



# BluGlass Limited

## At last...commercial negotiations now started

Bluglass Limited (ASX:BLG) has developed a proprietary low-temperature process - remote plasma chemical vapour deposition (RPCVD) - for fabricating light emission diode (LED) semi-conductors. The technology has inherent advantages that can increase LED performance (light output), and critically can either replace or complement the incumbent higher-temperature technology to maximise manufacturing options. Since November 2015, BLG and US-based Lumileds - one of the world's biggest manufacturers of high brightness (HB) automotive LEDs - have been in an exhaustive collaboration process, involving multiple testing of RPCVD semiconductor wafers manufactured at BLG's facilities in Sydney, and performance testing the RPCVD technology and LED wafers produced at Lumileds' own manufacturing facilities in the US.

**While the process has undoubtedly been slower than expected, a critical breakthrough has been made.** On 19 November 2018 at BLG's AGM, MD Giles Bourne announced that the two parties had commenced commercial negotiations. Although the timeframe around these negotiations was not disclosed, we suggest that after three years of collaboration and data testing, BLG will be eager to get a quick outcome one way or the other. Importantly, we note management's statement that "a key consideration for BluGlass in these negotiations is assessing the potential value of extending the company's exclusive collaboration with Lumileds compared to the potential value of engaging with others in the LED industry". This indicates to us that management is confident that other, even bigger LED manufacturers (i.e. Osram), could step in if commercial discussions with Lumileds prove unsuccessful.

### Risk-weighted target price: A\$0.43ps plus upside potential

Our base-case scenario assumes that BLG and Lumileds enter a commercial agreement; we assume BLG receives a one-off licencing payment of A\$15m in FY20E, with maiden technology royalties commencing in FY21E. Predicated on what we believe is a realistic effective royalty rate of 6% of revenue, we forecast royalty payments to BLG increasing significantly from A\$2m in FY21E to A\$55m in FY25E as 1) the RPCVD technology is increasingly adopted by Lumileds and, 2) Lumileds' sales of HB LEDs ramp up.

**Our estimated post-tax NPV<sub>10</sub> for the Lumileds royalty stream is A\$344m, equivalent to A\$0.81 per fully diluted share.** Adjusting for technology upside (we assume a nominal 5% of the estimated Lumileds royalty NPV) and FY19E net cash of A\$7m, we calculate BLG's un-risked equity value at A\$365m (A\$0.86ps). Attaching a 50% risk discount - primarily because of poor visibility on the timing and metrics of any commercial agreement with Lumileds - we calculate BLG's **risk-adjusted equity value at A\$182m or A\$0.43** per diluted share. At current share price levels, we believe that BLG offers attractive risk-adjusted upside potential. **We initiate coverage with a Speculative Buy (Higher Risk) recommendation.** In addition to unwinding of the risk-discount as details of any commercial agreement are disclosed, we see other opportunities for the share price to appreciate above our target price.

We estimate that over the past 10-years BLG has spent ~A\$60m on R&D; relative to this expenditure, our assumption of an initial one-off licencing payment of A\$15m may be on the conservative side. Although the key focus is on securing a commercial agreement with Lumileds, BLG is also collaborating with several partners in the power electronics and microLED space. Successful commercial agreements here could add significant value.

3 December 2018

Share Price: A\$0.34

Target Price: A\$0.43

Recommendation  
**Speculative Buy**

Risk Assessment  
**Higher**

### IT - Semiconductors (SC) & SC equipment

David Brennan, CFA

Senior Investment Analyst

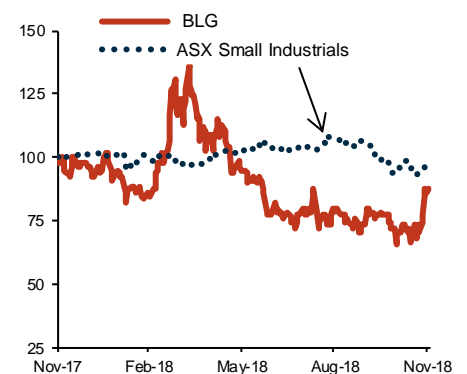
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### BluGlass Limited

ASX Code	BLG
52- week range	A\$0.25-A\$0.53
Market Cap (A\$m)	140
Shares Outstanding (m)	418
Av Daily Turnover (shares)	472,000
ASX All Ordinaries	5,828
2019E BV per share (A\$)	0.05
2019E EPS (A\$)	-0.01
2019E Net Cash/(Debt) (A\$m)	7.5

### Relative price performance



Source: Iress

## Financial Statements

### BluGlass Limited

Year ending June

Profit & Loss Statement (A\$m)	FY18A	FY19E	FY20E	FY21E	FY22E
Lumileds royalty (incl. FY20E licence)	0.0	0.0	15.0	3.1	13.8
Other revenue	0.7	1.00	1.25	1.50	1.75
<b>Revenue (total)</b>	<b>0.7</b>	<b>1.0</b>	<b>16.25</b>	<b>4.6</b>	<b>15.6</b>
Costs	(6.5)	(7.0)	(7.4)	(7.7)	(8.1)
<b>EBITDA</b>	<b>(5.7)</b>	<b>(6.0)</b>	<b>8.9</b>	<b>(3.1)</b>	<b>7.5</b>
Depreciation & Amortisation	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)
<b>Operating profit</b>	<b>(5.9)</b>	<b>(6.2)</b>	<b>8.7</b>	<b>(3.3)</b>	<b>7.3</b>
Other (R&D rebates)	1.9	2.0	2.0	0.0	0.0
<b>EBIT</b>	<b>(4.0)</b>	<b>(4.2)</b>	<b>10.7</b>	<b>(3.3)</b>	<b>7.3</b>
Interest income	0.2	0.5	0.2	0.4	0.3
Interest expense	0.0	0.0	0.0	0.0	0.0
Tax expense	0.0	0.0	0.0	0.0	0.0
<b>Reported NPAT</b>	<b>(3.8)</b>	<b>(3.7)</b>	<b>10.9</b>	<b>(2.8)</b>	<b>7.6</b>
<b>Normalised NPAT</b>	<b>(5.8)</b>	<b>(5.7)</b>	<b>8.9</b>	<b>(2.8)</b>	<b>7.6</b>

