





A Better Tomorrow

Vesuvius plc
Sustainability Report 2022

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Forward-looking statements

This Sustainability Report contains certain forward-looking statements with respect to the operations, strategy, performance, financial condition and growth opportunities of the Vesuvius Group. By their nature, these statements involve uncertainty and are based on assumptions and involve risks, uncertainties and other factors that could cause actual results and developments to differ materially from those anticipated.

The forward-looking statements reflect knowledge and information available at the date of preparation of this Sustainability Report and, other than in accordance with its legal and regulatory obligations, the Company undertakes no obligation to update these forward-looking statements. Nothing in this Sustainability Report should be construed as a profit forecast.

Find out more in our Annual Report

Including more detailed information on what we do, our plans for the future, financial performance and how we run our business.

[Download the full report](#) 

What we do, plans and performance

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Visit our website at www.vesuvius.com

Visit our online annual report at report2022.vesuvius.com

Our purpose

Think beyond. Shape the future.

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.

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.



Introduction: Progress on our sustainability roadmap

Alexander Laugier-Werth
VP Sustainability, HSE & Quality



Welcome to our third Sustainability Report. I thank you very much for your interest in Vesuvius' journey.

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.

Note: The content of this Sustainability Report is primarily based on our materiality analysis, feedback from our internal and external stakeholders, and the requirements of the UN Global Compact. It covers 100% of our operations (owned and joint ventures), with the following exceptions:

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. As we progress with the integration of these sites, they will be included in the scope of our sustainability reporting.

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 CO₂e emissions to reach net zero by 2050 at the latest
- Helping our customers reduce their own CO₂ 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.

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 has been externally verified by Carbon Footprint Ltd. The report has not been externally assured in its entirety. Senior management are involved in the ongoing review of the collection, management, verification and assurance of reporting information.

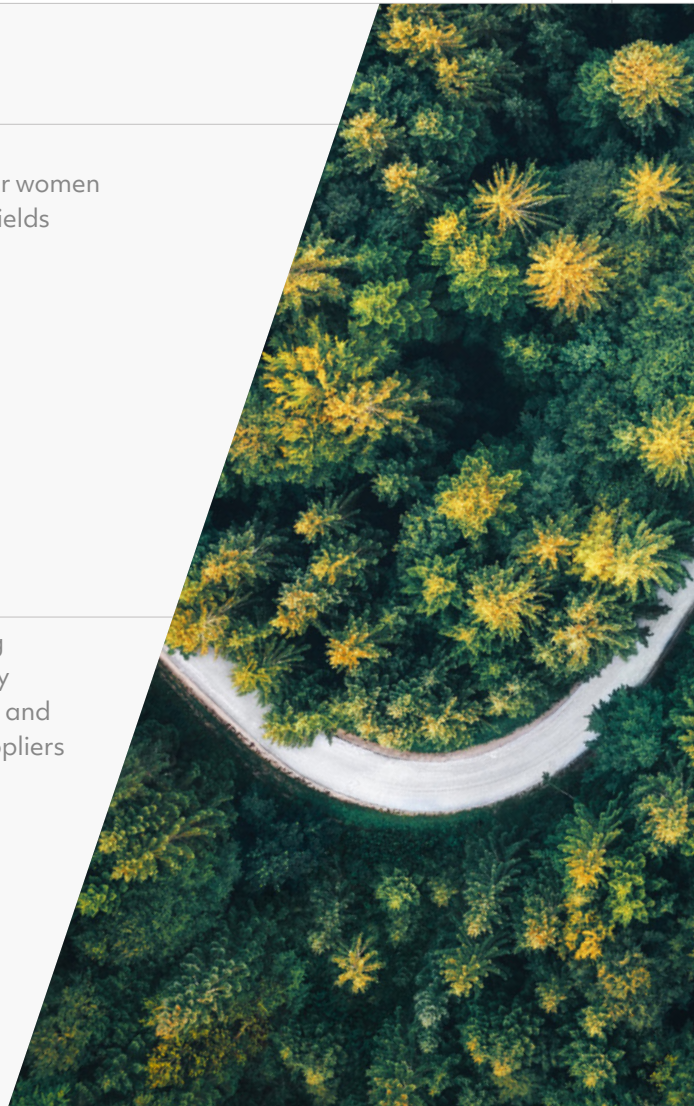
We are very proud of our progress to date, as exemplified by the external recognition of the rating agencies. Since 2020, our MSCI ESG rating has progressed from BBB to AA, and our EcoVadis rating from Silver to Gold. In 2022, we submitted our first CDP questionnaire, which received a B grade.

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

Areas of focus

<p>1</p> <p>Reducing Scope 1 and 2 emissions, evaluating Scope 3 emissions with our suppliers</p>	<p>2</p> <p>Determining CO₂ emissions avoided by customers, and creating further action plans to maximise this</p>	<p>3</p> <p>Switching to carbon-free electricity at our sites wherever possible</p>	<p>4</p> <p>Assessing new product developments and technologies based on their safety and environmental benefits</p>	<p>5</p> <p>Supporting education for women in scientific fields</p>
<p>6</p> <p>Increasing gender diversity in the Senior Leadership Group and at every level of the Company</p>	<p>7</p> <p>Increasing employee engagement</p>	<p>8</p> <p>Undertaking environmental impact analysis of capital expenditure; with the internal price of CO₂ emissions reviewed every year</p>	<p>9</p> <p>Seeking ISO 14001 certification of manufacturing sites not already certified</p>	<p>10</p> <p>Undertaking sustainability assessments and audits of suppliers</p>



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 we do for our Steel customers

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



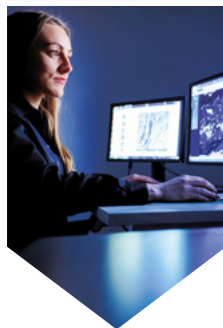
We combine these with robotics and mechatronic installations to lower cost, and improve safety and consistency



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 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 Foundry customers

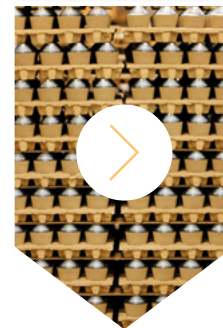
We provide customisable products and process technology to foundries that improve the quality of their castings



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

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**

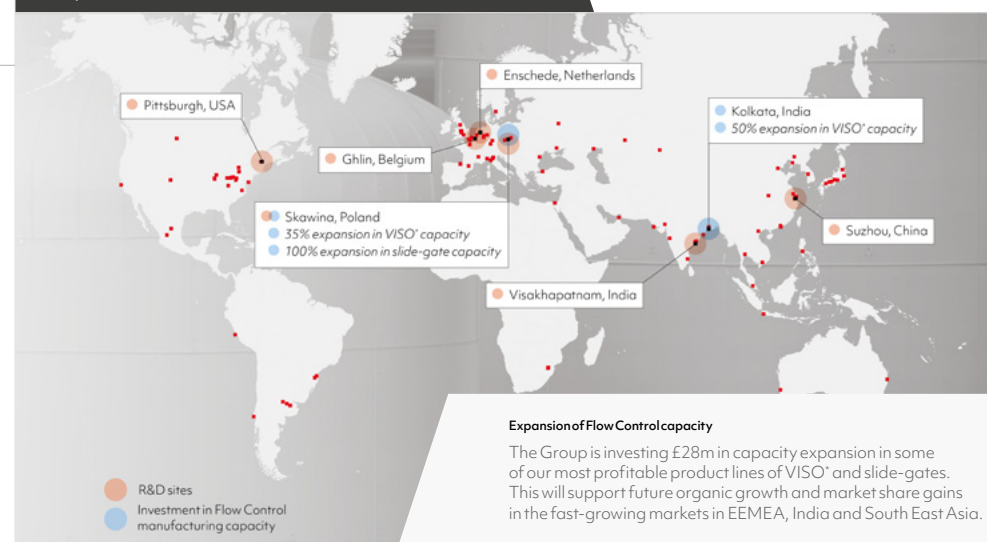
Our customers are steel producers and other high-temperature industries. Vesuvius is a world leader in the supply of refractory products, systems and solutions. These help our customers increase their efficiency and productivity, enhance quality, improve safety and reduce their costs and their environmental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

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



Breakdown by region

Americas

3,343 employees

20% Foundry
80% Steel

£741m
Revenue

EEMEA

4,242 employees

30% Foundry
70% Steel

£742m
Revenue

Asia-Pacific

3,549 employees

32% Foundry
68% Steel

£565m
Revenue

Our global presence

6

Continents

40

Countries

68

Sales offices

6

R&D centres
of excellence

55

Production sites

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

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.

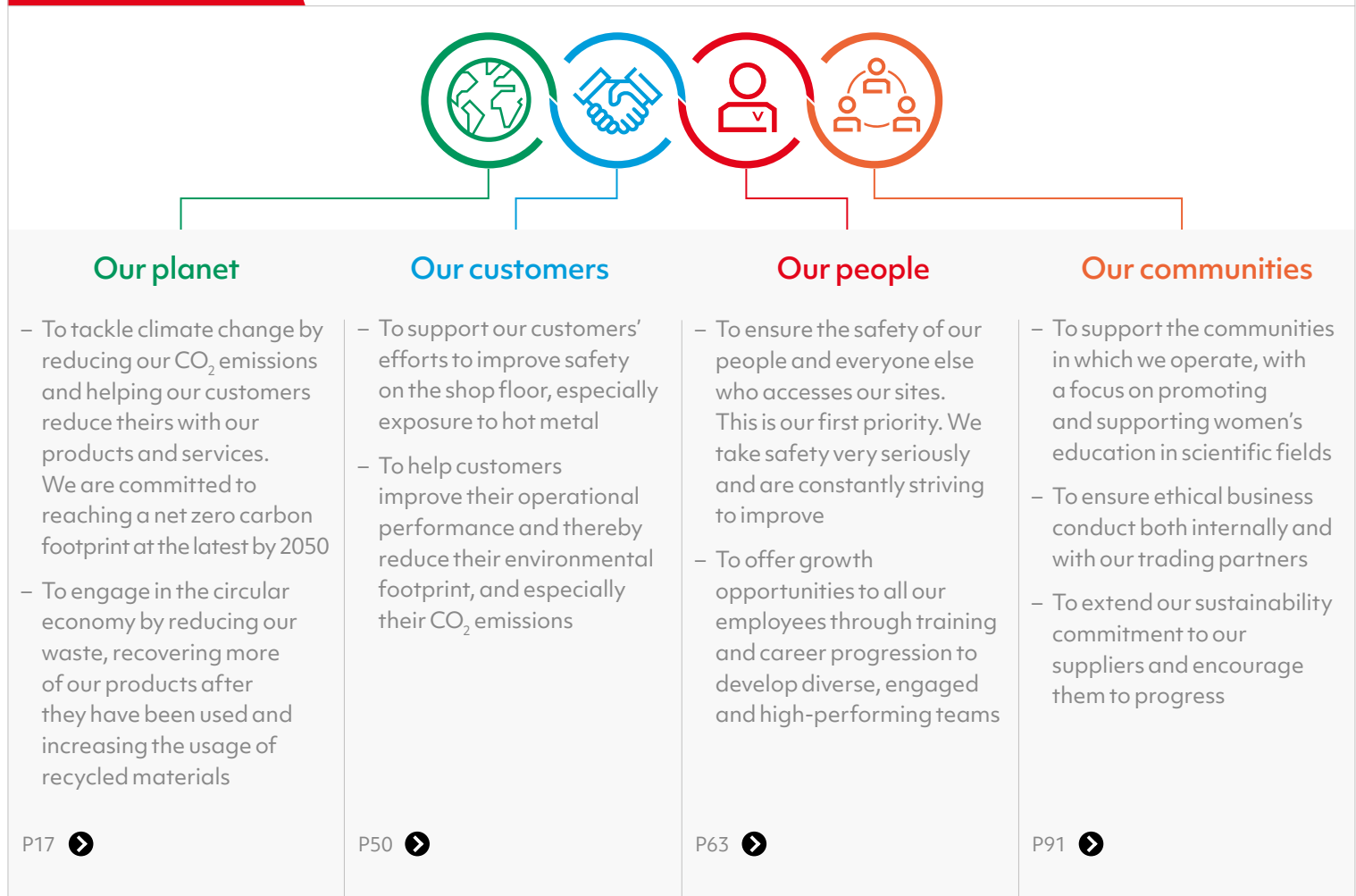
We aim to deliver sustainable, profitable growth to provide our shareholders with a superior return on their investment, whilst providing our employees with a safe workplace where they are recognised, developed and properly rewarded.

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 Sustainability strategy: towards a better tomorrow

Our strategic pillars



Our Sustainability journey

Evolution of our MSCI and EcoVadis ratings reflects the progress made in the deployment of our Sustainability strategy and disclosure.

