PITT STREET RESEARCH

Anteo Diagnostics

A blue-sky of Opportunities

Share Price: A$0.019

ASX: ADO

Sector: Healthcare

20 March 2019

POC and battery segments represent significant opportunities

Anteo Diagnostics, a Brisbane-based technology company, is developing a nano-chemistry technology to modify surfaces. The company has streamlined its focus from an initial target segment of the entire life sciences diagnostics and IVD space to specific areas such as the Point of Care (POC, representing a major chunk of IVD industry) and battery segments. The POC segment is a near-term opportunity for Anteo on the back of its more-than-a-decade-old experience in the IVD space. The opportunity in this >US$15bn market is huge due to the demand for nanoscale platforms in POC devices that can bring them head-to-head with lab-scale devices without compromising on advantages related to their ease of use. We thus believe that Anteo has a tremendous potential to make POC devices more effective. In fact, a few initial collaborations have already proven its potential as large players, such as GSK and QIAGEN, have shown interest in POC devices modified using Anteo's technology.

Anteo is also evaluating the potential of its technology in the battery segment, which represents a long-term opportunity for the company. It is currently conducting validation studies in this segment and has secured initial collaborations with battery component suppliers. These agreements represent an opportunity to bring the technology to a broader audience and drive adoption.

Investment Case

Anteo has decided to streamline its focus on high-value opportunities, including POC and batteries. The unmet need in both sectors is tremendously high and Anteo's technology aims to fulfill it. We believe Anteo's strategy to focus on important opportunities first is a great way to utilize its cash. The ongoing collaborations are expected to continue to drive the commercialization potential of this technology. Meanwhile, a licensing opportunity in other areas, such as medical devices, would be an added advantage.

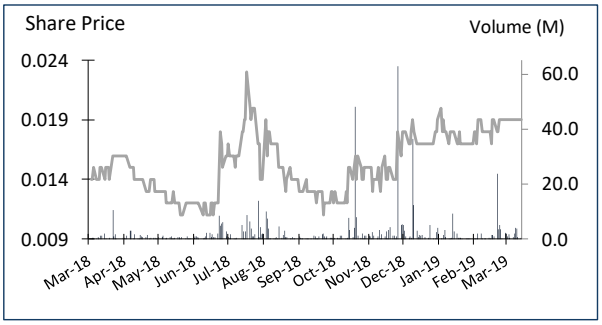
Valuation

We value Anteo at 2.9 cents per share base case and 4.0 cents per share optimistic case using a probability-weighted DCF valuation approach. We see Anteo being re-rated by the market as its Battery project yields highly efficient silicon composite anodes, and as the POC project moves towards commercialization.

Market Cap. (A$ m)	21.9
# shares outstanding (m)	1,152.8
# share fully diluted	1,163.3
Market Cap Ful. Dil. (A$ m)	22.1
Free Float	100%
12 months high/low	0.023 / 0.011
1 / 3 / 12-month performance	6% / 6% / 27%
Website	anteotech.com

Source: Company, Pitt Street Research

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



Source: Pitt Street Research

Valuation metrics	
DCF fair valuation range (A$)	.029 / .041
WACC	15%
Assumed terminal growth rate	None

Source: Pitt Street Research

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Analyst: Stuart Roberts

Tel: +61 (0)447 247 909

Stuart.roberts@pittstreetresearch.com

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Introducing Anteo Diagnostics (ASX: ADO)

Anteo Diagnostics (ASX: ADO) is a Brisbane-based nanochemistry technology and diagnostics company that develops products for the healthcare and energy sectors. Anteo's patented nanochemistry surface engineering technology, called Anteo Surface Technology, combines the strength and stability of covalent binding with the gentleness of passive binding through multipoint chelation. The company has been conventionally involved in providing materials and services for commercial applications using its reagents, binders, coatings, or primers. However, over the past couple of years, it decided to focus efforts on its surface coating technology through three products – AnteoCoat, AnteoBind, and AnteoRelease. Target markets for these products include protein binding and antibody coupling (e.g., point-of-care [POC] devices), primers for in vivo medical devices and clinical drug delivery, and coatings for industries such as life sciences, in vitro diagnostics (IVD), and energy.

Anteo's nanochemistry technology can be used to modify any surface to improve the binding of molecules. Thus, the application base of this technology is extremely diverse and is useful in industries such as medical devices, diagnostics, energy, electronics, industrial, environmental, and food and agriculture. In the early years of Anteo, diagnostics was its major area of focus. The company was making concentrated efforts to enhance particles, to improve their performance in IVD assays (particularly immunoassays with c.US$20bn market). Back then, Anteo saw enormous potential in this segment, considering the high volume of tests conducted every year. It had planned to target diagnostics giants – such as Roche, Abbott, and J&J – as well as particle manufacturers including Bangs Laboratories and Merck[1]. Considering the large industry base and the potential of its technology (then called Mix&Go) to make the assays quicker and more reliable, the company invested close to a decade in exploring its potential in the diagnostics industry. However, customer feedback and market analysis revealed the plenty of challenges associated with the market penetration of this technology. This is mainly because the diagnostics sector is tightly regulated and large players are reluctant to modify their fixed test menus with improved assays. Subsequent market analysis suggested that Anteo had developed overly broad solutions, which complicated the task of finding the best target customers in each area.

Anteo has used market analysis to streamline focus on high-value markets

Based on consequent learnings, Anteo decided to focus on specific segments, including POC, within the IVD space and lithium-ion (Li-ion) batteries, within the energy space. We believe Anteo's strategy to concentrate on the most lucrative growth segments to generate revenues has the potential to create value and sustain the business in the long term.

How DIAsource's divestment shaped the company's strategy

When Anteo acquired DIAsource ImmunoAssays back in 2016, it had a lot of debt on its balance sheet – owing large sums to the vendors of DIAsource, investors, and directors. This, combined with the management's lack of success in securing long-term financing for the acquisition, influenced the board's decision to sell the DIAsource business for US$18.5m in September 2017. The sale provided the company some cash to support value creation opportunities in the POC and battery segments after repaying all outstanding loans that it had secured. Thereafter, Anteo decided to focus on its core surface coating technology through three products – AnteoBind, AnteoCoat,

[1] The company was able to forge a licensing deal with these companies

and AnteoRelease. The company leveraged past investments in the technology to streamline most potential markets where it had the maximum opportunity to make a difference. Thus, DIAsource's divestment was crucial to help Anteo realize its technology's value.

Why Anteo's focus on POC and Li-ion batteries has the potential to bring long-term shareholder value

Anteo's strategy to focus on two initial areas – Li-ion batteries and POC – that entail a high-unmet need and near-term growth opportunities will make it possible to generate substantial revenues to sustain the company for at least a few years.

Within the battery segment, there is tremendous focus on improving energy density and battery capacity. One of the best strategies to achieve this is by using silicon in battery anodes. However, currently, the silicon content in Li-ion battery anodes is estimated to be limited to only about 6wt.% due to problems related to its expansion and contraction at a higher density. AnteoCoat helps overcome this issue, and Anteo believes it can increase the silicon content in anodes ultimately to up to 40wt.%. Considering the rising focus on electrification, especially with growing interest in improving the capacity of electric vehicles (EVs), Anteo has a potential to target an enormous market dominated by large players such as Samsung and Panasonic.

Within POC, there is increasing focus on developing nanoscale surfaces that can compete with lab-scale devices

Within the POC sector, there is an increasing interest in developing nanoscale surfaces with the same potential as lab-scale devices – compared with the IVD sector (wherein Anteo's technology is a value-add and not a must-have). The company has already entered into partnerships with POC device manufacturers and has demonstrated commercial potential. One of its partner companies, Ellume, recently secured an agreement with large players – GSK and QIAGEN – for its POC device. The deal has the potential to drive up the volume of testing conducted by Ellume and hence boost the demand of Anteo's technology. With an enormous near-term opportunity in POC and long-term opportunity in the battery segment, we believe Anteo is headed in the right direction.

Moreover, while Anteo has decided to deprioritize other sectors such as medical devices, drug delivery, and food and agriculture, it is still open to out-licensing opportunities where a collaborator shows interest. We strongly believe in the viability of Anteo's strategy to focus on two segments with the current cash-in-hand and utilize the revenues to decide the further course of action. Our assessment suggests that once the company has explored the opportunities in these segments, it can evaluate investing in other longer-term opportunities, such as medical devices/implants, to continue to grow the business.

Ten reasons to consider Anteo (ASX: ADO)

1) **Anteo's strategy to focus its efforts on only a couple of segments seems prudent.** The company previously targeted a plethora of immunoassays with its AnteoBind technology; however, it now has a deeper understanding of *'what the market wants'*, and it is building upon this knowledge by focusing its cash inflow only on two areas where the chances of success are the highest – the POC and battery segments.
2) **Anteo's technology has a 'blue sky' of applications.** Even though the company has decided to focus on two key applications of the technology – in the POC and energy sectors – we believe that the technology can be

applied to a number of other areas (medical devices being one). The potential of the company to garner licensing deals in these presently 'non-core' areas is evident.

3) **Anteo has a high potential for rapid uptake in the POC testing segment.** It has already collaborated with POC manufacturers and demonstrated that its technology offers improved assay performance within the cardiac, fertility, and infectious diseases space. With promising results from all the collaborations, we believe Anteo has a significant near-term opportunity with respect to generating revenues from the POC segment.

4) **The need for nanoscale devices in the POC testing segment is very significant.** Currently, there is high focus on making POC devices comparable with lab-scale devices without compromising on their ease of use. Anteo's nanotechnology aims to plug this gap and therefore has a huge market potential.

Based on results generated so far, Anteo's technology has received interest from battery component suppliers

5) **Anteo's initial results in the battery segment are promising.** The company has shown that AnteoCoat has the potential to address the problem of limited energy density of Li-ion batteries, along with the capability to reduce the cost of manufacturing. These benefits offered by Anteo are extremely encouraging for the battery sector.

6) **Anteo has already been able to strike deals with two battery makers in one month.** The deals demonstrate that battery component suppliers are already showing extremely positive interest in the technology's capability to improve the capacity of their batteries.

7) **Multiple large battery manufacturers are investing in improving the energy density of batteries.** In line with increasing focus on electrification, many large players are making investments in developing new technologies that can aid the future of EVs (expected to be a huge opportunity over the next few years). Some companies are also keen to strike collaborations with firms, such as Anteo, that have developed interesting technologies to boost battery capacity.

8) **Lithium-ion batteries are a massive market opportunity**. As the cost per GWh of a lithium-ion battery drops markedly over the next decade we see the global market opportunity rising from perhaps US$20bn today to more like US$130bn in 2030. This provides significant upside if Anteo's technology is adopted by any of the leading battery manufacturers.

9) **There is significant opportunity for the use of the technology in active implants.** There is a growing adoption of miniaturized implants as they are less harmful to the body during implantation. We are certain that as soon as Anteo finds a new collaborator (after conclusion of the Cook Medical partnership), it would demonstrate significant benefits for this sector as well.

