically integrated laser offering has been designed to meet the market's requirements and solve customers' biggest challenges.

Offerings range from a full suite of plug-and-play solutions (with customized wavelengths) to those for segments including industrial, defense, display and scientific industries. The product portfolio is divided into single and multi-mode. Recently, the company vertically integrated to bring downstream laser diode processing and packaging in-house, helping to expedite the processes for laser development timelines across different wavelengths. EpiBlu's specialized offerings also include custom epitaxy, foundry and characterization services, which should help BLG in enhancing its world-class epitaxy capabilities across numerous designs and applications.

Exhibit 22: BluGlass Offerings



2.7 Intellectual Property[xxxix]

BLG is working to optimize its intellectual property portfolio by streamlining its patent filings of certain mature patents. This is being done to rationalize the patents which are no longer essential to the company's current device and RPCVD hardware or filed in non-key semiconductor manufacturing jurisdictions. The company is committed to protecting its core patents (including tunnel junction, LED, and laser device and RPCVD hardware) in important semiconductor manufacturing jurisdictions. This approach should reduce the company's intellectual property management costs in the long run and align with its long-term device strategy. BluGlass's current intellectual property portfolio includes:

- 53 internationally granted patents in key semiconductor manufacturing jurisdictions, including Japan, Taiwan, China, the US and Europe
- 15 applications in the Patent Cooperation Treaty stage
- 8 patent families
- 17 trademarks

Exhibit 23: BLG's Intellectual Property Portfolio[xl]

2.8 Progress Update[xli]

Fremont Lasers Met Benchmarks

- After the acquisition of the Fremont facility, BluGlass made significant progress from first laser development runs in September 2022 to meeting commercial performance and feasible reliability benchmarks, launching its first GaN lasers at Photonics West in January 2023, and showcasing enhanced products at Laser World in June 2023.
- The company commenced vertical integration by transferring its core downstream manufacturing processes from four contract manufacturers to its Silicon Valley fabrication facility and is in the final stages of integration. The company is tackling the production and repeatability challenges to optimize its manufacturing process.
- BluGlass is implementing quality control measures and an excellence program across all of its manufacturing processes to improve repeatability, product availability, speed of delivery and manufacturing yields.

Strategic Partnerships

- In October 2023, BluGlass was named a member of the Commercial Leap Ahead for Wide Bandgap Semiconductors (CLAWS) Hub, led by North Carolina State University (NCSU). US Department of Defense has awarded USD 238 mn in FY 23 CHIPS and Science Act funding for the establishment of eight ME Commons regional innovation hubs The CLAWS club which has been awarded USD 39.4 mn, is one of eight ME Commons regional innovation hubs.
- BLG was recognized for its leading innovation in RPCVD epitaxy growth, novel architectures and longer-wavelength devices by being invited to join the prestigious SSLEEC Consortium at the UCSB. This invitation-only collaboration between industry leaders and pre-eminent GaN researchers is a testament to BLG's expertise in the field.
- BLG has entered a strategic development agreement with Ganvix for the development of GaN VCSELs for green wavelengths (515 nm-525 nm) using a combination of MOCVD and RPCVD technology. This partnership highlights BLG's ability to provide unique benefits and paves the way for developing solutions for high-growth future markets.
- As RPCVD technology offers key performance advantages, the company can deliver higher-power and efficient solutions, potentially helping to solidify its position as a leading innovator in the industry.

First Laser Portfolio

- The company took a significant stride by launching its first suite of GaN laser diodes at Photonics West in January 2023 across violet (405-420 nm) and blue (450 nm) wavelengths in single-and multi-mode devices, which are also available in a range of flexible form factors, thereby reducing the need for customers to undertake expensive post-purchase customization.

- During the year, BLG significantly optimized its product suite, which was released at Laser World of Photonics in June 2023. Among the new products, 450 nm lasers showed the biggest improvement, with power conversion efficiencies for single-mode and multi-mode devices up more than 55% and 42%, respectively.
- The enhancements broadened the target applications to include 3D printing, additive manufacturing, quantum computing, robotics and biotechnology. Higher-power, single-mode 405 nm and 420 nm devices are under development, along with single-mode and multi-mode 450 nm and longer-wavelength devices spanning 470 nm, 488 nm and 525 nm.

Rising Customer Orders

BluGlass had a successful year with orders from various industries including energy, medical device, and quantum photonics majors. Customers are providing positive and constructive feedback on BluGlass' launched productions, with customers qualifying BluGlass lasers across the full portfolio for use in next-generation and groundbreaking applications. BluGlass is striving to meet specific needs. Customer qualification in these applications can lead to BluGlass' lasers being 'designed-in' next-generation devices and will lead to recurring and growing orders. The company is in advanced discussions with multiple customers and expects both new purchase orders, and custom collaboration contracts in FY 2024 (July 2023 through June 2024).

DFB Development Program

During the year, BLG collaborated with UCSB to develop visible GaN DFB lasers using its proprietary RPCVD technology. The company demonstrated substantial performance improvements in its DFB laser developments, increasing the side-mode suppression ratio by more than 50% to deliver advanced single-performance frequency at 450 nm and longer-wavelength blue devices up to 478 nm.

Strengthened Expert Team

The company appointed Mr. Jim Haden as its new CEO in March 2023, following a highly successful year as president. His transformative leadership enabled BLG to evolve from an R&D company to a commercial provider of GaN lasers with a captive wafer fabrication facility. Under his leadership, the team at BluGlass gained valuable expertise in laser diode technology by bringing aboard a team of seasoned industry professionals, improving wafer fabrication, testing and packaging capabilities, and accelerating product delivery to customers. This enabled the successful integration of four contract manufacturers at BLG's Silicon Valley fabrication unit, which should be crucial to ongoing laser performance improvements and product releases.

2.9 Financials[xlii]

FY 2023

Increased Top-Line Growth Due to Higher Contribution from Tax Rebate

BLG reported a consolidated revenue of AUD 1.1 mn, which evolved from AUD 0.6 mn in FY 2022. Total revenue (including revenue from operations, finance income and other income) during the year rose to AUD 9.5 mn versus AUD 4.3 mn in FY 2022. Revenue from other income stood at c. AUD 8.4 mn versus AUD 3.7 mn in FY 2022. The R&D tax rebate, included in other income, is AUD 7.3 mn, an increase of c. 81% compared to the previous year.

Higher Expenses Led to Widening of Net Loss

Total expenses increased by AUD 7.6 mn from the previous year to c. AUD 21.3 mn. The increase was driven by the expenditure incurred for running the US fabrication facility and research costs associated with the fabrication supply chain.

Depreciation expense increased by 68% to AUD 3.9 mn (FY 2022: AUD 2.3 mn), mainly due to the full-year depreciation of the US facility. Employee benefits expenses rose by AUD 2.3 mn to reach AUD 6.3 mn during the year. The increased headcount was related to hiring at BluGlass' US facility.

The consolidated loss for the year increased by 26% to AUD 11.8 mn versus AUD 9.4 mn incurred in the previous year.

Capital Raised to Fund Fabrication Facility Expansion

Toward the end of the year, BLG raised AUD 10.7 mn via a placement and entitlement offer. The proceeds were used for additional fabrication equipment to scale and speed product delivery and expand the company's product range to increase market competitiveness. Additional proceeds of AUD 1.9 mn were received from the exercise of listed options. The company also secured AUD 1.46 mn R&D financing from Radium Capital in October 2023.

2.10 Business Strategy and Outlook

2.10.1 Strategy

BluGlass' strategy is based on the following:

Exhibit 24: BLG's Strategy

- **Business Model:** BluGlass aims to become the supplier of choice in the GaN laser diode market by tapping into the rapidly growing industrial, quantum, biotech, defense, scientific and display markets. Its business model is centered on creating partnerships, such as the CLAWS hub in ME commons garnering non-dilutive product development funds, enabling a continuous flow of cutting-edge, off-the-shelf, and customized laser products to customers. The company will also work to refine its RPCVD technology, thereby solidifying its market position.
- **Custom Projects:** BluGlass continues to build customer base and validate product offering with custom orders and repeat customers. Large custom laser projects are a key commercial strategy pillar as provide substantial and recurring revenues and can span multiple years leading to a path to profitability. They also complement direct-to-market visible laser offering and build the company's reputation as the industry's partner of choice. These projects fast-track and fund advanced roadmaps and next-gen product timelines aligning strongly with the company's long-term strategy. For instance, the commercial partnership as CLAWS Hub member as part of $238M ME Commons.
- **Vertical Integration:** To accelerate its long-term growth strategy of scaling its manufacturing and revenue generation capacity, the company acquired a Silicon Valley laser diode production facility lease and manufacturing equipment. Vertical integration is aimed at removing wafer processing contract manufacturers, thereby improving the quality and repeatability of the laser diodes expected by customers, and fast-tracking development timelines for higher-value products at extended wavelengths. At the same time, it is eliminating supplychain complexity and is on-track to halve wafer production costs, paving the way for higher margins and cash flow breakeven. The company has already launched its vertical integration process by transferring its core wafer processing and optical coating steps from four contract manufacturers to its Silicon Valley fabrication unit and is currently in the final stages of integration. It is tackling production and repeatability challenges to optimize its manufacturing process. The company is implementing new quality control measures and has launched an excellence program across its entire manufacturing process to improve repeatability, product availability, speed of delivery, and manufacturing yields. Its strategy is to complete its wafer fabrication vertical integration.
- **RPCVD Tunnel Junction:** Through its proprietary RPCVD technology, the company has achieved a world-first proof-of-concept by successfully demonstrating the working of 'active-as-grown' tunnel junction laser diodes. These prototypes have exhibited good lasing behavior, effectively addressing the critical performance requirements for high-value GaN laser diode applications. Currently, GaN laser diodes suffer from low conversion efficiencies, typically in the 40-45% range, resulting in almost half of the power consumed being lost in the form of heat due to highly resistive P-type layers. However, BluGlass's novel approach utilizing RPCVD has shown that this limitation can be overcome. This should enable unique benefits and eliminate highly resistive and performance-losing P-type layers, paving the way for a significant improvement in laser diode performance in the future. The company's strategy is to optimize its RPCVD tunnel junction laser diode design, epitaxy and fabrication to maximize laser performance.
- **Customer Orders and Reliability:** The company has recently acquired orders from various industries, including from major players in energy, medical devices and quantum photonics across its full product suite, for use in

groundbreaking applications. BluGlass is striving to meet specific needs and secure larger orders. The company is in advanced discussions with multiple customers and expects growing orders in the coming quarters. It aims to demonstrate reliability, thereby completing initial customer qualifications and later scaling up volume orders.