2020

- Sustainability Charter
- Sustainability Council
- Vesuvius adheres to the UN Global Compact
- Internal Price of Carbon
- Supplier assessment programme

2021

- Scope 1 and Scope 2 emissions externally verified
- Scope 3 emissions evaluated
- Sustainable Procurement Policy
- Sustainability scorecard
- First Sustainability Report
- TCFD disclosures

2022

- Roadmap to net zero
- CDP questionnaire
- Sustainability Report GRI aligned

MSCI 

BBB

A

AA

ecovadis








































CDP

B

Progress on our Sustainability targets

The Board has identified eleven 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 timeframes; these are set out in the table below. In view of the progress made, the reduction of Scope 1 and Scope 2 CO₂e emissions target was increased in 2022 from 10% to 20% and its coverage increased from Energy CO₂e to all CO₂e 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 schedule	1.08	 Our people	 
Energy consumption	By 2025, reduce energy intensity per metric tonne of product packed for shipment (vs 2019)	-10%	 On schedule	-6.0% ¹	 Our planet	 
CO₂e emission intensity	By 2025, reduce Scope 1 and Scope 2 CO ₂ e emission intensity per metric tonne of product packed for shipment (vs 2019)	-20%	 Ahead of schedule	-18.8% ^{1,2}	 Our planet	  
Wastewater	By 2025, reduce wastewater per metric tonne of product packed for shipment (vs 2019)	-25%	 Behind plan	-9.0%	 Our planet	  
Solid waste	By 2025, reduce solid waste (hazardous and sent to landfill) per metric tonne of product packed for shipment (vs 2019)	-25%	 On schedule	-13.8%	 Our planet	 
Recycled material	By 2025, increase the proportion of recycled materials from external sources used in production	7%	 Behind plan	6.0%	 Our customers	 
Gender diversity	By 2025, increase female representation in the Senior Leadership Group (approx. 160 top managers)	25%	 On schedule	20%	 Our people	
Compliance training	Increase the percentage of targeted staff who complete anti-bribery and corruption training annually	90%	 Ahead of schedule	99%	 Our communities	
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	  

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

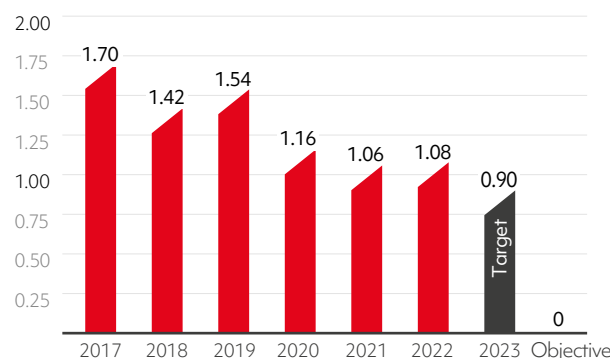
2. Does not include fugitive emissions (de minimis).

Our priorities

Become a zero-accident company

We are committed to providing a safe working environment for all our people. Safety is our top priority and our overriding commitment to health and safety is embedded throughout the organisation.

Group safety performance LTIFR



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

- Our Safety Breakthrough initiative has helped the company deliver and sustain a spectacular improvement since its launch in 2009
- We are committed to further improving
- We recognise that a lot remains to be achieved for us to reach our aim of zero accidents
- There has been a further step change since 2020



For further information on how we are improving performance

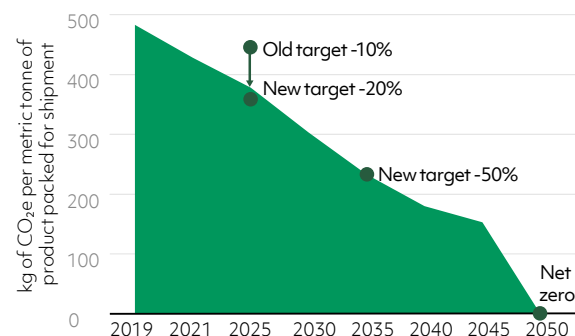
P63–90 ➔

Our priorities

Reach net zero CO₂e emissions by 2050 (Scope 1 and Scope 2)

We are committed to minimising direct and indirect CO₂ and other greenhouse gas emissions. We achieve this by reducing the energy intensity of our business and using cleaner energy sources. We support the Paris agreement and have committed to reach net zero CO₂e emissions by 2050 (Scope 1 and Scope 2).

Target emission intensity (Scope 1 and Scope 2)



Our energy conservation plan is now in its third cycle of improvement. We will be focussing on:

- Modernising and upgrading installed equipment to reduce our energy consumption
- Investing to renew equipment to the best available technologies and converting to less CO₂ intensive energy sources
- Generating clean energy
- When possible, replacing high CO₂e 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



For further information on how we are improving performance

P17–56 ➔

Our priorities

Help our customers reduce their CO₂ emissions

Approximately 8% of the world's CO₂ emissions are generated by the iron and steel industry.

We help our customers improve their casting operations' performance, thereby increasing the energy efficiency of their entire process.

Areas of expertise:

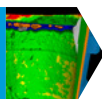
Material science



Application engineering



Digital solutions



Mechatronics



Benefits for customers:



Reduce exposure to hot metal



Reduce CO₂ emissions per tonne of steel produced



Reduce consumption of refractory material per tonne of steel



Improve metal yield (tonne of finished product per tonne of molten metal) and quality



Reduce weight of metal parts in vehicles



For further information on how we are improving performance

P50-62 ➔

Our priorities

Improve gender diversity at every level of the Company

Vesuvius recognises the value of a diverse and skilled workforce. We operate in 40 countries, employing people from 71 nationalities.

We recognise that further progress is needed on gender diversity.

% of women	2022	2025 ambition
Board & Group Executive Committee	33%	
Senior Leadership Group	20%	25%
Workforce	15%	

Change starts at the top. We have set a target to improve gender diversity in our Senior Leadership Group, but are also seeking to improve gender diversity throughout the organisation. We encourage managers throughout our business to leverage our decentralised entrepreneurial culture to drive programmes suited to local needs. Current initiatives include:

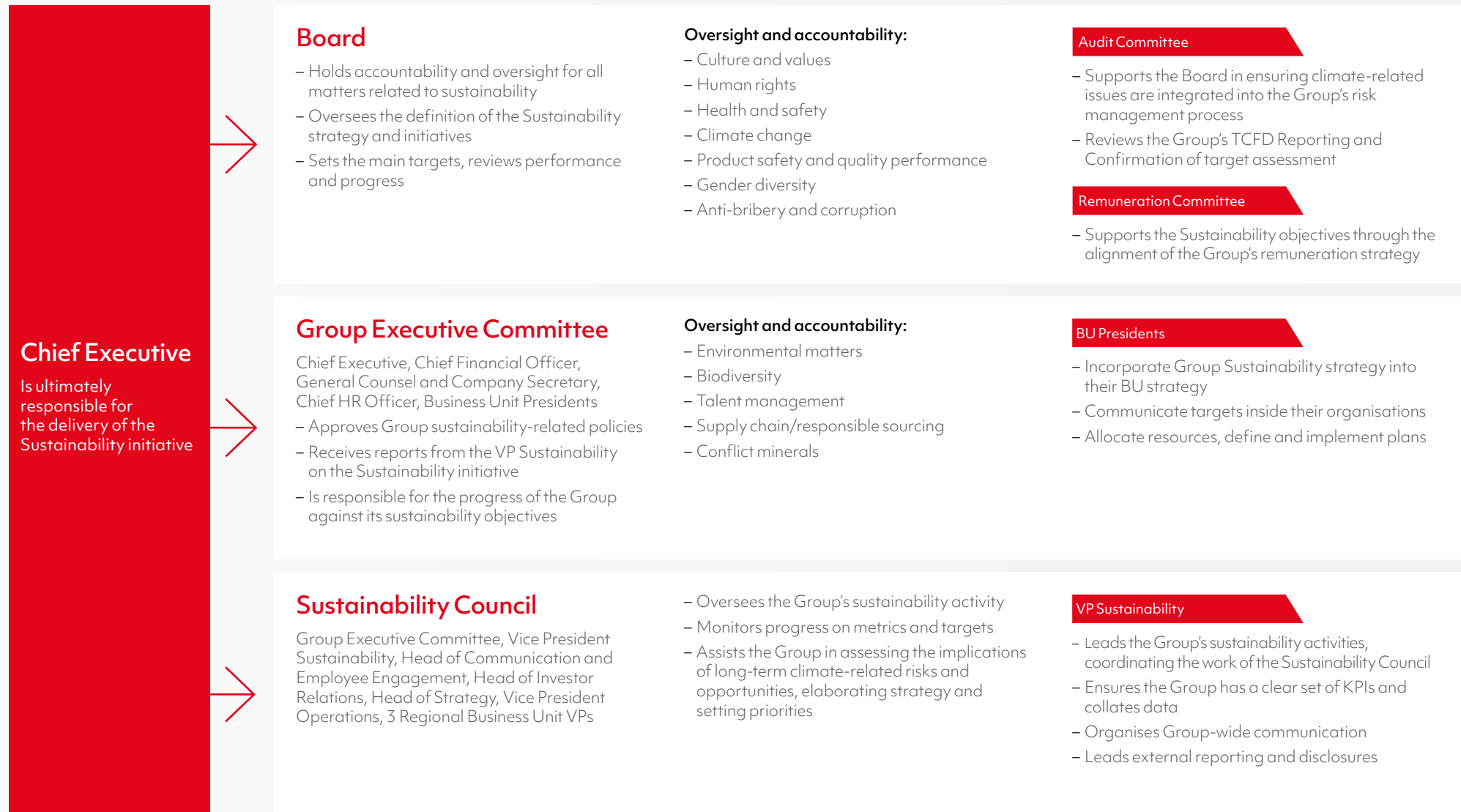
- Diversity and inclusion training programmes
- A diversity ambassadors programme (Poland)
- Flexible working arrangements (Germany and the USA)
- Supporting the education of women and girls in STEM (Poland and India)



For further information on how we are improving performance





P91–105 ➔


Our sustainability governance



Vesuvius materiality assessment

We focus 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.

Domain	Material topics	Additional topics
Our planet 	Energy efficiency and CO ₂ e emissions	<ul style="list-style-type: none"> – Renewable energy – Solid waste – Wastewater – Environmental management – Biodiversity
Our customers 	Customer energy efficiency and CO ₂ e emissions	<ul style="list-style-type: none"> – Sustainable products (durability, recyclability) – Recovered and recycled materials
Our people 	Health and safety	<ul style="list-style-type: none"> – Employee well-being – Gender diversity – Employee representation – Engagement and development
Our communities 	Sustainable supply chain/ responsible procurement	<ul style="list-style-type: none"> – Modern slavery – Education
Governance	Anti-bribery and corruption	<ul style="list-style-type: none"> – Code of Conduct/Business practices – Privacy and data security

More details on our materiality assessment process P111 

Environmental Policy	19	Roadmap to net zero	32
Tackling climate change	20	Using fewer resources	42

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.



Our planet



Our planet

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.

Moving to carbon-free energy

In 2022 alone, thanks to carbon-free electricity contracts and the use of solar panels, we avoided approximately 43,000 tonnes of CO₂ emissions.



Environmental Policy

We will operate all work and business activities in a manner which ensures appropriate care and protection of the environment.

We will comply with all applicable legal and other local environmental obligations. We will be proactive in preventing negative effects to the environment and will continuously improve our environmental management systems and performance.

Organisation and responsibilities

- We regard all environmental matters – including climate change – as a mainstream management responsibility. Executives and line managers are directly responsible for environmental matters in operations under their control. Management is accountable for environmental performance against objectives.
- Each and every employee is responsible and accountable for environmental matters in activities under their control.
- We will encourage our suppliers to adhere to the same environmental standards as we do.
- We expect everyone to participate positively in achieving our environmental aims.

Our beliefs

- Preserving the environment is good business.
- All employees must contribute to protect the environment.
- All environmental incidents are preventable.

Our commitments

- Minimise direct and indirect CO₂ 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.

Our actions

- We will raise environmental issues at all levels, openly consult with stakeholders to address them, and report regularly on them.
- We will build environmental protection into our products and processes.
- Environmental risk assessments will be undertaken to identify hazards, prioritise any deficiencies and correct them in an appropriate way, as well as to develop appropriate procedures.
- We will set targets and implement action plans to improve our environmental performance.
- All our investment decisions will include an analysis of their environmental impact. An internal price for CO₂ emissions will be included for the calculation of payback for all investments reaching the threshold for approval by the BU Presidents or Chief Executive.
- We will provide training to all employees and contractors to ensure that they understand their responsibilities and are able to act accordingly.
- Every business facility will have an appointed Environmental Manager.
- Every manufacturing site will implement an environmental management system that is aligned with ISO 14001.



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.

Reducing our impact

Vesuvius actively participates in measures to tackle climate change by reducing our CO₂e emissions and use of raw materials, alongside helping our customers reduce their own CO₂ 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 CO₂ 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 CO₂ 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.

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



Tackling climate change

Case study

Major investment delivers substantial CO₂ savings

Reaching our goal of being carbon neutral requires commitment, ingenuity, innovation and investment.

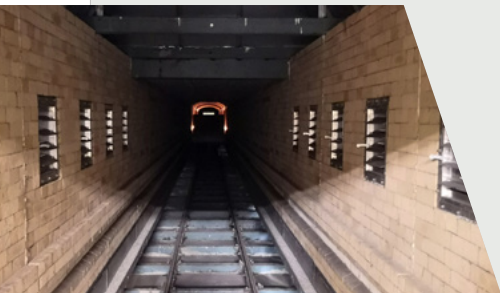
In recent years, one major investment was the installation of a natural gas-fired tunnel kiln at our plant in Wuhan, China, eliminating the use of coke oven gas as a fuel.

Coke oven gas is formed by heating coal to 1,100°C. It generates large amounts of CO₂ and other greenhouse gasses in its production and use. Natural gas, while not carbon-free, is a much cleaner alternative.

In 2019, our plant in Wuhan, China, converted their 93-metre-long tunnel kiln and the second preheating kiln from coal to natural gas fuel, dramatically improving CO₂ and other greenhouse gas emissions.

Compared with before the change, annual CO₂ emissions were reduced by 6,000 tonnes, a 69% CO₂ reduction improvement. The project also led to the reduction of NO_x emissions by 59% and dust emissions by 77%.

Waste heat from the high-temperature kiln is also recovered, and used for heating and to produce warm water for the staff washrooms.



Tackling climate change

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.

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 CO₂ 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.

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.

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.

In December 2021, a Vesuvius manufacturing site in Malaysia suffered damage from flooding due to an abnormally intense rainstorm. This disrupted operations for a few days but sound emergency and business recovery planning meant there was no material impact on the Vesuvius business and assets. Customer operations were unaffected.

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.

Tackling climate change

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					●			
	Toyokawa						●	●	
Taiwan	Ping Tung						●		
Brazil	Piedade				●	●			
	Resende		●	●					
	São Paulo				●	●			

Transition risks

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

- 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
- 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.

Tackling climate change

Case study

Small measures making a big difference

Across our global operations, our colleagues are innovating in practical ways to reduce our environmental footprint. Small things combine to make a big difference.