EBITDA Margin (%)	na	na	na	-66%	48%
Operating profit margin (%)	na	na	58%	-70%	47%
EPS Reported (A\$)	(0.01)	(0.01)	0.03	(0.01)	0.02
<b>EPS Normalised (A\$)</b>	<b>(0.01)</b>	<b>(0.01)</b>	<b>0.02</b>	<b>(0.01)</b>	<b>0.02</b>
EPS growth (%)	nm	nm	nm	nm	nm
DPS - Declared (A\$)	0.00	0.00	0.00	0.00	0.00
Avg. no. of fully-diluted shares (m)	393	422	422	422	422
YE no. of fully-diluted shares (m)	422	422	422	422	422

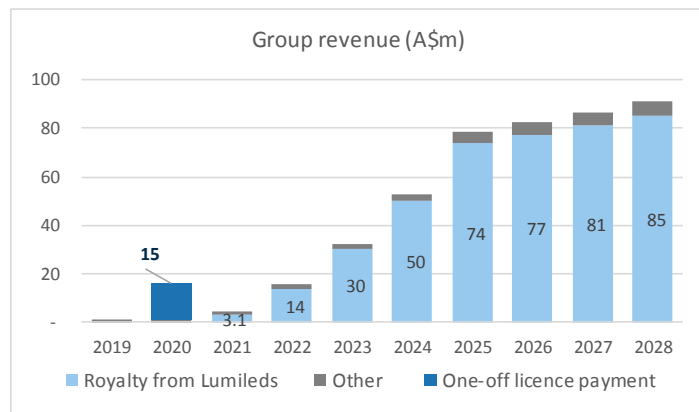
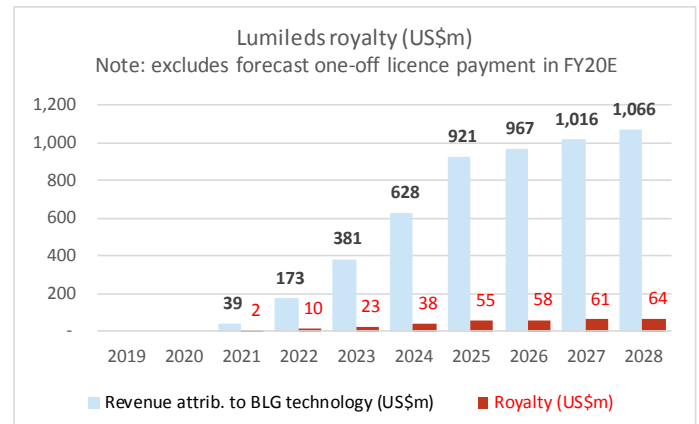
Cash Flow Statement (A\$m)	FY18A	FY19E	FY20E	FY21E	FY22E
EBITDA	(5.7)	(6.0)	8.9	(3.1)	7.5
Investment in working capital	0.1	0.0	0.0	(0.2)	0.0
Tax expense	0.0	0.0	0.0	0.0	0.0
<b>Operating Cash Flow</b>	<b>(5.6)</b>	<b>(6.0)</b>	<b>8.9</b>	<b>(3.3)</b>	<b>7.5</b>
Capex	(0.1)	(4.0)	(4.0)	(0.2)	(0.2)
Other investments	0.0	0.0	0.0	0.0	0.0
<b>Investing Cash Flow</b>	<b>(0.1)</b>	<b>(4.0)</b>	<b>(4)</b>	<b>(0)</b>	<b>(0.2)</b>
Net interest received / (paid)	0.2	0.5	0.2	0.4	0.3
Debt draw down / (repayment)	0.0	0.0	0.0	0.0	0.0
Dividends paid	0.0	0.0	0.0	0.0	0.0
Equity raised / (repaid)	10.5	0.0	0.0	0.0	0.0
<b>Financing Cash Flow</b>	<b>10.7</b>	<b>0.5</b>	<b>0.2</b>	<b>0.4</b>	<b>0.3</b>
Non-operating & Other	1.9	1.7	2.0	0.0	0.0
<b>Inc/(Dec) in Cash</b>	<b>6.8</b>	<b>(7.9)</b>	<b>7.1</b>	<b>(3.0)</b>	<b>7.6</b>

Balance Sheet (A\$m)	FY18A	FY19E	FY20E	FY21E	FY22E
Cash & Equivalents	15.4	7.5	14.6	11.6	19.2
Receivables	2.3	2.3	2.3	2.3	2.3
Inventories	0.1	0.1	0.1	0.2	0.2
Other Current Assets	0.1	0.1	0.1	0.1	0.1
PPE and Exploration & Development	0.3	4.1	7.9	7.9	7.9
Deferred tax asset	0.0	0.0	0.0	0.0	0.0
Other Non Current Assets	8.7	8.7	8.7	8.7	8.7
<b>Total Assets</b>	<b>26.7</b>	<b>22.6</b>	<b>33.5</b>	<b>30.7</b>	<b>38.3</b>
Payables and other current Liabilities	1.0	1.0	1.0	1.0	1.0
Short Term Debt	0.0	0.0	0.0	0.0	0.0
Long Term Debt	0.0	0.0	0.0	0.0	0.0
Other Liabilities (incl silver stream)	0.3	0.0	0.0	0.0	0.0
<b>Total Liabilities</b>	<b>1.3</b>	<b>1.0</b>	<b>1.0</b>	<b>1.0</b>	<b>1.0</b>
<b>Shareholders Equity</b>	<b>25.4</b>	<b>21.6</b>	<b>32.6</b>	<b>29.7</b>	<b>37.4</b>
Net Cash / (Debt)	15.4	7.5	14.6	11.6	19.2

