

A major hurdle passed

BluGlass (ASX:BLG) passed a major commercialisation milestone, demonstrating feasible reliability of its gallium nitride (GaN) laser diodes. The lasers have passed 500 hours of continuous operation with stable optical and electrical performance. The lasers maintained good performance and light-output, demonstrating less than 20% degradation – a key commercial standard for laser diodes. Testing will be ongoing but reaching this point is an important technical demonstration for the company.

Why feasible reliability is important

Feasible reliability of over 500 hours significantly de-risks the company's technical and commercialisation roadmaps and demonstrates that BLG's lasers are suitable for use in a number of applications. This achievement is critical for beta production and commercial product launches & validates the company's laser diode designs for potential customers. Pleasingly, this milestone was achieved with older iterations made by BLG's contract manufacturers. The company expects newer iterations with further improvements to the epitaxy, metals & facets, currently progressing through BLG's supply chain, will perform even better.

A lot to look forward to in 2023

We believe BLG has made steady progress towards commercialisation & will make further strides in the new year. BluGlass intends to launch beta products, commence pilot production, & complete lifetime testing over the coming year. As one of only a handful of end-to-end GaN laser diode manufacturers, BLG is timing its run to market alongside significant growth, with the GaN laser segment forecast to be a US\$2.5bn market by 2025. BluGlass is targeting the industrial, scientific and biotech verticals, which are expected to grow to US\$735m in 2025. These verticals focus on high-growth applications including electric vehicles, renewable energy battery storage and chip manufacturing.

All the building blocks are now in place

As outlined in our initiation report dated 27 September, we believe all the building blocks that should enable the company to make a successful entry into the laser diode market are in place. We intend to publish a full financial model & valuation in future reports. Please see Appendix I on page 7 for our SWOT analysis which includes the key risks.

Share Price: A\$0.029

ASX: BLG

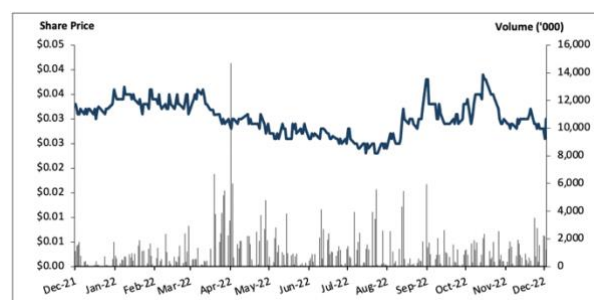
Sector: Technology

8 December 2022

Market cap. (A\$ m)	37.0
# shares outstanding (m)	1,275.8
# shares fully diluted (m)	1,456.1
Market cap ful. dil. (A\$ m)	42.2
Free float	100.0%
12-months high/low (A\$)	0.052 / 0.023
Avg. 12M daily volume ('1000)	1,236.0
Website	www.bluglass.com.au

Source: Company, Pitt Street Research

Share price (A\$) and avg. daily volume (k, r.h.s.)



Source: Refinitiv Eikon, Pitt Street Research

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BluGlass' GaN laser diodes achieved feasible reliability.

Feasible reliability demonstrated

On 21 November 2022, BluGlass announced that its GaN laser diodes achieved feasible reliability. The laser diodes successfully demonstrated more than 500 hours of continuous operation with stable optical power and voltage in reliability testing. They maintained solid performance and light-output during testing at 20-25 degrees Celsius (a typical operating temperature range in the industry), demonstrating light output with less than 20% degradation.

This is a key commercial standard for laser diodes as well as a prerequisite for beta production and commercial product launches. The milestone proves the suitability of BluGlass' lasers for a range of applications, including medical and scientific devices, many of which require less than 500 hours of continuous operation. This achievement is a result of BLG's increased focus on improving the four ingredients of reliable laser diodes, enhancing performance of its epitaxy, metals, facets and packaging. Technical improvements have been led by BLG President, Jim Haden, who was brought on by the company to solve reliability and launch commercial products. Feasible reliability also enables BLG to increase its engagement with potential customers who are awaiting alpha and beta products, indicating the design is ready for increased volume. There is a significant unmet need for BLG's laser diodes, which will provide greater flexibility, enhanced performance, and lower cost solutions.

The milestone will increase engagement with would-be customers

Are the results good enough?

It is indeed the case that reliability testing will be ongoing and some industries will require higher reliability – at the extreme end of the scale, space-based and industrial applications can require reliability of over 10,000 hours for instance. Reliability requirements vary greatly in the industry with some applications (e.g. pyrotechnics, airbags) require long shelf-life but single use applications. Many applications, including medical and scientific applications require less than 500 hours' reliability. Further, the company believes the milestone is sufficient to increase engagement with would-be customers. The company is progressing towards 1,000 hour and 2,000 hour lifecycle demonstrations.

BLG believes performance is now on a path of continuous improvement. The results achieved were recorded by older iterations made by contract manufacturers. Given feature-enhanced processing improvements and new epitaxy designs, future iterations are anticipated to demonstrate improved yield, reliability, and performance.

