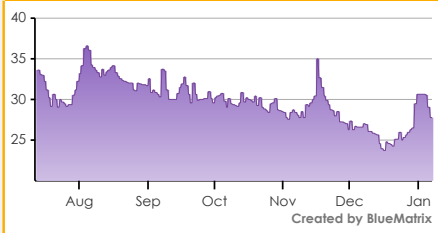
VERSARIEN PLC (LON:VRS)

10 January 2022

Diversified Metals & Mining

52-WEEK HIGH	**80.00p**
52-WEEK LOW	**22.00p**
PRICE	**27.70p**
MARKET CAP MLN	£53.9

Share Price



Major Shareholders

Hargreaves Lansdown - 21.21%	
Interactive Investor Services Ltd - 13.95%	
Lanstead Capital - 7.93%	
Neill Ricketts, CEO - 7.0%	
Shares in issue	194,149,790
Avg Three-month trading volume	540,187
Primary Index	
Next Key Announcement	January 2022

Company Information

Address: Units 1 A-D, Longhope Business Park, Longhope GL17 0QZ
Website: www.versarien.com

Analyst Details

Ed Stacey
ed.stacey@proactiveinvestors.com

Versarien - Graphene technologies for a cleaner world

Graphene applications become reality

Versarien is a speciality materials company focused on newly emerging applications of graphene as an additive in a range of different materials. The company has reached the point of delivering significant revenues from graphene technologies in the current financial year, and we expect substantial growth in the coming years.

Versarien recently reported results for the first half (H1) of fiscal 2022, the six-month period ended 30 September 2021. Key numbers from the release include:

- **Group revenues from continuing operations of £3.82mln, +41% versus H1 2020**
- **Revenues from graphene of £0.93mln, +166% versus H1 2020**
- **Cash of £3.46mln at 30 September 2021 versus £2.36mln at 31 March**

We argue that progress during the first half demonstrates the increasing commercial maturity of Versarien's graphene business.

Also recently announced, the company has entered into a partnership agreement with the UK clothing company Superdry for the development of graphene-enhanced garments using Versarien's GRAPHENE-WEAR technology. We note that the recently appointed non-executive chair Diane Savory OBE previously served on the board of directors of Superdry, and we believe that this partnership could become a significant driver of Versarien's expansion in the Leisure segment.

Versarien's growth strategy is based around a framework known as the GSCALE programme, which consists of six work packages; Graphene, Seat, Concrete, Arch, Leisure, and Elastomers. In this report, we outline the six different components of the growth strategy, and we examine the drivers in terms of revenue opportunity.

Environmental benefits from Versarien's graphene include 'lightweighting' of components for automotive and aerospace applications, reductions in concrete usage, increasing recyclability of plastics, improving functionality of bioplastics, and enabling new battery technologies. We believe that these factors will become an increasing driver for revenue growth over the next decade.

The company has two major capital expenditure (CapEx) programmes in progress to fulfil the additional demand anticipated in the next 1-3 years. These projects will increase the company's UK graphene powder production capacity some 10 times (10x) and graphene ink capacity 5x. Versarien also has an expansion programme ongoing at its Korean production facilities.

Investment conclusion

We argue that Versarien offers a compelling investment opportunity within the rapidly emerging industry of graphene materials technology. The company benefits from:

- A proven capability for delivering high-quality graphene powders and inks
- An application-specific framework for driving growth under the GSCALE programme
- Sufficient balance sheet resources to execute on the next phases of the growth strategy

We believe that the current share price leaves significant upside potential for shareholders as the revenue ramp-up progresses.

Neill Ricketts, chief executive officer

Ricketts is a graduate engineer with more than 20 years of senior level experience in manufacturing and engineering companies. He has worked with industry sectors from aerospace to Formula One, including significant work in the oil and gas sector. More recently, Ricketts was appointed to the advisory board of the United States National Graphene Association (NGA).

Diane Savory, non-exec chair

Diane Savory OBE DL became non-executive chair from 1 January 2022. Savory has, until recently, served as chair at GFirst LEP (Gloucestershire). She has previously worked at Superdry PLC for a total of 22 years, including as a main board director.