Substantial Shareholders	%	Date
SPP Technologies Co Ltd	13.7%	
Access Macquarie Limited	4.8%	Aug-18
HSBC Custody Nominees	3.8%	

Source: Company, IRESS, State One Stockbroking forecasts

Lumileds royalty calc	FY18A	FY19E	FY20E	FY21E	FY22E
Lumileds LED revenue (US\$m)	-	1,300	1,430	1,573	1,730
YoY growth (%)	-	-	10%	10%	10%
% revenue attrib. to BLG technology	na	0%	0%	2.5%	10.0%
Revenue attrib. to BLG tech (US\$m)	na	0.0	0.0	39	173
Effective royalty rate (%)	na	6%	6%	6%	6%
Royalty (US\$m)	na	0.0	0.0	2.4	10.4
AUD/USD exchange rate	na	0.75	0.75	0.75	0.75
<b>Royalty (A\$m)</b>	<b>na</b>	<b>0.0</b>	<b>0.0</b>	<b>3.1</b>	<b>13.8</b>



Leverage	FY18A	FY19E	FY20E	FY21E	FY22E
Debt (A\$m)	0.0	0.0	0.0	0.0	0.0
Net Debt/Equity	cash	cash	cash	cash	cash
Interest Cover (x)	na	na	na	na	na

Valuation Ratios (x)	FY18A	FY19E	FY20E	FY21E	FY22E
Normalised P/E	na	na	12.5	na	14.7
Price/OP Cash Flow	-20	-19	13	-34	14.9
Book value per share (A\$)	0.06	0.05	0.08	0.07	0.09
EV/EBITDA	-17	-18	11	-33	12.5
ROE (%)	-23%	-27%	27%	-10%	20%

Valuation	(A\$m)	(A\$/share)	Comment
Estimated NPV <sub>10</sub> valuation	340	0.81	30-year Lumileds royalty
Other BLG tech partnerships	17	0.04	Nominal 5% of royalty NPV
Enterprise value	357	0.85	
FY19E Net cash / (debt) (A\$m)	7	0.02	
Equity value (unrisked)	365	0.86	Equity valuation - unrisked
<b>Risk discount</b>	<b>50%</b>		<b>Timing / operational / risky</b>
<b>Equity value (risked) &amp; TP</b>	<b>182</b>	<b>0.43</b>	<b>Equity valuation - risked</b>

Note: Per share valuation based on 422 million shares (diluted)



## Valuation

### NPV

Underpinned by an assumed 30-year royalty stream from Lumileds – we calculate BLG's NPV<sub>10</sub> (un-risked) at A\$340m.

NPV:

A\$340m

Figure 1: NPV calculation

Year	1	2	3	4	5	6	7	8	9	10	11-30	30-Year
Financial Year (end-June)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028		Total
Lumileds royalty (A\$m)	-	-	3.1	14	30	50	74	77	81	85	2,238	2,653
Lumileds one-off licencing payment (A\$m)	-	15	-	-	-	-	-	-	-	-	-	15
Other revenue (A\$m)	1.0	1.3	1.5	1.8	2.0	2.3	5.0	5.3	5.5	5.8	200	231
<b>Total revenue (A\$m)</b>	<b>1.0</b>	<b>16.3</b>	<b>4.6</b>	<b>16</b>	<b>32</b>	<b>52</b>	<b>79</b>	<b>83</b>	<b>87</b>	<b>91</b>	<b>2,438</b>	<b>2,899</b>
Costs (A\$m)	(7)	(7)	(8)	(8)	(9)	(9)	(9)	(10)	(10)	(11)	(377)	(465)
<b>EBITDA (A\$m)</b>	<b>(6)</b>	<b>9</b>	<b>(3)</b>	<b>7</b>	<b>24</b>	<b>44</b>	<b>69</b>	<b>73</b>	<b>76</b>	<b>80</b>	<b>2,061</b>	<b>2,434</b>
Tax (A\$m)	-	-	-	-	(7)	(13)	(21)	(22)	(23)	(24)	(618)	(728)
<b>EAT (A\$m)</b>	<b>(6)</b>	<b>9</b>	<b>(3.1)</b>	<b>7</b>	<b>17</b>	<b>30</b>	<b>49</b>	<b>51</b>	<b>53</b>	<b>56</b>	<b>1,442</b>	<b>1,706</b>
Equity funding (A\$m)	-	-	-	-	-	-	-	-	-	-	-	-
Debt funding (A\$m)	-	-	-	-	-	-	-	-	-	-	-	-
Capex (A\$m)	(4.0)	(4.0)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.3)	(0.3)	(0.3)	(10)	(20)
Sustaining capex (A\$m)	-	-	-	-	-	-	-	-	-	-	-	-
<b>Cashflow (A\$m)</b>	<b>(10.0)</b>	<b>5</b>	<b>(3)</b>	<b>7</b>	<b>17</b>	<b>30</b>	<b>48</b>	<b>51</b>	<b>53</b>	<b>56</b>	<b>1,433</b>	<b>1,686</b>
Discount rate	10%											
<b>PV of cashflow (A\$m)</b>	<b>340</b>											

Source: State One Stockbroking forecasts

Note: Our discount rate of 10% is based on a calculated WACC of 10% and assumes 1) zero debt, 2) risk-free-rate of 2.5%, equity risk premium of 5%, stock beta of 1.3x.

