



# Weebit Nano Limited

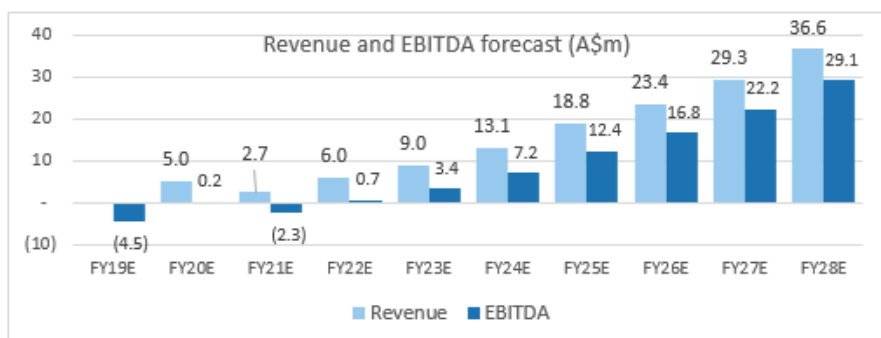
## A name to remember

Incorporated in Israel in 2015, and listed on the ASX in 2016, Weebit Nano (ASX:WBT) is developing an alternative to the incumbent NAND flash memory semiconductor via its proprietary Silicon Oxide (SiOx) Resistive RAM (ReRAM) technology. ReRAM is one of several emerging or next generation non-volatile memory (NVM) technologies that are forecast to become increasingly adopted by semiconductor manufacturers as the global "data economy" increasingly reveals the application design, functional, cost, and stability limitations of current memory unit technologies. Since listing, WBT has successfully met its targeted (pre-listing) technology milestones, and in June 2018 achieved the significant milestone of demonstrating a 1MB capacity ReRAM array at a transistor size of 40nm. At this level, WBT's technology is comparable to the incumbent technology in the embedded NVM market. Note: this is the first market segment that WBT is targeting; the embedded NVM market is estimated at US\$25bn (out of a total NVM market of ~US\$60bn).

In 2019, WBT in conjunction its long-standing French technology development partner Leti, will be looking to further optimise the technology parameters, reduce the transistor size to 28nm, and importantly, lab fabricate the units onto an industry-standard 300mm wafer. Successfully lab manufacturing to this specification should put WBT in a strong position ahead of production and commercial negotiations with semiconductor manufacturers / foundries. Management stated that partnership/collaboration discussions are already taking place.

### Revenue and EBITDA forecast

Our forecast group revenue profile is comprised of 1) an anticipated one-off licencing payment of A\$5m in FY20E and, 2) a royalty stream commencing in FY21E from sales of semiconductors using WBT's ReRAM technology.



### Risk-weighted target price: 6cps

Underpinned by an assumed 20-year royalty stream, we calculate WBT's un-risked equity value at A\$157m - equivalent to 9c per fully diluted share (pre-25:1 share consolidation scheduled for February 2019). Attaching a 33% risk discount - primarily because of technology risk associated with developing the ReRAM product to a commercial stage, and poor visibility on the timing and metrics of any commercial agreement - we calculate WBT's **risk-adjusted equity value at A\$105m or 6c** per diluted share.

At current share price levels, we believe that WBT offers attractive risk-adjusted upside potential with further significant upside potential as details of any commercial agreement are disclosed and the risk-discount is unwound. **We initiate coverage with a Speculative Buy (Higher Risk) recommendation.**

30 January 2019

Share Price: A\$0.026

Target Price: A\$0.06

Recommendation  
**Speculative Buy**

Risk Assessment  
**Higher**

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

David Brennan, CFA

Senior Investment Analyst

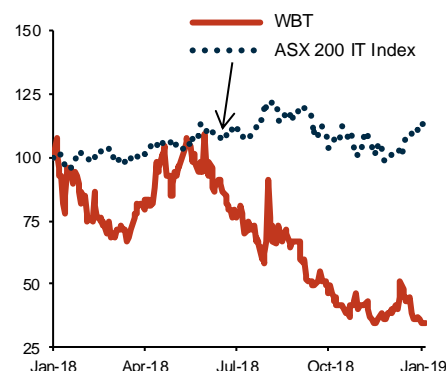
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### Weebit Nano Limited

ASX Code	WBT
52- week range	A\$0.022-A\$0.08
Market Cap (diluted) (A\$m)	46
Shares (diluted) (m)	1,815
Av Daily Turnover (shares)	5.65 million
ASX All Ordinaries	5,829
2019E BV per share (A\$c)	0.2
2019E EPS (A\$c)	-0.3
2019E Net Cash/(Debt) (A\$m)	3.2

### Relative price performance



Source: Iress

## Financial Statements

### Weebit Nano Ltd (WBT)

Year ending June

Profit & Loss Statement (A\$m)	FY18A	FY19E	FY20E	FY21E	FY22E
Royalty (incl. FY20E licence)	0.0	0.0	5.0	2.7	6.0
Licensing fee to Rice University	0.0	0.0	(0.1)	(0.0)	(0.1)
Corporate, G&A	(3.4)	(3.5)	(3.7)	(3.9)	(4.1)
R&D	(1.1)	(1.0)	(1.1)	(1.1)	(1.2)
<b>EBITDA</b>	<b>(4.4)</b>	<b>(4.5)</b>	<b>0.2</b>	<b>(2.3)</b>	<b>0.7</b>
Depreciation & Amortisation	0.0	0.0	0.0	0.0	0.0
<b>Operating profit</b>	<b>(4.4)</b>	<b>(4.5)</b>	<b>0.2</b>	<b>(2.3)</b>	<b>0.7</b>
NOI	0.0	0.0	0.0	0.0	0.0
<b>EBIT</b>	<b>(4.4)</b>	<b>(4.5)</b>	<b>0.2</b>	<b>(2.3)</b>	<b>0.7</b>
Interest income	0.1	0.1	0.1	0.1	0.1
Interest expense	0.0	0.0	0.0	(0.1)	(0.1)
Tax expense	0.0	0.0	0.0	0.0	0.0
<b>Reported NPAT</b>	<b>(4.3)</b>	<b>(4.4)</b>	<b>0.3</b>	<b>(2.3)</b>	<b>0.7</b>
<b>Normalised NPAT</b>	<b>(4.3)</b>	<b>(4.4)</b>	<b>0.3</b>	<b>(2.3)</b>	<b>0.7</b>
EBITDA margin (%)	na	na	na	-88%	12%
Operating profit margin (%)	na	na	na	-88%	12%
EPS Reported (A\$c)	(0.3)	(0.25)	0.0	(0.1)	0.0
<b>EPS Normalised (A\$c)</b>	<b>(0.3)</b>	<b>(0.3)</b>	<b>0.0</b>	<b>(0.1)</b>	<b>0.0</b>
Dividend payout (%)	na	na	0%	na	0%
<b>DPS (A\$c)</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
Dil Av no. of shares (m)	1,487	1,745	1,815	1,815	1,815
Dil YE no. of shares (m)	1,588	1,815	1,815	1,815	1,815