Investment summary

Versarien is a materials sciences company, with a focus on commercial applications of graphene. Since graphene was first isolated in 2004, a newly emerging industry has made steady progress, with graphene products now in commercial use in applications including electronic sensors, display screens, and sporting goods. We argue that the industry has now reached a commercial tipping point, with wide-ranging applications to come into usage within the next 2-3 years.

Within this rapidly evolving industry, we argue that Versarien benefits from the following key differentiators:

- Commercial partnerships and supply agreements in key industries including aerospace/defence, tyres, packaging, and speciality textiles
- Ongoing investments in new facilities to increase production capacity for graphene ink by up to 400%, and graphene powder by 900%
- Contract with the UK government Defence Science and Technology Laboratory (DSTL) to provide a step-change in graphene revenues for Versarien in FY2022
- New financing secured during 2020 and 2021 including equity investors, and government-backed loans, providing effectively over £5mln of available resources (details p8-9)

Leader in UK graphene, with a significant role to play in net-zero CO_2 initiatives

The company benefits from a supportive relationship with the UK government, as evidenced by the Innovate loan package, continuing work with the Government Catapults, the DSTL contract, and other initiatives such as a recently announced funding grant from the Department of Transport. Versarien is considered a leading player within the UK's graphene industrialisation strategy — the company's subsidiary 2-DTech was a spin-out from the University of Manchester (the university that first isolated graphene), and the subsidiary Cambridge Graphene Limited was a spin-out from the University of Cambridge. We believe that Versarien's technologies can play a significant role in the UK's net-zero CO_2 goals, and we expect a continued synergistic relationship between Versarien, the UK government, and academia. More details of the environmental benefits are included in our product segment discussions, p5-8.

In addition to the graphene business, Versarien has mature businesses in industrial sectors.

The biggest drivers of the revenue growth strategy are the six work packages of the company's GSCALE project for expanding the graphene business:

G — Graphene. The ramp-up of graphene production capacity in the UK.

S — Seat. This work package is now developing thermoset/carbon fibre composite applications using graphene, as demonstrated in the Lotus car bonnets.

Environmental benefits available from graphene in construction

C – Concrete. By enhancing concrete with very small amounts of graphene, Versarien can offer the construction industry gains in performance and reduced CO_2 emissions.

A – Arch. Graphene-enhanced thermoplastics for use in a wide range of industries.

L – Leisure. The use of graphene inks and graphene nanoplatelets in textile applications.

E – Elastomers. Graphene enhanced elastomer masterbatches for applications including automotive tyres, footwear, and oil and gas.

We examine the elements of the GSCALE project on p5-8.

Graphene market and Versarien's position

Graphene is an allotrope of carbon, which was first isolated at the University of Manchester, England, in 2004. It consists of a single layer of carbon atoms arranged in a 2-D honeycomb structure, and possesses physical properties that have made graphene a major focus of research for materials scientists. Properties include:

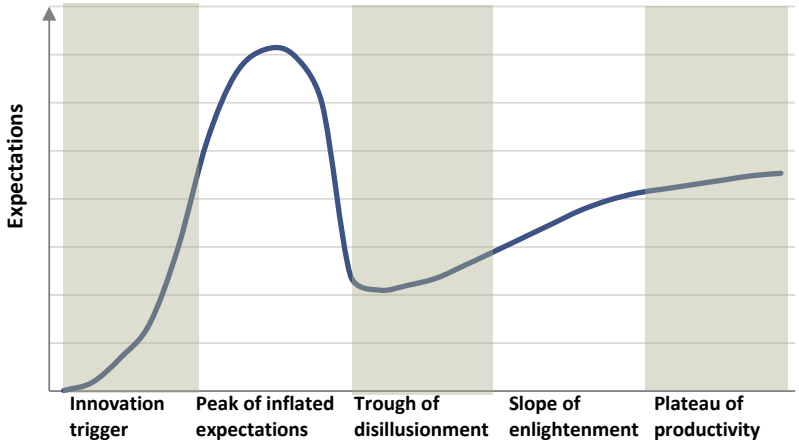
- Mechanical strength
- High thermal conductivity
- High electrical conductivity

Researchers have found that the addition of very small amounts of graphene can significantly transform the properties of materials including plastics, concrete, elastomers, composites, and others.