Note: As part of a commercial agreement with Lumileds, we assume BLG secures a one-off technology licence payment of A\$15m in FY20E.

### Target price, recommendation and risks

Including technology/new customer upside (at a nominal 5% of our estimated Lumileds-based NPV) and FY19E net cash of A\$7m, we calculate BLG's **un-risked equity value at A\$365m** or A\$0.86 per diluted share. Attaching a 50% risk discount, we calculate BLG's **risked equity value at A\$182m** or A\$0.43 per diluted share. Our rationale for employing a deep discount is primarily due to the poor visibility on the likelihood, timing, and attributes or conditions of any commercial agreement with Lumileds.

Target price:  
A\$0.43ps

Recommendation:  
Speculative Buy  
(Higher risk)

Figure 2: Equity valuation and target price

	(A\$m)	(A\$ per share)	Comment
Estimated NPV <sub>10</sub> valuation	340	0.81	Based on 30-year Lumileds royalty stream
Technology upside	17	0.04	Nominal 5% of royalty NPV
<b>Enterprise value</b>	<b>357</b>	<b>0.85</b>	
FY19E Net cash / (debt) (A\$m)	7	0.02	
Equity value (unrisked)	365	0.86	Equity valuation - unrisked
<b>Risk discount</b>	<b>50%</b>		<b>Timing / operational / effective royalty rate</b>
<b>Equity value (risked) &amp; target price</b>	<b>182</b>	<b>0.43</b>	<b>Equity valuation - risked</b>

Source: State One Stockbroking forecasts

At current share price levels, we calculate that BLG offers some 25% upside to our risk-adjusted target price. **We initiate coverage on BluGlass Limited with a Speculative Buy (Higher risk) recommendation.**

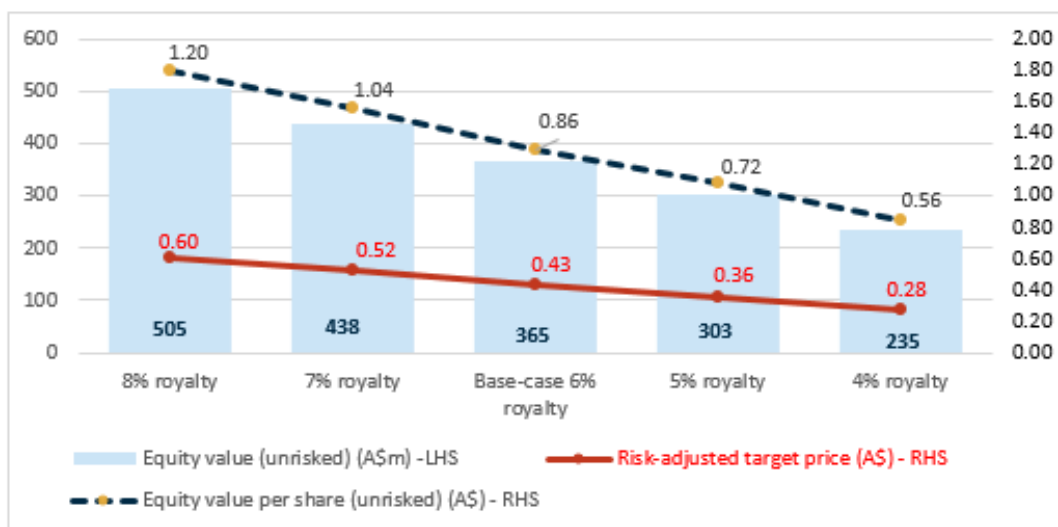
Risks to our earnings profile and target price include, but are not limited to:

- Global growth rates in LED demand, which in turn will determine manufacturing demand and the requirement for new innovative and cost-efficient means of manufacturing.
- 90% of our valuation stems from royalty payments to BLG via a technology licencing agreement with US-based LED manufacturer Lumileds. At this juncture, no agreement has been signed and there is no guarantee that an agreement will be successfully negotiated between the two parties.
- Our base-case scenario assumes a one-off licencing payment to BLG in FY20E and maiden technology royalties in FY21E. Delays to any commercial agreement will push-out these payment/royalty dates and negatively impact our valuation.
- Our base-case scenario assumes an effective royalty rate to BLG of 6% of LED revenue generated by Lumileds from BLG technology. A higher/lower royalty rate will increase/reduce BLG’s revenue stream relative to our forecast.
- Our forecast royalty stream is predicated on a ramp-up between FY21E and FY25E in the use of BLG’s technology in Lumileds’ manufacturing process. A less aggressive ramp-up profile relative to our base-case scenario will negatively impact forecast royalty streams and reduce our group valuation.
- Competition from new or alternative technology providers.
- Key personnel risk.

**Sensitivity to royalty rate**

Our base-case scenario assumes a long-term effective royalty rate of 6% of LED revenue generated by Lumileds from BLG technology. For each one (1) percentage point change relative to our base-case scenario, we calculate that BLG’s (un-risked) equity value changes by ~A\$70m (18%) or 16cps.

**Figure 3: Sensitivity to Lumileds royalty rate**



Source: State One Stockbroking forecasts

## Revenue assumptions

### Royalty stream from Lumileds

Predicated on our forecast adoption rate of BLG's technology into Lumileds manufacturing process increasing from 2.5% in FY21E to (a maximum of) 40% by FY25E, and assuming an effective 6% royalty rate, we forecast royalty payments to BLG increasing from A\$3m in FY21E to ~A\$74m in FY25E.