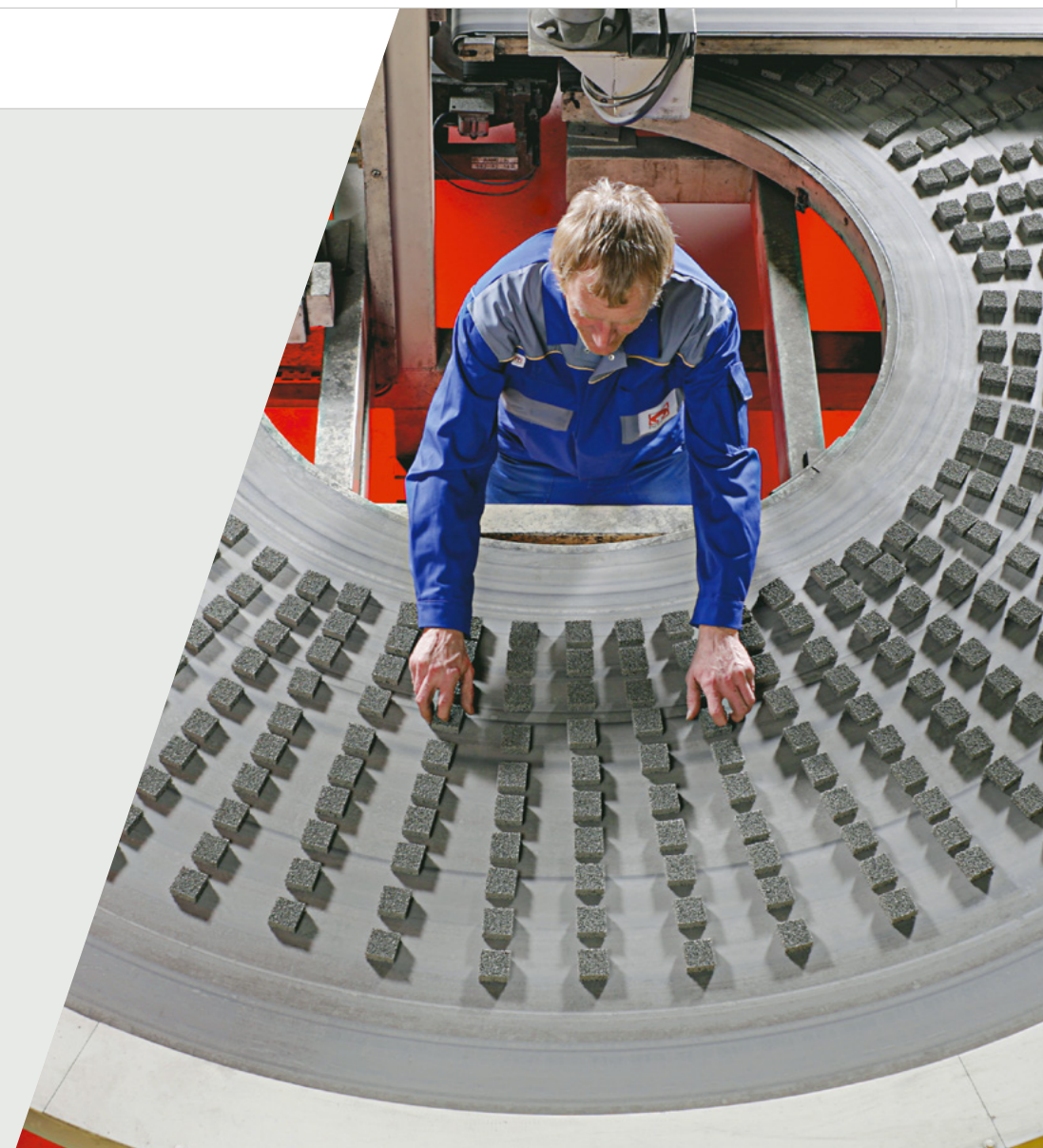
In the Netherlands, the R&D team designed a new Direct Impingement test method for filter strength testing which is both much faster and produces significantly less CO₂. The traditional method required several new batches of steel to be molten in the induction furnace, whereas with the new test method the metal remains molten and is recycled. The new method consumes around 30% less electricity and 50% less natural gas, saving in excess of a tonne of CO₂ in a test day.

In India, developments have been made in many areas of our business to reduce CO₂ emissions.

At our Mehsana site, the shell and the fibre lining of our kiln has been replaced to improve heat loss, which enhanced the heat efficiency of the kiln, leading to fuel savings of 5m³/MT and a 172kg/MT CO₂ reduction.

Our Pune site has introduced 'double filters' to enhance productivity by utilising the oven to its full capacity. The initiative reduced LPG consumption from 103kg/MT to 75kg/MT which delivered a CO₂ saving of 169kg/MT.

And our site in Puducherry has replaced its oven's conventional burners with energy efficient modulating burners, which operate a temperature sensing mechanism to only heat the oven when the temperature drops below a certain level. This delivers a fuel saving of 16kg LPG/MT and CO₂ reduction of 22kg/MT.



Tackling climate change

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 timeframe. 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 of our Annual Report.

Impact categories (trading profit)

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

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

Opportunities

			Potential annual impact on trading profit in the short, medium and long term		
Opportunity	Description	Impact	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

Impact categories (trading profit)

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

Catastrophic (>£25m)



High (£10–15m)



Minor (£1–5m)



Major (£15–25m)



Moderate (£5–10m)



Insignificant (£0–1m)



Risks

				Potential annual impact on trading profit in the short, medium and long term		
Risks	Description	Impact	Mitigating actions being undertaken	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

Tackling climate change

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'

Incomplete policy and fiscal packages distort competition, slowing down technology development and leading to geographic shifts in steel supply

3°C warming scenario

'Closed doors'

Regional/national self-interest drives economic policy, competition wins over cooperation, regulatory framework and technologies evolve differently

2°C warming scenario

'Global accord'

High cooperation and commitment to limit emissions facilitates technology development and the transition to a low carbon world

Tackling climate change

	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	<p>The European Union and United States implement carbon pricing mechanisms (taxation or cap and trade), but no carbon border adjustment mechanism or tariffs (or insufficient to prevent the transfer of manufacturing away from these regions)</p>	<p>The European Union and United States implement carbon pricing mechanisms (taxation or cap and trade), and carbon border adjustment mechanism or tariffs to protect their industries from delocalisation</p>	<p>All major economies implement carbon pricing mechanisms. The cost of CO₂ increases in all regions at a comparable pace</p>
2 Conversion of power generation from fossil fuels to clean electricity and hydrogen	<ul style="list-style-type: none"> – Fast growth of non-CO₂ 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 	<ul style="list-style-type: none"> – Fast growth of non-CO₂ 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 	<ul style="list-style-type: none"> – Fast growth of non-CO₂ 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	<ul style="list-style-type: none"> – 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 	<ul style="list-style-type: none"> – 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 	<ul style="list-style-type: none"> – 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	<p>High-technology steel market grows at 0.9% per year</p>	<p>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)</p>	<p>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)</p>
5 Aluminium market	<p>Aluminium market grows at 3% per year, especially High Pressure Die Casting (HPDC) and Low Pressure Die Casting (LPDC) processes</p>	<p>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</p>	<p>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</p>
Potential financial impact by 2035 (profit before tax)	<p>–£5m to £0m</p>	<p>£5m to £10m</p>	<p>£15m to £20m</p>

Tackling climate change

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 CO₂ 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-CO₂ 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 CO₂ 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.

Tackling climate change

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 CO₂ emitting (1% to 3% of a steel plant's CO₂ 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

Case study

Bringing our Sustainability initiative to life

Our regions are taking the lead in the deployment of sustainability initiatives for our business and for our customers.

In China, our colleagues have created a Regional Sustainability Council, which has representatives from all business functions and is led by the Regional Vice President.

One of its key initiatives is an annual competition, the 'Sustainability Star Activity Projects', to recognise the best energy efficiency and CO₂ reduction projects.

The 2022 winners included a project to reduce energy consumption in a conduction oil heating boiler and another to dramatically improve the yield of a customer's knuckle casting process.

The competition combines many benefits in addition to environmental improvements and cost savings. This is a great opportunity to develop problem solving capabilities at every level of the organisation and is a formidable tool for engagement and recognition.



Our roadmap to net zero

Energy conservation and CO₂e emissions reduction

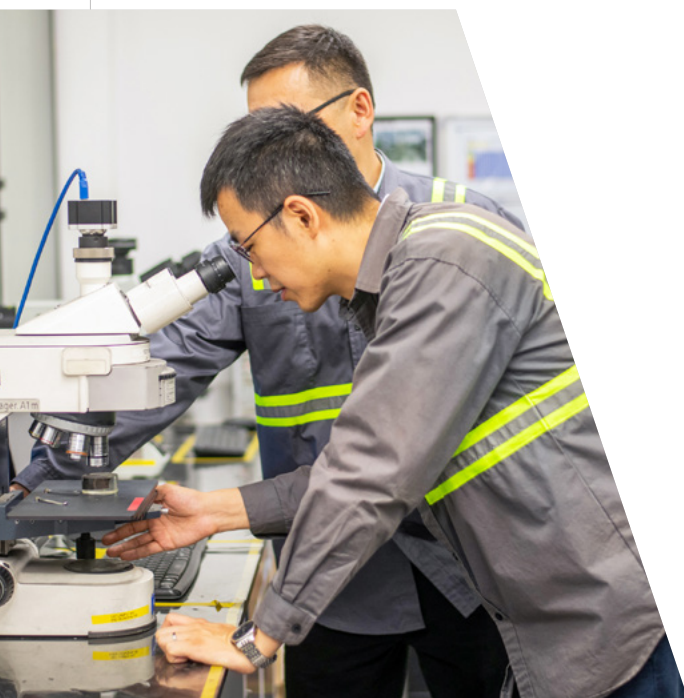
Our ambitions

Vesuvius is committed to minimising direct and indirect CO₂ and other greenhouse gas emissions, by reducing the energy intensity of our business and using cleaner energy sources.

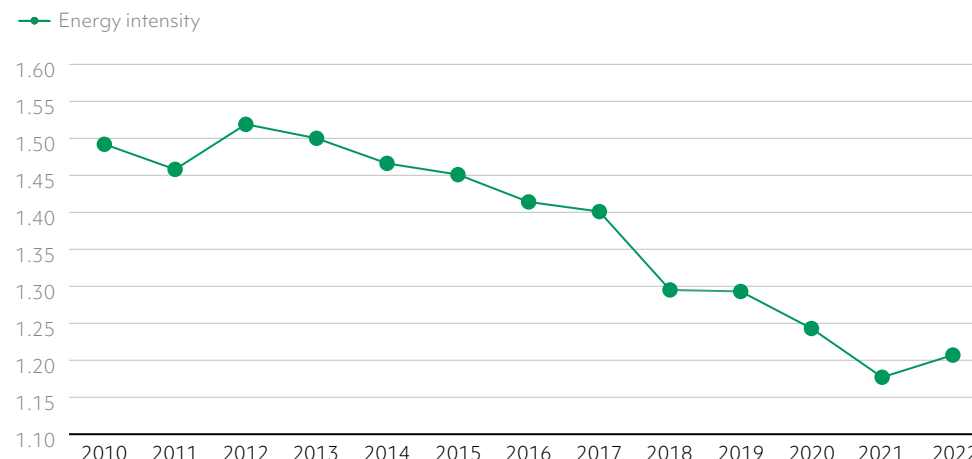
We support the Paris Agreement and have committed to reach net zero CO₂e emissions by 2050 (Scope 1 and Scope 2).

Our history

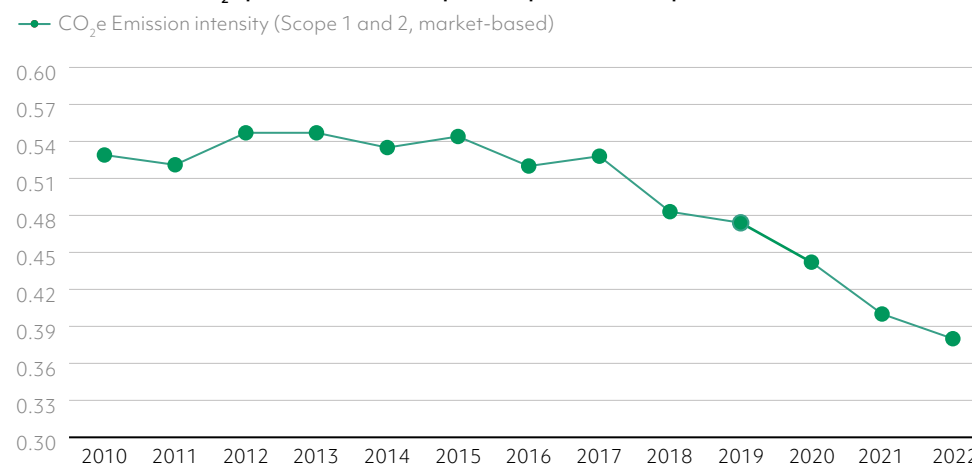
Our first commitment to reducing energy consumption and GHG emissions dates back to 2011 and the launch of Vesuvius' Energy Conservation Plan. In 2022, our energy consumption per tonne of product packed for shipment was 19% lower than in 2010. Since 2019, we have started converting to non-CO₂ emitting sources of electricity. As a result, our CO₂e emissions in 2022 were 28% lower than in 2010.



kWh of energy per metric tonne of product packed for shipment



Metric tonnes of CO₂e per metric tonne of product packed for shipment



Notes:

- 2022 includes the business of Universal Refractories, Inc (Vesuvius Penn Corporation) acquired in 2021, but excludes BMC (Yingkou YingWei Magnesium Co., Ltd) acquired late 2022.
- Operational Control Boundary.

Our roadmap to net zero

Our metrics and targets

We have set intermediate targets in our journey to reach net zero CO₂e 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 (CO₂, CH₄, N₂O, HFCs, PFCs, SF₆ and NF₃).