Industry expectations ran ahead of reality in the period 2012-15

The huge potential of graphene led to the formation of a wave of graphene-focussed enterprises, particularly during the period 2012-2015. We argue that the development of the graphene industry has resembled the template set out by the tech consultancy Gartner in its 'Hype Curve' for newly emerging technologies — expectations initially run ahead of deliverable reality. The following chart illustrates:

The Gartner 'Hype Curve'



Source: Proactive Research illustration of a concept by Gartner inc.

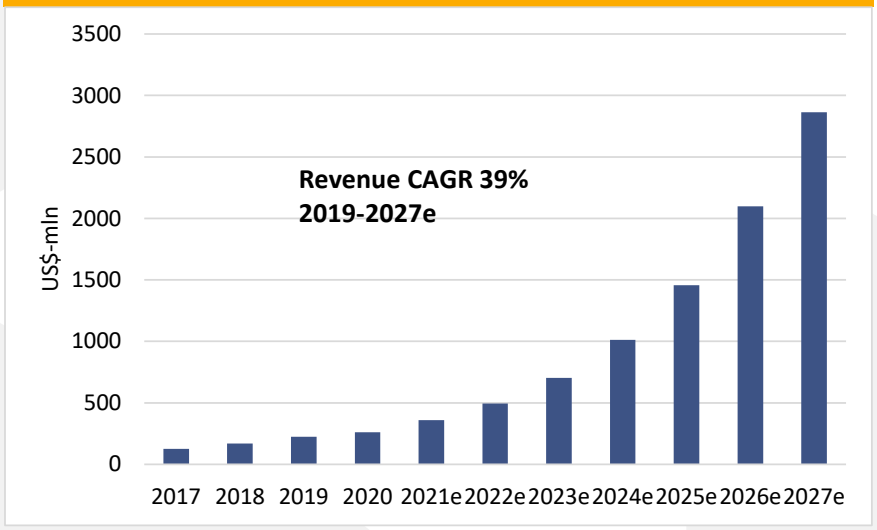
The industry has now reached its growth inflexion point

The industry has now entered the phase of scalable commercial utilisation of graphene, with industry revenues increasing at a compounded annual growth rate (CAGR) of 49% over the years 2018, 2019, 2020. We expect a continuation of strong growth in the next five years, driven by ongoing growth in existing applications and the emergence of new industrial applications that are now reaching the stage of full-scale commercialisation.

Strong industry growth trend for the years ahead

The following chart illustrates our growth expectation for the industry:

Growth in global demand for graphene

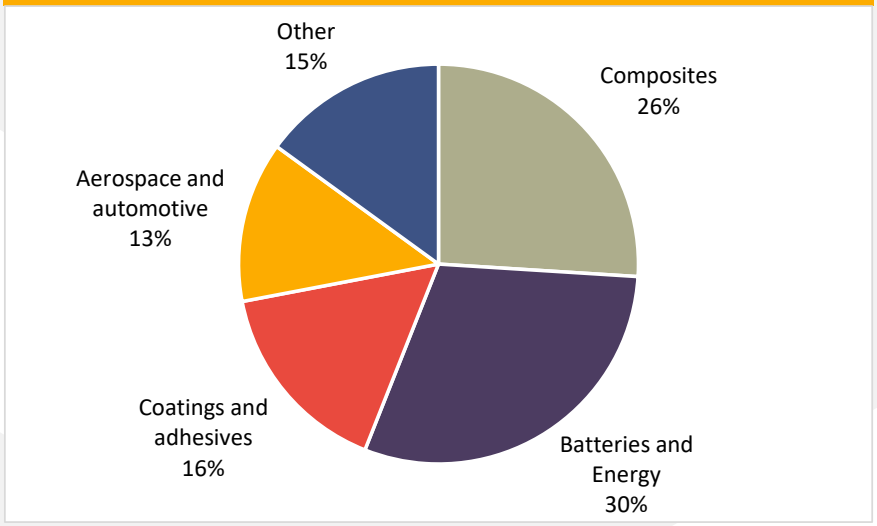


Source: Proactive Research, average of market sources

The biggest applications as of today are composite materials, batteries and energy equipment, coatings and adhesives, and aerospace and automotive technologies. These categories don't correspond directly with Versarien's GSCALE framework but give us an overview of the shape of the industry.