**Figure 4: Forecast 10-year Lumileds royalty stream (FY19E-FY28E)**

Year	1	2	3	4	5	6	7	8	9	10
Financial Year (end-June)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Lumileds LED revenue (US\$m)	1,300	1,430	1,573	1,730	1,903	2,094	2,303	2,418	2,539	2,666
YoY growth (%)	-	10%	10%	10%	10%	10%	10%	5%	5%	5%
% revenue attrib. to BLG technology (%)	0%	0%	2.5%	10%	20%	30%	40%	40%	40%	40%
Revenue attrib. to BLG technology (US\$m)	-	-	39	173	381	628	921	967	1,016	1,066
Effective royalty rate (%)	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
Royalty (US\$m)	-	-	2	10	23	38	55	58	61	64
AUD/USD exchange rate	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Royalty (A\$m)	-	-	3.1	13.8	30.5	50.2	73.7	77.4	81.3	85.3

Source: State One Stockbroking forecasts

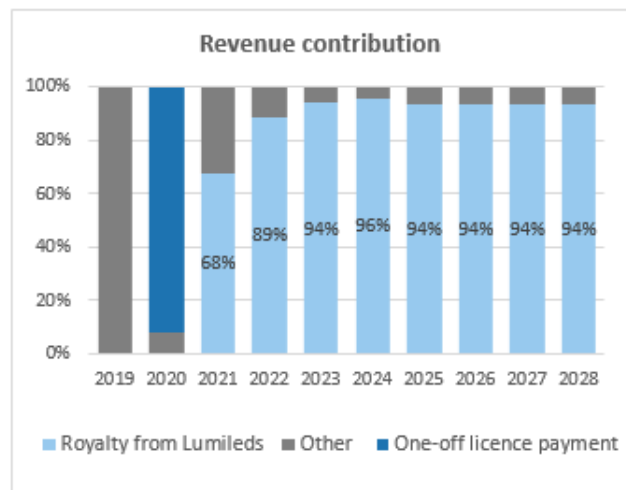
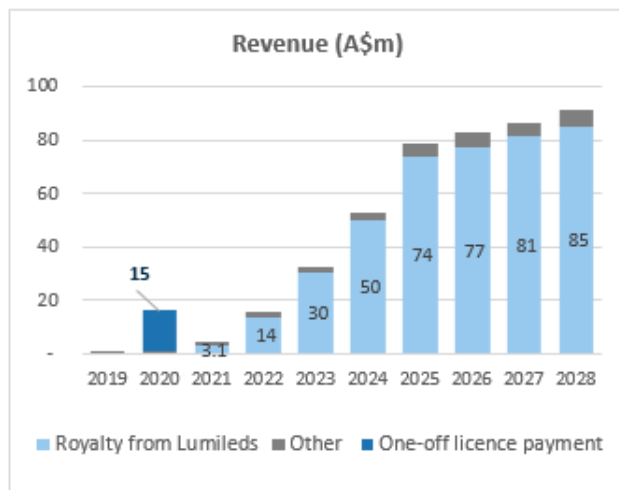
Note: Our estimated Lumileds LED revenue of US\$1,300m in FY19E is based on indicated revenue for the group of US\$2,000m in 2016 when electronics giant Philips sold its 80.1% stake in Lumileds to private equity group Apollo Global Management for US\$1.5Bn. We assume that around half of this revenue was addressable to BLG's LED technology. We forecast Lumileds LED revenue growth of 10% per annum out to FY25E, 5%pa out to FY30E, and 2%pa after FY30E.

### Group revenue

Our forecast group revenue profile is tabulated and graphed below; revenue is comprised of a 1) a royalty stream from Lumileds, 2) an anticipated one-off licencing payment from Lumileds in FY20E and, 3) income from foundry and retrofitting (Other).

**Figure 5: Forecast HPA production**

Group revenue (A\$m)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Royalty from Lumileds	-	-	3.1	14	30	50	74	77	81	85
One-off licence payment	-	15	-	-	-	-	-	-	-	-
Other	1.0	1.25	1.5	1.75	2.0	2.25	5.0	5.25	5.5	5.75
Total	1.0	16.3	4.6	15.6	32	52	79	83	87	91



Source: State One Stockbroking forecasts. Note: We have included forecast future R&D rebates under NOI (not revenue).

## BluGlass – background

BluGlass was founded in 2005 after more than 15 years' research at Sydney's Macquarie University, and floated in September 2006 on the ASX (ASX:BLG).

BLG is developing and commercialising a breakthrough light emitting diode (LED) semiconductor technology - remote plasma chemical vapour deposition (RPCVD). The process, which allows for efficient scalable production of LED semiconductors at lower temperatures relative to current manufacturing methods, offers the potential to improve LED product quality and light output at a lower manufacturing cost. RPCVD also has potential applications in other markets such as power electronics and concentrated solar cells.

BLG holds several patents in key semiconductor markets including the US, China, Europe and Japan.

In March 2016, BLG entered into an exclusive two-year coloration agreement with US-based Lumileds, a global leader in automotive LED lighting products and a major producer of high-end LEDs. The collaboration agreement was extended in March 2018. BLG also has technology collaborations with US-based Veeco Instruments and China-based HC SemiTek.

### Semiconductors, diodes and LEDs

Semiconductors have a conductivity lying between that of an insulator (i.e., rubber) and a good conductor of electricity (i.e., copper) - hence the name, semiconductor. Computer chips, both for CPU and memory, are composed of semiconductor materials, typically silicon or germanium. A pure silicon crystal - with no free electrons - is a poor conductor of electricity. However, adding impurities to the silicon (called doping) creates an excess or lack of electrons, and changes the characteristics of the silicon. In N-type doping, adding phosphorous or arsenic turns the silicon to a negatively charged (i.e., with excess electrons) conductor. In P-type doping, adding boron or gallium effectively converts the silicon to a positively charged conductor.