Our preferred metrics to monitor progress with our journey to net zero are energy and CO₂e emission intensity (energy consumption and CO₂e 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

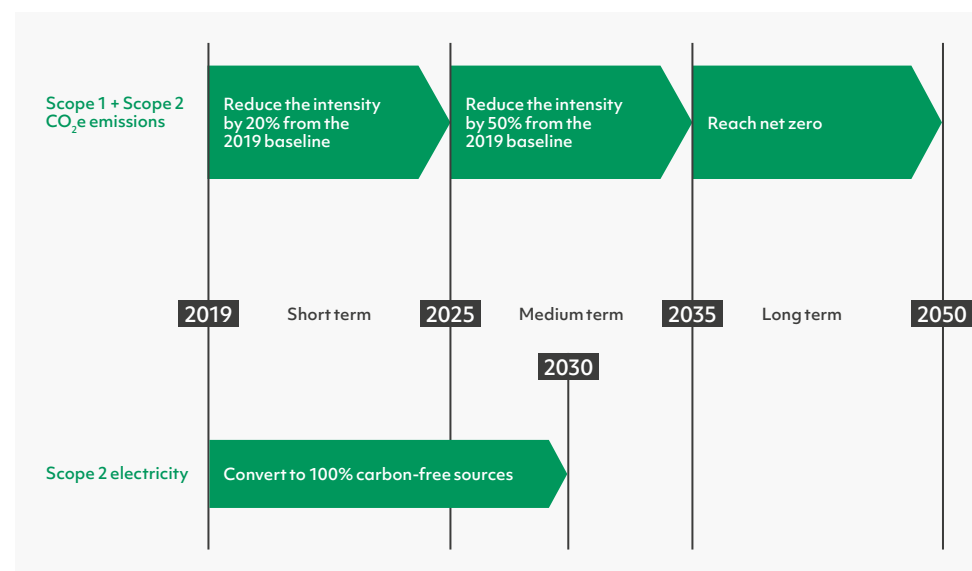
2019 was selected as the baseline for all energy and GHG emissions data and targets, absolute and relative, as this was the last year of normal trading prior to the COVID-19 pandemic.

- 10% improvement in the Group's energy intensity between 2019 and 2025
- 20% reduction in CO₂e emission intensity normalised per metric tonne of product packed for shipment (Scope 1 and Scope 2) by 2025
- 100% carbon-free electricity by 2030
- A reduction in total Scope 1 and Scope 2 CO₂e emission intensity of 50% by 2035
- 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 CO₂e 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 CO₂ emissions reduction targets.

Our journey to net zero



Our roadmap to net zero

Our plan

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

- 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 CO₂ emissions will increase the attractiveness of carbon-free processes
- No significant change to our business model and product portfolio

Some significant assumptions underpin our net zero plan, including:

- Modernising and upgrading installed equipment to reduce our energy consumption
- Investing to renew equipment to the best available technologies and converting to less CO₂ intensive energy sources
- When possible, replacing high CO₂e 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.

The achievement of our CO₂e 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 CO₂ intensive product line)
- Macroeconomic conditions and the capex cycle impacting plant loading (and thereby the energy efficiency of continuous processes)

Scope 1, 2 and 3 CO₂ and CO₂e 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.

c.£60m
incremental capital expenditure
between 2023 and 2035

Our roadmap to net zero

Our progress

Since 2019, we have undertaken a number of major projects to significantly reduce the Scope 1 CO₂ emissions of the Group by addressing some of its most CO₂e 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 CO₂ 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 CO₂.

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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ was initially set at €30 per tonne of CO₂ 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 CO₂ for 2023.

68%
of our electricity
is from carbon-free
sources

Our roadmap to net zero

Our progress continued

3

Improving our energy efficiency

We endeavour to use the best available technologies to reduce CO₂ 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 CO₂ 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.

18.8%¹

reduction in CO₂e emissions per metric tonne of product packed for shipment between 2019 and 2022

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 CO₂e 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 CO₂ emissions reduction as one of their prime objectives, was approved in 2022.

Next steps

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. We will also continue the conversion of our electricity supply to carbon-free sources.

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.

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

Our roadmap to net zero

Our results

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 CO₂. Dolime and the next six of our 32 main manufacturing processes account for 73% of our energy consumption and 79% of our location-based CO₂e emissions. These continue to be a clear focus for our investment to reduce CO₂e 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.

6%

energy intensity reduction
between 2019 and 2022

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 CO₂e emission intensity metric (CO₂e 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 CO₂e intensity and an 11% reduction in Process CO₂e intensity per metric tonne of product packed for shipment.*

The conversion by many of our sites to carbon-free electricity contracts has helped our CO₂e emissions reduce at a faster pace than our energy efficiency improvements.

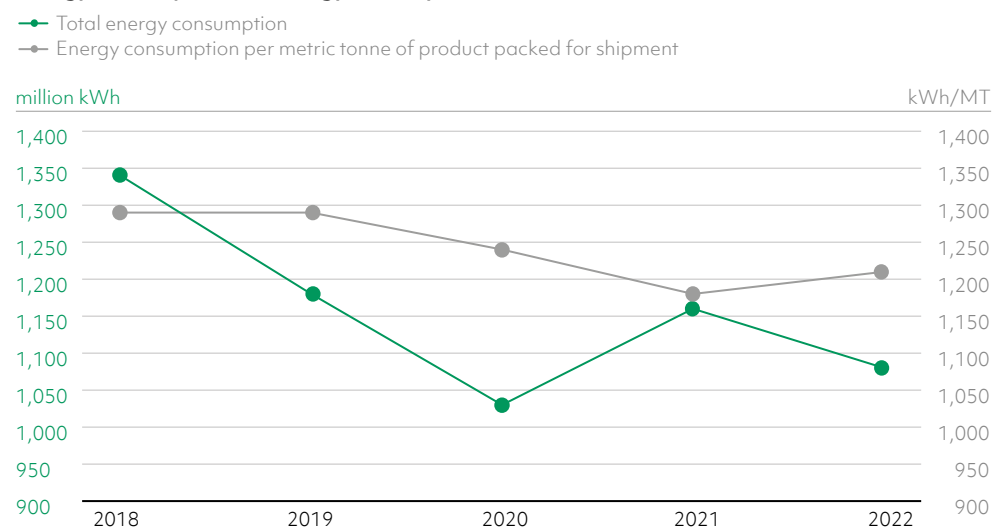
Vesuvius' 2022 total energy costs of £56.4m are c.2.8% of revenue. South Africa is the only country where we exceed the threshold to be submitted to a carbon tax or an emissions trading scheme. The Carbon Tax cost in 2022 was c.£0.2m.

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

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

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

Energy consumption and energy intensity evolution^{1,2}



Notes:

1. 2022 includes the business of Universal Refractories, Inc (Vesuvius Penn Corporation) acquired in 2021, but excludes BMC (Yingkou YingWei Magnesium Co., Ltd) acquired late 2022.

2. Operational Control Boundary.



For additional details on energy consumption and GHG emissions, see Further information

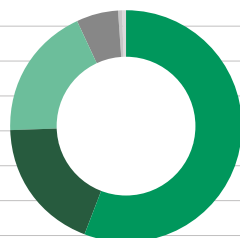
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Our roadmap to net zero

Our results continued

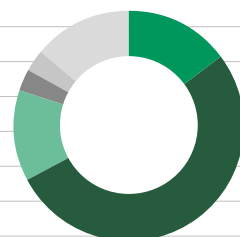
2022 energy consumption by fuel type %

Energy consumption	2022	
	'000 kWh	%
Natural gas	605,421	55.9%
Coal	202,272	18.7%
Electricity	202,010	18.6%
LPG	64,932	6.0%
Other fuels	5,132	0.5%
External heat	3,849	0.4%



2022 Scope 1 and Scope 2 CO₂e emissions per region (market-based) %

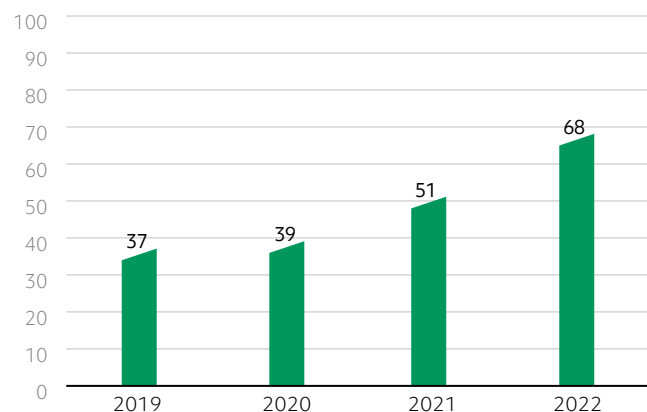
Metric tonnes CO ₂ e	2022	
	Metric tonnes	%
Europe and Middle East	49,588	15%
Africa	182,602	53%
China & NA	43,424	13%
India & SA	11,060	3%
South America	8,558	3%
US, Mexico, Canada	46,163	14%



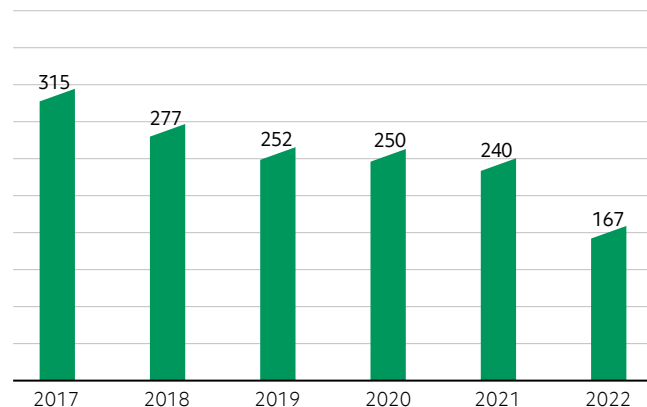
Our roadmap to net zero

Our results continued

Electricity from non-CO₂ emitting sources (% of total)

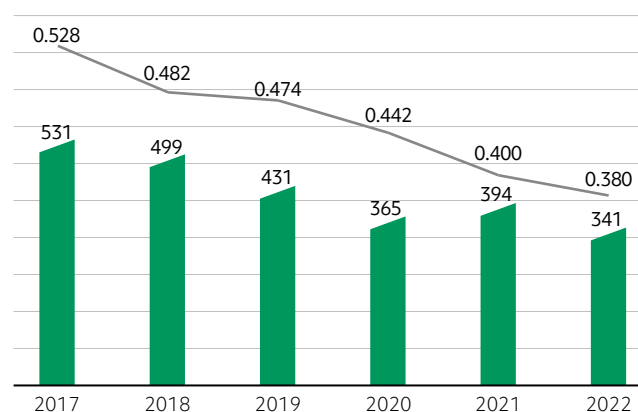


Evolution of CO₂e emissions per million £ revenue



■ CO₂e metric tonnes per million £ revenue (Scope 1 and Scope 2)

Evolution of CO₂e emissions (Scope 1 and Scope 2)



■ CO₂e '000 metric tonnes

— CO₂e metric tonnes per metric tonne of product packed for shipment

Notes:

- 2022 includes the business of Universal Refractories, Inc (Vesuvius Penn Corporation) acquired in 2021, but excludes BMC (Yingkou YingWei Magnesium Co., Ltd) acquired late 2022.
- Operational Control Boundary.
- Location-based Statutory Reporting of Global GHG emissions (metric tonnes of CO₂e) and energy consumption ('000 kWh).



For additional details on energy consumption and GHG emissions, see Further information

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Our roadmap to net zero

Our results continued

Scope 3 emissions

Vesuvius' Scope 3 CO₂e emissions, mainly upstream, contribute to a greater part of our total CO₂e emissions than our Scope 1 and Scope 2 emissions.

Scope 3 CO₂e 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 CO₂ emissions factors. In addition, we started collecting information on energy source, CO₂ 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 CO₂ emissions data related to transportation from our forwarders in all regions.

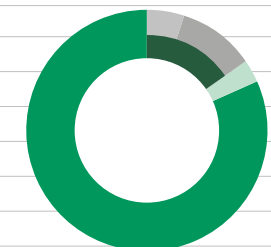
In parallel to this, various initiatives have been launched to reduce our Scope 3 CO₂ emissions. A few examples include:

1. Returnable packaging solutions being implemented both with suppliers and customers
2. Policies aimed at limiting the CO₂ emissions of Company fleet vehicles being deployed in various countries
3. 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

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

In 2022, Vesuvius' total Scope 1, Scope 2 and Scope 3 CO₂e emissions were 1,831,451 metric tonnes. This represented 895 metric tonnes per million £ revenue.

Metric tonnes CO ₂ e	2022	
	Metric tonnes	%
■ Scope 1 CO ₂ e emissions	284,879	15.6%
■ – Scope 1 Process CO ₂ e emissions	91,276	5.0%
■ – Scope 1 Energy CO ₂ e emissions ²	193,603	10.6%
■ Scope 2 CO ₂ e emissions (market-based)	56,517	3.1%
■ Scope 3 CO ₂ e emissions	1,490,055	81.4%
Total	1,831,451	100%



Notes:

1. Operational Control Boundary.

2. 2022 includes the business of Universal Refractories, Inc (Vesuvius Penn Corporation) acquired in 2021, but excludes BMC (Yingkou YingWei Magnesium Co., Ltd) acquired late 2022.



For additional details on energy consumption and GHG emissions, see Further information

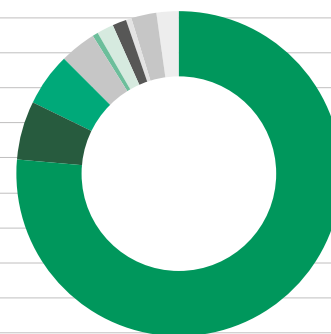
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Our roadmap to net zero

Our results continued

Scope 3 emissions

Metric tonnes CO ₂ e	2022	
	Metric tonnes	%
Purchased goods and services	1,137,416	76.3%
Capital goods	87,043	5.8%
Fuel- and energy-related activities (not included in Scope 1 or 2)	82,523	5.5%
Upstream transportation and distribution	51,231	3.4%
Waste generated in operations	7,926	0.5%
Business travel	26,810	1.8%
Employee commuting	20,400	1.4%
Upstream leased assets	6,375	0.4%
Downstream transportation and distribution	37,537	2.5%
Processing of sold products	32,794	2.2%
Total Scope 3 CO₂e emissions	1,490,055	100.0%



Vesuvius plc statement of verification



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.

