

02 March 2020

Investor Presentation – Path to Commercial Revenue

Australian semiconductor developer BluGlass Limited (ASX: BLG) is pleased to provide an updated company presentation – Path to Commercial Revenue, March 2020 Investor Update.

Please find a copy of this presentation attached.

This announcement has been approved for release by the directors of the Company.

About BluGlass

BluGlass Limited (ASX: BLG) is a global leader commercialising a breakthrough technology using Remote Plasma Chemical Vapour Deposition (RPCVD) for the manufacture of high-performance LEDs and other devices. BluGlass has invented a new process using RPCVD to grow advanced materials such as gallium nitride (GaN) and indium gallium nitride (InGaN). These materials are crucial to the production of high-efficiency devices such as power electronics and high-brightness (LEDs) used in next-generation vehicle lighting, virtual reality systems and device backlighting.

The RPCVD technology, because of its low temperature and flexible nature, offers many potential benefits over existing technologies including higher efficiency, lower cost, substrate flexibility (including GaN on silicon), and scalability.

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**BRIGHTER
FUTURE LOWER
TEMPERATURE**

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BLUGLASS (ASX:BLG)

PATH TO COMMERCIAL REVENUES
2020 INVESTOR UPDATE

MARCH 2020



FORWARD LOOKING STATEMENT

This document has been prepared by BluGlass Limited to provide readers with an update on the Company and the Company's technology.

Statements, opinions, technical data and information, or other material contained in this document, do not constitute commitments, representations or warranties by BluGlass Limited or associated entities, or its directors, agents and employees. Except as required by law, and only to that extent, directors, agents and employees of BluGlass Limited disclaim any loss, claim, demand, damages, costs or expenses of any nature whatsoever arising in any way out of, or in connection with, the information contained in this document.

This document includes certain information which reflects various assumptions, subjective judgment and analysis, and is subject to significant business, economic and competitive uncertainties, risks and contingencies, many of which are outside the control of, and are unknown to, BluGlass Limited. The assumptions may not prove to be correct. Recipients of the document must make their own independent investigations, consideration and evaluations prior to making any decisions to invest in the Company.

Information on Serviceable Addressable Markets (SAM), Target Addressable Markets (TAM) and Economic Scenarios are based on internal BluGlass modelling and assumptions, both of which depend on successful R&D outcomes and results achieved within estimated timetables. BluGlass recommends a cautious interpretation be taken by investors.



CORPORATE OVERVIEW:
PRIMED FOR GROWTH

DELIVERING A BRIGHTER FUTURE THROUGH LOWER TEMPERATURE RPCVD

CORPORATE FOCUS – DELIVERING SIGNIFICANT NEAR-TERM REVENUES



BluGlass' unique **RPCVD (Remote Plasma Chemical Vapour Deposition)** technology is a breakthrough alternative for the manufacture of gallium nitride (GaN) semiconductor materials



GaN is a critical component in millions of electronic devices today: from general lighting to mobile phones, laptops, TVs and other display technologies, to power electronics, medical devices and more



RPCVD's unique low temperature manufacturing platform offers GaN device manufacturers higher performing devices and novel applications, not possible using conventional manufacturing methods



BluGlass is currently exploring multiple go-to-market strategies across multiple global markets. Traditionally, the company has focused on commercialising our technology through IP development, licensing and capital equipment sales with global collaboration partners. This approach provides BluGlass access to significant global markets. This effort continues to advance with our strategic partners to ensure these large mid-long-term revenue opportunities are executed



In October 2019, BluGlass launched a new direct-to-market laser diode business unit to capture significant value in the near-term. This presentation provides an update on all BluGlass commercialisation activities, with a focus on the near-term laser diode business unit progress and opportunities

DELIVERING A BRIGHTER FUTURE THROUGH LOWER TEMPERATURE RPCVD

GROWING CUSTOMER PIPELINE & REVENUES



New laser diode product portfolio in development for direct-to-market sales to capture

+\$70M¹

in revenues by 2025

Growing customer revenues for wafer sales and foundry services

LEVERAGED TO HIGH GROWTH MARKETS

Partnerships with **multiple, global leaders** including:



& others under non-disclosure

BluGlass is building a portfolio of products & applications with **multiple revenue options in high-growth markets**

PATENTED TECHNOLOGY, ENABLING THE TECHNOLOGY OF TOMORROW



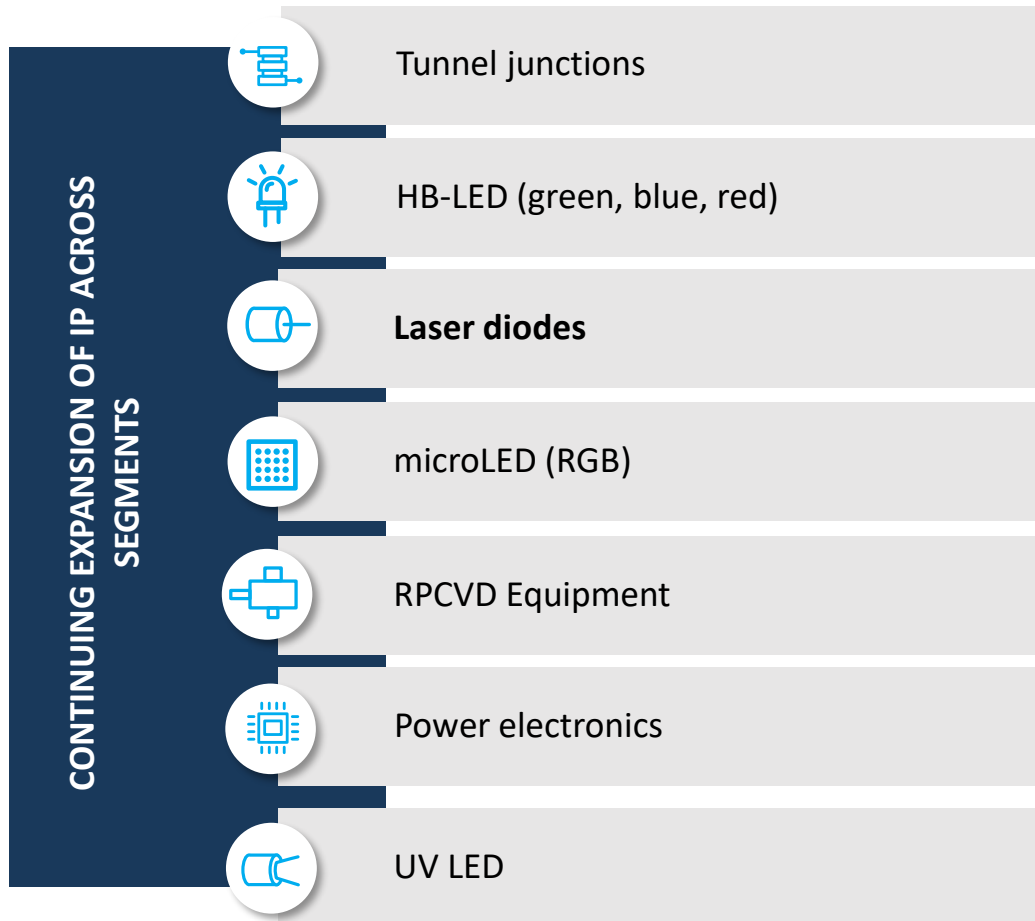
BluGlass' unique **Remote Plasma Chemical Vapour Deposition (RPCVD)** technology is being developed with industry partners & customers to solve the technology problems of today to enable the applications of tomorrow: **next-gen HB-LEDs, laser diodes, microLEDs, power electronics**