P and N-type semiconductors layered together and connected to a power source (-ve and +ve electrodes) forms a diode. Electrons moving from the N-type semiconductor to the P-type semiconductor release energy in the form of photons - the basic units of electromagnetic radiation. In silicon and germanium diodes, most of the energy is released in the form of heat.

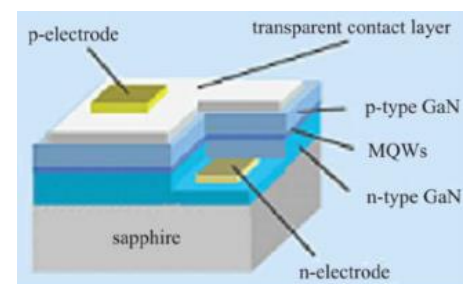
However, visible light emitting diodes (LEDs) produce photons with wavelengths that fall within the visible portion of the light spectrum.

Note: LEDs which emit invisible infrared light are used for remote controls.

The LED semiconductor material (and voltage) determines the colour of the visible light. Gallium nitride (GaN) material emits bright blue light. High-brightness red and amber LEDs use the aluminium indium gallium phosphide (AlInGaP) material system. Blue, green and cyan LEDs use the indium gallium nitride (InGaN) system. Together, AlInGaP and InGaN cover almost the entire light spectrum, with a gap at green-yellow and yellow (met with gallium phosphide (GaP) LEDs which emit red, yellow, and green light).

One method of achieving a larger spectrum of colours is to mix different colours of LEDs in the same device. Combining red, green, and blue LEDs in a single LED device, such as a lighting fixture or multi-chip LED, and controlling their relative intensities can produce millions of colours. Additionally, combining red, green, and blue in equal amounts produces white light. Yttrium aluminium garnet LEDs also emit white light.

**LED structure (schematic)**



Source: ResearchGate

### BLG's technology

LED semiconductors are currently manufactured using a process called metalorganic chemical vapour deposition (MOCVD). In this process, reactant gases are combined at elevated temperatures in a reactor to cause a chemical interaction, resulting in the deposition of materials onto a substrate.




In the MOCVD process, the atomic nitrogen (N) component of gallium nitride (GaN) semiconductors is derived from ammonia (NH<sub>3</sub>) heated to 1,200°C. However, indium (In), a component in the critical indium gallium nitride (InGaN) active layer between the two GaN semiconductors - is not stable at these temperatures. As a result, the active or photon producing layer - known in the industry as the multiple quantum well (MQW) - is fabricated at a lower temperature. Thus, the MOCVD process involves producing an initial -ve GaN semiconductor at an elevated temperature, the key InGaN active layer at a lower temperature, and the final or top +ve GaN semiconductor at an elevated temperature. The dialling up and down of temperatures degrades the key active layer, impacting on the LED's light generating performance.

BLG's alternative manufacturing process called remote plasma chemical vapour deposition (RPCVD) offers an important advantage over the incumbent MOCVD process, in that it uses nitrogen gas (N<sub>2</sub>) instead of ammonia, allowing for fabrication of the semiconductors and active layer to be done at one consistent lower temperature (~700°C). BLG's collaboration with Lumileds is currently focused on the fabrication of the InGaN active layer and upper +ve GaN semiconductor; however, we believe the collaboration may at some point be extended to fabricating the entire LED.

Deposition:  
change in  
state from  
gas to solid





### Figure 6: MOCVD versus RPCVD technologies

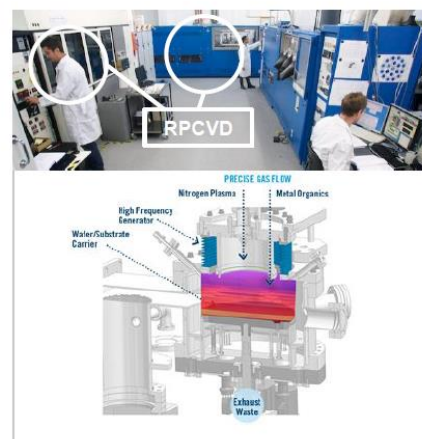
MOCVD (Metal Organic Chemical Vapour Deposition) – the industry incumbent technology

CHALLENGES	
	High temperature processes limits performance of the critical regions of the LED, microLED and power electronics devices
	Uses high volume of expensive ammonia as nitrogen source, produces toxic waste, more-difficult and costly to manage
	High temperature limits the choice of low-cost, larger silicon wafers for power electronics, microLEDs and LEDs



RPCVD (Remote Plasma Chemical Vapour Deposition) – the breakthrough alternative

OUR SOLUTION	
	Lower-temperature manufacturing processes
	Lower cost inputs
	Higher-performing devices
	Environmentally friendlier & more-sensitive