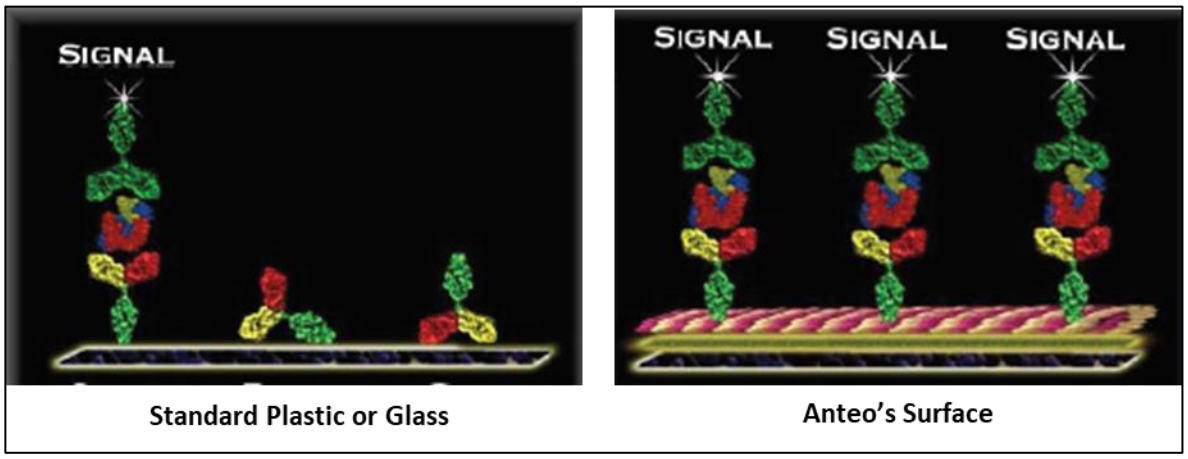
10) **Anteo is current trading underneath out valuation range**. We value Anteo at 2.9 cents per share base case and 4.0 cents per share optimistic case using a probability-weighted DCF valuation approach. We see Anteo being re-rated by the market as its Battery project yields highly efficient silicon composite anodes, and as the POC project moves towards commercialization.

Anteo's technology aims to change the way surfaces are developed

Anteo's surface chemistry technology uses polymeric metal ions to attach proteins to synthetic surfaces via chelation and coordination chemistry. The

technology utilizes multiple weak bonds to hold the proteins strongly in place. This works when polymeric metal ions form coordinate bonds with synthetic surfaces on one side and biomolecules on the other (Figure 1).

Figure 1: How Anteo's Surface Technology Works



Source: Company

How is Anteo's technology valuable?

The technology finds multiple applications across the life sciences and the diagnostics industry:

- **Diagnostics**: Glass and plastic surfaces are used to carry probes that can detect a target molecule.
- **Drug Manufacturing**: Surfaces are used to carry columns or membranes that can remove impurities from a batch of products.
- **Drug Discovery**: Surfaces hold the drug target, while a compound library is screened against that target.

Besides life sciences and diagnostics, Anteo is evaluating the use of its technology in the energy sector to build surface-modified silicon for use in battery anodes. Such diversified applications make the technology extremely valuable.

The technology offers several advantages over conventional methods used to bind molecules to surfaces:

- The mechanism aids the gentle immobilization of proteins onto the surface, resulting in improved performance and workflow advantages over conventional covalent or passive binding chemistries.
- The technology uses metal ions in a polymeric complex form that utilize multiple, slow-exchanging coordination interactions – leading to the formation of a strong, yet flexible, bond.
- The activated metal complex surface can remain stable for a long duration, which is an added advantage over most reactive covalent chemistries that degrade very quickly after chemical activation. In fact, Anteo's technology provides the flexibility to either have a ready-to-use activated surface or particle stored for up to 12 months.

Anteo's surface technology enables formation of strong bonds between target molecule and modified surface

– The platform works on a broad range of synthetic materials used in the life sciences and the diagnostics industry, as well as other industries (e.g., energy)

How is Anteo using this technology?

Traditionally, Anteo has been using its technology to create new surfaces and screen them to find the most optimal one for the target molecule. The company filed several patent applications in the early 2000s that outline its initial strategy for developing new surfaces using this technology:

– Anteo uses 'combinatorial chemistry' to make surfaces, which are built using a fundamental chemical unit called the Synthon. The unit comprises three elements – a chemical backbone coating on the solid substrate that comprises a passive and active constituent, a spacer unit, and a functional group. By introducing variations in these Synthon elements, Anteo is able to generate large libraries of surface coatings. The technology is covered by Anteo's WO/2003/095494 patent application.

– The company also has a patent application for a grafting method (WO/2002/050171), which includes a way of coating the selected polymer-based surface onto conventional glass or plastic surfaces. This process involves subjecting the conventional surface to physical stress, such as heat or radiation treatment.

– To make the entire process faster, the company has designed bioinformatics software that enables thousands of in-silico surfaces to be screened for their ability to bind to a particular target of interest.

Traditionally, this technology had been used to identify surfaces that appeared to be relevant to the target molecule[2], test them using a microarray[3], and feed the results into bioinformatics databases to allow further iterations of the virtual surface search process. Ultimately, Anteo's scientists have been able to select the optimal surface for the application in question.

However, Anteo's focus has now extended beyond the original use of the technology. In recent years, the company increased its focus on exploring the potential application areas of this technology (rather than on using the technology to discover surfaces). It is working on developing robust feasibility data and protocols acceptable to life sciences/energy companies. We believe that this strategy can help Anteo discover more targeted segments for its core capability, thus generating significant shareholder value in the long term.

Anteo is developing AnteoBind for POC testing and AnteoCoat for batteries

Anteo is focusing on three products – AnteoBind, AnteoCoat, and AnteoRelease

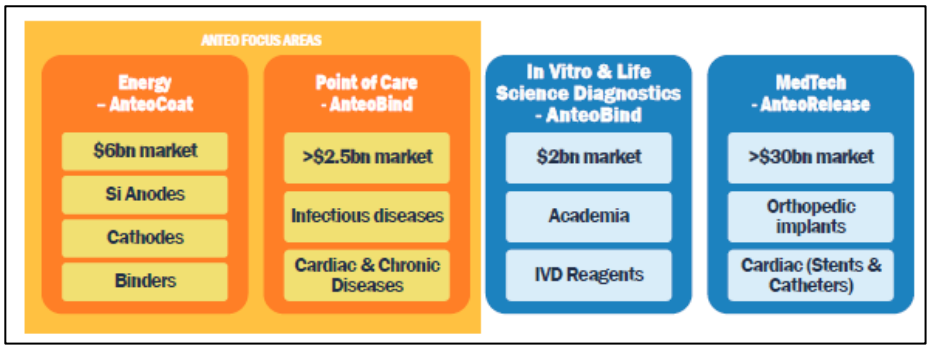
Historically, Anteo had been targeting life sciences, diagnostics, and R&D sectors through universal kits and assays based on its Mix&Go technology. However, the company eventually recognized the importance of streamlining its focus to specific segments, where its technology could be deployed and generate commercial value. Recently (2017–2018), the company re-strategized its focus to develop the following products that utilize its proprietary surface technology (

Figure 2):

[2] Anteo can generate thousands of potential surfaces a month using its software.
[3] A microarray is a surface containing an array of surface types, to allow multiple tests to be undertaken simultaneously.

- **AnteoBind**: Serves life science diagnostics segments – including in-vitro diagnostics (IVD) and POC
- **AnteoCoat**: Caters to Li-ion batteries within the energy segment
- **AnteoRelease**: Caters to the medical technology sector

Figure 2: Anteo's Focus Areas



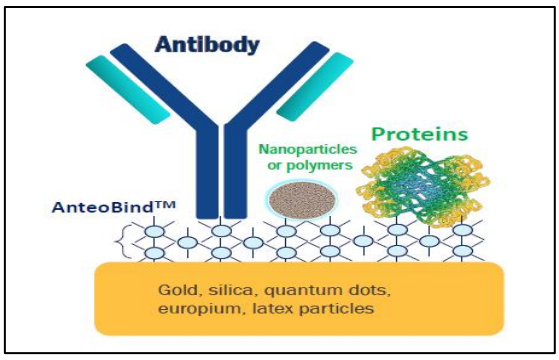
Source: Company

AnteoBind

The AnteoBind family of reagents addresses issues related to antibody conjugation in the life sciences and diagnostics sectors. These reagents use coordination interactions to gently attach macromolecules to the surfaces of a variety of materials (such as europium, gold, quantum dots, dyes, and potentially carbon) (Figure 3). AnteoBind is an extremely important technology in the wake of its multifold advantages, including the following:

- **Ease of Use**: The process of using AnteoBind is simple and only requires addition of the AnteoBind solution and washing off the excess. Moreover, the process is highly reproducible.
- **Stability**: Activated particles can be stored in a stable condition without any loss of functionality.
- **Active Binding**: AnteoBind decreases protein damage and improves assay performance.

Figure 3: Mechanism of Action of AnteoBind



Source: Company

It was found that benefits of AnteoBind did not outweigh regulatory cost in the IVD industry

IVD is the most advanced application of AnteoBind, and the company has already commercialized its assays and kits across multiple IVD platforms supporting life sciences and diagnostics companies. Although this was initially considered one of the most important revenue streams for Anteo, it was

observed that many IVD platforms that Anteo had been conventionally targeting had reached a performance plateau. Thus, Anteo re-evaluated its strategic focus and found that the benefits of AnteoBind (improved specificity and sensitivity) did not seem to outweigh the regulatory cost and burden associated with its commercialization.

Therefore, Anteo decided to target more specific segments within the IVD sector, including the POC segment, where there is a high unmet need for nanoscale surface areas. POC testing, done at the clinic at the time of consultation or during surgery, is a rapid diagnostic testing technique that bears quicker results and helps physicians in making better treatment decisions[4]. These POC systems are now evolving to compete with traditional laboratory-based platforms and the industry is focusing on making them more accurate and sensitive. These trends are driving improvements in reagents and materials used in lateral flow immunoassays (LFIA)[5] – a need that AnteoBind aims to fulfill.

AnteoBind has demonstrated high potential for use in LFIA

To develop prototypes and show the commercial potential of its technology, Anteo has so far collaborated with various industry partners – including Ellume, Atomo Diagnostics, Planet Innovation, and Sona Nanotech – to design improved LFIA tests for infectious diseases, fertility, and cardiac markers (troponin). The results from feasibility testing conducted by Anteo in collaboration with these partners indicate that the working prototypes of lateral flow tests using AnteoBind have performance characteristics equal to or better than those exhibited by existing commercially available tests. The benefits offered by AnteoBind in LFIA are as follows:

- **Improved reproducibility of conjugate manufacturing**: AnteoBind simplifies production, and improves test reliability and consistency. Additionally, the systems are stable when stored for a relatively longer duration.
- **Improved assay performance**: AnteoBind leads to quicker test reaction time, reduced sample size, better analytical sensitivity, and lower limit of detection
- **Faster commercialization**: It can significantly reduce development and transfer times.
- **Quantitative testing**: There is scope for quantitative tests with possible multiplexing strips.

Anteo was also able to demonstrate promising outcomes when the prototype results were transitioned into a 'real-world' serum-based system. With proven expertise in IVD and extremely promising early-stage results in the POC segment, we believe that AnteoBind provides significant near-term opportunities for Anteo.