Source: 1. Internal BluGlass modelling based on industry sources, \$AU

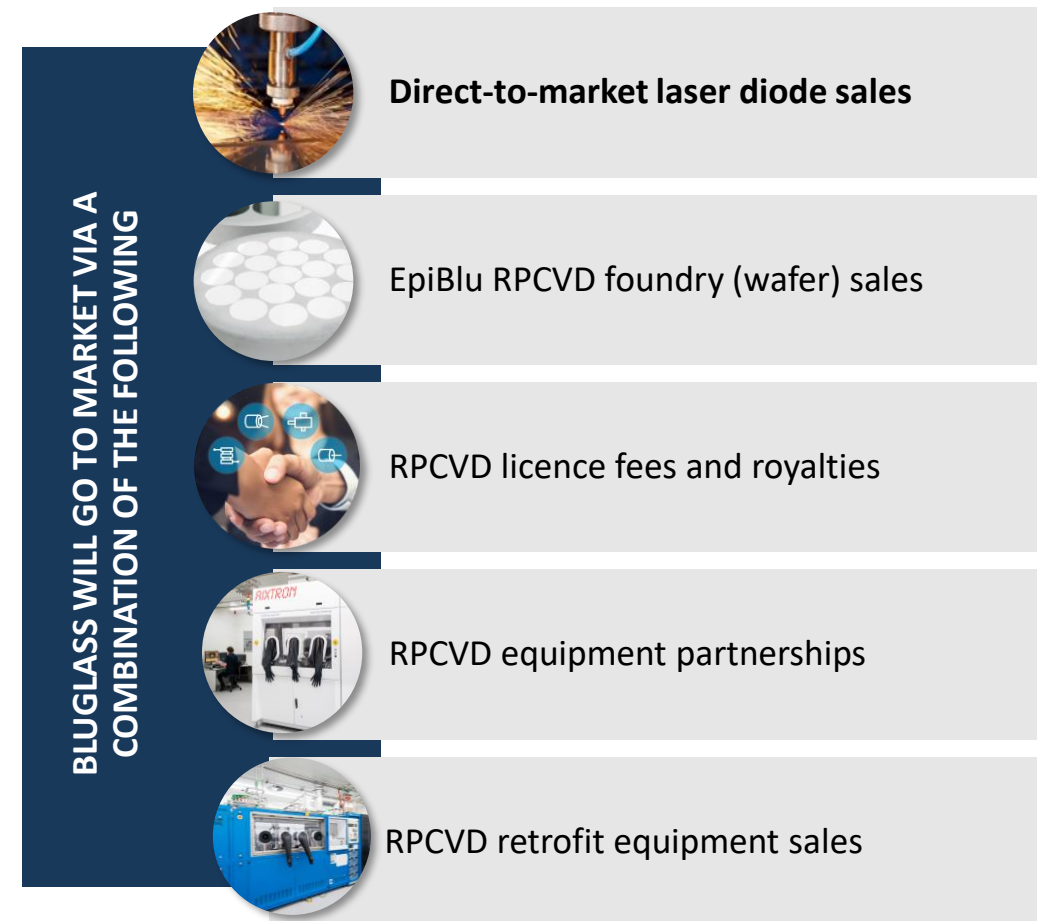
A PLATFORM TECHNOLOGY WITH MULTIPLE GO-TO-MARKET OPTIONS

BluGlass' patented RPCVD semiconductor manufacturing technology has demonstrated R&D results, showing competitive advantages with potential application in multiple high-growth market segments

RPCVD TECHNOLOGY PORTFOLIO



MULTIPLE GO-TO-MARKET OPTIONS



BLUGLASS
DIRECT-TO-MARKET
LASER DIODE BUSINESS



BLUGLASS TO TARGET LASER DIODES MARKET – NEW BUSINESS UNIT

CAPITALISING ON OUR TUNNEL JUNCTION CAPABILITIES



GaN laser diodes (LDs) represent an emerging market opportunity in need of a competitive technology solution such as RPCVD. It represents a Serviceable Addressable Market (SAM) for BluGlass in excess of **US\$658M by 2025***



BluGlass is launching a new business unit exploiting **BluGlass' unique RPCVD tunnel junction technology**, expected to enable higher brightness & higher efficiency GaN laser diodes



Multiple end-use applications in markets such as industrial cutting / welding (initial target), laser displays, automotive lighting and scientific applications with a combined total application market in excess of **US\$27B in 2025***



Expected LD demonstration and product launch in CY2020, **with growing revenues expected in 2021**. BluGlass is seeking to secure the manufacturing supply chain to support commercialisation of laser diodes

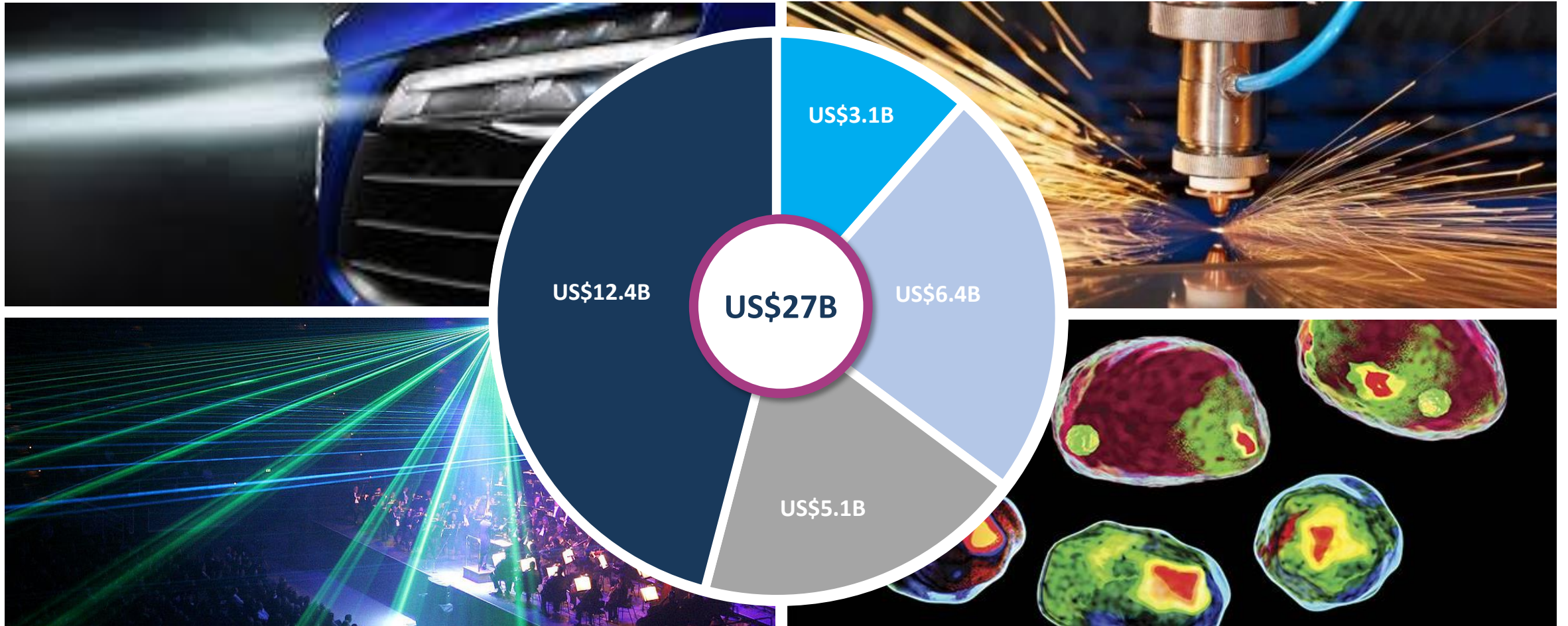


BluGlass has the **pre-installed RPCVD capacity onsite** in Silverwater to grow significant laser diode (high-value and high-margin product) revenues and build a profitable business unit



