We think beyond today's solutions and shape the future through innovation.

Our purpose

Vesuvius is a global leader in molten metal flow engineering and technology, serving process industries operating in challenging high-temperature conditions.

We think beyond today to create the innovative solutions that will shape the future, delivering products and services that help our customers make their industrial processes safer, more efficient and more sustainable.

In turn, we provide our employees with a safe workplace where they are recognised, developed and properly rewarded, and aim to deliver sustainable, profitable growth to provide our shareholders with a superior return on their investment.

Name: Efren Evangelista
Role: Ferrous Metallurgist & Foundry Development Expert
Location: Suzhou

Our business

We're harnessing technology to create solutions that drive our customers' success

In 2022 we spent £36m on R&D, developing innovative products and solutions in our six R&D centres that will enable our customers to optimise their efficiency.

Name: Ertan Eser
Role: Group Leader Sedex
Location: Borken

Name: Kritika Raman
Role: Trainee Engineer
Location: Kolkata

Name: Tiago Dos Santos
Role: Research Engineer – VISO
Location: Ghlin

At a glance

We are a global group providing products and solutions to industrial customers who manage the flow of molten metal. Our technology-led solutions allow our customers to tackle complex problems in their production. Our customers are predominantly in the steel and foundry industries and we serve them from two Divisions.

Steel

Revenue £1,496m

Our customers are steel producers and other high-temperature industries. Vesuvius is a world leader in the supply of refractory products, systems and solutions. These help our customers increase their efficiency and productivity, enhance quality, improve safety and reduce their costs and their environmental impact.

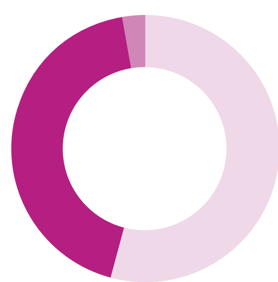
Business Units

Flow Control
Steel production volume is the primary driver of demand for Flow Control's products, whilst the trend for 'high-technology steel' allows us to leverage our advanced solutions and achieve above-market growth rates.

Sensors & Probes
Steel production volume and the need to increase the quality and consistency of cast steel drives demand for our Sensors & Probes business.

Advanced Refractories
Steel production volume and certain other high-temperature industries, such as aluminium, copper, cement, petrochemical and energy from waste, are the drivers for the Advanced Refractories Business Unit's product demand.

Revenue breakdown by Business Unit

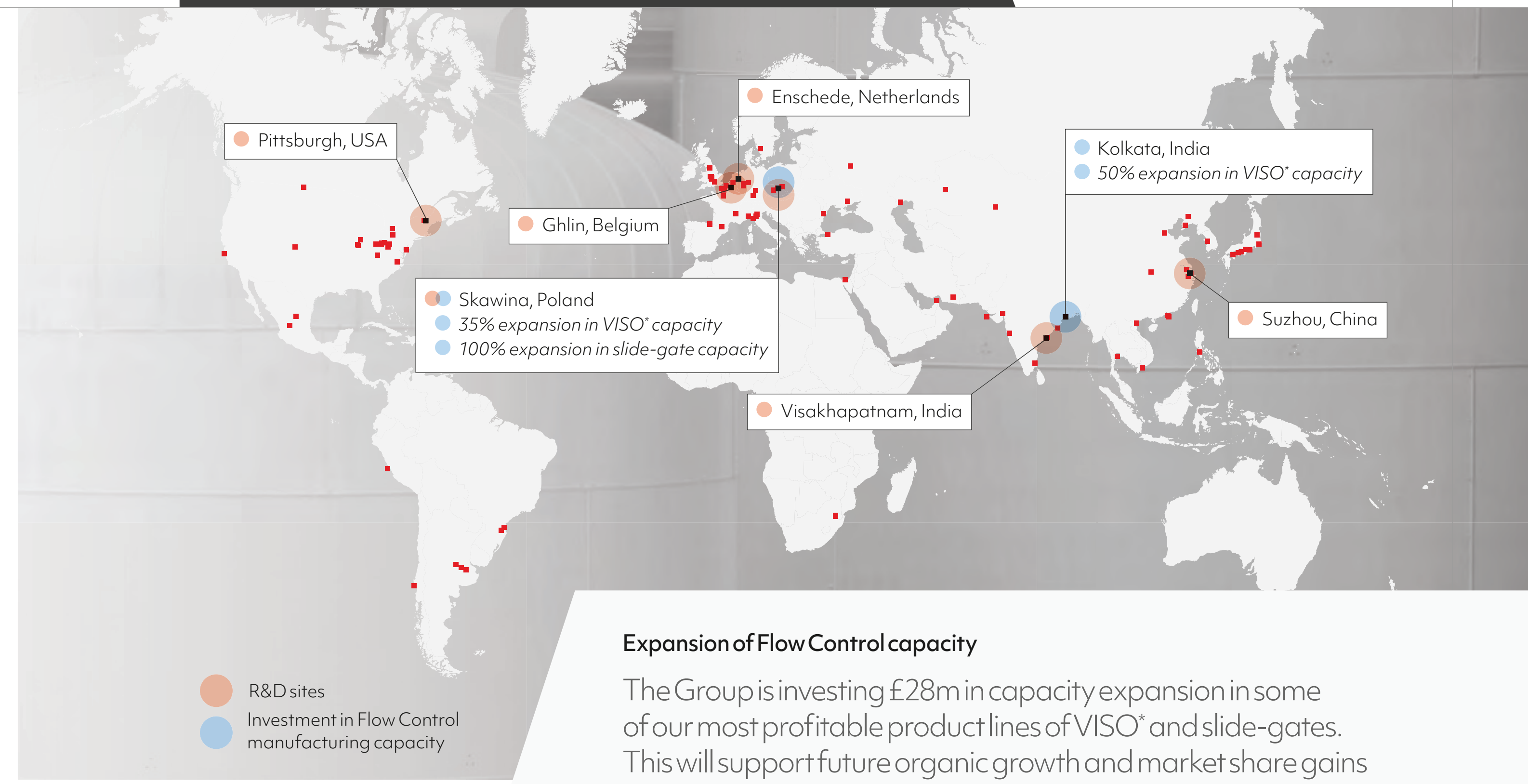


Foundry

Revenue £551m

We are a world leader in the supply of consumable products, technical advice and application support to the global foundry industry, improving casting quality and foundry efficiency. Our primary customers are ferrous and non-ferrous foundries serving various end-markets, from large bespoke castings to high-volume automotive pieces. We operate in the foundry sector under the Foseco brand. Product demand in our Foundry Division is driven by higher sophistication, demanding higher quality metal and increasingly more complex castings.

Our production, R&D and commercial sites worldwide



Expansion of Flow Control capacity

The Group is investing £28m in capacity expansion in some of our most profitable product lines of VISO* and slide-gates. This will support future organic growth and market share gains in the fast-growing markets in EEMEA, India and South East Asia.

Breakdown by region

Americas
3,343 employees

20% Foundry
80% Steel

£741m
Revenue

EMEA
4,242 employees

30% Foundry
70% Steel

£742m
Revenue

Asia-Pacific
3,549 employees

32% Foundry
68% Steel

£565m
Revenue

Our global presence

6	40	68	6	55
Continents	Countries	Sales offices	R&D centres of excellence	Production sites

* Trademark of the Vesuvius Group of companies, unregistered or registered in certain countries, used under licence.

What we do

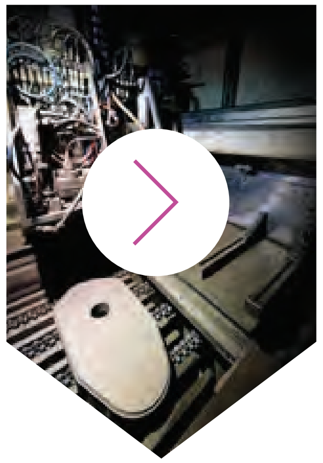
We draw on years of technical expertise and investment in innovation, to provide solutions, products and services that are critical to the success of our customers in the steel , foundry and other high-temperature industries.

What is a refractory?

Refractories are ceramic materials designed to withstand the very high temperatures encountered in modern manufacturing. More heat-resistant than metals, they are used to line the hot surfaces found inside many industrial processes.

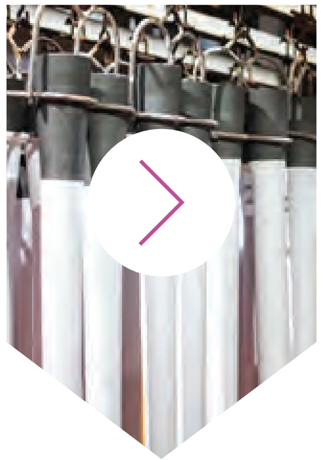
What we do for our Steel customers

We supply refractory products, flow control systems and process measurement solutions to our Steel Division customers

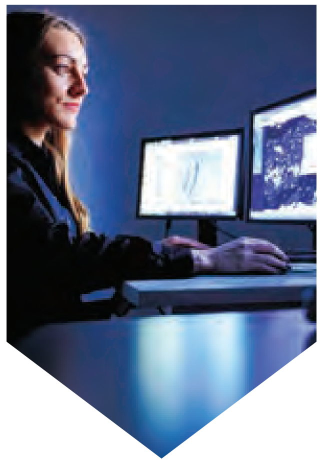


We combine these with robotics and mechatronic installations to lower cost, and improve safety and consistency

Our solutions address the key challenges of our customers in the steel industry, such as maintaining steel quality and reducing energy usage during the casting process



Our products and their applications preserve the purity of the steel as it moves through the production process, from initial refining to the cast steel slab, bar or ingot



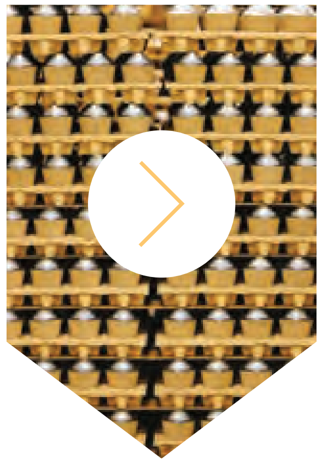
Our solutions help to improve safety, quality and consistency. They reduce energy usage, and lessen the environmental impact of the steel-making process

What we do for our Foundry customers

We provide customisable products and process technology to foundries that improve the quality of their castings

We combine this with technical advice, application engineering and computer modelling to improve process outcomes

Our solutions address the key challenges of our foundry customers of casting quality and production efficiency



Our products and solutions clean the molten metal, improve the solidification of that metal, and reduce wastage in the final casting

Our castings contribute to the improvement of product quality and manufacturing efficiency, whilst reducing the environmental impact of the casting process

Our investment proposition

We believe that Vesuvius offers a compelling opportunity for investors. As a global business with industry-leading R&D and a strong focus on growing economies we offer a unique proposition with exciting potential for profit generation.

Name: Maike Frericks
Role: Team Leader Delivery Management/SCM
Location: Borken

Each of these elements enables us to drive profitable growth with a cash-generative model.

Statutory EPS

67.2p

	Statutory EPS
22	67.2p
21	37.7p
20	15.3p

Sales generated by market-leading sustainable products[1]

17.9%

	Sales generated by market-leading sustainable products
22	17.9%
21	17.5%
20	16.0%

1. Using Vesuvius' internal scorecard.

Principal reasons to invest

1 We operate in long-term growth markets

- Demographic growth, urbanisation and sustainability needs are driving the growth of steel and foundry markets globally
- Growing green energy infrastructure is increasing demand for steel
- Demand for high-tech steel and high complexity castings are growing ahead of the market

2 We are an industry leader

- We are a global leader where our products are primarily focused – in flow control and foundry solutions
- We provide technology-based solutions which help our customers improve their sustainability, safety, quality and cost performance
- We have a worldwide presence, and are especially strong in the fastest growing regions of India, South-East Asia, Middle East, Africa and Latin America whilst maintaining leadership in Europe and North America

3 We are leading the technology race

- We spend twice as much on R&D as a percentage of sales than our closest competitors
- This investment enables us to maintain and even increase 'clear blue water' between us and competitors
- 16% of our sales are in products launched in the last five years. Our objective is for this to reach 20%

4 Technology leadership gives us pricing flexibility and market opportunities

- We can compensate for cost increases
- We gain market share in Flow Control and Foundry through superior technology
- Our solutions are a very small part of the cost structure of our customers. This cost is outweighed by the benefits of our technological differentiation

5 We have a strong sustainability strategy

- We have reduced our carbon footprint by more than 18% since 2019
- We plan to reduce it by 50% by 2035, so that we will be net zero by 2050
- Our products enable our customers to improve their own carbon footprint
- 75% of our R&D pipeline is dedicated to products with superior sustainability characteristics

6 Sustained free cash flow generation and a strong balance sheet pave the way for growth

- We have made the strategic choice not to be integrated upstream in mining. This reduces our need for maintenance capex and enables us to be free cash flow generative at every point of the market cycle
- We maintain strong and prudent balance sheet management
- Solid free cash flow and a strong balance sheet allow us to seize organic and non-organic growth opportunities

Chairman's statement

The people, products and expertise in place for long-term sustainable growth

Carl-Peter Forster
Chairman

Dear Shareholder,

I am delighted to be reporting to you for the first time as Chairman of Vesuvius, having joined the Board at the end of 2022. Vesuvius has delivered a stand-out performance in 2022, with financial results significantly ahead of the Group's expectations at the beginning of the year. This has been achieved through a keen focus on commercial excellence and demonstrates the agility of our business, and the ability of our people, to respond to economic challenges. I would like to thank all of my Vesuvius colleagues for the professionalism and dedication they showed during 2022 and for their steadfast contribution to these excellent results.

Safety

The number one priority at Vesuvius is to provide our employees with a safe workplace, so that they return home safely to their families at the end of each working day. Therefore, only the highest levels of safety performance can be accepted. Vesuvius believes that all work-related injuries or ill health are preventable, making safety the responsibility of every Vesuvius employee. There is an understanding that working safely is a clear condition of employment. Against this background, it is deeply regrettable that we suffered a fatality at our joint venture site in Wuhan, China during 2022. We are determined to ensure that lessons learnt from this accident are shared across the Group to prevent further incidents. Our thoughts remain with the family and friends of the colleague we lost.

Initial impressions

I have received a warm welcome to Vesuvius over the past few months. I have visited our sites in Borken, Germany; Skawina, Poland and Ghlin, Belgium; and been impressed by the depth of knowledge and expertise that exists in our operations. My first interactions with the business tell me that Vesuvius' CORE values of Courage, Ownership, Respect and Energy are clearly alive and well, and embedded in the organisation.

It is already clear to me that R&D is a core component to our success and the delivery of our strategy. There is deep technical expertise in the organisation and the spark of innovation is truly alight across all Business Units. I am looking forward to increasing the breadth and depth of my technical understanding of our products and solutions as I continue to visit our sites in the year ahead.

Strategy

I believe that Vesuvius' key strength is its ability to add value to our customers, by driving efficiency and productivity improvements in their processes, as well as providing support to make their operations safer and more environmentally friendly. We are passionate about our products and solutions, which help our customers deliver consistently higher quality finished products, with an improved metallurgical structure and using fewer resources. In this way, Vesuvius plays an important role in improving our customers' commercial, quality and environmental outcomes. Our extensive R&D capability, deep product knowledge, and long-standing steel and foundry process expertise enable us to partner with them to innovate and adapt to their changing needs.

During the year the Board conducted its annual review of the strategy for each Business Unit. Each has a tailored plan for profitable growth and higher profit margins, focused on innovation, quality and long-term sustainability. Against this background, the Board reaffirmed its support for a significant investment programme in the Group – particularly focusing on our growth markets across the world.

People

People are clearly at the heart of Vesuvius, and understanding the work undertaken to ensure we have the right people in the right places in the business remained a key focus for the Board in 2022. During further COVID-19 disruption in China in 2022, our people once again excelled in their dedication, maintaining operations at our sites despite further lockdowns. I give my thanks to those teams. Likewise, when the conflict broke out in Ukraine, our colleagues continued to support the organisation, despite immense personal challenges. We are thankful that our people there remain safe, and on behalf of the Board I thank them for the work they continue to do in extremely difficult circumstances.

The recent cyber security incident has demonstrated the depth of our organisational resilience and culture. We are responding to the considerable challenges this has posed and at every site our people have worked incredibly hard to restore production, reinstate systems and serve our customers, demonstrating our core values to the full.

> "R&D is a core component to our success and the delivery of our strategy"

Members of the Board made visits to sites in Belgium, Brazil, Germany, India, Japan, Mexico and the Netherlands during the year. It is during these visits that the Directors can speak first-hand with our people, holding 'town hall' meetings, listening to their questions and feedback, and taking the temperature of the organisation. An employee engagement survey was again conducted in 2022. In its fourth year, participation remained high at 92%, and team feedback reports were provided to more than 700 managers. It is in the action planning that will come from the reports that the real value to the business will be delivered. The information we receive from the engagement survey and the face-to-face interactions at sites support the Board in understanding and assessing the health and consistency of the Group's culture.

Sustainability

The Group has set clear internal operational targets around sustainability performance, particularly in relation to our CO_2 emissions and energy consumption. Our focus on sustainability is increasingly entwined with our R&D capabilities, where our research enables us to continue to bring innovative, more efficient solutions to our customers. We also see ongoing commercial opportunities for the business as the energy transition accelerates, with renewable energy production plants (such as wind or solar) requiring significantly more high-quality steel than those powered by fossil fuels, and as such, driving growth in the steel industry. We have set the target of reaching a net zero carbon footprint at the latest by 2050. This will require capital investment in our operations, and the development and adoption of new production technologies. We have clear priorities, targets and milestones identified as we progress on this journey.

The Board and governance

I would like to thank John McDonough for the depth and dedication of his service in his ten years as Chairman of Vesuvius, steering the Group from its establishment as an independent public company. Whilst John leaves Vesuvius a thriving Company, in his words, and in my view, there is more to come.

In line with our plans for Board succession, we welcomed Carla Bailo to the Board as a Non-executive Director last month. Jane Hinkley, who has served the Group diligently for ten years will step down at the 2023 AGM. Jane leaves us with very many thanks for her service.

In 2023, we will also welcome Mark Collis to the Board as the successor to Guy Young, our departing CFO. Mark brings a wealth of operational finance experience to us, having worked in a number of international businesses, both inside and outside the UK. We keenly anticipate his integration into our Board and management team. We must, of course, thank Guy for his leadership of the finance function, and the considerable expertise he has brought over the past seven years in its development and operation.

The Board conducted an evaluation of its performance in 2022. This indicates that I have joined a Board that is open in its deliberations and is clear about the key strategic and operational drivers of the business. The output of this 2022 process will be used to help set priorities for the Board's activities in 2023.

Dividend

The Vesuvius dividend policy aims to deliver long-term dividend growth, provided this is supported by cash flow and underlying earnings, and is justified in the context of our capital expenditure requirements and the prevailing market outlook. The Board has recommended a final dividend of 15.75 pence per share (2021: 15.0 pence per share) for the year ended 31 December 2022. If approved at the Annual General Meeting, this final dividend will be paid on 31 May 2023 to shareholders on the register at 21 April 2023.

Annual General Meeting

The Annual General Meeting will be held on 18 May 2023. The Notice of Meeting and explanatory notes containing details of the resolutions to be put to the meeting accompany this Annual Report and are available on our website: www.vesuvius.com.

Looking ahead

As an incoming Chairman I am provided with a good opportunity to assess the Board's priorities. I believe that Vesuvius has a clear strategy for growth, and for delivering superior returns to our shareholders. In the months and years ahead we will deliver on our strategy. We will maintain our primary focus on safety, drive innovation through our dedicated R&D capabilities, deliver market-leading quality products and solutions, and maintain robust financial management to support investment in the business, and where appropriate, acquisitions. The year ahead will present economic, commercial and operational challenges. I am confident that we have the people, products and expertise to face them and continue on our path of long-term sustainable growth.

Carl-Peter Forster
Chairman
2 March 2023

Chief Executive's strategic review

Record profitability despite a challenging trading environment

Patrick André
Chief Executive

Trading profit
£m

£227m

22	227
21	142
20	101

Return on sales
%

11.1%

22	11.1
21	8.7
20	7.0

In 2022, we delivered record results and profitability, despite a difficult environment in both our Steel and Foundry markets and challenging inflationary cost pressure.

A difficult market environment

Steel markets, after a promising start to the year, weakened significantly during the second half. This decline was exacerbated in EMEA by the consequences of the Ukrainian conflict. India was the only major region in the world to exhibit a positive growth in 2022. Overall, steel production in the world excluding China declined by 6.5% in 2022. In China, steel production also declined, for the second year in a row, by 2.1%.

In 2022, foundry markets remained well below their pre-pandemic level, both in China and in the world excluding China. In particular, various supply chain bottlenecks continued to limit the recovery of the automotive sector. In EMEA, other foundry sectors were also affected by the conflict in Ukraine.

Challenging inflationary cost pressure

The cost of most raw materials used for the manufacture of refractories remained at a high level in 2022, above their long-term average. At the same time, energy costs increased very significantly, especially in Europe, as a consequence of the Ukrainian conflict. Most other cost inputs also registered abnormally high increases, due to the general inflationary environment. The only significant exception to this inflationary trend was sea freight, which declined progressively during the second half of the year, after the peak in 2021.

Strong market share gains and pricing performance leading to record results and profitability

Both the Steel and Foundry Divisions achieved a strong commercial performance in 2022, gaining market share in most regions and in doing so partially mitigated the volume decline in end-markets. The main exception was Russia, due to the cessation of sales to sanctioned customers.

We were particularly pleased with the performance of our Flow Control Business Unit, which continued to expand its market share in volume in all regions.

At the same time as we grew market share, we successfully increased our prices in all Business Units, fully compensating for the increase in our cost base. This ability to simultaneously improve market share and prices is made possible by the technological differentiation in our products and solutions driven by our continual investment in research and development.

Thanks to this market share and pricing performance in 2022 we delivered our best results and profitability ever. Our revenue reached £2,047m (an increase of 25% compared to 2021), our trading profit reached £227m (an increase of 60%) and our return on sales was 11.1%. These results far exceeded those of our previous record year pre-pandemic in 2018, despite significantly lower sales volumes due to the persisting market weakness in 2022. Assuming similar volumes as 2018, our return on sales would have been very close to our objective of 12.5%, demonstrating the impact of the cost competitiveness and technology strategy we have engaged in over the past five years and the profitability potential of the Group once its Steel and Foundry end-markets fully recover.

Strong free cash flow generation despite record growth in investments and safety stock rebuild

Our growth-generating investment programme continued apace in 2022 and will support the progression of our results and profitability in years to come. The expansion of our VISO* and slide-gate production capacity in Flow Control, launched in 2021, is proceeding as planned and will enable us to benefit from the upcoming market growth in India, South East Asia and EEMEA from 2024.

In 2022, we also initiated the construction of a new Flow Control flux plant in India, which will become operational in 2024, and Advanced Refractories began the construction of a new state-of-the-art basic monolithics plant in India. This will enable us to introduce our latest technological innovations and increase our presence in this fast-growing market in the coming years.

In the Foundry Division, construction of a new flux production line in China has commenced. This will enable us to increase our presence in the growing aluminium foundry market in the country.

At the same time as investing in capacity expansion, we also took the decision to increase our safety stock of products and raw materials, to protect our customers. This followed on from the two force majeure incidents we experienced at the end of 2021, which resulted from the lack of reliability in the freight and logistics market. We successfully accomplished this in 2022 and re-established full security of supply for our customers in spite of ongoing reliability issues in the logistics market during the year.

Despite these significant cash investments in growth-generating capital expenditure and working capital for our customers, our strong financial results, coupled with stringent cash management discipline, enabled us to generate a significantly positive free cash flow and further reduce our level of debt in 2022. Our leverage ratio also declined during the year from 1.4x at 31 December 2021 to 0.9x at 31 December 2022.

Increased R&D investment, laying the foundation for future growth

We significantly increased our investment in research and development in 2022, spending £36m, an increase of 18% over 2021. This was fully expensed in our profit and loss statement. Our main focus areas remain innovation in materials science, with the objective to continuously improve the performance of our consumables, and the development of mechatronics solutions enabling our customers to substitute operators to manipulate our consumables and, by doing so, improve their safety, reliability, cost and quality performance.

We successfully launched 15 new products in 2022 in our three Business Units. Our New Product Sales ratio, defined as the percentage of our sales realised with products which didn't exist five years ago, reached 16.2% in 2022, up from 15.3% in 2021.

In June 2022, we formally opened our Ghlin centre of excellence for R&D and Mechatronics, which focuses on developing new products and showcasing them to customers. I'm delighted with the impact the site is having. We have welcomed 25 customer delegations to the Ghlin centre in the first six months of opening.

We intend to continue to reinforce our research and development effort in the coming years and accelerate the launch of new innovative products to support our growth and market share gain ambitions.

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> "Our growth-generating investment programme continued apace in 2022"

Stable safety performance

After the significant improvement registered in 2021, we stabilised our safety results in 2022 with a Lost Time Incident Frequency Rate of 1.08 vs 1.06 in 2021. We remain, however, unsatisfied with this level and are intensifying our efforts to progress rapidly towards our objective of zero incidents. Despite much good work at many sites, I am profoundly sorry to report that in 2022 there was a fatality at our joint-venture manufacturing site in Wuhan, China. The incident was investigated fully, in conjunction with the local Chinese authorities, and we will ensure that we learn the necessary lessons to prevent this tragedy ever being repeated.

A new Sustainability ambition. Significant progress in our journey to net zero

In 2022, we continued to implement our action plan to decarbonise our activities. In particular, we reinforced our energy savings initiatives and accelerated our programme to shift our electricity consumption worldwide to non-carbon emitting sources. Thanks to these efforts, we reduced our carbon footprint by 18.8% as compared with our 2019 reference year (versus 15.5% in 2021).

To progress faster towards our goal of having a net zero carbon footprint by 2050 at the latest, we also set ourselves a new intermediary target to reduce our CO_2 footprint by 50% before 2035, as compared with our 2019 reference year. To achieve this objective, we have defined a detailed capital expenditure programme of c.£60m which will be gradually implemented over the next 12 years.

Successful integration of acquisitions

In 2022 we continued with the integration of Universal Refractories ('Universal'), the specialty refractory business in the United States, which we acquired in December 2021. The integration has involved the regional consolidation of the manufacturing of advanced refractory and foundry products of Vesuvius and those acquired from Universal, to create centres of excellence and more efficient operations.

We also acquired Bayuquan Magnesium Co (BMC) in October 2022, a world-class basic monolithic refractory plant in China and a long-standing manufacturing partner of ours. The acquisition secures strategically valuable basic monolithic volumes at a plant which benefits from very competitive local raw material access. This acquisition will support our further development in the fast-growing Asia-Pacific region.

Board Chairman

As communicated last year, John McDonough stood down from the Board, as planned, in December 2022, and leaves with our sincere thanks. I'm delighted to welcome Carl-Peter Forster to the Board as Chairman and look forward to working with him in the coming months and years to build on the success achieved to date.

Chief Financial Officer

Guy Young chose to leave Vesuvius, having worked as CFO for seven years, concluding his work with us in mid-February 2023. I would like to thank him once again for his support and service to the business. We announced in January that Mark Collis will be joining Vesuvius as CFO, by July this year. Mark has a wealth of experience in international finance roles in John Wood Group plc and other quoted businesses, and I'm looking forward to him joining the team. In the intervening time, I am grateful to my colleague Richard Sykes, who has worked at Vesuvius in numerous operational and finance roles, for taking on the position of interim CFO.

Cyber update

On 6 February 2023, we announced that we had suffered a cyber security incident. In order to contain the threat, we voluntarily shutdown our systems on a precautionary basis. During this period our sites instigated manual procedures and work arounds to maintain production, shipping and invoicing. We have since worked tirelessly on the reinstatement of our systems, and I am pleased to report that the initial period of major disruption has been short, and all sites and significant systems are now operational. As such we expect the impact on trading to be modest, limited to one-off costs of between £3m and £5m.