Source: Company

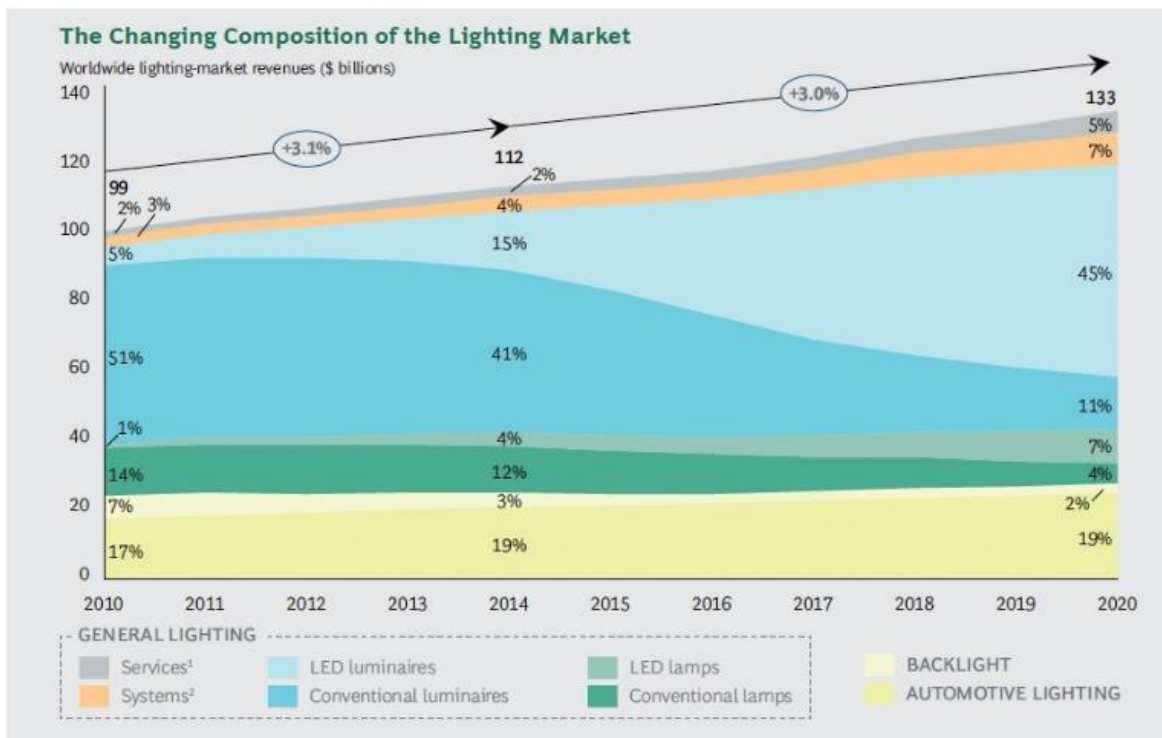
## LEDs – transforming the lighting market

LEDs are forecast to dramatically disrupt the conventional fluorescent/compact fluorescent (CF) and incandescent/halogen lighting marketplace. Incandescent bulbs convert less than 5% of the energy they use into visible light, with standard (home) light bulbs averaging about 2.2%. The remaining energy is converted into heat. The [luminous efficacy](#) of a typical incandescent bulb is 16 [lumens](#) per watt, compared with 60 lm/W for a compact fluorescent bulb or 150 lm/W for some white LED lamps. In addition to higher light and energy efficiency, advantages of LEDs relative to conventional lighting include, extended life (30-50k hours versus 1,000 hours for an incandescent light and ~10,000 hours for a CF), cold temperature operation, durability, “instant on”, rapid cycling, and importantly controllability/intelligence (LEDs being semiconductors are inherently compatible with controls).

With lighting estimated to consume about 20% of global electricity usage, it is little wonder that governments are increasingly introducing regulation and or initiatives (rebates) to replace legacy incumbent lighting technologies with more cost and energy efficient technologies – including LEDs.

According to 2015 industry analysis by the Boston Consulting Group (BCG), the global lighting market is forecast to grow at, or close to, historical rates of 3%pa out to 2020, with rapidly developing economies in China, SE Asia and Latin America accounting for some 70% of lighting-industry growth. Importantly, BCG forecasts a significant shift in the luminaires (light fixtures) segment, which accounts for 75% of the lighting market. BCG forecasts that LED’s share of the luminaires segment will increase to 80% by 2020, from around 25% in 2014 (with conventional technology’s share decreasing to 20% from 75% over the same period).

**Figure 7: Composition of global lighting market**

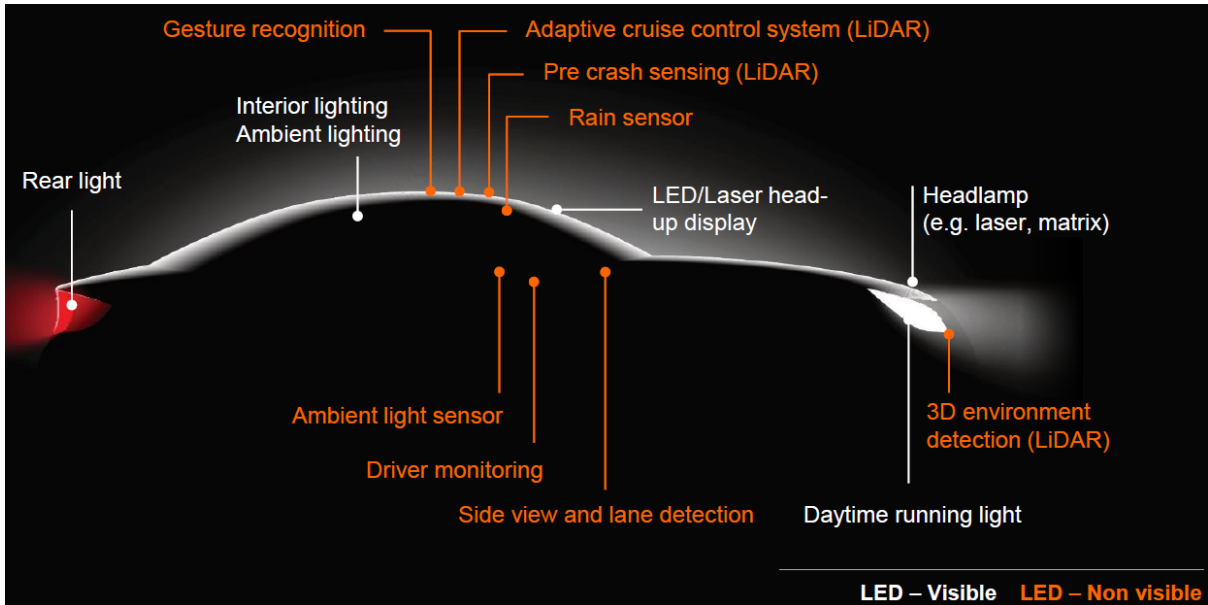


Source: Consultancy.uk (Original Source: Boston Consulting Group (BCG))



Although not specifically addressed in the BCG report, automotive lighting - which accounts for a significant 19% of the global lighting industry - is also forecast to also go through transformational changes. Even today, LEDs in automobiles can be used for a broad range of applications (see figure below), and the adoption of these technologies will become more mainstream as LED costs fall. It is in the automotive LED sector where Lumileds is an important player, that Lumileds is looking to gain a competitive advantage via BLG's low-temperature RPCVD technology.