Cash Flow Statement (A\$m)	FY18A	FY19E	FY20E	FY21E	FY22E
EBITDA	(4.4)	(4.5)	0.2	(2.3)	0.7
Investment in working capital	(0.4)	0.0	0.0	0.0	0.0
Tax expense	0.0	0.0	0.0	0.0	0.0
<b>Operating Cash Flow</b>	<b>(4.9)</b>	<b>(4.5)</b>	<b>0.2</b>	<b>(2.3)</b>	<b>0.7</b>
Capex	(0.1)	0.0	0.0	0.0	0.0
Other investments	0.0	0.0	0.0	0.0	0.0
<b>Investing Cash Flow</b>	<b>(0.1)</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
Net interest received / (paid)	0.1	0.1	0.1	0.0	(0.0)
Debt draw down n / (repayment)	0.0	0.0	0.0	2.5	0.0
Dividends declared	0.0	0.0	0.0	0.0	0.0
Equity raised / (repaid)	6.4	4.2	0.0	0.0	0.0
<b>Financing Cash Flow</b>	<b>6.6</b>	<b>4.3</b>	<b>0.1</b>	<b>2.5</b>	<b>(0.0)</b>
Non-operating & Other	0.0	0.0	0.0	0.0	0.0
<b>Inc/(Dec) in Cash</b>	<b>1.7</b>	<b>(0.2)</b>	<b>0.3</b>	<b>0.2</b>	<b>0.7</b>

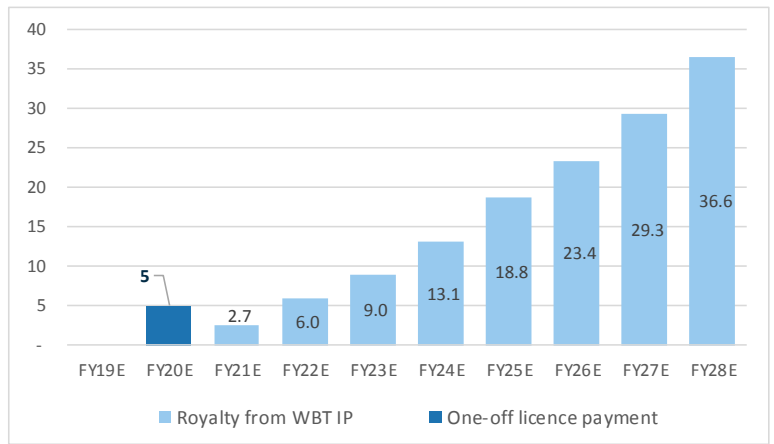
Balance Sheet (A\$m)	FY18A	FY19E	FY20E	FY21E	FY22E
Cash & Deposits	3.4	3.2	3.5	3.7	4.4
Receivables	0.6	0.6	0.6	0.6	0.6
Inventories	0.0	0.0	0.0	0.0	0.0
Other Current Assets	0.0	0.0	0.0	0.0	0.0
PPE and Exploration & Development	0.0	0.0	0.0	0.0	0.0
Deferred tax asset	0.0	0.0	0.0	0.0	0.0
Other Non Current Assets	0.1	0.1	0.1	0.1	0.1
<b>Total Assets</b>	<b>4.0</b>	<b>3.8</b>	<b>4.1</b>	<b>4.3</b>	<b>5.0</b>
Payables and other current Liabilities	0.5	0.5	0.5	0.5	0.5
Short Term Debt	0.0	0.0	0.0	2.5	2.5
Long Term Debt	0.0	0.0	0.0	0.0	0.0
Other Non Current Liabilities	0.0	0.0	0.0	0.0	0.0
<b>Total Liabilities</b>	<b>0.5</b>	<b>0.5</b>	<b>0.5</b>	<b>3.0</b>	<b>3.0</b>
<b>Total Equity</b>	<b>3.5</b>	<b>3.3</b>	<b>3.6</b>	<b>1.3</b>	<b>2.0</b>
Net Cash / (Debt)	3.4	3.2	3.5	1.2	1.9

Major Shareholders	%	Date
IBI Trust Management	31.9	
102 Cap Mngt	3.1	Sep-18
Silver Horizon	2.0	

Source: Company, IRESS, State One Stockbroking forecasts

Royalty calculation	FY18A	FY19E	FY20E	FY21E	FY22E
Emerging NVM market (US\$m)	-	900	1,500	2,500	4,000
YoY growth (%)	-	n/m	67%	67%	60%
WBT market share of RRAM market (%)	-	0.0%	0.0%	20.0%	25.0%
WBT market share (US\$m)	-	0	0	200	450
Effective royalty rate (%)	-	1.0%	1.0%	1.0%	1.0%
Royalty (US\$m)	-	0.0	0.0	2.0	4.5
AUD/USD exchange rate	-	0.75	0.75	0.75	0.75
<b>Royalty (A\$m)</b>	<b>-</b>	<b>0.0</b>	<b>0.0</b>	<b>2.7</b>	<b>6.0</b>

### Forecast 10-year royalty profile (FY19E-FY28E) (A\$m)



Source: State One Stockbroking forecasts

Leverage	FY18A	FY19E	FY20E	FY21E	FY22E
Debt (A\$m)	0	0	0	3	3
Net Debt/Equity	cash	cash	cash	na	na
Interest Cover (x)	na	na	na	na	na