Outlook

Looking forward, we expect to continue to successfully achieve market share gains through technological differentiation and new product launches. We are also confident in our ability to cover cost increases with pricing. Accordingly, we are confident that our 2023 results will be in-line with our expectations, despite several headwinds:

- As anticipated, the Steel and Foundry markets remain weak, and we anticipate the rate of recovery to be slow and only improve later in the year
- The planned reduction in our own inventory to normalised levels, which is a drag on fixed cost absorption, will continue throughout the first half of 2023
- The negative impact of the cyber security incident incurred at the beginning of the year

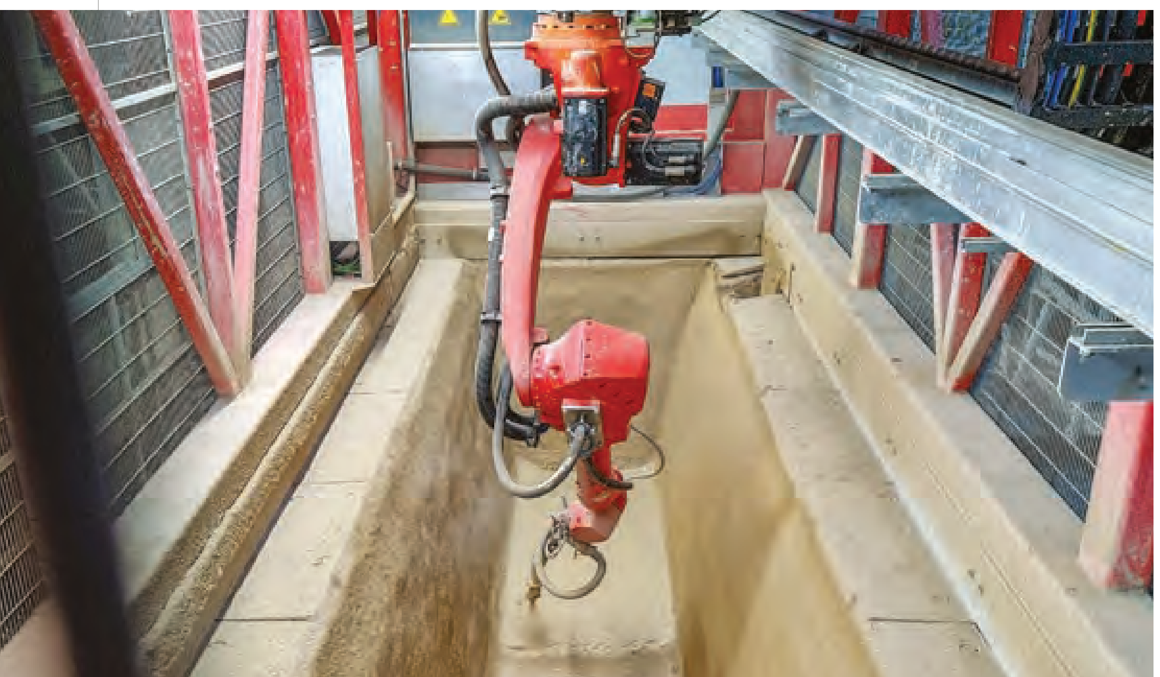
Looking beyond 2023, we expect the positive impact of our investment in R&D, long-term growth initiatives, and development of our capacity in fast growing regions, will result in accelerated growth and profitability.

Patrick André
Chief Executive
2 March 2023

Our external environment

Solutions for the changing demands of business

Changes in our markets present both challenges and opportunities. We have responded to long-term trends by positioning ourselves for growth.



BASILITE QuickStart* is a tundish working lining spray mass to be used on a single, combined, drying and preheating cycle using less energy, less water and delivering higher quality.

Helping our customers tackle climate change

What's happening

The pressure on the Steel and Foundry industries to reduce greenhouse gas (GHG) emissions, particularly CO_2, is increasing significantly as governments are enforcing stricter regulations, especially in the EU, the US and China.

Our customers are focusing on reducing absolute energy consumption and GHG emissions through technological changes away from higher emission processes, as well as reducing energy consumption and GHG emissions via increased efficiency. In the steel industry the rise of scrap availability and of its recycling, is supporting a shift to electric arc furnaces away from blast furnaces to produce steel. Alongside this, the use of direct-reduced iron in combination with green hydrogen in steel production to manufacture 'Green Steel' (where hydrogen itself is made using sustainable energy) is gaining traction.

Our Foundry customers are experiencing a drastic change in their end-markets as parts of the world shift towards hybrid and electric vehicles, which alongside, the significant movement towards green electricity generation, is accelerating a transition away from traditional ferrous casting into non-ferrous casting.

How we are responding

We work closely with our customers to develop new products and technologies to meet these challenges with sustainability being a critical focus in new product development.

Our Steel Division is partnering with customers to develop refractory solutions for next-generation steel-making processes. Additionally, we continue to develop new products with superior sustainability characteristics.

Our Foundry Division teams are developing new filtration, feeding, mould coating and molten metal treatment products to support the availability of higher-performance metal and the manufacture of lighter-weight components for the automotive industry. They are also developing new products for aluminium foundries to support the fast-growing market in electric vehicles.

* Trademark of the Vesuvius Group of companies, unregistered or registered in certain countries, used under licence.

Responding to the demand for higher quality steel and foundry products

What's happening

The importance of technology to differentiate steel and foundry producers continues to grow, supported by the development of more demanding product applications.

Steel producers are increasingly focused on supplying higher-quality steel grades for automotive and power generation, where the consistency of the finished steel is fundamental. This is driving an above-market growth forecast for high-technology steel in all regions.

In foundries, there continues to be a trend towards higher metal and process quality, as they focus on a greater number of applications that require castings to combine high strength with thinner, lighter profiles and greater complexity.

How we are responding

Vesuvius is strongly positioned to facilitate these upgrades and to benefit from these trends. We have a wide product and service offering designed to support the production of high-technology steel and complex cast components across our broad, global manufacturing base.

We continue to invest heavily in R&D with dedicated centres of excellence to think beyond what exists today.

Vesuvius' innovative portfolio of products and services, together with its global footprint, enable us to provide high-technology solutions to our worldwide customers.

Harnessing automation

What's happening

Our customers face ever-increasing regulation and scrutiny to ensure the safety of their workforce in all parts of their operations, as well as continuously improving their process efficiency.

Advancements in automation can transform production, bringing greater consistency whilst lowering cost. At the same time, robots can support or even substitute operators in hazardous production areas, significantly improving safety performance.

With labour shortages a growing challenge in some markets, automation can create more flexible operations and reduce reliance on manual operators.

How we are responding

Vesuvius has the global and in-depth capability to combine know-how in steel mills and foundries with robotic capabilities to deliver superior safety performance in hazardous areas of production.

We provide laser technology to assess refractory wear, allowing targeted repair with our broad range of refractory consumables and application solutions – for efficient and safe operation. We have invested significant resources in the development of our mechatronics capabilities to shape the future operations of steel and foundry plants with our current robotics offering (e.g. tundish, continuous casting) as well as with new automation capabilities in other areas. We are also exploring new ways to integrate continuous data capture into our solutions to give our customers further insights into the use of consumables in their production processes.

Robotics R&D centre of excellence in Ghlin

Vesuvius' Smart Tundish Spray Robot (TSR), is known for its safe, consistent and reliable performance. In 2022, Vesuvius launched the next generation TSR in our Mechatronics centre of excellence in Ghlin, Belgium; building on this success to deliver further innovations to improve the user interface and enhance the ease of its operation.

Our markets

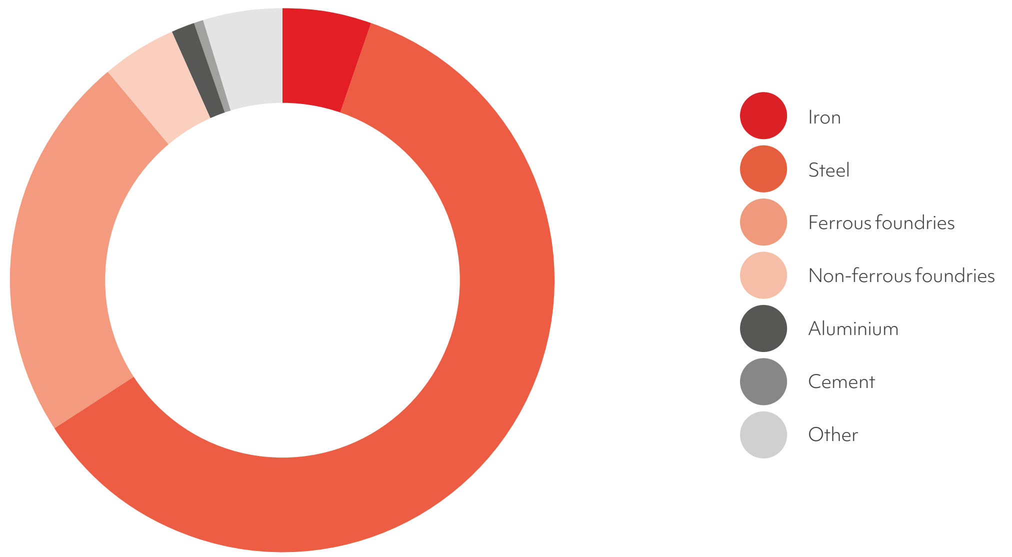
We have core end-markets in steel-making and ferrous foundry with an increasing focus on aluminium, cement and non-ferrous foundries.

We develop long-term working relationships with our customers to understand their needs and develop tailored solutions that meet them.

Vesuvius sales by customer activity

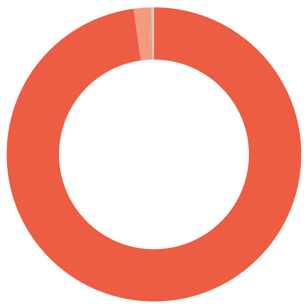
Vesuvius' key customers continue to be steel producers and ferrous foundries, with the strategic ambition to further grow in non-ferrous foundries and other high temperature industrial processes such as aluminium and cement.

Breakdown by customer activity

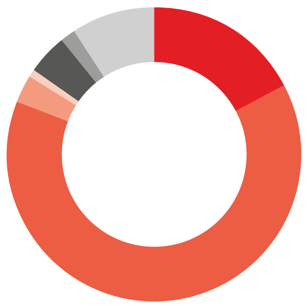


Business Unit breakdown

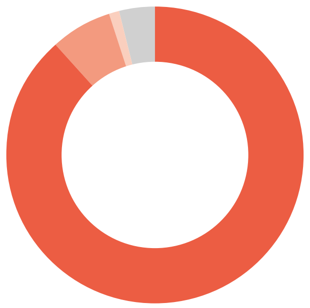
Flow Control



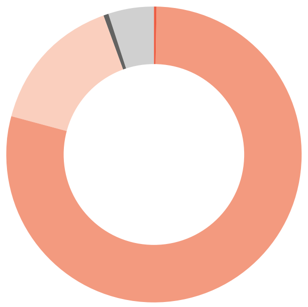
Advanced Refractories



Sensors & Probes



Foundry



Name: Marco Andre De Oliveira Dutra
Role: Quality Inspector
Location: Rio de Janeiro

Name: Isadora Della Libera Godoy
Role: Quality Inspector
Location: Rio de Janeiro

Name: Lukas Anibal Simoes Faustino
Role: Quality Inspector
Location: Rio de Janeiro

Our strategy

What we want to achieve
Our Strategic Objectives

Our purpose is to be a global leader in molten metal flow engineering and technology. We think beyond today to create the innovative solutions that will shape the future, delivering this through our Strategic Objectives.

We achieve profitable growth by focusing our efforts on the high-quality, high-technology segments of the steel and foundry markets, and concentrate on increasing the automation and efficiency of our manufacturing base.

Objectives	Measurements	
Always put safety first	Lost Time Injury Frequency Rate	
Deliver profitable growth	Underlying revenue growth	
Generate value for our shareholders	Trading profit Return on sales Headline profit before tax	Headline EPS Return on invested capital
Maintain an efficient capital structure	Free cash flow Average working capital to sales	Interest cover Net debt to EBITDA
Deliver industry-leading sustainable operations and solutions	Energy intensity CO_2e emission intensity Wastewater Solid waste	Recycled material Compliance training Supply chain
Think beyond in innovation	Total R&D spend New product sales	
Foster talent, skill and motivation in our people	Gender diversity	

We measure and monitor our performance against these Strategic Objectives through our Key Performance Indicators (KPIs).

See our **Key Performance Indicators** on p36 and 37

How we are doing it
Our execution priorities

How we are progressing
Performance in 2022

Reinforcing our technology leadership

Vesuvius was built and grew through technology breakthroughs. We focus on delivering market-leading technology which continues to drive our unique value proposition and underpins our ability to deliver ongoing value enhancement to our customers.

During 2022, we invested £36m in R&D, 1.8% of revenue. We remain committed to spend c.2% of sales on innovation every year. We invest throughout the product cycle from front-end innovation to existing product development, focusing on the projects that deliver the highest impact to our customers.

Developing our technical service offering and increasing penetration of value-creating solutions

As steel and foundry markets in developing economies become more quality focused, we have the opportunity to significantly increase our penetration of these markets through the value delivered by our solutions.

In 2022, we continued our drive to bring new products to the market, with a number of significant launches. Triad Z Bond* is a new Advanced Refractories mix which is five times stronger than bricks, with better carbon retention. ACTICOTE TS* is a new Foundry insulating coating for sand cores that slows down the heat extraction from the liquid metal, improving its metallurgical structure.

Capturing growth in developing markets

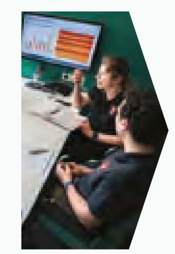
Building on our long-standing presence in all markets, we can leverage the high growth enjoyed by our customers' industries in emerging markets, which are large consumers of steel goods and foundry castings.

Major acceleration of expansion capex in 2022 with £53m of total capex (c.60%) spent on growth projects, particularly in Flow Control, to serve fast growing developing markets in Asia.

In 2022 we outperformed the market in developing market regions: Flow Control outperformed in India, South-East Asia and Latin America, and Foundry also performed well in Asia-Pacific and South America.

Improving cost leadership and margins

We continuously pursue initiatives to adapt our business and our cost base to the changing trading environment.



We were successful in recovering input cost increases through pricing in 2022. At the same time, our volumes grew ahead of market growth, demonstrating the value of our products to our customers.

Driving sustainability within Vesuvius and for customers

We develop products that seek to help our customers drive efficiency and reduce their environmental footprint, and we are focusing on reducing the environmental impact of our own operations. See our Sustainability section on p50-85.

In 2022, we made excellent progress on our carbon reduction target, such that, in June, we decided to increase our ambition from a 10% reduction by 2025 to a 20% reduction.

We continue to develop our plans to reach a net zero carbon footprint by 2050 at the latest.

* Trademark of the Vesuvius Group of companies, unregistered or registered in certain countries, used under licence.

Business model

A profitable, flexible, cash-generative model focused on sustainable growth

Our key resources

Financial capital

We use the cash generated by our business to invest in innovation, people, operating assets, technology and sales to generate further growth.

Manufacturing capital

We have a global footprint, with 55 production sites on six continents, giving us proximity to our customers.

Intellectual capital

We have six R&D centres of excellence, together with dedicated R&D staff worldwide, generating innovative products and services that help our customers make their industrial processes safer, more efficient and more sustainable.

Human capital

We invest in developing our skilled and motivated workforce of more than 11,000 people and provide them with a safe environment in which to work.

Social capital

We champion our Values and our ethical conduct. We maintain strong relationships with customers and our wider stakeholder groups.

Natural capital

We utilise high-quality raw materials, secured through reliable, and well developed sustainable supply chains.

R&D centres of excellence	6
Employees	11, 134
Production sites	55

What we do

We develop and manufacture high-technology products and solutions to assist our customers in the management of molten metal. We operate a profitable, flexible, cash-generative and growth-building business model. Over many years, we have built the brand equity of our Vesuvius and Foseco products through technology leadership, reliability and service.

Our sustainable competitive advantages

Global presence

Our local manufacturing, local expertise and global knowledge of customers' processes give us a special relationship with our customers.

Read more about Our global presence on p4 and 5

Optimised manufacturing

Low-cost lean manufacturing provides reliable 'just-in-time' products.

Read more about Our operations on p42-47

Advanced technology

Our continuing investment in Vesuvius' R&D centres of excellence is reflected in all areas of our offering. We are therefore able to provide our customers with sophisticated, innovative, custom designed solutions.

Read more about our Value-added solutions on p14 and 15

Service and consistency

Our knowledge of end-market processes, specifications and techniques around the world gives our experts an unparalleled ability to support our customers.

Read more about Our operations on p42-47

How we deliver

- Our industry experts are embedded at many customer locations and are therefore ideally placed to collaborate with customers to identify potential service and process improvements. This also enables us to grow our solutions and service portfolio.
- We develop high-technology products that deliver quality enhancement, efficiency gains and energy savings to our customers. We focus on environmental sustainability in our own business through the efficient use of energy and natural resources.
- Our model is profitable by allowing value pricing for bespoke products and services. It generates growth as we enlarge our market with additional innovative products and solutions.
- Our model is resilient to end-market volatility due to the flexibility of our diversified manufacturing footprint and adjustable cost base, increasingly supported by automation.
- Our commitment to ethical business delivers strong, long-term, sustainable commercial relationships.

The value we create

Our investors

Strategic alignment

Our cash-generative and low capital intensity business provides returns to our shareholders and underpins sustainable growth.

Our customers

Strategic alignment

Our investment in innovation creates cutting-edge products and solutions delivering enhanced value for our customers. Our technology solutions improve customer safety and remove operators from the most dangerous parts of our customers' processes.

Our people

Strategic alignment

We focus on the health and safety of all our staff. We engage with our people, encouraging and rewarding high performance to create an environment where all can realise their individual potential.

Our communities

Strategic alignment

We are committed to maintaining positive relationships with the communities in which we operate. Our social responsibility activities complement our Values and we encourage our employees to engage with communities and groups local to our operations.

Name: Paulina Kołodziejczyk
Role: Production Manager
Location: Skawina

Section 172(1) Statement – Stakeholders

Effective engagement with stakeholders promotes the long-term sustainability of the Group

Strategic alignment

Always put safety first

Deliver profitable growth

Generate value for our shareholders

Maintain an efficient capital structure

Deliver industry-leading sustainable operations and solutions

Think beyond in innovation

Foster talent, skill and motivation in our people

See more about **Our strategy** on p18 and 19

Vesuvius is required to provide information on how the Directors have performed their duties under Section 172 of the Companies Act 2006 during the year. This requires the Board to promote the success of the Company over the long term for the benefit of shareholders as a whole, whilst having regard to a range of other key stakeholders and interests.

The Board recognises the need for the Group to have effective engagement with, and encourage participation from, all key stakeholders to promote these long-term interests. The Group's key stakeholder groups, reflecting those who have the biggest impact on the business, and our modes of engagement are outlined in the tables on pages 25 and 26.

The Board confirms that it has acted in accordance with the Section 172 requirements throughout the year, considering the impact of its decisions on shareholders and other stakeholders, and taking into account their differing views and requirements.

The likely consequences of any decision in the long term

The Board is responsible for the overall direction of the Group. It sets the Group's strategy, oversees the allocation of resources and monitors the performance of the Group, to ensure that the Group is structured appropriately for the challenges and opportunities of the future. In performing these duties, the Board is focused on the sustainable success of the Group in the long term, and the existence of a culture that supports this success. Throughout the year, the Board considered the long-term consequences of the decisions it made, focusing on the interests of relevant stakeholders as appropriate. Examples of how the Board considered Stakeholders' interests in some of the key decisions it took during the year are given opposite. Further information on the Group's strategy can be found in Our strategy on pages 18 and 19.

Acquisition of Bayuquan Magnesium Co

Stakeholder alignment

- Shareholders
- Employees
- Customers

Strategic alignment

The Board approved the acquisition of Bayuquan Magnesium Co (BMC) in October 2022. BMC has been a long-standing toll manufacturing partner of the Advanced Refractories Business Unit. The acquisition secures strategically valuable basic monolithic volumes at a plant which benefits from competitive local raw material access.

The transaction helps our overall goal of improving the profitability of Vesuvius, by capturing the full end-to-end margin of BMC's production. This allows us to enhance our customer offering. It also strengthens our supply chain in this critical product for our Advanced Refractories strategy. We are delighted to welcome BMC's 285 employees to the Group.

Ongoing operational response to cost of living pressures

Stakeholder alignment

- Employees

Strategic alignment

The Board was cognisant of the impact of the global macroeconomic environment on employees during the year, with increases in prices and interest rates causing cost of living pressures in many countries. The very significant inflationary pressures in a small number of our jurisdictions were also considered.

The Board reflected on these pressures when setting salary merit increase budgets for the year. As a result, the 2023 weighted average salary increase budget for the wider global workforce was c.9%, and in Europe the budget was c.12%. In some jurisdictions part of the 2023 budget was applied early to address the particularly significant issues faced by the workforce.

Reaction to conflict in Ukraine and Russian sanctions

Stakeholder alignment

- Shareholders
- Employees
- Customers
- Suppliers

Strategic alignment

Following the commencement of hostilities in Ukraine, the Board was kept briefed on the safety and whereabouts of our colleagues in Ukraine, and of the efforts being made throughout the Group to support Ukraine.

At the start of the conflict in Ukraine, the Board took the decision to suspend deliveries to all Russian customers. Having considered the potential impact of this decision on our employees, customers, suppliers and wider stakeholders, as well as reflecting on the approach taken by the majority of our peers and the effectiveness of stopping all trade with Russia, the Board subsequently resolved to continue to supply non-sanctioned customers in Russia.

Capex Approval of India Flux Plant

Stakeholder alignment

- Customers
- Employees
- Shareholders

Strategic alignment

The Board reviewed a proposal for the construction of a manufacturing site for fluxes on the freehold land in Visakhapatnam, India, acquired by the Group during the year. This investment will provide locally manufactured flux, which is a complementary offering to our other Flow Control product lines.

The construction of the flux facility on the new freehold land provides a further base for the expansion of our manufacturing to support the fast-growing market in India and South-East Asia, shortening supply chains and driving efficiency for our customers. It builds on the existing manufacturing and R&D presence of Vesuvius in Visakhapatnam, India.

Section 172(1) Statement continued

The interests of the company's employees

The Board takes the health and safety of the Group's employees as its primary responsibility. Following the fatal incident at a joint venture site in Wuhan, China in 2022, the Board received regular briefings on the investigations into the root cause of the event, and the actions being taken throughout the business to apply lessons learned.

At each Board meeting the Board received a report on the Group's performance against health and safety KPIs and reviewed, in detail, the circumstances of any Lost Time Injuries that had been reported.

During the year, the Board also reviewed progress against the specific HR objectives for each Business Unit and monitored the initiatives being implemented to develop, retain and motivate employees, and improve succession planning.

Jane Hinkley serves as the designated Non-executive Director responsible for workforce engagement and she oversaw the Board's engagement activities during the year. This included a review of the results of the global employee engagement survey and a series of site visits by Board members.

Further information about the Group's approach to health and safety and employment matters can be found on pages 74-80, including details of the engagement survey results. Information about the work of the Board's Committees in considering and supporting the interests of the Company's employees can be found in the Nomination and Remuneration Committees' Reports on pages 110–143.

The need to foster the company's business relationships with suppliers, customers and others

During 2022, the Board received presentations on end-markets, the dynamics of the Group's relationships with customers and suppliers, and key matters of concern to them. It discussed the steps being taken by the Group to respond to customers' ongoing requirements, and the research and development, marketing and new product launch strategies being actioned to respond to these. The Board reviewed information on the Group's performance against key manufacturing quality targets and was updated at Board meetings on actions undertaken to rectify any significant quality issues or customer complaints, particularly if these indicated repeat issues that required investigation. Further information on the Board's focus on suppliers, customers and others can be found in the Corporate Governance Statement on page 95.

The impact of the company's operations on the community and the environment

Supporting our customers' efforts to reduce their own environmental footprint and improve safety on the shop floor is a key element of the Group's strategy. Throughout 2022, the Board discussed each Business Unit's progress with this strategy. It also received biannual presentations from the VP Sustainability on the work of the Sustainability Council and the Group's progress against its sustainability targets. In addition, the Board and Audit Committee monitored the Group's progress with TCFD compliance. Further details of the Board's oversight of sustainability can be found in the Sustainability section on pages 50–85. The Board recognises that the success of the Group's operations is dependent on maintaining positive relations with the communities in which we operate. During 2022, the Board continued to encourage Vesuvius' sites to support their local communities through charitable activities and community events. Examples of which can be found in the Our Communities section on page 83.

The desirability of the company maintaining a reputation for high standards of business conduct

The Board takes seriously the Group's obligation to maintain a high standard of business conduct and assessed compliance with this requirement through a variety of mechanisms during 2022, including reports from Internal and External Audit, along with feedback from the Group's employee engagement survey. The Board received formal reports during 2022 on the Group's compliance activities, including the Group's risk assessment programme and training practices, and specific issues raised through the Group's Speak Up helpline and internal reporting processes. Further details of the Group's compliance activities can be found in the Our communities section on pages 81-85.

The need to act fairly as between members of the company

The primary focus of the Board's business decisions is on ensuring the long-term sustainability of the Group. The Board recognises that, in seeking to maintain long-term profitability, the Group is reliant on the support of all of its stakeholders, including the Group's workforce, its customers, suppliers and the communities in which its businesses operate. In taking capital allocation decisions during 2022, the Board was cognisant of the need to balance the interests of different stakeholders. Decisions on the Group's approach to investment opportunities, working capital, capex, R&D, investment in people, dividend policy and pension contributions were all considered against this backdrop.

Our stakeholders

Why this stakeholder is important to us	Issues that matter to them	Our response and engagement
Our people With our decentralised management model, the dedication and professionalism of our people, their capacity to own their roles and their drive for results are the most significant contributors to Vesuvius' success. We focus on the health and safety of all our staff, and operate with a clear set of CORE Values that are embedded across the business. We engage with our people, encouraging and rewarding high performance to create an environment where all can realise their individual potential.	Health and safety Diversity and inclusion Remuneration evolution International mobility Employee engagement Development and retention Career opportunities Sustainability performance	We have a fundamental focus on health and safety and the care of all employees There is continuing dialogue between employees and their managers, including the conduct of regular performance reviews We operate a competitive remuneration and benefits strategy, emphasising talent development with tailored career-stage programmes Living the Values and other award schemes celebrate individual achievements in the demonstration of our values Our global communication mechanisms include an intranet, global email communications and a Vesuvius news app, alongside forums such as local 'town hall' meetings The Group operates local works councils, recognises trade unions and is negotiating the re-establishment of its European Works Council Wide-ranging internal training is offered on key job-related issues, with programmes such as the Vesuvius University – HeaTt – and the Foseco University
Customers Engaging with, and listening to, our customers helps us to understand their needs and identify opportunities and challenges. Collaborating with our customers enables us to drive value for them, using our expertise to improve the safety and efficiency of their manufacturing processes, enhancing their end-product quality and reducing their costs.	Health and safety Production efficiency Product quality and performance Innovation and provision of solutions Environmental performance	We employ highly skilled technical experts to help us understand our customers' needs, and to identify opportunities and solutions for them We engage with customers on safety leadership and support their training requirements Our extensive R&D capability, deep product knowledge and long-standing steel and foundry process expertise enable us to partner with them to innovate and adapt to their changing needs We maintain senior-level dialogue with all key customers, including Directors' visits to customers' sites, as appropriate We establish customer relationships on a global basis as required, complemented by diverse local servicing capability Our business model focuses on collaboration with customers, to provide customised solutions. Our technical solutions enable customers to drive production efficiency, improving value creation and environmental outcomes We provide technical customer training, including operating the Foseco University, and participate in industry forums and events
Suppliers and contractors Maintaining a flexible workforce through the use of contractors and cost-effective access to high-quality raw materials is vital to our success. Our suppliers and contractors are critical to our business.	Operational performance Responsible procurement Trust and ethics Payment practices	Vesuvius conducts regular visits to key suppliers Senior-level relationships are built with large suppliers All suppliers/brokers for major raw materials have regular interaction with the Global Purchasing Team Dedicated category directors build long-term relationships and product expertise for key raw materials Vesuvius conducts a rigorous and consistent supplier accreditation procedure Effective working protocols, including work risk assessments, are established with contractors

Section 172(1) Statement continued

Our stakeholders continued

Why this stakeholder is important to us	Issues that matter to them	Our response and engagement
Investors The support of our equity and debt investors, and continued access to funding, is vital to the performance of our business. We work to ensure that our investors and lenders have a clear understanding of our strategy, performance and objectives, recognising that supportive investors are more likely to provide the Company with funds for expansion. We engage with lenders to fulfil our compliance obligations and to ensure that we have clear knowledge and awareness of market sensitivities and trends.	Shareholder value Financial and operational performance Strategy and business development Dividend and gearing policy Sustainability strategy and performance Governance Transparency and ethical behaviour	Vesuvius' Investor Relations strategy is managed by our Head of Investor Relations. She, along with the Chief Financial Officer and Chief Executive, hold regular meetings with key and prospective investors The Group Treasurer and CFO hold regular meetings with key personnel from banks and other lenders who provide the Group's debt funding. The Group Treasury function also maintains an ongoing dialogue with key relationship banks and other local banks in the countries in which Vesuvius operates The Group's Annual Report provides an overview of the Group's activities. Regular announcements and press releases are published to provide updates on the Group's performance and progress The AGM provides all shareholders with an opportunity to directly engage with the Board There is ongoing dialogue with the Company's analysts to address enquiries and promote the business The Chair of the Remuneration Committee consults with our largest shareholders on significant remuneration matters
Communities We are committed to maintaining positive relationships with the communities in which we operate. Our social responsibility activities complement our Values and we encourage our employees to engage with communities and groups local to our operations.	Career opportunities Operational performance Transparency and ethical behaviour Environmental performance	We provide work experience and internships to local university students and school children We maintain contact with universities to identify local talent and our businesses attend careers fairs and provide student work placements and internships Many of our sites sponsor local charitable activities and participate in local volunteering initiatives We maintain clear oversight and control of the environmental impact of our production sites We have a clear strategy for carbon reduction in our manufacturing process
Environmental agencies and organisations Good environmental management is aligned with our focus on cost optimisation, operational excellence and long-term business sustainability. We engage with appropriate organisations to ensure that we are complying with regulatory requirements, and to publicise our performance.	Governance and transparency Operational performance Reporting on performance metrics Environmental performance	Vesuvius is a signatory to the UN Global Compact We publish a full Sustainability Report online which can be accessed via the Vesuvius website We regularly engage with government agencies who visit our sites and carry out inspections We respond to environmental research as part of customer and supplier due diligence We participate in environmental and social responsibility research and questionnaires

Risk, viability and going concern

The Board continually monitors the internal and external risks that could significantly impact the Group's long-term performance

The Group undertakes a continuous process to review and understand existing and emerging risks.