AnteoCoat

Anteo is evaluating the ability of AnteoCoat – another nano-coating technology – to augment the performance of silicon when used as a replacement for graphite in Li-ion batteries. Silicon, when used in battery anodes, overcomes challenges related to performance and low energy density (contributed by use of graphite alone). However, it is highly unstable in this environment[6]. AnteoCoat is designed to address the stability challenges associated with the use of silicon and in turn improve battery performance. The technology provides a 'drop-in' approach for developing

[4] These tests are best suited for situations where a small number of analytes are tested
[5] Gold colloids have dominated the LFIA space historically
[6] Refer to the section 'Anteo's technology overcomes challenges prevailing in the battery industry' for detailed coverage on industry challenges

high-performance battery materials, compatible with current and near-term battery manufacturing processes. The advantages offered by AnteoCoat are as follows:

- It supplements the current graphite anodes without requiring significant new capital and equipment
- It can be built on commercially available raw materials (Si particles, carbon conductors, and polymer binders)
- It has low-cost, highly-scalable, and environmental-friendly processing
- In conjunction with graphite it offers higher battery capacity, longer battery life, smaller and lighter batteries.
- It is versatile, i.e., it works with both particle materials and bulk/film electrodes for high-performance batteries

AnteoCoat is being evaluated for its potential to augment the performance of silicon in Li-ion batteries

To evaluate the performance of AnteoCoat, Anteo engaged with two third parties – Polaris Battery Labs (a US-based laboratory testing consulting company) and CustomCells (a Germany-based Li-ion battery manufacturer) – and demonstrated that AnteoCoat has the potential to improve battery capacity considerably. Due to favorable results and strong interest from manufacturers of Li-ion batteries, in 2016, Anteo decided to develop in-house capabilities for manufacturing half-coin Li-ion batteries, specifically in nano-binders and coatings. By 2018, the company transitioned the entire battery-related work in-house to decrease reliance on third-party evaluation. This decision has given Anteo greater control over development parameters, experimental timelines, and the protection of commercially sensitive information.

With respect to its intellectual property (IP), Anteo has adopted a broad patent strategy that targets key Li-ion consumer and producer markets. The company has already filed for patent protection over AnteoCoat[7].

Anteo is focusing on improving battery performance by using AnteoCoat in battery anodes, cathodes, and silicon binders. For improving the performance of anodes and increasing their silicon content, the company is using one of the two approaches – modify the surface of silicon or form silicon composites (Figure 4). Initial tests have indicated that AnteoCoat improves battery performance by forming strong bonds between silicon and binder, which enhances structural integrity. Moreover, the integrity is maintained even after hundreds of deep charge/discharge cycles. Thus, AnteoCoat significantly improves battery life.

Figure 4: Uses of AnteoBind

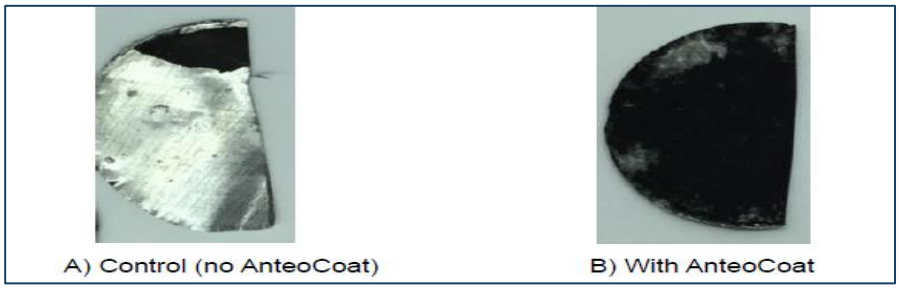
Source: Company

Anteo has also conducted some initial studies to evaluate the use of AnteoCoat on cathodes. In initial tests, a metal complex cathode coated with AnteoCoat was intact after 1,000 deep charge/discharge cycles, with some residual white separator material, while the metal complex cathode not

[7] Source: '*Anteo Files its Battery Patent in Key Lithium-ion Markets*', 30 October 2017

coated with AnteoCoat was cracked and a majority of the cathode material had dislodged from the supporting foil (Figure 5).

Figure 5: AnteoCoat for Cathodes



Source: Company

Anteo has received significant interest in surface modified silicon from global manufacturers of battery materials. The company has already signed material transfer agreements with two potential commercial partners to evaluate the performance of AnteoCoat and the potential for joint commercialization of silicon active material products. High opportunity in the battery segment, along with Anteo's fast-paced movement, points toward a significant upside potential for the technology in the near term.

AnteoRelease

AnteoRelease includes binders and coatings based on Anteo's nanotechnology that cater to the medical devices market, especially in the area of active implantable medical devices (AIMDs) in the cardiology, diagnostic imaging, orthopedics, and dental sectors. The technology is being evaluated for its potential to improve the durability and consistency of devices, thus reducing or eliminating health risks to patients during and after surgical processes. Initial feasibility results from a collaboration with Cook Medical are quite encouraging. However, the company is currently exploring cost-effective options to realize the value of the AnteoRelease technology.

POC testing – a near-term opportunity for Anteo

As part of its strategy to focus on specific segments within the IVD space, Anteo is evaluating the use of AnteoBind in the POC testing segment to overcome challenges associated with current technologies, such as conjugation inefficacies[8]. The following industry developments are expected to benefit Anteo's POC strategy:

There is increasing focus on technology advancements in the POC testing market

– **Prevalence of chronic and infectious diseases** – which require diagnostic tools that can produce rapid, specific, accurate, robust, and actionable results with the requirement of minimal infrastructure[9] – is rising. As per the World Health Organization (WHO), infectious diseases are a leading cause of death in low-income countries and contributed to 5.7 million deaths worldwide in 2016[10]. Similarly, the global prevalence of chronic

[8] Conjugation inefficacies are seen with the use of europium, gold, quantum dots, dyes, and potentially carbon in detection systems during assay development.
[9] J Clin Microbiol. 2017 Aug;55(8):2313-2320.
[10] Top 3 infectious diseases – lower respiratory infections (3.0 million deaths), diarrheal diseases (1.4 million deaths), and tuberculosis (1.3 million deaths)

diseases such as diabetes has increased from 4.5% in 1980 to 8.5% in 2014[11].

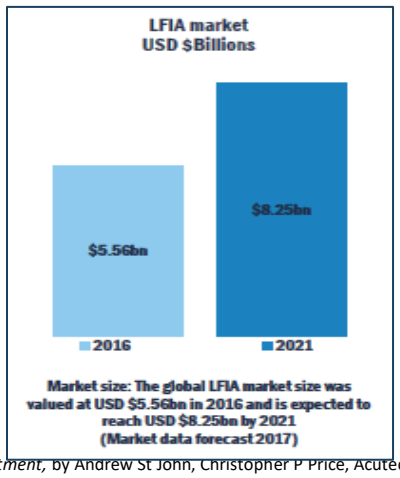
- **Focus on technology advancements,** such as miniaturization, introduction of lab-on-chip devices, nanotechnology, and microfluidics, has increased in the past few years. These advancements not only reduce the overall cost of diagnostics, but also help in performing rapid testing through the use of simple and portable devices[12,13]. Moreover, the new generation of POC devices are increasingly employing nanotechnology solutions; these solutions require newly designed methods to bind macromolecules to biological surfaces (a need that Anteo's technology aims to fulfill).
- **Growing need for cost-effective and rapid testing is driving the need for POC testing**. POC tests enable rapid treatment decision-making, thereby reducing the overall mortality rate[14]. Furthermore, these tests are also cost-effective due to limited or no requirement of infrastructure and low requirement of skilled staff[15,16].
- **Existing platforms have reached a performance plateau** with regard to sensitivity and specificity. Therefore, demand for solutions that increase accuracy and efficiency of platforms is quite high.

In terms of value, POC testing is a multibillion-dollar market. According to industry reports, it was valued at US$15.4bn in 2016 and is expected to reach US$20.9bn by 2024. With a growing focus on use of nanoscale in POC testing, Anteo will likely be able to gain significant market share.

Global market for POC testing is expected to reach US$20.9bn by 2024

Within the POC segment, Anteo is particularly targeting LFIA with its AnteoBind technology. LFIA represents an attractive growth opportunity considering its huge growth potential (Figure 6). According to MarketsandMarkets[17], the global market for lateral flow testing is expected to post a 7.7% CAGR during 2018–2023 to reach US$8.7bn. Moreover, Anteo is particularly focusing on developing this technology for use in infectious and cardiovascular diseases. According to the WHO, cardiovascular diseases were responsible for 17.9 million deaths globally in 2016[18]. With an enormous addressable market, LFIA manufacturers are continuously incorporating new technologies to improve performance of their platforms, thus generating a potential opportunity for Anteo.

Figure 6: LFIA Market (US$bn, 2016–2021)



[11] According to a report published by WHO in October 2018
[12] Lab Chip. 2001 Dec;1(2):83-95.
[13] Lab Chip. 2012 Jun 21;12(12):2118-34.
[14] See *Benefits of point-of-care testing in the Emergency Department*, by Andrew St John, Christopher P Price, Acutecaretesting.org, March 2018
[15] In a study by Straub et. al., the average expected total cost in the POC branch was US$329 lower for every treated patient than that in the standard laboratory branch
[16] Clin Microbiol Infect. 2010 Aug;16(8):1070-6.
[17] The firm's name has no spaces in it – see www.marketsandmarkets.com.
[18] Source: WHO, Key Facts: Cardiovascular Diseases.

Source: Company

China represents an interesting opportunity in the IVD and POC markets

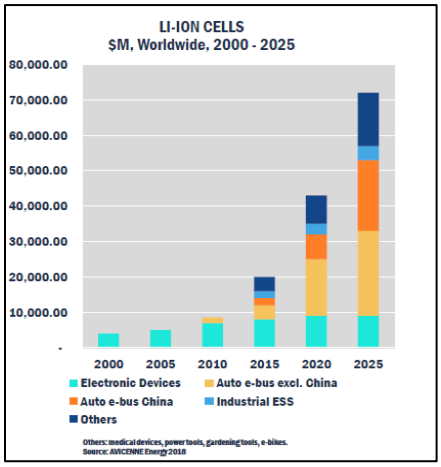
Geographically, Anteo is increasingly focusing on China as an initial target market. Reports suggest that although North America accounts for the largest share of the POC market globally (42% in 2016)[19], it is closely followed by Europe and APAC. APAC is expected to witness the highest growth rate in the LFIA testing segment between 2017 and 2023 due to rapid growth in the healthcare industry in India and China. In fact, China represents one of the most exciting and untapped opportunities in the POC market, accounts for 20% of the country's IVD market (c.US$1.2bn by 2022)[20]. Further, China is also believed to be a key manufacturing site for POC tests, with a keen focus on the use of new technology/solutions for improving the performance of its current generation of assays. To tap this opportunity, Anteo has already signed a distribution agreement with Shanghai GeneoDx Biotechnology Co. Ltd (GeneoDx), a China-based IVD company with established connections with various Chinese POC manufacturers. The agreement aims to gather market feedback on AnteoBind product range and refine its value proposition[21]. With the right strategy in place, Anteo seems to be all set to cater to this huge market segment.

Battery segment – a novel sector beyond life sciences

Since its inception, Anteo's management has been confident of a considerable potential for the company's technology in numerous diverse fields, including the energy or battery sector. If successful, the company expects to be able to garner significant amounts of money from battery manufacturers on the back of increasing focus on electrification across different segments.

The market opportunity of Anteo's technology is extremely significant, considering the industry's focus on capacity expansion and cost reduction. The Li-ion battery market is estimated to be valued quite attractively at US$70bn by 2025 (as estimated by Avicenne Energy) (Figure 7).