**Source: Internal BluGlass modelling based on industry sources, including Strategies Unlimited, Markets & Markets, Laser & Photonics Marketplace 2018*

GLOBAL LASER END-MARKET FORECAST BY APPLICATION SEGMENTS (2025)



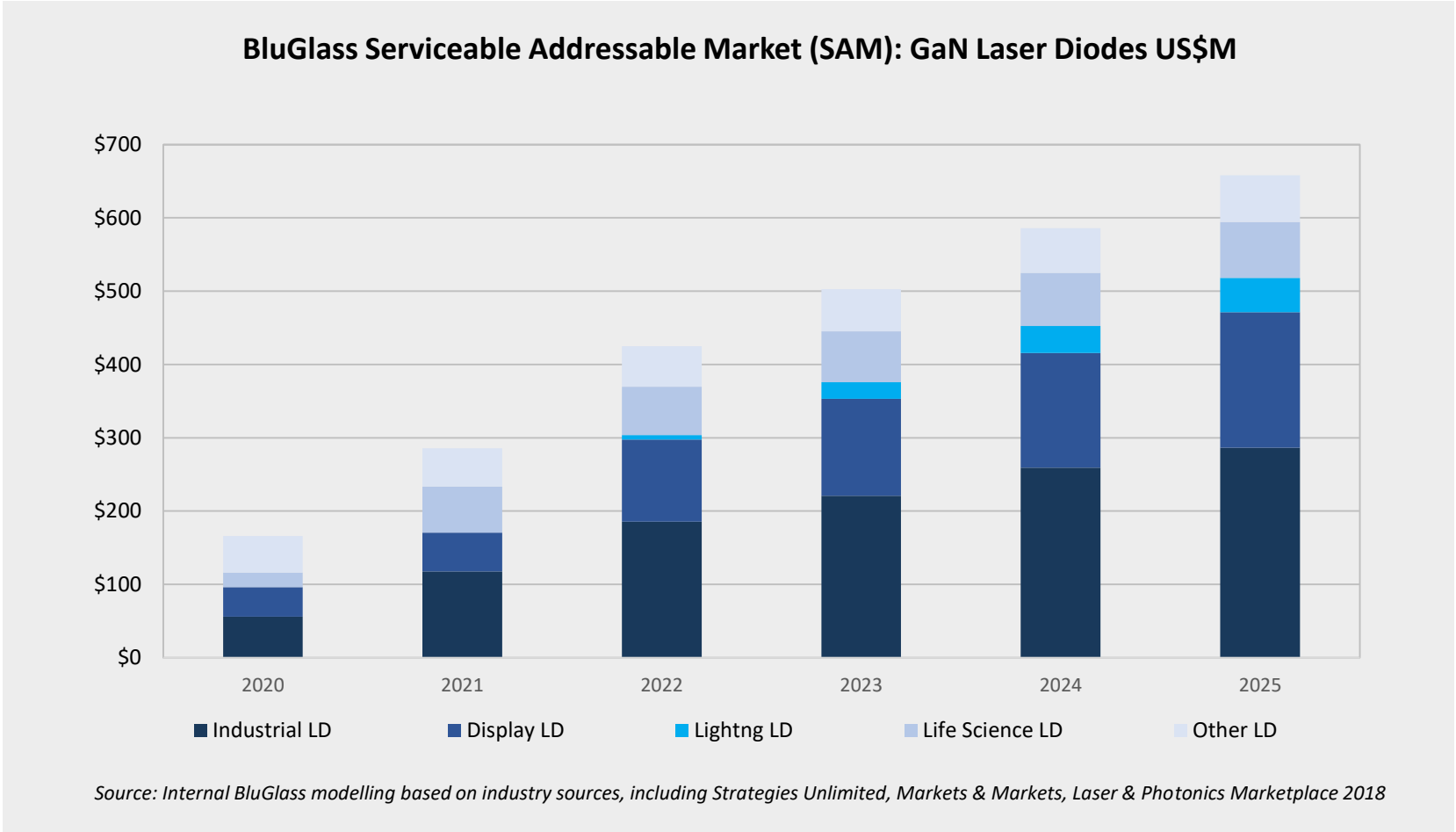
■ Industrial cutting/welding ■ Life sciences ■ Laser display ■ Automotive

Source: Internal BluGlass modelling based on industry sources, including Strategies Unlimited, Markets & Markets, Laser & Photonics Marketplace 2018

SERVICEABLE ADDRESSABLE MARKET (SAM) FOR GaN LASER DIODES

BluGlass has taken a conservative approach to analysing the growth opportunities (addressable markets) for high-performance GaN LDs

US\$658M
 GaN laser diode market opportunity by 2025



ECONOMIC SCENARIOS - BLUGLASS TARGET MARKET REVENUES

Target revenue is based on the timely achievement of technical milestones.

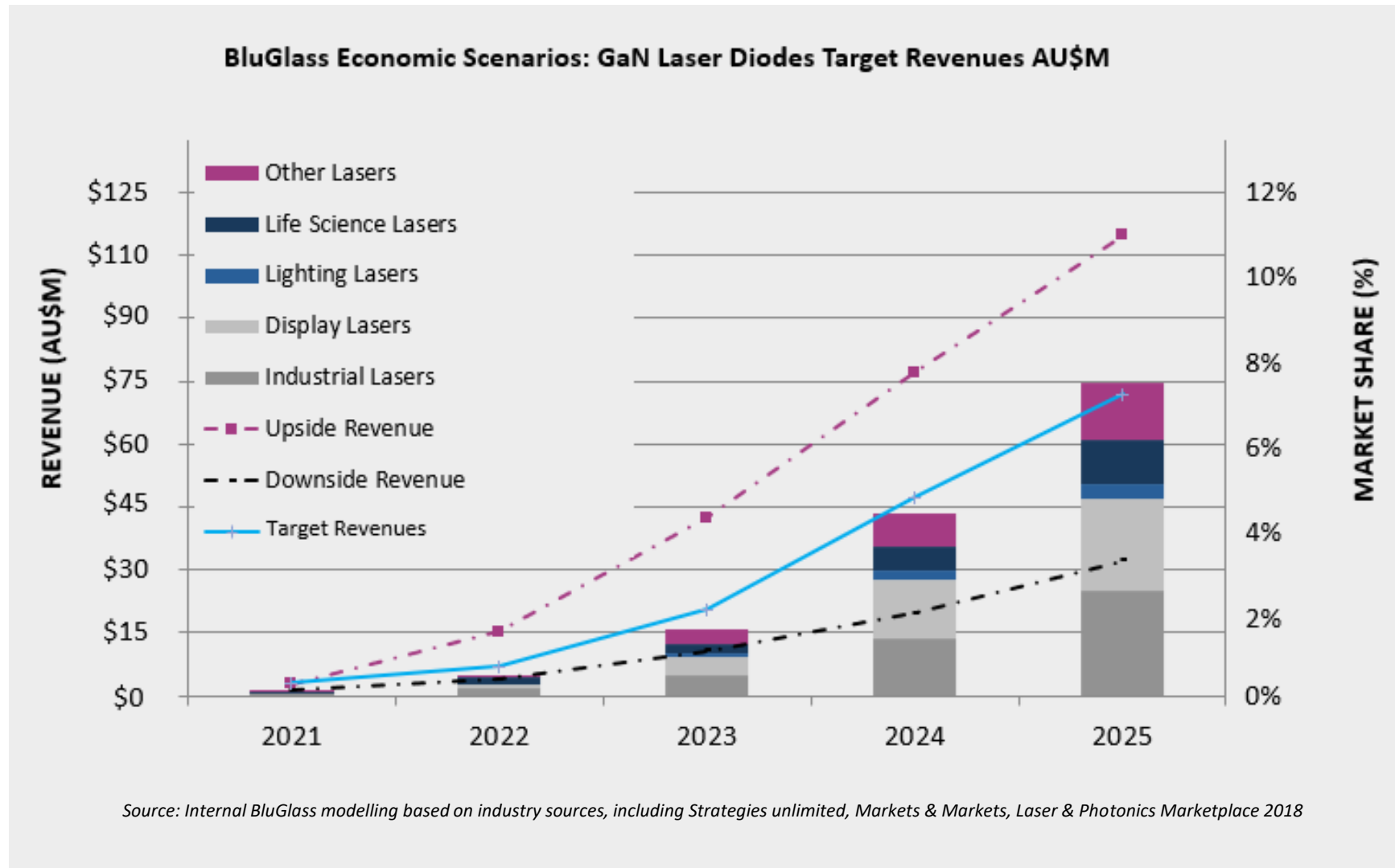
Upside revenue is based on the timely achievement of BluGlass' technical milestones and accelerated customer demand and market growth.