Risk management in 2022

Each year, the Board exercises oversight of the Group's principal risks, undertaking a specific review of the way in which the Group manages those risks. This process provides the Board with a clear understanding of the individuals within the business responsible for the management of each of its principal risks and the mitigation in place to address it. The Board also reviews and, where appropriate, updates the Group's risk appetite for those issues identified as principal risks and the associated adequacy of the steps being taken to mitigate them.

The Board has overall responsibility for establishing and maintaining a system of risk management and internal control and for reviewing its effectiveness. The Group undertakes a continuous process to identify and review risk. This assessment undergoes a formal review at half-year and at year end. The risks identified by the business are compiled centrally to deliver a coordinated picture of the Group's key operational risks. These risks are then reviewed by the Group Executive Committee.

As part of this review, each Non-executive Director contributes their individual view of the top-down strategic risks facing the Group – drawing on the broad commercial and financial experience they have gained both inside and outside the Group – as well as their views on the Group's risk appetite. The results of this assessment are then overlaid on the internal assessment of risks to build a comprehensive analysis of existing and emerging risk. In this way, the Directors' views on each of the principal risks and on emerging risks in general, are independently gathered and integrated into the management discussions and actions taken on risk.

The process covers both financial and non-financial risks, and considers the risks associated with the impact of the Group's activities on employees, customers, suppliers, the environment, local communities and society more generally.

As in previous years, in 2022, the Group's assessment of principal risks was reviewed and considered against any emerging risks and uncertainties that were identified through this internal review process. Alongside this, the Board continued to monitor the implications of emerging macro trends on the business. These trends included automation in manufacturing, business digitalisation, automotive electrification, geopolitical tension and in particular the significant steps being taken in our end-markets to combat climate change as businesses commit to future net zero emissions targets. All of these could act as disruptors to our business. Commentary on some of these areas is contained in the Our external environment section on pages 14 and 15 of this Report. No additional critical macro trends were identified in 2022.

The Board also conducted further physical site visits in 2022. The Directors believe that this direct engagement with staff is the most effective way to assess the 'temperature' of the organisation – hearing first-hand about issues, concerns and potential risks that might impact the Group. More details on the site visits conducted can be found on page 95.

Risk remains an integrated part of all Business Unit presentations to the Board, informing the Board of the operational approach taken to risk management on a day-to-day basis.

Changes to risk in 2022

In 2022, the Board continued to focus on the Group's existing risks, and the processes to mitigate and manage them, whilst remaining alert to the potential for there to be other emerging risks. The risks posed by the COVID-19 pandemic broadly receded during 2022, other than in China, where we continued to be alert to the potential for disruptions to our operations and limitations on movement around the country. Ahead of the recent cyber incident, the Board had noted the developing trends in cyber threats to business in general, and had reflected this in the principal risks of the business in terms of business continuity.

Other emerging risks were assessed, with the Board considering the pressures on the business from inflation and interest rates, and the effects of the increasingly difficult environment for energy pricing and supply, which deteriorated further during the year as a result of the conflict in Ukraine.

The Board also considered the continuing work required to ensure that the Group's decentralised management and talent pipeline delivers the Group's profitable growth ambitions, whilst also consistently displaying behaviours in line with the Group's values in the conduct of all business.

Against the more uncertain economic backdrop, broader business continuity risks were highlighted by the Board. With job markets in some jurisdictions becoming increasingly difficult post-pandemic, these focused on people and the need to ensure that the business has the right management with the rights skills in the right places. This has to be coupled with the ability to retain and develop these people and a bench of talent lower down the business to support succession planning.

The Board also considered security of supply of raw materials and the geopolitical trends potentially moving away from the drive for globalisation.

It was noted that a number of these and other issues were already addressed in the Group's principal risks and by related mitigation activities.

Risk, viability and going concern continued

Issues identified in certain of the Group's principal risks materialised during 2022. The Group's existing measures in mitigation were initiated and reviewed to ensure their continuing effectiveness. These were most notably:

Business interruption: In the first half of the year, considerable work was done on security of energy resources in the light of the disruption of the Russian gas supply to Europe. This focused on plans to ensure that our European facilities could continue to operate, and the ability to transfer production in the event of an interruption in gas supply. Our business in Ukraine suffered very significant challenges but continued to operate to the extent possible, with the exceptional support of our people based there. In addition, our business in China continued to experience lockdowns related to the COVID-19 pandemic, and addressing these risks was a clear focus for our regional management in China.

In January this year, we also suffered an explosion at our site in South Africa, which damaged some equipment and required the instigation of our business continuity plan to mitigate the impact on our customers.

End-market risk: The global economic outlook deteriorated significantly in the second half of 2022, with particular concern indicated for the mature European economies. The effects of this did not have a significant impact in 2022 given the sharp focus on the commercial performance of our Steel and Foundry Divisions. Whilst the geographic diversity of our business and our presence in developing markets stand as robust mitigation to any regional disruptions or economic decline, the effects of this projected global decline continue to be carefully monitored.

Complex and changing regulatory environment: The conflict in Ukraine led to a significant increase in sanctions and restrictions relating predominantly to Russia, imposed by the United Kingdom, the European Union and the United States. The Group monitored these developments closely and using our established internal team and processes, took steps to assess and respond to each iteration of these restrictions as they were imposed.

People, culture and performance: The shift in working patterns to more remote working that come about as a result of the COVID-19 pandemic continues to be in place in the majority of our geographies. Whilst Vesuvius does not have a global policy in this regard, enabling our businesses to tailor their approach as necessary, a concerted effort has been made to bring our people back to the physical workplace where possible. This is considered to be particularly important in the context of instilling new joiners with a sense of the culture and values of Vesuvius, which we believe cannot be adequately transmitted in fully remote working structures.

Despite the aforementioned challenges, the Board did not identify any new principal risks during 2022 or any overall material change to the Group's identified principal risks and uncertainties, albeit that within those risks a number of issues manifested themselves during the year. As such, the Group's statement of principal risks and uncertainties was unchanged in 2022 from 2021.

Cyber security

The Audit Committee and Board receive regular updates on the Group's activities in regard to cyber security, including general developments and specific actions and activities within the Vesuvius business. A comprehensive plan was established in 2020 to further strengthen Vesuvius' overall IT security. This was progressed in 2021 and continued to be the focus in 2022, with a number of activities undertaken to strengthen and refine our systems and controls during the year. A holistic approach is taken to addressing cyber challenges, focusing on the improvement of the Group's overall IT infrastructure, procedures and framework. The Group continues to run regular training programmes on cyber/IT security. See page 105 in the Audit Committee report for further information on the Group's approach to cyber security.

2023 cyber incident

In February, the Group was the subject of a cyber incident involving unauthorised access to our IT systems. This required the instigation of the Group's Cyber Incident Plan. Our systems were shut down to contain the incident on a precautionary basis, and our sites implemented their business continuity plans to maintain their operations. The investigation is still ongoing and the Board continues to monitor the impact of the incident and receives regular updates on progress to address it, including the actions being taken to mitigate the immediate risk of further incidents. Going forward, consideration will be given to any additional strategic or operational improvements required to the Group's systems and processes, to further reduce the potential for future attacks and further improve the Group's resilience for dealing with such incidents.

Climate change

The Group's overall risk management processes also incorporate consideration of the potential impact of climate-related risks on the Group. The Group does not regard climate change itself to represent a material stand-alone risk for the Group's operations.

Whilst a significant proportion of the Group's revenue is generated from steel manufacture and automotive castings, industries that are under transition as a result of their focus on improving environmental performance, we believe these changes will be positive for the Group. The opportunities in the Group's business strategy, which is founded on helping our customers to improve their manufacturing efficiency and the quality of their products – and therefore reduce their climate impact – will play a critical part in the development of the Group going forward. We also see potential benefits for the Group from the acceleration of the energy transition, as this will create continued demand for the high-quality steel produced using Vesuvius' products and solutions.

The Group continues to recognise that climate change could present further uncertainty for the Group in terms of increased regulation, the evolution of the geographical distribution of our customer base and the costs of meeting more onerous disclosure requirements. Further information about the Group's consideration of climate-related risks and opportunities can be found in the Our planet section on pages 57-65.

The risks we associate with our sustainability performance and our end-customers' sustainability transition – badged as ESG – are identified as a separate element of the Group risk register, recognising the work Vesuvius can do to mitigate the environmental impact of our customers' processes. Other elements of this risk are incorporated into the appropriate principal risk and uncertainty that the Group has identified. The Group continues to focus internally on the action we can take to drive our business' sustainability. In 2022, the Group continued its focus on the identified environmental sustainability KPIs, with a particular focus on reducing energy consumption and CO_2e emissions, recycling and waste disposal. Under the Group's Sustainability initiative we seek to drive a lower CO_2e emission intensity, reduce normalised energy usage, and take the steps necessary to meet the target set of being absolute CO_2e emissions net zero by 2050 at the latest. Further information can be found in the Our planet section on pages 57–70.

Risk mitigation

The principal risks identified are actively managed in order to mitigate exposure. Senior management 'owners' have been identified for each principal risk, and they manage the mitigations of that specific risk and contribute to the analysis of its likelihood and materiality. This analysis is reported to the Board. The risks are analysed in the context of our business structure which gives protection against a number of principal risks we face with diversified currencies, a widespread customer base, local production matching the diversity of our markets and intensive training of our employees. Additionally, we seek to mitigate risk through contractual measures. Where cost-effective, the risk is transferred to insurers. Our processes are not designed to eliminate risk, but to identify our principal risks and seek to reduce them to a reasonable level in the context of the delivery of the Group's strategy.

Business continuity

In partnership with our risk management advisers and our insurers, we seek to identify the most effective means of reducing or eliminating insurable risks, through a combination of risk management and the placing of insurance cover.

Our insurer property loss control programme is based upon insurer loss modelling and focuses on insured losses. The insurer's loss control engineers undertake a series of on-site inspections focused on machinery breakdown, fire, natural catastrophe and other property damage and business interruption risks. These surveys yield a series of loss-reduction recommendations. The execution of these recommendations is agreed with site management and then followed through to completion.

In parallel, Vesuvius' own loss management programme focuses on strategic sites and sites that are not routinely covered by the insurer programme. Assisted by an independent consultant, we undertake property loss control and business continuity surveys using Vesuvius' bespoke risk and exposure-based protocol.

These reports yield further risk reduction recommendations, and improvement actions and timescales are agreed and followed through by site management. To support the Group's loss control activities, risk management workshops are conducted covering loss prevention, emergency planning, crisis management and business recovery. As the footprint of the Group develops and, in certain cases, production concentrates in a smaller number of flagship sites, business continuity planning is conducted to ensure that sufficient resilience remains in the manufacturing network to address projected supply interruptions.

With regard to fire safety, the Group monitors all fire-related near misses or minor dangerous occurrences. Any fires, including overheating, are reported and analysed both locally and by senior HSE management in order that safety improvement initiatives can be prioritised and communicated throughout the Group. Underlying causes are established with detailed analysis undertaken as a means of proposing improvement priorities in order that safety and process safety initiatives can be targeted on a risk-assessed basis.

Internal control

The Group's internal control system is designed to manage, rather than eliminate, the financial risks facing the Group and safeguard its assets. No system of internal control can provide absolute assurance against material misstatement or loss. The Group's system is designed to provide the Directors with reasonable assurance that problems are identified on a timely basis and are dealt with appropriately.

The Audit Committee assists the Board in reviewing the effectiveness of the Group's system of internal control, including financial, operational and compliance controls, and risk management systems. The key features of the Group's system of internal control are set out in the table overleaf.

Reviewing the effectiveness of risk management and internal control

The internal control system covers the Group as a whole and is monitored and supported by the Group's Internal Audit function, which conducts reviews of Vesuvius' businesses and reports objectively both on the adequacy and effectiveness of the system of internal control and on those businesses' compliance with Group policies and procedures. The Audit Committee receives reports from the Group Head of Internal Audit and reports to the Board on the results of its review.

The Group also conducts a self certification exercise by which senior financial, operational and functional management certify the compliance, throughout the year, of the areas under their responsibility with the Group's policies and procedures and highlight any material issues that have occurred during the year.

As part of the Board's process for reviewing the effectiveness of the system of internal control, it delegates certain matters to the Audit Committee. Following the Audit Committee's review of internal financial controls and of the processes covering other controls, the Board annually evaluates the results of the internal control and risk management procedures conducted by senior management. Since the date of this evaluation, there have been no significant changes in internal controls or other matters identified which could significantly affect them.

In accordance with the provisions of the UK Corporate Governance Code, the Directors confirm that they have carried out a robust assessment of the principal and emerging risks facing the Company, including those that threaten its business model, future performance, solvency or liquidity. They have also reviewed the effectiveness of the Group's system of internal control and confirm that the necessary actions have been taken to remedy any control weaknesses identified during the year and to the date of this report.

Further detail regarding the Audit Committee's review of the effectiveness of the Group's risk management and internal control systems is contained in the Audit Committee report on pages 104-106.

Risk, viability and going concern continued

Key features of risk management and internal control

Strategy and financial reporting	Comprehensive strategic planning and forecasting process Annual budget approved by the Board Monthly operating financial information reported against budget Key trends and variances analysed and action taken as appropriate
Vesuvius GAAP	Accounting policies and procedures formulated and disseminated to all Group operations Covers the application of accounting standards, the maintenance of accounting records and key financial control procedures
Operational controls	Operating companies and corporate offices maintain internal controls and procedures appropriate to their structure and business environment Compliance with Group policies on items such as authorisation of capital expenditure, treasury transactions, the management of intellectual property and legal/regulatory issues Use of common accounting policies and procedures, and financial reporting software used in financial reporting and consolidation Significant financing and investment decisions reserved to the Board Monitoring of policy and control mechanisms for managing treasury risk by the Board Clearly delegated authority for capital expenditure, purchasing, customer contracts and hiring
Risk assessment and management	Continuous process for identifying, evaluating and managing any significant risks Risk management process designed to identify the key risks facing each business Reports made to the Board on how those risks are managed Each major Group Business Unit produces a risk map to identify key risks, and assess the likelihood of risks occurring, as well as their impact and mitigating actions Top-down risk identification undertaken at Group Executive Committee and Board meetings Board review of insurance and other measures used in managing risks across the Group The Board is notified of major issues and makes an annual assessment of whether risks have changed Ongoing assurance processes by the legal function and Internal Audit including the annual self-certification process Externally supported Speak Up whistleblowing line
Internal Audit	Reviews Vesuvius' businesses and reports on the adequacy and effectiveness of their systems of internal control and compliance with Group policies and procedures Agrees action plans for the resolution of any improvement actions identified by their audits, and monitors with local management and the Business Unit Presidents, progression with their completion Reports to the Audit Committee on the results of each audit and provides regular updates on high-priority action items The Audit Committee discusses the key risks identified by Internal Audit

Principal risks

The risks identified on pages 32 and 33 are those the Board considers to be the most relevant to the Group in relation to their potential impact on the achievement of its Strategic Objectives. All of the risks set out on these pages could materially affect the Group, its businesses, future operations and financial condition, and could cause actual results to differ materially from expected or historical results. The Group continues to focus on risk mitigation, and whilst, as identified above, certain elements of the Group's risks have manifested in 2022 and 2023, the principal risks of the Group remain the same. These risks are not the only ones that the Group faces or will face. Some risks are not yet known and some currently not deemed to be material could become so.

Viability Statement

In accordance with the UK Corporate Governance Code, the Directors have assessed the viability of the Group over a three-year period to 31 December 2025, taking into account the Group's current position and the potential impact of the principal risks and uncertainties. The Directors have determined that three years is an appropriate period over which to provide the Viability Statement because this is the Company's planning cycle and it is sufficiently funded by financing facilities with average maturity terms of approximately six years. The projected cash flows for the next three years have been based on the latest Board-approved budgets and strategic plans.

In making this statement, the Directors have carried out a robust assessment of the principal risks that may threaten the business model, future performance, solvency and liquidity of the Group. This is embodied in annual review of a three-year business plan which includes a review of sensitivity to 'business as usual' risks, such as profit growth and working capital variances, severe but plausible events and the impact these could have on the Group's debt covenants and available liquidity. The results take account of the availability and likely effectiveness of the mitigating actions that could be taken to avoid or reduce the impact or occurrence of the underlying risks. Whilst the review has considered all the principal risks identified by the Group, the following were selected for enhanced stress testing: an unplanned drop in customer demand; debt recovery risk due to customer default; business interruption due to the unplanned closure of several key plants; and raw material price inflation. The Group's prudent balance sheet management, flexible cost base able to react quickly to end-market conditions, access to long-term capital at acceptable financing costs and well geographically diversified international businesses leave it well placed to manage these principal risks. In performing the stress testing, certain assumptions were made, including that: customer failures result in write-offs of the full value of the receivables with no lost revenue replacement; and cash flow is supported by working capital releases, restricted capital expenditure and operating cost reductions. Under the enhanced stress testing described above, a potential breach of a covenant would only occur in the event of an unforeseen reduction in revenue of greater than 30%. Accordingly, the Directors confirm that they have a reasonable expectation that the Group will be able to continue in operation and meet its liabilities as they fall due over the three-year period to 31 December 2025. Furthermore, the Board believes that the Group continues to be well positioned for success in the longer term because of: our exposure to long-term growing end-markets; our market-leading position that is supported by ongoing investment in innovation and R&D; our strong degree of customer intimacy with around a third of our employees working at customer facilities; and the focus we have on building quality teams with clear organisational responsibility.

Going concern statement

The Group's available committed liquidity stood at £494m at year-end 2022, up from £456m at year-end 2021, as a result of lower borrowings under the Group's committed facilities and an increase in recorded cash balances. The Directors have prepared cash flow forecasts for the Group for the period to 30 June 2024. These forecasts reflect an assessment of current and future end-market conditions, which are expected to be challenging in 2023 and to recover thereafter (as set out in the 'outlook' statement in the Chief Executive's Strategic Review in this document), and their impact on the Group's future trading performance.

The Directors have also considered a severe but plausible downside scenario, based on an assumed protracted COVID-19-related demand impact, despite emerging confidence that the worst of the pandemic may be behind us. This downside scenario assumes: a decline in business activity and profitability in 2023 and 2024 to the level achieved in H2 2020, the period most severely impacted by COVID-19; working capital as a percentage of sales in the downside case consistent with that in the base case; and dividends not paid in 2023 then reinstated.

On a full-year basis relative to 2022, this implies a 30% decline in sales and a c.57% decline in Trading Profit.

The Group has two covenants; net debt/EBITDA (under 3.25x) and an interest cover requirement of at least 4.0x. In this downside scenario, the forecasts show that the Group's maximum net debt/EBITDA (pre-IFRS 16 in-line with the covenant calculation) does not exceed 1.0x, compared to a leverage covenant of 3.25x, and the minimum interest cover reached is 9x compared to a covenant minimum of 4x.

The forecasts show that the Group will be able to operate within the current committed debt facilities and show continued compliance with the Company's financial covenants. On the basis of the exercise described above and the Group's available committed debt facilities, the Directors consider that the Group and the Company have adequate resources to continue in operational existence for a period of at least 12 months from the date of signing of these financial statements and that there is no material uncertainty in respect of going concern. Accordingly, they continue to adopt a going concern basis in preparing the financial statements of the Group and the Company.

Viability process

Identify
Viability time horizon and risk analysis framework

Assess
Principal risks and stress scenarios

Model
Viability against risk scenarios, examining probabilities and impacts

Report
See Viability Statement

Principal risks and uncertainties

Risk	Potential impact	Mitigation
End-market risks Vesuvius suffers an unplanned drop in demand, revenue and/or margin because of market volatility beyond its control. Strategic alignment	Unplanned drop in demand and/or revenue due to reduced production by our customers Margin reduction Customer failure leading to increased bad debts Loss of market share to competition Cost pressures at customers leading to use of cheaper solutions	Geographic diversification of revenues Product innovation and service offerings securing long-term revenue streams and maintaining performance differential Increase in service and product lines by the development of the Technical Services offering R&D includes assessment of emerging technologies Manufacturing capacity rationalisation and flexible cost base Diversified customer base: no customer is greater than 10% of revenue Robust credit and working capital control to mitigate the risk of default by counterparties
Protectionism and globalisation The Vesuvius business model cannot adapt or respond quickly enough to threats from protectionism and globalisation. Strategic alignment	Restricted access to market due to enforced preference of local suppliers Increased barriers to entry for new businesses or expansion Increased costs from import duties, taxation or tariffs Loss of market share	Highly diversified manufacturing footprint with manufacturing sites located in 26 countries Strong local management with delegated authority to run their businesses and manage customer relationships Cost flexibility Tax risk management and control framework together with a strong control of inter-company trading
Product quality failure Vesuvius staff/contractors are injured at work or customers, staff or third parties suffer physical injury or financial loss because of failures in Vesuvius products. Strategic alignment	Injury to staff and contractors Product or application failures lead to adverse financial impact or loss of reputation as technology leader Incident at customer plant causes manufacturing downtime or damage to infrastructure Customer claims from product quality issues	Quality management programmes including stringent quality control standards, monitoring and reporting Experienced technical staff knowledgeable in the application of our products and technology Targeted global insurance programme Experienced internal legal function overseeing third-party contracting
Complex and changing regulatory environment Vesuvius experiences a contracting customer base or increased transaction and administrative costs due to compliance with changing regulatory requirements. Strategic alignment	Revenue reduction from reduced end-market access Disruption of supply chain and route to market Increased internal control processes Increased frequency of regulatory investigations Reputational damage Trade restrictions	Compliance programmes and training across the Group Independent Internal Audit function Experienced internal legal function including dedicated compliance specialists Global procurement category management of strategic raw materials
Failure to secure innovation Vesuvius fails to achieve continuous improvement in its products, systems and services. Strategic alignment	Product substitution by customers Increased competitive pressure through lack of differentiation of Vesuvius offering Commoditisation of product portfolio through lack of development Lack of response to changing customer needs Loss of intellectual property protection	Enduring and significant investment in R&D, with market-leading research A shared strategy for innovation throughout the Group, deployed via our R&D centres Stage gate process from innovation to commercialisation to foster innovation and increase alignment with strategy Programme of manufacturing and process excellence Quality programme, focused on quality and consistency Stringent intellectual property registration and defence
Business interruption Vesuvius loses production capacity or experiences supply chain disruption due to physical site damage (accident, fire, natural disaster, terrorism), or other events such as industrial action, cyber attack or global health crises. Strategic alignment	Loss/closure of a major plant temporarily or permanently impairing our ability to serve our customers Damage to or restriction in our ability to use assets Denial of access to critical systems or control processes Disruption of manufacturing processes Inability to source critical raw materials	Diversified manufacturing footprint Disaster recovery planning Business continuity planning with strategic maintenance of excess capacity Physical and IT access controls, security systems and training Cyber risks integrated into wider risk-management structure Well-established global insurance programme Group-wide safety management programmes Dual sourcing strategy and development of substitutes
People, culture and performance Vesuvius is unable to attract and retain the right calibre of staff, fails to instil an appropriate culture or fails to embed the right systems to drive personal performance in pursuit of the Group's long-term growth. Strategic alignment	Organisational culture of high performance is not achieved Staff turnover in growing economies and regions Stagnation of ideas and development opportunities Loss of expertise and critical business knowledge Reduced management pipeline for succession to senior positions	Internal focus on talent development and training, with tailored career-stage programmes and clear performance management strategies Contacts with universities to identify and develop talent Career path planning and global opportunities for high-potential staff Internal programmes for the structured transfer of technical and other knowledge Clearly defined Values underpin business culture Group focus on enhancing gender diversity
Health and safety Vesuvius staff or contractors are injured at work because of failures in Vesuvius' operations, equipment or processes. Strategic alignment	Injury to staff and contractors Health and safety breaches Manufacturing downtime or damage to infrastructure from incident at plant Inability to attract the necessary workforce Reputational damage	Active safety programmes, with ongoing wide-ranging monitoring and safety training Independent safety audit team Quality management programmes including stringent manufacturing process control standards, monitoring and reporting
Environmental, Social and Governance criteria Vesuvius fails to capitalise on the opportunity to help its customers significantly reduce their carbon emissions as environmental pressure grows on the steel industry or Vesuvius fails to meet the expectations of its various stakeholders including employees and investors. Strategic alignment	Loss of opportunity to grow sales Loss of opportunity to increase margin Loss of stakeholder confidence including investors Reputational damage	Development and implementation of a new Sustainability initiative, which includes stretching targets focused on reducing the Group's energy usage, CO_2 emissions, waste and recycled materials R&D focus on products that assist customers to reduce carbon emissions and improve their own sustainability measures Skilled technical sales force to develop efficient solutions for our customers Globally disseminated Code of Conduct sets out standards of conduct expected and ABC Policy adopted with zero tolerance regarding bribery and corruption Internal Speak Up mechanisms to allow reporting of concerns Extensive use of due diligence to assess existing and potential business partners and customers

Strategic alignment

- Always put safety first
- Deliver profitable growth
- Generate value for our shareholders
- Maintain an efficient capital structure
- Deliver industry-leading sustainable operations and solutions
- Think beyond in innovation
- Foster talent, skill and motivation in our people

See more about **Our strategy** on p18 and 19

Our performance

We're optimising efficiency through our innovative products

We develop high-technology products that deliver quality enhancement, efficiency gains and energy savings to our customers. Our solutions help our customers to lower their production costs and improve efficiency, by improving product yield.

Name: Jefferson Correa Dos Santos
Role: Production Process Leader
Location: Rio de Janeiro

Name: Phelipe Oliveira Dias De Abreu
Role: Quality Inspector
Location: Rio de Janeiro

Name: Teresa Tondera
Role: Laboratory Manager
Location: Skawina

Name: Joe Yi
Role: M&T Director – Steel China & North Asia
Location: Suzhou

Key Performance Indicators

Financial KPIs[1]

Strategic alignment	KPI	Purpose	Link to remuneration
Deliver profitable growth	**Underlying revenue growth** % 22: 18 21: 18 20: -13	Provides an important indicator of organic (like-for-like) growth of Group businesses between reporting periods. This measure eliminates the impact of exchange rates, acquisitions, disposals and significant business closures	
Generate value for our shareholders	**Trading profit** £m 22: 227 21: 142 20: 101	Used to assess the trading performance of Group businesses	
	Return on sales % 22: 11.1 21: 8.7 20: 7.0		
	Headline profit before tax £m 22: 217 21: 137 20: 92	Used to assess the financial performance of the Group as a whole	
	Headline EPS p 22: 56.5 21: 35.3 20: 23.2	Used to assess the underlying earnings performance of the Group as a whole	**Annual Incentive Plan and Vesuvius Share Plan** – Read more about these on p133-137
	Return on invested capital % 22: 10.7 21: 7.5 20: 4.9	Used to assess the financial performance of the Group	**Annual Incentive Plan and Vesuvius Share Plan** – Read more about these on p133-137
Maintain an efficient capital structure	**Free cash flow** £m 22: 123 21: -0.3 20: 114	Used to assess the underlying cash generation of the Group	
	Average working capital to sales % 22: 23.8 21: 20.9 20: 23.2	One of the factors driving the generation of free cash flow is the average working capital to sales ratio, which indicates the level of working capital used in the business	**Annual Incentive Plan** – Read more about this on p133, 135 and 136
	Interest cover 22: 29.8x 21: 30.5x 20: 14.5x	Interest cover and net debt to EBITDA are used to assess the financial position of the Group and its ability to fund future growth	
	Net debt to EBITDA 22: 0.9 21: 1.4 20: 1.2		

1. For definitions of alternative performance measures, refer to Note 4 of the Group Financial Statements.

Non-financial KPIs

Strategic alignment	KPI	Target/description	Link to remuneration
Always put safety first	**Lost Time Injury Frequency Rate** 22: 1.08 21: 1.06 20: 1.16	LTIFR of below 1 Work-related illness or injuries which resulted in an employee being absent for at least one day – measured per million hours worked	**Vesuvius Share Plan** – Read more about this on p133-137
Think beyond in innovation	**Total R&D spend** £m 22: 36 21: 31 20: 28	At constant 2022 currency	
	New product sales % 22: 16 21: 15 20: 12	Sales of products launched within the last five years as a % of total revenue	
Deliver industry-leading sustainable operations and solutions	Energy intensity kWh per metric tonne of product packed for shipment -6.0%[2]	10% reduction in energy intensity by 2025 (vs 2019)	
	CO_2e emission intensity -18.8%[2,3]	20% reduction of Scope 1 and Scope 2 CO_2e emission intensity per metric tonne of product packed for shipment by 2025 (vs 2019)	**Annual Incentive Plan and Vesuvius Share Plan** – Read more about these on p133-137
	Wastewater -9.0%	25% reduction of wastewater per metric tonne of product packed for shipment by 2025 (vs 2019)	
	Solid waste -13.8%	25% reduction of solid waste (hazardous and sent to landfill) per metric tonne of product packed for shipment by 2025 (vs 2019)	
	Recycled material 6.0%	7% of raw materials used in production to be recycled materials from external sources by 2025	
	Compliance training 99%	At least 90% of targeted staff to complete Anti-Bribery and Corruption training annually	
	Supply chain 48%	By the end of 2023, conduct sustainability assessments of raw material suppliers covering at least 50% of Group spend	
Foster talent, skill and motivation in our people	Gender diversity 20%	25% female representation in the Senior Leadership Group (approximately 160 top management) by 2025	**Annual Incentive Plan and Vesuvius Share Plan** – Read more about these on p133-137

2. Re-baselined using pre-acquisition data for the business acquired from Universal Refractories, Inc.
3. Does not include fugitive emissions (de minimis).