The following chart illustrates:

Demand for graphene by market segment



Source: Proactive Research - average of market sources

Three formats of Versarien product

Versarien produces graphene in three main formats, powder, ink, and chemical vapour deposition (CVD) films, as well as related products.

Graphene Powder

Versarien produces high-quality few-layer graphene powder, consisting of flakes with a thickness of 5 to 10 atomic layers. This has applications in composites, energy applications, biomedical applications, membranes, coatings, and sensors and electronics.

Graphene Ink

The company produces a range of water or solvent-based inks branded as GRAPHINKS that are printable graphene and related material (GRM) inks and coatings that bring multi-functionality (high electrical and thermal conductivity, fire retardation, ultra-violet protection, etc.), produced via a high-pressure homogenisation process that offers high yield and uniform size distribution. These can be used in textiles, coatings, printed electronics, antennas, sensors, energy storage devices, and other applications.

CVD Films

Through its operations in Korea, Versarien holds more than 100 patents covering areas including the use of CVD methods to produce high-quality single-layer and dual-layer graphene and methods to produce graphene-based thin-film laminates for potential use in electronics and other applications. The company produced its first samples from the new Korean facility in October 2021 and made its first sales of CVD graphene materials in November 2021.

Versarien's graphene revenues have grown faster than the industry in recent periods

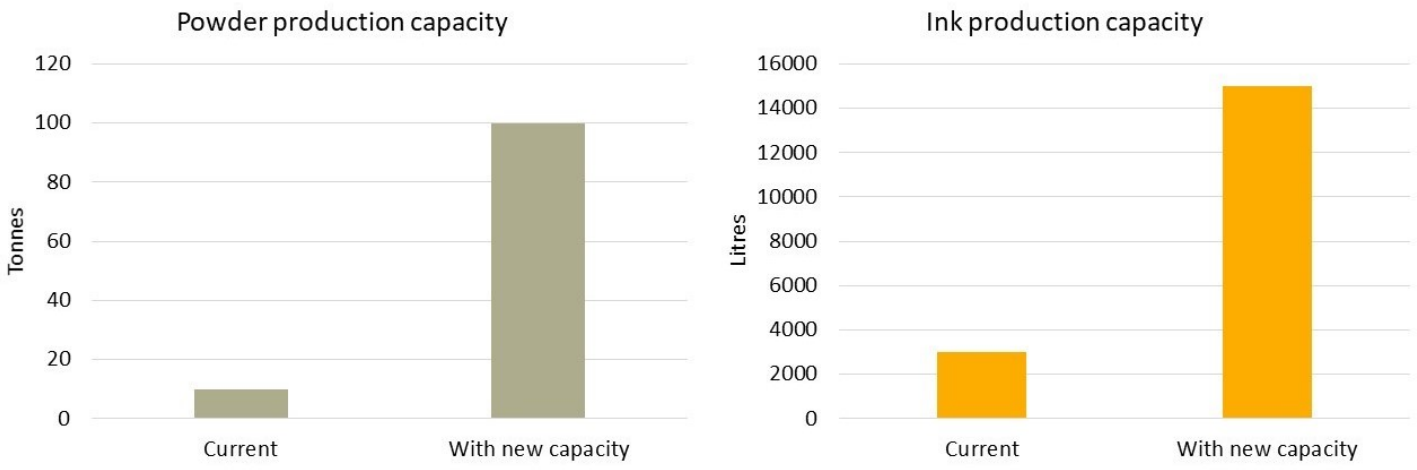
Versarien's graphene revenues increased 5x in the year to March 2021 versus 2020 (Proactive Research estimate based on company releases), and grew 166% in H1 2021 versus H1 2020. We anticipate a continuation of strong growth in the coming 3-5 years.

Investments in new capacity

Versarien has announced two major projects in the last six months to increase its UK graphene production capacity. At the preliminary results stage in August 2021, the company announced the acquisition of graphene manufacturing assets from a former competitor in Spain, to provide up to an additional 100-tonne powder capacity per annum. The company also placed orders for the purchase of graphene ink equipment to give up to an additional 12,000 litres of ink capacity. Both of these will be installed at a new state-of-the-art production facility in Longhope, Gloucestershire.

The following chart illustrates the increases in Versarien's production capacity.