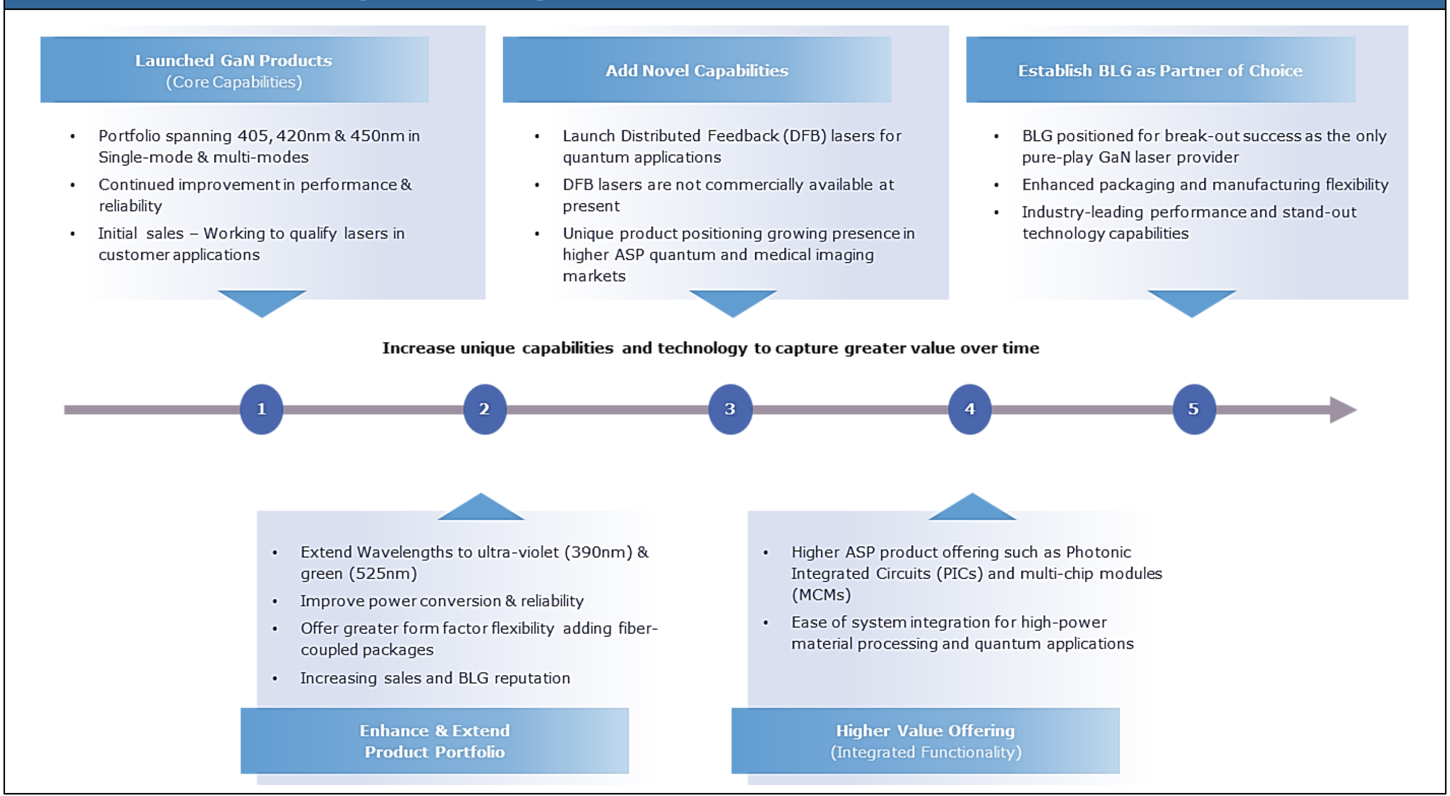
- **Products:** The company offers a full suite, end-to-end laser diode design, fabrication and packaging capability ranging from small-batch customized laser diode products to high-volume production. The company plans to offer a range of laser diode products across a broad spectrum of wavelengths, ranging from 395-450 nm in single- and multi-mode versions. Recently, the lasing wavelengths of BLG lasers have increased from 450 nm to 488 nm. In the future, the company aims to extend its wavelength range, moving beyond blue 488 nm to the green wavelengths ranging from 500-525 nm and further into UV down to 395 nm, using the Company's proprietary RPCVD technology.
- **DFB Offerings:** Together with the collaboration of UCSB, combined with RPCVD, BLG has taken significant strides in its GaN DFB laser diode performance. The company improved DFB side-mode suppression ratio, a critical requirement to enable single-frequency lasing performance, by more than 50% since Photonics West, delivering advanced single-frequency performance at 450 nm and demonstrating longer-wavelength DFB lasers up to 478nm. While significant progress has been made in extending the operating wavelength from blue to cyan, BLG's strategy calls for developing single frequency true-green sources.

Overall, BLG's strategy remains focused on meeting customer demands and becoming the GaN laser partner-of-choice.

2.10.2 Outlook

Currently, the company's priority remains validating product performance and qualifying BluGlass lasers in customer applications. It is making significant progress in the development of higher-powered lasers in the core wavelengths (405-450 nm) and next-generation products. Ongoing manufacturing refinements should continue to enhance laser performance and yield, enabling BLG to bring better-quality lasers to market at a much faster pace. Discussions with potential customers have highlighted the crucial need for an agile manufacturing partner to address unmet market needs and deliver brighter, better-performing and longer-wavelength devices in the rapidly growing visible laser market.

Exhibit 25: BLG's Pathway to Becoming a Partner-of-Choice[xliii]



The company intends to leverage its RPCVD technology to bring novel solutions to market with collaboration partners. Cases in point include BLG's development of green GaN VCSEL with Ganvix and visible DFB lasers with UCSB. Although these solutions are not commercially available, they should enable BLG to further differentiate itself in the GaN laser market. Recent customer engagement confirms the growing need for an agile and dedicated provider in this market, and the increasing importance of visible laser diodes to enable future technologies. The company also plans to complete the integration of its external wafer fabrication contract manufacturers into its Silicon Valley facility and establish regional distribution agreements in key laser jurisdictions, including Europe and the US.

This positions BluGlass to achieve revenue of c. USD 170.0 mn, with gross margin of 45%, thereby significantly benefiting shareholders.

2.11 Company Milestones[xliv]

Exhibit 26: BluGlass Milestone Timeline	
Year/ Period	**Event**
2005-2006	• BluGlass Limited spun out from Macquarie University • Listed on ASX (ASX:BLG)
2007	• New state-of-the-art semiconductor deposition and demonstration plant opened in Silverwater, Sydney
2010	• Entered joint venture with SPTS Technologies to establish new equipment company; JV partner invested USD 5.2 mn in BluGlass to develop a new generation of RPCVD machines
2012	• Successfully completed preliminary research to produce low-temperature P-GaN using RPCVD • Achieved proof-of-concept milestone, producing RPCVD-grown N-GaN films with industry-equivalent electrical properties • Acquired SPTS Technologies' 49% interest in the EpiBlu joint venture
2015	• Veeco Instruments' (NASDAQ: VECO) evaluation of RPCVD for green LEDs moved to the next iteration after promising initial results on two-inch wafers • BluGlass shipped its first RPCVD foundry customer order for green LEDs • Signed a collaboration agreement with US-based top-tier LED manufacturer Lumileds to develop novel LED applications
2018	• Entered into a collaboration agreement with global leader AIXTRON to investigate the use of BluGlass's proprietary manufacturing technology, RPCVD, and began exploring a novel application with significant commercial potential • Agreed with Lumileds to extend the Phase I collaboration
2019	• Entered into collaboration with US lighting company Luminus, to work jointly on high-performance LED devices for projector LEDs • Launched direct-to-market laser diode business unit to leverage BluGlass's unique RPCVD Tunnel Junction technology • Entered a joint development agreement with Bridgelux to collaborate on cascade LEDs for the growing general lighting market to establish a path for mainstream applications in the general lighting market • Opened Paul Dunnigan laboratories at its state-of-the-art facility in Silverwater, Sydney, to expand RPCVD development and commercialization operations • Implemented its unique RPCVD P-GaN technology in high-performance micro-LED display prototypes, together with its foundry customer X-Celeprint
2020	• Presented a new paper at SPIE Photonics West about its recent laser diode development work, using the company's unique 'active-as-grown' tunnel junctions to improve conversion efficiency in lasers • Awarded a USD 250K matched-funding innovation grant with AMCG to manufacture smarter, more efficient plasma deposition sources for the company's 300 series RPCVD manufacturing platforms

	• Commissioned the largest RPCVD manufacturing platform, the BLG-500. The commercial-scale RPCVD system was successfully retrofitted on to a modern-generation manufacturing platform, the AIXTRON 2800 G4 • Received a US-government-funded subaward contract from Yale University to assist the US Defense Advanced Research Projects Agency (DARPA) to develop novel laser diode technology
2021	• Advanced the development of its first standard laser diode product with successful completion of the optical coating step of the manufacturing process of several 405 nm laser devices • Showcased its latest laser diode product development progress and custom GaN epitaxy services with customers and industry participants at the virtual SPIE Photonics West conference • Strengthened the leadership team and appointed renowned laser executives Mr. Jean-Michel Pelaprat and Mr. Jim Haden to the company's board and management • Demonstrated a proof-of-concept milestone with the world-first RPCVD tunnel junction laser diodes utilizing its proprietary RPCVD and tunnel junction technologies
2022	• Acquired Silicon Valley laser diode production facility lease and manufacturing equipment for USD 2.5 mn to fast-track its growth strategy, significantly increasing its laser diode manufacturing capacity and bringing forward higher-value product development timelines • Shipped the first laser diode product prototypes (405 nm and 420 nm) to the initial customer as part of the product development process • Joined the UCSB's SSLEEC consortium; this recognized the company's leading innovation in RPCVD epitaxy growth, novel laser architectures and longer-wavelength GaN devices • Silicon Valley production facility commences conversion to gallium nitride laser processing and starts contributing to technology roadmaps • Achieved feasible reliability, successfully demonstrating more than 500 hours of continuous operation with stable optical power and voltage in reliability testing • Entered into a paid collaboration agreement with Ganvix Inc. to develop cutting-edge GaN VCSELs for green wavelengths (515 nm-525 nm)
2023	• Produced GaN laser diodes at its Silicon Valley production facility and achieved or exceeded contract manufacturer performance benchmarks • Launched its first suite of GaN laser products (405 nm, 420 nm and 450 nm wavelengths in both single-mode and multi-mode devices) for customer purchase at leading industry conference, SPIE Photonics West, in San Francisco, California • Secured initial purchase orders for its 405 nm and 420 nm, 250mW single-mode GaN lasers from industry-leading OEMs • Appointed President Jim Haden as CEO • Secured AUD 10.2 mn in commitments from international and Australian institutional and sophisticated investors via a placement • Received new laser purchase orders (single-mode devices in 405 nm, 420 nm and 450 nm and early prototype high-power 405 nm 3W multi-mode laser) for testing in quantum sensing and surgical applications • Showcased enhanced GaN laser products at Europe's pre-eminent industry conference, Laser World of Photonics, and received positive feedback • Nearly completed wafer fabrication vertical integration; four out of five contract manufacturers transferred in-house • Wins position as commercial partner as part of CLAWS Hub which has been awarded USD 39.4 mn, by the US Department of Defense, in the US Microelectronics Commons

2.12 Company Premiums[xlv]

a) **High Entry Barriers and Lack of Pure-Play Suppliers:** GaN lasers are crucial for global OEMs, systems integrators, electronics manufacturers, defense contractors and research organizations. However, due to the complexity of manufacturing laser diodes, there are significant barriers to entry for new players, resulting in a limited number of end-to-end GaN laser diode suppliers. BluGlass stands out from the limited competition. Based on a decade of extensive R&D work, BLG has developed a multitude of unique technological advantages and a wide range of customizable product offerings. This puts the company in a highly advantageous position to meet the diverse needs of its customers.

b) **Differentiated Offerings Separate BLG from Competitors:** With extensive experience in the photonics industry, the company has identified the challenges faced by customers. They demand more flexibility, faster development, improved performance and cost-effective solutions. These requirements are difficult for large suppliers to meet due to limited form factor flexibility and a sporadic availability of many wavelengths. Consequently, end customers must undertake substantial customization and post-purchase packaging. BLG is one of a handful of GaN laser suppliers worldwide, and its pure-play status means it is well positioned to address these unmet customer needs. With cutting-edge facilities and a vertically integrated supply chain in Australia and the US, the company provides in-demand wavelengths for industrial, biotech, display, defense, quantum, and scientific applications.

c) **RPCVD Technology Provides Added Advantage:** The introduction of BLG’s revolutionary RPCVD technology is solidifying the company’s position as the leading end-to-end GaN laser diode supplier globally. Although BLG’s initial focus is to offer violet and blue laser diodes using industry recognized MOCVD technology, its long-term ambition remains to expand into green laser diodes using its proprietary RPCVD technology, an upgraded version on MOCVD, which addresses the challenges of high temperatures and the use of toxic carrier gases. The company aims to develop novel laser architectures leveraging its proprietary RPCVD and tunnel junction technology for development of longer wavelength devices.

d) **Vertical Integration of Downstream Supply Chain:** BLG’s acquisition of a commercial Silicon Valley laser diode production facility lease and manufacturing equipment for USD 2.5 mn is helping the company accelerate its long-term growth strategy by allowing it to significantly scale its manufacturing and revenue generation capacity, thereby improving the quality and repeatability of the laser diodes expected by customers and fast-tracking development timelines for higher-value products at extended wavelengths. It should also eliminate supply chain complexity and halve wafer production costs, paving the way for higher margins and cash flow breakeven. Acquisition of a fabrication facility has provided synergistic benefits by taking downstream laser diode processing and packaging facility in-house, where it can turn laser diode wafers into customer-ready products. Management believes that a fully operational fabrication facility will boost BLG’s top line to c. USD 170.0 mn, while annual wafer capacity should increase from c. 2,500 wafers to c. 10,000 with 48 development iterations per year, compared to only 4-5 development iterations per year while using multiple contract manufacturers.

e) **Experienced Management:** The foundation of any successful company is a strong and experienced management team. BluGlass has built a team of industry experts with rich experience. A case in point is the appointment of Mr. Jim Haden as CEO. He has over 30 years of laser industry expertise with a proven record of transforming advanced technology businesses. Mr. Haden’s experience includes his recent role at Soraa Laser Diode, where he personally guided the operations and development teams, leading to an improvement and ramping-up of high-power blue GaN lasers and associated packaging and improving manufacturing yields. These products were later delivered to several customers. He had several other significant achievements at other companies where he worked. The board is enriched by the presence of the industry veteran Mr. Jean-Michel Pelaprat, who has over 30 years of experience in establishing, commercializing and scaling laser and semiconductor businesses.