Financial review

Strong commercial performance to counteract challenging markets

The following review considers a number of our financial KPIs and sets out other relevant financial information.

Revenue
£2,047m
Reported change 25%
Underlying[1] change 18%

Trading profit[2]
£227m
Reported change 60%
Underlying[1] change 50%

Statutory EPS
67.2p
Reported change 78%

Return on sales[2]
11.1%
Reported change 240bps
Underlying[1] change 240bps

1. Underlying basis is at constant currency and excludes separately reported items and the impact of acquisitions and disposals.
2. For definitions of alternative performance measures, refer to Note 4 of the Group Financial Statements.

Basis of preparation

All references in this financial review are to headline performance unless stated otherwise. See Note 4.1 to the Group Financial Statements for the definition of headline performance.

Introduction

The year 2022 was a record year for the Group in terms of trading profit and return on sales, despite the depressed underlying markets, driven mainly by price increases to recover cost inflation. This has allowed us to pay an attractive dividend to our shareholders, while increasing investments in strategic areas.

2022 performance overview

We are pleased with the performance of the Group in 2022; the Business Units had good success in recovering cost increases on a timely basis whilst gaining market share in most regions, demonstrating the strength of the Group positioning in the market driven by the technological differentiation of our products and solutions. Reported revenue increased by £404m over the prior year (+25%) and by £300m on an underlying basis (+18%).

On a reported basis, the Steel and Foundry Division revenue increased by 28% and 17% respectively in the year.

Our volume performance in the Steel Division was broadly flat, compared to a c.7.0% decline in steel production in the world excluding China and Iran. Our resilient performance was driven by market share gains in Flow Control everywhere in the World and market share gains in Advanced Refractories in most regions. Our Foundry Division experienced a low single digit volume decline due primarily to still very depressed underlying markets and some limited market share losses due to priority given to pricing.

Thanks to our efficient price increases, a resilient commercial performance and a product mix benefit, we have achieved a record trading profit of £227m, 50% higher than prior year on an underlying basis; and a record return on sales of 11.1%, higher than the prior year by 240 bps on an underlying basis.

Our cash management performance was robust, achieving an 82% cash conversion, thanks to a strong operational performance partially offset by an investment in trade working capital and a continuous investment in strategic capacity expansion. As a result, we have decreased our net debt position and improved our leverage ratio of net debt to EBITDA to 0.9x from 1.4x in December 2021.

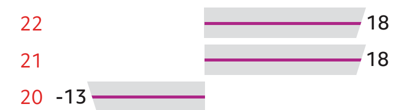
Revenue

£m	2022 Revenue As reported	Acquisitions/ (disposals)	Underlying	2021 Revenue As reported	Currency	Acquisitions/ (disposals)	Underlying	% change Reported	Underlying
Steel	1,496	(34)	1,462	1,172	58	(2)	1,227	28%	19%
Foundry	551	(3)	548	471	12	–	483	17%	13%
Total Group	2,047	(37)	2,010	1,643	70	(2)	1,710	25%	18%

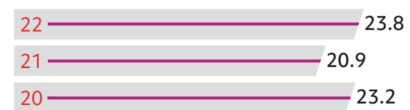
Trading profit

£m	2022 Trading profit As reported	Acquisitions/ (disposals)	Underlying	2021 Trading profit As reported	Currency	Acquisitions/ (disposals)	Underlying	% change Reported	Underlying
Steel	173	(5)	167	102	5	0.2	107	69%	56%
Foundry	54	(1)	54	40	0	–	41	35%	32%
Total Group	227	(6)	221	142	5	0.2	148	60%	50%

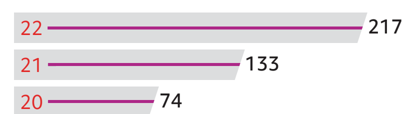
Underlying revenue growth* %
18%



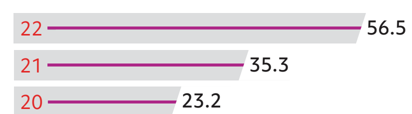
Average working capital to sales* %
23.8%



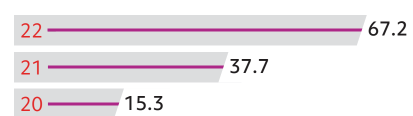
Operating profit £m
£217m



Headline earnings per share* pence
56.5p



Statutory earnings per share pence
67.2p



* For definitions of alternative performance measures, refer to Note 4 of the Group Financial Statements.

Dividend

The Board has recommended a final dividend of 15.75 pence per share to be paid, subject to shareholder approval, on 31 May 2023 to shareholders on the register at 21 April 2023. When added to the 2022 interim dividend of 6.5 pence per share paid on 16 September 2022, this represents a full-year dividend of 22.25 pence per share.

It remains the Board's intention to deliver long-term dividend growth, provided this is supported by underlying earnings, cash flows, capital expenditure requirements and the prevailing market outlook.

Key Performance Indicators

We have identified a number of KPIs against which we have consistently reported. As with prior years, we measure our results on an underlying basis, where we adjust to ensure appropriate comparability between periods, irrespective of currency fluctuations and any business acquisitions and disposals.

This is done by:

- Restating the previous period's results at the same foreign exchange (FX) rates used in the current period
- Removing the results of disposed businesses in both the current and prior years
- Removing the results of acquired businesses in both the current and prior years

Therefore, for 2022, we have:

- Retranslated 2021 results at the FX rates used in calculating the 2022 results
- Removed the results of the refractories business acquired from Universal during 2021

Objective: Deliver growth

KPI: Underlying revenue growth

Reported revenue for 2022 was £2,047m, which equated to £2,010m on an underlying basis. Reported revenue for 2021 was £1,643m, which equated to £1,710m on an underlying basis. 2022 underlying revenue increased by 18% year-on-year. The increase in revenue in Steel and Foundry has mainly been driven by price increases to compensate for cost inflation.

Objective: Generate sustainable profitability and create shareholder value

KPI: Trading profit and Return on Sales

We continue to measure underlying trading profit of the Group as well as trading profit as a percentage of sales, which we refer to as our Return on Sales or RoS.

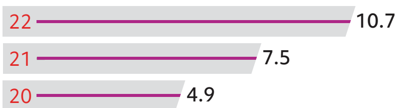
Trading profit for 2022 was £227m and Return on Sales was 11.1%. On an underlying basis, trading profit increased by 50% and Return on Sales by 240 bps. The increase in trading profit and Return on Sales is primarily due to product mix, price increases and recovery of the 2021 input cost headwind.

The Steel Division recorded Return on Sales of 11.5%, a 270 bps underlying improvement from 2021. Trading profit increased by 56% on an underlying basis, to £173m during the period. Return on Sales in the Foundry Division increased by 140 bps year-on-year on an underlying basis, to 9.9% in 2022. Trading profit was £54m, representing a 32% increase on an underlying basis versus prior year.

Financial review continued

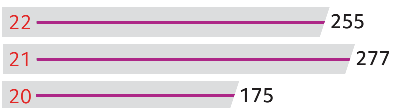
Return on invested capital* %

10.7%



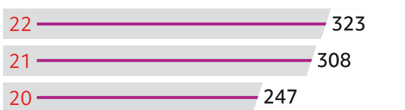
Net debt* £m

£255m



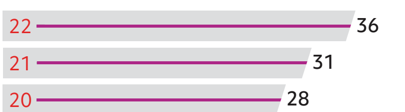
Unutilised committed debt facilities £m

£323m



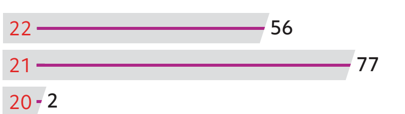
Total R&D spend** £m

£36m



Net defined benefit pension deficit £m

£56m



* For definitions of alternative performance measures, refer to Note 4 of the Group Financial Statements.

** At constant 2022 currency.

KPI: Headline PBT and headline EPS

Headline profit before tax (PBT) and headline earnings per share (EPS) are used to measure the underlying financial performance of the Group. The main difference between trading profit and PBT is net finance costs which were £11m in 2022, £5m higher than 2021.

Our Headline PBT was £217m, 58% higher than last year on a reported basis. Including amortisation (£10m) our PBT of £207m was 62% higher than last year. Headline EPS from continuing operations at 56.5p was 60% higher than 2021.

KPI: Return on invested capital (ROIC)

The Group has adopted ROIC as its key measure of return from the Group's invested capital. The RONA performance measure has been replaced with ROIC, which provides a more complete measure of Vesuvius' returns. ROIC is calculated as trading profit less amortisation of acquired intangibles plus share of post-tax profit of joint ventures and associates for the previous 12 months after tax, divided by the average (being the average of the opening and closing balance sheet) invested capital (defined as: total assets excluding cash plus non-interest-bearing liabilities), at the average foreign exchange rate for the year.

Our ROIC for 2022 was 10.7% (2021: 7.5%).

Objective: Maintain strong cash generation and an efficient capital structure

KPI: Free cash flow and working capital

Fundamental to ensuring that we have adequate capital to execute our corporate strategy is converting our profits into cash, partly through strict management of our working capital. The Group generated adjusted operating cash flows of £186m, representing a 307% increase versus 2021. This implies a cash conversion rate in 2022 of 82% (2021: 32%). 2022 cash conversion was driven by strong operational performance partially offset by an investment in trade working capital and an investment in capital expenditure of which c.60% is in growth capex. The majority of the growth capex has been invested in expanding Flow Control capacity in our Poland and India plants. Free cash flow from continuing operations was £123m in 2022 (2021: £(0.3)m).

We measure working capital both in terms of actual cash flow movements, and as a percentage of sales revenue. Trade working capital as a percentage of sales in 2022 was 23.8% (2021: 20.9%), measured on a 12-month moving average basis. In absolute terms on a constant currency basis, trade working capital increased by £35m in 2022.

The decrease in inventory on a constant currency basis versus December 2021 (£2m) was offset by increased debtors (£9m) and reduced creditors (£28m).

KPI: Net debt and interest cover

The Group had committed borrowing facilities of £722m as of 31 December 2022 (2021: £706m), of which £323m was undrawn (2021: £308m).

Net debt on 31 December 2022 was £255m, a £22m decrease from 31 December 2021, as significantly higher free cash flow of £123m was offset by a foreign exchange adjustment of £21m, a £58m dividend payment to shareholders, an increase in leases of £11m, ESOP share purchases of £7m and the acquisition of Bayuquan Magnesium Co for £4m.

At the end of 2022, the net debt to EBITDA ratio was 0.9x (2021: 1.4x) and EBITDA to interest was 29.8x (2021: 30.5x). These ratios are monitored regularly to ensure that the Group has sufficient financing available to run the business and fund future growth.

The Group's debt facilities have two financial covenants: the ratios of net debt to EBITDA (maximum 3.25x limit) and EBITDA to interest (minimum 4x limit). Certain adjustments are made to the net debt calculations for bank covenant purposes, the most significant of which is to exclude the impact of IFRS 16.

KPI: R&D Spend

We believe that our market-leading product technology and services deliver fundamental value to our customers and that the primary mechanism to deliver that value is to invest significantly in research and development. In 2022 we spent £36m on R&D activities (2021: £31m at constant 2022 currency), which represents 1.8% of our revenue (2021: 1.8%).

Financial risk factors

The Group undertakes regular risk reviews and, as a minimum, a full risk assessment process twice a year. As in previous years this included input from the Board in both the assessment of risk and the proposed mitigation. We consider the main financial risks faced by the Group as being those posed by a decline in our end-markets, leading to reduced revenue and profit as well as potential customer default. We also monitor carefully the challenges that come from broader financial uncertainty, which could bring lack of liquidity and market volatility. Important but lesser risk exists in interest rate movements, foreign exchange rate movements and cost inflation, but these are not expected to have a material impact on the business after considering the controls we have in place. See Note 25 to the Group Financial Statements.

Our key mitigation of end-market risk is to manage the Group's exposure through balancing our portfolio of businesses geographically and to invest in product innovation. We do so through targeted capital investment in new and growing businesses and a combination of capital and human resource in emerging markets. When considering other financial risks, we mitigate liquidity concerns by financing, using both the bank and private placement markets. The Group also seeks to avoid a concentration of debt maturities in any one period to spread its refinancing risk. The Group's liquidity stood at £494m at 31 December 2022. We define liquidity as undrawn committed debt facilities plus our cash on balance sheet, less the cash in China which is used as collateral against an equivalent loan from Standard Chartered.

Taxation

A key measure of tax performance is the headline effective tax rate (ETR), which is calculated on the income tax associated with headline performance, divided by the headline profit before tax and before the Group's share of post-tax profit of joint ventures. The Group's headline ETR, based on the income tax costs associated with headline performance of £57m (2021: £36m), was 26.5% (2021: 26.4%).

The Group's total income tax costs for the period include a credit within separately reported items of £39m (2021: £16m) which primarily relates to a credit of £38m (2021: £16m) following the recognition of certain deferred tax assets.

A tax charge reflected in the Group Statement of Comprehensive Income in the year amounted to £8m (2021: £13m credit) which primarily comprises a £7m charge (2021: £13m credit) in respect of tax on net actuarial gains and losses on employee benefits, inclusive of the buy-in of the UK pension scheme.

We expect the Group's headline effective tax rate on headline profit before tax and before the share of post-tax profits from joint ventures to be between 27% and 28% in 2023.

Capital expenditure

Capital expenditure in 2022 was £104m (2021: £67m) of which £85m was in the Steel Division (2021: £47m) and £19m in the Foundry Division (2021: £20m). Capital expenditure on revenue-generating customer installation assets, primarily in Steel, was £8m (2021: £6m).

Pensions

The Group has a limited number of historical defined benefit plans located mainly in the UK, USA, Germany and Belgium. The main plans in the UK are closed, and those in the USA largely closed to further benefits accrual. All of the liabilities in the UK were insured following a buy-in agreement with Pension Insurance Corporation plc (PIC) in 2021. This buy-in agreement secured an insurance asset from PIC that matches the remaining pension liabilities of the UK Plan, with the result that the Company no longer bears any investment, longevity, interest rate or inflation risks in respect of the UK Plan.

The Group's net pension liability at 31 December 2022 was £56m (2021 full year: £77m liability). There has been a decrease in the liabilities of German and Belgian plans due to an increase in bond yields.

Corporate activity

On 8 October 2022, the Group acquired Bayuquan Magnesium Co (BMC), a world-class basic monolithic refractory plant in China with revenues of RMB 120 million (c.£14 million) in 2021. BMC has been a long-standing manufacturing partner of Vesuvius Advanced Refractories and in recent years has supplied us with 100% of its production volumes. The acquisition secures strategically valuable basic monolithic volumes at a plant which benefits from very competitive local raw material access. It will support our further development in China, South-East Asia and North Asia.

Operating review

Steel Division

Revenue
£m
£1,496m

Trading profit
£m
£173m

Vesuvius comprises two Divisions, Steel and Foundry. The Steel Division operates as three Business Units, Flow Control, Advanced Refractories and Sensors & Probes.

Changes described are versus 2021 on an underlying basis, excluding the impact of foreign exchange and acquisitions and disposals, unless otherwise noted.

Vesuvius' Steel Division reported revenues of £1,496m in 2022, an increase of 28% compared to 2021 and 19% on an underlying basis, reflecting the benefits of the business acquired from Universal Refractories for the first full year and a particularly strong performance in the key markets of NAFTA, India and South America, where revenue grew by 33%, 31% and 30%, respectively.

These revenue increases were achieved in the context of a declining market. Steel production in the world excluding China and Iran, which accounts for approximately 90% of Vesuvius' sales, declined by 7.0% year-on-year with India the only country among the top-15 global producers to grow year-on-year. Vesuvius also ceased sales to sanctioned customers in Russia in compliance with the sanctions regimes imposed in response to the Ukrainian conflict.

Flow Control significantly outperformed the steel market in all major regions, with overall flat volumes despite the market contraction. In Advanced Refractories, underlying volumes modestly declined, still outperforming the market despite price increases.

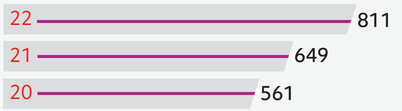
Steel Division trading profit improved 69% to £173m (+56% on an underlying basis), with return on sales expanding 280bps to 11.5%, reflecting excellent recovery of input cost rises, product mix benefits and the margin accretion of the acquisition.

Steel Division	2022 (£m)	2021 (£m)	Change (%)	Underlying change (%)
Flow Control revenue	811	649	25%	20%
Advanced Refractories revenue	645	489	32%	19%
Sensors & Probes revenue	40	34	19%	11%
Total Steel Revenue	**1,496**	1,172	28%	19%
Total Steel Trading Profit	**173**	102	69%	56%
Total Steel Return on Sales	**11.5%**	8.7%	+280bps	+270bps

Crude steel production year-on-year change	2021/2022
China	-2.1%
India	5.5%
NAFTA	-5.5%
South America	-5.2%
EMEA	-11.4%
EMEA ex. Iran	-13.1%
EU 27+UK	-10.8%
World	-4.2%
World ex. China and Iran	-7.0%

Source: World Steel Association.

Revenue
£m
£811m



Pascal Genest
President, Flow Control

Flow Control

The Flow Control Business Unit supplies the global steel industry with consumable ceramic products, systems, robotics, digital services and technical services. These products are used to contain, control and monitor the flow of molten steel in the continuous casting process. The consumable ceramic products that Vesuvius supplies have a short service life (often a matter of a few hours) due to the significant wear caused by the extremely demanding environment in which they are used. Our colleagues work alongside customers in steel plants to ensure that our products are correctly utilised. The quality, reliability and consistency of these products and services and the associated robotic solutions and digital services we provide are therefore critical to the quality of the finished metal being produced and the productivity, profitability and safety of our customers' processes.

In 2022, revenues in the Group's Flow Control business increased by 20% year-on-year to £811m, driven by price increases to recover input costs and market share gains in a declining market.

In EMEA, revenues grew 12% compared to 2021, versus declines in steel production of 11.4%, reflecting significant price increases while volume reduced, still outperforming the market by several percent. Turkey was a stand-out performer in the period, continuing to show very substantial volume growth. In the Americas, underlying revenues grew 34%; this outperformance was driven by growth in volumes in both regions, outperforming steel production declines of 5.5% and 5.2% in NAFTA and South America respectively, as well as pricing. In Asia-Pacific, revenues grew 11%, versus steel production growth of 5.5% in India, and declines of 2.1% and 8.1% in China and South-East Asia, respectively. Our volumes in India grew double-digit and South-East Asia grew c.3%.

Strategic highlights from the year

The focus during 2022 was on commercial excellence, including improving lead times, and on major investments in capacity in our fastest growing regions, for our key product ranges.

At our plant in Skawina, Poland, we are part way through a major expansion programme to increase EMEA capacity in VISO* products by 35% and slide-gates by 100%. The programme spans two years, with key milestones achieved in 2022, and the VISO* presses now operational. At our plant in Kolkata, India, we are increasing capacity in VISO* products by 50%. This will enable us to better serve the fast-growing markets of both India and South-East Asia.

Looking forward

The completion of the expansion project at Skawina will be the key focus this year, and we anticipate that the new slide-gate capacity will be operational by the end of the year. This expansion will support our strategic market objectives. In addition, we are progressing work on additional flux capacity in India, which is expected to become operational in 2024.

We are also continuing our efforts to develop new products with superior sustainability characteristics, to help our customers drive efficiency and reduce their environmental footprint.

Flow Control Revenue	2022 (£m)	2021 (£m)	Change (%)	Underlying change (%)
Americas	321	217	48%	34%
Europe, Middle East & Africa (EMEA)	275	248	11%	12%
Asia-Pacific	214	184	16%	11%
Total Flow Control Revenue	**811**	649	25%	20%

* Trademark of the Vesuvius Group of companies, unregistered or registered in certain countries, used under licence.

Steel Division continued

Revenue
£m

£645m

22	645
21	489
20	459

Revenue
£m

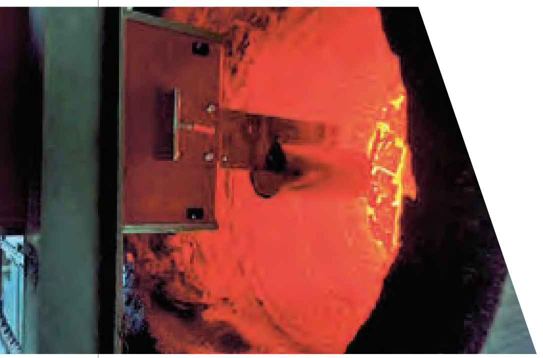
£40m

22	40
21	34
20	26

Davide Guarnieri
Director, Sensors & Probes

Advanced Refractories

The Advanced Refractories Business Unit supplies specialist refractory materials designed to protect the steel-making plant and equipment such as the ladle or tundish from the molten metal. In order to maximise their effectiveness, we offer advanced installation technologies which harness mechatronic solutions, computational fluid dynamics capabilities and lasers. The specialist refractory materials are subject to extreme temperatures, corrosion and abrasion; they are in the form of powder mixes (which are spray-applied or cast onto the vessel to be lined) and refractory shapes (e.g. bricks and other larger precast shapes). The service life of the products that Advanced Refractories supplies can vary (some a matter of hours and others for a period of years) based upon the type of refractory and the level of wear. An integral part of our success depends upon our best-in-class installation technologies which improve the consistency and performance of installed Vesuvius refractories as well as the high level of collaboration with our customers.



Advanced Refractories reported revenues of £645m in 2022, an increase of 19%. Overall, we outperformed the market, with a significant price rise to cover costs, and volumes that were only modestly negative excluding the benefit of the business acquired from Universal Refractories. The business outperformed a market that declined 7.0% overall, regaining some market share lost in 2021 when we prioritised pricing over volume.

Revenues grew 17% in the Americas, with good performance in South America which grew volumes 19%, versus steel production declines of 5.2%. Including the benefit of the business acquired from Universal Refractories (for which this was the first full year of ownership) and other underlying adjustments, revenues in that region grew 48%. In EMEA, revenues grew by 21% during the period reflecting significantly positive pricing, offset by mid-single-digit volume declines, compared to market production declines of 13.1% (EMEA excluding Iran, Source: WSA). In Asia-Pacific, revenues grew 19% driven by double-digit pricing increases and a strong outperformance in India (+13% volume growth).

Strategic highlights from the year

In 2022, we completed a number of key milestones in the integration of the specialty refractory business based in Pennsylvania, USA, which we acquired from Universal Refractories, Inc. in December 2021. This business is focused on tundish (steel continuous casting) applications as well as consumable products for the foundry industry. The acquisition was strategically important, for our core tundish business and expanding our North American presence among electric arc furnace (EAF) steel producers. In the year, we have successfully consolidated certain manufacturing activities into our NAFTA manufacturing footprint, facilitated by an IT system integration, which lays the groundwork for further efficiencies.

In June 2022, we opened our mechatronic centre of excellence in Ghlin, Belgium, alongside R&D on the same site. The upgrade to our R&D facilities generates economies of scale benefits, increasing collaboration and offers improved proximity to production. The site now regularly welcomes customer groups to see and learn about the benefits our solutions offer, as well as being our centre for the development of these products.

Finally, in October 2022, we acquired Bayuquan Magnesium Co (BMC), a world-class monolithic factory in China. BMC has been a long-standing manufacturing partner for Vesuvius and its acquisition strengthens our supply chain for this strategic product.

Looking forward to 2023

In 2023, we will build on the foundations laid in 2022, to develop our mechatronic technology. This new capability creates the opportunity for a material step-up in customer installations of robotic solutions.

In addition, we will continue the process of integrating the business acquired from Universal Refractories into our NAFTA operations. In R&D, we will increase the focus on delivering new products that improve our customers' environmental footprint.

Advanced Refractories Revenue	2022 (£m)	2021 (£m)	Change (%)	Underlying change (%)
Americas	245	165	48%	17%
Europe, Middle East & Africa (EMEA)	231	188	23%	21%
Asia-Pacific	170	136	25%	19%
Total Advanced Refractories Revenue	645	489	32%	19%

Steel Sensors & Probes

The Steel Sensors & Probes Business Unit offers products to our customers to enable them to make their underlying processes more efficient and reliable. The Business Unit focuses on providing a range of products that enhance the control and monitoring of our customers' production processes, complementing Vesuvius' strong presence and expertise in molten metal engineering. This aims to create new technologies that can be integrated into expert process management systems. By using these technologies, customers can focus on critical parameters within their processes, enabling them to refine their production methods to improve quality, lower production costs and maximise efficiency.

Revenues in Steel Sensors & Probes were £40m in 2022, representing an underlying increase of 11% year-on-year, reflecting a strong performance in the Americas, in particular South America.

Looking forward to 2023

In 2023, we will continue to execute our revenue growth and market share gain strategy, in all regions. Thanks to our manufacturing and commercial footprint, we believe that we are well placed to serve our customers and to seek to expand our sales in Asia, further consolidating our strength in the global marketplace. Finally, we will continue to invest in the development of innovative products to support our customers on their journey towards greener, safer and more profitable steel production.

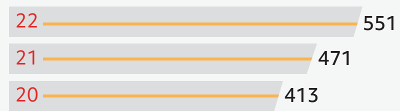
Steel Sensors & Probes Revenue	2022 (£m)	2021 (£m)	Change (%)	Underlying change (%)
Americas	29	23	25%	13%
Europe, Middle East & Africa (EMEA)	11	10	6%	8%
Asia-Pacific	0.4	0.4	(0.2%)	(3%)
Total Steel Sensors & Probes Revenue	40	34	19%	11%

Foundry Division

Revenue
£m
£551m

Trading profit
£m
£54m

Revenue
£m
£551m



Karena Cancilleri
President, Foundry

The Foundry Division is a world leader in the supply of consumable products, technical advice and application support to the global foundry industry to improve the performance and quality of ferrous and non-ferrous castings. Vesuvius operates under the brand Foseco in the foundry market. The foundry process is highly sequential and is critically dependent on consistency of product quality and productivity optimisation. Working alongside customers at their sites, our engineers provide on-site technical expertise in addition to advanced computational fluid dynamics capabilities to develop the best customised solutions. The conditioning of molten metal, the nature of the mould used and, especially, the design of the way metal flows into the mould are key parameters in a foundry, determining both the quality of the finished castings and the labour, energy and metal usage efficiency of the foundry. Vesuvius' products and associated services to foundries improve all of these parameters.

The end-markets for Foundry remained weak, with growth in the Americas, a broadly flat market in Europe and a mixed picture in Asia, with China impacted by declines in the heavy vehicle market.

Vesuvius' Foundry Division reported revenues of £551m in 2022, an increase of 13%. On a reported basis, including some benefit from the business acquired from Universal Refractories, the Foundry Division revenue was up 17%. The increase in sales reflects pricing increases which successfully offset cost inflation. We also achieved market share gains in most core regions and products, the only significant exception being Western Europe where we lost some market share due to priority being given to price increases.

The Foundry Division also achieved meaningful margin recovery, with trading profit growing 32% to £54m, as Return on Sales increased 140bps to 9.9%.

The Foundry Division grew revenues in all major regions. Foundry revenues in the Americas grew 27% year-on-year, driven by a strong commercial performance and market share gains. In EMEA, underlying revenues increased by 16%, with particularly strong revenue growth in Germany, Spain, France and Turkey, driven primarily by price increases to offset inflation, as well as market share gains in Turkey. In Asia-Pacific, our businesses grew in revenue in all major countries except China, reflecting our excellent commercial delivery. Trading profit and return on sales increased substantially, demonstrating our overall strong performance.

Foundry Division	2022 (£m)	2021 (£m)	Change (%)	Underlying change (%)
Foundry revenue	551	471	17%	13%
Foundry trading profit	54	40	35%	32%
Foundry Return on Sales	**9.9%**	8.6%	+130bps	+140bps

Foundry revenue	2022 (£m)	2021 (£m)	Change (%)	Underlying change (%)
Americas	145	100	45%	27%
Europe, Middle East & Africa (EMEA)	225	199	13%	16%
Asia-Pacific	181	172	5%	3%
Total Foundry Revenue	**551**	471	17%	13%
Total Foundry Trading Profit	**54**	40	35%	32%
Total Foundry Return on Sales	**9.9%**	8.6%	+130bps	+140bps

Strategic highlights from the year

In 2022, the two most significant new product launches were Rotoclene* and Acticote TS*.

Rotoclene* is a revolutionary molten metal treatment technology for steel foundries, which delivers a significant improvement in melt and casting quality, reducing the amount of rework of the casting post its solidification and the associated labour costs. A reduction of the amount of waste also leads to a reduction in the energy consumption and CO_2 footprint of a foundry as it achieves a better ratio of weight of finished castings to metal melted.

Acticote TS* is a coating which enables foundries to produce iron castings with thinner sections than previously achievable. This enables the weight of key automotive components to be reduced, reducing costs for foundries and delivering fuel efficiency benefits for the ultimate end-customers.