Valuation Ratios (x)	FY18A	FY19E	FY20E	FY21E	FY22E
Normalised P/E	na	na	0.0	na	0.0
Price/OP Cash Flow	-8	-9	203	-17	58
Book value per share (A\$)	0.00	0.00	0.00	0.00	0.00
EV/EBITDA	-8	-8	185	-17	55
ROE (%)	-123%	-132%	8%	-173%	34%

Valuation	(A\$m)	(A\$ per share)	Comment
Estimated NPV10 valuation	146	0.08	30-year IP royalty stream
Technology upside	8	0.00	Nominal 5% of royalty NPV
Enterprise value	154	0.09	
FY19E Net cash / (debt) (A\$m)	3	0.00	
Equity value (unrisked)	157	0.09	Equity valuation - unrisked
<b>Risk discount</b>	<b>33%</b>		<b>Timing /operational/royalty</b>
<b>Equity value (risked) &amp; target price</b>	<b>105</b>	<b>0.06</b>	<b>Equity valuation - risked</b>

Note: Per share valuation based on 1,716 million shares (diluted)

Total Return	Recommendation
Current share price (A\$)	0.03
Fcast one-year capital gain / (loss)	128%
Fcast one-year dividend yield	0%
<b>Speculative Buy</b>	

Company Description
Weebit Nano Ltd (ASX:WBT) is an Israeli-based semiconductor company seeking to develop and commercialise the group's silicon oxide (SiOx) ReRAM (Resistive RAM) technology into the next generation of flash memory chips. ReRAM is non-volatile, fast, cost effective and can endure a significantly higher number of program erase cycles compared to incumbent flash memory technologies.

## Valuation

### NPV

Underpinned by an assumed 20-year intellectual property royalty stream from WBT's SiOx ReRAM technology, we calculate WBT's NPV<sub>10</sub> (un-risked) at A\$146m.

NPV:

A\$146m

Figure 1: NPV calculation

Revenue year	-	1	2	3	4	5	6	7	8	9	10-20	20-Year Total
Financial Year (end-June)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028		
IP royalty (A\$m)	-	-	2.7	6	9	13	19	23	29	37	958	1,097
One-off licencing payment (A\$m)	-	5	-	-	-	-	-	-	-	-	-	5
Other revenue (A\$m)	-	-	-	-	-	-	-	-	-	-	-	-
<b>Total revenue (A\$m)</b>	-	5.0	2.7	6	9	13	19	23	29	37	958	1,102
Licensing fee to Rice University	-	(0.1)	(0.0)	(0.1)	(0.1)	(0.2)	(0.3)	(0.4)	(0.4)	(0.5)	(14)	(17)
SG&A, Corporate	(3.5)	(3.7)	(3.9)	(4.1)	(4.3)	(4.5)	(4.7)	(4.9)	(5.2)	(5.4)	(81)	(125)
R&D (A\$m)	(1.0)	(1.1)	(1.1)	(1.2)	(1.2)	(1.3)	(1.3)	(1.4)	(1.5)	(1.6)	(23)	(36)
<b>EBITDA (A\$m)</b>	<b>(4.5)</b>	<b>0.2</b>	<b>(2.3)</b>	<b>0.7</b>	<b>3</b>	<b>7</b>	<b>12</b>	<b>17</b>	<b>22</b>	<b>29</b>	<b>839</b>	<b>924</b>
Tax (A\$m)	-	-	-	-	-	-	(4)	(5)	(7)	(9)	(252)	(276)
<b>EAT (A\$m)</b>	<b>(4.5)</b>	<b>0.2</b>	<b>(2.3)</b>	<b>0.7</b>	<b>3</b>	<b>7</b>	<b>9</b>	<b>12</b>	<b>16</b>	<b>20</b>	<b>587</b>	<b>648</b>
Equity funding (A\$m)	-	-	-	-	-	-	-	-	-	-	-	-
Debt funding (A\$m)	-	-	-	-	-	-	-	-	-	-	-	-
Capex (A\$m)	-	-	-	-	-	-	-	-	-	-	-	-
Sustaining capex (A\$m)	-	-	-	-	-	-	-	-	-	-	-	-
<b>Cashflow (A\$m)</b>	<b>(4.5)</b>	<b>0.2</b>	<b>(2.3)</b>	<b>0.7</b>	<b>3</b>	<b>7</b>	<b>9</b>	<b>12</b>	<b>16</b>	<b>20</b>	<b>587</b>	<b>648</b>
Discount rate	10%											
<b>PV of cashflow (A\$m)</b>	<b>146</b>											

Source: State One Stockbroking forecasts

Note: Our discount rate of 10% is based on a calculated WACC of 10% and assumes 1) zero long-term debt, 2) a risk-free-rate of 2.5%, 3) an equity risk premium of 5% and, 4) a stock beta of 1.3x.

Note: As part of a commercial agreement, we assume WBT secures a one-off technology licence payment of A\$5m in FY20E.

### Target price, recommendation and risks

Including technology/new customer upside (at a nominal 5% of our estimated royalty-based NPV) and FY19E net cash of A\$3m, we calculate WBT's **un-risked equity value at A\$157m** or A\$0.09 per diluted share. Attaching a 33% risk discount, we calculate WBT's **risked equity value at A\$105m** or A\$0.06 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.

Target price:  
A\$0.06ps

Recommendation:  
Speculative Buy  
(Higher risk)

Figure 2: Equity valuation and target price

	(A\$m)	(A\$ per share)	Comment
Estimated NPV <sub>10</sub> valuation	146	0.08	Based on 20-year IP royalty stream
Technology upside	8	0.00	Nominal 5% of royalty NPV
<b>Enterprise value</b>	<b>154</b>	<b>0.09</b>	
FY19E Net cash / (debt) (A\$m)	3	0.00	
Equity value (unrisked)	157	0.09	Equity valuation - unrisked
<b>Risk discount</b>	<b>33%</b>		<b>Timing / revenue / effective royalty rate</b>
<b>Equity value (risked) &amp; target price</b>	<b>105</b>	<b>0.06</b>	Equity valuation - risked

Source: State One Stockbroking forecasts. Note: Diluted shares calculated as 1,815m; 25:1 consolidation planned for Feb 2019