Figure 7: Li-ion Battery Market (2000–2025)



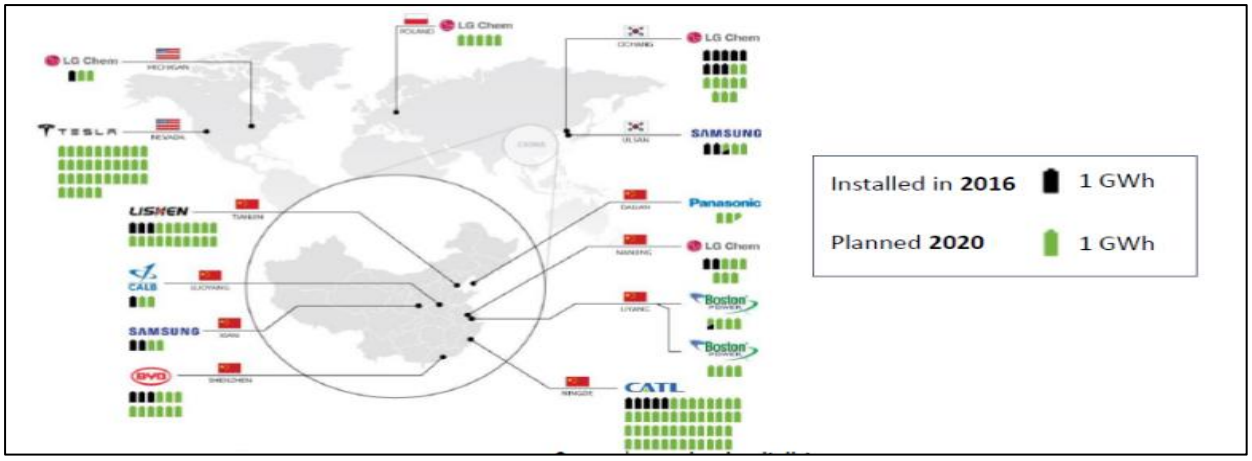
[19] Reports published by Transparency Market Research and Mordor Intelligence.
[20] See *Anteo Diagnostics looks to expand market footprint in Chinese in-vitro market,* By George Tchetvertakov, December 13, 2018.
[21] See Anteo's ASX announcement dated 13 December 2018 and headlined 'Distribution agreement with major China-based Diagnostic Company'.

Source: Company

According to forecasts by Benchmark Mineral Intelligence, Li-ion battery production capacity is expected to rise 399% over the next decade (passing the impressive 1 TWh milestone)[22]. The demand is fueled by growing need for plug-in vehicles, automation, and battery-operated material-handling smart devices and other industrial goods. Of all the major areas of application, growth in the electromobility sector is expected to account for a major chunk of the battery market's growth. Bloomberg predicts that the demand for EVs would increase from 1.1m in 2017 to 11m in 2025 and 30m in 2030[23]. This will have an extremely positive impact on Li-ion batteries, as these are the major sources of power supply for EVs. In fact, Sanford C. Berstein & Co. predicts that the market for EV batteries will hit the US$500bn mark by 2050[24].

There is enormous demand for Li-ion batteries with improved energy density, as the more power a battery can store, the longer is the vehicle's range[25]. Most demand and capacity expansions have been seen in China, followed by the US, Korea, and Poland. Li-ion battery manufacturers in China are expected to grow capacity 6X by 2020[26] (Figure 8).

Figure 8: Global Capacity (Installed and Planned)



Source: Benchmark Mineral Intelligence (2017)

Li-ion battery manufacturers in China are expected to grow capacity 6X by 2020

Leading EV manufacturers, such as Samsung, have already set targets to improve battery capacity by 30% by 2020. To achieve this, manufacturers are primarily working to improve the materials used for making anodes (c.US$1.16bn market) and/or cathodes (c.US$4.7bn market). BMW hybrids – slated for introduction in 2023 – would be equipped with battery packs that have silicon-based anodes[27]. Samsung has already developed a way to boost the energy density of batteries by c.28% using a technology that covers the cathode and anode material with graphene balls (synthesized from silicon dioxide)[28]. Tesla's 'Model 3' batteries, made by Panasonic, start with an anode made up of 10% silicon, which provides a 30% boost in energy density[29]. While the two companies are measuring improvements in different ways,

[22] See *Battery Megafactory Forecast: 400% Increase in Capacity to 1 TWh by 2028,* By Jeff Desjardins, Visual Capitalist, October 19, 2018.
[23] China will lead this transition, with sales there accounting for almost 50% of the global EV market in 2025.
[24] See *EV Growth Increases Lithium-Ion Battery Demand,* Ultralithium, November 1, 2018.
[25] See *How electric car batteries are improving despite drawbacks, risks,* By Anna Hirtenstein, Automotive News, October 18, 2018.
[26] See *China Leading the Charge for Lithium-Ion Megafactories,* By Jeff Desjardins, Visual Capitalist, February 17, 2017.
[27] See *The Race For Silicon Anodes,* By Debra Fiakas, ALT Energy, August 28, 2018.
[28] See *Samsung's Reveals Li-Ion Battery with Graphene Balls: Higher Capacity, Faster Charging,* By Anton Shilov, AnandTech, November 29, 2017.
[29] See *Model 3 batteries with 10% silicon anodes for higher energy density and lower cost,* By Brian Wang, Next Big Future, April 7, 2016.

what their research efforts show is that silicon will increasingly be used in battery anodes[30]. In fact, the opportunity in the use of silicon in battery anodes is so high that market research companies estimate the anode battery market to grow at a 20.8% CAGR during 2018–2028, to US$982.6m.

The interest of large global companies in increasing battery capacity represents a huge commercial opportunity for Anteo, especially as some of these companies are looking for expansion and investment opportunities in novel technologies that improve anode capacity. For example, in October 2018, LG Chem invested in Enevate Corporation – an advanced Li-ion battery technology start-up based in the US. Enevate's HD-Energy technology for EVs enables production of Li-ion cells with up to 50% higher capacity than conventional graphite cells[31].

Manufacturing cost of batteries is expected to reach a tipping point at US$100/kWh by 2025

Besides capacity improvement, the industry is focusing on reducing the cost of battery manufacture to keep up with the industry demand for lower battery prices[32]. According to a 2018 McKinsey report, the manufacturing cost of batteries fell from US$1,000/kWh in 2010 to US$230/kWh by 2017. It is also estimated that the manufacturing cost of batteries will reach a tipping point at US$100/kWh by 2025 – at this point, EVs will be cheaper than combustion engine cars[33].

A market model developed by Boston Consulting Group predicts that the global capacity for battery cell production will exceed market demand by ~40% in 2021, exerting considerable pressure on battery prices[34]. To survive this challenging market scenario and utilize capacity optimally, producers will have to slash prices. However, to preserve margins, producers will need to reduce manufacturing costs[35]. Thus, over the next few years, the focus of the industry will be to develop production processes that reduce the costs of silicon anode batteries to improve capacity while cutting battery prices.

Hence, Anteo has access to tremendous opportunities with the silicon-modified and silicon composite approaches that use AnteoCoat to improve battery capacity, as well as optimize the manufacturing process, and hence reduce the cost of production.

AnteoCoat is extremely valuable for the battery sector

Current challenges in the battery industry

Batteries are employed in a variety of applications – such as consumer electronics, electric vehicles[36], and energy storage systems. Most of these applications primarily rely on Li-ion batteries as a dominant source[37,38] and require progressively higher energy density to satisfy the need for longer runtimes, smaller and lighter products, and lower cost. However, certain challenges associated with batteries impede their performance. These include the following:

[30] Tesla and Samsung's disclosures relate to different metrics. Tesla just claims energy density, which can mean various things, while Samsung specifically claims energy density by volume.
[31] Other players that are developing technologies to improve silicon content in anodes include Amprius Inc., Nexeon Limited, XG Sciences Inc., CONNEXX SYSTEM Corporation, and OneD Material.
[32] It is estimated that Li-ion battery prices decreased **80%** between 2010 and 2018.
[33] By McKinsey's Centre for Future Mobility.
[34] BCG estimates that batteries' cost per kWh will fall to US$80–105 by 2025 and to US$70–90 by 2030.
[35] See *The Future of Battery Production for Electric Vehicles,* Boston Consulting Group, September 11, 2018.
[36] Cost reduction and high energy density are the two challenges being faced by Li-ion batteries in electric vehicles.
[37] Li-ion batteries are a dominant source of energy storage for applications such as wearable or portable devices, power tools, and electric vehicles.
[38] Mater Today. 2015 Jun; 18(5):252-264.

- **Low energy density**: Conventionally, graphite has been used as an active material in batteries due to its high coulombic efficiency and better cycle performance. However, graphite anodes have limited capacity to absorb ions due to the presence of a limited number of ion storage sites within the sp2 hexagonal structure of carbon (graphite material)[39]. Moreover, new active high-energy anode and cathode battery materials can deliver high capacity but are currently limited by their stability[40]. Thus, there is an urgent need for a new anode/cathode material that can store a higher number of ions in their solid-state structure.
- **Manufacturing cost**: The manufacturing cost of Li-ion batteries is ~40% higher than that of Nickel-cadmium batteries (that use cadium-based anodes) because of the extra protection required to regulate voltage and current[41,42].
- **Aging**: Li-ion batteries have a relatively shorter life and age rapidly depending not only on the time, but also on the number of charge and discharge cycles that it has undergone. The problem is exacerbated by ongoing chemical reactions between the negative electrode and electrolyte, storing fully charged batteries for large durations, and charging batteries at lower temperatures but using them at high temperatures[43].

These challenges point toward an emerging need for new materials that could help in reducing the cost of Li-ion batteries while also improving energy density and battery life.

Anteo's technology aims to overcome these challenges

Silicon is touted to be one of the most likely substitutes to graphite for overcoming challenges associated with Li-ion batteries[44]. It improves energy density by absorbing a higher number of Li-ions per silicon atom. However, poor stability has been a major roadblock to the broad adoption of silicon. Silicon materials expand and contract by 300–400% during charge and discharge cycles, causing the anode to break apart. This increases mechanical stress and causes destruction of silicon structure associated with silicon electrolyte interface – ultimately leading to battery failure[45,46]. Therefore, in the current scenario, the use of silicon in battery anodes is limited to only up to 6wt.%.

Currently, the percentage of silicon used in battery anodes is limited to up to 6wt.%

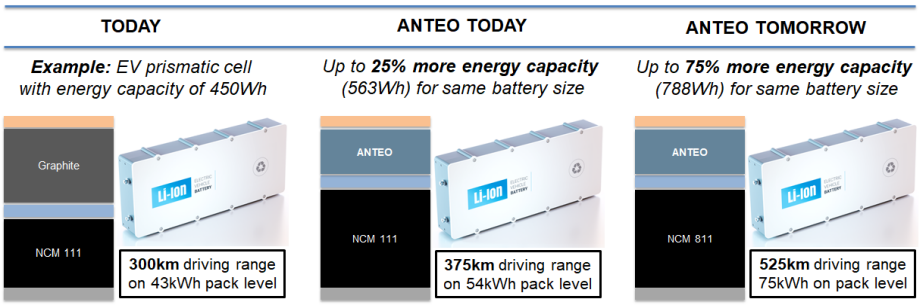
Proof-of-concept studies show that an AnteoCoat layer over silicon acts as a protective net that allows the silicon anode to expand and contract without breaking down during charge and discharge cycles. These studies demonstrate that Anteo's nanotechnology offers the following advantages:

- Increase the capacity and energy density of batteries resulting in
  - Smaller batteries for advanced mobile electronics
  - Lighter batteries for weight sensitive applications such as electric vehicles and drones

[39] See *Improving Battery Solutions With Energy Density,* ECN.
[40] For example, swelling/shrinking of silicon, tin, and germanium based anodes and sulphur based cathodes; partial solubility of cathode material in electrolyte, etc.
[41] Nickel-cadmium (NiCd) cells came into existence before Li-ion batteries. These batteries use cadmium as anode, nickel hydroxide (as cathode) and aqueous potassium hydroxide as the electrolyte. These cells have been widely used in portable power tools, electric devices, and emergency lightening; however, with the emergence of Li-ion technology, their adoption has been limited (despite Li-ion being costly).
[42] Li-ion and NiCd batteries differ in their chemical composition, environmental impact, applications and costs.
[43] See *Solving the problem of lithium-ion battery ageing,* The Engineer, October 5, 2018.
[44] With a theoretical capacity of 3579mAh/g, Silicon can store almost 10x more energy per weight than graphite (372mAh/g).
[45] J. Electroanal. Chem. 2017; 164(1); A6294-A6302.
[46] Solid electrolyte interface is a passive layer formed on the electrode surfaces from the decomposition of electrolytes.