We also continue to make significant progress in our strategy of growing in non-ferrous end-markets with the commercial team now largely in place and sales increasing by >30% during the year.

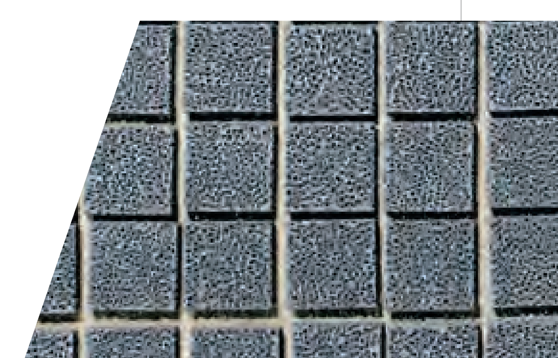
Looking forward to 2023

2023 has the potential to be a record year for new product launches in Foundry with a significant number of products in the final stages of development. These innovative products will support the manufacture of lighter-weight, high-performance components. We are also focusing on developing products for high growth end-markets such as wind turbines and electric vehicles.

Amongst these is Duratek Supermelt*, a next generation clay-graphite crucible which outperforms the competition with superior fracture toughness, high-temperature strength and oxidation resistance to ensure longer life in its use in demanding aluminium melting operations.

We are also developing WASCO*, a water-soluble binder which will enable the use of sand cores for high pressure die casting applications. This is because of its ability to achieve the required strengths in this demanding process whilst being easy to remove from the finished casting. This gives greater design flexibility to foundries, weight saving benefits for the finished casting and reduces downstream processing costs.

We continue to develop value-added ancillary services for our customers such as our crucible management application, which will help our customers more effectively monitor the performance of this critical product in their production process.



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Sustainability

We're helping our customers reduce their environmental impact

The pressure on industry to reduce greenhouse gas emissions is increasing. We work closely with our customers to develop new products and technologies to meet these challenges, with sustainability being a critical focus in new product development.

Name: Leandro Cesar
Role: Senior Development Associate
Location: Pittsburgh

Name: Agnes Hessling
Role: Executive Assistant Foundry Europe
Location: Borken

Name: Song Li
Role: Senior R&D Engineer
Location: Suzhou

Progress on our Sustainability roadmap

Alexander Laugier-Werth
VP Sustainability, HSE & Quality

Non-financial and Sustainability Information Statement

This Non-Financial and Sustainability Information Statement provides information on the Group's activities and policies in respect of:

Environmental matters
Our planet p57-70

Climate-related reporting
TCFD p54

The Company's employees
Our people p74-80

Social matters
Our communities p81-85

Respect for human rights
Our communities p81

Anti-corruption and anti-bribery matters
Our communities p82

This statement also details, where relevant, the due diligence processes implemented by the Company in pursuance of these policies.

Further information, disclosed in other sections of the Strategic Report is incorporated into this statement by reference including:

Information on the Group's principal risks
Details of the Group's principal risks relating to these non-financial and sustainability matters are detailed in the Group's schedule of principal risks and uncertainties. p32-33

Risk, viability and going concern p27-31

Details of the Group's business model p20-21

Details of the Group's non-financial KPIs p37

The fight against climate change continues to require higher-technology steel and larger, more complex castings. Wind and solar energy production capacity are both considerably more steel-intensive than fossil fuel power stations, and these are both set to grow considerably. Allied to this, the steel-making process is itself decarbonising thanks to efforts to improve the performance of existing assets, and the shift from blast furnaces to electric arc furnaces.

Vesuvius supplies consumable refractory products and engineering solutions that are critical to the performance of metal casting processes. Every day, we help our customers improve the safety, energy efficiency, yield and reliability of their processes, and every day, we work in close partnership with the most advanced steelmakers to develop the refractory products for the green steel-making and casting processes of the future.

Vesuvius' Sustainability strategy, formally launched at the end of 2020, brings together all our environmental, social and governance initiatives into one coordinated programme. The strategy is built on four pillars: our planet, our customers, our people and our communities.

We have set out four key sustainability strategic priorities. Targets for three of these are embedded into our management incentive arrangements.

- Becoming a zero accident company
- Reducing our Scope 1 and Scope 2 CO_2 emissions to reach net zero by 2050 at the latest
- Helping our customers reduce their own CO_2 emissions
- Increasing gender diversity in the Senior Leadership Group and at every level of the Company

We are signatories to the UN Global Compact and report annually on our sustainability activities, commitments and progress. We also prepare a separate Sustainability Report each year, which gives a more in-depth overview of our sustainability activities. This can be accessed via our website: www.vesuvius.com.

We are very proud of our progress to date, as exemplified by the external recognition of the rating agencies. Since 2020, our MSCI ESG rating has progressed from BBB to AA, and our EcoVadis rating from Silver to Gold. In 2022 we submitted our first CDP questionnaire, which received a B grade.

We are committed to transparent and thorough reporting on our sustainability performance. We would welcome any input or feedback to: sustainability@vesuvius.com.

Alexander Laugier-Werth
VP Sustainability, HSE & Quality

Note: Waste and recycling data contained in this report does not include the two sites acquired from Universal Refractories at the end of 2021, nor the site acquired in October 2022 with the acquisition of BMC. The energy and emissions data also doesn't include BMC, whilst the safety data for BMC has been included from the date of acquisition.

Our Sustainability journey

Areas of Sustainability focus

- Reducing Scope 1 and 2 emissions, evaluating Scope 3 emissions with our suppliers
- Determining CO_2 emissions avoided by customers, and creating further action plans to maximise this
- Switching to carbon-free electricity on our sites wherever possible
- Assessing new product developments and technologies based on their safety and environmental benefits
- Supporting education for women in scientific fields
- Increasing gender diversity in the Senior Leadership Group and at every level of the Company
- Increasing employee engagement
- Undertaking environmental impact analysis of capital expenditure; with the internal price of CO_2 emissions reviewed every year
- Seeking ISO 14001 certification of manufacturing sites not already certified
- Undertaking sustainability assessments and audits of suppliers

Our Sustainability journey

	2020	2021	2022
	– Sustainability Charter – Sustainability Council – Vesuvius adheres to the UN Global Compact – Internal Price of Carbon – Supplier assessment programme	– Scope 1 and Scope 2 emissions externally verified – Scope 3 emissions evaluated – Sustainable procurement policy – Sustainability scorecard – First Sustainability Report – TCFD disclosures	– Roadmap to net zero – CDP questionnaire – Sustainability Report GRI aligned
MSCI	BBB	A	AA
ecovadis			
CDP			B

Vesuvius' Environmental Policy

We commit to:

- Minimise direct and indirect CO_2 and other greenhouse gas emissions, by reducing the energy intensity of our business and using cleaner energy sources
- Minimise the consumption of water and other resources
- Reduce waste at source and during production
- Increase the usage of recycled materials and promote the development of the circular economy
- Minimise any pollution or releases of substances which could adversely affect humans or the environment
- Avoid negative impacts on biodiversity

See the full policy on www.vesuvius.com for further details.

Our Sustainability strategy and objectives

Creating a better tomorrow for our planet, our customers, our people and our communities

We create innovative solutions that enable our customers to improve their safety and quality performance, reduce their environmental footprint, become more efficient in their processes, and reduce costs.

We aim to deliver sustainable, profitable growth to provide our shareholders with a superior return on their investment, whilst providing our employees with a safe workplace where they are recognised, developed and properly rewarded.

Our Sustainability initiative embodies this purpose. It sets out the Group's formal objectives and targets for supporting our customers, our employees and our communities, and for protecting our planet for future generations. It is embedded in the Group's overall strategy and informs how we deliver on the Group's execution priorities.

The key objectives and priorities of our Sustainability initiative are outlined here. They were defined following the identification and analysis of the Group's most important and material sustainability risks and opportunities.

Our planet

– To tackle climate change by reducing our CO_2 emissions and helping our customers reduce theirs with our products and services. We are committed to reaching a net zero carbon footprint at the latest by 2050

– To engage in the circular economy by reducing our waste, recovering more of our products after they have been used and increasing the usage of recycled materials

p57

Our customers

– To support our customers' efforts to improve safety on the shop floor, especially exposure to hot metal

– To help customers improve their operational performance and thereby reduce their environmental footprint, and especially their CO_2 emissions

p71

Our people

– To ensure the safety of our people and everyone else who accesses our sites. This is our first priority. We take safety very seriously and are constantly striving to improve

– To offer growth opportunities to all our employees through training and career progression to develop diverse, engaged and high-performing teams

p74

Our communities

– To support the communities in which we operate, with a focus on promoting and supporting women's education in scientific fields

– To ensure ethical business conduct both internally and with our trading partners

– To extend our sustainability commitment to our suppliers and encourage them to progress

p81

Our planet · Our customers · Our people · Our communities

Progress on our Sustainability targets

The Board has identified 11 significant non-financial KPIs for the business and its strategy. Two KPIs relate to innovation (Total R&D spend and percentage of new product sales), while the remaining nine cover the Group's main Sustainability objectives.

We have set stretching targets for the Group's sustainability KPIs to reach within set time frames, these are set out in the table below. In view of the progress made, the reduction of Scope 1 and Scope 2 CO_2e emissions target was increased in 2022 from 10% to 20% and its coverage increased from Energy CO_2e to all CO_2e emissions.

KPI	Measure	Target	2022 progress vs plan[1]	2022 progress	Main domain	UN Sustainable Development Goals
Safety	Lost Time Injury Frequency Rate below 1	<1	On plan	1.08	Our people	3, 8
Energy intensity	By 2025, reduce energy intensity per metric tonne of product packed for shipment (vs 2019)	-10%	On plan	-6.0%[1]	Our planet	9, 13
CO_2e emission intensity	By 2025, reduce Scope 1 and Scope 2 CO_2e emission intensity per metric tonne of product packed for shipment (vs 2019)	-20%	Ahead of schedule	-18.8%[1,2]	Our planet	9, 12, 13
Wastewater	By 2025, reduce wastewater per metric tonne of product packed for shipment (vs 2019)	-25%	Behind plan	-9.0%	Our planet	6, 9, 12
Solid waste	By 2025, reduce solid waste (hazardous and sent to landfill) per metric tonne of product packed for shipment (vs 2019)	-25%	On plan	-13.8%	Our planet	9, 12
Recycled material	By 2025, increase the proportion of recycled materials from external sources used in production	7%	Behind plan	6.0%	Our customers	9, 12
Gender diversity	By 2025, increase female representation in the Senior Leadership Group (approx. 160 top managers)	25%	On plan	20%	Our people	5
Compliance training	Increase the percentage of targeted staff who complete anti-bribery and corruption training annually	90%	Ahead of schedule	99%	Our communities	16
Supply chain	By the end of 2023, conduct sustainability assessments of our raw materials suppliers covering at least 50% of Group raw material spend	50%	Ahead of schedule	48%	Our communities	8, 10, 17

Progress key

Behind plan · On plan · Ahead of schedule · Target achieved

Vesuvius' contribution to the UN Sustainable Development Goals

3 · 5 · 6 · 8 · 9 · 12 · 13

1. Re-baselined using pre-acquisition data for the business acquired from Universal Refractories, Inc.
2. Does not include fugitive emissions (de minimis).

Task Force on Climate-related Financial Disclosures

The Task Force on Climate-related Financial Disclosures (TCFD) has developed a disclosure framework to help companies improve and increase the understanding of their reporting of climate-related financial information. The climate-related financial disclosures included in this Annual Report are consistent with the TCFD Recommendations and Recommended Disclosures, and have been prepared taking into account the Guidance for all Sectors.

In preparing this TCFD disclosure we considered recent developments in global affairs and macro trends, such as:

- The acceleration of the electric vehicle market growth (and consequently the faster peak and decline of the hybrid vehicles market)
- The energy crisis and price gaps that appeared between regions, and at the same time, the rapid reduction of the cost per installed kWh of renewable energy and associated massive investments plans

We concluded that the underlying assumptions and drivers of our scenario analysis, and the risks and opportunities that we have identified, do not require any significant modification this year.

We are aware of a growing acceptance that the 1.5°C global warming ambition will not be met, which supports the assumption in our scenario plans that the most optimistic scenario is a 2°C increase in global warming.

The table sets out where you can find information on how we have applied each of the recommendations of the TCFD.

Topic		Disclosure summary	Vesuvius disclosure	
Governance	Disclose the organisation's governance around climate-related risks and opportunities.	a Describe the Board's oversight of climate-related risks and opportunities.	*Sustainability: TCFD* *Risk, viability and going concern* *Directors' Remuneration Report*	p55 p27-31 p116-143
		b Describe management's role in assessing and managing climate-related risks and opportunities.	*Sustainability: TCFD* *Risk, viability and going concern*	p55-56 p27-31
Strategy	Disclose the actual and potential impacts of climate-related risks and opportunities on the organisation's businesses, strategy, and financial planning where such information is material.	a Describe the climate-related risks and opportunities the organisation has identified over the short, medium and long term.	*Sustainability: Our planet*	p57-60
		b Describe the impact of climate-related risks and opportunities on the organisation's businesses, strategy and financial planning.	*Sustainability: Our planet* *Our external environment* *Sustainability: Our customers*	p57-65 p14-15 p71-73
		c Describe the resilience of the organisation's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario.	*Sustainability: Our planet*	p61-63
Risk management	Disclose how the organisation identifies, assesses and manages climate-related risks.	a Describe the organisation's processes for identifying and assessing climate-related risks.	*Sustainability: Our planet* *Risk, viability and going concern*	p57-60 p27-31
		b Describe the organisation's processes for managing climate-related risks.	*Sustainability: Our planet* *Risk, viability and going concern*	p57-60 p28-29
		c Describe how processes for identifying, assessing and managing climate-related risks are integrated into the organisation's overall risk management.	*Sustainability: Our planet* *Risk, viability and going concern*	p57-60 p27-31
Metrics and targets	Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.	a Disclose the metrics used by the organisation to assess climate-related risks and opportunities in line with its strategy and risk management process.	*Sustainability*	p53
		b Disclose Scope 1, Scope 2 and, if appropriate, Scope 3 GHG emissions, and the related risks.	*Sustainability: Our planet*	p66-68
		c Describe the targets used by the organisation to manage climate-related risks and opportunities and performance against targets.	*Sustainability: Our planet*	p53 and p66-70

Sustainability governance structure

Board oversight

The Board holds overall accountability and oversight for all matters related to sustainability and the management of all risks and opportunities, including the impact of climate change on the Group. In setting the Group's strategy it ensures that sustainability is embedded at the heart of the Group and is reflected in the operational plans of each Business Unit. The Board formally reviews all significant sustainability programmes.

The Board's oversight of the Group's response to climate change is integrated both into its monitoring of the Group's broader sustainability strategy and initiatives, and its approach to significant capital and other investments. The Board formally discusses the Group's Sustainability initiative at least twice per year. It sets the Group's priorities and targets, and reviews the Group's performance and progress against them.

It also monitors the Group's external ESG ratings, and in 2022 has focused on the Group's roadmap to net zero.

The Board has undertaken a detailed assessment of the Group's climate-related risks and opportunities, including the Group's physical and transition risks. It has also considered the formulation of the three different climate-related scenarios constructed to assess the potential financial implications of climate change and assessed the impact of climate-related risks and opportunities on the Group's strategy. It is our policy for every capital expenditure above £5m requiring Board approval to include a sustainability assessment, which incorporates climate-related parameters.

The Group's Audit Committee supports the Board in ensuring climate-related issues are integrated into the Group's risk management process and reviewing the Group's TCFD reporting. As the Executive Director with key responsibility for the delivery of the Group's strategy, our Chief Executive, Patrick André, is ultimately responsible for the Sustainability initiative.

The Remuneration Committee supports the Group's Sustainability Initiative and climate change-related objectives, through the alignment of the Group's remuneration strategy. All Business Unit Presidents and each of the regional Business Unit Vice Presidents have a part of their annual incentive compensation tied to performance targets on CO_2 emissions reduction. In addition, the Executive Directors and other members of the Group Executive Committee participate in the Group's Long-Term Incentive Plan, with the vesting of 20% of each award based on three ESG measures, focused on a reduction in the Group's Scope 1 & 2 CO_2 emissions, a reduction in the Lost Time Incident Frequency Rate and an improvement in the gender representation in senior management.

Our Sustainability governance

Chief Executive
Is ultimately responsible for the delivery of the Sustainability initiative

Board
- Holds accountability and oversight for all matters related to sustainability
- Oversees the definition of the Sustainability strategy and initiatives
- Sets the main targets, reviews performance and progress

Audit Committee
- Supports the Board in ensuring climate-related issues are integrated into the Group's risk management process
- Reviews the Group's TCFD Reporting and confirmation of target assessment

Remuneration Committee
- Supports the Sustainability objectives through the alignment of the Group's remuneration strategy

Group Executive Committee
Chief Executive, Chief Financial Officer, General Counsel and Company Secretary, Chief HR Officer, Business Unit Presidents
- Approves Group sustainability-related policies
- Receives reports from the VP Sustainability on the Sustainability initiative
- Is responsible for the progress of the Group against its sustainability objectives

BU Presidents
- Incorporate Group sustainability strategy into their BU strategy
- Communicate targets inside their organisations
- Allocate resources, define and implement plans

Sustainability Council
Group Executive Committee, Vice President Sustainability, Head of Communication and Employee Engagement, Head of Investor Relations, Head of Strategy, Vice Presidents Operations, three Regional Business Unit VPs
- Oversees the Group's sustainability activity
- Monitors progress on metrics and targets
- Assists the Group in assessing the implications of long-term climate-related risks and opportunities, elaborating strategy and setting priorities

VP Sustainability
- Leads the Group's sustainability activities, coordinating the work of the Sustainability Council
- Ensures the Group has a clear set of KPIs and collates data
- Organises Group-wide communication
- Leads external reporting and disclosures

Task Force on Climate-related Financial Disclosures continued

Management oversight

In 2020, with the launch of the Group's new Sustainability initiative, a governance structure was established, comprising a Sustainability Council, supported by the new role of VP Sustainability, and a clear set of KPIs and targets were delineated. The Vesuvius Sustainability Council is chaired by the Chief Executive, and comprises the Group Executive Committee, VP Sustainability, regional Vice Presidents from each Business Unit, Head of Strategy, Head of Communication and Employee Engagement, Head of Investor Relations and Vice Presidents of the Operations.

It meets on a quarterly basis and oversees the Group's sustainability activity, monitors progress against our targets, and assists the Board with identifying and assessing the implications of long-term climate-related risks and opportunities, elaborating sustainability strategy, and setting priorities. The Council reports to the Board twice per year.

The VP Sustainability leads the Group's sustainability activities, coordinating the work of the Sustainability Council including the Group's assessment of climate change risks and opportunities and formulation of climate-related scenarios. He is also responsible for the collation of data to assess the Group's performance against its sustainability targets and KPIs, producing quarterly performance reports, managing Group-wide communications, and leading external reporting and disclosures.

Responsibility for the progress of the Group against its sustainability objectives lies with the Group Executive Committee and, operationally, each Business Unit President. These BU Presidents, along with the Regional BU VPs, ensure the Group sustainability strategy is reflected in each BU's strategy, communicating the sustainability targets inside their organisations and implementing plans – including overseeing resources and capital allocation, and selecting R&D priorities – to achieve these targets and address the climate-related risks and opportunities.

The VP Sustainability is responsible for overseeing reporting on the Group's sustainability matters and metrics. Formal channels for reporting a range of data points are embedded in the organisation. Escalation mechanisms, routine reviews, and internal controls such as auditing and due diligence are in place to ensure transparency, consistency and completeness of information. For certain topics these are supported by independent third-party verification.

Our Sustainability Council and VP Sustainability ensure that we have a clear set of KPIs and targets to track the Group's progress.

Scope 1, 2 and 3 CO_2 and CO_2e emissions

Scope 1 covers emissions from fuels used in our factories and offices, fugitive emissions and non-fuel process emissions.

Scope 2 relates to the indirect emissions resulting from the generation of electricity, heat, steam and hot water we purchase to supply our offices and factories.

Scope 3 includes all other indirect emissions that occur in the Company's value chain.

Vesuvius materiality assessment

Our Sustainability initiative focuses on our most significant sustainability issues and opportunities. These are defined by our ongoing materiality assessment, which identifies and prioritises issues based on two criteria: the impact or likely impact on the achievement of Vesuvius' Strategic Objectives; and the impact or potential impact on Vesuvius' stakeholders and their interests.

Name: Sukanta Rit
Role: Senior Engineer FC M&T
Location: Kolkata

Our planet

Vesuvius recognises the urgency of tackling climate change, the finite nature of most natural resources, and the obligation we have to preserve the environment for future generations. By their very nature, refractory products help our customers to reduce heat loss and the energy consumption of their processes. We are committed to making a strong contribution to the reduction of their greenhouse gas emissions. We also want to grow our engagement in the circular economy by extending the lifetime of our products, recovering and recycling more of our products after they have been used, and increasing the proportion of recycled materials in our recipes. Environmental compliance at our sites, reduction in waste and increased recycling are key to Vesuvius' operations and can be a significant differentiator for our business.

Tackling climate change

We are committed to reducing our environmental footprint by reaching net zero greenhouse gas emissions by 2050 at the latest and helping our customers reduce their emissions through improvements in the efficiency of their operations.

Supporting policy development

Vesuvius supports the Paris Agreement's central aim, to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2°C above pre-industrial levels, and pursuing efforts to limit the temperature increase even further to 1.5°C, via the implementation of its roadmap to net zero.

As the world transitions to a low-carbon global economy, Vesuvius supports the call for policymakers to:

- Build a level global playing field, including carbon border adjustments and robust and predictable carbon pricing for companies. This will strengthen incentives to invest in sustainable technologies and to change behaviours
- Develop the necessary energy production and distribution infrastructure to provide access to abundant and affordable clean energy

Reducing our impact

Vesuvius actively participates in measures to tackle climate change by reducing our CO_2e emissions and use of raw materials, alongside helping our customers reduce their own CO_2 footprint thanks to the use of our products and services. Vesuvius embraces society's expectations for greater transparency around climate change, expressed by initiatives such as the recommendations of the TCFD.

Supporting our customers

According to estimates from the World Steel Association (WSA), on average for 2021, 1.91 metric tonnes of CO_2 were emitted for every tonne of steel produced. The WSA also estimated that the steel industry generates between 7% and 9% of global direct emissions from the use of fossil fuels. The iron and steel industries are taking action to address the decarbonisation challenge. We want to support them and will work in partnership with them to develop more sustainable solutions.

With around 10kg of refractory material required per tonne of steel produced, the careful selection and use of energy-saving refractories can beneficially impact the net emission of CO_2 in the steel manufacturing process. In the foundry process, the amount of metal melted versus the amount sold as finished castings is the critical factor impacting a foundry's environmental efficiency. Vesuvius continuously works with its customers to increase this metal yield.

Climate-change-related risks and opportunities

The actions being taken by governments and societies around the world to mitigate climate-change, and the changes in temperature and weather patterns resulting from it, present both opportunities and risks to Vesuvius. In its broadest context, we believe that the need for climate-change initiatives will create ever greater opportunities for the Group to support our customers – to improve their efficiency and reduce their environmental impact.

Methodology

Each year the Group undertakes a robust assessment of the principal and emerging risks which could have a material impact on the Group. A number of sustainability risks are recorded in this analysis (see the Risk, viability and going concern section on p27-33 of our Annual Report). In line with the recommendations of the TCFD, Vesuvius also undertakes a review of the key climate-related opportunities and risks that we foresee impacting the Group over the short, medium and long term.

The Audit Committee has reviewed and approved our climate-related risk and opportunity register, and considered the significance of climate-related risks in relation to risks identified in the standard risk management process. Climate-related risks are reviewed every six months as part of the Group's standard risk management process, to ensure the register reflects any material changes in the operating environment and business strategy, and to ensure that the management of climate-related risks is integrated into our overall principal risk management framework.

The Business Units use the analysis of risks and opportunities to inform their business development priorities and focus their R&D project portfolios. They factor climate-change risks and opportunities into their business planning processes, assessing the long-term impacts on profitability of both the risks and opportunities.

Physical risks and business continuity

Thanks to significant restructuring efforts carried out since 2017, Vesuvius now operates in a resilient and optimised global footprint. Proximity with customers limits transportation and associated CO_2 emissions, ensures higher flexibility and reactivity, and reduces working capital. Yet, a significant amount of redundancy for most product lines remains, providing backup in case of local disruption and ensuring continuity of supply for our customers.

Tackling climate change continued

Vesuvius operates in 55 manufacturing sites and six R&D centres of excellence located in 26 countries. From time to time our operations can be subject to physical damage driven by weather events, such as severe storms and flooding, water shortages or wildfires, whose frequency and intensity may be exacerbated by climate change. Such events may also impact the manufacturing capabilities of our customers, our tier 1 and lower tier suppliers and our supply chain logistics.

Sites are routinely audited by our insurers and our external risk manager. Their reports are combined with water stress analyses (based on the Aqueduct water risk atlas) covering all our manufacturing sites and R&D centres of excellence, along with our history of events, to create our physical and weather event risks map. This provides a comprehensive analysis of our sites' susceptibility to physical risks arising from climate change.

In 2022, we continued updating our risk map. 24 sites were identified as being high risk for at least one type of weather event (flooding, hailstorm, lightning, storms and tornadoes), and four are located in areas of very high water stress. None of our sites were materially affected by any major weather events in 2022.

We anticipate that the occurrence of adverse weather events will continue to increase, and we therefore manage our business to prepare for them and mitigate their impact when they do occur.

As the Group has restructured and concentrated its manufacturing footprint on a reduced number of locations, our strategy to address short-term risks has transitioned from a focus on redundant capacity to improved prevention and risk management.

Local and product line business continuity plans are maintained by our manufacturing sites and are regularly reviewed. Vesuvius sites maintain and exercise emergency plans to deal with such events as part of their normal risk management and business continuity processes. Exercises and drills are organised covering IT disaster recovery, fire, explosion, weather and geophysical events, and our processes are improved based on the lessons learned.

Climate-related risks and opportunities analysis

Transition risks

We believe that the main climate change transition risks facing the Group relate to:

1. The potential for carbon taxing or emissions rights trading schemes to be introduced or increased, without effective border adjustment mechanisms to accompany them, in Europe and the US, but not uniformly in other regions; and
2. The rapid transition from iron to aluminium for light vehicle castings

An increase in the cost of carbon emissions would affect our manufacturing costs. We are addressing this through our energy efficiency improvement initiatives and conversion to non-fossil fuels wherever possible. Long-lasting energy price increases and significant differences between Europe and other regions would further exacerbate this risk, affecting our customers' manufacturing footprint and our own.

A very rapid transition from iron to aluminium for light vehicle castings would affect our revenue in the iron castings market. We expect this to be compensated for by increased sales for aluminium castings, and growing sales of products for thin-section automotive component iron castings and turbo-charger castings for hybrid vehicles.

Sites with the highest exposure to weather events

Country	Site	Water stress	Flood – water bodies	Flood – precipitation	Hailstorm	Lightning	Wind – tropical storms	Wind – extra tropical storms	Tornado
China	Anshan	○							
	Changshu		●						
Belgium	Ostend							●	
Czech Republic	Trinec		●						
Italy	Muggio				●				
Netherlands	Hengelo		●						
Poland	Skawina		●						
South Africa	Johannesburg				●	●			
United Kingdom	Tamworth		●						
India	Kolkata		●	●			●		
	Mehsana	○							
	Puducherry	○							
	Pune	○							
	Vizag						●	●	
Mexico	Monterrey		●						
	Ramos Arizpe		●						
USA	Champaign				●				●
	Charleston		●						●
	Chicago Heights				●				●
	Conneaut			●		●			●
	Coraopolis		●			●			
	Wampum		●			●			
	Wurtland					●			
Japan	Toyokawa						●	●	
Taiwan	Ping Tung						●		
Brazil	Piedade				●	●			
	Resende		●	●					
	São Paulo				●	●			

Climate-related risks and opportunities analysis

Vesuvius considers the key climate-related opportunities and risks that we foresee impacting the Group over the following short, medium and long-term time horizons.

Short term (2025)

Our current strategic plans operate within this time frame. Most of the intermediate sustainability targets approved by the Board were set with 2025 as a deadline. This horizon encompasses our capital expenditure cycle, allowing time to decide, implement and measure the progress of actions.

Medium term (2035)

This is the most likely horizon for the regulatory frameworks (such as the EU Emissions Trading System and Carbon Border Adjustment Mechanism) currently being defined in many regions to reach their full effect. We anticipate that the major adjustments to customers' footprints and technology investments will be in full swing by then.

Long term (2050)

This deadline has been retained by the United Nations and many policy-making bodies to set decarbonisation goals. Vesuvius is committed to reaching net zero by 2050 at the latest.

The opportunities we have identified are integrated into the Group's business strategy and are being pursued by the relevant BUs. See Our business on p1-33.