Versarien production capacity



Source: Proactive Research, from company releases

These new capacity additions support Versarien's pipeline of growth opportunities across all the GSCALE verticals.

In addition to the capacity expansions in the UK, Versarien opened a new facility in Korea during 2021, following the acquisition of assets from Hanwha Aerospace

and strategic investment from Graphene Lab Co Ltd (see p9). The new facility will focus on CVD graphene and other graphene technologies. CVD graphene can be used in sensors, electronics, and other applications. The Korean facility expands Versarien's footprint in Asia as well as adding new technological capabilities for the group.

The GSCALE programme

The GSCALE project is the central framework for Versarien's growth strategy, based around six separate work packages, G, S, C, A, L, and E:

Work Package G — Graphene

The Graphene work package is focused on scaling the production of high-quality graphene in the form of powder and ink. The new production capacity that was announced with the preliminary results in August will be integrated into a new facility in Longhope, Gloucester.

Work Package S (Seat) — Carbon fibre developments in transport

The Seat package was originally devised to develop lighter flame-retardant seat backs for the aerospace industry, using graphene dispersed in various thermoset systems used in fibre-reinforced polymer composites.

The package has expanded to include rail products including interior applications and door panels. There are also increasing opportunities in the automotive space, due to electric vehicles requiring lightweight structures to enhance range.

Vehicle weight reductions offer lower fuel consumption

The market for composite materials currently stands at £4bn per year, and we believe that graphene-enhanced composites are likely to take a growing share of this market over the next decade. Composite materials offer performance gains for materials used in rail, automotive, and aerospace applications, as well as environmental advantages including weight reduction benefits that reduce fuel consumption and which can increase range for electric vehicles.

Versarien has announced plans to increase its graphene/resin dispersal capacity from 5 litres per day to 100 litres. The dispersal of graphene within resin is the key enabling process for graphene-enhanced polymer composites.

Work Package C (Concrete) — Construction applications

The properties of concrete for construction can be significantly enhanced by the addition of very small amounts of graphene — typically less than 0.1% concentrations.

Cement production accounts for 5-10% of all human carbon emissions

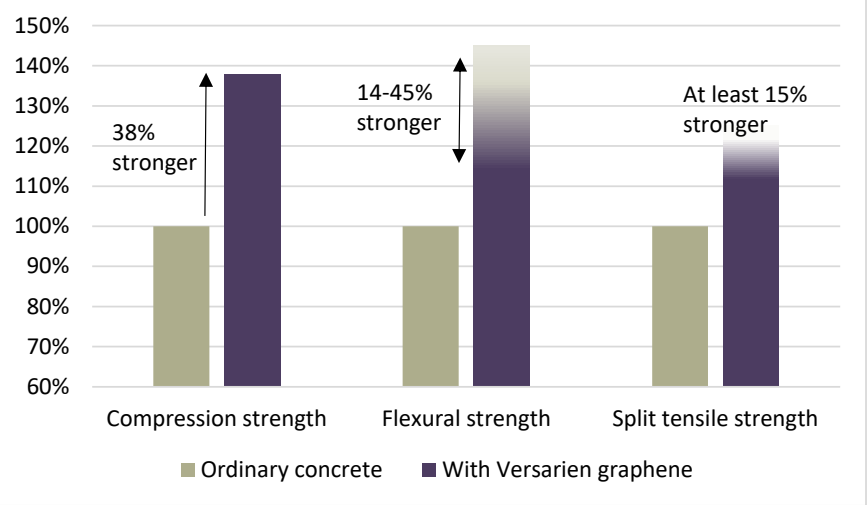
These enhancements can enable increased durability for structures, more efficient construction processes (lighter, faster, cheaper) and also less volume of concrete required. Cement production accounts for 5-10% of all human CO_2 emissions globally, and therefore reductions in concrete usage can play an important part in governmental efforts to achieve net-zero carbon emissions by 2050.

Versarien has undertaken trials of a CEM1 concrete mix with the addition of Versarien's GRAPHINKS graphene ink, at concentrations of a fraction of a per cent, using an independent test house to measure performance improvements. These tests have shown that the enhanced concrete has:

- Improved compression strength (+38%)
- Improved flexural strength (>14% - 45%)
- Improved split tensile strength (>15%)
- Improved water permeability (> 200% - 0mm to 2mm)
- Faster curing without micro-cracking
- Increased corrosion resistance

The following chart summarises some of these results.