2.13 Company Risks[xlvi]

a) **Loss of Key Management Personnel**: BLG is led by a group of industry experts who possess extensive experience in commercializing technology in new markets. Chairman James Walker has more than 25 years of experience as a chartered accountant, company secretary and senior executive for AIM and ASX-listed technology companies. Jean-Michel Pelaprat has over 30 years of experience in establishing, commercializing and scaling laser and semiconductor businesses. Recently appointed CEO Jim Haden has over 30 years of laser industry expertise and a proven record of transforming advanced technology businesses. All are crucial to BluGlass's successful execution of its business strategy. Any loss of key management might adversely affect the company’s operations and future performance.

b) **Development and Commercialization of Technologies:** BluGlass' long-term roadmaps rely on the successful development and commercialization of its RPCVD technology, which is in the alpha stage. While RPCVD forms an important pillar, and will enable further differentiation, it is not the only path to breakout success for the business. Company's highly differentiated business model of manufacturing agility, customisation and form factor flexibility would support in building a highly successful business with the MOCVD offerings. Qualification processes with larger clients may also be time-consuming, potentially leading to further delays and postponed shareholder return.

c) **Intellectual Property:** BluGlass relies upon a combination of patents, know-how, trade secret protection and confidentiality agreements to protect its technologies. Legal standards relating to the validity, enforceability and scope of protection of intellectual property rights are uncertain. Effective patent, trademark, copyright and trade secret protection may not be available to BluGlass in every country in which its products may be sold. Accordingly, despite its efforts, BLG may not be able to prevent third parties from infringing upon or misappropriating its intellectual property.

d) **Competition:** BLG operates in an industry that faces tough and ever-changing competition, both domestically and globally. The emergence of new technologies could potentially pose a threat, making it harder for BluGlass to differentiate itself from its peers. The sheer size and financial stability of some of its competitors may pose difficulties for BluGlass as it strives to maintain its competitive edge in the technology market. In particular, the company's ability to acquire new technology interests could be negatively affected if it fails to respond effectively and swiftly to the strategies and actions of its competitors and potential rivals, or to the entrance of new competitors into the market. This may, in turn, impede the financial condition and rate of growth of BluGlass.

e) **Commodity prices:** BLG's product relies heavily on gallium as its main raw material. Any geopolitical instability can lead to a shortage of supply, driving up the metal's price. For instance, China's restriction on Gallium export has caused an increase in the price, as China controls c. 80-90% of the global gallium supply. The higher cost of procurement may have an impact on the company's profitability in the short term. Additionally, a lack of raw materials may result in lost clients and business for the company.

f) **Financing:** BLG is currently in a pre-revenue stage and is generating modest revenues through grants and tax rebates. It will have to raise significant funds to pursue its business strategy and planned capex. While it has raised the required financing in the past, it is plausible that it might not be able to raise enough funds to meet its future requirements due to unpredictable circumstances, such as adverse market conditions or economic downturns, which could lead to short-term headwinds.

2.14 Shareholding Pattern[xlvii]

The company had 1,528,045,654 shares of common stock issued and outstanding on November 20, 2023. The shareholding pattern is as follows:

Exhibit 27: Top Shareholding Pattern (November 20, 2023)

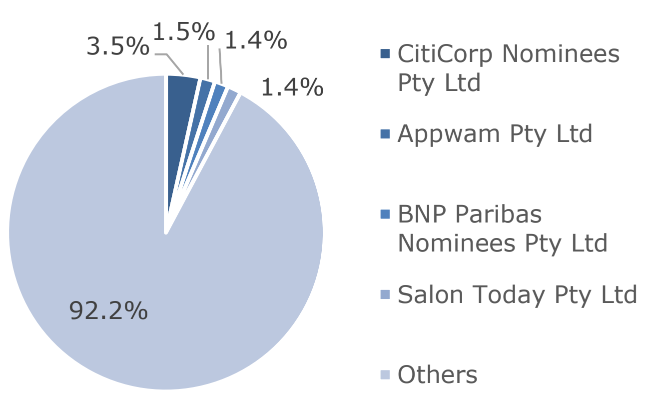


Exhibit 28: Top Shareholding Pattern (November 20, 2023)

Shareholders	Shares outstanding
CitiCorp Nominees Pty Ltd	53,231,136
Appwam Pty Ltd	22,500,000
BNP Paribas Nominees Pty Ltd	21,781,514
Salon Today Pty Ltd	21,000,000
Others	1,409,533,004
Total	**1,528,045,654**

2.15 Listing and Contact Details

BluGlass Limited is publicly listed on ASX in 2006 and is traded under the symbol 'BLG'.

Company Contacts

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Contact No: +61 2 9334 2300

Website: https://bluglass.com/

Email Id: admin@bluglass.com

3. News[xlviii]

- **Confirmation to receive AUD 7.3 mn R&D rebate:** In October 2023, BluGlass has received confirmation from the Australian Taxation Office that the Company will receive its full AUD 7.3 mn rebate, which is a non-dilutive cash injection, for R&D activities carried out across its Australian and US facilities in FY23. This rebate supports company's ground-breaking RPCVD technology development and helps offset the operational costs as the company commercialise their GaN laser technology.
- **Wins position as part of the CLAWS hub:** In October 2023, BluGlass was named a member of the Commercial Leap Ahead for Wide Bandgap Semiconductors (CLAWS) Hub, led by North Carolina State University (NCSU). US Department of Defense has awarded USD 238 mn in FY 23 CHIPS and Science Act funding for the establishment of eight Microelectronics (ME) Commons regional innovation hubs The CLAWS club which has been awarded USD 39.4 mn, is one of eight ME Commons regional innovation hubs.
- **Received order from an existing customer:** In September 2023, BluGlass received a custom GaN laser project order from an existing customer, a leading USA-based research laboratory. This will encompass BLGs' multi-mode GaN lasers in custom laser bars – where multiple emitters are arrayed to address high-power applications. These bars will also feature custom lenses, attracting a higher average selling price (ASP).
- **Appointed new full-time CFO:** In September 2023, BluGlass appointed Mr. Samuel Samhan as Chief Financial Officer on a full-time basis, effective immediately. With over two decades of relevant experience in the field of financial leadership and commercial operations experience, Samuel's hands-on experience will be vital in boosting BLG's profitability.
- **Showcased enhanced products at Laser World:** In July 2023, BluGlass showcased enhanced performance across 405 nm and 450 nm wavelengths, a new ultra-violet 397 nm alpha product and improved DFB laser data at the Laser World of Photonics.
- **Secured new GaN laser orders:** In July 2023, BluGlass received orders from a quantum photonics pioneer and a leading medical device manufacturer for testing related to quantum sensing and surgical applications.
- **Improvements in DFB laser demonstration:** BluGlass progressed its development of visible GaN DFB lasers, demonstrating substantial performance improvements with its collaboration partner, the UCSB. The company increased the side-mode suppression ratio by more than 50% in its latest DFB development, delivering advanced single-frequency performance at 450 nm, and using its proprietary RPCVD technology extended into longer-wavelength blue devices up to 478 nm.
- **Vertical integration of Silicon Valley facility nears completion:** During the quarter ending June 2023, BluGlass transferred core downstream manufacturing processes from four contract manufacturers to its Silicon Valley production facility. The company is now in the final stages of integrating its remaining contract manufacturer, responsible for thinning, cleaving and N-metallization processes.
- **Successful completion of Phase 1 of Ganvix VCSEL development:** During the quarter ending March 2023, BluGlass successfully completed Phase 1 of its paid collaboration agreement for the development of green GaN VCSELs with Ganvix Inc. Building on the green multi-quantum well (MQW) epitaxial development of Phase 1, the two companies were collaborating to combine Ganvix's nano porous VCSEL architecture with BluGlass's proprietary RPCVD technology to demonstrate the commercial feasibility of green GaN VCSELs. The paid collaboration, if commercialized, could result in ongoing customer revenues for BluGlass.
- **Raised AUD 10.7 mn in capital:** In March 2023, BluGlass received commitments for AUD 10.2 mn via a placement to institutional and sophisticated investors and a further AUD 500K from a rights issue to existing shareholders The proceeds are being used to scale product delivery and for capex needs.
- **Appointed Jim Haden as CEO:** On March 3, 2023, BluGlass announced the appointment of President Jim Haden as CEO. Mr. Haden brought BluGlass' GaN laser technology to market. Under his leadership the company significantly improved laser performance and reliability, launched its first suite of products and secured initial customer orders. He was instrumental in acquiring the purpose-built Silicon Valley laser production fabricator.
- **Received first orders:** In February 2023, BluGlass received multiple initial customer orders for its 405 nm and 420 nm single-mode devices from leading laser OEMs in the quantum and industrial segments and a renowned international energy research institution.
- **Launched its first suite of commercial GaN laser products:** In January 2023, BluGlass launched its first suite of commercial GaN laser products for customer purchase at Photonics West in San Francisco. BluGlass launched a

suite of six laser products at the leading industry conference, SPIE Photonics West, comprising 405nm, 420 nm and 450 nm wavelengths in single-mode and multi-mode devices.

- **Feasibility and reliability of laser diodes demonstrated:** On November 21, 2022, BluGlass announced that its GaN laser diodes had achieved feasible reliability, successfully demonstrating more than 500 hours of continuous operation with stable optical power and voltage in reliability testing, enabling the company to increase engagement with potential customers.
- **Received all required regulatory approval for Silicon Valley facility:** On September 21, 2022, BluGlass's US Silicon Valley fabrication facility received all required regulatory approval to begin processing. The fabrication facility had several operational manufacturing processes for GaN laser diode development and is contributing to the company's technical roadmaps.
- **Collaboration with Ganvix:** In November 2022, BluGlass signed a paid development agreement with Ganvix Inc., a leading developer of nano-porous GaN VCSELs, to develop green GaN VCSELs in 515 nm-525 nm wavelengths. Under the agreement, BluGlass is to use its low-temperature RPCVD technology to provide Ganvix with green quantum-well epitaxy.
- **Invitation to join UCSB's SSLEEC consortium:** On September 14, 2022, BluGlass joined UCSB's SSLEEC consortium, giving the company access to UCSB's world-class faculty, facilities and specialist GaN researchers.
- **Acquired a laser diode facility in Silicon Valley:** In March 2022, BluGlass acquired a 19,000 sq. ft. purpose-built commercial laser diode production facility lease and manufacturing equipment in Silicon Valley for USD 2.5 mn. This is enabling the company to bring fabrication processes in-house, thereby speeding up production, reducing manufacturing costs and increasing margins.

4. Management and Governance[xlix]

Exhibit 29: Management and governance		
Name	**Position**	**Experience**
James Walker	Non-Executive Chair	• Non-Executive Chair of BluGlass Ltd since 2017 • Non-executive Chair of Native Mineral Resources • Successfully completed the ASX-IPO of thedocyard Ltd. and DroneShield; before that, he was CFO of Seeing Machines Ltd. • Over 25 years of experience as a chartered accountant and company secretary of various high-growth private companies
Jean-Michel Pelaprat	Non-Executive Director	• Non-Executive Director of BluGlass since May 2021 • Held various leadership positions in high-growth photonics businesses such as NUBURU (Co-Founder and Director), Vytran, Novalux Inc. and Coherent Inc. • Over 30 years of experience establishing, commercializing and scaling laser and semiconductor laser businesses
Stephe Wilks	Non-Executive Director	• Non-Executive Director of BluGlass since May 2021 • Expertise includes extensive technology leadership, strategic finance, merger and acquisition (M&A) and governance expertise • Headed several technology companies, including BT Asia Pacific, XYZed Pty Ltd (an Optus company), Nextgen Networks, Personal Broadband Australia and NM Rothschild and Sons
Vivek Rao	Non-Executive Director	• Non-Executive Director of BluGlass since May 2016 • Held a number of technology leadership and managerial roles in the industry and is presently Executive Vice President and Chief Operating Officer (COO) of SPT Microtechnologies with c. 27 years of semiconductor industry experience
Jim Haden	CEO	• CEO of BluGlass Ltd since September 2021 • Responsible for overseeing all aspects of the business and for transitioning BluGlass from its R&D origins to a technology development and product manufacturing company • Previously held leadership positions at nLIGHT, Coherent Incorporation, JDS Uniphase and Spectra Diode Lasers • Over 30 years of laser industry expertise and a demonstrated record transforming advanced technology businesses
Dr. Ian Mann	COO & Chief Technology Officer (CTO)	• CTO & COO of BluGlass • Responsible for determining the direction of the company's R&D operations • Previously CEO of Bandwidth Foundry International Pty Ltd.
Samuel Samhan	Chief Financial Officer (CFO)	• Recently appointed as CFO of BluGlass Limited • Over 20 years of experience in financial leadership and commercial operations positions • Prior experience involves being Chief Operating and Financial Officer at Digital Wellness, while other roles include head of Commercial and Business Transformation at Vitality Works – Sanitarium Workplace Health and Wellness, and Commercial Manager at Evolution Healthcare Group. • Holds a bachelor's in accounting, MBA, and is a graduate of the Australian Institute of Company Directors.
Brad Siskavich	Executive Vice President	• Executive Vice President of Business Development at BluGlass Ltd since 2018 • Previously worked in senior research and business development roles at Emcore, Oxford Instruments and Masimo Semiconductor • Some 25 years of experience developing and commercializing new compound semiconductor and laser technologies
Stefanie Winwood	Head of Corporate Communications and Investor Relation (IR)	• Responsible for Corporate Communications, IR and Marketing • Expertise includes investor relations and communications management, branding and identity creation and management; media and stakeholder relations; coaching and training • Over 15 years of experience in building brands and businesses

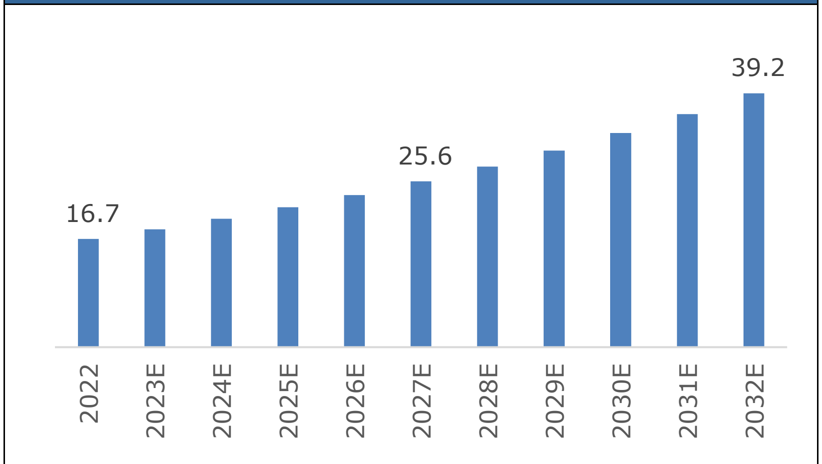
5. Industry Overview

5.1 Market Overview

5.1.1 Laser Technology Market

Laser technology underpins advanced technology capabilities, with the benefits of visible lasers behind many global megatrends – from electrification, digitization, and decarbonization to space exploration and next-generation medical technology.