Very high (>£25m)	Moderate (£5–10m)
Major (£15–25m)	Minor (£1–5m)
High (£10–15m)	Insignificant (£0–1m)

Opportunities

Opportunity	Description	Impact	Potential annual impact on trading profit in the short, medium and long term: Short term 2025	Medium term 2035	Long term 2050
Products and services					
Ability to diversify business activities	Commercialise refractory solutions for low-CO_2 emitting processes in the production of aluminium to replace carbon-based products	Increased revenue and trading profit	Minor	Minor to moderate	Minor to major
	Commercialise refractory solutions for hydrogen-based Direct Reduction Iron production and steel to replace traditional refractory products		Insignificant	Insignificant to minor	Insignificant to high
Markets					
Access to new markets	Accelerated growth of the wind turbine market	Increased revenue and trading profit	Minor	Minor	Minor to high
	Accelerated growth of the aluminium castings market for electric vehicles and light-weighting		Minor	Minor	Moderate to high
	Accelerated growth of ferrous castings for hybrid vehicles (turbo-chargers) and thin-section castings for internal combustion engines		Insignificant to minor	Insignificant to minor	Insignificant
	Accelerated growth of the high-technology steel segment		Minor	Minor to high	High to very high

Tackling climate change continued

Impact categories (trading profit)

We have assessed our risks and opportunities, and sorted them according to the following classification:

Catastrophic (>£25m)	Moderate (£5–10m)
Major (£15–25m)	Minor (£1–5m)
High (£10–15m)	Insignificant (£0–1m)

Risks

Risks	Description	Impact	Mitigating actions being undertaken	Potential annual impact on trading profit in the short, medium and long term: Short term 2025	Medium term 2035	Long term 2050
Physical risks						
Increased frequency and severity of extreme weather events (heatwaves, rain and river flooding, cyclones, snow)	Physical damage to Vesuvius locations and people Business disruption due to natural disaster	Increased cost due to physical damage Reduced revenue from business interruption	Mitigating actions for severe weather events and the associated risks are included in the business continuity plans of plants, and insurance is purchased	Minor	Minor	Minor
Transition risks – Policy and legal						
Carbon taxing/emissions rights trading/border adjustment mechanisms introduced or extended	Increase in manufacturing costs	Increased operating costs (main risk in Europe)	Capex to improve energy efficiency and conversion to non-fossil fuels to eliminate CO_2 emissions. Relocation of manufacturing to reflect movements in customer base	Minor	Insignificant to moderate	Insignificant to high
Transition risks – Market						
Rapid growth of aluminium casting processes for light vehicle castings at the expense of traditional ferrous and other non-ferrous processes (due to conversion to electric vehicles)	Shift from castings using a high level of consumables to low consumable processes creates risk of revenue loss for the Foundry Division	Reduced revenue from shrinking market as some traditional castings will disappear or be converted to alternative processes	In ferrous, push to develop sales of feedex and coatings for thin-section automotive components, and products for turbo-charger casting. Invest in R&D, marketing and sales force. In non-ferrous, develop products for HPDC and LPDC processes and increase penetration in markets with lower usage of refractories	Minor	Moderate to high	Moderate to major
Transition from internal combustion engines to electric vehicles will lead to the decline of sand and gravity castings	Reduced volume of aluminium power train components	Reduced revenue from shrinking market of consumables for sand and gravity castings	Adapt product portfolio, focusing on HPDC and LPDC	Minor	Minor to moderate	Moderate
Transition from Blast Furnaces – Blast Oxygen Furnaces converted to Direct Reduction Iron or Electric Arc Furnaces (EAF) for iron and steel making	Share of EAF in total steel production increases	Reduced size of market where Vesuvius is strongest, leading to weaker positions in the steel market	Adjust R&D and product development priorities. Redeploy sales force, focusing on EAF market	Insignificant	Minor to moderate	Minor to moderate

Climate change scenario analysis

Vesuvius has undertaken scenario analysis to seek to quantify the likely impact of climate change on the business and to test the resilience of the Group's strategy to the changes that lie ahead.

We considered three scenarios, modelling the potential financial impact of 2°C, 3°C and 4°C temperature increases on our business.

Best case scenario

In formulating our scenarios, we took as our 'best case' a 2°C scenario. This was based on the premise that despite the tremendous acceleration of public awareness, regulation, technology development and capital allocation in recent years, we doubt that there is sufficient time for the 1.5°C target to be achieved. We therefore identified our most optimistic scenario as 2°C.

Our assumption is that any further acceleration which would allow the planet to get back onto a 1.5°C course would reinforce the main characteristics and accelerate the timeline of our 2°C scenario, without fundamentally changing its features.

From assumptions to strategy

The scenarios take as their starting point the regulatory and macroeconomic assumptions underpinned by the International Energy Agency's WEO 2020 Stated Policies Scenario and Sustainable Development Scenario.

Supplementing this we have identified, for each scenario, the areas of our business in which changes may occur, such as the evolution of end-markets, customer footprint, pace and breadth of technology transition in iron and steel making, pace of conversion from fossil fuels to clean electricity and hydrogen, and evolution of the aluminium market. We then evaluated the potential magnitude of the risks and opportunities in each scenario. We analysed the implications for Vesuvius and considered our strategic response in terms of our manufacturing and our commercial footprint, our portfolio of products and services, the conversion of our manufacturing processes to clean energy and the prospects for our aluminium casting business. With this approach, the impacts on all key areas of the business were covered (sales, R&D, manufacturing and procurement). The outcomes of the scenario analyses have been taken into account in formulating plans for achieving the Group's strategy.

Three long-term scenarios

4°C warming scenario 'Good intentions hampered by fear of economic war'	3°C warming scenario 'Closed doors'	2°C warming scenario 'Global accord'
Incomplete policy and fiscal packages distort competition, slowing down technology development and leading to geographic shifts in steel supply	Regional/national self-interest drives economic policy, competition wins over cooperation, regulatory framework and technologies evolve differently	High cooperation and commitment to limit emissions facilitates technology development and the transition to a low carbon world

Tackling climate change continued

	4°C warming scenario – 'Good intentions hampered by fear of economic war'	3°C warming scenario – 'Closed doors'	2°C warming scenario – 'Global accord'
1 Regulatory and macroeconomic environment	The European Union and United States implement carbon pricing mechanisms (taxation or cap on trade), but no Carbon Border Adjustment Mechanism or Tariffs (or insufficient to prevent the transfer of manufacturing away from these regions)	The European Union and United States implement carbon pricing mechanisms (taxation or cap on trade), and Carbon Border Adjustment Mechanisms or Tariffs to protect their industries from delocalisation	All major economies implement carbon pricing mechanisms. The cost of CO_2 increases in all regions at a comparable pace
2 Conversion of power generation from fossil fuels to clean electricity and hydrogen	– Fast growth of non-CO_2 emitting electricity sources (nuclear and renewable) in Europe – The cost of fossil fuels increases significantly in Europe – Energy prices differ greatly between Europe and the rest of the world over a long period of time – Coal reduces progressively, but does not disappear. Natural gas continues to grow outside Europe – Hydrogen does not become available on a wide scale and economically competitive until well after 2040	– Fast growth of non-CO_2 emitting energy sources (nuclear and renewable) in Europe – The cost of fossil fuels increases significantly in Europe. Coal reduces progressively, but does not disappear, natural gas continues to grow outside Europe – Energy prices in Europe and the rest of the world realign progressively – Hydrogen becomes available on a wide scale in the USA and Europe and economically competitive between 2030 and 2040	– Fast growth of non-CO_2 emitting energy sources (nuclear and renewable) in all regions – The cost of fossil fuels increases significantly (taxation), coal as a source of energy disappears, natural gas starts to reduce – Energy prices in Europe and the rest of the world realign progressively – Hydrogen becomes available on a wide scale and economically competitive between 2030 and 2040 – Fast electrification of the automotive industry – Fast growth of hydrogen-fuelled heavy vehicles
3 Technology transition – iron and steel making	– The transition in blast furnaces to clean processes (e.g. Direct Reduction Iron (DRI), hydrogen, Carbon Capture Storage (CCS), Carbon Capture Utilisation Storage (CCUS)) does not happen on a large scale – US steel producers convert blast furnaces to DRI and Electric Arc Furnaces (EAF) to benefit from the low cost and high availability of natural gas	– European iron making transitions to clean processes (e.g. hydrogen, DRI, CCS, CCUS). The speed of the transition is dictated by the availability of green hydrogen in large quantities – Some US blast furnaces are converted to hydrogen, others to DRI & EAF – Chinese steel plants convert to clean iron and steel-making processes, albeit at a slower pace – Little or no transition outside China, the EU and USA	– Fast transition of iron making to clean processes in all regions; blast furnaces are revamped ahead of their normal schedule – European and Chinese integrated steel making grows primarily in hydrogen-based iron production, implementing CCS and CCUS technologies as well – DRI and EAF grows in the US (benefiting from the availability of low cost shale gas) and Europe – Customers also invest to increase the performance of furnaces, including downstream of casting
4 High-technology steel market	High-technology steel market grows at 0.9% per year	High-technology steel market grows at 1.2% per year (light-weighting and material efficiency efforts by downstream industries accelerate shift from lower to higher performance grades)	High-technology steel market grows at 1.6% per year (light-weighting and material efficiency efforts by downstream industries accelerate shift from lower to higher performance grades)
5 Aluminium market	Aluminium market grows at 3% per year, especially High Pressure Die Casting (HPDC) and Low Pressure Die Casting (LPDC) processes	Aluminium market grows at 5% per year (driven by the demand for transportation, construction and packaging) until 2030. Growth of HPDC/LPDC at a higher pace in the US and EU markets. Moderate development of secondary aluminium casting	Aluminium market grows at 7% per year (driven by the demand for transportation, construction and packaging) until 2025. Growth of HPDC/LPDC at a higher pace in the US and EU markets. Rapid development of secondary aluminium casting
Potential financial impact by 2035 (profit before tax)	-£5m to £0m	£5m to £10m	£15m to £20m

Key factors impacting Vesuvius' three climate change scenarios

1 Regulatory and macroeconomic drivers differentiate our scenarios

Firstly, effective border adjustment mechanisms to accompany carbon taxation, or cap and trade systems in regions with ambitious emissions reduction objectives, will greatly support the implementation of technologies required to decarbonise steel making (including the development of hydrogen as the reducing agent). Conversely, the absence or ineffective implementation of border adjustments would lead to significant delocalisation of the steel industry and a displacement of CO_2 emissions to other countries rather than a significant reduction on a worldwide scale. The energy crisis which started in late 2021 and is particularly acute in Europe, has resulted in additional costs and loss of competitiveness for the European steel industry. In the short term, this was addressed by the temporary stoppage of steel plants. If the energy cost gap with other regions remains over a number of years, this could result in the permanent closure of steel plants and delocalisation of production to other regions. This shift in our customer footprint would lead to the need to adapt our own manufacturing footprint.

Secondly, public policy will significantly affect the relative cost and availability of non-CO_2 emitting energy sources vs fossil fuels and their associated infrastructures. These will greatly influence the pace of deployment of various technologies and industries (electric vehicles, carbon-free hydrogen, decarbonised steel making). Infrastructure, construction and other downstream markets will also be incentivised to reduce steel consumption, accelerating the shift towards high-technology steel. Rising energy costs as experienced since the end of 2021 will positively affect the growth rate of investment in renewable energies and penetration of electric vehicles in the automotive markets.

Finally, the level of international cooperation to encourage and support less developed economies to engage in the technology transition will also affect our customer manufacturing footprint.

2 The future of steel

All three scenarios assume that the strong connection between world GDP and world steel output will continue, supported by urbanisation and rising living standards, as there is no significant substitute for steel. The fight against climate change is expected to have a far-reaching impact on many different industries translating into the accelerated growth of the high-technology steel segment in which Vesuvius has a key presence. For example, solar and wind power plants, where investment is growing fast, are far more steel intensive per kWh of installed capacity than their fossil fuel equivalents. Likewise, hydrogen transportation, another area of rapid growth, also requires considerable amounts of special grades of steel for new pipelines and ships.

3 Technology transition

Our scenarios consider the pace and extent of the technology transition in iron and steel making. The Blast Furnace – Basic Oxygen Furnace (BF-BOF) route for steel making is significantly more CO_2 intensive than the Electric Arc Furnace (EAF) route. However, EAFs cannot currently be used to produce all higher quality steel grades and they rely on the availability of scrap steel (itself a function of the level of economic development). Going forward, quality levels produced by EAFs will continue to improve.

Various technologies to decarbonise the BF-BOF route are being developed, including solutions which seek to capture the carbon as it is emitted and either store it or use the carbon in other processes. Alternatively the BF-BOF route may be replaced by a combination of DRI and EAF.

Hydrogen-based DRI associated with EAFs has the potential to be nearly carbon-free if carbon-free electricity and hydrogen are available. We anticipate that there will be a gradual reduction in steel production via the BF-BOF route and growth in the EAF route. The extent and pace of this change will depend on technologies coming to maturity, the availability of infrastructure (carbon-free electricity and hydrogen), and regulatory frameworks.

Conclusion on strategic resilience

Sustainability has always been at the heart of Vesuvius' business and the Group's analysis concludes that the opportunities for the Group manifested by the global pressure to mitigate climate change outweigh the risks. Our technology helps our customers improve their process efficiency and their environmental footprint.

We estimate the financial impact of the opportunities and risks on the Group will be most adverse under a 4°C scenario and most positive under a 2°C scenario. Under all three scenarios, we expect to benefit from the continuing growth in the production of steel in line with GDP, along with the accelerating shift towards higher performance iron and steel castings, as we support customers to maximise the efficiency and quality of their production. With our technological expertise, strong customer relationships and broad manufacturing footprint, we expect to play a key role in supporting our customers' efforts to decarbonise their operations.

We also believe there is a low downside for Vesuvius in all three scenarios as approximately 75% of our business in steel is in the steel casting part of the operation which, as a stand-alone process, is low CO_2 emitting (1% to 3% of a steel plant's CO_2 emissions), and which we do not expect to be affected by technology shifts that the decarbonisation of iron and steel making will require.

Whilst the electrification of light vehicles and ongoing light-weighting efforts are expected to translate into a shrinking of the market for certain iron castings, it is anticipated that this will be more than compensated for by the growth in other markets such as wind turbines and aluminium castings.

We do not anticipate that climate change will lead to any significant changes in our access to capital or require the impairment of assets on a material scale.

Tackling climate change continued

Roadmap to net zero

We have set intermediate targets in our journey to reach net zero CO_2e emissions by 2050 (Scope 1 and Scope 2), in line with the Paris Agreement and the UK's commitment in the Climate Change Act 2008 (2050 Target Amendment) Order 2019. These emissions encompass the seven GHGs listed by the Intergovernmental Panel on Climate Change in the Kyoto Protocol (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6 and NF_3).

Our preferred metrics to monitor progress with our journey to net zero are energy and CO_2e emission intensity (energy consumption and CO_2e emissions per tonne of product packed for shipment). These reflect the progress made in our operations better than absolute metrics. Managing this energy intensity not only has environmental benefits but it is also part of our long-term strategy to enhance our cost competitiveness.

Our Targets

– 10% improvement in the Group's energy intensity between 2019 and 2025

– 20% reduction in CO_2e emission intensity normalised per metric tonne of product packed for shipment (Scope 1 and Scope 2) by 2025 (vs 2019 baseline)

– 100% carbon-free electricity by 2030

– A reduction in total Scope 1 and Scope 2 CO_2e emission intensity of 50% by 2035 (vs 2019 baseline)

– Zero Scope 1 and Scope 2 emissions by 2050

Our targets cover 100% of Vesuvius' operations and are to be achieved without the use of any offsets (or only to address residual emissions). They are aligned with the Science Based Targets initiative (SBTi) requirements for a well below 2°C global warming scenario.

The Group Energy CO_2e emissions reduction targets have been cascaded to all Business Units, which have built action plans accordingly. Portions of the Group Executive Committee's Long-Term Incentive Plan and senior management annual variable compensation are linked to the achievement of CO_2 emissions reduction targets.

Our Plan

Our roadmap to net zero is based on five key areas of focus:

– Modernising and upgrading installed equipment to reduce our energy consumption

– Investing to renew equipment to the best available technologies and converting to less CO_2 intensive energy sources

– When possible, replacing high CO_2e emission electricity (generated from coal) with greener electricity or other sources of energy

– Reducing our energy wastage, recovering heat to feed processes and hot water

– Generating clean energy

It is estimated that we will need to invest c.£60m of incremental capital expenditure between 2023 and 2035 to support our roadmap.

Some significant assumptions underpin our net zero plan, including:

– The availability of the necessary technologies, at an affordable level and at a scale appropriate for our industry, especially for the firing of refractory ceramics and carbon capture

– The development of additional production capacity and distribution infrastructure for renewable energy and hydrogen, and their cost competitiveness

– Adequate policy support to foster innovation and ensure the cost of CO_2 emissions will increase the attractiveness of carbon-free processes

– No significant change to our business model and product portfolio

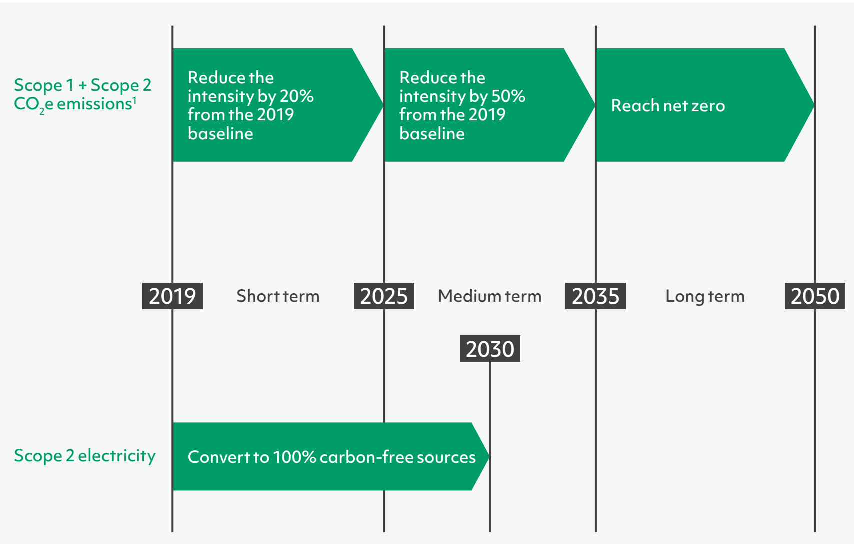
The achievement of our CO_2e emissions targets will also be sensitive to:

– The growth of revenue, organically, and from acquisitions and divestitures

– Product mix evolution (especially driven by dolime volume, which is the most CO_2 intensive product line)

– Macroeconomic conditions and the capex cycle impacting plant loading (and thereby the energy efficiency of continuous processes)

Our journey to net zero



1. Re-baselined using pre-acquisition data for the business acquired from Universal Refractories.

Our Progress – Key Group initiatives for energy conservation and for increasing energy efficiency

Since 2019, we have undertaken a number of major projects to significantly reduce the Scope 1 CO_2 emissions of the Group by addressing some of its most CO_2e intensive installations. We closed the Skawina brick plant, eliminated dirty coke oven gas as a fuel in Wuhan, replacing it with a new natural gas-fired tunnel kiln, transferred the Tyler plant activity to Monterrey, and replaced the burner system of the Olifantsfontein rotary kiln. We also took advantage of the closure of our Chinese plant at Kuatang and the relocation of its activity to replace all drying ovens and kilns with new ones, with an energy efficiency improvement target of 20%.

In 2021, new capital expenditure worth circa £1.7m dedicated to 25 incremental improvement projects, which had energy efficiency and CO_2 emissions reduction as one of their prime objectives, was approved. Nine sites converted to carbon-free electricity contracts, taking the total number to 12, representing 20% of our manufacturing sites and R&D centres of excellence. We also inaugurated solar panel installation in our plant in Igorre, so by the end of 2021, four sites were equipped with renewable energy installations, and one had invested in a combined heat and power installation.

Progress in 2022

1 Carbon-free energy sources

The Group supports the transition towards renewable energy sources and cleaner carbon-free technology when possible. Our energy strategy includes an ongoing effort to convert to carbon-free electricity contracts whenever practical and economically manageable, invest in solar panels, and the conversion of processes to electricity as soon as the technology is cost-effective.

In 2022, 20 sites converted to carbon-free electricity contracts, taking the total number to 32, representing 52% of our manufacturing sites and R&D centres of excellence.

In 2022, 58% of the grid electricity consumed in our sites was generated from renewable sources, and 68% using processes that did not emit CO_2.

During 2022, we also inaugurated solar panel installations in eight new plants, taking the total number of manufacturing sites and R&D centres of excellence equipped with renewable energy installations to 11. We have a further 26 sites investigating solar panel projects.

2 Capital commitments and internal CO_2 pricing

We include an environmental impact analysis in the evaluation of each of our capital expenditure projects as these are the key decisions that drive long-term future sustainability performance, and CO_2 emissions in particular.

Our Environmental policy, which is the responsibility of the Chief Executive and the Group Executive Committee, covers all our operations and states that all our investment decisions will include an analysis of their environmental impact. An internal price for CO_2 emissions (Scope 1 and Scope 2) is included in the calculation of payback for all investments reaching the threshold for approval by the BU Presidents or Chief Executive.

Vesuvius views this shadow pricing mechanism as a key tool to ensure that the environmental impact of long-term investment decisions is understood. It seeks to ensure that the best available technology is adopted, even in locations where no external cost for carbon is in place or foreseen.

The internal price of CO_2 was initially set at €30 per tonne of CO_2 in 2020. This price is reviewed annually and is applicable across all Business Units and all regions. It has been set at €90 per tonne of CO_2 for 2023.

3 Improving our energy efficiency

We endeavour to use the best available technologies to reduce CO_2 emissions in all our major capital expenditure projects.

We have undertaken a Group-wide programme of energy efficiency and established formal efficiency programmes in all Business Units and regions. These include projects to upgrade or retrofit equipment to improve energy efficiency and reduce CO_2 emissions, such as the introduction of new refractory furniture and installation of heat recovery systems in ovens and kilns, upgrades of compressors, replacement of light sources with LED lights, solar panel installation and the purchase of electric forklift trucks.

In 2022, the Board approved major capacity expansion capital expenditure projects totalling more than £20m. Available technologies and their impacts in terms of energy efficiency and CO_2e emissions were systematically considered for these projects, and the most efficient technologies for the purpose selected. In addition, new capital expenditure worth c.£5.6m dedicated to 166 projects with energy efficiency and CO_2 emissions reduction as one of their prime objectives, was approved in 2022.

Next steps to achieve our Net Zero Plan

Various projects are being studied that will help us deliver our short-term (2025) targets on the road to net zero, including: the installation of further solar panels, retrofitting of ovens and kilns, replacement of older and less efficient units, burner setting optimisation and loading and cycle optimisation.

In the medium term (2035), we anticipate that further emissions reduction will be possible through upgrades to our ovens and kilns, and possibly the use of a combination of natural gas and renewable energy such as carbon-free hydrogen to fire refractory materials. We estimate the incremental capital commitment required by our decarbonisation roadmap until 2035 will be approximately £60m (approx. £5m per year). We do not expect the useful economic lives of our existing assets to be materially affected by our plans until 2035. Precise capital expenditure project lists have been defined for the 2025 horizon. We will continue using the internal price of carbon to assess the relative benefit and prioritise projects.

We also anticipate evolutions in our product portfolio towards less energy-intensive products (such as resin-bonded and unshaped refractories) to continue.

In the longer term (2050), various technologies are promising candidates for the near zero emissions curing and firing of refractory products (electricity, carbon-free hydrogen, synthetic gas, biomass). We currently foresee that carbon capture solutions will be available for our industrial application during the 2035-2050 period.

We are progressively adapting our product and process R&D programmes to explore such opportunities.

Tackling climate change continued

Our energy consumption and Scope 1 and Scope 2 CO_2e emissions

While Vesuvius' products differ significantly in the energy intensity of their manufacture, most of our manufacturing processes are not energy intensive nor do they produce significant quantities of waste and emissions. Dolime production, which uses coal to calcine dolomite, is our major emitter of CO_2. Dolime and the next six of our 32 main manufacturing processes account for 73% of our energy consumption and 79% of our location-based CO_2e emissions. These continue to be a clear focus for our investment to reduce CO_2e emissions.

Between 2019 and 2022 the Group achieved an overall reduction in energy intensity (normalised to per metric tonne of product packed for shipment) of 6% vs a target of 10% by 2025. Progress in 2022 was adversely affected by lower volumes, resulting in lower fill rates for continuous processes and lower energy efficiency.

During the same period, our CO_2e emission intensity metric (CO_2e emissions per metric tonne of product packed for shipment, Scope 1 and Scope 2, market-based) progressed by 18.8%, vs a target of 20% by 2025. This includes a 21% reduction in Energy CO_2e intensity and an 11% reduction in Process CO_2e intensity per metric tonne of product packed for shipment.*

* Re-baselined using pre-acquisition data for the business acquired from Universal Refractories.

Scope 1 covers emissions from fuels used in our factories and offices, fugitive emissions and non-fuel process emissions.

Scope 2 relates to the indirect emissions resulting from the generation of electricity, heat, steam and hot water we purchase to supply our offices and factories.

The conversion by many of our sites to carbon-free electricity contracts has helped our CO_2e emissions reduce at a faster pace than our energy efficiency improvements.

Vesuvius' 2022 total energy costs of £56.4m are c.2.8% of revenue. South Africa is the only country where we exceed the threshold to be submitted to a Carbon Tax or an Emissions Trading Scheme. The Carbon Tax cost in 2022 was c.£0.2m.

Scope 1, Scope 2 and Scope 3 emissions (market-based)

In 2022, Vesuvius' total Scope 1, Scope 2 and Scope 3 CO_2e emissions were 1,831,451 metric tonnes. This represented 895 metric tonnes per million £ revenue.

	2022		2021		2020		2019	
Metric tonnes CO_2e	**Metric tonnes**	**%**	Metric tonnes	%	Metric tonnes	%	Metric tonnes	%
Scope 1 Process CO_2e emissions	**91,276**	**5.0%**	101,121	5.4%	88,516	5.9%	106,737	6.0%
Scope 1 Energy CO_2e emissions[1]	**193,603**	**10.6%**	209,592	11.2%	183,741	12.2%	215,836	12.0%
Scope 1 CO_2e emissions	**284,879**	**15.6%**	310,713	16.6%	272,257	18.0%	322,573	18.0%
Scope 2 CO_2e emissions (market-based)	**56,517**	**3.1%**	82,519	4.4%	92,145	6.1%	106,681	5.9%
Scope 3 CO_2e emissions	**1,490,055**	**81.4%**	1,483,438	79.0%	1,147,557	75.9%	1,363,709	76.1%
Total	**1,831,451**	**100%**	1,876,670	100%	1,511,959	100%	1,792,963	100%

Notes:

1. Includes fugitive emissions.

Note: The numbers are collated from entities within the Group's Operational Control Boundary.

Vesuvius plc long-term energy consumption and energy intensity (aggregate of Scope 1 and Scope 2)

	2022[1]	2021	2020	2019	2018
Total energy consumption (million kWh)	**1,084**	1,159	1,026	1,176	1,339
Energy consumption per metric tonne of product packed for shipment (kWh/MT)	**1,207**	1,177	1,243	1,293	1,294

Notes:

1. 2022 includes the business of Universal Refractories, Inc but excludes BMC.

Note: The numbers are collated from entities within the Group's Operational Control Boundary.

Fuel consumption, emissions and normalised emissions for the main fuels consumed across the Group (location-based (Operational Control Boundary) statutory reporting)

In 2022, the Group's normalised energy consumption increased by 2.6% to 1,207kWh per metric tonne (2021: 1,177). Location-based emissions increased by 2.1% to 0.428 metric tonnes CO_2e per metric tonne product packed for shipment (2021: 0.419) and market-based emissions increased by 4.8% to 0.38 metric tonnes CO_2e per metric tonne product packed for shipment (2021: 0.40).

A significant reduction in CO_2e resulted from reductions in the production of dolime. The remaining decreases were primarily driven by changes in production volumes and product mix. Natural gas use decreased by 6%, electricity consumption by 3% and coal (a CO_2 intensive fuel) consumption by 10%, to 27.2 thousand metric tonnes (2021: 30.3).

During 2022, the Group also consumed 292 cubic metres of diesel (-17% on 2021: 352) primarily in the operation of forklift trucks on its sites and 165 cubic metres of fuel oil, an increase of 5% (2021: 157). In total 457 cubic metres of oil was used as fuel in 2022 (-10% on 2021: 508).

Greenhouse Gas (GHG) reporting

We have reported to the extent reasonably practicable on all the emission sources required under Part 7 of the Accounting Regulations which fall within our Group Financial Statements.

Statutory reporting is location-based according to the GHG Protocol.

In reporting GHG emissions, we have used the GHG Protocol Corporate Accounting and Reporting Standard (revised edition) methodology to identify our location-based GHG inventory of Scope 1 (direct) and Scope 2 (indirect) CO_2e. We report in metric tonnes of CO_2 equivalent (CO_2e). We have used emission factors from the UK Government's (DBEIS) and the IEA GHG Conversion Factors for Company Reporting 2022 in the calculation of our GHG emissions.

Our energy-related greenhouse gas (GHG) emissions, reported as carbon dioxide equivalents (CO_2e), include direct emissions of the three main GHGs (carbon dioxide (CO_2), methane (CH_4) and nitrous oxide N_2O).

Process related emissions of the following in CO_2 equivalent and in metric tonnes are not significant:

- Direct methane CH_4 emissions
- Direct nitrous oxide N_2O emissions

Emissions of the following in CO_2 equivalent and in metric tonnes are not significant:

- Direct sulphur hexafluoride (SF_6) emissions
- Direct HFC emissions
- Direct PFC emissions

The Group also meets all its obligations in relation to the Producer Responsibility Packaging Waste regulations and the Energy Saving Opportunity Scheme by which the UK implemented the EU Energy Efficiency Directive.