At current share price levels of 0.026, we calculate that WBT offers significant upside to our risk-adjusted target price. **We initiate coverage on Weebit Nano 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 memory demand and semiconductor chips.
- Price cyclicality in the global semiconductor market may lead to potential licensees (semiconductor manufacturers) pushing out licensing decisions around merging memory technologies.
- Technology risk associated with developing the group's ReRAM product to a viable commercial stage.
- Our valuation stems from royalty payments to WBT via a technology licencing agreement. At this juncture, no agreement has been signed and there is no guarantee that an agreement will be successfully negotiated between WBT and any interest party (semiconductor manufacturer or consumer electronics provider). Our base case scenario assumes royalty payments to WBT commencing in FY21E.
- Our base-case scenario assumes a one-off licencing payment to WBT in FY20E and maiden technology royalties in FY21E. Technology development setbacks or delays to any commercial agreement will push-out these forecast payment/royalty dates and negatively impact our valuation.
- Our base-case scenario assumes an effective royalty rate to WBT of 1% of revenue generated by sales of memory chips (produced by a third party) using the group's ReRAM technology. A higher/lower royalty rate will increase/reduce WBT's revenue stream relative to our forecast. Our 1% royalty rate assumes that WBT enters into a non-exclusive licence deal. Licence fees and royalty payments in non-exclusive licence deals are typically lower compared to an exclusive licence deal. On the upside, non-exclusive licencing should enable WBT to sign multiple licensees and have a larger revenue base.
- Based on our forecast EBITDA profile, we calculate that WBT will need to raise funding (for working capital and/or project development) prior to estimated maiden +ve EBITDA in FY22E. We assume WBT securing debt funding of A\$2.5m in FY21E. However, if debt funding is not available, WBT may have to tap the equity markets, which depending on the terms, may be dilutive for existing shareholders.
- WBT's SiOx ReRAM technology is one of a number of technologies, including other ReRAM technologies, targeting to compete in the emerging non-volatile memory (NVM) space. ReRAM's market share within this market, and WBT's market share within the broader ReRAM technology space is uncertain at this juncture. Our forecast royalty stream is predicated on a ramp-up between FY21E and FY25E in the use of WBT's technology. A less aggressive adoption profile relative to our base-case scenario will negatively impact forecast royalty streams and reduce our group valuation.
- WBT doesn't directly own the patents underlying the technology but licenses their use from Rice University in the US. In December 2018, WBT and Rice University refined the licence agreement to capture the group's commercialisation timetable. We assume a licence fee to Rice University of 1.5% of royalty fees attributable to WBT. A higher licence fee, relative to our base-case scenario, would reduce our forecast WBT profit profile.
- Competition from new or alternative technology providers.
- Key personnel risk.

## Background

Incorporated in Israel in 2015, Weebit Nano Ltd (WBT) was built to address the growing need for data storage and embedded Non-Volatile Memory (NVM) technology. WBT has secured several patents to ensure commercial and legal protection over its silicon oxide Resistive RAM (SiOx ReRAM) technology; the technology was invented by Professor James Tour of Rice University and is licensed to WBT under a Licence Agreement.

Following a A\$5.04m capital raise, Weebit Nano listed on the ASX in August 2016 via a reverse takeover of junior exploration company Radar Iron Limited. The effective consideration paid to Weebit Nano shareholders and options holders was A\$37.5m (750m shares including 17.3m performance rights at the IPO issue price of 5cps).

Dynamic random-access memory (DRAM) or Static RAM (SRAM) – colloquially called “RAM” – is the most widely used form of active or primary storage (i.e., where data is stored and directly accessible by a computer’s CPU). RAM is fast, has a long life-span (number of erase cycles), and DRAM, in particular, is inexpensive (in terms of dollars per gigabyte). The downside is that the memory is volatile, i.e., when the device or computer is shut down, data contained in the RAM is lost.

**Non-Volatile Memory (NVM)** or flash memory is a type of memory that can retrieve stored information after the equipment or device - usually a computer - has been power cycled (i.e., power turned off then back on). It is used as permanent or secondary storage. Early NVM data storage methods included paper tape and punched cards.

Currently, NAND and NOR flash memory are the most common NVM technologies used in the mass market because of their affordability, storage density, and access speeds. These technologies are found in most modern cell phones, in memory cards and in internal or external hard disk drives and solid states drives.

Emerging applications like 5G, IoT, AI and associated devices (e.g., smartphones, in-home assistants, self-driving cars) are not only large consumers of data but are also large consumers of rapidly processed data. Emerging NVM technologies looking to meet this challenge include ferroelectric RAM (FRAM), magneto resistive RAM (MRAM), Phase Change Memory (PCM) and resistive RAM (RRAM), including WBT’s SiOx ReRAM.

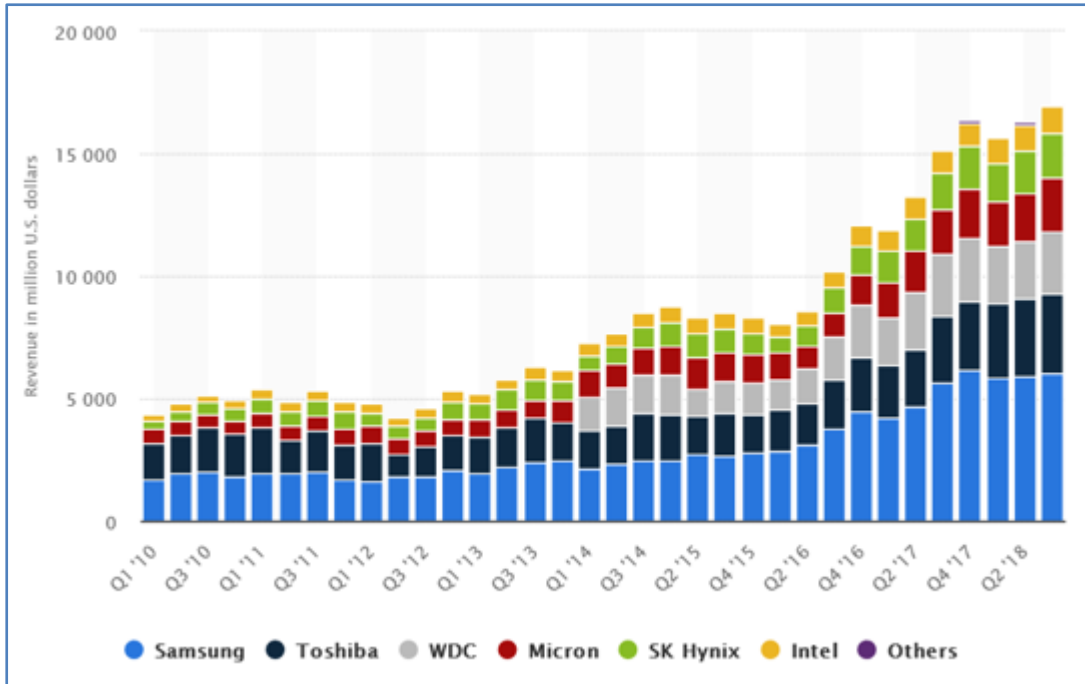
NVM is typically used for the task of secondary storage, or long-term persistent storage. The dominant forms of NVM used presently have limitations that make them unsuitable for use as primary storage. Typically, NVM costs more, provides lower performance (particularly speed), or has a limited lifetime (erase cycles) compared to volatile RAM. WBT is looking to address these issues via its ReRAM memory technology, which could provide the benefits of non-volatile flash memory and the speed of volatile DRAM.