Performance enhancement of concrete with Versarien graphene



Source: Proactive Research, from Versarien news releases

There are some 25mln tonnes of ready-mix concrete per year used in the UK annually. This represents both a substantial carbon-emissions reduction opportunity and a significant revenue opportunity for Versarien.

The company is also working with additive manufactured concrete printing technology to produce graphene-enhanced 3D printed structures, with applications in rail infrastructure projects among others.

Work Package A (Arch) — Graphene in polymers

The Arch package is concerned with thermoplastics with enhanced graphene characteristics. Product categories include:

- Consumer and commodity thermoplastics
- Engineering polymers
- Speciality plastics

Development projects within this package include polyolefin compounds for extrusion moulding, and graphene-enhanced thermoplastic polyurethane, nylon PA12, cellulose acetate, and polycarbonate for eyewear. The company also has an agreement in place for an initial batch of portable suction devices for clearing blocked airways in emergency medicine, using biopolymers.

There are 3.3mln tonnes of plastic processed each year in the UK alone, representing a major revenue opportunity for Versarien as well as a key focus area for industries to improve sustainability.

Enabling more use of biopolymers and recycled polymers

An important application for graphene is the use of graphene to enhance recycled polymer products to match the performance of a virgin polymer, thus reducing the world's use of oil-based raw materials. In addition, graphene can be used to enhance the functionality of bio-polymers, allowing manufacturers to bypass oil-based materials entirely for some applications.

Work Package L — Leisure

The leisure package uses graphene inks and graphene nanoplatelets in various applications, primarily in textiles. Graphene can be applied to textiles via printing, coating or blending and provides benefits including thermal regulation, wicking, drying, and water repellency with applications in activewear and other product categories.

The UK's textile industry stands at £5.8bn per year and can benefit from graphene technologies in terms of reduced use of oil-derived polymers, improved functionality of materials, the extension of garment lifetime, and improved recyclability.

The company has partnerships in place with industry players including MAS Holdings and Coats PLC and has sample garments in testing with a number of well-known activewear brands, as well as a supply agreement with Canadian boutique brand Crosslete using print technology.

Partnership with Superdry represents a benchmark customer relationship in textiles

In November 2021 Versarien announced a partnership agreement with the UK clothing company Superdry, for the development of advanced textiles incorporating Versarien's GRAPHENE-WEAR technology. Superdry represents an important potential benchmark customer for Versarien's textiles technologies.

Work Package E — Elastomer

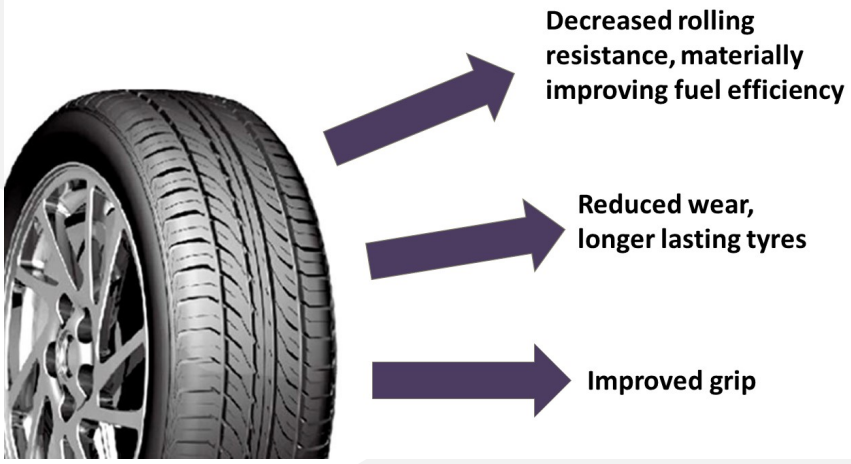
The Elastomer package is focused on two main industry segments — oil & gas, and automotive tyres.

As an additive within automotive tyre compounds, graphene has the potential to reduce rolling resistance thereby reducing emissions or in the case of electric vehicles offering increased range. This can be achieved while also improving wear and grip (usually tyre compounds must make a trade-off between resistance, wear, and grip).