All sites report their energy consumption and GHG emissions on a quarterly basis. Performance and variation are analysed, and improvement plans built accordingly.

Our energy and Scope 1 and Scope 2 GHG data covers 100% of Vesuvius' operations including the business acquired from Universal Refractories, Inc and joint ventures, but excluding, for 2022, BMC (acquired late in 2022) and, for 2019 and earlier, the management joint venture with Anshan Angang Refractories which was outside of the operational control boundary.

2019 was selected as the baseline for all energy and GHG emissions data and targets, absolute and relative, as this was the last year of normal trading prior to the COVID-19 pandemic. Progress is measured against the 2019 performance.

In 2022, two new sites acquired with the business acquired from Universal Refractories in December 2021, were included. 2019 to 2021 figures were restated to include estimated energy consumption and GHG emissions of these two facilities.

Global GHG emissions and energy consumption Location-based statutory reporting (Operational Control Boundary)

Emissions and energy sources	**UK and Offshore CO_2e '000 metric tonnes 2022**	**Global CO_2e '000 metric tonnes 2022**	**Proportion relating to the UK and Offshore Area**	UK and Offshore CO_2e '000 metric tonnes 2021	Global CO_2e '000 metric tonnes 2021	Proportion relating to the UK and Offshore Area	**UK and Offshore energy used '000 kWh 2022**	**Global energy used '000 kWh 2022**	**Proportion relating to the UK and Offshore Area**	UK and Offshore energy used '000 kWh 2021	Global energy used '000 kWh 2021	Proportion relating to the UK and Offshore Area
Combustion of fuel and operation of facilities including fugitive emissions (Scope 1)	**2.268**	**285**	**0.8%**	2.433	311	0.8%	**11,839**	**877,757**	**1.3%**	12,688	949,036	1.3%
Electricity, heat, steam and cooling purchased for own use (Scope 2)	**0.608**	**99**	**0.6%**	0.556	102	0.5%	**2,740**	**205,859**	**1.3%**	2,503	210,415	1.2%
Total GHG emissions and energy	**2.876**	**384**	**0.7%**	2.989	413	0.7%	**14,578**	**1,083,616**	**1.3%**	15,191	1,159,451	1.3%
Change	**-3.8%**	**-7.0%**					**-4.0%**	**-6.5%**				

	Metric tonnes CO_2e per metric tonne of product packed for shipment				kWh of energy per metric tonne of product packed for shipment			
Vesuvius' chosen intensity measurement (location-based statutory reporting)	**UK and Offshore 2022**	**Global 2022**	UK and Offshore 2021	Global 2021	**UK and Offshore 2022**	**Global 2022**	UK and Offshore 2021	Global 2021
Emissions and energy reported above normalised to metric tonnes CO_2e per metric tonne of product packed for shipment	**4.173**	**0.428**	3.389	0.419	**21,150**	**1,207**	17,223	1,177
Change	**23.1%**	**2.1%**			**22.8%**	**2.6%**		

	Metric tonnes of CO_2e per £m revenue			
Total GHG emissions as metric tonnes CO_2e per £m revenue (location-based)	**23**	**188**	27	251
Change	**-15.9%**	**-25.4%**		

Tackling climate change continued

Metric tonnes CO_2e	2022 Metric tonnes	2022 %	2021 Metric tonnes	2021 %	2020 Metric tonnes	2020 %	2019 Metric tonnes	2019 %
Purchased goods and services	**1,137,416**	**76.3%**	1,159,810	78.2%	871,993	76.0%	1,039,766	76.2%
Capital goods	**87,043**	**5.8%**	62,004	4.2%	53,736	4.7%	68,461	5.0%
Fuel- and energy-related activities (not included in Scope 1 or 2)	**82,523**	**5.5%**	94,274	6.4%	86,544	7.5%	102,374	7.5%
Upstream transportation and distribution	**51,231**	**3.4%**	48,791	3.3%	30,762	2.7%	31,937	2.3%
Waste generated in operations	**7,926**	**0.5%**	5,833	0.4%	5,660	0.5%	6,312	0.5%
Business travel	**26,810**	**1.8%**	15,488	1.0%	13,574	1.2%	31,373	2.3%
Employee commuting	**20,400**	**1.4%**	20,400	1.4%	20,400	1.8%	20,400	1.5%
Upstream leased assets	**6,375**	**0.4%**	6,375	0.4%	6,375	0.6%	6,375	0.5%
Downstream transportation and distribution	**37,537**	**2.5%**	37,761	2.5%	25,770	2.2%	27,231	2.0%
Processing of sold products	**32,794**	**2.2%**	32,794	2.2%	32,794	2.9%	29,875	2.2%
Total Scope 3 CO_2e emissions	**1,490,055**	**100.0%**	1,483,530	100.0%	1,147,608	100.0%	1,364,104	100.0%

Scope 3 emissions

Vesuvius' Scope 3 CO_2e emissions, mainly upstream, contribute to a greater part of our total CO_2e emissions than our Scope 1 and Scope 2 emissions.

Scope 3 CO_2e emissions for 2019 to 2022 were calculated using the Quantis Scope 3 Evaluator software, in line with the GHG protocol. The evaluation covered 100% of operations.

The categories in the table above represent more than 95% of Vesuvius' total estimated Scope 3 emissions.

We assessed the most relevant and influenceable elements of our Scope 3 emissions, and purchased goods and services represent the largest category. Since 2021, we undertook a more focused evaluation of emissions associated with raw materials using publicly available average CO_2 emissions factors. In addition, we started collecting information on energy source, CO_2 emissions data and reduction plans from our raw materials suppliers as part of our Request for Quotation process. Suppliers representing 26% of the raw material spend have responded to our requests.

In 2022, we focused on the four categories of raw materials that make up approximately half of our Scope 3 emissions from purchased goods and services. We started engaging with our suppliers, supporting them with training and evaluation tools to evaluate their Scope 1 and Scope 2 emissions.

We also started collecting CO_2 emissions data related to transportation from our forwarders in all regions.

In parallel to this, various initiatives have been launched to reduce our Scope 3 CO_2 emissions. A few examples include:

- Returnable packaging solutions being implemented both with suppliers and customers
- Policies aimed at limiting the CO_2 emissions of Company fleet vehicles being deployed in various countries
- The encouragement of commuting to work by bus or other forms of collective transportation services. Vesuvius organises such services for more than 1,000 Vesuvius employees

Vesuvius plc statement of verification

CO₂e Reduced Organisation

Scope 1, Scope 2 and Scope 3 carbon footprint reporting and supporting evidence contained herein for the period 1 January 2019 to 31 December 2022 were verified by Carbon Footprint Ltd in accordance with the ISO 14064 Part 3 (2019): Greenhouse Gases: Specification with guidance for the verification and validation of greenhouse gas statements.

A copy of the limited assurance statement can be found on our website: www.vesuvius.com.

Product responsibility – Growing our engagement in the circular economy

The drive to improve the sustainability performance of Vesuvius and the refractory industry's products was initiated many decades ago. Continuous improvements have led to considerable reductions in both the raw materials used and the quantity of product shipped to landfill. As the amount of refractory material consumed per tonne of steel cast levels off, the purpose and value of the use of refractory materials will move from delivering insulation to an even greater emphasis on helping to improve steel quality and process efficiency.

Product durability

Our first, and preferred, strategy to reduce the depletion of resources is the extension of product durability.

We are continuously working to extend the lifetime of our consumable products. Strategies include the development of advanced materials, the design of shapes that allow dual usage of products, and product repair and remanufacture. For mechanisms and equipment, we also offer wear monitoring and maintenance services to our customers to ensure their optimum performance and extend their lifetime.

Product recyclability

At the same time as reducing the quantity of raw materials required for each casting, technical solutions and economic cycles have grown to enable the recycling of refractory materials after usage in the production of iron and steel. Whereas in the early 1970s nearly all refractory materials were disposed of after use, it is estimated that more than half are now recycled. In Europe, as little as 5% of refractory materials now go to landfill.

As part of our product end of life management programme, we are developing various initiatives with customers, such as:

- Recovery and remanufacture of products after usage
- Recovery and recycling of refractory materials after usage
- Various options with regard to mechanisms and equipment, including rental

Recovered and recycled materials

Vesuvius is determined to increase the usage of recovered and recycled materials in its product formulations.

Increasing the share of recovered and recycled materials in product formulations poses multiple challenges, in terms of availability, consistency of quality, competitiveness versus virgin material whose prices fluctuate, regulatory frameworks for the transportation of end-of-life waste materials, and validations to ensure that product performance and reliability remain unaffected.

Recycled material usage

	2022	2021	2020	2019
Amount of recycled materials used in Vesuvius products (metric tonnes)	**66,137**	76,482	57,035	68,373
Amount of recovered materials that are not recycled used in Vesuvius products (metric tonnes)	**0**	0	0	0
Percentage of recycled materials in Vesuvius products from total materials	**6.0%**	6.2%	5.6%	5.9%
Percentage of revenue from products including recycled materials	**23.1%**	24.0%	23.3%	21.1%

All recovered materials undergo some processing before their usage in our products. Therefore, they are all included in the recycled materials category, and the recovered materials category is empty.

Name: Kyle Repine
Role: Senior Lab Technician
Location: Pittsburgh

Reducing consumption

Material waste

The Board has set a target of a 25% reduction of our solid waste (hazardous and sent to landfill) per metric tonne of product packed for shipment by 2025 (vs the 2019 baseline).

Manufacturing sites have started building action plans covering both hazardous and non-hazardous waste to eliminate, reduce and recycle waste. A wide range of actions have been initiated to reduce the amount of waste, such as closed conveyor and dust extraction systems, process improvements to reduce scrap and process waste generation, re-engineering of product recipes to include internally recycled material, and identification of recycling opportunities in other industries for by-products.

In 2022 the ratio of solid waste (hazardous and sent to landfill) per metric tonne of product packed for shipment reduced by 13.8% vs 2019, (2021: reduced by 22.7%). The 2022 performance was notably affected by the disposal of materials that had been damaged during the severe weather event and subsequent flooding that affected our plant in Malaysia in December 2021. A few sites also disposed of waste material that had been accumulated over a long period of time.

Water consumption

We aim to reduce both the amount of fresh water consumed in our manufacturing process and social water consumption. The main area of focus is the reduction of wastewater. Vesuvius works to reduce the consumption of water in its manufacturing operations by recycling and improving water management processes. No salt water or cooling water is abstracted, with no related outflow.

Various technological solutions have been implemented to reduce our water consumption and wastewater. Most noteworthy, investment in wastewater treatment installations have been made in 26 plants. Dry filter installations for particulates removal also allow far lower water consumption than wet scrubbers.

In 2022, our overall freshwater consumption per tonne of product packed for shipment decreased by 19.4% vs our baseline of 2019. As with energy use, normalised consumption of water varies with product mix. This decrease was driven by an evolution in our product mix towards products that require less water in their processing, and actions taken to reduce wastewater (-10.2%).

Five-year evolution of fresh water consumption

	% change 2022/2019	2022	2021	2020	2019	2018
Water in m³	-20.4%	678,973	745,732	747,439	853,381	896,785
Water in m³ used per metric tonne of product packed for shipment	-19.4%	0.756	0.757	0.905	0.939	0.866
Water in m³ used per £ million revenue	-33.8%	330	454	513	499	499

Wastewater

The Board has set a target for the Group to reduce the amount of wastewater per metric tonne of product packed for shipment by 25% by 2025 (vs the 2019 baseline).

Our sites with the highest level of water consumption are equipped with wastewater treatment plants. These represent 43% of all manufacturing sites and R&D centres of excellence. Additionally, many types of activity are routinely undertaken by our sites to control and reduce their water consumption, and we have action plans in place to reduce our wastewater generation globally. Some of the most significant examples include:

- Replacing wet scrubbing systems for particulate removal with dry filter systems
- Optimising container cleaning processes
- Installing high pressure stations to improve the efficiency and speed of tool cleaning
- Optimising production schedules to reduce the need for cleaning between recipes
- The provision of environmental awareness training to employees

Environmental exceedances

Vesuvius is committed to addressing environmental exceedances and complying with local regulations. All exceedances are reported in a central database. Any significant exceedance or environmental incident is reported to the Group Executive Committee.

In 2022, Vesuvius recorded 60 minor environmental incidents. Of these, two related to emissions to air, five to emissions to water and 53 to ground.

Total environmental releases across the Group in 2022 are estimated to have totalled 11 metric tonnes (including 3.2 metric tonnes of water-based materials) and 1.3 m³ of hydrocarbons, with the balance being solids and powders.

All releases to water and to the ground were fully contained.

Where incidents occur, they are managed via Vesuvius' site environmental response plans and reported through the Vesuvius incident reporting system. We comply with local reporting requirements in respect of such incidents. In Germany, a slightly increased legionella contamination was detected in showers and remedial action taken. An existing earlier action in relation to a disused US property for wastewater exceedances remains open. Two regulatory actions issued in 2021 against Vesuvius in Belgium also remain open; action plans to address them are being implemented. No action was taken by any authority in relation to an environmental incident in 2022 which resulted in financial penalties against Vesuvius. The Group does not operate any mines and consequently the Group generates zero tailings waste.

(Metric tonnes)	% change 2022/2019	2022	2021	2020	2019
Ratio of wastewater per tonne of product packed for shipment	-9.0%	0.263	0.268	0.290	0.289

Supporting our customers' journey to net zero

Vesuvius is committed to growing its contribution to a sustainable world, through products and services that improve safety, maximise environmental performance, reduce greenhouse gas emissions, and contribute to the circular economy.

Sustainable solutions

Our products have the potential to help customers reduce and avoid greenhouse gas emissions when compared with their current practices by amounts that far exceed the emissions required to manufacture and distribute them.

We actively cooperate with customers to help them evaluate the CO_2 emissions reduction our products bring to their complete value chain.

Our customers in the iron, steel and aluminium industries are embracing the challenge of dramatically reducing their CO_2 emissions. Many have pledged to reach net zero by 2050. They are investing significantly to transform their manufacturing technologies for the long term, working on a range of initiatives including the direct reduction of iron with carbon-free hydrogen and the replacement of carbon anodes in aluminium smelting. We contribute to their efforts through technology partnerships and developing new products for the next generation zero emissions aluminium, iron and steel making processes.

Product lifecycle assessments/ assessing our portfolio

We have created a comprehensive scorecard to evaluate our products over their full product life cycle (raw materials, manufacturing, transportation, use phase, and end of life). We rate our products in comparison with the standard offering in the market considering their performance in terms of health and safety, environmental impact, greenhouse gas emissions, and end-of-life processing. All criteria are assigned a weighting. In line with our objectives to reduce both our own CO_2 emissions and help our customers reduce their CO_2 emissions, we give these criteria a significantly higher weighting.

Performing this analysis supports our objective to develop and supply products that provide our customers with a superior overall sustainability performance against the market standard.

In 2022, we continued the roll-out of this internal scorecard across our product portfolio and assessed 97% of our consumable products. Of our 2022 sales 17.9% were generated from products with superior sustainability characteristics. Our objective is to continue growing their share of our product portfolio year after year.

Reduced heat losses

Minimise casting temperature

Extend production sequence length, reduce downtime

Increase metal yield in castings

Reduce downgrading, re-melting of scrap and repair of defects

Improve metal performance

Maximise casting speed and throughput

Reduce and avoid greenhouse gas emissions

Product sustainability benefits scorecard

Improves users' comfort, health and safety	Safety in manufacturing and transportation
	Safety during usage
	Exposure to health hazards
Limits our impact on natural resources	Product weight
	Product lifetime
	Recycled materials
Minimises energy consumption and emissions	Cradle to grave greenhouse gas emissions
	Reduced and avoided CO_2 emissions for the customer
	Volatile compounds emissions
Reduces waste, avoids landfill and increases recycling	Waste generation during manufacturing and usage
	Recyclability after usage

Supporting our customers' journey to net zero continued

Sustainable R&D

Vesuvius invests significantly in new product development, working closely with our customers to offer optimised solutions for their specific needs. We have a unique combination of expertise covering a wide range of fields including metallurgy, refractory ceramics, robotics and mechatronics, and IT. This is combined with close contact with customers through our network of account managers and service teams, and through regular technical and R&D meetings with our key customers to drive innovation.

When designing new products, the Marketing and Technology teams in our six R&D centres of excellence listen to our customers, closely observing their processes to understand their current and future challenges, needs and expectations.

We combine this learning with the information we have collected from our analysis of past issues, and seek to achieve both incremental improvements and breakthrough innovations in safety, robustness, reliability and performance, to steer the development of next-generation products and services.

We have formally integrated sustainability considerations into product R&D. Using the same health and safety, environmental impact, greenhouse gas emissions, and end-of-life processing criteria and scorecard as we use in the assessment of the existing product portfolio, we have begun a complete assessment of the pipeline of R&D and new product development projects, to check that their contribution is aligned with our sustainability ambitions, adjust priorities and allocation of resources, and fine-tune the selection of new projects entering the pipeline. All new product development projects are assessed using these criteria.

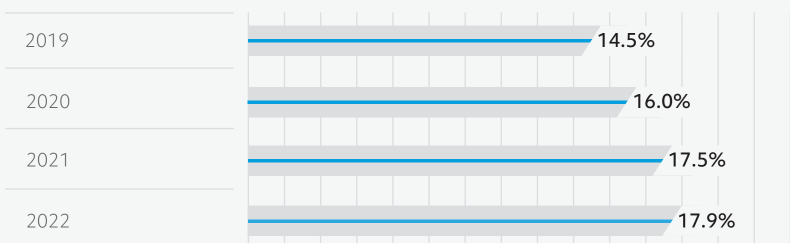
R&D covers a wide range of activities ranging from fundamental research and front-end innovation to the evaluation of alternative material sources and support to operations.

Using our internal product sustainability benefits scorecard we assess whether new products from our R&D have better sustainability characteristics than those already on the market - either from Vesuvius or from our competitors. Where we assess that they do, we consider these to be products with superior sustainability characteristics, which we term 'market-leading sustainable products'.

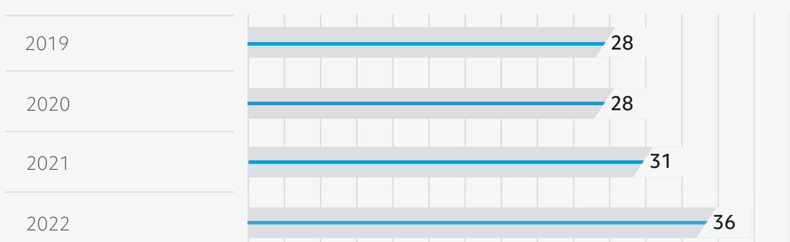
The challenge of decarbonising iron making and aluminium smelting requires the development and industrialisation of radically new technologies. We complement our internal efforts with partnerships with over a dozen research institutions, universities and strategic customers, working to develop the refractory solutions that will support these novel processes. In 2022, the Group spent £8.2m, representing 23% of the Group's central functions and processes R&D spend, on the development of market leading sustainable products (vs £9.7m, 31% in 2022).

Vesuvius' investment in innovation and sustainability

% of sales generated by market-leading sustainable products*



R&D spend (£m)**



* Using Vesuvius' internal scorecard.
** At constant currency.

75%
of new product development projects were dedicated to market-leading sustainable products

Product safety and quality

At the core of our business is the desire to help our customers improve their operational performance and efficiency. Customers rely on the quality of our products, and their structural integrity, to ensure the safety of their employees by controlling the flow of molten metal in their operations.

The reliability and performance of our products are critical to our customers in terms of safety on the shop floor, overall equipment effectiveness, labour productivity and metal yield, and their environmental impact (reducing energy consumption, CO_2 emissions and refractory material waste).

Many of our products allow our customers to achieve improved metallurgical properties in their products, for example, allowing the production of better wind turbine components or the light-weighting of vehicles.

Product safety and quality

New product development

Product safety is paramount to us. We have implemented a wide range of practices to optimise the safety and quality performance of our products in use, reduce failures and increase their lifetime.

We follow a strict stage gate process for the development of new products, ensuring that safety performance objectives are defined from the initial stages and progressively completed up to the product launch. Key deliverables include risk assessments, preparation of user and maintenance documentation, manufacturing control plans, and Vesuvius and customer operator training. We undertake extensive testing through rigorous alpha and beta trials, with systematic trial reports to confirm that targeted performance and robustness objectives are met and to allow for fine-tuning before product launch. Safety data sheets are available for all consumable products.

The development of human-centred robotic solutions for steel shops reduces the ergonomic strain on our customers' operators together with their exposure to high temperatures.

Safety and quality in use – product feedback

Our constant performance monitoring develops deep and lasting relationships with our customers.

After product launch, whenever a safety-related incident (an injury or a dangerous occurrence) occurs at one of our customers that may have involved a Vesuvius product or service, it is systematically reported and investigated. Likewise, all quality and performance issues raised by the Vesuvius field teams or by customers are systematically reported, documented and classified, based on their nature and severity.

Issues and incidents are dealt with through a rigorous problem-solving methodology and in-depth investigation using the 8D practical problem-solving methodology. This ensures we identify root causes, implement corrective actions, and prevent them recurring. The outcome of the investigation, including root causes and corrective actions, is shared with the customer and lessons learned are incorporated into the design of following generations of products.

Name: Janusz Raś
Role: Group Leader
Location: Skawina

Our people

We provide our employees with a safe workplace, where they are recognised, developed and properly rewarded.

Health, safety and well-being at work

Safety is our top priority and our overriding commitment to health and safety is embedded throughout the organisation.

Our approach is to identify, eliminate, reduce or control all workplace risks, and an ongoing system of training, assessment and improvement is in place to focus on achieving this. We remain fundamentally committed to protecting the health and safety of employees, contractors, visitors, customers and any other persons affected by our activities.

We want to become a zero-accident company and are striving to become a best-in-class organisation for safety performance and leadership.

Our beliefs

1 Good Health and Safety is Good Business
2 Safety is everybody's responsibility
3 Working safely is a condition of employment
4 All work-related injuries and work-related ill-health are preventable

Health and safety governance

The Board has overall responsibility for health and safety-related matters and delegates authority for the management of the health and safety performance of the business to the Chief Executive. The Health and Safety Policy is signed by all members of the Group Executive Committee and the Business Unit Presidents are responsible for its deployment.

The Board receives monthly information on every Lost Time Injury and key safety performance indicator. In addition, the Board carries out a biannual review of health and safety performance and overall Company safety strategy. Annual presentations of Business Unit strategy also include health and safety strategy. The results of our Group Safety Audits are presented to the Board twice per year.

Group safety audits

The Group operates a central safety auditing team of three auditors, each with more than ten years' experience, who report to the VP Sustainability, HSE & Quality. The team's main purpose is to verify the deployment and ongoing application of the Group's standards and policies in our locations, including our manufacturing sites, R&D facilities and the customer locations in which a significant number of our employees operate daily. Each audit also includes an assessment of the site's HSE leadership. During 2022, the team conducted 65 audits.

Following each audit, action plans are created by the site management teams to address any issues identified and work on completing these is assessed on a regular basis. The observations made during audits have been used to improve the Group's training programmes and to enhance the Group's health and safety standards. The results of the Group HSE audits, as well as the progress of action plans addressing the most critical issues, are reported to the Board twice a year.

Sites are also encouraged to carry out self-assessments, based on the Group safety audit compliance checklist, to monitor their progress.

Safety audits and improvement opportunities

In 2022, 80% (2021: 78%) of our working population performed routine safety audits every month. This generated an average of nine (2021: seven) implemented safety improvement opportunities per person from more than 10,200 (2021: 10,000) employees, resulting in an improvement in worker safety.

The audit programme involves employees at all levels – from the Group Executive Committee and safety specialists, through to local site management, employees and directly supervised contractors.

2022 safety performance

Our Lost Time Injury Frequency Rate (LTIFR) of 1.08 per million hours worked in 2022 was stable vs 2021 (1.06). Excluding third-party contractors and visitors, the LTIFR was 1.08. (Third-party contractors and visitors LTIFR 2022: 1.02.)

Fatalities and severe injuries

Sadly, in 2022, one of our colleagues suffered a fatal injury during a maintenance operation at the site of our joint venture partner in Wuhan, China. We are actively taking steps to learn from this tragedy and improve our systems and procedures to prevent any similar occurrence. Another of our colleagues was killed in a road traffic accident while commuting to work. Vesuvius is providing financial and social support to their families.

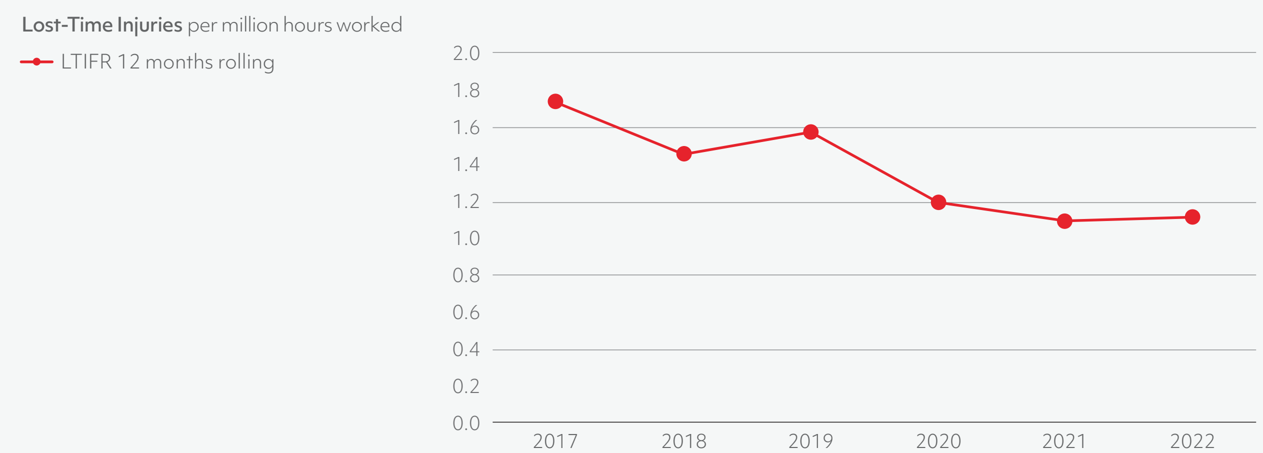
There were also several severe injuries in 2022. One of our colleagues in Brazil lost the tip of a finger in a moving conveyor belt. Another in China suffered some severe burns, from which he has fully recovered, from the explosion of raw materials during the charging of a mixer. The victims of two more injuries required short hospitalisations. Following full root cause analyses of each incident, robust preventative measures were implemented across Vesuvius with changes made to our HSE standards to reduce the risk of recurrences.

Lost time and medically treated injuries

Vesuvius operates a robust and comprehensive process for the timely reporting of incidents. In our internal standards, third-party contractors are included, and we use more stringent definitions for Lost Time Injuries (LTIs) and 'severe accidents' than the definitions used by many regulatory bodies. All sites are required to report on all Medically Treated Injuries (MTIs), to maintain the focus on safety. As an illustration of the precautionary preventative approach taken by Vesuvius in accident investigation, all LTIs and MTIs required a full 8D report.

Whilst 2020-2022 were unusual years because of the COVID-19 pandemic and associated changes in working, we believe that the long-term significant improvements in Lost Time Injury rates reflect a broader trend of underlying improvement for the Group and result from a strong management commitment to change.

Lost-Time injuries



2022 Safety performance

Performance indicators	Employees and directly supervised contractors 2022	Third-party contractors and visitors 2022	All employees, contractors and visitors 2022
Work Related Death	1	0	1
Severe Injuries	6	0	6
Lost Time Injuries (LTI)	29	1	30
LTI Frequency Rate (LTIFR) per million hours	1.08	1.02	1.08
Medically Treated Injuries (MTI)	178	6	184
MTI Frequency Rate (MTIFR) per million hours	6.6	6.1	6.6
Safety Audits (number)	120,307	0	120,307
Safety Audits per 20 employees per month	16	0	16

People and Culture

Our focus on People and Culture strategy aims to build an outstanding business by ensuring we have the individuals, skills and capabilities critical to the delivery of our strategy.

We seek to develop outstanding people. We ensure our people managers have what they need to lead their diverse, engaged and high-performing teams for business and personal growth. These goals are strongly underpinned by a values-driven, winning culture that embraces diversity of thinking and continuous innovation to achieve high levels of performance and growth.

We create this culture by building broad organisational understanding of our strategy, goals and accountability, supported by our CORE Values and positive management behaviours. We seek to foster a working environment that is inclusive and diverse, where people can be themselves without fear of harassment, bullying or discrimination. True to our decentralised business model, each of our Business Units has their own strategic HR agenda supporting delivery of their business strategies.

Our principles and approach

Vesuvius is a geographically and culturally diverse group, employing more than 11,000 people in 40 countries.

Our geographical diversity places us close to our customers around the globe. It also highlights the importance of maintaining and applying strong and consistent values and ethical principles in our worldwide approach to business. Our employees' engagement with our values and culture is vital to our success and the sustainable delivery of the Group's strategy.