- Batteries that can hold substantially more charge without any change in battery size resulting in
    - Increased driving range for electric vehicles
    - Longer runtimes per charge for mobile electronics and energy storage systems
- Cheaper batteries in $ per unit of energy stored

Figure 9: Energy Capacity Comparison of Anteo's Technology vs. Graphite in Batteries



Source: Company

Anteo's coated silicon particles improve capacity of anodes

Taking anodes as an initial target segment, Anteo has conducted multiple validation studies, which prove that the use of AnteoCoat improves the performance of silicon anodes in batteries on a commercial scale.

Silicon Particle Validation Studies conducted with third parties, 2017-2018

During 2017–2018, Anteo collaborated with two companies, Polaris Battery Labs and Customcell, to provide third-party validation to the impact of AnteoCoat on commercially important aspects of battery manufacturing and performance. The collaborations aimed to generate data that demonstrated the effects of varying concentrations of AnteoCoat on a variety of ratios of silicon incorporated into an anode. The company studied the performance of AnteoCoat on half-cell (with Polaris) and full-cell (with Custom Cells) battery prototypes.

Polaris half-cells. The results of Polaris' work on Anteo's coated silicon particles demonstrated the following (Figure 10):

- For a 10wt.% silicon anode, a better starting capacity could be realized compared to a 10wt. % silicon anode without AnteoCoat
- A working 30wt.% silicon anode could be created by using Anteo's coated silicon particles
- A functional 30wt.% silicon anode could not be created by Polaris in the absence of AnteoCoat

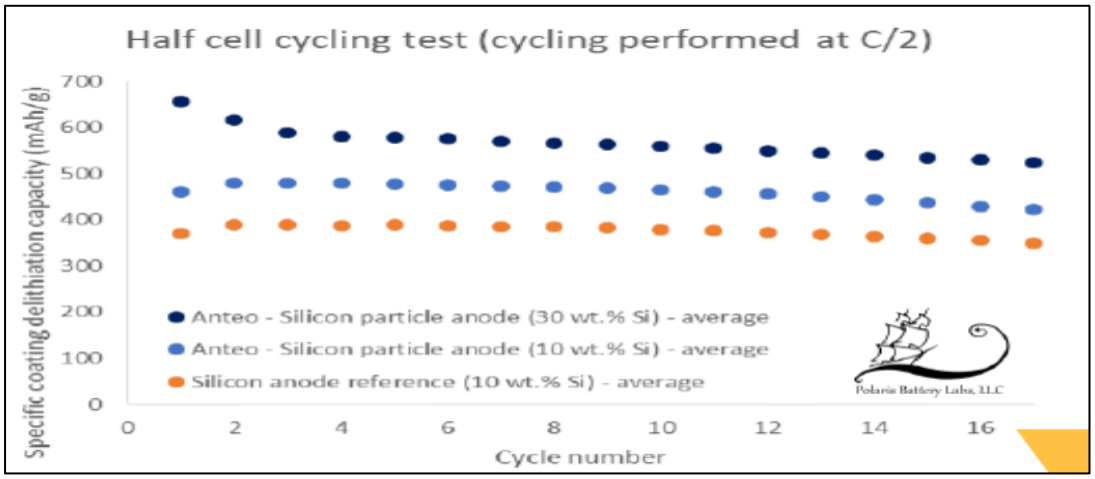
Based on these results, Polaris noted that use of AnteoCoat bore the following commercial benefits:

- **Cost benefits**: It works with both water and organic solvents and can be formulated using GRAS (Generally Regarded as Safe) materials. This simplifies waste disposal, translating to cost advantages for battery manufacturers. Moreover, it can be used on commercially available silicon particles.
- **Performance benefits**: The coating, being very thin (a few nanometers), does not take up much volume in the battery cell, thus providing

performance benefits to manufacturers. Further, it does not require silica oxide removal.

– **Flexibility of use**: It can be used on silicon materials with a wide range of particle sizes (nanometer or micrometer). Moreover, it can work with different types of polymer binders with different molecular weights (MW), including less viscous low-MW polymers.

Figure 10: Silicon Particle Validation Study Results (Half-cell)



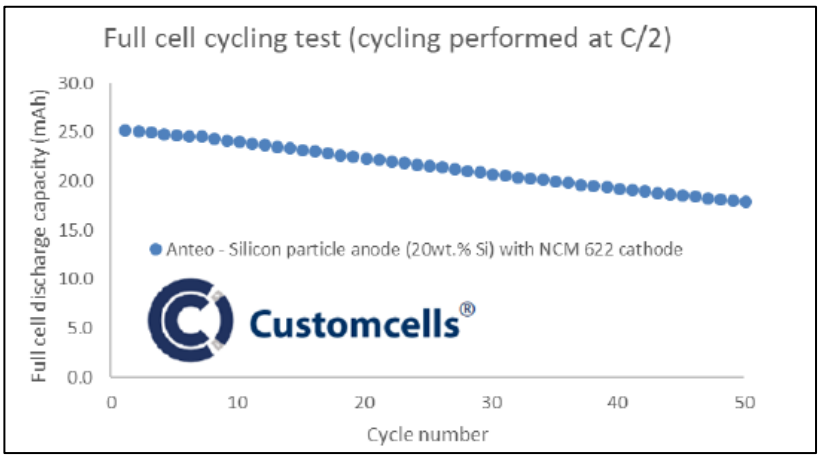
Source: Company

Composite silicon particles allow incorporation of a higher level of silicon

Customcells full cells. Meanwhile, in another study conducted in collaboration with Customcells, it was found that Anteo's coated silicon particles can be used to produce 20wt.% silicon anode electrodes. The study showed that full cells can be successfully created with normal cycling behavior (Figure 11).

The results from both Polaris and Customcells show that Anteo's technology is able to achieve substantial improvement in anode capacity, compared with a conventional graphite anode. This points to a high value opportunity for AnteoCoat in creating coated silicon anode particles.

Figure 11: Silicon Particle Validation Study Results (Full Cell)



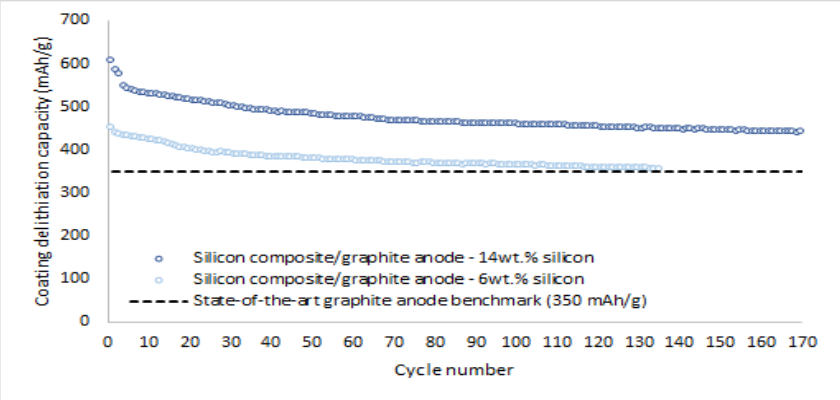
Source: Company

Silicon Composite Validation Studies conducted internally, 2019

Possibly the most exciting announcement which Anteo has made regarding the efficacy of its silicon composite anodes came in February 2019. Internal work at the company's lab in Brisbane showed that AnteoCoat could create 14wt.% silicon anodes, which in turn could achieve a 57% improvement in reversible cycling capability compared to graphite anodes. These 57% are a marked improvement over state-of-the-art graphite anodes, which appear to be competitive with the development interests of battery industry leaders[47].

Moreover, cycle testing at 2h charge and discharge intervals of these silicon composite containing anodes demonstrated good capacity retention beyond 170 charge and discharge cycles as shown in Figure 12.

Figure 12: Silicon composite validation study results (internal)



Source: Company

When used in batteries, even though coated silicon particles show significant improvement in performance over graphite alone, they are useful only when the battery requires a low–medium silicon content of 20wt.%. Beyond this point, the integration of individual silicon particles with a conventional graphite anode becomes challenging and yields lower-than-expected capacity. To improve performance even further, the company used AnteoCoat to create a silicon composite that would allow the incorporation of even higher levels of silicon. The silicon composite combines silicon with other components in a conductive network structure before it integrates into the graphite anode. This process eliminates the need for integration of individual silicon particles and achieves medium to high silicon content anodes. The company aims to be able to achieve a silicon fraction of up to 40wt.% using this strategy.

The results to date have shown that Anteo's silicon carbon composites produce a working half-cell battery using an anode with a silicon content of

[47] The 57% claimed in Anteo's announcement referred to an improvement on the electrode level whereas the Tesla's and Panasonic claims refer to improvements on the cell level. Anteo believes that its results translate into similar improvements on the cell level, but direct comparisons are somewhat problematic.

24wt.%. Recently, the company has also shown that composites developed using AnteoCoat (Vial B and C) vastly improved tap density compared to nano-silicon bulk material (Vial A) yielding up to 10x gain in density, as shown in Figure 13.

Figure 13: Silicon composite validation study results (internal)

Source: Company

Higher tap density enables greater energy storage through higher levels of silicon in an equivalent volume as used in conventional electrode systems. Though the silicon composite structure and cycle efficiency is still being optimized, the approach, if successful, is likely to provide huge commercialization benefits to Anteo.

Battery Separator and Wettability Validation Studies

AnteoCoat is being evaluated to improve manufacturing processes of batteries

Besides the above two approaches aimed at increasing silicon capacity, Anteo is also evaluating the potential of AnteoCoat to improve electrode performance and generate cost reductions by increasing electrode and battery processing efficiencies. The company's in-house battery team has identified that surface-modified carbon using AnteoCoat improves wetting and dispersion of carbon in water. This indicates a potential use of AnteoCoat in improving manufacturing processes across the battery sector. The following approaches are being undertaken:

- Focusing on processing efficiency improvement during component mixing and electrode coating steps
- Targeting an improvement in manufacturing efficiencies during electrolyte addition and formation steps

The results of all these validation studies indicate that AnteoCoat has significant potential to address a major unmet need in the Li-ion battery market and overcome challenges associated with the use of silicon/graphite.