The global memory chip industry expanded by an unprecedented 70% to US\$125 billion in 2017 (Source: [Reuters article January 2018](#)), largely underpinned by robust growth in smartphones and cloud services that require ever more powerful chips to store increasing bytes of data.

NAND flash memory chips comprise a significant (US\$60bn) component of the total market. South Korean multinational Samsung controls about 30% of the flash memory chip market; other large manufacturers are Intel (US), Micron (US), SK Hynix (South Korea), SanDisk/Western Digital (US), and Toshiba (Japan).

We believe it is this market that WBT is looking to compete in, as technological challenges to flash memory scalability offers potential opportunities for the group’s ReRAM technology.

**Figure 3: Quarterly NAND flash manufacturers' revenue**



Source: Company, original source: Statista

Currently, the emerging technology flash memory market is relatively small- at ~US\$300m, but it is anticipated to grow significantly as the embedded memory market grows at a faster pace than the broader NVM market.

### WBT's SiOx ReRAM technology

Conventional (i.e. NAND) flash memory stores data in arrays of memory cells that are made using floating-gate transistors. Each cell contains two gates, namely, the control gate and the floating gate, and to program a single cell, a voltage charge is applied to the control gate. Electrons are then attracted toward the control gate, and the flow gate traps them within the substrate where they can remain for years under normal operating conditions. Constant erase, writing and reading eventually wear out the components of the NAND flash, so it is rated according to the number of erase cycles it can handle.

In contrast, ReRAM memory is based on the resistance level of cell material sandwiched between two electrodes, rather than on an electrical charge. WBT's ReRAM technology uses silicon nano-filaments (5nm to 7nm in diameter) as the switching mechanism between the two electrodes and importantly, uses silicon oxide (SiOx) as the cell memory material. This is important as the SiOx material is CMOS (Complementary Metal Oxide Semiconductor) compatible – the incumbent technology used to manufacture integrated circuits.

As a result, WBT's SiOx cells can be manufactured using existing semiconductor manufacturing processes, materials, and equipment. Our understanding is that several competitor ReRAM technologies being developed are based on memory material that is not commonly used in the semiconductor industry i.e., praseodymium (Pr), manganese (Mn), calcium (CA), and cerium (Ce)

## SiOx ReRAM product development in 2018

February 2018: Successful development of a 40nm 4kb memory cell array (i.e. an array with 4,000 cells); this scale up follows from the initial development of a single memory cell in November 2017.

May 2018: Extension of agreement with French research institute CEA-Leti (Leti) - a global leader in the field of micro-electronics and IT - to further develop and optimise WBT's ReRAM memory technology. WBT and Leti initiated the joint development program in September 2016.

June 2018: Successful development of a 40nm 1Mb memory cell array (i.e. an array with 1,000,000 cells); this scale up follows from the development of a 4kb memory cell array (4,000 cell array) in November 2017. At this level, the memory capacity is larger than is currently being used across most of the embedded NVM market, which is the first market segment the company is targeting.

August 2018: First packaged memory chips produced containing the SiOx ReRAM arrays. This is an important step in WBT's productization and commercialisation efforts as it enables interested technology partners to test the product capabilities in-house, while also allowing WBT to further test and refine the product outside the Leti laboratory.

October 2018: Leti laboratory reports successful data retention results on its scaled down 40nm array. The results indicate that WBT's technology can maintain stored information for over 10 years, which is above the requirement to be commercially viable. Data retention is one of the most crucial reliability parameters in the non-volatile memory market and poses a significant challenge in emerging memory technologies.

November 2018: WBT announces that it is to partner with the Non-Volatile Memory Research Group of the Indian Institute of Technology Dehli (IITD) to work jointly on a Neuromorphic ReRAM project. Artificial Intelligence (AI) is expected to play an increasingly significant role in future technology applications.

November 2018: WBT raises A\$4.5m (before costs) in a placement and oversubscribed share purchase plan (SPP) at 3.5cps. Funds will be used to facilitate the progress of the ReRAM technology to the next stage of productization, including scaling down to 28nm, further progressing talks with potential partners, and initiating work with production fabs.

December 2018: Appointment of Jackson Lam as VP Strategic Alliances, China, in an advisory capacity. Mr Lam will be responsible for WBT's partnerships in China, including customers, potential industry partners, and investors. The Chinese government recently allocated a 300 Yuan (US\$47bn) fund for developing the country's semiconductor industry - this makes China a prime target for semiconductor providers/ aspiring semiconductor providers.