Downside revenue is based on a delay in the attainment of certain technical milestones that reduces the number of laser diode products for sale or slower customer demand and market growth.

Assumptions used in creating these scenarios:

BluGlass' economic scenarios rely on key technology (including RPCVD & tunnel junction performance), financing, supply chain and market penetration assumptions. A number of these assumptions are set out on this and the following slide.

Any failure to achieve the assumed outcomes will have a material affect on the economic scenarios outlined here. In particular, BluGlass has not yet manufactured its initial laser diode product, and any target market revenues outlined should be considered speculative until proven.



BLUGLASS GaN LASER DIODE – BUSINESS RISK ASSESSMENT

TECHNOLOGY RISK

Laser diode long-term reliability

- Laser diode burn-in and long-term reliability testing & verification required prior to commercial volume manufacturing of laser diodes
- Initial 100% LD testing will be implemented prior to product shipment to ensure product quality and limit performance variation

Development delays in proving competitive advantages

- BluGlass will work closely with the laser diode fabrication suppliers to accelerate development iterations and will bring laser diode design capabilities in house
- BluGlass will leverage its many years of LED and tunnel junction development that carries over to laser diode design and production

RPCVD uniformity

- The latest BLG-300 and G4 RPCVD chamber designs will be implemented in our new expanded facility and used for the development and production of laser diodes

Substrate supply

- BluGlass aims to ensure reliable and repeatable supply of free-standing GaN substrates as vendor quality can impact LD performance and vendor substitution requires re-qualification

MARKET RISK

Macro-economic conditions slow the adoption rates of laser cutting and welding systems

- As a technology platform, the TJ LD design can be rapidly tailored to meet the needs of alternative market segments such as Life Science & Consumer (display & AR/VR)

Regulatory hurdles slow adoption of laser lighting in automotive and general lighting segments

- BluGlass is entering the industrial and “other” traditional markets segments first as the quickest path to market, and will simultaneously address qualification and product requirements for more heavily regulated secondary market segments such as automotive and general lighting

Finance Risk

- The Laser Diode business will require additional capacity to meet growth forecasts and will require sufficient (additional) funding

Competition Risk

- BluGlass is developing specific laser diodes to meet unmet industry needs. BluGlass may compete against other companies looking to develop similar products

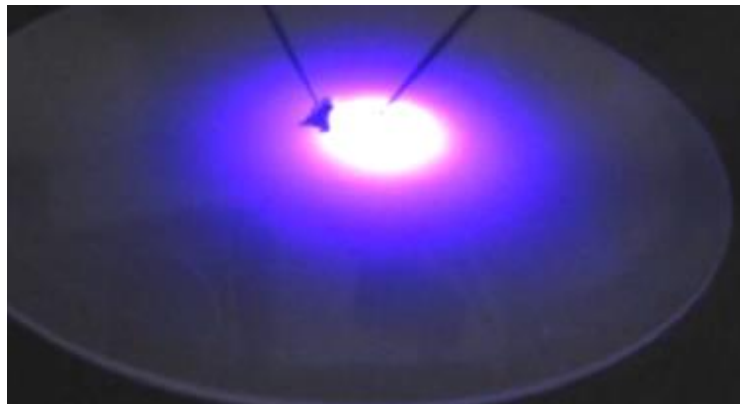
THE COMMERCIAL LASER DIODE OPPORTUNITY

THE NEED

- The market now demands high-brightness, high-efficiency GaN laser diodes, for a wide variety of end-use customers, in multiple applications:
Industrial cutting/welding (initial target), laser displays, automotive lighting and scientific applications
- Affordable, high-performance, high-efficiency laser diodes will be required for this next phase of market growth and GaN LD technology adoption
- Many unmet needs for custom LD development exist within select low-volume yet high value applications

THE SOLUTION

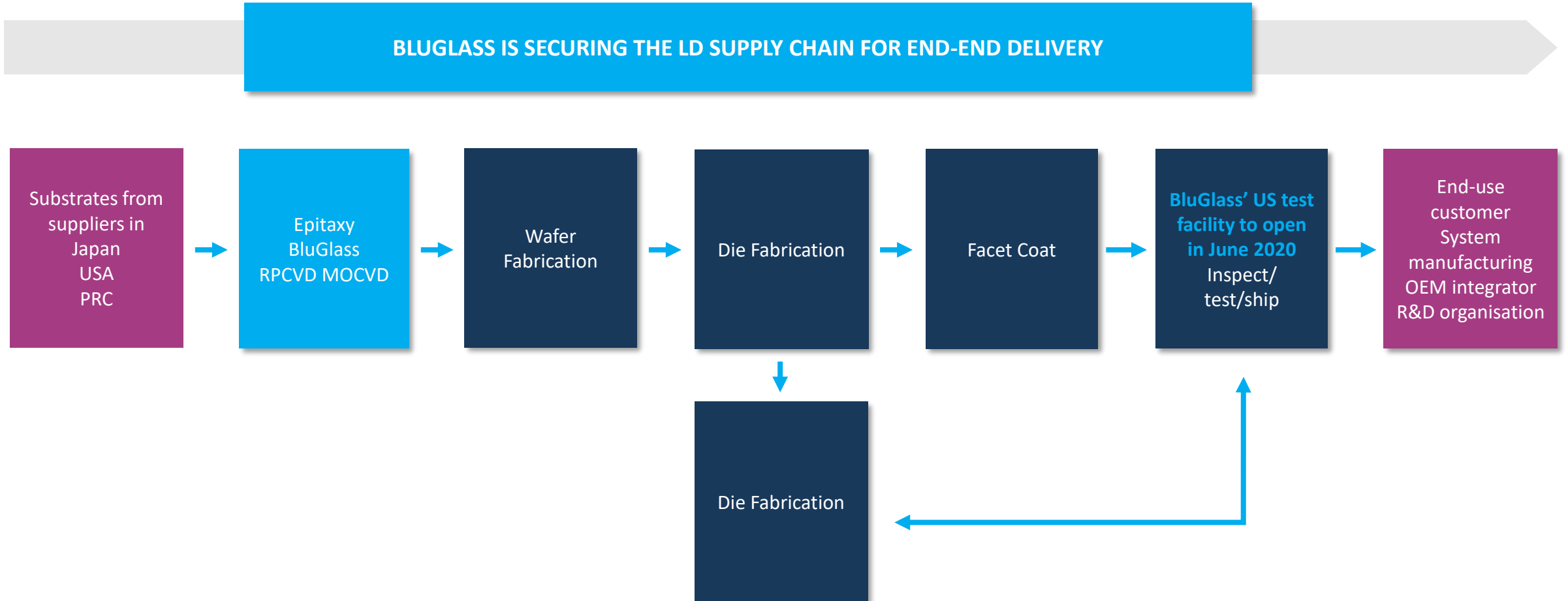
- BluGlass' RPCVD and Active-As-Grown (AAG) epitaxial growth technology enable a new Tunnel Junction-integrated GaN laser diode
- This new design and associated manufacturing technology exploits our existing, patented, RPCVD process
- Enables high-brightness and high-efficiency laser diodes to be produced at commercial scale
- Barriers to entry to the market (long development times of novel technology, high capital investment, IP protection) all work in BluGlass' favour, and protect BluGlass from other new entrants