Anteo is well ahead in commercialization of AnteoBind for POC applications while AnteoCoat is catching-up in the battery sector

As a commercial strategy, Anteo intends to move its products and services higher-up in the value chain across all the business areas that it targets. For Anteo, POC testing represents more immediate opportunities for developing sustainable revenue streams, while other larger-value opportunities in the battery sector ensure that the company has a balanced portfolio.

POC – Strategic Focus on Sustainable Revenue Streams

Anteo has already inked four partnerships for POC testing

During FY2016–FY2018[48], the company witnessed increased interest in AnteoBind's potential in POC devices and made significant progress with its POC partnerships, such as the following:

- **Partnership with Atomo Diagnostics (June 2016):** The partnership was aimed at developing a rapid test strip for cardiac troponin using Anteo's coating technology for integration with the AtomoRapid platform. This partnership concluded in FY2017, and the device demonstrated a good lower limit of detection of cardiac troponin.
- **Partnership with Ellume (October 2016):** Anteo entered into a five-year supply agreement with Ellume – an Australia-based diagnostics company. Ellume has developed a novel detection technology that integrates its unique quantum dot nanoparticles with novel optics, electronics, and software into a digital platform. Anteo has worked with Ellume in the earlier stages of quantum dot enablement, and it expects to provide support across Ellume's product pipeline related to influenza, respiratory syncytial virus, group A streptococcus, and chlamydia. In December 2018 and January 2019, Ellume announced commercial partnerships with GSK and QIAGEN for respiratory care and TB diagnostic products, respectively. This validated AnteoBind's capabilities to improve the performance of its partner's products. We believe that collaborations with large pharma/diagnostic companies will provide huge commercial benefits to Anteo, as it can expect test volume (and, consequently, demand for Anteo's technology) to go up in the future.
- **Partnership with Planet Innovation, Deakin University, and DMTC (November 2016):** The partnership focused on advancing the technology readiness of Planet Innovation's novel POC platform – a low-cost, high-sensitivity POC system that uses a reader technology. In FY2017, Anteo reported that its technology showed a lower limit of detection of biomarkers than the third-party assay benchmark. For next steps, Anteo is concentrating on enhancing the robustness and reproducibility of its conjugates while aiming for the maximum achievable assay sensitivity.
- **Partnership with Sona Nanotech (January 2019):** Anteo recently announced a collaboration with Sona Nanotech to co-develop products with the potential to improve the performance of LFIA. Under the terms of agreement, Sona will supply its gold nanorod technology to Anteo, which will combine it with AnteoBind and various biomarkers such as cTnI (cardiac troponin, a biomarker of heart attack), CRP (C-reactive protein - is an inflammatory marker often used in sepsis diagnosis) and HCG (Human chorionic gonadotropin, the fertility marker used in pregnancy tests).

These collaborations indicate that Anteo has already established strong foothold in the IVD/POC market and has an opportunity to generate substantial revenue in the short term.

Strategically, Anteo is now in a position to undertake the following activities:

- **Capitalize on positive interest from customer leads**: AnteoBind Particle Conjugation Kits were well received by different stakeholders at meetings such as the Merck IVD conference, the Advanced Lateral Flow Course (ALFC), and the American Association of Clinical Chemistry (AACC) Clinical Lab Expo. Anteo continues to build upon this interest in the potential of AnteoBind to improve accuracy by focusing on 'quantitative' POC testing.

[48] The company's financial year ends on June 30.

Anteo plans to explore the POC/IVD market in China

- **Explore future development options with existing partners**: Market interactions have confirmed that a significant number of POC assay developers are interested in the use of gold nanoparticles. Therefore, Anteo is actively progressing this opportunity and to this end has re-inked a partnership with IMRA to develop AnteoBind activated gold particle kits. It is also continuing discussions to support future developments with Ellume, Atomo Diagnostics, etc.
- **Revitalize large market opportunities**: In December 2018, Anteo entered a distribution agreement with China-based GeneoDx for marketing its new particle conjugation kits based on AnteoBind. This agreement is an extremely important development for Anteo, as it provides access to a diverse POC manufacturing sector eager to embrace new technologies. With strong connections in the China IVD market, GeneoDx seems to be an ideal partner to promote the benefits of Anteo's technology in one of the most lucrative markets globally.

With a robust strategy plan in place, we believe Anteo is well positioned to be at the forefront of assay development. It plans to achieve the following goals in the short and medium term to achieve a higher value of its technology across the POC/IVD value chain (Figure 14).

Figure 14: Timeline for POC Advancement

Source: Company

Short-term Goals:

- Launch a prototype of IMRA Gold Particle Conjugation Kit by late 2019 and begin activities for first customer 'alpha' testing
- Continue to focus on development of the first generation of Anteo Activated Particle kits for customer assessment in Q1 2019

Medium-term Goals:

- Obtain the ISO certification and prepare to offer conjugation services

Energy – Strategic Focus on Diversifying Portfolio

Anteo is making significant progress on the use of AnteoCoat to meet battery performance expectations. The company has concluded test work on the coating of silicon particles and on composite silicon carbon particles to address limitations related to silicon expansion in batteries. The results are promising; however, the company still believes that more development work is required to highlight the benefits of AnteoCoat.

In FY2018, the company achieved an important commercial milestone by signing material transfer agreements with battery component suppliers:

- First APAC/global collaborator (August 2018): The collaboration aims to assess the potential of AnteoCoat to improve battery anode performance. The first steps under the agreement include defining the feasibility study parameters to determine the work that can be conducted by both parties.
- Second Europe-based collaborator (November 2018): The alliance aims to demonstrate the improvement in material processing and electrochemical performance when products from both the parties are combined in Li-ion battery anodes.

In 2018, Anteo signed an MTA with two battery component suppliers

Anteo has commenced the initial stages of evaluation after it received the proprietary silicon material from its collaborators. This would involve the creation of baseline electrodes using the new silicon materials. Further, development activities that combine internal and external work, in line with continued focus on developing high-value silicon active material products using AnteoCoat, are in progress.

With recent collaborations in place, Anteo seems to be well positioned to take its technology to the battery market. Its focus areas include the following:

Near-term Goals:

- Continue to build Anteo's reputation at international and national tradeshows and conferences to create awareness and initiate commercial leads.
- Establish relationships with new potential partners and enhance relationships with existing partners by continuing with opportunities for joint material development and commercialization.
- Complete the initial stages of evaluation of proprietary silicon materials supplied by collaborators (Figure 15).
- Continue to develop surface-modified silicon for near-term applications.

Medium-term Goals:

- Make progress with the development of silicon composites for medium–long-term applications.
- Continue to refine the physical and chemical properties of Anteo-fabricated silicon composites and improve the level of integration with other components in the anode coating.
- Complete the electrochemical evaluation of a silicon composite anode.
- Commence testing for industry feedback on composite materials.

In the coming months, Anteo's initial focus will be on increasing efforts in developing AnteoCoat for surface-modified silicon particles targeting low- to mid-range silicon content anodes. The company is looking to further the development of silicon composite opportunity targeting medium–high silicon content anodes as a longer-term focus.

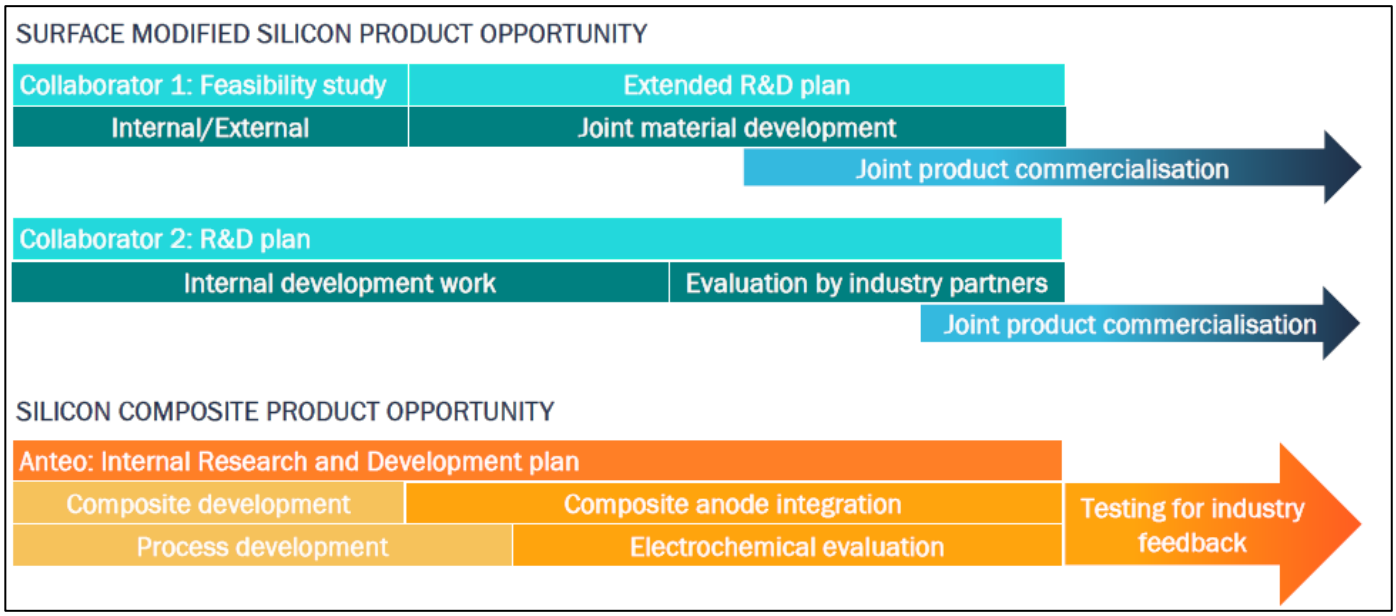
Anteo is looking beyond Cook Medical in the medical device space

Medical Technology – Looking Beyond Cook Medical

Currently, Anteo is consolidating data generated for applications such as heparin coating, and will engage with other medical device companies apart

from Cook Medical to develop the commercial benefits of its AnteoRelease technology. Though the company has slowed internal efforts in this area, it will continue to explore cost-effective ways to realize value from this opportunity.

Figure 15: Energy Sector Development Focus (18-month timeline)



Source: Company

Other business areas in focus – immunoassays (IVD) and implants

Since its establishment, Anteo has been targeting to push the use of its Nanologue technology (called Mix&Go) in the IVD and R&D segments within the life sciences market, especially within the immunoassay space. According to MarketsandMarkets, the global IVD market is expected to grow at a 5.2% CAGR over 2018–2023 to reach US$87.9bn. Based on technology, the market is segmented into immunochemistry/immunoassay, clinical chemistry, molecular diagnostics, hematology, microbiology, coagulation & hemostasis, urinalysis, and other technologies (patient self-testing, POC testing, lateral flow assays, and tissue processing). Of these, the immunochemistry/ immunoassay segment dominates the market. In fact, the market for immunoassays is expected to grow at a 6.1% CAGR during 2018–2023 to reach US$27.2bn. This is primarily fueled by the rise in incidences of infectious and chronic diseases, ageing populations, and the development of novel assays.

Regionally, North America dominates the IVD market, and this is likely to continue over the next few years. With more than 13bn tests performed in the US alone[49], the market is quite lucrative for Anteo's technology. Moreover, all immunoassays are susceptible to sample-specific interference, which can lead to erroneous test results and unfavorable patient outcomes. Thus, there is a high unmet need for simple, inexpensive, and automatable solutions that mitigate interference without affecting lab workflow and turnaround time. Though the market is dominated by Tier 1 players (e.g., Roche, Millipore Sigma, and Philips), c.20% of the market is highly

[49] See *Integrating Laboratories Into The PCMH Model Of Health Care Delivery,* Cola Lab White Paper, 2015.