Exhibit 30: Evolution of Laser Technology Market[l]



Lasers are being used in the development of quantum computing and sensing, materials processing and advanced manufacturing, as well as in many surgical procedures, next generation medical diagnostics and treatments. In manufacturing, lasers are used throughout the supply chain for cutting, engraving, drilling, and marking a broad range of materials. Lasers are increasingly being adopted in the production of automobiles, aerospace applications, and the production of advanced materials, not only in the cutting and welding of components, but also in implementing advanced technologies such as ADAS.

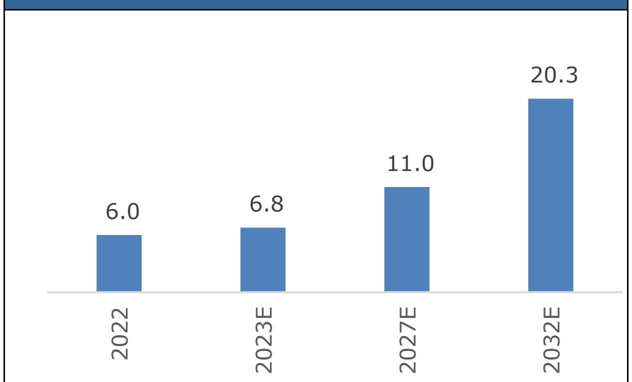
The rising adoption of high-tech applications globally, such as smartphones, smart TVs, 3D printing, electric vehicles and renewable energy storage, as well as significant advances in industrial materials processing (automotive, aviation and others) is likely to keep the laser technology market growing at a CAGR of c. 8.9% to c. USD 39.2 bn by 2032[li].

5.1.2 Laser Diode Market[liii]

A laser diode is a semiconductor device similar to an LED in which a diode pumped directly with electrical current can create lasing conditions at the diode's junction. However, LED emits incoherent light in all directions, as compared to the light waves emitted from a laser diode, which have the same frequency and phase. A case in point, similar to the LED, is the light emitted by the Sun, in which the light is scattered in all directions, resulting in photons of multiple frequencies being emitted simultaneously, while the waves are not in phase. Because of this special characteristic, laser devices are used in a wide range of applications.

The laser diode is set to experience a surge in demand, owing to its light weight, small size, low power consumption and increasing popularity in the telecommunication, medical and industrial sectors. Because of their compact design and affordability, laser diodes are fast replacing traditional semiconductors. They emit a narrow beam of light with a wide wavelength and high level of targeting accuracy, making them a popular choice for many end-use industries. They operate on small-volt batteries and consume less power than gas and solid-state lasers, thereby driving demand across various verticals.

Exhibit 31: Evolution of Laser Diode Market[lii]



The total addressable market globally of laser diodes is projected to increase from USD 5.3 bn in 2021 to USD 20.3 bn in 2032 at a CAGR of 13.0%.

Working Principle

Before understanding the working of a laser diode, understanding the working principles of an LED is important.

- LEDs are composed of two types of semiconductor materials: 'N-type semiconductor' with an excess of electrons, where the charge carriers are the electrons themselves, and 'P-type semiconductor' with a lack of electrons, where the charge carriers are the gaps (holes) due to missing electrons.

- When these two materials are joined by a battery in direct polarization, the electrons flow from 'N-type' to 'P-type' semiconductors. This leads to an occurrence of **"spontaneous emission"**. At the point of contact between the two materials, electrons and holes recombine, and due to the difference in the amount of energy that an electron can have in the atoms of each semiconductor, a resultant photon is released. This recombination occurs spontaneously whenever an electron and a hole are in close proximity and as a result, "**stimulated emission**" occurs. More specifically, if a photon with the needed energy passes through a place where an electron and hole meet, it results in a recombination and emission of a new photon, which has the same frequency, polarization and phase as the first photon.
- To enhance this behavior, a laser diode has additional processing to form a waveguide, which promotes the recombination of electrons and holes in a given volume and functions as a channel to a given photon. At a low forward bias, although there is a certain number of photons generated by "stimulated emission", the majority of the photons are generated by "spontaneous emission". Above the turn-on voltage, the majority of photons are created by stimulated emission (Light Amplified Stimulated Emission Radiation)
- Reflectors are placed at both sides of the diode. At one end of the diode, there is a fully reflective coating, while at the other end of the diode there is another reflector that lets out of the laser beam. This arrangement is called a "**Fabry-Perot resonator**" in which the emitted photons continuously bounce back and forth between the two ends, thereby continuously generating more stimulated emission, allowing the light beam to exit only from one end.

5.1.3 GaN Laser Diode Market

The laser technology industry is expected to reach a total addressable market value of over USD 30.0 bn by 2029. Within this market, approximately 10% is attributed to the GaN laser diode segment, which is projected to expand to approximately USD 3.0 bn by 2029 and USD 3.9 bn by 2032. Growth in this sub-segment is largely driven by an increase in use across a wide range of applications, including both generic and specialized needs.

Over the past few years, the importance of GaN laser diodes has been on the rise due to their ability to offer a significant edge over traditional IR lasers in terms of size, weight, absorption (particularly in metals), angle beam, as well as current consumption, voltage, and power requirements. Their unique advantages have made them a preferred choice for various applications, contributing to the growth of the GaN laser diode market.

5.2. Blue Lasers[liv]

5.2.1 Overview

The most common form of GaN laser is the "blue laser". This is a device that emits a light beam in the wavelength range of 400-500 nm, visible as violet or blue to the human eye. The light beam produced is temporally coherent and can be well-collimated, which allows it to have numerous applications in industry and science. The characteristics of different blue lasers are predominantly determined by gain media and their properties. The term blue laser can refer to any of the following:

- A **compact, high-power 400-500 nm wavelength laser head**, which is a laser module for industrial, scientific and other applications. The main difference from standard laser modules is that these laser heads are designed to achieve the highest power density at the focused beam spot with a long lifetime.
- A **400-500 nm wavelength laser module**, which is larger in size than a laser head, although laser heads are sometimes simply referred to as laser modules.
- A **400-500 nm wavelength laser diode**, for which the most popular blue laser diodes are those that emit beams at the wavelengths of 405 nm, 445 nm, 447 nm and 450 nm.

Out of all the gain mediums that exist for blue semiconductor lasers, GaN is considered the best.

5.2.2 Brief History

Blue lasers were initially created through helium-cadmium, argon or krypton gas as a mere laboratory curiosity in 1992. However, with the advent of edge-emitting blue semiconductor laser diodes around 2000, the situation changed.

Blue lasers now feature favorable electrical-to-optical power conversion, which has led to their increasing popularity on the market. High-power projectors and Blu-Ray technology have created a major market for blue laser diodes, leading to the development of new and improved varieties. While blue lasing is achievable with several different types of lasers, semiconductor blue laser diodes are increasingly preferred due to their uniformly good electrical-to-optical efficiencies, small sizes, cost effectiveness, high operating temperatures and lifetimes.

5.2.3 Why Blue Laser is Preferred over IR laser

When it comes to certain applications, using a blue laser rather than IR lasers (such as fiber lasers and CO_2 lasers) can be highly beneficial. Although fiber lasers can be focused to a smaller spot size due to their lower **beam parameter product** (BPP), they require a larger cooling system and are not efficient at processing certain metals such as copper. Copper absorbs 5% of the incident 1.064 µm IR light and <1% of the incident 10.6 µm IR light, but **65% of the incident 450 nm** blue laser beam at room temperature. On the other hand, despite the low price-to-power ratio of CO_2 lasers, **copper absorbs <1% of CO_2 laser light** meaning only a small fraction of the optical power is absorbed on copper. CO_2 lasers, while low in price-to-power ratio, have **poor electrical-to-optical power conversion**, meaning only a small percentage of electrical power is converted to light. Consequently, CO_2 lasers consume a significant amount of **electrical power**, which results in a higher electrical bill. In contrast, blue lasers offer a smaller beam waist, allowing for higher precision and the ability to process a wider range of materials, including metals. With their **high reliability and lower power consumption**, blue laser diode modules and laser heads are often the superior choice for such applications.

Blue lasers offer the ultimate advantage of **efficiently absorbing laser beams by metals**. This makes blue lasers a **universal tool** for processing many materials. Additionally, blue laser heads have a much higher power density than **Fiber lasers**. Moreover, the **high-power density and absorption rate** of the blue laser beam allow it to be used much more effectively, even though it is smaller in one dimension than gas lasers. This is a significant advantage for various high-tech applications, such as microchip and PCB board manufacturing, electric vehicle batteries and renewable energy storage applications. Blue lasers are capable of effectively processing a wide range of materials, including titanium, copper or gold, as well as other materials such as wood or leather.

Exhibit 32: IR Versus Blue Laser Absorption[lv]R

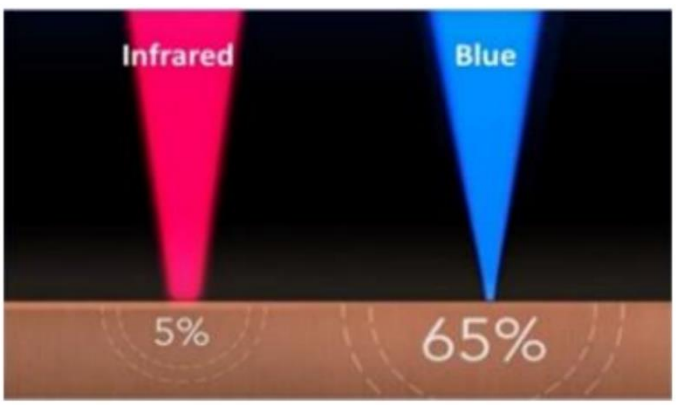
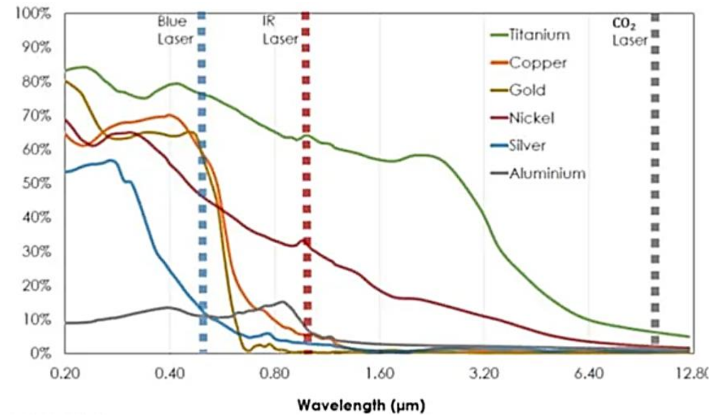


Exhibit 33: Absorption Characteristics of Various Metals Versus Wavelengths[lvi]



The graph depicted above clearly demonstrates that the absorption rate of metals is significantly higher for the 445 nm (0.445 µm) blue laser beam as compared to CO_2 (10,600 nm) and fiber (typically 1,030 – 2,050 nm) lasers. Additionally, single-mode blue lasers can achieve a power density that is **50% higher**. This implies that blue lasers can discharge **almost 20x more energy** on to the illuminated material at the same power level when compared to IR lasers, thereby making blue lasers a more suitable choice for various applications.