RPCVD PERFORMANCE ADVANTAGES FOR LASER DIODES

	DESCRIPTION	RPVCD	MOCVD
Active-As-Grown (AAG) Technology	Unique technology advantage proprietary to BluGlass' RPCVD deposition technology	✓	✗
Higher performing devices	<ul style="list-style-type: none"> • Higher LD brightness and efficiencies • Reduced optical loss • Lower contact and device resistance 	✓	✗
Productivity and cost improvements	<p>New LD epitaxy design enables downstream process optimisation:</p> <ul style="list-style-type: none"> • Fewer process/fabrications steps • Lower LD cost to end-user 	✓	✗
Unique laser diode design	<p>RPCVD's Active As Grown p-GaN technology enables the use of tunnel junctions and n-AlGaIn layers in the LD design</p> <ul style="list-style-type: none"> • n-AlGaIn layers can be used to efficiently confine the light within the laser diode; removes performance constraints currently inherent in laser diode devices by reducing optical losses and improving laser diode brightness and efficiency • RPCVD can deliver the tunnel junctions and n AlGaIn layers at commercial wafer scales to deliver these laser diode performance advantages 	✓	✗
IP protection	RPCVD hardware and process technology and AAG epitaxial growth techniques for laser diodes are extensively covered by 71 patents within 8 patent families, with 12 new applications under way	✓	

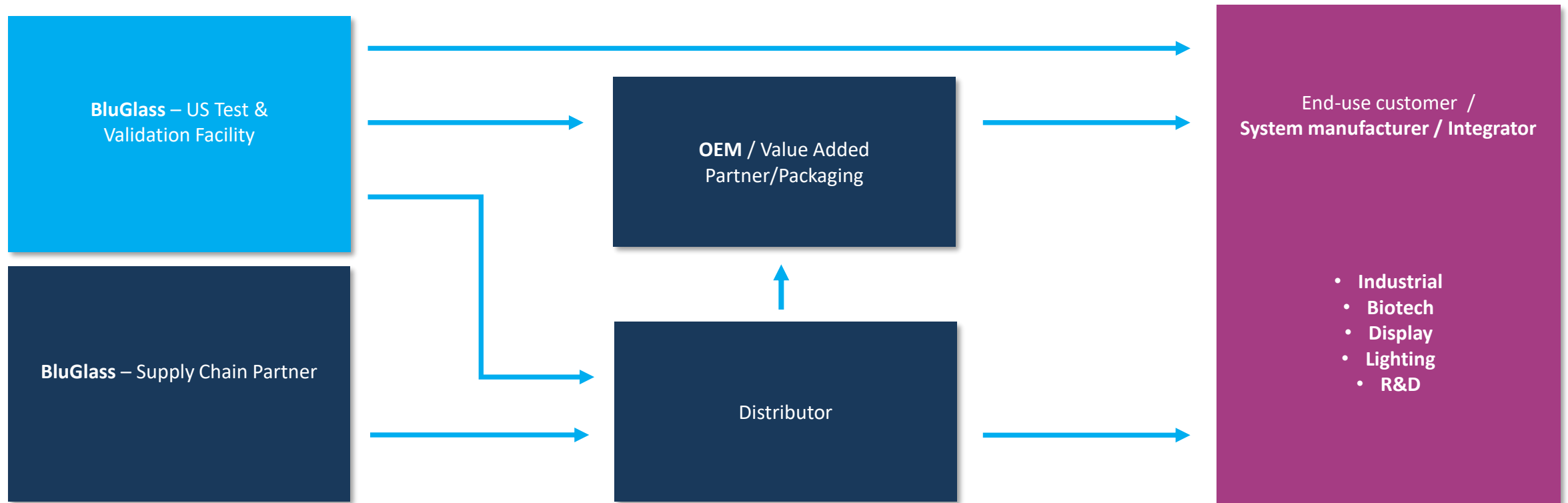
BLUGLASS LASER DIODE SUPPLY CHAIN PROPOSITION: DIRECT-TO-MARKET



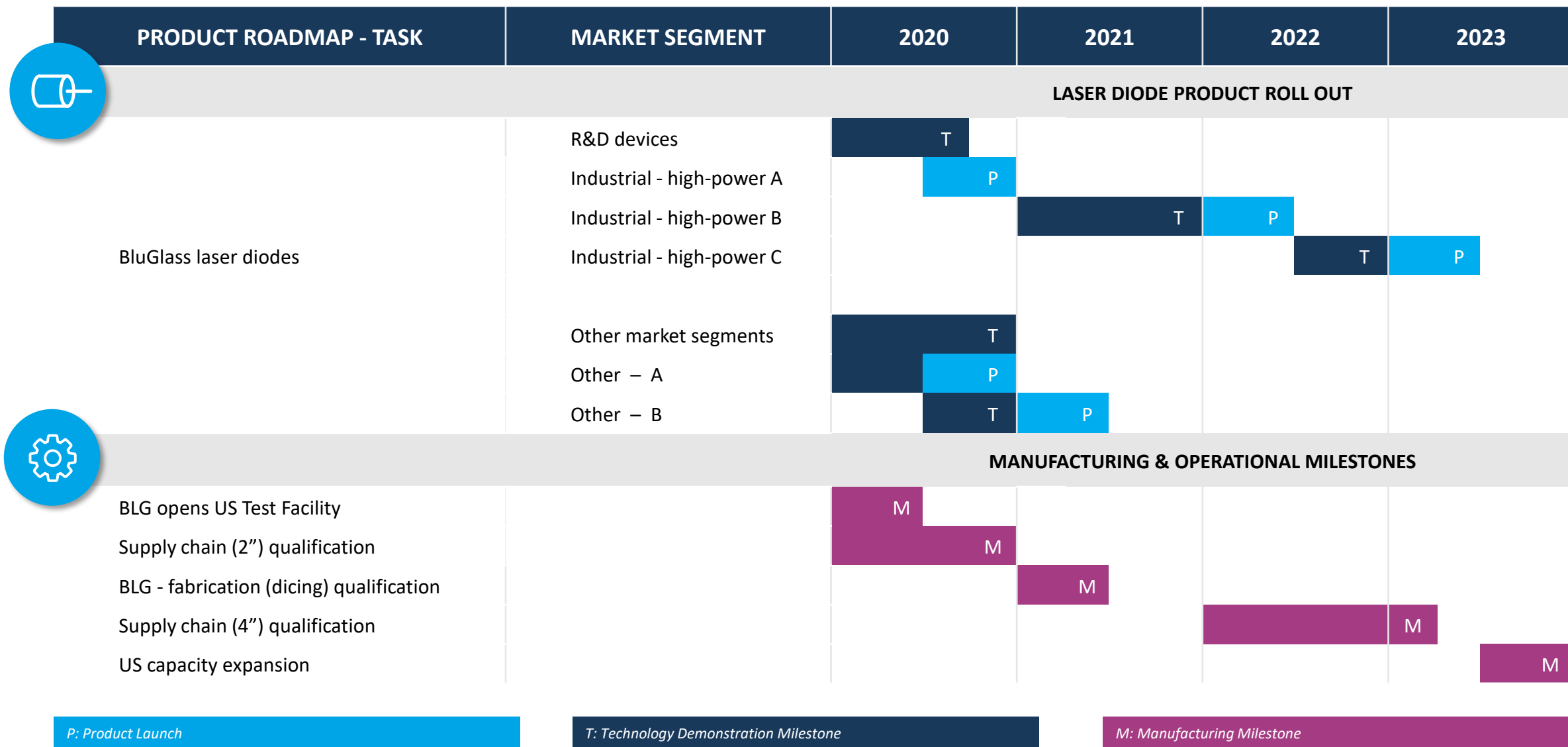
BLUGLASS LASER DIODE: CHANNEL MANAGEMENT

BLUGLASS CHANNEL MANAGEMENT FROM EPI TO INTEGRATION

BluGlass is taking a selective, multi-channelled approach to the laser diode Market, dependent on each end-market. BluGlass will maintain ownership and control of all laser diode IP, designs, specifications and product verification..