More than 13 billion tests are performed in the US alone, representing tremendous opportunity for Anteo

fragmented. We believe that Anteo can target these 20% of niche small-to-mid sized laboratories – a considerable opportunity in this huge market.

Besides diagnostics, Anteo is targeting the adoption of its nanoscale technology in assays and technologies used for R&D. The global market for pharmaceutical and biotech R&D is forecast to grow 2.4% annually by 2022. Moreover, total R&D spending is expected to reach US$181bn in 2022, up from US$156.7bn in 2016[50]. According to a 2016 US Science Board report, although the US accounts for 27% of global R&D expenses, China claims 20% and growing at a faster rate. If this trend continues, China's R&D expenses will surpass those of the US by 2020. Demand for domestic assay development in the IVD sector is also growing in China. Therefore, it is an important market for Anteo, and the company is already exploring partnerships with distributors in the region (e.g., distribution agreement with GeneoDx).

Immunoassays are quite extensively used in life sciences laboratories, in either R&D or commercial setting, to help identify predictive biomarkers or potential targets for new drug candidates. As the focus on R&D and identification of potential new markers continues to grow, demand for immunoassays in drug discovery is increasing steadily[51]. Moreover, the opportunity of their use in companion diagnostics and personalized medicines is expected to continue to drive demand for improved surfaces and assays. With the advantages of improved sensitivity and reduced cost, the opportunity for adoption of immunoassays and other surfaces modified using Anteo's technology is significant.

Meanwhile, Anteo's nanotechnology-based binders and coatings can be utilized to enhance the performance of medical devices across different applications, including active implantable medical devices. On the back of technological advancements, the global medical device market is projected to reach US$138.7bn by 2023, exhibiting c.7% CAGR during 2018–2023. The medical implants market is expected to garner US$116bn by 2022. Though the opportunity in this segment is huge, Anteo has demonstrated higher focus on other opportunities and exploring cost-effective options to realize the value of AnteoRelease, after its feasibility project with Cook Medical concluded in 2017[52].

[50] See *2018 Global life sciences outlook,* Deloitte, 2018.
[51] See *The Rise of Multiplex Immunoassays in Drug Discovery,* By Andrew W. Hudacek, April 30, 2018.
[52] Cook Medical opted to progress with an alternative solution to their problem of coating stability, as it did not require regulatory submission.

Valuing Anteo

We value Anteo at 2.9 cents per share base case and 4.0 cents per share optimistic case using a probability-weighted DCF valuation approach.

Figure 16: Our valuation of Anteo

	Base case	Optimistic case
PoC Diagnostic (A$m)	3.0	10.0
Battery technology (A$m)	34.9	47.3
Total programme value	37.8	57.3
Value of tax losses	17.0	17.0
Corporate overhead	-17.1	-17.1
Cash now (A$m)	2.3	2.3
Cash to be raised (A$m)	7.5	7.5
Option exercises (A$m)	0.0	0.0
Total value (A$m)	47.5	67.0
Total diluted shares (million)	1,663.3	1,663.3
Per share valuation range	$0.029	$0.040
Valuation midpoint	$0.035	
Share price now (A$ per share)	$0.019	
Upside to midpoint	81.6%	

Source: Pitt Street Research

General assumptions

Discount rate. We used a WACC of ~15%, appropriate in our view for a 'Speculative' risk rating[53].

Opportunities valued. For the Point of Care project, we valued a single diagnostic while for the Battery project we valued a licensing to a single battery maker. While Anteo's technology is applicable across a range of sectors, the company's lack of success at attracting licensees suggests this relatively limited valuation approach at this stage.

Probability of success. For the Point of Care project, we used a 50% probability of success, to reflect the fact that the proposed diagnostics would use similar binding reagents as standard diagnostics. For the Battery Project we used a 12.5% probability of success, to reflect the large number of lithium-ion battery makers globally.

Time horizon. For the Point of Care project we used a 14-year time horizon in our DCFs followed by a terminal value. For the Battery project we ended our

[53] For a relevant discount rate, we use varying WACCs depending on the risk for Life Science companies. We start with an RFR of the Australian ten year bond rate (2.7%) and an ungeared beta of 1.1 but use a variable MRP of 7.5%-11.5% (7.5% for 'medium risk' companies, 9.5% for 'high risk' companies and 11.5% for 'speculative' companies). Ordinarily we regard Life Science companies with existing businesses, or who have enough capital to reach the market with their products, as 'Medium' risk. Companies that have small revenue streams from marketed products but that are still potentially in need of capital are 'High' risk. Everything else is 'Speculative'. We have used a Speculative risk rating for Anteo to reflect the skepticism with which the market greeted the Zoetis deal of May 2018.

DCF at 2037, as per the likely expiration of the current enabling intellectual property[54].

Currency. We assume the AUD/USD exchange converges on 0.7 over a three-year period from now.

Tax, We assume a 30% corporate tax rate.

Capital. We assume, purely for valuation purposes, that Anteo raises another A$7.5m at 1.5 cents per share. Obviously, a higher share price could alter this assumption.

Valuing the PoC project

We assume:

- Anteo develops a PoC device that costs the company another US$4m (optimistic case) up to US$6m (base case)
- The company formally licenses the diagnostic to a pharma or diagnostics industry partner in FY21 (optimistic case) or FY22 (base case);
- Global product launch beginning in FY22 (optimistic case) or FY23 (base case);
- Upfront payments post the licensing agreement of US$2-5m;
- Milestone payments of US$10m-$15m;
- Peak sales globally of ~US$80m (base case) to US$120m (optimistic case).
- A royalty to Anteo of 3% (base case) to 5% (optimistic case).

Valuing the Battery project

We estimate that the world's current output of lithium-ion batteries is ~125 Gwh[55] and that the typical battery sells for ~US$180/KWh. We developed two models for the global lithium-ion battery market out to 2030.

- In Market Model 1, annual global battery output rises to ~1,800 Gwh and selling prices decline to ~US$75/KWh by 2030. Between 2030 and 2037, the annual growth rate on battery output rises at half the rate of the growth to 2030 on flat selling prices.
- In Market Model 2, electric vehicles do not mainstream as quickly as the first model suggests, but the market still grows vigorously, with annual output increasing to ~360 Gwh and selling prices declines to ~US$130/KWh by 2030. As per Market Model 1, after 2030 the annual growth rate on battery output rises at half the rate of the growth to 2030 on flat selling prices.

  We used these models to develop base and optimistic case valuations. In each case we assume that Anteo's silicon composite anodes go into commercial production in 2022 with Anteo collecting royalties. For conservatism's sake we assume that the royalty stream ceases in 2030 due to alternative silicon-based approaches coming forward from competing research groups.

  Base case. For our base case valuation, we assume that Anteo's market share grows from 1% in 2022 to 2.5%[56] in 2030 and beyond using Market Model 1, with Anteo earning a 3% royalty.

[54] WO/2017/165916.
[55] For background consider various industry estimates developed by Bloomberg NEF (bnef.com).
[56] 2.5% representing the 'innovators' as per Diffusion Theory – See *Diffusion of Innovations, 5th Edition* by Everett M. Rogers (New York: Free Press, 2003)

Optimistic case. For our optimistic case valuation, we assume that Anteo's market share grows from 1% in 2022 to 7.5%[57] in 2030 and beyond using Market Model 2, with Anteo earning a 5% royalty. In effect, a slower decline in manufacturing costs for lithium-ion batteries means greater market share for a technology that can make for more efficient batteries.

Potential for valuation uplifts

We believe we have been conservative in developing our valuation range, so there is significant opportunity to increase this in the event of commercial success by Anteo:

- For the battery project, a successful licensing deal would reasonably lead to an increase in the probability weighting assigned to our valuations. As we note above, this is currently only 12.5%. Consequently we could reasonable increase this eightfold in the event of a deal being announced.
- For the Point-of-Care project, we valued only a single project, resulting in only a nominal value for this potentially very valuable platform. Progress in signing up multiple partners beyond the Ellume collaboration can reasonably justify more of a platform valuation than a single-product valuation.
- For the other applications of the Anteo technology, commercial progress here can justify separate valuations.

Re-rating Anteo

We see a number of factors helping to re-rate Anteo towards our valuation range:

- The ability of Anteo to show significant benefits of using AnteoCoat in the battery sector with the 2 battery makers that the company has recently engaged with.
- The ability of Anteo to drive adoption of AnteoBind in the POC segment as it receives interest from new partners.
- Demand for AnteoBind rising as existing partners continue to strike collaboration deals with large players for products using the technology.
- Partnering or collaboration agreements related to AnteoRelease.

Anteo has an experienced management team

Anteo's management has the skills and expertise to target new market segments with its surface technology

Christopher Parker, the current acting CEO, joined Anteo in April 2018 and is expected to serve the company on a short-term contract basis (now extended until June 30, 2019). He was appointed to give time to the company Board to conduct a considered search for a permanent CEO after Dr. Stefan Enderling resigned due to personal reasons. Mr. Parker brings >20 years of experience in the medical device and diagnostics industry, predominantly with Roche. Before retiring in H2 2017, he was the MD of Roche's UK and Ireland diagnostics affiliate and held the responsibility for all Roche's diagnostic products. Thereafter, he moved back to Australia and formed Stratigent Consulting – a business research and consulting firm. We believe that Mr. Parker's experience with one of the largest pharmaceutical and diagnostics

[57] Since 15% represents the 'innovators' plus the 'early adopters' in Diffusion Theory, this case suggests that roughly half of those market segments adopt Anteo's technology.

companies globally is a great opportunity for Anteo and is extremely important to Anteo's development strategy in battery and diagnostics sectors.

Dr. N. Joe Maeji, CSO, has been associated with Anteo for more than a decade. He was a co-founder and founding CEO of Bio-Layer Pty Ltd that became Anteo Technologies. Prior to joining Anteo, Maeji had managed successful R&D projects in the biotechnology and life science industry over a span of 20 years. His experience in securing funds for new technology development as well as in creating and securing extensive IP portfolios would continue to support Anteo through its venture into new market segments.

Dr. Charlie Huang, Head of R&D, has >20 years of experience in leading R&D projects across technology and medical device companies. Prior to joining Anteo in 2013, Huang held senior R&D roles in several public listed healthcare and IVD companies including Panbio Ltd, Alere, Cellestis Ltd, and QIAGEN.

Manuel Wieser, Head of Battery Development, has extensive experience in lithium ion battery R&D, technology commercialisation and a strong background in international collaborations. Previously, Wieser was Product Development Manager at Nano-Nouvelle, a materials company developing nano-structured current collector technology for lithium ion batteries and next generation lithium metal anodes, where he was instrumental in taking the technology from lab scale to pilot production ready.

Although the company's Board underwent a few changes in FY2018 due to its redirection and sale of DIAsource business, it now has a stable Board with expertise in the segments that Anteo plans to target.