A deal with Ganvix

Further encouraging news came from the company on 24 November when it announced a paid development agreement with leading GaN Vertical Cavity Surface Emitting Laser (VCSEL) developer Ganvix. BluGlass will provide Ganvix with green quantum-well epitaxy services using its proprietary remote plasma chemical vapour deposition (RPCVD) technology, thereby enabling Ganvix to develop its own products – namely green VCSELs for advanced applications.

This deal not only depicts BluGlass' market potential and promise relative to its peers but also expands its market opportunity (as the company is focused on edge-emitting lasers, not surface emitting lasers) and advances its development roadmaps.

Green VCSEL are expected to find significant market applications across the consumer electronics and medical sectors - perhaps most obviously in augmented and virtual reality headsets, where the tiny size of the surface emitters would be advantageous.

Although revenue during the initial development phase will not be material, the company expects material revenues to flow once commercialisation occurs.

What does 2023 hold?

In 2023, shareholders should look forward to the ramping up of Fremont and early stage commercialisation.

In our view, there are two further things shareholders should anticipate in CY23 beyond further product testing. First, the ramping up of Fremont. And second, the launch of beta products, pilot production and early-stage commercialisation.

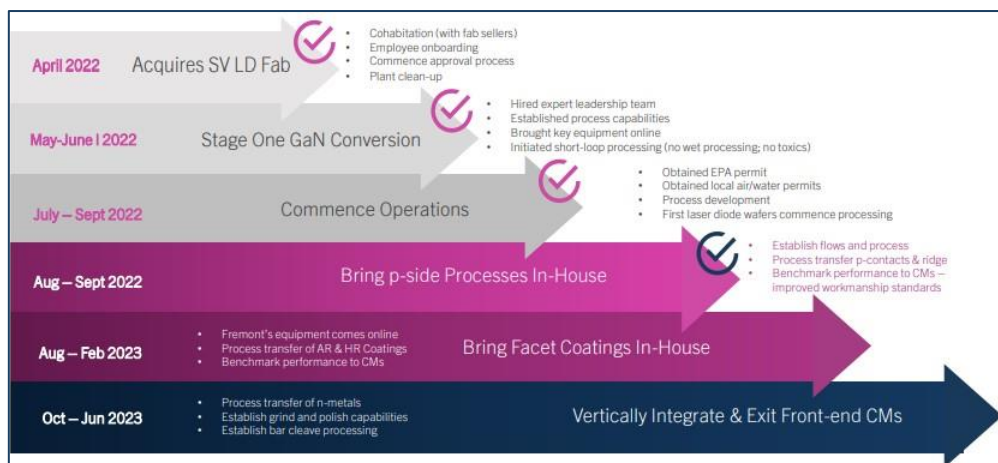
The Fremont fab will ramp up

BLG acquired the Fremont fab (a 19,000 square ft commercial laser diode production facility in Silicon Valley) for US\$2.5m. As outlined in our initiation report, we believe the company is on to a winner with Fremont. This is for two reasons.

First, because it acquired the asset at quite a bargain (given it was bought at a fraction of the cost it would take to build a fab from scratch). Second, it will make a significant difference to the company. It has already expanded the company's manufacturing capability, fast-tracked timelines and allowed it to conduct processing in house. It also places it in a position to win US defence and government contracts than if it only had the Silverwater facility.

Since April, the company has undertaken significant work to get the fab fully operational as outlined in Figure 1. It has secured all necessary permits to operate the facility, hiring an expert leadership team and transitioning the key equipment over from the previous fab owners. Over 1H CY23, BluGlass intends to formally bring the remaining equipment online, transfer the process of relevant coatings and metals and establish a number of capabilities including bar cleave, polishing and grinding.

Figure 1: BluGlass' progress with Fremont fab



Source: Company

Early-stage commercialisation

BLG also plans to launch products to market in CY23, spanning underserved and in-demand wavelengths, to deliver early-stage commercialisation. Shareholders can expect more customers to trial BLG's products, become confident with the quality of the product and availability of supply ahead of customer's placing repeat orders.

BLG will be attending a major laser diode industry conference (SPIE Photonics West in San Francisco) in January. BluGlass has generated significant interest from the industry to date, with highly anticipated product releases. The Fremont fab's enhanced product quality, accelerated product development combined with improving laser performance, should lead to further momentum for the business.

A significant opportunity

As one of only a handful of end-to-end GaN laser diode manufacturers globally, BLG is timing its run to market well, with the GaN laser segment forecast to be a US\$2.5bn market by 2025. The company is targeting the industrial, scientific and biotech verticals which are expected to be worth a combined US\$735m in 2025, and should enable BLG to build market-share. Industry growth is underpinned by high-growth applications including electric vehicles, renewable energy battery storage and chip manufacturing.

A critical need for GaN laser diodes exists

GaN laser diodes have wide ranging applications across generic and specialised needs (Figure 2). They offer significant advantages over conventional lasers such as small size, lightweight, wide-angle beam as well as low current, voltage and power requirements. Consequently, the growth prospects for the GaN laser diode market are highly promising.