BLUGLASS LASER DIODE PRODUCT: SUPPLY ROADMAP & TIMETABLE



OUR TECHNOLOGY & PATENT PORTFOLIO

The background features a grid of small dots that transitions from a dark blue on the left to a bright pink on the right. Three horizontal light streaks, resembling fiber optic or laser beams, cut across the grid from left to right.

BLUGLASS RPCVD TECHNOLOGY

RPCVD (Remote Plasma Chemical Vapour Deposition) – A breakthrough alternative for the manufacture of gallium nitride (GaN) semiconductor materials



Lower-temperature manufacturing processes, **several hundred degrees cooler** than the incumbent, MOCVD



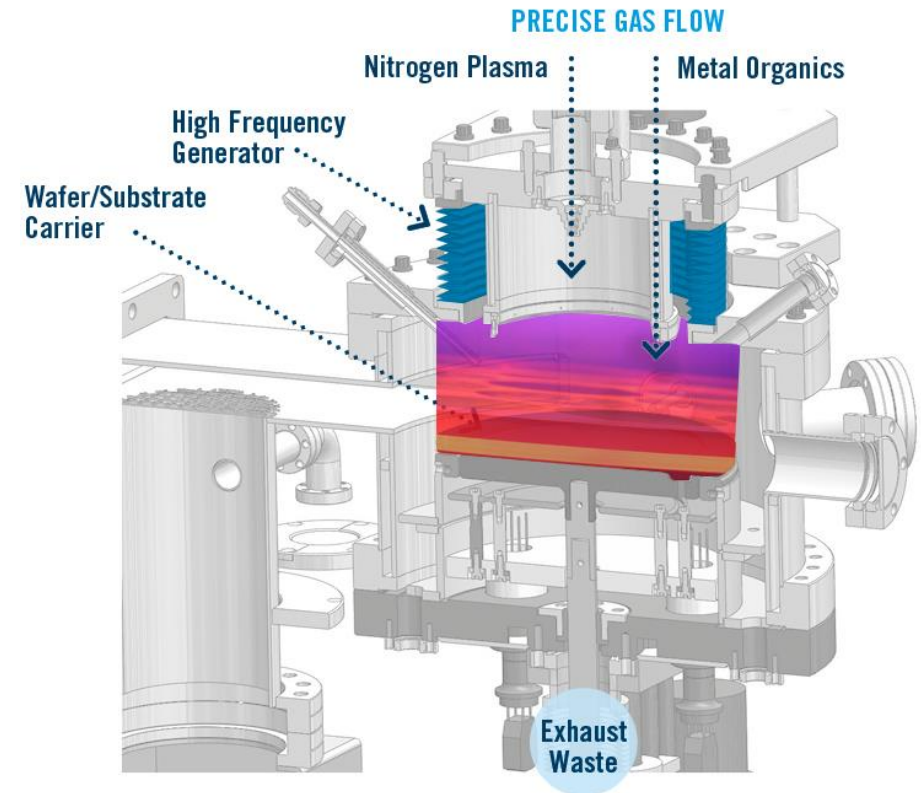
Higher-performing devices, **targeting greater than 10% improvement in light output**



Lower cost inputs replacing expensive ammonia with low cost nitrogen and low-cost substrates (silicon)



Active nitrogen density, from plasma source independent from **growth temperature**

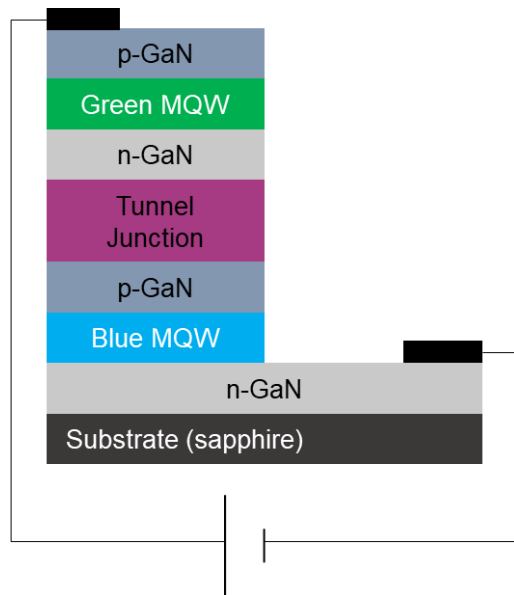


TECHNOLOGY ADVANTAGES OF RPCVD BY APPLICATION

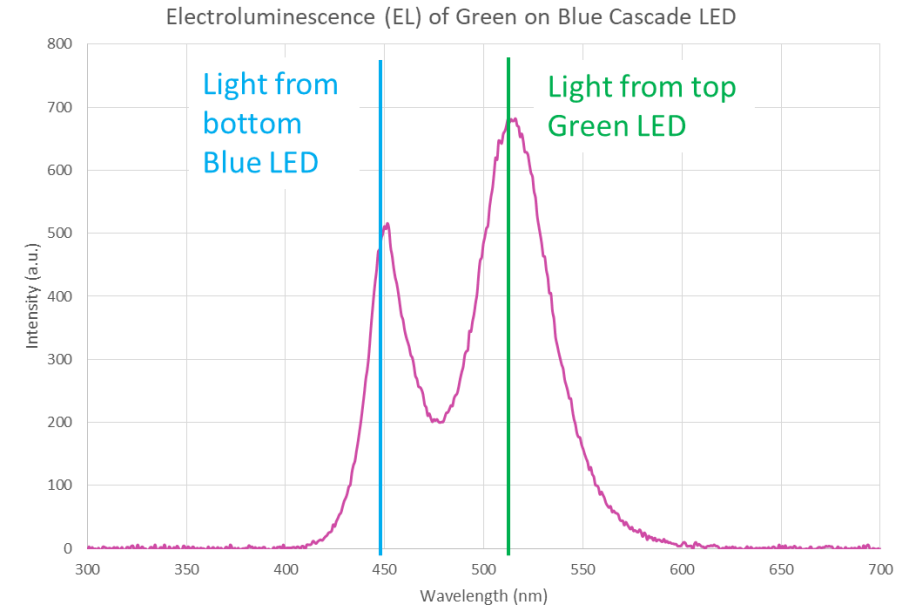
		High Active Nitrogen at Low Temperature	Low Hydrogen	Sharp Doping Profiles	High Doping Concentrations	Low Thermal Damage	Active-As-Grown p-GaN (AAG)
	Laser Diodes	✓	✓	✓	✓	✓	✓
	Cascade LEDs	✓	✓			✓	
	microLEDs	✓	✓	✓			
	RGB LEDs	✓	✓			✓	
	LEDs - ITO Replacement	✓	✓	✓	✓	✓	✓
	Power Electronics	✓	✓	✓	✓	✓	✓

PROOF OF CONCEPT MILESTONE ACHIEVED: GREEN ON BLUE CASCADE LED

Two colour cascade LED: green-on-blue demonstration confirms proof of concept of BluGlass' RPCVD tunnel junctions



2-colour **cascade LED**. Single device with two active regions, each emitting at different wavelength. Only the tunnel junction is grown with RPCVD.