- **Dr. Jack Hamilton**, Independent Non-executive Chairman, has >30 years of experience in the energy sector, holding senior positions for over 15 years. His experience ranges across functions including, strategy development, commercial marketing, and M&As. Further, Hamilton has a board level involvement for >10 years as a Non-Executive Director in listed/non-listed companies in Australia and other countries.
- **Dr. Geoff Cumming**, Non-executive Director, has >20 years of experience in healthcare and biotechnology sectors. Previously, he was serving as MD of Roche Diagnostic Systems. Currently, he is the Chairman of Sienna Diagnostics, an ASX listed company, and a Non-executive Director of Multiple Sclerosis Research Australia, a not-for-profit organization.
- **Matt Sanderson**, Non-executive Director, was appointed to the board in October 2017 and supports Anteo's focus on strategy, profitable execution, and commercial growth. For over 10 years, Sanderson has served as a director of private investment companies investing in public and private companies.

Appendix I – Glossary

Active Implantable Medical Devices – Medical devices intended to be introduced surgically or medically into the human body. These devices rely on a power source not provided by the body or gravity. Examples include implantable hearing aids, cardiac pacemaker systems, and implantable infusion pumps.

Antibody Conjugation – A process wherein an antibody attaches to a substrate such as an enzyme, toxin, or inorganic compound.

Biomolecules – Biological molecules, including large macromolecules (or polyanions) such as proteins, carbohydrates, lipids, and nucleic acids, as well

as small molecules such as primary metabolites, secondary metabolites, and natural products.

Cardiac Troponin – Troponin (proteins found in the cardiac and skeletal muscles) released by heart into the bloodstream when it is damaged.

Chelation – A type of bonding between ions/molecules and metal ions. It involves the formation separate coordinate bonds between a polydentate ligand and a single central atom.

Combinatorial Chemistry – A technique that allows a large number of different but structurally similar molecules to be produced quickly. These compound libraries are produced as mixtures, sets of individual compounds, or chemical structures generated by computer software.

Companion Diagnostics – A diagnostic test used to determine a drug's applicability to a specific person. The tool provides information essential to the safe and effective use of a corresponding therapeutic product.

Coordination Chemistry – A study of compounds that have a central atom surrounded by molecules or anions, known as ligands.

Coulombic Efficiency – The ratio of the output of charge by a battery to the input of charge.

Generally Regarded as Safe (GRAS) – A product with a long history of use and therefore with a well-known safety record.

Immunoassay – A test that uses biochemistry to measure the presence and/or concentration of an analyte (e.g., macromolecules).

In Vitro Diagnostics (IVD) – A device used for in vitro examination of specimens derived from human body to provide information for diagnostic, monitoring, or compatibility purposes.

Lateral Flow Immunoassays (LFIA) – A simple-to-use POC device used to confirm the presence or absence of a target analyte. The most commonly known type of lateral flow test is the pregnancy test.

Li-ion Batteries – A type of battery that uses a lithium metal oxide in the cathode and a carbon-based material in the anode.

Microarray – A laboratory tool used to detect the expression of thousands of genes at the same time.

Nanoscale – Structures with a length scale of 1–100 nanometers.

Point-of-care (POC) – A rapid diagnostic testing technique, performed in the surgery/clinic at the time of consultation, which facilitates the generation of faster results and better treatment decisions.

Quantum Dot – Nanoparticles of semiconductors, with diameter in the range of 2–10 nanometers, that glow a particular color when illuminated by light.

Appendix II – Capital Structure

		% of fully diluted	Note
Ordinary shares, ASX Code ADO (million)	1,152.8	99.3%	
Unlisted options (million)	8.0	0.7%	Exercise price 0.01 cents, expiry date 30 September 2019
Fully diluted shares	1,160.8		

Appendix III – IP Position

Anteo's intellectual property derives from the following applications:

Use of metal complexes, WO/2006/002472, priority date July 2, 2004, invented by Benjamin Muir, Michael Barden, Dennis Rylatt, Joe Maeji, Carmel Hillyard, and Alain-Dominique Gorse[58].

- This patent pertains to a method of immobilizing proteins on a substrate via a metal-ion-based coordination complex – without modifying the chemical structure of the proteins. This is achieved by treating the substrate with a composition that contains an amine-based ligand (e.g., ethylenediamine) and a transition metal ion containing compound (e.g., chromium chloride).

Binding systems, WO/2011/140590, priority date May 10, 2010, invented by Joe Maeji, Liqun Yang, Nevin Abernethy, Barbara Fontanelle, and Olya Savvina.

- This application covers a method for making a synthetic substrate amenable to protein immobilization. It involves the incorporation of a metal-ion-based coordination complex on the substrate, followed by their oligomerization. The new modified substrate is easy to use and has a long shelf life, even in an activated state.

Conjugating Molecules to Particles, WO/2015/021509, priority date August 13, 2013, invented by Chang-Yi Huang and Joe Maeji.

- This patent application pertains to the use of activated microparticles/nanoparticles – bearing a transition metal-ion-based coordination complex on their surface – to link two different biomolecules. Unlike covalent-bond-based linking, coordination complex-based linking is faster, uniform, and does not require high quantities of biomolecules.

Hetero functional binding systems, WO/2015/192183, priority date June 17, 2014, invented by Chang-Yi Huang and Joe Maeji.

- This application covers a method of binding hydrophobic ligands onto a hydrophobic substrate by exposing it to a composition containing a transition metal-ion-based coordination complex. The method is much easier to control and does not require the use of any specialized equipment.

A composition, **WO/2016/168892**, priority date April 20, 2015, invented by Chang-Yi Huang, Quansheng Song, and Joe Maeji.

- This application covers an electrode for a battery that incorporates a swelling-prone active material (e.g., silicon carbide) held together using a transition metal-ion-based coordination complex. The use of this complex limits the extent of swelling during charging and discharging operations, and allows the re-establishment of bonds once the active material has contracted back to its original size. This increases the functional life of the electrode.

Functional coating, **WO/2017/027931**, priority date August 20, 2015, invented by Chang-Yi Huang and Joe Maeji.

- This application pertains to the use of a transition metal complex to stabilize heparin coatings on medical devices. The process is simple and

[58] This patent application has been granted in the US as Patent No. 8,168,445 in May 2012 and as Patent No. 9,234,891 in January 2016.

does not require the formation/breakage of covalent bonds or chemical modification of heparin.

Method of controlled competitive exchange, WO/2017/083938, priority date November 20, 2015, invented by Chang-Yi Huang and Joe Maeji.

- This application pertains to the use of a polymeric metal-ion-based coordination complex for the competitive exchange of different-sized ligands. It is based on the principle that multidentate ligands (larger molecules) slowly replace monodentate ligands (smaller molecules) incorporated in a polymeric metal coordination complex. The method is easy to control and finds application in the controlled release of therapeutics in vivo.

Conductive composites, WO/2017/165916, priority date March 29, 2016, invented by Chang-Yi Huang, Joe Maeji, and Quansheng Song.

- This application pertains to stable active material compositions used to manufacture battery electrodes. The composition – containing two nonidentical active materials with different surface properties – includes a transition metal complex to stabilize the mixed active material, thus increasing the active life of the electrode.

Appendix IV – Major Shareholders

- First Cape Management is the only major shareholder (5.9%)

Appendix V – Companies to Watch

Company	Location	Code	Market cap (USDm)	Web
Ferroglobe	London., UK	GSM	389	ferroatlantica.es
NanoEnTek	Gyeonggi-do, Korea	039860.KQ	121	nanoentek.com
Vermillion	Austin, Tx.	VRML	100	vermillion.com
OncoSil Medical	Sydney, Australia	OSL.AX	65	oncosil.com.au
MGX Minerals	Vancouver, Canada	XMG.CN	37	mgxminerals.com
Archer Exploration	Adelaide, Australia	AXE.AX	10	archerx.com.au
Sparton Resources	Toronto, Canada	SRI.V	5	spartonres.ca
Anteo Diagnopstics			16	

Ferroglobe. This material innovation company has recently started exploring opportunities in the Li-ion battery market. In June 2018, it formed an alliance with a US-based company, BioSolar, to develop and jointly market silicon-based anode materials for Li-ion batteries. The efforts will use BioSolar's Si-based anode material technology for developing silicon anodes[59].

NanoEnTek. This digital POC testing developer has created the FREND system, which is capable of detecting single or multiple analytes quantitatively. The system leverages the concept of micro-fluidics to measure analyte

[59] The clinical data will be used for regulatory submissions in the EU, the US, Australia, and Asia.

concentration. It has already received the US FDA clearance and is available for commercial use.

OncoSil Medical. This medical device company has developed a unique technology – phosphorous-32 microparticles suspended in diluent – called OncoSil. The device is an active implantable (radiological) medical device injected during an endoscopic ultrasound. As of now, clinical studies around the device are being conducted.

Vermillion. The company has developed OVA1 – a protein-based IVD test intended for ovarian cancer risk assessment. It was launched by its subsidiary ASPiRA Labs in October 2018 (post receiving the US FDA clearance).

MGX Minerals. The company's wholly owned subsidiary – ZincNyx Energy – has developed a patented regenerative zinc-air flow battery capable of offering flexibility in choosing energy/power ratios and scalability[60,61]. The battery has already reached the commercialization stage[62].

Archer Exploration. This company focused on advancing minerals has successfully assembled functional fuel-cell Li-ion batteries using its Campoona graphite material – in collaboration with the University of New South Wales[63]. It is also seeking partnership opportunities with Li-ion battery manufacturers for integrating Campoona graphite in their supply chain.

Sparton Resources. This mineral and energy company is developing vanadium flow batteries for energy storage applications. It uses vanadium as a liquid electrolyte and stores energy by the process of oxidation/reduction between vanadium ions. The company is also commissioning 12 MWh vanadium flow batteries in China.

[60] Depending on the size of fuel tank of the zinc-air flow battery

[61] The battery uses zinc particles to efficiently store energy. It does not contain high-cost materials, such as lithium, vanadium, or cobalt, and thus provides mass storage of energy at lower costs.

[62] Received the first shipment of battery components for its 20 KW output per 120 KWh storage zinc-air fuel cell battery in August 2018.

[63] The batteries that use the company's Campoona graphite have also been validated for their performance.

Appendix VI – Risks for Anteo

Risks specific to Anteo. We see five major risks for Anteo as a company and as a listed stock:

- **Licensing risk.** Anteo is now focusing on developing nanoscale technology for a specific segment – POC – within the IVD sector. This entails the risk of its technology failing to gain much interest in this segment from particle companies or LFIA manufacturers.
- **Sentiment risk**. Biotech investors tend to prefer drug development stocks with late-stage pipeline drugs rather than a new technology where regulatory or commercial payoff may be less understood.
- **Cash risk**. There is the risk that Anteo's current cash flow may exhaust faster than expected and that it may not have enough funds to take its R&D efforts forward in its strategic segments – energy and POC.
- **Collaboration risk**. Anteo could fail to secure a partner for exploring the AnteoRelease technology in the medical device segment.
- **Timing risk**. There is a possibility that the commercialization of products based on Anteo's technology may take longer than expected.

Risks related to pre-revenue life sciences companies in general. The stocks of biotechnology and medical device companies without revenue streams from product sales or ongoing service revenue should always be regarded as speculative in character. As most biotechnology and medical device companies listed on the Australian Securities Exchange fit this description, the term 'speculative' can reasonably be applied to the entire sector. The fact that the intellectual property base of most biotechnology and medical devices lies in science not generally regarded as accessible to layman adds to the risk associated with the sector.

Caveat emptor. Investors are advised to be cognizant of the abovementioned specific and general risks before buying any the stock of any biotechnology and medical device company mentioned in this report, including Anteo Diagnostics.

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