Details of the methodology used for GHG data collection and reporting can be found in Further information on p115.



For additional details on energy consumption and GHG emissions, see Further information

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Using fewer resources

Contributing to 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.

As stated in our Environmental Policy, we aim to promote the development of the circular economy. The Vesuvius product strategy combines multiple approaches.



Product durability

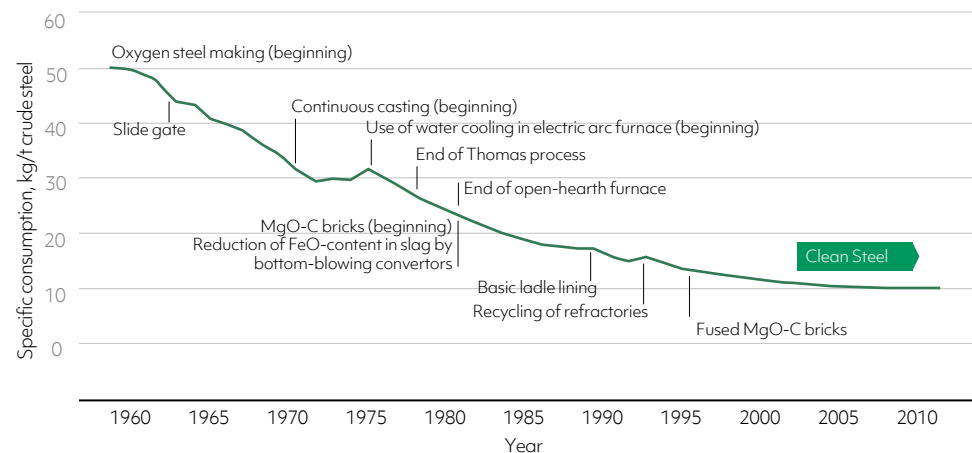
Our first, and preferred, strategy to reduce the depletion of resources is the extension of product durability.

The amount of refractory material required per tonne of steel cast has been reduced by 80% since 1960, and the average product lifetime multiplied by as much. Approximately 10kg of refractory material are now consumed per tonne of steel cast, with some customers requiring as little as 7kg.

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.

We have introduced innovative refractory lining monitoring, to enable repairs to be made only where needed. Our i-GVARD* system automates the monitoring of slide-gate wear, providing decision-makers with critical data to choose when to renew refractory plates. We have developed longer life Duraflex* ladle shrouds, and methodologies to reuse bottom slide-gate plates as top plates. Each of these systems and processes drives production efficiency and reduces refractory volumes.

Amount of refractory consumed per tonne of steel cast in Germany



Source: Statistisches Jahrbuch der Stahlindustrie.

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

Using fewer resources

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.

A large portion of this is open loop recycling, with spent refractories used in low value-adding applications such as aggregates for roadbed materials.

Closed loop recycling will allow greater substitution of virgin material by secondary material, with a positive impact on Scope 3 CO₂ emissions. It is estimated that only 7% of spent refractories currently enter closed loop recycling.

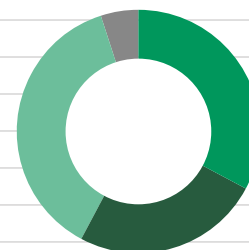
Many factors such as consistency of material quality, cost of sorting and mineral processing, transportation costs, and the administrative burden associated with the transportation of waste, have prevented the wide adoption and investment in closed loop recycling. We therefore support initiatives being pursued by authorities to improve the regulatory framework for the circulation of waste materials across borders, making it easier for them to be recovered and recycled in different countries.

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

Distribution of refractory material after use in the steel industry in Europe %

- 33% Dissolution in hot metal, steel or slags
- 25% Internal recycling
- 37% External recycling
- 5% Landfilling



Source: A review of recycling of refractories for the iron and steel industry, Researchgate November 2017.

Product resource efficiency

Product technology

Similar to the clear environmental advantages solar and wind offer over fossil fuel energy sources, or electric vehicles over internal combustion engines for transportation, certain applications can be served by alternative product technologies that are far less CO₂ intensive.

For some uses, it is possible to replace bricks or other products requiring high-temperature firing with resin-bonded refractories, with significantly lower CO₂ emissions. Other applications can be fulfilled by unshaped refractories, which in addition to not requiring high-temperature firing, can be repaired between campaigns, thereby extending their lifetime and reducing the quantity of material to recycle or dispose of after usage.

Vesuvius also offers powder coatings to its Foundry customers. These are mixed with water at the customer's premises rather than in our plants. This offers significant environmental benefits, through the reduced consumption of plastic packaging, reduced weight and volume transported and associated CO₂ emissions, and increased shelf life.

Using fewer resources

Recovered and recycled materials

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

A comprehensive quarterly reporting system for the use of recovered and recycled materials by all manufacturing sites was launched in 2019. It includes the reporting of recovered and recycled materials from sources external to Vesuvius and across Vesuvius facilities. In 2020, the Board set a target for 7% of the raw materials used by the Group in production to be recycled materials from external sources by 2025 (measured by weight of materials).

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.

Cross-functional teams incorporating experts from R&D, Purchasing, and Manufacturing are working to identify and analyse opportunities in order to increase the share of recovered and recycled materials.

In 2022, 66,137 metric tonnes of recycled materials were used in our products. The percentage of recovered or recycled materials from external sources used in production was 6.0% (6.2% in 2021). 23.1% of our revenue was generated from products that include recycled materials (24.0% in 2021). We estimate that more than 68,000 metric tonnes of Scope 3 CO₂e emissions were avoided by using recycled materials in lieu of virgin materials.

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.

Bio-based raw materials

Vesuvius uses and has used for many years eco-friendly or bio-based input materials in products including:

- Calcined waste from rice agriculture biomass
- Furfural and Furfuryl alcohol from corn cobs biomass
- Sulphite lye/calcium lignosulphonate from paper manufacture waste
- Wood flour from wood waste
- Bio Ethanol-based solvents

8,000 tonnes of bio-based raw materials were included in our products in 2022.

23.1%
of our revenue is from
products including
recycled materials

Using fewer resources

Reducing consumption

We believe that preserving the environment is good business. We strive to improve our material efficiency by reducing waste at source and during production, and minimising consumption.

Material waste

A quarterly reporting system for material waste from all manufacturing sites was implemented in 2019. This was enhanced in 2020 by introducing the separate reporting of toxic and other hazardous waste.

Our system now includes the reporting of waste to landfill, toxic and other hazardous waste, waste for recycling, waste to sewers and by-products (materials recovered and recycled outside the site where they were generated).

-13.8%

solid waste (hazardous and sent to landfill) per metric tonne of product packed for shipment in 2022 vs 2019

100% of our manufacturing sites report the various categories of waste and by-products they generate (waste coming from construction and demolition projects is not included, as it stems from exceptional projects and would distort the measure of progress in operations).

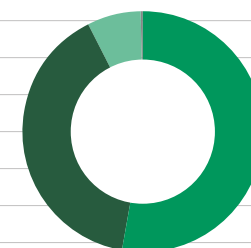
The Board has set a target of a 25% reduction of our solid waste (hazardous and sent to landfill) per metric tonne of product packed for shipment by 2025 (vs the 2019 baseline).

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.

Breakdown of 2022 solid waste %

- **53%** Recycled waste (by-products)
- **39.8%** Non-hazardous waste
- **7.2%** Other hazardous waste
- **0.03%** Toxic waste



Raw materials and waste

Manufacturing site raw materials & waste/(metric tonnes)	% change	2022	2019
Ratio of solid waste and by-products in metric tonnes per tonne of product packed for shipment	-15.1%	0.073	0.086
Ratio of solid waste per tonne of product packed for shipment (in metric tonnes)	-13.8%	0.035	0.040
Ratio of by-products per tonne of product packed for shipment (in metric tonnes)	-16.3%	0.039	0.046



For additional details on raw materials and waste, see Further information

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Using fewer resources

Hazardous and toxic waste

We are committed to the reduction of toxic and other hazardous waste.

Whenever relevant, action plans to reduce hazardous waste are incorporated by manufacturing sites into their solid waste reduction action plans.

Manufacturing sites ensure that hazardous and toxic materials, and waste, are stored in protected containers and kept in delineated storage areas, with sufficient retention capability to prevent any release in case of accidental spillage.

In 2022, 15.4% of our solid waste (excluding recycled waste) was classified as hazardous (2021: 13.2%), while toxic waste represents 0.065% of solid waste (excluding recycled waste).

Out of our manufacturing sites and R&D centres of excellence handling hazardous and toxic waste, 71% have defined emergency plans including provisions relating to toxic and hazardous waste and materials. Of these 54% have tested them through simulation exercises in 2022.

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, investments in wastewater treatment installations have been made in 26 plants. Dry filter installations for particulate removal also allow for lower water consumption than wet scrubbers.

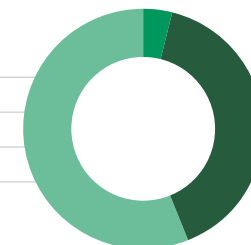
-9.0%

wastewater per metric tonne of product packed for shipment in 2022 vs 2019

Location of manufacturing sites	Number of main manufacturing sites	Percentage of revenue 2022
Very high-water stress	4	4%
Moderate to high water stress	20	40%
Low to moderate water stress	33	56%

Notes:

This data covers 100% of our manufacturing sites.
Water stress classification based on World Resources Institute Aqueduct Water Risk Atlas.
Revenue from manufactured products.



In 2022, total water consumption was 678,973 cubic metres or 679 megalitres. 660 thousand metric tonnes (97.2%) were consumed in our manufacturing sites, the remaining 19 thousand tonnes (2.8%) in our R&D centres of excellence, offices and warehouses. 31,016 metric tonnes were incorporated into our finished products (4.6% of total fresh water), the balance being consumed as part of our manufacturing processes and social water (95.4%).

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%).

Water stress

An assessment of all Vesuvius manufacturing sites was carried out using the Aqueduct Water Risk Atlas. A small number of the areas in which Vesuvius operates are water stressed. In these areas, we make strenuous efforts to reclaim, recycle and minimise the overall consumption of water.



For additional details on raw materials, waste, and water, see Further information P122-123 ➔

Using fewer resources

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).

Various technological solutions have been implemented to reduce water consumption and the volume of wastewater discharged. Most noteworthy, investments in wastewater treatment installations have been made in 26 sites. 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:

1. Replacing wet scrubbing systems for particulate removal with dry filter systems
2. Optimising container cleaning processes
3. Installing high pressure stations to improve the efficiency and speed of tool cleaning

4. Optimising production schedules to reduce the need for cleaning between recipes

5. The provision of environmental awareness training to employees

Dry filter installations for particulate removal allow far lower water consumption than wet scrubbers.

All wastewater is within regulatory permit limits, except for one site. Action plans are in place and investments approved to resolve this by the end of 2023. No substances of concern are recorded. Discharges in areas with water stress are not significant. All wastewater is discharged to municipal sewer systems.

Our wastewater performance has been adversely affected by investments in regenerative thermal oxidisers. Such installations allow far more efficient reduction of air emissions than water-based processes. As a result, wastewater which was formerly transformed into steam in the cleaning of air emissions is now released in liquid form and included in our wastewater emissions.

(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

Emissions into the air

Whilst measurements have confirmed that these do not represent a material topic, some Vesuvius manufacturing processes can lead to low levels of emissions into the air. These include post thermal treatment residual Volatile Organic Compounds (from the curing and firing of products including solvents and resin binders, or pitch impregnation), residual GHGs from the combustion of fuels and process emissions, and residual dusts post capture and filtration.

Vesuvius' emissions of VOC, residual GHGs, and residual dusts are at levels too low to warrant any form of continuous measurement and reporting of quantities emitted, but manufacturing plants with identified potential exposure monitor their levels of emissions into the air through regular sampling, and actively work to reduce them.

Vesuvius is committed to working towards the complete elimination of emissions into the air. Various programmes have been developed over the years, including the upgrade of equipment to the best available technologies, and the implementation of filtration, vapour extraction and regenerative thermal oxidiser systems.



For additional details on raw materials, waste, and water, see Further information P122-123 ➔

Using fewer resources

Biodiversity and greenery

As an integral part of its commitment to operate all work and business activities in a manner which ensures appropriate care and protection of the environment, Vesuvius is committed to not contribute to any net loss of biodiversity.

We undertake routine surveys of all manufacturing sites and monitor the evolution of regulations related to biodiversity.

We do not have any sites located within high conservation value areas, critical biodiversity areas, or biodiversity-sensitive areas. 7 sites are located near (within approximately 1.5km) of critical biodiversity areas or biodiversity-sensitive areas.

We have not identified any biodiversity risks from our ongoing operations, other than accidental environmental releases and emissions into the air as detailed elsewhere in this report.

The very limited footprint of Vesuvius' sites contributes significantly to limiting our Company's impact on biodiversity.

Actions have been taken in various manufacturing sites to increase greenery and biodiversity on their grounds and in neighbouring communities, including planting trees.

The Vesuvius biodiversity policy is available to view at: www.vesuvius.com.

Environmental monitoring and environmental regulation

Vesuvius operates sites in some developing markets where environmental concerns have become politically significant as air quality deteriorates, and residential expansion takes people closer to areas historically reserved for manufacturing.

All our factory emissions to air, ground and water, as well as waste are proactively managed in accordance with local regulations. All our manufacturing operations monitor key environmental indicators.

Regular analysis

Regular analysis enables us to act to reduce our emissions where possible and to operate more efficiently. Environmental performance records are kept for the period of time required to comply with local regulations.

Manufacturing plants maintain and test emergency plans to ensure compliance with local regulations and Vesuvius standards in the event of an accidental release.

Reports from external inspections, including those with findings, are centrally stored and shared internally with executive and senior management. Where local authorities carry out routine inspections, observations, recommendations and actions are recorded and acted upon appropriately.

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 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.