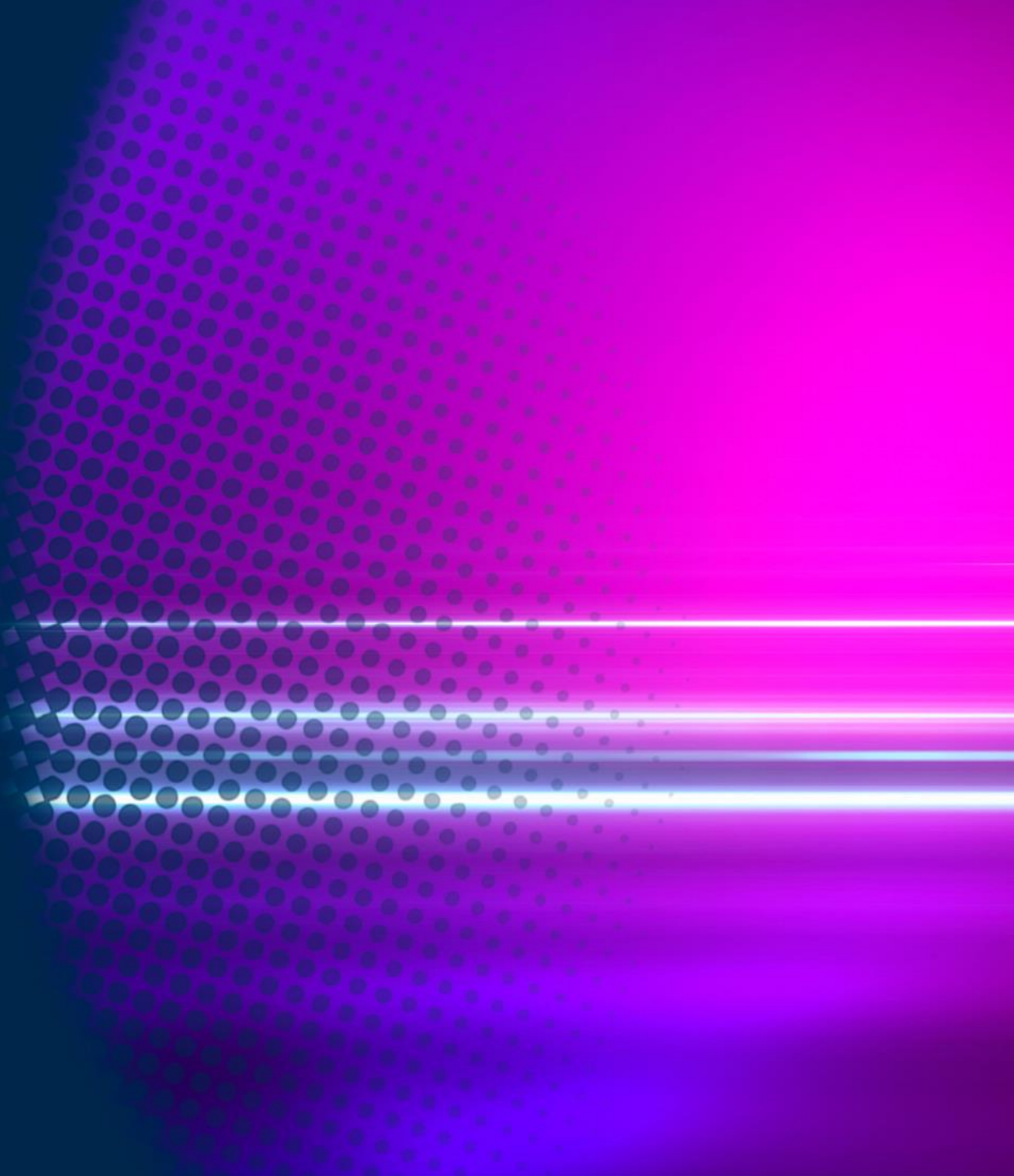
BluGlass wafer level LED quick test of Green on Blue Cascade LED. The emission spectrum shows two peaks, one from the blue active region and one from the green active region – the signature of a cascade LED.

GLOBAL PATENT PORTFOLIO

- Our Intellectual Property portfolio is a critical foundation for our future commercial success and underpins our licensing-based business model
- In July 2019 BluGlass was awarded a key US Patent for buried activated p-GaN in tunnel junctions
- This important patent brings our internationally granted patent portfolio to a total of **71 patents** in key semiconductor jurisdictions across **8** patent families



OUR CAPABILITIES



BRINGING PRODUCT & TECHNOLOGY DIFFERENTIATION TO MARKET



LEVERAGED TO LARGE AND GROWING MARKETS

RPCVD delivers **quantifiable performance advantages** in multiple high growth photonics markets

New **laser diode business** addresses high-value and high-margin market



STRONG PATENT PORTFOLIO

71 International Patents granted in key semiconductor markets (USA, Europe & Asia)

12 applications under way

Across **8 Patent Families**



BREAKTHROUGH AUSTRALIAN TECHNOLOGY POISED FOR GLOBAL IMPACT

Demonstrated competitive advantages with applications in multiple markets

Commercialisation partnerships & programs under way with **multiple, global leaders**



MULTIPLE COMMERCIALISATION PATHS

Generating foundry revenues now with growing pipeline

LD product portfolio in development

Licensing fees / royalties

Equipment sales with equipment partner or retrofit installed base



EXPERIENCED BOARD, MANAGEMENT & ADVISORY TEAM

Global expertise in research & commercialization

Global leadership in commercialising technology in international markets

Deep specialist industry expertise

NEW MANUFACTURING LABORATORIES

SIGNIFICANT INCREASE IN RPCVD MANUFACTURING CAPACITY AND CAPABILITY



\$6 million in additional equipment and associated infrastructure



Semiconductor wafer growth under way in the first of two additional semiconductor deposition systems, the BLG-300II