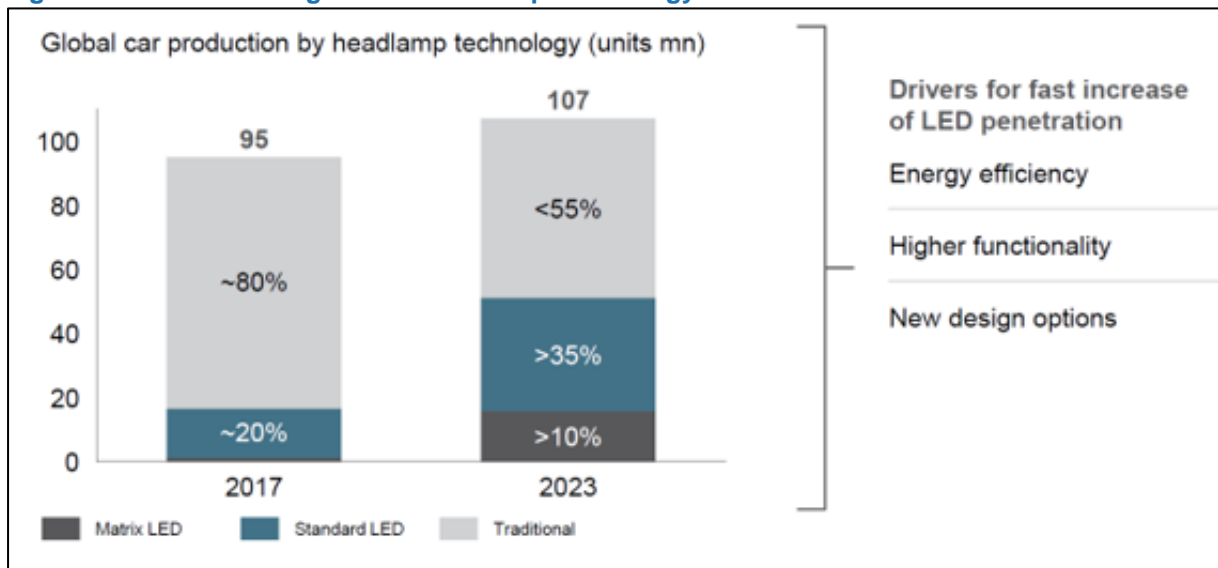
**Figure 8: LED application in automobiles**



Source: Osram

Osram, the global LED automotive supplier in the world, forecasts that the automotive headlamp market will go from ~80% traditional halogen / HID (xenon) in 2017 to <55% by 2023.

**Figure 9: Forecast change in car headlamp technology between 2017 and 2023**



Source: Osram

## Non-Executive Chairman and MD/CEO Profiles Source: Company website



**DR. WILLIAM JOHNSON**  
Non Executive Chairman  
BS-Phy, MS-EE, PhD

Dr. William Johnson is a seasoned CEO with extensive business development, M&A, technological leadership, and hands-on leadership roles in operations ranging from start-ups to Fortune 500 high technology companies.

Over the years, Bill has held top management positions with high technology companies including Ulvac Corp., Varian Associates, Intevac Inc., Oryx Instruments and Materials Corp., and Therma-Wave, Inc. From 2003-2008, he was founder and managing director of Crane Ridge Associates, providing consulting and M&A guidance to high tech clientele.

In 2007 on behalf of Sumitomo Precision Products (SPP), he led the acquisition of assets of Aviza Technology and integrated them with an existing SPP subsidiary, Surface Technology Systems, thereby forming SPTS Technologies, a manufacturer of capital equipment for the semiconductor and related micro-device industries. Serving as President and Chief Executive Officer of SPTS, he orchestrated the 2011 management buy-out of SPTS and the 2014 sale to Orbotech Technologies.

Bill recognized the strategic potential of BluGlass in 2010, and had SPTS acquire a cornerstone investment in the company and form a JV with BluGlass to solidify the plasma basis of the RPCVD process. Since 2010 he has served as a non-executive director.



**MR. GILES BOURNE**  
Managing Director & Chief Executive Officer  
B.A. (Hons), MBA, FAICD

Giles is a senior executive with over 20 years of international business development experience gained in the clean-tech, technology and manufacturing sectors. He is a specialist in developing offshore business opportunities, securing inward expansion investment, setting up domestic and international partnerships, JV's and licensing deals for Australian corporations.

Giles' focus at BluGlass is to provide leadership as well as developing sales and marketing structures to support the commercialisation of BluGlass' LED and solar technology.

During his time at BluGlass, Giles has lead the team to secure a strategic partnership with global semiconductor equipment company SPTS Technologies, secured more than \$25M in Government and Private Investment and supported the technology team to its proof of concept milestone.

In 2014 Giles was invited to be part of the Judging Panel of the prestigious Australian Technologies Competition ([www.austechcomp.com](http://www.austechcomp.com)), Australia's premier technology acceleration program and an initiative supported by the Australian Federal government. . Giles has been a member of the panel for the past three years.

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