The following diagram illustrates:

Reduced rolling resistance increases vehicle range

Performance enhancement of tyres with Versarien graphene



Source: Proactive Research, from Versarien news releases

The company has tyre compounds in testing and now has an agreed pricing structure in place to move forwards with large-scale trials during 2021.

In addition to the oil & gas and automotive applications, the elastomer technology also has potential applications in footwear, and Versarien has distributed masterbatches for manufacturer testing and for production trials. The global footwear industry is forecast to reach US$440bn per year by 2026, and represents a significant additional potential market for Versarien's graphene technologies.

Other graphene technologies — energy storage solutions

Through its Gnanomat subsidiary in Spain, Versarien produces a range of hybrid nanocomposites made up of graphene and other carbon materials with nanoparticles and additives of different sources for industrial applications. In particular, these materials have applications in next-generation energy storage

devices, including enhanced lithium-ion batteries, metal-air batteries, and hybrid capacitors that combine the qualities of pseudocapacitors and super-capacitors. Hybrid capacitors potentially offer a fast-charging, low degradation alternative to existing energy storage devices.

Gnanomat develops and manufactures its own products and collaborates with final users designing integrated nanomaterials. We believe that these products potentially extend the range of Versarien's presence in the sustainable technologies space.

Recent deals - revenue projects and financing

During 2020 and 2021 Versarien has announced a number of significant deals that have advanced the position of the company's graphene businesses. We summarise some of the most important deals:

DSTL contract — defence

In November 2020 the company announced a product development agreement with the Defence, Science and Technology Laboratory (DSTL), a branch of the UK's Ministry of Defence. The contract covers polymer composites and other applications and has a value of £1.95mln, of which £1.6mln will be recognised as revenue during the full year to March 2022 (FY 2022). This is the company's largest graphene contract to date.

Graphene Labs deal — Korea

In December 2020 Versarien announced the acquisition of graphene production assets and intellectual property from South Korean company Hanwha Aerospace.

Korean partnership has brought significant new capital plus market access

Subsequently, in April 2021 the company announced a collaboration agreement with another South Korean company, called Graphene Lab Co Ltd, which specialises in chemical vapour deposition graphene. The collaboration will use some of the intellectual property acquired from Hanwha.

In connection with the collaboration agreement, Graphene Lab made a strategic investment in Versarien, injecting £1.93mln of new capital in exchange for a 2.2% equity stake.

Since the acquisition, Versarien has relocated and commissioned the plant and equipment acquired from Hanwha, and been able to produce high-quality CVD graphene samples. The company will next begin commercialising the 100-plus patents acquired by collaborating with institutions and South Korean companies as well as working with Graphene Lab on government projects.

£5mln loan facility from Innovate UK, of which some £1.7mln still to come

Significant financing deals

In July 2020 Versarien was awarded a £5mln loan by Innovate UK, which is a government-backed entity that supports technology-rich small and medium enterprises (SMEs) in the UK. Of this loan, £3.34mln had been drawn down by September 2021, with £1.66mln still to come during FY 2022 and 2023.

In March and December 2020, Versarien announced two share subscriptions by Lanstead Capital Investors LP, for £6mln and £3.5mln respectively. The proceeds of these share issuances were pledged into schemes called a sharing agreement, under which Versarien receives back the proceeds over an agreed timeframe (24 months and 18 months for the two deals respectively) on a monthly basis with upwards or downwards adjustments depending on the Versarien share price.

The following table summarises the deals that have brought new capital into the business.

Financing raised

Funder/investor	Date announced	Type of deal	Total amount
Innovate UK	June 2020	Loan	£5mln
Lanstead Capital Investors LLC	Mar 2020 & Dec 2020	Equity	Variable total
European Union	Jan 2021	Grant	€0.36mln
Graphene Lab limited	April 2021	Equity	£1.93mln

Source: Proactive Research, from Versarien news releases

Versarien ended H1 September 2021 with £3.5mln of cash on the balance sheet. The company still has some £1.7mln to be drawn down on the Innovate UK loan, and further cash to come from the Lanstead deal.

We argue that Versarien's capital position is sufficient to sustain activity through FY March 2023e. Furthermore, we believe that the company has a supportive shareholder base and could raise additional capital to support the growth strategy as required.