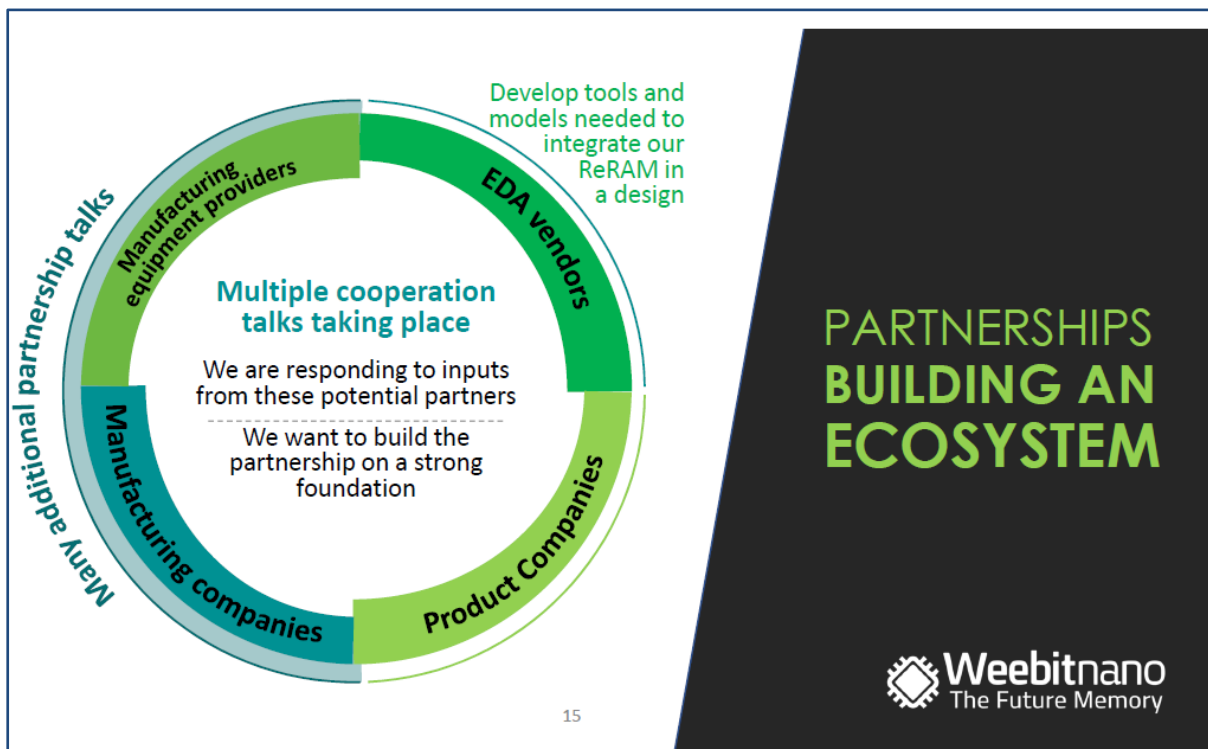
December 2018: Extension of agreement with French research institute Leti to include manufacturing the ReRAM memory cells on 300mm diameter production fab standard wafers; the memory cells are currently being produced on 200mm research lab wafers. In addition, the new vehicle size will be reduced to 28nm from 40nm. Scaling the technology up to a 300mm wafer will align the technology with current established manufacturing processes, while the move down to a 28nm vehicle will allow the cells to fit the ever-smaller geometries being used in the market.

## Expected timeline to commercialisation

In December 2018, WBT and Rice University announced that they had agreed to amend the original licence agreement dated 24 March 2015 to reflect the company’s progress towards commercialisation of the SiOx ReRAM technology and the change in focus towards the embedded memory market. The first annual minimum royalty payment has been delayed by one year from 1 January 2019 to 1 January 2020 to reflect the current commercialisation schedule. **WBT is targeting to manufacture 300mm wafers at 28nm in a research lab setting at Leti’s facilities in (calendar year) 2019, before the end-goal of entering into semiconductor production fabrication arrangements in 2020 with a yet-to-be decided/disclosed third party.**

On 9 January 2019, WBT announced that it had entered into a partnership with Silvaco Inc., a US-based electronic design automation and semiconductor IP provider, to develop TCAD models of WBT’s ReRAM technology. On 14 January 2019, WBT reported that tests carried out by Leti indicate that the ReRAM cells demonstrate stable voltage levels and endurance at levels competitive to production NVMs. In addition to technical parameter improvements, tests were carried out on production flexibility with wafers produced using a variety of tools and technologies. WBT stated that “we believe this progress ensures our ReRAM memories are very attractive for companies using leading-edge designs including leading Artificial Intelligence and Internet of Things applications”. We believe that the process optimisation developments announced in January will ultimately assist in the technology transfer to commercial manufacturers and put the group in a strong position with negotiating royalty terms. According to information presented at the group’s 2018 AGM, WBT is currently negotiating with a broad spectrum of industry participants including chip manufacturers.”

**Figure 4: Negotiations taking place**

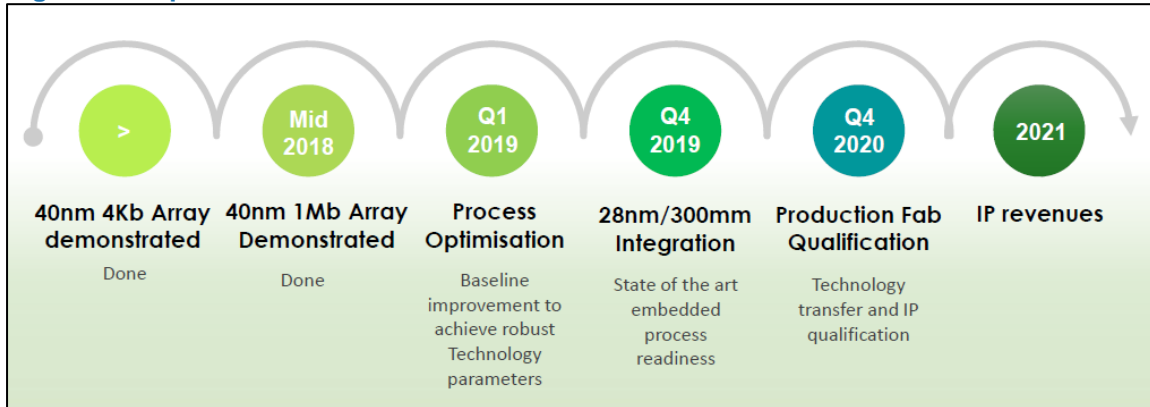


Source: Company



Predicated on WBT’s current timeline, the group is targeting to have a commercial agreement in place that would allow for first intellectual property (IP) royalties to be received in 2021 (2H FY21E). In addition, we suggest that, typical with IP royalty agreements, WBT should be able to negotiate a one-off licencing payment; for modelling purposes we assume a (nominal) A\$5m in FY20E.