Vesuvius has established a framework for explaining and embedding the culture and principles we consider to be fundamental to our success. To do this we communicate openly and transparently within the organisation, through 'town hall' meetings, senior management visits, management feedback, performance evaluation, measuring staff engagement and responding to the feedback we receive. Critically, there is ongoing and consistent communication of our CORE Values and the principles of our Code of Conduct. This is underpinned by engaging staff across the Group in both general and targeted training, to ensure a consistent understanding of our policies and procedures.

This transparency of communication also extends to our stakeholders. We want to increase the knowledge and understanding of our stakeholders, through internal and external reporting, and transparent and meaningful disclosure. Our Sustainability Report is a key part of this.

Our CORE Values

The Group's CORE Values – Courage, Ownership, Respect and Energy – are actively supporting the Group's priorities, encouraging consistent behaviours across the Group to sustain our business success in the future.

These Values, and the behaviours underpinning them, convey the mindset and attitudes we expect each employee to show every day. They are at the heart of the culture of the Group, promoting our image to external stakeholders, and underpinning the commercial promise we provide to our customers.

The Values are reinforced through our performance management systems and are celebrated each year through our Living the Values Awards which select regional and global winners for each Value.

At each of our sites we display CORE Values posters in local languages and use tools such as screen savers as a constant reminder of the behaviours our people display.

Vesuvius' Values

Courage

- I systematically say, decide and do what is right for Vesuvius including when it is difficult, unpopular, or not consensual
- I express my opinions openly during discussions, but I also defend Group decisions once they've been taken, even if they do not correspond to my initial position
- I proactively take leadership responsibility on difficult projects and topics that are important to the Group's performance, motivated by the perspective of success rather than paralysed by the risk of personal failure

Ownership

- I am personally accountable for the consequences of my actions and for the performance of the Group in my area of responsibility or oversight, without blaming external circumstances or the actions of others
- I demonstrate an entrepreneurial spirit, looking for and seizing business opportunities and I immediately address problems that come up as soon as I become aware of them
- I manage the Group's money and resources as though they were my own

Respect

- I demonstrate respect for other people's ideas and opinions even if I disagree with them
- I welcome open debate. I listen to others, foster esteem and fairness with customers, suppliers, co-workers, shareholders and the communities where we operate
- I communicate my objectives clearly and take time to explain all decisions. I behave with the highest level of integrity. I promote diversity at all levels of the Company

Energy

- I work hard and professionally in pursuit of excellence
- I constantly raise the bar and challenge the status quo. For me, the sky is the limit
- I lead by example, inspiring and motivating my team to go the extra mile. I promote a positive and energising work environment.
- I continuously deliver outstanding customer experience and innovative solutions
- I never underestimate competitors and permanently strive to reinforce the Group's leadership position

Code of Conduct

Our Code of Conduct sets out the standards of conduct expected, without exception, of everyone who works for Vesuvius in any of our worldwide operations.

The Code of Conduct emphasises our commitment to ethics and compliance with the law, and covers every aspect of our approach to business, from the way that we engage with customers, employees, the markets and other stakeholders, to the safety of our employees and workplaces.

Everyone within Vesuvius is individually accountable for upholding its requirements. We recognise that lasting business success is measured not only in our financial performance, but in the way we deal with our customers, business associates, employees, investors and local communities.

The Code of Conduct is displayed prominently at all our sites and is published in our 29 major functional languages. It is available to view at: www.vesuvius.com.

We continue to enhance the policies that underpin the principles set out in the Code of Conduct. These assist employees to comply with our ethical standards and the legal requirements of the jurisdictions in which we conduct our business. They also give practical guidance on how this can be achieved.

The Code of Conduct covers eight key areas:

Eight key areas

1. Health, safety and the environment
2. Trading, customers products and services
3. Anti-bribery and corruption
4. Employees and human rights
5. Disclosure and investors
6. Government, society and local communities
7. Conflict of interests
8. Competitors

Diversity - 31 December 2022

	Female	Male	Total	Female	Male
Board	3	5	8	37.5%	62.5%
Group Executive Committee members	2	5	7	29%	71%
Leadership roles reporting to members of the GEC	12	40	52	23%	77%
Directors of Subsidiaries included in consolidation[1]	20	85	105	19%	81%
Senior Managers[2]	**34**	**130**	**164**	**21%**	**79%**
All other employees	1,642	9,328	10,970	15%	85%
Grand total	**1,676**	**9,458**	**11,134**	**15%**	**85%**

1. Of the 105 employees who are directors of Group subsidiaries but not members of the GEC or direct reports of the GEC, 19% are women. This disclosure is made to comply with regulatory requirements. It includes directors of dormant companies. Some individuals hold multiple directorships.
2. Senior Managers as defined for the purposes of Section 414C(8)(c) includes directors of the Company's subsidiaries.

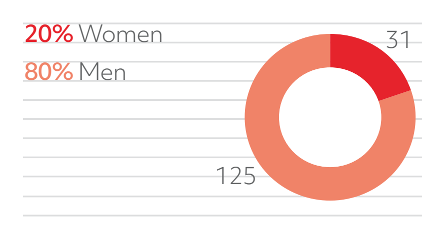
Diversity and inclusion

As an organisation, Vesuvius has a global, multicultural operational and customer base, which we wish to reflect inside our organisation with a multicultural, diverse community of excellent professionals from all backgrounds. This starts by focusing on broad diversity of gender and nationality, with an aim to ensure that all employees and job applicants are given equal opportunity and that our organisation is representative of all sections of society where we operate. Vesuvius operates in 40 countries around the world, employing people with 71 nationalities, making us a truly diverse business. We regard this diversity as a critical aspect of our success and future growth, as it allows us to access the widest range of skills and experience. Each employee is respected and valued and as a result they are all able to give their best. All employees are given help, training and encouragement to develop their full potential and utilise their unique talents.

Overall responsibility for implementing the Group's Diversity and Equality Policy rests with the Executive Directors. The Nomination Committee monitors progress with meeting its objectives. At the end of 2022, the Senior Leadership Group (comprising c.160 senior managers) consisted of 22 nationalities located in 22 countries. 15% of our overall workforce were women, which remained stable versus 2021.

Over the past three years we have made visible progress in gender diversity. Females now represent 20% of our Senior Leadership Group, a level that we consider is still too low, but which represents a significant improvement as compared with the level of 15% in 2019. Our ambition remains to reach 25% women in this tier by the end of 2025. Copies of the Board Diversity Policy and Group Policy on Diversity and Equality are available to view on the Vesuvius website: www.vesuvius.com. Further information on the Group's approach to promoting diversity can be found on p112 and 113.

Senior Leadership Group %



People and Culture continued

2022 Distribution of Vesuvius employees – full-time versus part-time

	Full-time employees	Full-time employees (%)	Part-time employees	Part-time employees (%)
Permanent salaried	4,391	99%	48	1%
Permanent hourly	5,939	100%	12	0%
Total Permanent	**10,330**	**99%**	**60**	**1%**
Temporary salaried	86	97%	3	3%
Temporary hourly	649	99%	6	1%
Total Temporary	**735**	**99%**	**9**	**1%**

Employee engagement

Companies with highly engaged staff deliver better business outcomes. They have lower absenteeism, lower staff turnover, fewer safety incidents, better product quality, and higher productivity, sales and profitability.

At Vesuvius, we regard engagement as critical to our ongoing success and we work hard to listen to our people and act when issues impacting engagement are identified.

Engagement is a collective responsibility, particularly among our management community. We conduct an annual employee engagement survey to measure our employees' attitudes to Vesuvius and their work. The survey generates reports of team responses to the survey. Managers then share the results openly with their teams and, working together, develop action plans to address issues.

The survey has been conducted since 2019 in partnership with Mercer. The results are clustered in eight strategic categories and benchmarked externally against global and manufacturing industry results.

Employee engagement action plans

We focus action plans not on the pure statistics, but on seeking to bring about meaningful change in line with our CORE Values of Courage, Ownership, Respect and Energy. For example, much of the action taken to date has resulted in improved Employee Experience and Safety.

In 2022, thanks to a tremendous effort by local management, supported by an effective communication campaign, we again achieved a very high participation level in our engagement survey with 92% of all employees completing it, the same level of participation as we achieved in 2021.

Following improvements across six of the eight categories of questions in 2021, the overall engagement score increased by 2% in 2022, again showing an upward trend in six out of the eight question categories. For the fourth consecutive year, safety remained our top strength with employees confident in the Company's approach to safety. Other highlights included increases in Employee Experience, Senior Leaders Effectiveness and Survey Follow-Up.

While there was an increase in the belief that action plans from the 2021 survey had a positive impact, it remains an area for improvement.

Internal communications

We continue to develop our internal communications programme, to ensure we have a strong mix of channels to reach our diverse population. The Chief Executive regularly addresses the whole Group via Company-wide email and video, delivering strategic messages, and in 2022 he held 13 interactive virtual sessions with the Senior Leadership Group to share business updates. Company news and announcements are regularly shared on the Group intranet and staff news app, whilst screen savers are used to support major communication campaigns. We also utilise posters and site 'town hall' meetings for on-site communications. Whenever possible, face-to-face communication is conducted at different levels of the organisation providing the necessary opportunities for interactive Q&A sessions with business leaders.

Employee consultation and industrial relations

Vesuvius supports freedom of association and the right to collective bargaining. In all of the countries in which we operate, the Group informs and consults local works councils and trade unions on matters concerning the Vesuvius business as required. These processes and procedures are regulated by local law and generate constructive dialogue between employee representatives and management, which provides benefit to our business. In 2022, 73% of permanent employees were represented by Collective Agreements that include working conditions such as local works councils, trade unions or other bodies.

In addition to local employee representation, the Group has, in the past, operated a European Works Council (EWC) containing representatives from each of the EU countries in which Vesuvius has employees. The existing EWC Agreement terminated in 2020, following notice given by management and the departure of the UK from the European Union. The Group continues to be engaged in the process of negotiating the agreement for the formation of a new EWC with a Special Negotiating Body.

Career management

Talent management

The Group Executive Committee holds direct responsibility for the roles and development of our senior leaders, jointly reviewing capability needs and deciding on succession and cross-organisational moves for the leadership group. This illustrates the strong commitment at the highest level of our organisation to growing the Group using its Company-wide resources.

We employ individuals with an entrepreneurial mindset and an international outlook. Whether they are recent graduates or seasoned professionals, everybody who wants to leave their mark in a dynamic rapidly developing business environment has a chance to succeed. Special attention is paid to building strong, diverse teams that bring different backgrounds and experiences to our daily work.

Leadership pipeline

Strengthening the leadership pipeline and facilitating people development throughout the organisation remain key areas of focus for Vesuvius. We continue to work hard to ensure that we have the right capability in every part of the organisation to drive our strategy and realise market opportunities. As a result, we have built high-calibre leadership teams, many of whom are relatively new to their roles and to Vesuvius. We empower our people to drive the business with an entrepreneurial spirit, and to develop a performance-oriented culture.

We aim to adopt an ideal balance between external hires and internal promotion, fuelled by a strong process of backup and succession planning, especially for management positions. In 2022, only 28% of middle and top management vacancies were filled by internal candidates, reflecting a period of transformation and capability building from external hires. In 2022, the percentage of key leadership roles reporting directly to members of the Group Executive Committee with more than three years of service was 42%.

Training and development

Our leaders take responsibility for managing and developing their teams. They are provided with access to a central resource, offering expertise in Global Rewards and Mobility, Talent and Performance Management, Culture and Learning, and supported by Group-wide processes and information systems.

We encourage and reward high performance, foster talent and aim to create an environment where all can realise their individual potential. To meet the demands of the business and add rigour to our employee value proposition, we have launched training programmes to assist our employees to develop their skills and progress their careers.

Our Learning Management System (LMS) provides a global hub for Vesuvius online training courses. Mandatory training courses are automatically assigned to new joiners and completion statistics are easily reportable. Targeted training courses can also be allocated to employees in specific roles, e.g. Modern Slavery training for specific people in purchasing.

Mentoring programme

In 2022, Vesuvius continued its mentoring programme focused on leadership and talent development. There are currently 49 mentees taking part in the 12-month programme, of which 11 are women.

Mentees learn from the experience and perspectives of a more senior person in Vesuvius, creating an individual personal development plan to enhance their careers and leadership capabilities. The programme ensures internal knowledge transfer and builds a broader, deeper and more ready talent pool.

Technical training

HeaTt training is aimed at the continuous technical development of Vesuvius employees. Courses range from entry to expert levels and are continuously updated to keep pace with developing technology and delivery methods, thereby guaranteeing that Vesuvius experts are at the forefront of technical innovation. They are a great way for our hugely experienced technical experts to pass on their knowledge to the next generation and ensure the sustainability of our know-how. The first introductory module is mandatory for all new employees and is available on the LMS, allowing participants to access learning at anytime, anywhere.

Expert levels of HeaTt training are still held face-to-face, as the course content is not suitable for web-based training. In 2022, 650 employees completed the first module online, four employees completed the second module online and 87 employees completed face-to-face HeaTt training sessions.

Compliance training

During the year, we continued to develop our training programme. This is based on the principles contained in the Vesuvius Code of Conduct and associated anti-bribery, corruption and other compliance policies and procedures. Training gives our employees a clearer understanding of the scope of risks that exist as we conduct our business and gives context to how the Group expects each employee to respond to those risks.

The Board has set a target of at least 90% of targeted staff completing the Anti-Bribery and Corruption training annually. 4,917 employees, representing 99% of the targeted staff and 44% of the total full- and part-time employees, completed the 2022 Anti-Bribery and Corruption training.

Mandatory online training courses - 2022 Participation	Number of employees trained	% of targeted audience completing course	Total training hours
Anti-Bribery and Corruption	4,917	99%	2,163
Gifts, Hospitality and Entertainment	4,174	99%	2,074
Modern Slavery	127	100%	35
Anti-Tax Evasion	138	100%	40
Data Protection	1,297	100%	586
Cyber Security Awareness – 5 Basic Modules[1]	1,155	73%	1,348
Cyber Security – USB Safety Training	415	92%	62
Cyber Security – Anti-phishing	464	88%	220

1. The Cyber Security Awareness training consists of five modules. 73% of employees allocated the training in 2022 have already completed all five modules.

People and Culture continued

Global reward

Reward and recognition are integral components of our employee value proposition, enabling us to attract, engage and retain key talent and highly qualified employees. Our systems and processes are designed to create a market-competitive and rewarding environment for all our employees and to reinforce the vision, strategy and expectations set by the Board.

We seek to create a culture that champions performance, building a strong link between individual performance and pay. Our global job grading framework, based on a structured, market-leading evaluation methodology, enables us to compare roles and ensure internal consistency throughout the organisation.

We are committed to creating reward and performance management systems which are transparent and objective, where employees receive equal pay for work of equal value, regardless of their age, race, disability, sexual orientation, gender, marital, civil partnership or parental status, religion or beliefs. Our management Annual Incentive Plans are measured against both Vesuvius' financial targets and personal performance, an incentive structure consistent with that of our Executive Directors. The Vesuvius Share Plan for Executive Directors and Group Executive Committee members encourages robust decision-making based on long-term goals rather than short-term gains and works to align the interests of participants with those of shareholders.

In 2022, 98% of our salaried permanent employees undertook an annual performance review with their line management. This compared with 93% in 2021, 95% in 2020 and 92% in 2019.

Global mobility

Vesuvius operates worldwide. We believe that our companies should be managed and staffed by local personnel. However, we also provide selected groups of employees with a range of international assignments. These assignments are usually for a limited period, most often three years.

International assignees do not come from one or two countries alone. We have a truly international mix of nationalities in our mobile population. Individuals move not only within a region, but also between regions. Our mobility programme shows that our assignee population is as diverse as our Group.

Vesuvius operates international assignment policies which support the varying nature and circumstances of these assignments – whether they be short-term, longer-term or require extended commuting. In addition, we do actively support, where appropriate, localisation of employees upon international assignment and provide comprehensive support to aid integration, settlement and localisation in the new environment. These policies are supplemented with clearly identified benefits, delivering support appropriate to the nature of the assignment. We manage international assignments with flexibility, catering for changing expectations and demands from employees, whilst at the same time meeting the needs of the business.

Key rationale behind international assignments

Vesuvius considers individuals for international assignment for three primary reasons:

- Providing Vesuvius companies with skills that are not locally available and that are required at short notice. This typically occurs in countries where we are establishing or developing our presence. The number of assignees working on this basis diminishes over time as the organisation matures and we recruit and train local talent to take over
- Career development. We believe that the personal development plan of any employee being developed for a senior management or senior expert position should include a posting outside their home country. This encourages them to develop the skills necessary to function successfully in an international environment. These postings are tailored to the needs of the organisation and the needs of the individual
- Enhancing diversity. Management teams benefit from having a mix of gender and cultures. In specific cases, we use international assignments to support this goal

Our communities

We seek to establish strong relationships with key stakeholders and support the communities in which we operate

A responsible company

Vesuvius is committed to making a positive contribution to society. As part of this, we focus on operating an ethical business with appropriate policies in place to ensure compliance with the regulations and laws in all our markets.

Governance and policies

Vesuvius' operating policies underpin the principles set out in our Code of Conduct. They are the practical representation of our status as a good corporate citizen, and they assist employees to understand and comply with our ethical standards and the legal requirements of the jurisdictions in which we conduct our business. They also give practical guidance on how this can be achieved.

Human rights

The Group Human Rights and Labour Policy reflects the principles contained within the UN Universal Declaration of Human Rights, the International Labour Organisation's Fundamental Conventions on Labour Standards and the UN Global Compact, to which the Group is a signatory. The Policy applies to all Group employees. It sets out the principles for our actions and behaviour in conducting our business and provides guidance to those working for us on how we approach human rights issues. The Group commits not to discriminate in any of our employment practices and to offer equal opportunities to all. The Group respects the principles of freedom of association and the effective recognition of the right to collective bargaining, and opposes the use of, and will not use, forced, compulsory or child labour. These principles have been integrated into the work of our procurement teams as we assess our suppliers and their business practices. The policy was reviewed and updated in 2023.

Prevention of slavery and human awareness training on child labour, slavery and/or human trafficking

During 2022, we published our seventh transparency statement outlining the Group's approach to the prevention of slavery and human trafficking in our business and supply chain. A copy of our latest statement is available to view on our website: www.vesuvius.com.

Since the publication of our first statement we have conducted a risk assessment of our purchasing activities, seeking to identify, by location and industry, where the potential risks of modern slavery are highest. Our assessment identified the following four industries that pose a higher risk of modern slavery for Vesuvius:

1. Mining and extractive industries (raw materials)
2. Textiles (personal protective equipment (PPE) and work clothing)
3. Transport and packaging
4. Maintenance, cleaning, agricultural work, and food preparation (contracted workers)

Following our modern slavery risk assessment, we provided webinar training to our key purchasing staff and we continue to use an online e-learning module to upgrade the training given to all supplier-facing staff. This provides key guidance on the red flags associated with modern slavery to assist them in identifying these during supplier visits and accreditation. Since the launch of the Modern Slavery red flag training we have trained 100% of the targeted staff.

See the Group's Statement on the Prevention of Slavery and Human Trafficking

www.vesuvius.com/en/sustainability/our-policies/statement-on-modern-slavery.html

Our principles – a responsible company continued

Business ethics/anti-bribery and corruption and working with third parties

Vesuvius' Code of Conduct affirms our commitment to competing vigorously, but honestly, and not seeking competitive advantage through unlawful means. We conduct ourselves ethically in all public affairs activities, in alignment with local laws and regulations. We do not engage in unfair competition, exchange commercially sensitive information with competitors, or acquire information regarding a competitor by inappropriate means. When received for business purposes, we safeguard third-party confidential information and use it only for the purpose for which it was provided.

We engage with various third-party representatives and intermediaries in our business. We recognise that they can present an increased bribery and corruption risk. Our procedure on working with third parties clearly outlines our zero-tolerance approach to bribery and provides practical guidance for our employees in identifying concerns and how to report them.

Vesuvius engages with third-party sales agents, many of whom operate in countries where we do not have a physical presence. Our employees' use of, and interaction with, sales agents is supported by an ongoing training programme for those who have specific responsibility for these relationships.

As part of our communication around anti-bribery and ethics, employees are actively encouraged to consult on ethical issues. They have open access to the Compliance Director and Legal function who provide support on a regular basis.

During 2022, the Group continued the due diligence review of our third-party representatives and intermediaries. Following the prior years' enhanced review of sales agents, custom clearance agents, distributors and logistics providers, we conducted repeat due diligence. We also conducted due diligence on any new third parties introduced into the organisation.

Our due diligence processes will continue to be extended using a risk-based approach during 2023 and beyond.

Name: Gabriel Rodrigues Soares
Role: Quality Inspector
Location: Rio de Janeiro

Community engagement

Vesuvius wants to make a positive contribution to the communities in which we work by supporting a wide variety of fundraising and community-based programmes around the world.

We prefer participation in events, donations in kind to registered not-for-profit organisations, and participation in community programmes, to cash donations. Our Anti-Bribery and Corruption policy defines rules for the proper handling of donations and sponsorship.

Below are some examples of the many community programmes and activities our colleagues were involved in throughout 2022.

United Kingdom

Colleagues from our Foundry Tamworth site took part in a triathlon to raise funds for the Child Growth Foundation, a charity which supports children, adults and families affected by growth conditions.

Belgium

Every year, Vesuvius Ghlin sponsors an award for the best postgraduate work in mechatronics at the Polytechnic Faculty of Mons. The 2022 award was given to a student for his work on the 'Instrumentation of a manipulator robot for control by the vision system'.

Poland

In 2022, colleagues in Poland continued their support for Ukrainian refugees with a number of initiatives, including purchasing a range of educational materials and toys for Ukrainian children attending a primary school in Skawina.

Germany

In April 2022, Vesuvius Borken presented a cheque for €36,000 to Aktion Lichtblicke e.V. (Action Rays of Hope Association) to support their work with people affected by the war in Ukraine. When the conflict in Ukraine started and the first donations were received from the workforce, the works council developed the 'Plus 5-Initiative' where improvement suggestions made by colleagues generated a company donation of €5 per suggestion. This raised €18,000, which management then doubled.

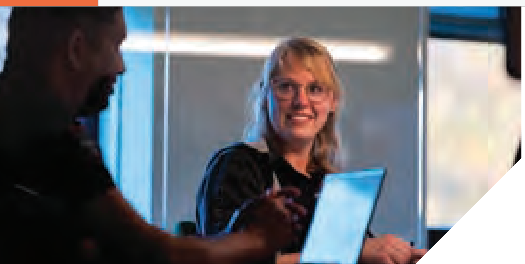
India

Vesuvius India is keen to encourage girls and women to participate in STEM (Science, Technology, Engineering and Mathematics) careers. It organised for a group of local residents to visit its Kolkata site to help them envisage a technical career. This was part of an ongoing #EducatetheGirlChild project.

China

As part of a partnership with the volunteer association in Suzhou Industrial Park, Vesuvius China organised a community project named 'Caring for the Heart'. The project promotes CPR training and family first aid activities. It popularises the concept of 'caring for your heart' and 'caring for your family' and improves people's awareness of heart disease and their ability to deal with emergencies.

Responsible sourcing



Vesuvius recognises the crucial role that its suppliers play in creating value in the products and services that Vesuvius ultimately provides to its customers. In addition to the consistent and timely supply of materials, products, and services which are of the highest quality, we expect our suppliers to operate in a manner that is appropriate, in terms of their ethical, legal, environmental and social responsibilities.

Principles

Overall, our objective is to encourage suppliers to implement a meaningful sustainability programme, embrace the UN Global Compact principles, evaluate and reduce our upstream CO_2 emissions and identify potential risks (and if necessary, address them) in our supply chain. The satisfaction of our customers' requirements, the safety and reliability of Vesuvius' products, and the efficiency of Vesuvius' internal processes are dependent on the reliability of its network of suppliers. Vesuvius is committed to ensuring that we utilise high-quality raw materials, secured through reliable and well-developed raw material suppliers. The principles of sustainable procurement are prescribed within the Vesuvius Sustainable Procurement Policy and supported by supplementary processes.

Sustainable Procurement Policy

We operate a Sustainability Procurement Policy which outlines key criteria for suppliers. The policy uses the Group Procurement's 'Request for Quotation' (RFQ) process to engage a significant number of Vesuvius suppliers and is provided in conjunction with the Vesuvius Terms and Conditions of Purchase.

For suppliers to participate in the RFQ, they are obliged to accept and agree to the terms of the Sustainability Procurement Policy, as it forms an addendum to Vesuvius' standard contract clauses. This policy is available on the Vesuvius website.

The policy applies to all suppliers of goods and/or services either used in our manufacturing processes and/or sold directly by us to customers, including Tolling and Resale suppliers. It applies to suppliers, their agents and their sub-contractors. Once accepted, it is the responsibility of the supplier to verify and monitor compliance against this policy – both for their operations and those of any sub-contractors. Compliance with the requirements in the policy is a key consideration in the selection of suppliers.

The major elements of the Sustainability Procurement Policy are:

- Employees and human rights
- Ethical and compliant business practices
- Environment
- Quality
- Business continuity
- Documentation and Verification encompassing Supplier due diligence and Supplier assessments

Since its launch in 2021, 181 suppliers (51% of the targeted group participating in the RFQ process) representing a spend of £213m, have already formally agreed to comply with the policy.

Supplier sustainability assessment criteria

Environment	Labour and Human Rights	Ethics	Sustainable Procurement
Energy Consumption & GHGs	Employee Health & Safety	Corruption	Supplier Environmental Practices
Water	Working Conditions	Anti-competitive Practices	Supplier Social Practices
Biodiversity	Social Dialogue	Responsible Information Management	
Local & Accidental Pollution	Career Management & Training		
Materials, Chemicals & Waste	Child Labour, Forced Labour & Human Trafficking		
Product Use	Diversity, Discrimination & Harassment		
Product End-of-Life	External Stakeholder Human Rights		
Customer Health & Safety			
Environmental Services & Advocacy			

21 criteria based on international standards

Supplier sustainability assessments

As part of our sustainability agenda, Vesuvius has implemented a Supplier Sustainability Assessment programme, setting targets for the proportion of the total raw material spend value covered by the assessment. The topic boundary extends to all suppliers of goods either used in our manufacturing processes and/or sold directly by us to customers, including Resale suppliers.

Vesuvius has partnered with an independent third-party service provider – EcoVadis – to rate our raw materials suppliers using a detailed set of criteria. These cover four themes and 21 criteria based on international standards: Labour and Human Rights; Ethics; Environment; and Sustainable Procurement.

Group procurement and regional procurement teams are heavily involved in the programme. In 2022, 23 (2021: 94) (Total to date: 118) employees from these teams have received specific training on supplier sustainability assessments (100% of the target group).

In 2019, the Board approved a target to assess at least 50% of our raw material spend by the end of 2023. Various criteria were chosen to select participating suppliers such as supplier size and risk metrics, including:

- Category of raw material
- Availability of alternative sources
- Share of supplier revenue with Vesuvius
- Grades in previous assessments
- New suppliers
- Supply chain incidents

Since its launch, 230 suppliers have joined the programme, representing a spend value of £280m, being approx. 14% of the Group's raw material suppliers, representing 48% of the Group's raw material spend, and 33% of the Group's spend on goods used in our manufacturing processes and/or sold directly by us to customers.

Of the rated suppliers, 13% did not meet the minimum score defined by Vesuvius and were asked to implement improvement actions within a three-year timeline. Routine reviews and an annual reassessment will enable progress to be measured.

Supplier CSR and Quality audits

Vesuvius conducts an annual Supplier Audit programme targeting their Corporate Social Responsibility (CSR) practices, product quality and security of supply. The programme is led by the Group's Purchasing and Quality teams, located across all regions. The goal of the audits is to verify that our suppliers abide by fundamental principles regarding the environment and social practices, and reduce the number of quality issues that may affect our raw materials, and consequently our operations and those of our customers.

As part of this, we carry out on-site inspections, share expectations with our suppliers, identify risks, and adapt our internal controls accordingly. We encourage our suppliers to improve their own processes and help them prioritise actions to achieve this. Commencing in 2022, a number of 'red flag' items have been included in our on-site verification questionnaire, especially addressing human rights issues, such as child or forced labour, for which immediate escalation and investigation is required in case any breach is detected.

In 2022, 139 (2021: 138) audits were conducted (100% on-site) at 136 (plus 3 follow up) supplier facilities (2021: 138, 13 follow up), representing 79.4% of targeted suppliers. No cases of human rights breaches were detected as part of the supplier audit programme. One supplier received grades below threshold. Where suppliers fail to meet the required standards, action is taken either to support them to improve or our relationship with them is terminated.

Areas of focus include:

Quality management rules:
Final inspection, controls at important process steps, management of incoming materials, data tracking, customer feedback and communication.

Management of non-conformities:
Reaction to non-conformities, protection of customer, problem resolution and application of lessons learned.

Sustainability criteria:
This aligns the supplier audits as a second platform to drive and visibly verify supplier sustainability efforts and programmes, complementing the assessments carried out by our third-party partner.

The Strategic Report set out on pages 1-85 contains a fair review of our businesses, strategy and business model, and the associated principal risks and uncertainties. We also deliver a review of our 2022 performance and set out an overview of our markets and our stakeholders. Details of our principles, and our people and community engagement, together with our focus on safety, are also contained in the Strategic Report.

Approved by the Board on 2 March 2023 and signed on its behalf by

Patrick André
Chief Executive