The table below showcases the superiority of blue lasers over fiber laser and CO_2 laser heads:

Exhibit 34: Blue Laser Comparison with IR Lasers

Particulars	Blue laser[lvii]	Fiber laser[lviii]	CO_2 laser head[lix]
Wavelength [nm]	445	1064	10600
Average power [W]	6.0	50.0	75
Beam waist size [µm]	50 by 4.0	11	64
Average power density [kW/cm^2]	3,000	12,900	580
Absorption on copper [%]	65	5	<1

Absorbed power density of copper [kW/cm²]	1,900	600	5
Lifetime [h]	30,000	100,000	1,000-3,000
Power supply voltage [V]	12-24 DC	110-220 AC	100-240 AC
Visibility	Visible	Invisible	Invisible
Dimensions [cm]	4 x 5.5 x 10.5	13.2 x 40.3 x 44.8	4 x 6 x 16
Unit weight [kg]	0.22	19	1
Cost per kW of average power [000's USD]	170	360	20
Cost per kW of power density [USD]	0.33	1.4	2.6
Cost per kW of absorbed power density on copper [USD]	0.51	30	300

5.2.4 Application Areas

The industrial segment (in terms of market size) is likely to remain a dominant vertical for GaN laser diode applications. However, demand from the scientific and bio-medical segments, besides defense and displays, is expected to grow significantly. The following are the areas where GaN laser diodes are used:

Exhibit 35: GaN Laser Market Verticals: By 2025[lx]

Industrial

- **Wavelengths:** 405 nm, 450 nm, 525 nm
- **Target Applications:** Materials processing, machine vision & sensing, 3D printing, semiconductors
- **Customer Landscape:** IPG Photonics, nLight, NUBURU, Coherent
- **Market Size:** USD 400 mn

Scientific

- **Wavelengths:** 405 nm, 420 nm, 450 nm, 488 nm, 525 nm
- **Target Applications:** Quantum computing, sensing & navigation, florescence microscopy
- **Customer Landscape:** Coherent, Toptica, AOSense, Modulight
- **Market Size:** USD 100 mn

Biotech/Life Science

- **Wavelengths:** 405 nm, 420 nm, 450 nm, 488 nm, 525 nm
- **Target Applications:** Flow cytometry, Next-Gen DNA Sequencing, Photodynamic Therapy
- **Customer Landscape:** 10X Genomics, Pac Bio, Lumencor, Element Biosciences
- **Market Size:** USD 60 mn

Display

- **Wavelengths:** 450 nm and 525 nm
- **Target Applications:** AR, VR & mixed reality, Pico projectors, heads-up display
- **Customer Landscape:** Apple, Google, META, Samsung
- **Market Size:** USD 60 mn

Defense/R&D

- **Wavelengths:** 405 nm, 420 nm, 450 nm, 488 nm, 525 nm
- **Target Applications:** Navigation & guidance systems, detection & sensing, advanced materials processing
- **Customer Landscape:** DARPA, Lockheed Martin, Northrup Grumman, Boeing
- **Market Size:** USD 115 mn

5.2.5 Key Industrial Players

Exhibit 36: Key Industry Players by Segment[lxi]

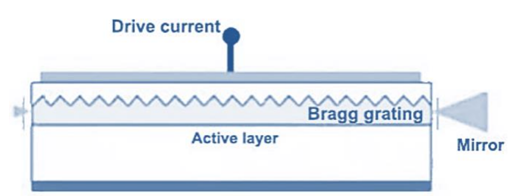
5.3 BluGlass' DFB Laser Development[lxii]

Overview

Compact, single-wavelength laser light sources have become a necessity in the field of quantum information science. Research in this area relies heavily on stimulated light interaction with unique materials that require specific wavelengths to target individual atomic interactions. According to a recent Mackenzie report, quantum computing is one of the most revolutionary technologies that is set to reach widespread commercial application in a decade's time. Meanwhile, quantum sensing and quantum communication are ready for deployment in critical industrial and scientific applications.

DFB[lxiii]

Exhibit 37: DFB Lasers Schematic Diagram[lxiv]



DFB is a type of single frequency (or single wavelength) laser diode where the key layers within the device include a periodically structured element or "**diffraction grating**". The structure builds a one-dimensional interference grating (**Bragg scattering**), and the grating provides optical feedback for the laser. To stabilize the lasing wavelength, the diffraction grating is formed close to the P–N junction of the diode. This grating acts like an optical filter, causing a single wavelength to be fed back into the gain region making the laser output only a single frequency that is more stable during operation. Just like a Fabry-Perot laser, the device contains two facets; one with a highly reflective (HR) coating that confines the light within the cavity, and the other with a low- or anti-reflection coating (AR) that allows some light to leak out. The DFB lasing wavelength is governed by the pitch of the grating which is set during manufacturing resulting in a very stable lasing frequency which is less sensitive to temperature variation.

The Fabry-Perot laser diode is the most common type of laser diode commercially available in the market and is utilized in a wide range of applications. Fabry-Perot laser diodes are sometimes categorized as follows:

- **Single-mode:** Single-mode laser diodes are optimal for use in applications where a diffraction-limited beam is paramount. Single-mode lasers generally provide less overall power than multimode diodes, but the narrow active area allows for higher power density and lower capacitance, allowing for quicker switching and making them well-suited for high-speed applications.

- **Multi-mode:** Multi-mode laser diodes, also known as broad area lasers (BALs), are the perfect choice when consistent and scattered power is needed for an application. They deliver higher power outputs and are spatially and longitudinally multi-mode with broad beam diffraction that enables light emission on a wider surface area. This feature makes them the optimal solution for illumination, but with the proper focusing optics, also industrial and medical applications.

The key difference between the two types is the far field distribution in the lateral direction. A single-mode laser shows a bell-shaped far-field distribution with only one peak, while a multi-mode laser exhibits a distribution with multiple peaks.

Exhibit 38: Far Field of a Single Mode Laser

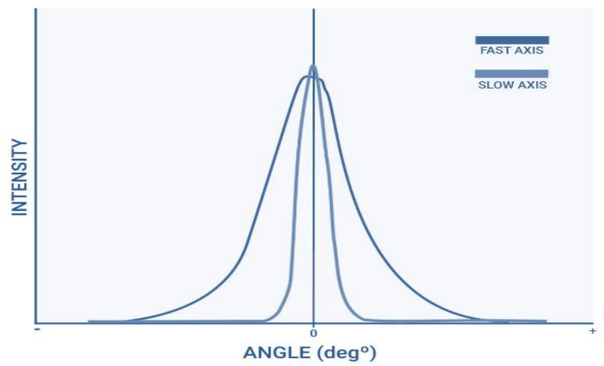
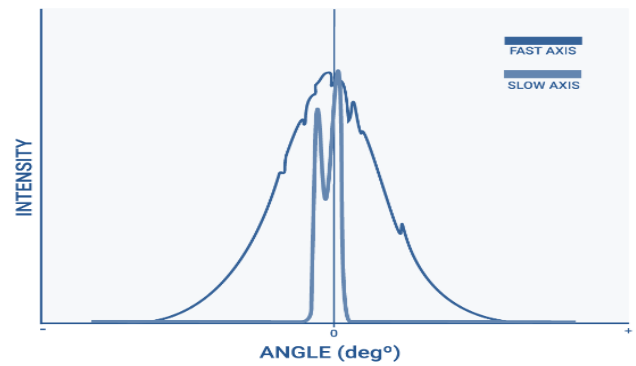


Exhibit 39: Far Field of a Multi-Mode Laser



Why Are DFBs Preferred over Fabry–Perot Lasers in Some Applications?

DFB lasers tend to be much more stable than Fabry–Perot lasers. They are used frequently where clean single-frequency operation is needed, especially in high-speed fiberoptic telecommunications, and in the case of visible lasers, in quantum computing and quantum sensing applications.

In a Fabry–Perot laser, there are two broad-band reflectors at the two ends of the lasing optical cavity, where light bounces back and forth between the two mirrors and forms **longitudinal modes** or **standing waves**. The front reflector has lower reflectivity than the back reflector, which allows the light to come out, forming the output of the laser diode. The mirrors are generally broad-band and reflect many wavelengths, and as a result, the laser simultaneously supports multiple longitudinal modes – which means the laser light consists of a broader spectrum of wavelengths. This spectrum of light tends to vary as the temperature of the laser changes, thereby leading to the variation of longitudinal modes of the laser. As a result, the spectrum tends to be **less stable** and **highly temperature dependent**. This variation of the modes equates to a variation of the laser frequency (wavelength), which is undesirable for applications where a single specific frequency is required.

One solution to control frequency is to replace the mirrors with a **diffraction grating**. This is known as a "**distributed Bragg reflector**" (DBR) laser, where the longitudinal diffraction-grating mirrors reflect and reinforce only a single wavelength of light back into the cavity. Because the diffraction-grating reflects a narrower band of wavelengths than simple mirrors, the device lases at only very narrow or specific wavelengths governed by the design of the DBR. This makes DBR lasers more spectrally stable than Fabry-Perot lasers with broadband coatings.

In **DFB lasers**, the grating is located continuously along the cavity and interacts with the lasing mode over the entire length of the device, rather than just at the facets. This design changes the modal behavior considerably, making the laser more stable than both Fabry-Perot and DBR lasers. DFB lasers are widely used in optical communication applications where a precise and stable wavelength is crucial, especially for high data rate, long-distance transmission.

How DFB is Changing the Landscape

In the past, quantum demonstrations were limited to benchtop equipment with external cavity lasers and tunable dye lasers, which are large and expensive. BluGlass has made significant advances in GaN-based DFB laser diodes, providing a more cost-effective alternative. GaN devices are highly efficient and emit high-quality UV to green laser light. BluGlass' visible DFB lasers have demonstrated near single wavelengths with extremely narrow **full width at half-maximum** (FWHM) wavelength distribution and high **side mode suppression ratio** (SMSR), making them highly desirable. These compact DFBs are fabricated at the wafer scale, making them ideal for portable platforms and high-volume production to meet the demands of the quantum market and applications.

The quantum market presents strong opportunities for visible laser diode manufacturers like BluGlass, as many atomic transitions occur at visible wavelengths. Customers are increasingly interested in these technologies for applications such as advanced robotics, biomedical applications, atomic clocks for quantum navigation, and military and commercial applications. In addition, single-wavelength visible laser sources offer unique performance properties that can unlock significant opportunities in the field of underwater ranging, communication, and next-generation display and wearable technologies, including augmented reality (AR) and virtual reality (VR) applications.

BluGlass' research efforts on the development of GaN-based DFB laser diodes have been driven by the considerable opportunity presented by these emerging quantum markets and strong customer interest. DFB lasers are the ideal candidate to meet the strict frequency, beam fidelity, narrow linewidth requirements, and high power and efficiency needed for these next-generation technologies.

BluGlass' DFB Laser Development

Through its proprietary RPCVD technology, BLG has demonstrated significant progress in strict frequency control, beam fidelity and narrow linewidth with its recent GaN DFB laser. This has led to improved laser performance, including side mode suppression ratio, lower operating voltage and higher efficiency. The beam linewidth has been proven stable over a wide range of drive currents and has wavelength-tuning capability. BluGlass, together with UCSB, has made significant improvements in its GaN DFB performance using RPCVD for longer wavelength devices. The side-mode suppression ratio (a critical requirement to enable single-frequency lasing performance) has improved by more than 50% since Photonics West, delivering advanced single frequency performance at 450 nm and demonstrating longer-wavelength DFB lasers up to 478 nm.