(£m)	2022	2021	2020	2019
Total cost of environmental fines and penalties levied	0	0	0	0

Using fewer resources

Environmental management/ certifications

External annual compliance audits are carried out by the global assurance provider, LRQA. 100% of our ISO 14001: 2015 certifications cover the handling of waste and hazardous materials, including regular environmental impact audits and implemented risk prevention procedures (including emergency planning and testing) relating to waste and hazardous materials handling.

Where previously the decision to pursue ISO 14001 certification was taken at a local level, Group policy is now for all production sites to seek ISO 14001 certification.

We have 22 manufacturing sites certified to ISO 14001: 2015, representing 39% of sites controlled by Vesuvius (office spaces, customer locations, and warehouses are out of scope as waste and hazardous materials are not material at these locations). 52% of sites reporting hazardous and toxic waste have ISO 14001: 2015 certifications.

A list of certified sites can be found on p125 and may be viewed on the Vesuvius website: www.vesuvius.com.

Environmental awareness training

Environmental protection requires efforts from all parts of society, including government, companies and individuals. Vesuvius employees need to understand the main environmental risks in their site, and how to prevent and react in the case of incident. We also believe that it is important to foster the right behaviours inside and outside the workplace. Environmental awareness training programmes are therefore being developed in many of our sites, covering a wide range of topics, such as:

- Types and sources of pollution
- Scope 1, 2, and 3 CO₂ emissions
- Vesuvius policies and procedures
- Different categories of waste and how they should be handled
- Good behaviours to adopt inside and outside the Company

5,700

employees received environmental awareness training in 2022

Case study

Vesuvius Monterrey celebrates World Environment Day

Engaging our people in our sustainability agenda is critical to our success, and a key aspect of this is helping our people understand the challenges the world faces due to climate change.

In June 2022, Vesuvius Monterrey in Mexico celebrated 'World Environment Day' to raise awareness about climate challenges and generate discussion on what more we can do to improve the sustainability of our operations.



Supporting our customers' journey to net zero 51 ➤

Product safety and quality 57 ➤

Our technology helps our customers improve the operational performance of their processes and their environmental footprint.



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 CO₂ 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 CO₂ 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.

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



Supporting our customers' journey to net zero

Case study

Ladle lasers help increase capacity and reduce CO₂ emissions

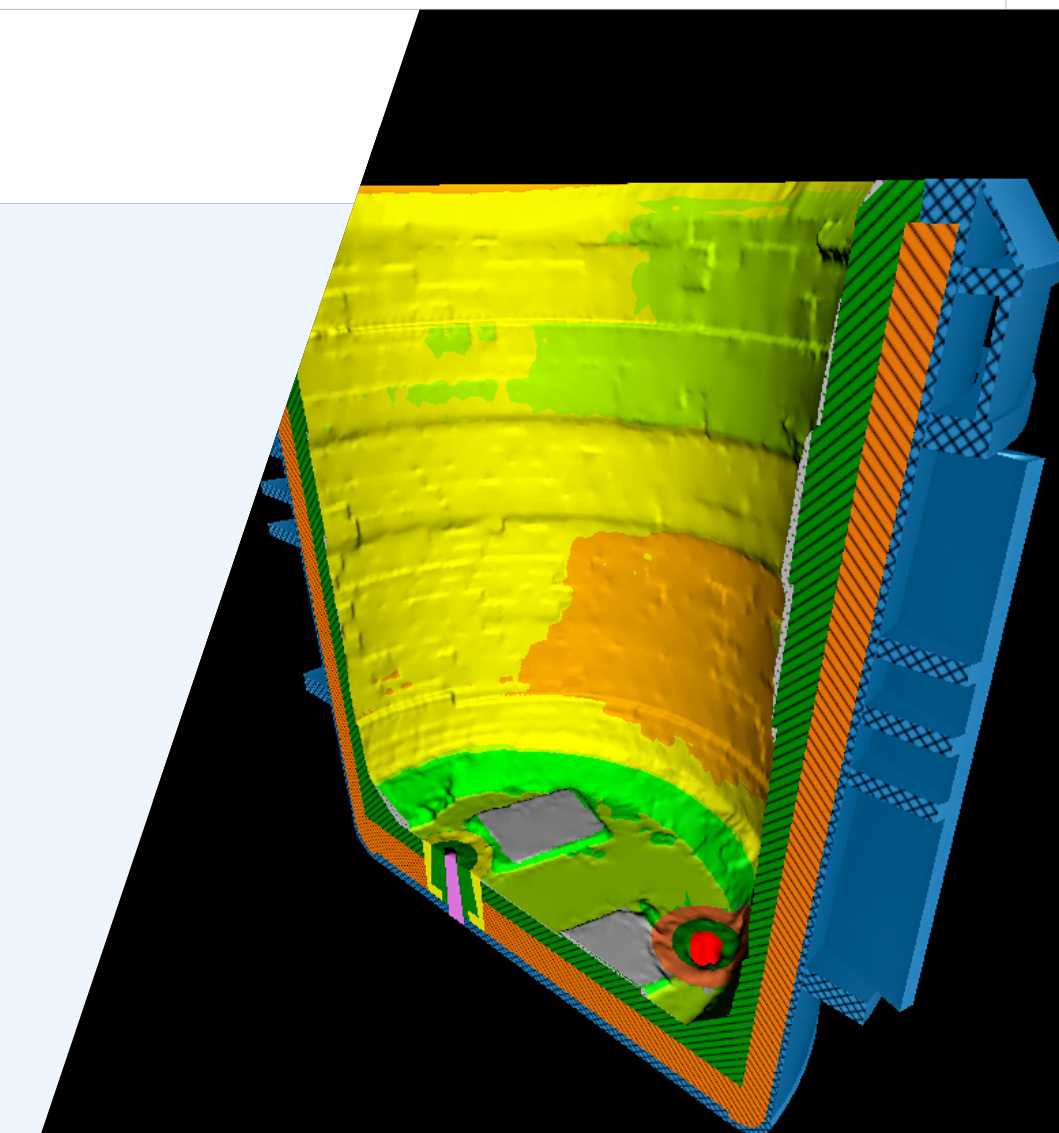
Vesuvius' unique combination of refractory expertise and digital technologies is key to improving our customers' process performance.

Our customer, a US-based Electric Arc Furnace steel plant, wanted to optimise their cost structure by extending the lifetime of their ladle refractory lining.

Our Process Metrix lasers allowed our customer to monitor the wear of their refractory lining heat after heat and determine how many more heats could be safely processed before repair or replacement was necessary.

As the ladle fleet was also the bottleneck of their production process, they were also able to create further value by using the wear measurement data to recalculate the available volume in each ladle after each heat, to maximise the quantity of steel per ladle.

This has delivered a steel production increase of 1.75% and a 5.7% reduction in refractory consumption per tonne of steel. On top of that, they also achieve significant carbon benefits with nearly a 0.9% reduction in CO₂ per tonne of steel, more than 6,000 tonnes of CO₂ emissions per year.



Supporting our customers' journey to net zero

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 CO₂ emissions and help our customers reduce their CO₂ 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.

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

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.

17.9%
of sales generated
by market-leading
sustainable products

Supporting our customers' journey to net zero

Case study

INSTA* coatings cut CO₂ emissions and costs for India foundry customers

An innovative approach to refractory coatings is offering foundry customers substantial CO₂ emission cuts and costs savings.

High quality refractory coatings are critical to the foundry process, ensuring defect-free cast surfaces and helping to reduce cost and the environmental footprint of the foundry through:

- Lower consumption rates
- Reduced drying energy requirements
- Reduced scrap and re-work
- Improved cast component operating efficiency and lifespan

Some customers asked Foseco to develop a solution to overcome environmental issues related to the use of non-returnable plastic packaging and the transportation of water that can account for up to 50% of the weight of the product.

Foseco developed the INSTA* coatings technology, a powder-based coating system that can be reconstituted within the foundry using specially designed mixing equipment.

The supply of a powder instead of a pre-prepared liquid coating eliminates the use of plastic buckets.

The powder volume, being approximately half that of a liquid coating, also results in reduced costs and emissions. Additionally, powder coatings have an increased storage shelf-life and are not affected by temperature variations.

In India in 2022, customers reported CO₂ reductions associated with the use of INSTA* coatings of nearly 2,000 MT, while eliminating approximately 78,000 plastic buckets.

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



Supporting our customers' journey to net zero

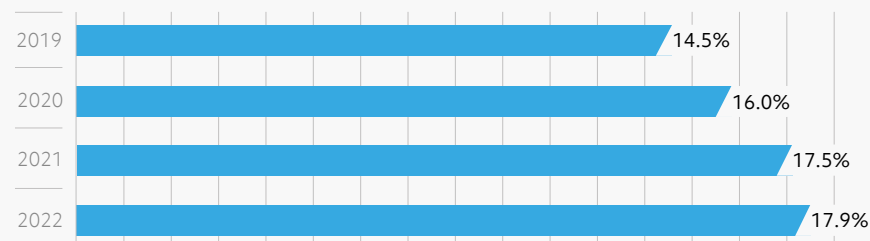
Using our internal product sustainability benefits scorecard we assess whether new products from our R&D have better sustainability characteristics than those already on the market – either from Vesuvius or from our competitors. Where we assess that they do, we consider these to be products with superior 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). These constituted 75% of our New Product Development projects. Our objective is to reach 100% of such products in the development pipeline.

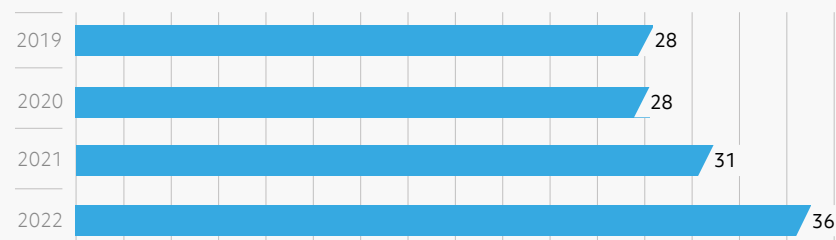
Vesuvius' investment in innovation and sustainability¹

	2022	2021
R&D spend	36	31
R&D spend dedicated to the development of market-leading sustainable products ²	8.1	9.7
%	23%	31%

% of sales generated by market-leading sustainable products²



R&D spend (£m)¹



1. At constant 2022 currency.

2. Using Vesuvius' internal scorecard.

In 2023-24, we plan to launch 41 new products (2022: 15), of which 25 will allow customers to achieve superior sustainability performance (2022: 11).

75%

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

Supporting our customers' journey to net zero

Case study

Increasing customer productivity and reducing their costs

Increasing customer productivity and reducing their operational costs are key aspects of the value we bring to our customers.

When a customer in South America presented the challenges they were experiencing with their Electric Arc Furnace (EAF), the Vesuvius Advanced Refractories team mobilised their expertise to understand and address the customer's issue.

The customer was producing seamless pipes using a technology that provides increased thermal efficiencies by improving productivity due to its cold charge method.

When they came to Vesuvius, they needed to increase their production campaign from their average of 15 days to 21 days.

First, the team evaluated the main wear mechanism and the EAF process that supported the demand. They then contacted our UK R&D experts to review the technology and quality of the products involved. After carrying out this analysis, the team focused its investigation on the wear and tear that the slag door suffers from the displacement of bricks.

The team then developed a novel slag door with a new assembly design that delivered improved door clamping by applying specially shaped 'jam bricks'.

The project was completed in a record four weeks. During subsequent tests the EAF reached its best mark of 453 heats in a production campaign of 28 days, producing 60,400 tonnes of steel, setting a record for our customer's operations and far exceeding the project's objectives.



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, CO₂ 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

Policy and governance

The Board oversees the Group's product safety and quality performance. Quality performance figures, along with all material product safety issues, are reported to the Board.

Responsibility for the safety and quality performance of our products lies with the Group Executive Committee. Product safety issues and quality performance are reported and discussed during each Group Executive Committee meeting.

As stated in our Quality Policy, we operate all work and business activities to ensure that the quality of our products and services consistently meets the requirements of our internal and external customers. We seek to be proactive in preventing customer issues, and to continuously improve our quality management systems and performance.



Product safety and quality

Case study

Innovative design takes our Tundish Spray Robot to the next generation

The increasing use of robotics in the steel-making process is improving safety and productivity for our customers.

Vesuvius already has a leading reputation for developing the Smart Tundish Spray Robot (TSR), known for its safety, consistency and reliability compared with manual spraying.

In 2022, Vesuvius launched the next generation TSR in our centre of excellence, Mechatronics, Ghlin.

The next generation TSR has the best features from previous models but with some new innovations, these include:

- KUKA/Siemens platform
- New Robot Code
- Cage/spray mixer station design
- Operator-friendly Vesuvius interface (this gives full control in robot spraying routines and parameter selection)

The implementation of our TSR at one customer significantly increased their tundish turnover as the TSR brings efficient space utilisation for the tundish lining bay, which is crucial to the success of the second phase of their expansion project, adding an extra 3.5m tons capacity.



Product safety and quality

New product development

Product safety is paramount to us. Our products – robotics, systems and consumables – are critical to the safety and quality of our customers' operators. 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.

Our automated and robotic systems are fully customised and embedded into our customers' processes. Their design and implementation require additional precautions to ensure optimum safety during the project and in operations. Teams working on their development and installation at customers' sites therefore receive targeted safety training focused on the specific risks at various project stages.

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. Development projects follow the ISO 10218-2 norm (Safety requirements for industrial robots). External expert consultancy support is provided along with regular audits, and all follow the rules required for CE conformity or equivalent regulation.

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.

Each of our product managers is tasked with responsibility for collecting feedback on our products and managing improvements. Routine debriefing is

organised after projects are completed. Field trial reports and incident reports are routinely reviewed to collect information on failures and improvement opportunities.

Regional Business Unit management teams are responsible for organising problem-solving teams to address issues and lead routine reviews of ongoing quality performance. Quality performance, including the number of customer complaints, the number of repeat complaints for the same issue and their severity, is reported to the Board on a regular basis, and reviewed during each Group Executive Committee meeting. The most serious issues and those that affect, or could potentially affect, multiple customers are reviewed in detail during these meetings. Adverse trends result in prompt, clearly defined initiatives to permanently solve issues and prevent repeats.