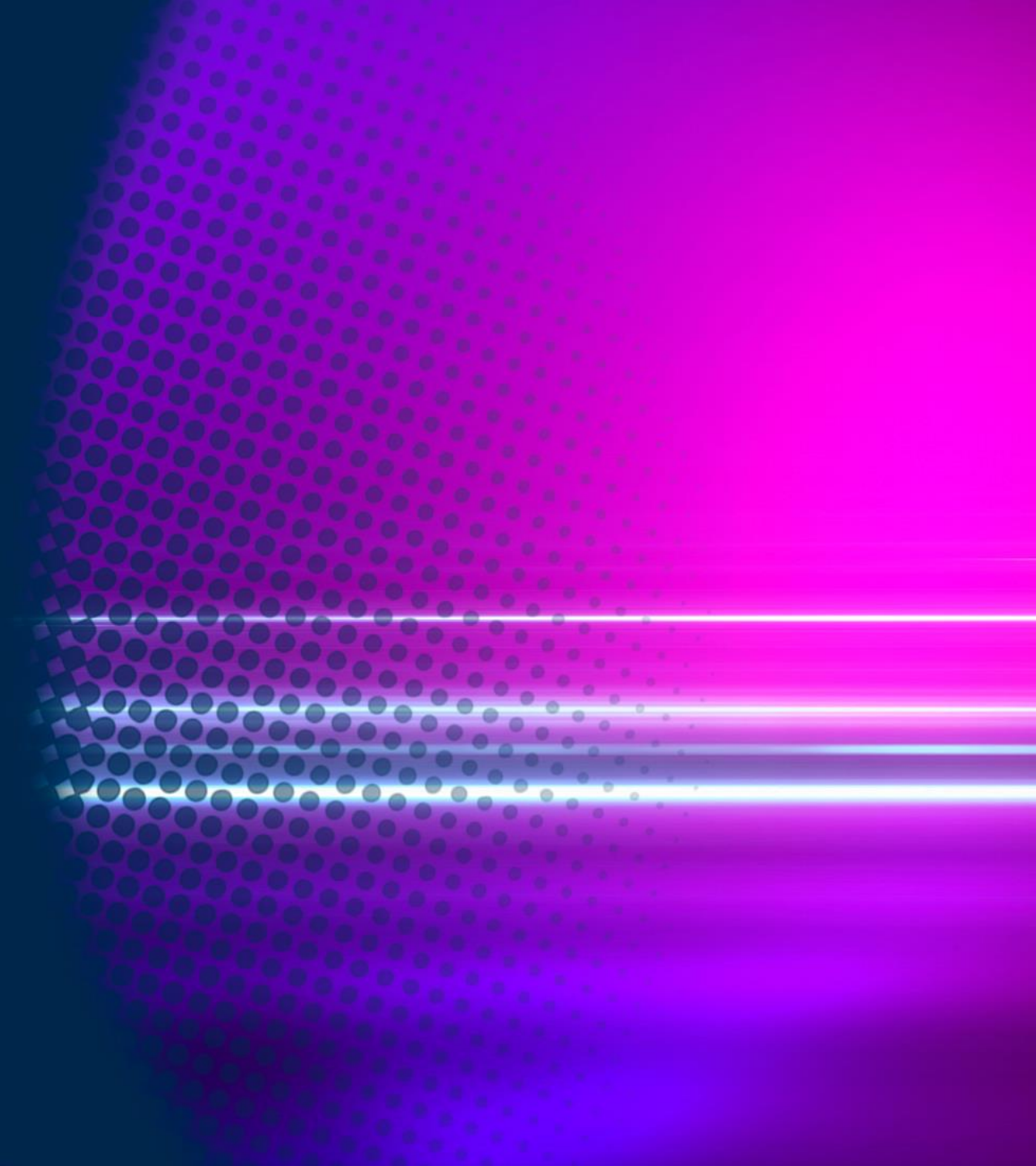
Second deposition system, the commercial scale AIX-2800 G4, is currently being commissioned onsite at Silverwater with equipment partner, AIXTRON



Once complete, wafer manufacturing output capability increased three-fold

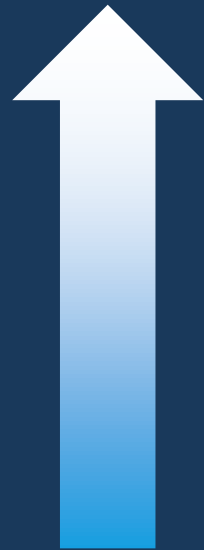


COMMERCIALISATION ACTIVITIES IN MULTIPLE MARKETS



HIGH-GROWTH & LARGE END MARKETS

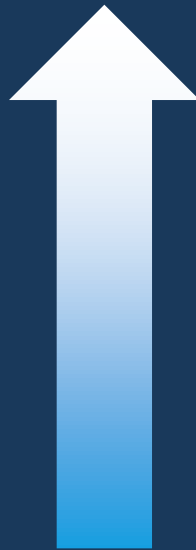
GLOBAL LED MARKET (PACKAGED LEDS)



Global packaged LED market was worth
\$16.7B
in 2018

Source: Strategies Unlimited, \$US

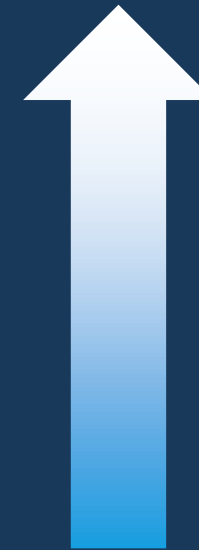
GLOBAL MICROLED MARKET



The emerging microLED market from near \$0 base is expected to reach
\$20.5B
by 2024

Source: Strategies Unlimited, \$US

GLOBAL GAN POWER ELECTRONICS MARKET



The emerging GaN power electronics market is expected to reach
\$270M
by 2021

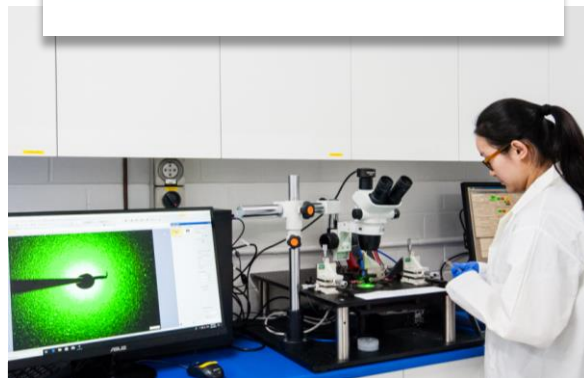
Source: Yole Développement, and Markets and Markets, \$US

COMMERCIAL & PARTNER ENGAGEMENTS



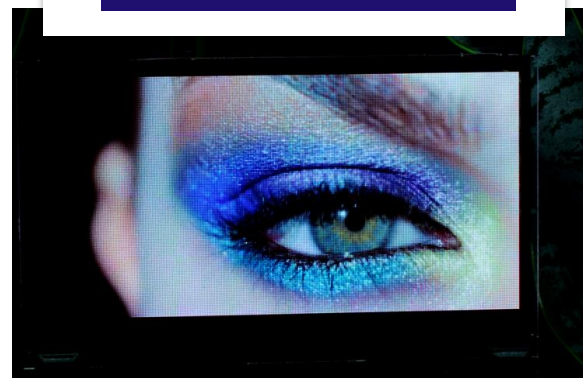
- International leader in LED solutions for the general lighting market
- JDA covers foundry revenues while partners jointly investigate new applications

\$6.8B general lighting market (packaged LEDs) (2018)



- International leader in LED solutions for projector & display applications
- Projectors require ultra-high efficiency and low heat solutions such as cascade LEDs

\$6.8 general lighting market (packaged LEDs) (2018)



- X-display (X-Celeprint spin-off) is a world leader in micro-transfer printing (μ TP) technology
- Using RPCVD to deliver active matrix microLED display prototypes

\$20B microLED market (2024)





- AIXTRON collaborating on scaling RPCVD technology
- And evaluating RPCVD equipment

\$1.4B global MOCVD equipment market(2025)

Sources: Strategies Unlimited, Yole Développement & Markets and Markets, Market Study Report LLC

GO-TO-MARKET ACTIVITY

	DEVELOPMENT PROGRAM	END MARKET	EVALUATION	JOINT DEV/ FOUNDRY	COMMERCIALISATION & MANUFACTURING
	RPCVD TUNNEL JUNCTION TECHNOLOGY				
	Bridgelux JDA	US\$6.1B in 2018 ¹		✓	
	Luminus Collaboration	US\$6.1B in 2018 ¹		✓	
	Continuing HB-LED collaboration discussions	Multiple high-growth market segments	✓		
	Laser diode applications	US\$14B in 2019 ³	✓	✓	
	LED APPLICATIONS				
	Continuing HB-LED collaborations	Multiple high-growth market segments	✓		
	RPCVD EQUIPMENT				
	AIXTRON collaboration & scaling program	MOCVD market to US\$1.4B by 2025 ¹	✓	✓	
	Other capital equipment manufacturers		✓		
	microLEDs				
	X-Celeprint (now X-Display)	MicroLED market to US\$20B by 2024 ²		✓	
	EU and USA microLED display manufacturers	Packaged LED market US\$16.7B		✓	
	OTHER APPLICATIONS				
	Leading integrated device manufacturer (IDM)		✓		

Sources: 1: Market Study Report, LLC 2019. 2: Yole Développement, and Market and Markets. 3: Strategies in Light.



THANK YOU

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