Exhibit 40: Emission Spectra from DFB Laser Chips in Previously Published Work

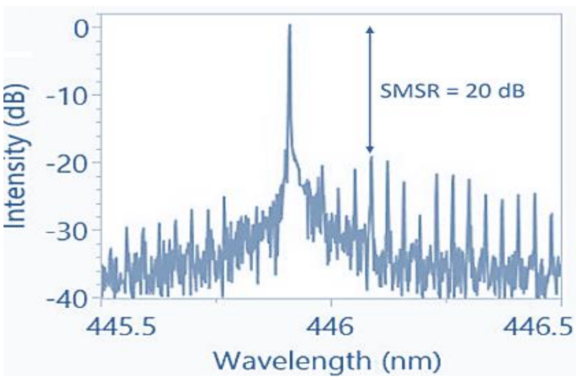
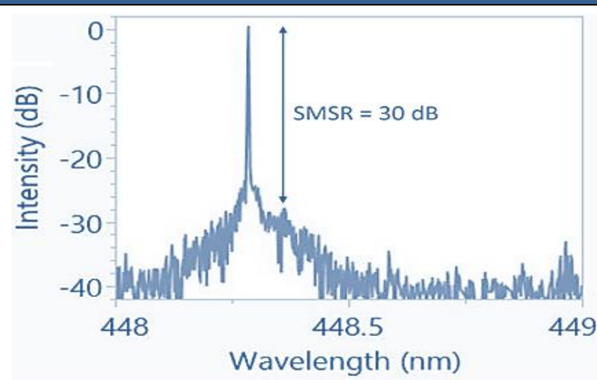
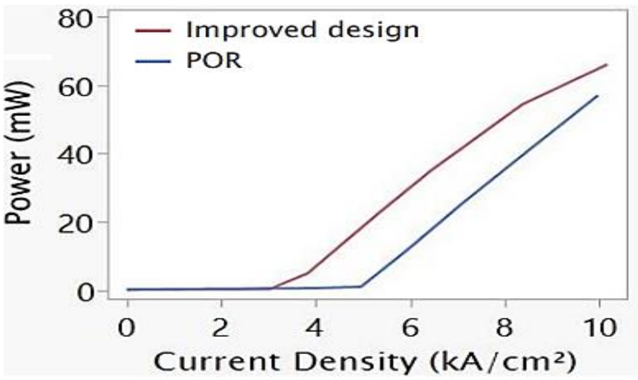
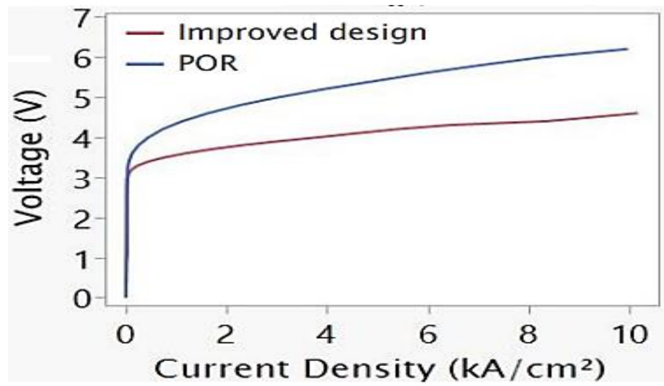


Exhibit 41: Emission Spectra from DFB Laser Chips with Improved Chip Design



BluGlass' latest development iterations also demonstrate lower threshold and voltage performance, achieving higher powers across similar current densities.

The graph below showcases how BLG's improved grating and epitaxial design have improved threshold and decreased operating voltage, resulting in higher efficiency and reduced heat generated as waste. Fundamental improvements to the epitaxial material led by RPCVD have expanded single-frequency emission towards longer wavelengths, showcasing the potential of RPCVD to outperform traditional growth methods in fabricating long-wavelength GaN laser diodes.

Exhibit 42: Comparison of Previously Published Output Power with BLG's Improved Grating Design	Exhibit 43: Comparison of Previously Published Output Voltage with BLG's Improved Grating Design
	

5.4 Key Trends[lxv]

The key trends visible in the global laser diode market are as follows:

Laser diode industry - major need to address limitations

The laser diode industry has long been crippled by high initial costs and low output power. Since single-laser diodes cannot supply the power output required for specific applications, multiple lasers must be operated simultaneously (thereby increasing the cost of the laser system) to match the power requirements for such applications. The output of laser diodes is also greatly dependent on temperature, so any increase in temperature translates into higher power losses. To address these limitations, companies such as BluGlass have developed low-cost, high-power laser diodes that meet the needs of end-user industries.

Traditional IR lasers might be a thing of the past

The visible laser market is experiencing steady growth and is now the most promising segment in the industry. The laser technology market is likely to keep growing at a CAGR of c. 8.9% to reach c. USD 39.2 bn by 2032. Within this market, approximately 10% is attributed to the GaN laser diode segment, which is projected to expand to around USD 3.0 bn by 2029 and USD 3.9 bn by 2032. GaN lasers, which cover the visible spectrum from ultraviolet to green wavelengths, possess many advantages over traditional IR lasers. They offer superior brightness and higher energy absorption in metals, making them ideal for more accurate, cleaner and faster material processing, essential in today's miniaturized high-tech applications. Their exceptional performance properties are also paving the way for new applications in quantum sensing and computing, robotics, biotechnology and medical therapies.

GaN segment poised to become the fastest-growing segment of the laser diode market

The GaN segment is set to experience exceptional growth, driven by the use of GaN-based laser diodes in LiDAR applications. As a result, there should be long-term growth opportunities for companies operating in this segment. GaN-based laser diodes should also see increased demand due to technological innovations in consumer electronics, such as AR and VR devices, and particularly in 3D sensing applications.

VCSEL diodes - the fastest-growing segment of the laser diode market by technology

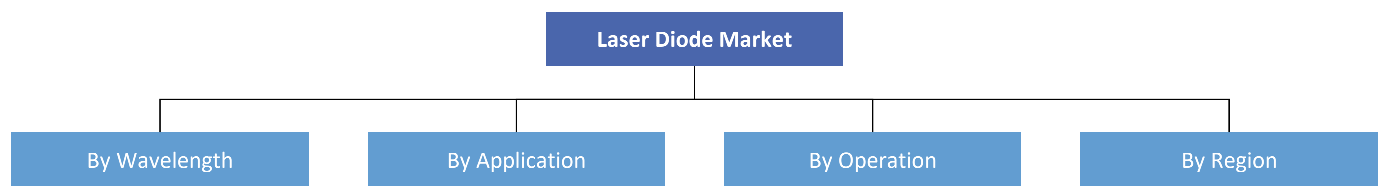
VCSEL laser diodes are the most rapidly expanding segment in the laser diode market. This growth can be attributed to the increasing adoption of VCSEL technology in LiDAR applications and the increasing use of VCSEL in data communications. VCSELs are known for their high efficiency and cost-effectiveness, making them ideal for use in a range of applications such as data communication and 3D sensing. The surge in the application of 3D sensing in smartphones is projected to be the primary driving force behind growth of the VCSEL market.

Asia-Pacific is expected to dominate, followed by North America

The laser diode market is witnessing significant growth in the Asia-Pacific region, primarily due to the constant demand for material processing in various industries. The expansion of the telecommunication and industrial sectors and increasing projects in China, India and South Korea are expected to add to this growth. Laser diodes are crucial for precision, efficiency and versatility in handling various materials, making them indispensable for the automotive sector, heavy industries and regional manufacturing. Laser diodes are used for various applications such as laser cutting, welding and surface treatment. In the Asia-Pacific region, the automotive industry is witnessing substantial growth, and laser diodes play a crucial role in automotive manufacturing processes, including precision cutting of components and welding of body parts. The general manufacturing sector in the Asia-Pacific region relies on laser diodes for applications such as marking, engraving and micromachining. The thriving electronics manufacturing industry also contributes to the demand for laser diodes in printed circuit board (PCB) manufacturing, microelectronics production and semiconductor fabrication. Due to the region's robust industrial activities and the constant demand for material processing in automotive, heavy industries and general manufacturing, the Asia-Pacific region is leading in the laser diode market. North America is the second-fastest growth market, with advanced medical facilities in the US employing various medical devices that are manufactured using laser diodes. The use of laser diodes in surgical operations is increasing steadily. The presence of prominent telecommunication, aerospace & defense and automotive companies, such as AT&T, Verizon Wireless, Boeing and General Motors, is also expected to boost growth of the laser diode market in North America.

5.5 Market Segmentation

Exhibit 44: Market Segmentation

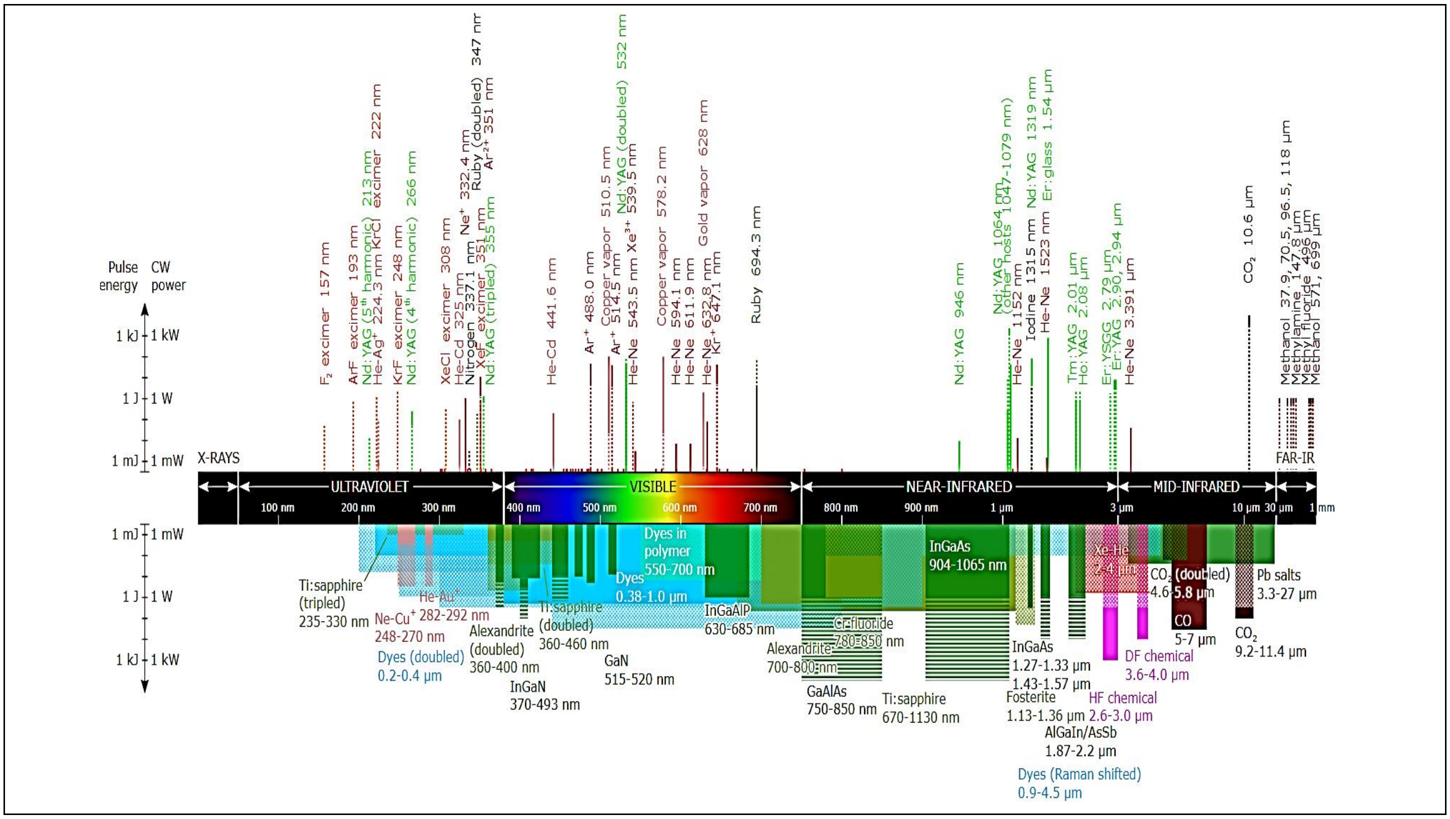


5.5.1 By Wavelength

By wavelength, the laser diode market is divided into:

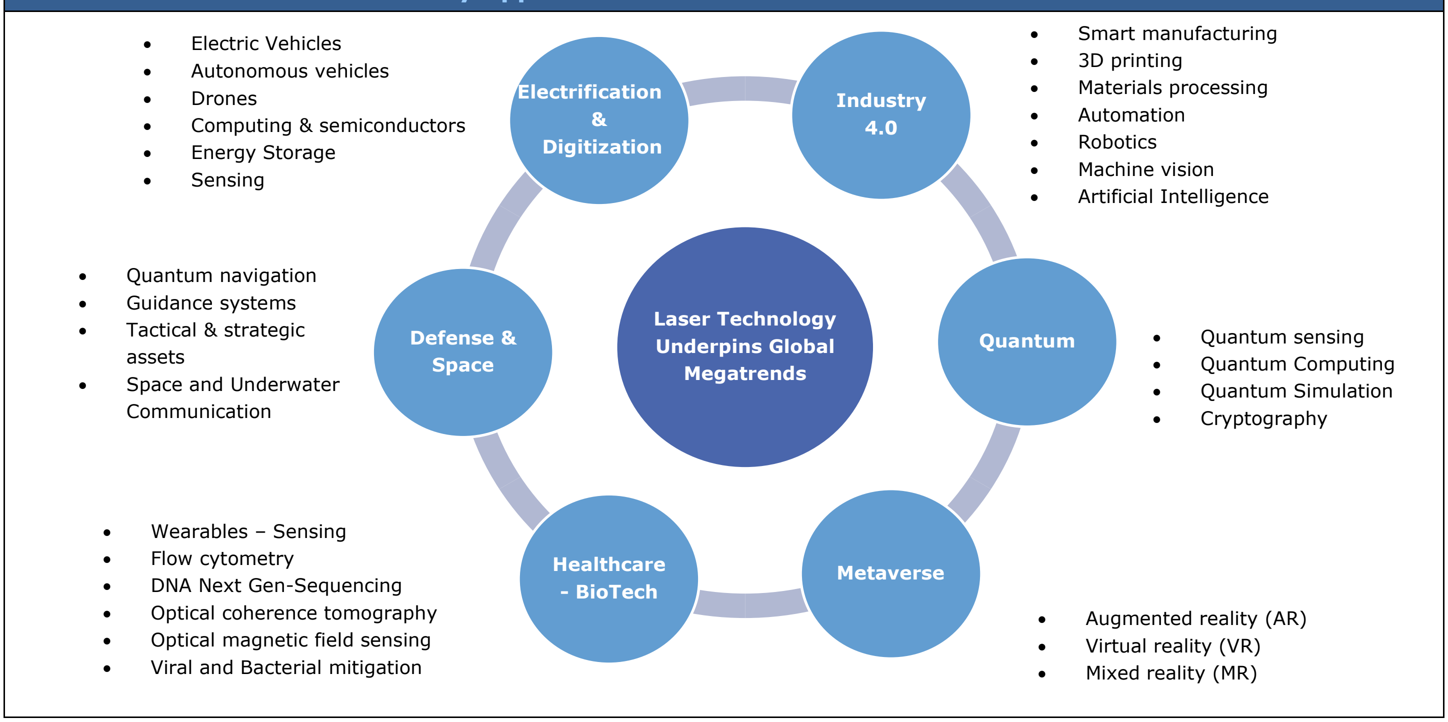
- Ultraviolet (<400 nm);
- Violet (400 – 450 nm);
- Blue (450 – 490 nm);
- Green (490 – 560 nm);
- Yellow (560 – 590 nm);
- Orange (590 – 635 nm);
- Red (635 – 700 nm);
- Near IR (700 – 1,400 nm);
- IR (>1,400 nm).