**Figure 5: Steps towards commercialisation**



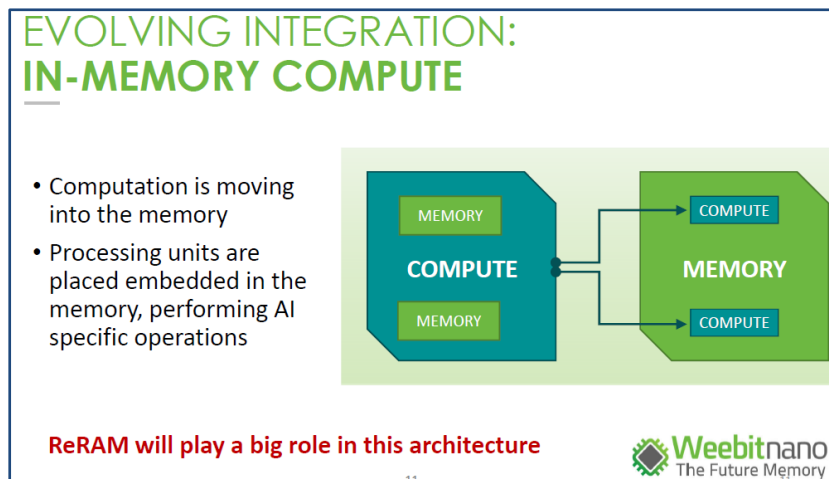
Source: Company

## Market size

Ever-growing data generation driven by mobile devices, the cloud, the IoT and big data, as well as novel artificial intelligence (AI) and virtual reality (VR) will demand continuous advancements in memory technologies. The broad consensus is that DRAM scaling will continue in the next five years (albeit at a slower pace), while continuous advancements in 3D integration approaches will allow NAND density to increase. Thus, the view is that emerging NVM technologies will not replace NAND and DRAM but they will rather complement them in “combined” memory solutions.

Significant upside potential for emerging NVM technologies lies in storage-class memory (SCM), also known as persistent memory; SCM is seen by many industry analysts as having the potential to be even more disruptive than flash. SCM is a hybrid storage/memory tier, slightly slower than DRAM but non-volatile (i.e., content is preserved during a power cycle).

**Figure 6: New application for emerging NVM technologies**



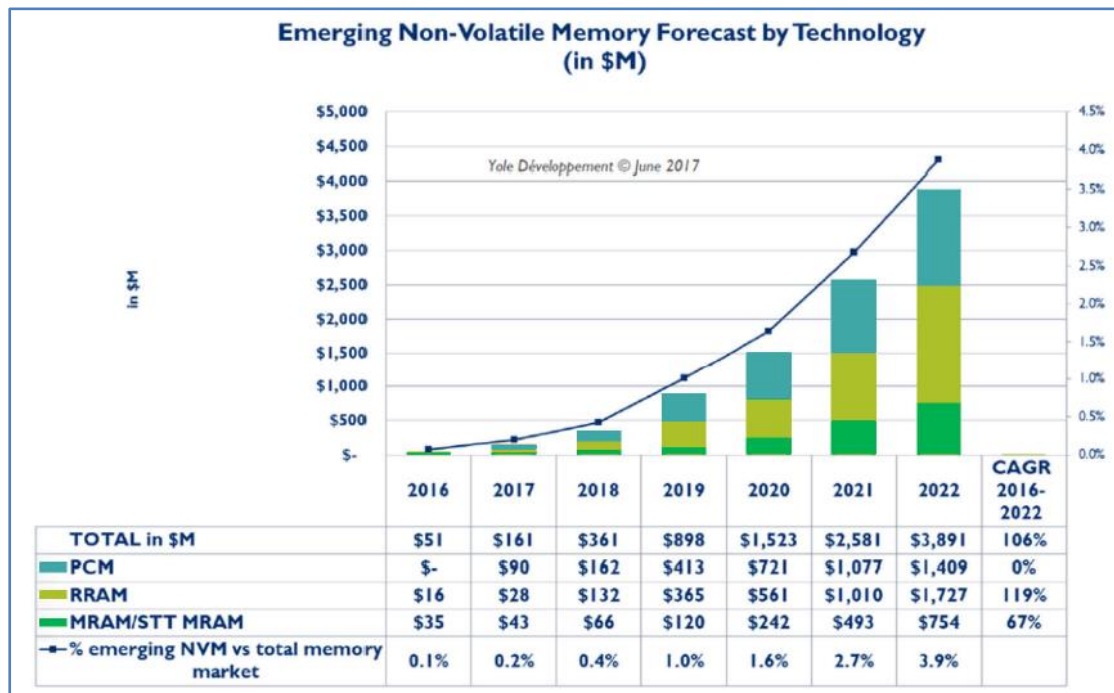
Source: Company

## Forecast royalty stream

Emerging NVM technology is forecast to benefit from the dynamic ecosystem (mobile devices, the cloud, the IoT, AI and VR) requiring ever-growing data generation. Forecasts supplied by WBT indicate the market for aggregate NVM technologies increasing by 13x from ~US\$300m in 2017/2018 to ~US\$3.9bn by 2022.

**Importantly, WBT indicates that resistive RAM (RRAM) technology will be a key player, accounting for some 45% of forecast revenues in 2022.**

Figure 7: Forecast growth in emerging NVM technology



Source: Company, May 2018 presentation

Using the above emerging NVM market profile and RRAM market share as a guide, and assuming WBT's share of the RRAM market increases from 20% in FY21E (maiden year) to a maximum of 40% by FY25E, we forecast royalty payments to WBT (assuming an effective unchanged rate of 1% on attributable revenues) increasing from A\$2.7m in FY21E to ~A\$19m in FY25E.