Along with our focus on the completeness and quality of reporting, a strong emphasis is placed on the effectiveness of our problem-solving. Our cross-functional teams involve sales, research and development, and manufacturing experts, who work collaboratively to address the most challenging technical issues.

Product safety and quality

Safety and quality in use – product feedback continued

Whenever relevant, subsequent changes made to the design of products are deployed to installations in service at other customers and lessons learned are incorporated into the design of following generations of products. We monitor the number of CCARs (Customer Corrective Action Requests), severity 1 CCARs (safety-related incidents or quality issues affecting the customer of our customer), and repeat CCARs.

These processes allow us to learn from problems, provide feedback for the development of future products and constantly evolve and update our services in line with changing customer expectations and technological developments.

Case study

Partnering with customers to improve shopfloor safety

Vesuvius' commitment to safety goes far beyond our own operations. We partner with our customers to improve safety on their shop floor.

In 2022, Vesuvius colleagues and teams received awards and praise from many of our customers in appreciation for the contribution our people make to safety.

One of our most valued customers, Ternium, has recognised our work to improve safety at their sites in Brazil and Mexico.

Ternium Brazil recently awarded Vesuvius 'Safe Supplier' status after a rigorous review that included audits, employee training and capability assessments, work environment review and equipment and tools inspections.

Ternium Mexico have also recognised our work to improve safety at their sites, awarding our Health, Safety and Environment Coordinator, Josué Zamor, their Best Industrial Safety Leader. Josué was selected after an evaluation process that involved hundreds of suppliers.

Our customer and Vesuvius' joint success is the result of routine cooperation on training, auditing, drills and continuous improvement activities.



Product safety and quality

Our goal is to reach zero product safety-related issues (injuries and dangerous occurrences). Product safety and quality targets are set by the Group Executive Committee on an annual basis.

In 2022, no product failures led to customer employee lost time injuries. In 2022, our teams recorded, reported, and investigated 14 (2021: 21) customer health and safety related issues: five minor injuries (two incidents involving burns, one involving two persons suffering chemical splashes, and one person tripping) and ten dangerous occurrences. These were fully investigated, and corrective actions implemented.

We were not notified of any non-compliance with regulations and/or voluntary codes concerning the health and safety impacts of products and services in 2022.

Excellence in problem-solving

Training

The 8D methodology is implemented as the primary problem-solving tool across the Group. It is a consistent approach designed to identify root causes and ensure appropriate corrective action is taken. The Group has developed its problem-solving capabilities through training and coaching in the correct use of the 8D practical problem-solving methodology. On a yearly basis, more than 2,000 problems are addressed using this technique.

8D – The eight disciplines of practical problem-solving

D1	Clarify the problem
D2	Grasp the current situation
D3	Contain & set target
D4	Analyse causes
D5	Define countermeasures
D6	Execute & track progress
D7	Check results
D8	Standardise & establish controls

In 2020, to spread the quality breakthrough practices and tools, we undertook a thorough assessment of the problem-solving capabilities and practices in each of our Business Units regionally, identifying the gaps and required actions to reinforce them where necessary, especially in terms of staffing and training. In 2021, we started implementing these plans despite the difficulties caused by the COVID-19 pandemic. Their deployment has continued in 2022, with over 400 employees receiving the 4-day 8D practical problem-solving training.

Recognition

An annual 8D Awards Competition is organised to recognise the best teams and projects. This competition is organised across all Business Units, in each region, with a jury composed of senior managers and sponsored by members of the Group Executive Committee.

In 2022, more than 110 projects were presented in the Regional 8D Competitions. In addition to recognising the best problem-solving and projects, these events are an opportunity to recognise talent and disseminate knowledge.



Product safety and quality

Regulatory compliance

Quality management system – ISO 9001 certification

Vesuvius places a high value on ISO 9001: 2015 certification and the business assurance that this quality management system brings. We have 63 certified Vesuvius and customer sites, employing quality professionals to maintain and develop quality systems under our Quality Policy. 100% of the management systems used to make our products are covered by ISO 9001: 2015. A list of certified sites is available to view on the Vesuvius website: www.vesuvius.com.

99.7% of products (by revenue) are covered by our ISO 9001: 2015 internationally certified quality management system.

99.7%

of our products are covered by our ISO 9001: 2015 internationally certified quality management system

REACH regulation

For the development and production of consumable products, we have implemented R&D screening of raw materials and chemicals to avoid introducing unwanted substances into the recipes and processes. Where potentially hazardous substances are nonetheless required, strict validation checklists have been defined to ensure adequate protection measures are taken at every step of the process. We document regulatory compliance through Safety Data Sheets for all raw materials consumed and all products manufactured, and share these with customers.

Our objective is to remain fully compliant with our registration obligations under the Registration, Evaluation, Authorisation and restriction of Chemicals (REACH) regulation.

Since 2007, Vesuvius has appointed REACH managers for its Steel and Foundry Divisions, implementing an ongoing process to identify the REACH-impacted raw materials based on their Safety Data Sheets. These substances are then monitored throughout the production process in Vesuvius. This also allows us to track the quantities consumed and verify that these remain within the limits of our registrations. Results are documented in a central database. We routinely organise training sessions for employees in the R&D, Sales, and Purchasing organisations to ensure that any new substance included in a new product recipe or otherwise purchased will be incorporated into our monitoring and registration process.

Updates to the lists of substances under REACH regulation issued by the European Chemicals Agency (ECHA) are continuously reviewed and our internal monitoring adapted whenever necessary. Vesuvius also monitors projected changes to the list of substances under REACH regulation, to proactively take into account future evolutions in our product development processes.

Whenever relevant, we also participate in the consultations led by ECHA to define the most appropriate status for substances.

We launched a programme of formal assessments of our suppliers, with an objective to assess all relevant suppliers of raw materials. In 2022, 200 suppliers were contacted, of which 78 (35%) have already answered. All but two are already complying with the UK and EU REACH regulations or have initiated the registration process.

Following the UK's departure from the EU in 2021, we adapted our registrations and purchasing organisation and systems to ensure that we remain fully compliant with our obligations both in the United Kingdom and in the European Union.

Health, safety and well-being at work	64 ➤
Health and Safety Policy	65 ➤
People and Culture	75 ➤

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



Our people



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.

Case study

Health and safety, our top priority

As Vesuvius aims to become a zero-accident company, the health and safety of our people must be our top priority. In India, our colleagues have been bringing that commitment to life with a broad range of programmes and activities.

Many of our safety initiatives are driven internally by management and often by the teams themselves. For example, our Puducherry Plant celebrated the 51st National Safety Week in March, with a range of activities to create awareness and continue to build our safety culture. An unusual and interesting initiative was an Elocution and Essay Competition, conducted by the Government of Puducherry, with the theme of Nurturing Young Minds to Develop Safety Culture and Safe Material Handling Practice in Factories.

We also work in close cooperation with local authorities and other stakeholders. At our Mehsana site the team focused on Fire Safety and Emergency Evacuation training that covered fire prevention, emergency preparedness and evacuation, rescue operations,

first aid and spill kit usage. Thirteen of our colleagues participated in an interactive workshop, an employee engagement activity that combined theory and practical application.



Health and Safety Policy

We will operate all work and business activities in a manner which ensures the physical and mental health and safety of employees, contractors, visitors, customers and any other persons affected by these activities.

We will comply with the legal health and safety obligations.

We will be proactive in preventing injuries and ill-health, and continuously improve our health and safety systems and performance.

Organisation and responsibilities

- We regard health and safety matters as a mainstream management responsibility. Executives and line managers are directly responsible for health and safety matters in operations under their control. Management is accountable for health and safety performance against objectives.
- All employees have a responsibility to take care of themselves and others whilst at work. We expect everyone to participate positively in the task of preserving workplace health and safety.
- We will encourage our suppliers to adhere to the same health and safety standards as we do.

Our beliefs

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

Our commitments

- We will abide by simple and non-negotiable standards.
- We will report transparently and thoroughly investigate any incident to learn, share, and avoid repeats.
- Risk assessments will be undertaken to identify hazards, prioritise any deficiencies and correct them in an appropriate way, as well as to develop appropriate safe work procedures.
- Every business facility will follow the agreed health and safety plans, committing to reduce the frequency and severity of injuries, improve workstation ergonomics, prevent exposure to hazardous substances, and minimise the risk of occupational diseases.
- We will ensure awareness about health and safety issues and provide training for all new employees and contractors, and then at least annually, to ensure that they understand their responsibilities and are able to act accordingly.
- Every business facility will have an appointed Health and Safety Manager.

Our aims

- No Accidents.
- No Repeat Injuries.
- No Harm to People.

Health, safety and well-being at work

COVID-19

The COVID-19 pandemic led to long periods of lockdown, remote work, and supply chain disruptions, during which all parts of the organisation demonstrated incredible levels of adaptation and commitment to our customers and the business. Building on Group guidance and support for vaccination, our management teams across all regions implemented a wide range of measures adapted to local circumstances, to keep our colleagues safe while on our premises and provide as much support as possible to those who were isolated and working remotely.

Due to the outstanding efforts of our colleagues around the world we were able to maintain service to our customers during these difficult times.

From the start of the pandemic until the end of 2022, c.4,300 of our colleagues were reported ill due to COVID-19. Tragically, 14 of them lost their lives.

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.

Safety performance remains the priority item on the agenda at all our Group Executive Committee and management meetings. The Group Executive Committee reviews all the more serious health and safety incidents, including all Lost Time Injuries (LTIs), and the responses to these from local management.

The Group VP Sustainability, HSE & Quality is responsible for setting the Group's policies for health and safety and controlling their application.

The Business Units are responsible for the implementation of these policies and are directly accountable for the health and safety performance of their operations, with each Business Unit determining its own priorities and resource allocations, aligned with Group-wide targets on safety performance.

A majority of senior managers has a portion of their variable compensation tied to the achievement of safety performance targets.

Health and safety governance

The Board

Overall responsibility for health and safety-related matters, approves targets

Chief Executive

Takes responsibility and is accountable for the safety performance of the Company, sets targets

Vice President Health and Safety

Defines standards, organises Group safety audits and benchmarks and guides strategy

Business Unit Presidents

Are responsible for resources, training, action plans and performance

Health, safety and well-being at work

Safety leadership

Since 2018, Business Unit Presidents and Regional Business Unit Vice Presidents have been made fully accountable for their safety performance. At a Group level, policies and standards are regularly reviewed and refreshed whilst Group Safety Audits are made against the policies and standards with the close involvement of the Site Managers. To enhance behavioural safety, Executive Safety Tours, Safety Tours by senior management and Local Safety Audits are carried out and performance is measured and reported monthly.

Safety Tours are also undertaken in customer locations including both those where Vesuvius has employees and others where requested by customers, who recognise the benefit of a third-party perspective on safety.

80%

of all employees participated in safety audits every month

All site management teams must develop and implement site safety improvement plans, incorporating the identification and reduction of the site's main risks, compliance with the Group safety standards, deployment of shop floor safety leadership practices and resolution of issues highlighted during Group safety audits. Improvement plans are now in place for all production sites, with implementation being the direct responsibility of local managers.

Any site experiencing a severe incident, an LTI, a medically treated injury, or a serious dangerous occurrence is required to investigate the incident. Vesuvius' investigation procedures are based on the 8D practical problem-solving tool, which aims to identify the true root causes of incidents to prevent a repeat. Results are formally presented to management, with details of the 8D-based root causes. The site then incorporates the findings into their site safety improvement plans and shares its incident investigation so that improvement actions can be cascaded throughout the organisation.

Every business facility has an appointed health and safety manager, who works with management and all employees to review site health and safety, assess training needs and develop and implement site safety improvement plans. These local health and safety managers are assisted by central experts who not only identify adverse trends and respond to them, but also enable the sharing of best practice across Vesuvius.

The LTI frequency charts prepared monthly for each Business Unit and site show where injuries have been reduced and where further effort is required, through a combination of a behaviour-based approach to safety and the implementation of physical safeguards. We focus on the safety of all personnel, whether they are employees, third-party contractors or visitors.

Based on the analysis of the type of accident, type of injury and parts of the body affected, the businesses develop risk-based action plans that consider both the frequency and severity of incidents and track progress. Every site management team receives a monthly dashboard of health and safety-related performance indicators, covering both lagging and leading metrics.

Employee participation in safety leadership is key. It is evidenced through the participation in safety audits, and involvement in joint management worker health and safety committees. In 2022, on average 80% of all employees participated in safety audits every month.

In 2022, almost 8,100 employees in manufacturing sites representing 73% of the total workforce across all locations) were represented in formal joint management worker health and safety committees.

Our employees are highly supportive of the Group's efforts to improve workplace safety and acknowledge how seriously we take this issue. In the 2022 I-Engage employee engagement survey, 86% agreed that the Company would address safety concerns if they were raised (vs 83% in 2021).

Health, safety and well-being at work

Occupational health and diseases

Vesuvius has developed and implemented a variety of programmes to ensure that we provide our employees with work conditions that are not detrimental to their health. These include the routine monitoring of noise, dust levels and volatile organic compounds emissions.

Occupational health and personal safety management is blended at all of our sites. Occupational health hazards are covered in risk assessments. We provide occupational health services that are relevant to hazards and risks to which employees and others are exposed at our operations (e.g. forklift drivers), such as routine health check-ups.

In line with our values, and our commitment to employee engagement, benefits including access to healthcare and medical support are managed locally in accordance with local laws.

Directly supervised contractors are treated the same as employees.

73%

of the total workforce are represented in formal joint management worker health and safety committees

Employee well-being

We recognise that ensuring the well-being of our employees goes beyond the provision of safe working conditions and the prevention of occupational diseases. In line with our decentralised organisational principles, individual sites are encouraged to provide their staff with additional mental health and well-being support.

As a result, in 2022, various programmes were initiated, including burn-out prevention training (Belgium), mental health workshops (Brazil), nutrition sessions (Egypt), an employee financial and legal assistance programme (Poland), hybrid working arrangements to encourage work-life balance (USA), and family medical leave to care for sick children (USA).