Exhibit 45: Laser Diode Market by Wavelength[lxvi]



5.5.2 By Application[lxvii]

Exhibit 46: Laser Diode Market by Application



5.5.3 By Operation[lxviii]

The laser diode market can be classified by operations in either:

- Continuous-wave (CW) mode
- Pulsed mode

The type of operation is largely dependent on whether the power output is essentially continuous over time or whether its output takes the form of pulses of light on one or the other time scale.

CW lasers are essential for several laser applications that require constant beam output power. Many types of lasers can be operated in a CW mode to meet this requirement. For CW operation, the gain medium's population inversion must be replenished regularly by a steady pump source, which is not feasible in some lasing media. In other lasers, it may require pumping the laser at an impractically high continuous power level, leading to excessive heat production, consequently damaging the laser, making it impossible to run in CW mode. On the other hand, **pulsed operation** of lasers refers to all lasers that are not CW, producing optical power in pulses of various durations at different repetition rates. This technology addresses several different needs, resulting in a broad range of applications. Some lasers are pulsed because they cannot be run continuously, while others require the production of high-energy pulses.

In cases where the modulation rate is significantly slower than the cavity lifetime and the duration of energy storage in the lasing medium or pumping mechanism, the laser can be classified as a **"modulated"** or **"pulsed" CW laser**. This is the category that most laser diodes used in communication systems fall under.

The global market for laser technology is dominated by the CW mode, which reached a value of c. USD 4.9 bn in 2021[lxix]. This growth can be attributed to the increasing use of the CW mode in various fields such as information processing and medical applications, which include surgical removal of tissues, welding a detached retina and ophthalmological surgery. The CW mode is particularly attractive due to its stable output and ability to emit a continuous beam of radiation. In contrast, the pulsed mode emits radiation in different time intervals, resulting in lower stability and lower power outputs with short laser pulses. Pulsed mode lasers are less in demand compared to CW mode lasers.

5.5.4 By Region

Most of the global laser diode market is divided into the following major markets:

- **Asia-Pacific** consists of China, India, South Korea, Japan, Australia, Indonesia, Malaysia, Vietnam, Taiwan, Bangladesh, Pakistan and the Rest of Asia-Pacific.
- **North America** comprises the US, Canada and Mexico.
- **Europe,** which includes the UK, France, Germany, Italy, Spain, Sweden, Austria and the Rest of Europe.
- **Middle East and African** markets comprise South Africa, Gulf Cooperation Council (GCC), Egypt, Nigeria and the Rest of Middle East and Africa.
- **South America's** mainstays are Brazil and Argentina.

The laser diode market is dominated by the Asia-Pacific region. The need for surgical laser devices, rapid growth in the electronic industry, government investments in technology and the intention to encourage manufacturing industries are all contributing to the market's growth in this region. The demand for consumer electronics in densely populated areas, such as India and China, is further fueling this growth. North America is the second dominant region in the global laser diode market, driven by high EV production, increasing consumer purchasing power and technological innovation. The presence of large telecom firms and research and development activities are also adding to the market's growth.

5.6 SWOT Analysis[lxx]

Exhibit 47: SWOT Analysis of the Industry

Strengths
- High barriers to entry because of the complex processes involved
- Growing application areas of laser diodes in various industries
- Surge in demand for high-power laser diodes for industrial applications and increasing investments in military & defense, leading to high demand for laser technology

Weaknesses
- High initial investment required for industrial applications
- Export restrictions on Gallium from China owning to new export controls

Opportunities
- Development of newer technologies such as VCSEL and DFB
- Increasing applications in the biomedical field
- Expanding fiber laser market
- Mandatory use of laser technology, stemming from several countries, including the US, implementing strict regulatory norms regarding clear labeling

Threats
- Fluctuations in the price of raw materials
- Environmental concerns over the mining and refining of rare earth elements, which can release harmful byproducts into water, ground and air

5.7 Key Competitor Analysis

Exhibit 48: Pure-Play Company Comparison

Particulars	BluGlass Limited	OSRAM	Nichia	Kyocera SLD (KSLD)
Company type	Listed (ASX: BLG)	Listed (SWX: AMS)	Privately owned	Listed (TSE:6971)
Headquarters	New South Wales, Australia	Premstätten, Austria	Tokushima, Japan	Kyoto, Japan
Market cap	Approx. AUD 67.2 mn	Approx. AUD 2.5 bn	NA	Approx. AUD 27.9 bn
Current status	Pre-revenue stage	Approx. USD 3.2 bn from its semiconductor business (FY 2022)	NA	Approx. USD 339.1 mn from electronic components (FY 2022)
Operating segments	NA	Semiconductors, lamps & systems	LED, laser diode, cathode and magnetic materials	Core components business, electronic components business and solutions business segments
Areas of priority	Laser diodes, by offering differentiated and high-mis offerings, different form factors, custom wavelengths, and novel devices *"Aims to be a supplier of choice"*	Aims to further scale its micro-LED segment through the development of micro-LED technology; currently working on an ultra-small-scale micro-LED technology	Development of GaN-based semiconductor lasers by diversifying the wavelength range and enhancing optical output power	Development of its unique technology and leveraging it to generate white light for night vision purposes
Wavelengths	Continues to invest in the development of its 405-450 nm products; aims to extend its wavelength range moving beyond 450 nm to the green wavelengths ranging from 500-525 nm and further into UV down to 395 nm	Produces violet, blue and green laser diodes	Spans the UV region to the visible blue and green light regions	Operates in blue wavelength only

Form factors	Flexible	Limited	Limited	Limited
Mode	Both single- and multi-mode	Multi-mode	Both single- and multi-mode	Multi-mode
Technology usage	Traditional technology (MOCVD) combined with its proprietary RPCVD; RPCVD will be used to produce high-end wavelength products	Usage of traditional technology	Usage of traditional technology	Usage of traditional technology
Strategy to drive financial improvement	Driving margin improvement through downstream supply chain integration and via its proprietary low-cost RPCVD technology	Leveraging low-cost technology combined with sustained price negotiations	Economies of scale	By achieving manufacturing efficiencies
End users market	Quantum, defense, industrial, biotech, scientific, display	Automotive, consumer and industrial in semiconductors; automotive, industrial and medical in lamps & systems	Industrial, automotive, optical pickup, lighting and projections	Automotive, consumer, technology, medical and industrial
Weaknesses	Production is currently in the alpha stage; company has not yet reached the commercialization stage	Shifting focus toward micro-LED, lack of superior technology such as RPCVD, lack of flexibility in form factors, difficulty delivering products in all of the available wavelengths and limited to providing a narrow range of packaging formats for customers	Lack of superior technology such as RPCVD, lack of flexibility in form factors, difficulty delivering products in all of the available wavelengths and limited to providing a narrow range of packaging formats for customers	Focus on producing only white light for lighting and automotive segments; limited selection of single mode products in the portfolio

See important disclosures on page 52 of this report.

6. Valuation

The fair market value of the company's shares stood between AUD 139.2 mn and AUD 280.4 mn on November 20, 2023. The fair market value for one of the company's publicly traded shares stood between AUD 0.09 and AUD 0.18 on November 20, 2023. The valuation approach followed is Blended Valuation (DCF and Relative Valuation).

6.1 DCF Method

Valuation	
Risk free rate (Rf)	4.5%[lxxi]
Beta	0.9[lxxii]
Market return	9.5%[lxxiii]
Cost of equity	8.9%
Cost of debt (after tax)	5.5%
WACC (Discount Rate)	8.9%

Year Ending – June (AUD 000's)	2024E	2025E	2026E	2027E	2028E	2029E	2030E
FCFF (Low)							
Free Cash Flow to Firm	(14,423.5)	(16,826.7)	(10,625.6)	(4,387.8)	1,701.6	6,587.6	8,441.9
Discount factor	0.9	0.9	0.8	0.7	0.7	0.6	0.6
Present Value of FCFF	**(13,532.6)**	**(14,503.0)**	**(8,413.2)**	**(3,191.5)**	**1,137.0**	**4,043.7**	**4,760.4**
FCFF (High)							
Free Cash Flow to Firm	(13,811.3)	(14,460.7)	(12,412.8)	2,260.4	10,717.8	19,980.4	20,641.5
Discount factor	0.9	0.9	0.8	0.7	0.7	0.6	0.6
Present Value of FCFF	**(12,958.2)**	**(12,463.8)**	**(9,828.3)**	**1,644.2**	**7,161.6**	**12,264.6**	**11,639.6**

Arrowhead Fair Value Bracket	Low	High
PV of Cash Flow	10,977.0	69,790.1
Terminal Value	368,278.4	622,630.8
PV of Terminal Value	135,867.1	229,704.0
Total Present Value of Firm	146,844.1	299,494.2
Less: Net Debt	(1,240.8)	(1,853.0)
Equity Value	148,084.9	301,347.2
Shares on issue	1,528,045.7	1,528,045.7
Fair Share Value Bracket	**0.10**	**0.20**
Current Market price [lxxiv]	0.06	0.06
Upside/(Downside)	64.3%	234.3%
Current Market Cap.	90,154.7	90,154.7
Target Market Cap.	**148,084.9**	**301,347.2**

Sensitivity Analysis

Sensitivity Table – High		WACC (%)				
		7.5%	7.8%	8.0%	8.3%	8.5%
GROWTH RATE (%)	1.0%	0.23	0.22	0.21	0.20	0.19
	1.5%	0.25	0.24	0.22	0.21	0.20
	2.0%	0.27	0.25	0.24	0.22	0.21
	2.5%	0.29	0.27	0.25	0.24	0.23
	3.0%	0.32	0.30	0.28	0.26	0.24

Sensitivity Table - Low		WACC (%)				
		7.5%	7.8%	8.0%	8.3%	8.5%
GROWTH RATE (%)	1.0%	0.12	0.11	0.10	0.10	0.09
	1.5%	0.13	0.12	0.11	0.10	0.10
	2.0%	0.14	0.13	0.12	0.11	0.11
	2.5%	0.15	0.14	0.13	0.12	0.11
	3.0%	0.17	0.15	0.14	0.13	0.12

Approach for DCF Valuation

Time Horizon: The Arrowhead fair valuation for BluGlass Limited is based on the DCF method. The time period chosen for the valuation is 144 months (2024E-35E).

Terminal Value: This is estimated using a terminal growth rate of 2.0%.

Prudential nature of valuation: It should be noted that Arrowhead's fair value bracket estimate is a relatively prudent estimate, as it discounts the eventuality of any new products being launched in the market or any significant change in the strategy.