Figure 8: Forecast 10-year 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
Emerging NVM market (US\$m)	900	1,500	2,500	4,000	5,000	6,250	7,813	9,766	12,207	15,259
YoY growth (%)	-	67%	67%	60%	25%	25%	25%	25%	25%	25%
RRAM market share of emerging NVM (%)	35%	37%	40%	45%	45%	45%	45%	45%	45%	45%
WBT market share of RRAM market (%)	0%	0%	20%	25%	30%	35%	40%	40%	40%	40%
WBT market share (US\$m)	-	-	200	450	675	984	1,406	1,758	2,197	2,747
Effective royalty rate (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Royalty (US\$m)	-	-	2.0	5	7	10	14	18	22	27
AUD/USD exchange rate	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
<b>Royalty (A\$m)</b>	-	-	<b>2.7</b>	<b>6.0</b>	<b>9.0</b>	<b>13.1</b>	<b>18.8</b>	<b>23.4</b>	<b>29.3</b>	<b>36.6</b>

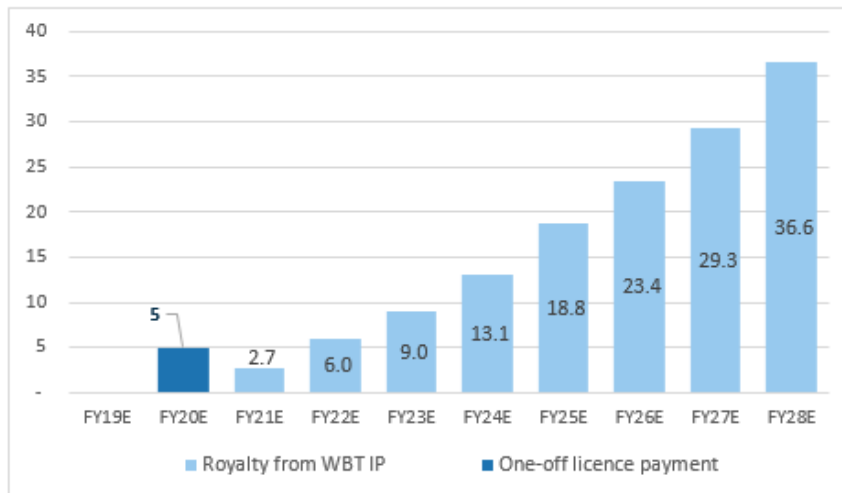
Source: State One Stockbroking forecasts.

## Revenue

Our forecast group revenue profile is comprised of a 1) the royalty stream from WBT's ReRAM technology and, 2) an anticipated one-off licencing payment in FY20E.

**Figure 9: Forecast revenue to FY28E (A\$m)**

Group revenue (A\$m)	FY19E	FY20E	FY21E	FY22E	FY23E	FY24E	FY25E	FY26E	FY27E	FY28E
Royalty from WBT IP	-	-	2.7	6.0	9.0	13.1	18.8	23.4	29.3	36.6
One-off licence payment	-	5	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	-	<b>5.0</b>	<b>2.7</b>	<b>6.0</b>	<b>9.0</b>	<b>13.1</b>	<b>18.8</b>	<b>23.4</b>	<b>29.3</b>	<b>36.6</b>



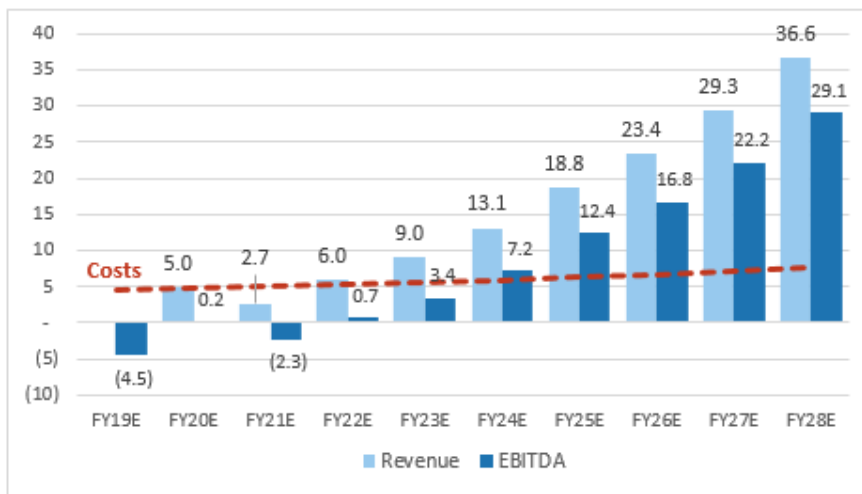
Source: State One Stockbroking forecasts.

## EBITDA

Predicated on our forecast revenue and cost profile, we forecast WBT's achieving first +ve EBITDA in FY22E.




**Figure 10: Forecast revenue to FY28E**



	FY19E	FY20E	FY21E	FY22E	FY23E	FY24E	FY25E	FY26E	FY27E	FY28E
Revenue (A\$m)	-	5	2.7	6.0	9.0	13.1	18.8	23.4	29.3	36.6
Costs (A\$m)	(4.5)	(4.8)	(5.0)	(5.3)	(5.6)	(5.9)	(6.3)	(6.7)	(7.1)	(7.5)
<b>EBITDA (A\$m)</b>	<b>(4.5)</b>	<b>0.2</b>	<b>(2.3)</b>	<b>0.7</b>	<b>3.4</b>	<b>7.2</b>	<b>12.4</b>	<b>16.8</b>	<b>22.2</b>	<b>29.1</b>



Source: State One Stockbroking forecasts.

Leadership team Source: Company

<b>EXECUTIVE DIRECTOR</b>	<b>CHAIRMAN</b>	<b>CEO</b>
 <b>Yoav Nissan-Cohen</b>	 <b>David Perlmutter</b>	 <b>Coby Hanoach</b>
<p>PhD. in Applied Physics, focus on SiOx memories</p>	<p>Ex-Intel EVP IEEE Fellow</p>	<p>Extensive management and sales experience</p>
<p>CEO of Tower Semiconductor for 9 years</p>	<p>Led Intel into the Data Center</p>	<p>38 years in the semiconductor domain</p>
<p>Board member, Saifun Semiconductor (NROM Flash)</p>	<p>Brought to Market: Centrino™ mobile technology</p>	<p>Heavily involved in Verisity and Jasper acquisitions</p>

<b>CTO</b>	<b>CFO</b>
 <b>Amir Regev</b>	 <b>Alla Felder</b>
<p>Two decades in Semiconductor engineering</p>	<p>20 Years CPA experience</p>
<p>45nm NOR Flash Technology Development at Micron</p>	<p>Senior Manager at PWC Israel</p>
<p>Was part of Automotive division at Intel</p>	<p>Active Board member of multiple companies in TASE and NASDAQ</p>

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