Investment conclusions

We argue that Versarien offers compelling investment opportunity within the rapidly emerging industry of graphene materials technology. The company benefits from:

- A proven capability for delivering high quality graphene powders and inks
- An application-specific framework for driving growth, under the GSCALE programme
- Investment projects underway to dramatical upscale volume
- A solid capital position

We believe that the current share price leaves significant upside potential for shareholders as the revenue ramp-up progresses.

General Disclaimer and copyright

LEGAL NOTICE – IMPORTANT – PLEASE READ

Proactive Research is a trading name of Proactive Investors Limited which is regulated and authorised by the Financial Conduct Authority (FCA) under firm registration number 559082. This document is published by Proactive Research and its contents have not been approved as a financial promotion by Proactive Investors Limited or any other FCA authorised person. This communication is made on the basis of the 'journalist exemption' provide for in Article 20 of The Financial Services and Markets Act 2000 (Financial Promotion) Order 2005 and having regard to the FCA Rules, and in particular PERG 8.12.

This communication has been commissioned and paid for by the company and prepared and issued by Proactive Research for publication. All information used in the preparation of this communication has been compiled from publicly available sources that we believe to be reliable, however, we cannot, and do not, guarantee the accuracy or completeness of this communication.

The information and opinions expressed in this communication were produced by Proactive Research as at the date of writing and are subject to change without notice. This communication is intended for information purposes only and does not constitute an offer, recommendation, solicitation, inducement or an invitation by, or on behalf of, Proactive Research to make any investments whatsoever. Opinions of and commentary by the authors reflect their current views, but not necessarily of other affiliates of Proactive Research or any other third party. Services and/or products mentioned in this communication may not be suitable for all recipients and may not be available in all countries.

This communication has been prepared without taking account of the objectives, financial situation or needs of any particular investor. Before entering into any transaction, investors should consider the suitability of the transaction to their individual circumstance and objectives. Any investment or other decision should only be made by an investor after a thorough reading of the relevant product term sheet, subscription agreement, information memorandum, prospectus or other offering document relating to the issue of securities or other financial instruments.

Nothing in this communication constitutes investment, legal accounting or tax advice, or a representation that any investment or strategy is suitable or appropriate for individual circumstances or otherwise constitutes a personal recommendation for any specific investor. Proactive Research recommends that investors independently assess with an appropriately qualified professional adviser, the specific financial risks as well as legal, regulatory, credit, tax and accounting consequences.

Past performance is not a reliable indicator of future results. Performance forecasts are not a reliable indicator of future performance. The investor may not get back the amount invested or may be required to pay more.

Although the information and date in this communication are obtained from sources believed to be reliable, no representation is made that such information is accurate or complete. Proactive Research, its affiliates and subsidiaries do not accept liability for loss arising from the use of this communication. This communication is not directed to any person in any jurisdiction where, by reason of that person's nationality, residence or otherwise, such communications are prohibited.

This communication may contain information obtained from third parties, including ratings from rating agencies such as Standard & Poor's, Moody's, Fitch and other similar rating agencies. Reproduction and distribution of third-party content in any form is prohibited except with the prior written consent of the related third-party. Credit ratings are statements of opinion and are not statements of fact or recommendations to purchase, hold or sell securities. Such credit ratings do not address the market value of securities or the suitability of securities for investment purposes, and should not be relied upon as investment advice.

Persons dealing with Proactive Research or members of the Proactive Investors Limited group outside the UK are not covered by the rules and regulations made for the protection of investors in the UK.

Notwithstanding the foregoing, where this communication constitutes a financial promotion issued in the UK that is not exempt under the Financial Services and Markets Act 2000 or the Orders made thereunder or the rules of the FCA, it is issued or approved for distribution in the UK by Proactive Investors Limited.

London
+44 207 989 0813
The Business Centre
6 Wool House
74 Back Church Lane
London E1 1AF

New York
+1 347 449 0879
767 Third Avenue
Floor 17
New York
NY 10017

Vancouver
+1 604-688-8158
Suite 965
1055 West Georgia Street
Vancouver, B.C. Canada
V6E 3P3

Sydney
+61 (0) 2 9280 0700
Suite 102
55 Mountain Street
Ultimo, NSW 2007