6.2 Relative Valuation

Exhibit 49: Peer Set[lxxv]

Company Name	Ticker	Latest Market Cap (AUD 000's)	Latest Enterprise Value (AUD 000's)	Latest Total Assets (AUD 000's)	Latest Book Value (AUD 000's)	EV/Total Assets	EV/Book Value
Ams-OSRAM AG	SWX:AMS	1,498,278.6	5,224,638.2	13,887,500.0	4,454,600.0	0.4	1.2
IQE plc	AIM:IQE	377,865.8	462,944.2	524,900.0	310,400.0	0.9	1.5
Kyocera Corporation	TSE:6971	30,990,818.8	30,254,631.2	45,927,100.0	34,202,900.0	0.7	0.9
Nuburu, Inc.	NYSEAM:BURU	12,164.6	10,355.9	19,300.0	(2,710.0)	0.5	
Nuvoton Technology Corporation	TWSE:4919	2,807,991.4	1,638,362.5	1,764,900.0	841,300.0	0.9	1.9

Sanan Optoelectronics Co.,Ltd	SHSE:600703	15,479,562.6	15,822,904.3	12,455,500.0	8,094,700.0	1.3	2.0
Sharp Corporation	TSE:6753	6,854,424.2	11,217,234.8	19,889,700.0	2,494,500.0	0.6	4.5
Arima Lasers Corporation	TPEX:3627	33,351.9	20,695.4	56,400.0	41,800.0	0.4	0.5
Han's Laser Technology Industry Group Co., Ltd.	SZSE:002008	5,138,181.4	5,373,573.4	6,807,400.0	3,288,500.0	0.8	1.6
Q.S.I Co., LTD.	KOSDAQ:A066310	100,910.6	79,933.7	100,600.0	95,100.0	0.8	0.8
Coherent Corp.	NYSE:COHR	8,330,488.5	1,733,220.1	20,601,000.0	10,861,500.0	0.1	0.2
Median						**0.7**	**1.3**

Particulars	High	Low
Book Value (Forward Basis)	304,799.6	160,162.4
Book Value (FY 2024)	112,448.2	59,087.9
PEER EV/ BV	1.3	1.3
Arrowhead Premium/(Discount)	30.0%	30.0%
Enterprise Value (Cal. Using EV/BV)	**194,737.8**	**102,328.4**
Less: Net Debt	(1,853.0)	(1,240.8)
Implied Equity Value	**196,590.8**	**103,569.2**
Shares o/s	1,528,045.7	1,528,045.7
Intrinsic Value per share (AUD)	**0.13**	**0.07**
Current market Price (AUD)	0.06	0.06
Upside / (Downside)	118.1%	14.9%

6.3 Blended Valuation

Blended Valuation	High	Low	Weightage
DCF (AUD)	0.20	0.10	80%
Relative Valuation (AUD)	0.13	0.07	20%
Blended Value (AUD)	**0.18**	**0.09**	
Upside/(Downside)	211.0%	54.4%	
Target Market Cap. Bracket (AUD '000s)	**280,395.9**	**139,181.8**	

Important information on Arrowhead methodology

The principles of the valuation methodology employed by Arrowhead BID are variable to a certain extent, depending on the subsectors in which the research is conducted, but all Arrowhead valuation research possesses an underlying set of common principles and a generally common quantitative process.

With Arrowhead Commercial and Technical Due Diligence, Arrowhead extensively researches the fundamentals, assets and liabilities of a company, and builds solid estimates for revenue and expenditure over a coherently determined forecast period.

Elements of past performance, such as price/earnings ratios, indicated as applicable, are present mainly for reference purposes. Still, elements of real-world past performance enter the valuation through their impact on the commercial and technical due diligence. Elements of comparison, such as multiples analyses, may be to some limited extent integrated in the valuation on a project-by-project or asset-by-asset basis. In the case of this BluGlass Limited report, there are no multiple analyses integrated in the valuation.

Arrowhead BID fair market value bracket

The Arrowhead Fair Market Value is given as a bracket. This is based on quantitative key variable analysis, such as key price analysis for revenue and cost drivers or analysis and discounts on revenue estimates for projects, especially relevant to those projects estimated to provide revenue near the end of the chosen forecast period. Low and high estimates for key variables are produced as a tool for valuation. The high-bracket DCF valuation is derived from the high-bracket key variables, while the low-bracket DCF valuation is based on the low-bracket key variables.

In principle, an investor who is comfortable with the high-brackets of our key variable analysis will align with the high-bracket in the Arrowhead Fair Value Bracket, and likewise in terms of low estimates. The investor will also take into account the company intangibles – as presented in the first few pages of this document in the analysis of strengths and weaknesses and other essential company information. These intangibles serve as supplementary decision factors for adding or subtracting a premium in the investor’s own analysis. The bracket should be understood as a tool provided by Arrowhead BID for the reader of this report and the reader should not solely rely on this information to make his decision on any particular security. The reader must also understand that on one hand, global capital markets contain inefficiencies, especially in terms of information, and that on the other hand, corporations and their commercial and technical positions evolve rapidly: this present edition of the Arrowhead valuation is for a short to medium-term alignment analysis (one to twelve months). The reader should refer to important disclosures on page 52 of this report.

7. Appendix

7.1 BLG's Financial Summary

Exhibit 50: Financial Summary	*Low Bracket Estimates*						
Year ending June	**2024E**	**2025E**	**2026E**	**2027E**	**2028E**	**2029E**	**2030E**
Revenue (AUD '000)	14,708.5	24,770.7	46,739.1	83,042.6	119,373.3	152,131.7	180,597.3
EBITDA (AUD '000)	(12,326.3)	(15,141.7)	(13,383.3)	(5,285.9)	6,741.2	14,924.7	21,043.8
Operating Profit (AUD '000)	(14,708.1)	(17,541.1)	(15,505.0)	(7,451.2)	4,518.2	12,439.7	18,176.4
Net Income (AUD '000)	(14,968.4)	(17,727.6)	(15,658.7)	(7,569.8)	3,228.8	9,025.9	13,224.4
EPS (AUD cents)	(1.0)	(1.2)	(1.0)	(0.5)	0.2	0.6	0.9
Growth rates (%)							
Revenue	54.6%	68.4%	88.7%	77.7%	43.7%	27.4%	18.7%
Operating Profit	NA	NA	NA	NA	NA	175.3%	46.1%
Net Income	NA	NA	NA	NA	NA	179.5%	46.5%
EPS	NA	NA	NA	NA	NA	179.5%	46.5%
EBITDA	NA	NA	NA	NA	NA	121.4%	41.0%
Margins (%)							
Gross Margins	69.0%	55.1%	47.7%	46.8%	49.5%	49.5%	50.0%
Operating Profit Margin	(100.0%)	(70.8%)	(33.2%)	(9.0%)	3.8%	8.2%	10.1%
Net Profit Margin	(101.8%)	(71.6%)	(33.5%)	(9.1%)	2.7%	5.9%	7.3%
EBITDA Margins	(83.8%)	(61.1%)	(28.6%)	(6.4%)	5.6%	9.8%	11.7%
Ratios							
ROA	(66.5%)	(75.6%)	(55.3%)	(19.2%)	6.1%	13.0%	14.8%
ROE	(103.2%)	(128.1%)	(127.4%)	(64.2%)	24.4%	46.4%	43.2%
Debt/Equity	0.2x	0.2x	0.2x	0.1x	0.1x	0.0x	0.0x

Exhibit 51: Financial summary	*High Bracket Estimates*						
Year ending June	**2024E**	**2025E**	**2026E**	**2027E**	**2028E**	**2029E**	**2030E**
Revenue	15,123.0	26,354.3	51,903.2	97,069.9	140,269.6	179,281.9	213,257.4
EBITDA	(11,780.4)	(13,566.5)	(9,112.1)	5,132.8	21,927.8	31,991.0	39,715.6
Operating Profit	(14,162.1)	(15,965.9)	(11,233.8)	2,967.5	19,704.8	29,506.1	36,848.2
Net Income	(14,422.5)	(16,152.4)	(11,387.5)	2,079.7	14,315.0	21,484.4	26,854.8
EPS (cents)	(0.9)	(1.1)	(0.7)	0.1	0.9	1.4	1.8
Growth rates (%)							
Revenue	58.9%	74.3%	96.9%	87.0%	44.5%	27.8%	19.0%
Operating Profit	NA	NA	NA	NA	564.0%	49.7%	24.9%
Net Income	NA	NA	NA	NA	588.3%	50.1%	25.0%
EPS	NA	NA	NA	NA	588.3%	50.1%	25.0%
EBITDA	NA	NA	NA	NA	327.2%	45.9%	24.1%
Margins (%)							
Gross Margins	70.7%	57.8%	51.2%	50.8%	53.8%	53.1%	52.8%
Operating Profit Margin	(93.6%)	(60.6%)	(21.6%)	3.1%	14.0%	16.5%	17.3%
Net Profit Margin	(95.4%)	(61.3%)	(21.9%)	2.1%	10.2%	12.0%	12.6%
EBITDA Margins	(77.9%)	(51.5%)	(17.6%)	5.3%	15.6%	17.8%	18.6%
Ratios							
ROA	(62.8%)	(62.8%)	(35.7%)	4.8%	22.6%	23.1%	21.0%

ROE	(97.6%)	(106.5%)	(68.8%)	10.7%	51.5%	46.9%	38.3%
Debt/Equity	0.2x	0.2x	0.1x	0.1x	0.0x	0.0x	0.0x

7.2 BLG's Balance Sheet Forecast

Exhibit 52: Consolidated Balance Sheet	*Low Bracket estimates*						
Year Ending – June	**2024E**	**2025E**	**2026E**	**2027E**	**2028E**	**2029E**	**2030E**
Total current assets	15,003.7	15,539.3	24,934.0	37,121.5	50,063.6	67,129.9	85,354.1
Total Non-current assets	8,338.6	7,998.5	8,132.9	8,564.9	9,658.4	11,645.3	14,352.2
TOTAL ASSETS	**23,342.3**	**23,537.9**	**33,066.9**	**45,686.4**	**59,722.0**	**78,775.2**	**99,706.4**
Total current Liabilities	3,761.9	7,140.3	17,676.9	31,129.3	42,133.9	52,307.9	60,121.9
Total Non-current Liabilities	4,463.0	3,846.8	3,365.9	2,993.3	2,703.4	2,478.5	2,304.0
TOTAL LIABILITIES	**8,224.9**	**10,987.1**	**21,042.8**	**34,122.6**	**44,837.4**	**54,786.5**	**62,425.9**
Total Shareholder's Equity	15,117.4	12,550.8	12,024.0	11,563.8	14,884.6	23,988.7	37,280.5
TOTAL LIABILITIES & EQUITY	**23,342.3**	**23,537.9**	**33,066.9**	**45,686.4**	**59,722.0**	**78,775.2**	**99,706.4**

Exhibit 53: Consolidated balance sheet	*High Bracket estimates*						
Year Ending – June	**2024E**	**2025E**	**2026E**	**2027E**	**2028E**	**2029E**	**2030E**
Total current assets	15,905.1	19,190.2	28,468.1	42,087.9	66,141.7	98,818.1	131,512.9
Total Non-current assets	8,338.6	7,998.5	8,132.9	8,564.9	9,658.4	11,645.3	14,352.2
TOTAL ASSETS	**24,243.7**	**27,188.7**	**36,601.0**	**50,652.8**	**75,800.1**	**110,463.4**	**145,865.2**
Total current Liabilities	4,117.3	8,670.0	14,818.7	27,053.9	38,084.1	51,409.7	60,063.8
Total Non-current Liabilities	4,463.0	3,846.8	3,365.9	2,993.3	2,703.4	2,478.5	2,304.0
TOTAL LIABILITIES	**8,580.3**	**12,516.8**	**18,184.6**	**30,047.2**	**40,787.5**	**53,888.2**	**62,367.9**
Total Shareholder's Equity	15,663.4	14,671.9	18,416.4	20,605.6	35,012.6	56,575.2	83,497.3
TOTAL LIABILITIES & EQUITY	**24,243.7**	**27,188.7**	**36,601.0**	**50,652.8**	**75,800.1**	**110,463.4**	**145,865.2**

8. Analyst Certifications

I, Sumit Wadhwa, certify that all the views expressed in this research report accurately reflect my personal views about the subject security and the subject Company, based on the collection and analysis of public information and public Company disclosures.

I, Ayushi Saraswat, certify that all the views expressed in this research report accurately reflect my personal views about the subject security and the subject Company, based on the collection and analysis of public information and public Company disclosures.

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Investors must make their own investment decisions based upon their specific investment objectives and financial situation utilizing their own financial advisors as they deem necessary.

Investors are advised to gather and consult multiple sources of information while preparing their investment decisions. Recipients of this report are strongly advised to read the Information on Arrowhead Methodology section of this report to understand if and how the Arrowhead Due Diligence and Arrowhead Fair Value Bracket integrates alongside the rest of their stream of information and within their decision-making process. Past performance of securities described directly or indirectly in this report should not be taken as an indication or guarantee of future results. The price, value of, and income from any of the financial securities described in this report may rise as well as fall and may be affected by simple and complex changes in economic, financial and political factors.

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8. Notes and References

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[lvii] Opt Lasers' µSpot Blue Laser Head with Anamorphic Prisms (PLH3D-XT-50)
[lviii] Top Manufacturer's CW Fiber Laser
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