However, there are very few end-to-end GaN laser diode manufacturers globally and BLG has three major advantages. First, BLG can be a more agile partner, with flexibility to meet individual client needs because, unlike its major competitors who are largely focused on the high-volume LED and microLED markets, BLG is a dedicated GaN laser diode manufacturer. Second, BLG will position itself to offer its laser products in a range of form factors, to make product integration easier and more cost effective for its customers, while also addressing unmet product/wavelength needs. And third, its proprietary Remote Plasma CVD (RPCVD) process enables it to manufacture higher-value, higher-performance laser diodes.

BLG has three major advantages compared to its peers



Figure 2: BluGlass' initial target markets



Source: Company

Conclusion

We believe BLG is in for a big year in CY23 and the announcement of feasible reliability is an important milestone that significantly matures the company, de-risking its technical and commercialisation roadmaps, and setting it up for big things to come.

We expect the company to carve out an attractive niche and become a share player in the global market with few GaN manufacturers globally, and those that exist unable to provide dedicated and flexible solutions to customers. BLG has set itself up well by developing a range of offerings to meet unmet needs in the market. Further, with the Fremont acquisition, which has expedited the company's development, production, and revenue capacity, we believe BluGlass is poised to enjoy a successful future in a fast-growing market.

Appendix I – SWOT Analysis

Strengths: – The acquisition of the laser diode fab in Fremont in Silicon Valley is likely to be a game changer for BLG and fast tracks its transition to a product company. – BLG will be focusing on blue laser diodes across high-potential segments (industrial, scientific, biotech) with unmet needs and strong customer demand – BLG provides flexibility in form factors. This enables customers to avoid undertaking extensive customisation and packaging work at the post-purchase phase. – There is a management team in place with the required expertise in laser diode manufacturing. It has a clear vision and realistic plan of action to achieve its medium-term targets. – In the short term, BLG aims to release products by relying on contract manufacturers. In the longer run, it aims to transfer its manufacturing capabilities in-house to its facility in Fremont. This will provide BLG complete control of its manufacturing processes. – BLG is debt-free and has sufficient capital resources to continue operations until FY23. – BLG’s revolutionary RPCVD technology operates at low temperatures and utilises substantially less hydrogen while depositing layers. This technology helps achieve brighter and more cost-effective lasers.	Weaknesses: – BLG laser diodes processed at contract manufacturers have successfully demonstrated more than 500 hours of continuous operation with stable optical power and voltage in reliability testing. Ongoing tests are providing feedback for continued fabrication improvements through BLG’s new Fremont fab. – Production is currently in the alpha stage and the company has not yet reached the commercialisation stage. Qualification processes with some larger clients can take a long time. – BLG needs some time before transitioning all its manufacturing capabilities in-house from contract manufacturers. The longer the reliance on contract manufacturers for development, the longer it will take to launch new products. – While the company has sufficient short-term cash resources, it is unlikely to turn into a cash flow positive company until 2024/25. – There remain technical risks in demonstrating the performance and manufacturing advantages of BLG’s RPCVD technology.
Opportunities: – BLG is targeting underserved wavelengths for use in industrial, scientific and biotech applications. These target segments hold promising potential for growth. – Potential to grow in the green laser diodes space. Development work for green laser diodes is currently in the epitaxy phase with next generation products likely to be expedited by the acquisition of the fab to fast track BLG’s advanced roadmaps. – Scope for improvement in state-of-the-art facet coating capabilities through potential capital investments. – BLG is one of only a handful of end-to-end GaN laser diode manufacturers globally. – Market growth is currently constrained by limited players, and immaturity of GaN laser diode performance (~45% efficiency in state-of-the-art laser diodes today, compared with the +90% efficiency of LEDs).	Threats: – BLG’s competitors are established players in the market and are substantially bigger in size. – Larger R&D budgets at its competitors could threaten BLG’s currently perceived niche segments in GaN laser diodes. – Adverse financial market conditions may limit BLG’s ability to raise additional funding at attractive terms.

Appendix II – Analysts’ Qualifications

Marc Kennis, lead analyst on this report, has been covering the Semiconductor sector as an analyst since 1997.

- Marc obtained an MSc in Economics from Tilburg University, The Netherlands, in 1996 and a post graduate degree in investment analysis in 2001.
- Since 1996, he has worked for a variety of brokers and banks in the Netherlands, including ING and Rabobank, where his main focus has been on the Technology sector, including the Semiconductor sector.
- After moving to Sydney in 2014, he worked for several Sydney-based brokers before setting up TMT Analytics Pty Ltd, an issuer-sponsored equities research firm.
- In July 2016, with Stuart Roberts, Marc co-founded Pitt Street Research Pty Ltd, which provides issuer-sponsored research on ASX-listed companies across the entire market, including semiconductor companies.

Nick Sundich is an equities research analyst at Pitt Street Research.

- Nick obtained a Bachelor of Commerce/Bachelor of Arts from the University of Sydney in 2018. He has also completed the CFA Investment Foundations program.
- He joined Pitt Street Research in January 2022. Previously, he worked as a financial journalist at Stockhead for more than three years.
- While at university, he worked for a handful of corporate advisory firms.

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