Safety Standards

Over the years, Vesuvius has developed a set of 34 Safety Policies and Standards. These are regularly reviewed and updated, based on the best practices implemented in sites and learnings from incidents in particular. The Group Safety Audit checklist is designed to cover the essential points of the Group Safety Policies and Standards.

The list of Standards can be found in Further information on page 126.

Risk assessments and high-risk activities

We routinely carry out risk assessments to identify and rate hazards and implement protective measures to minimise exposure.

These include:

- Engineering solutions to eliminate or minimise risks
- Procedural measures, such as training and auditing
- Work instructions, written with the involvement of the employees who carry out the tasks, with illustrations and in local languages
- Providing personal protective equipment to employees free of charge

Emergency preparedness

Using risk assessments as a basis to identify and rate possible risks, our manufacturing sites build procedures, which can cover a variety of incidents (injury, fire, weather events, earthquake etc.) and train teams to respond optimally in case of emergency. Emergency procedures are routinely tested via drills and exercises, sometimes organised jointly with the local fire departments.

Almost 1,200 employees are trained first aiders (to address injuries and health issues) and more than 2,300 are first responders (in case of fire, chemical spill, confined space rescue, foreseeable emergency scenarios).

Control of contractors

Contractor management is a particularly important area of attention, as it involves employees of third-party companies working on our premises to perform various types of project work. Vesuvius has defined strict rules which are outlined in the Control of Contractors Standard. These rules include operating guidelines such as a pre-screening for safety performance and risks before a contract is signed, a commitment to respecting the same safety standards as Vesuvius employees and a safety induction for all contractor employees on Vesuvius sites. The presence of all contractors on site is registered. All activities subject to a Permit to Work are audited on a daily basis.

Safety performance targets for contractors are set at the same level as for Vesuvius employees. Contractor safety management and performance is monitored and reported with employee safety performance.

Health, safety and well-being at work

Core Safety Rules

In 2019, we launched the Vesuvius 8 Core Safety Rules that outline our colleagues' basic safety responsibilities. These were rolled out across the organisation as the mandated practices for employee and manager conduct. In conjunction with this, the Group has implemented procedures to ensure the rules are followed. The rules were incorporated into the contractual terms of all relevant employees, and all employees are expected to report breaches and violations of the rules, with appropriate sanctions imposed whenever required. Failure to do so is a disciplinary issue.

8 Core Safety Rules



1. I always wear mandated personal protective equipment



2. I only operate equipment or vehicles if trained and authorised



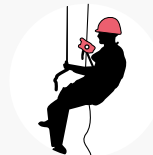
3. I do not remove, bypass or tamper with machine guarding and safety devices



4. I lock, tag and try before any intervention on a machine



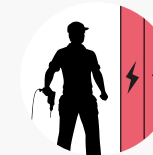
5. I make sure all high-risk activities are covered by a daily Permit to Work



6. I always ensure my fall protection is secure before working at height



7. Before entering a confined space, I check I will be able to breathe and escape



8. I only perform electrical work if certified and authorised

Customer locations

In line with our safety priority, we have spent decades improving systems, processes and technology at our sites to protect our people at work. We also apply the same safety standards for our teams working at customer locations.

Our Customer Location Standard addresses the specific risks faced by our employees whilst operating in customer locations and applies to approximately 3,100 Vesuvius employees worldwide. The Standard focuses on structuring cooperation between our customers' management teams and our own to ensure health and safety issues are jointly identified and addressed.

For new contracts in customer locations, we use a formal risk assessment which aims to identify significant risks to our employees and contractors. This enables appropriate control measures to be agreed and implemented with the support of our customers in advance of work commencing. These are then formally included in the contractual conditions we impose when working at a customer site.

Health, safety and well-being at work

Process Safety

In 2020, Vesuvius launched a new Process Safety initiative, starting with an analysis of the high-risk processes in the Company, the elaboration of a global process safety framework and a first technical standard covering high-pressure isostatic presses.

In 2021, whilst this standard was being rolled out, we developed our second process safety standard, covering dust and explosive powders, whose deployment was initiated in 2022.

Housekeeping

The continuing use of 5S, the workplace organisation method, throughout the Group has driven significant improvements in our workplace environment. Employees are encouraged to develop ownership of their working areas and take pride in their cleanliness and organisation. The added support of our lean specialists has been key to improving plant safety by removing hazards for employees and offering a clean, bright and safe working environment. Regular 5S audits led by team leaders ensure continuous improvement of working conditions and promote a safer workplace.

In 2022 we reviewed and issued an updated version of our housekeeping standard.

Safety training

Our proprietary TurboS training is a part of the Group's Safety Breakthrough initiative, which was instigated in 2008. It pulls together all of our safety management practices, and includes a strong focus on the standardisation of all of our repetitive activities. TurboS also integrates good management practices in the workplace, with a strong emphasis on developing an organisation that enables everybody to work to the same high standards in safety performance.

The TurboS training pulls together all of our safety management practices. Using a train-the-trainer approach, TurboS training sessions are tailored to the audience and their activities. For example, there is a special training course developed for employees at customer locations that focuses on the specific risks faced by these individuals.

We regard the understanding and application of the Group Safety Standards by management and all employees as essential to ensure their proper implementation on the shop floor and ongoing adherence. We therefore expect our managers to carry out compliance self-assessments for their sites based on the Group Safety Audit checklist and invest in the training of employees on the HSE standards. In 2022, more than 8,900 employees (representing 81% of the total workforce) received more than 100,000 hours of training on safety standards and safety leadership (TurboS), representing on average, more than 9 hours per person. In addition to the training on Group Safety Standards and TurboS, Business Units and sites develop and offer programmes addressing the specific processes and risks. Communication and training on hand safety and ergonomic practices have been major areas of recent focus.

The list of Safety training programmes can be found in Further information on page 127.

9 hours
 of safety training per
 person in 2022

Health, safety and well-being at work

Safety auditing

Executive Safety Tours

This tone from the top is also demonstrated by the requirement for all senior managers, irrespective of discipline, to perform Executive Safety Tours, report on their findings to local operations management and follow up on improvement requirements. In this structure, all employees understand that they have a responsibility to take care of themselves and others whilst at work. Through this process, we expect everyone to participate positively in the task of preserving workplace health and safety. The tours encourage dialogue with staff, setting action points for discussion and implementation. In this way, these tours provide visible safety leadership on the shop floor in our sites and at our customer locations. Along with our daily safety audits, they are a central pillar of our Safety Breakthrough initiative.

209

Executive Safety Tours carried out by top management

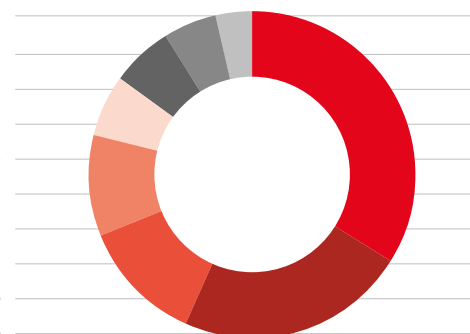
Executive Safety Tours

■ Europe: 71
■ NAFTA: 48
■ South America: 25
■ China: 21
■ South America: 13
■ Australia/New Zealand: 13
■ North Asia: 11
■ South East Asia: 7

Total: 209

In 2022, 209 Executive Safety Tours were carried out by members of the Group Executive Committee and their direct reports. This represented an increase from the 80 conducted in 2021, primarily because of the lifting of travel restrictions imposed by the COVID-19 pandemic. In 2022, 14 Executive Safety Tours were conducted at Customer Locations (2021: none), enabled by the relaxation of travel and customer COVID-19 visitor restrictions.

The number of Safety Tours conducted by middle management increased significantly in 2022 to 617, of which 102 were in customer locations, (2021: 287 of which 21 were in customer locations), assisted by the introduction of a mobile app to enhance the process and a Company-wide training programme.



Groupsafety 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.

Travel restrictions due to the COVID-19 crisis prevented the team from completing the full 2022 audit plan of inspection visits. Instead, the remote assessment programme developed in 2020 was used to reach sites that could not be physically audited. These assessments were carried out via videoconferences, during which the site management team presented the progress made in the implementation of Group safety standards and improvement plans for the coming months. In 2022, we carried out 34 remote assessments.



For additional details on our safety performance, see Further information

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Health, safety and well-being at work

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.

In 2022, 30 LTIs were reported (2021: 29) which resulted in 1,642 lost days (2021: 1,778) giving the LTI frequency

rate for the year of 1.08 (2021: 1.06) per million hours, and a severity frequency rate of 59 days lost (2021: 65). In 2022, 113 Recordables were reported (2021: 123), resulting in a recordable frequency rate of 4.0 (2021: 4.5) per million hours. In 2022, 184 MTIs were reported (2021: 200) out of a total of 512 injuries reported (2021: 629), resulting in an MTI frequency rate of 6.6, (2021: 7.3) per million hours. Vesuvius includes third-party contractors and visitors in reporting.

Main types of work-related injury

In 2022, the main causes of work-related injuries were, in descending order of frequency: handling, lifting, or carrying; slips, trips and falls; and contact with moving machinery. The main injuries suffered were, in descending order of frequency: contusions, sprains and strains, lacerations, grazes and fractures. The main body parts affected were, in descending order of frequency: hands and fingers, upper limbs, lower limbs and feet. Based on this incident data, targeted campaigns are being launched by the Business Units.

1.08

Lost Time Injury
Frequency Rate



For additional details on our safety performance, see Further information

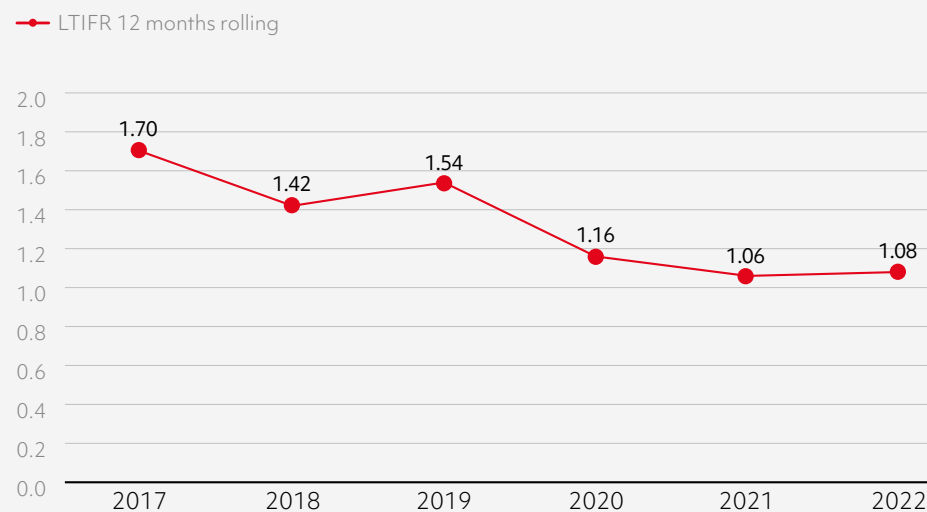
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Health, safety and well-being at work

Dangerous Occurrences

Vesuvius Dangerous Occurrences include all non-lost time and non-medically treated injury incidents and incidents with and without actual damage whether work related or not. Since 2021, there has been renewed emphasis on the reporting of dangerous occurrences and injuries so that root cause analysis can be undertaken, and preventative action plans implemented to prevent future occurrences. Consequently, there was an increase in the number of Dangerous Occurrences reported in 2022 to 2,536 (2021: 1,200; 2020: 779). Out of the Dangerous Occurrences occurring in 2022, the more serious 10% that could have resulted in a severe accident also required a full 8D report, the remainder being dealt with via line PPS (Practical Problem Solving).

Lost time injuries per million hours worked



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



For additional details on our safety performance, see Further information

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Health, safety and well-being at work

Safety awards and recognition

In addition to our efforts to keep our employees and contractors safe, we take pride in sharing our safety management practices with our customers. We are very proud of the external recognition received by our teams for their safety leadership and achievements. Some of the awards received in 2022 included:

Czech health award

Our Czech team received a 'Podnik podporující zdraví' (Corporate Health Encouragement Awards) in recognition of their work to promote the health and safety of our colleagues.

Ternium Safe Supplier Brazil and Mexico

Vesuvius was recognised as a 'Safe Supplier' by Ternium in Brazil and our colleague Josué Zamora was personally recognised as their Best Industrial Safety Leader at Ternium Monterrey.

Contractors safety in India

The Vesuvius Team at TSLJ achieved a four-star rating in Contractor Safety Management (CSM) and received a certificate of appreciation. Our team at AMNSI were awarded first place for an HSE perpetual trophy for Best Safety Performance.

Vesuvius Thailand wins TATA's highest 5-Stars safety award

In 2022, Vesuvius Thailand received 5-star safety awards for two of TATA's sites where our colleagues were recognised for excellence in the planning of safety systems and processes, the implementation of the system and safety procedures and Zero LTI (lost time injuries) in the last year.

China recognised for refractory materials safety

Our customer in Shaoguan, China, recognised refractory material safety. The customer's evaluation of refractory material safety delivered two awards recognising the excellent cooperation between Vesuvius and our customers.

Vesuvius Safety Awards

Vesuvius has also created internal Safety Awards, to recognise its best performing locations. In 2022, we distributed Safety Awards to 11 regions, as recognition of their outstanding performance in the previous year. These regions each completed 2021 without recording a Lost Time Injury, recorded a participation of more than 80% of employees in monthly Safety Audits, and implemented more than ten improvement opportunities per person per year.

Looking forward

We are determined to continue our journey to zero accidents. Learning from past incidents, we will strive to reduce the number and severity of injuries by focusing on both pillars:

People development and behaviours

- Training and auditing
- Core Safety Rules
- Safety days

Equipment and activities

- Lifting and handling
- Machine guarding
- Process safety

ISO 45001: 2018 certification

We have 5 manufacturing sites (representing 9% of our manufacturing sites), 1 warehouse and 3 Vesuvius operations in customers certified to ISO 45001: 2018, representing 8.1% of total employees. Vesuvius sites choose to certify based on local regulatory and customer requirements. A list of certified sites is available to view on our website: www.vesuvius.com.



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.

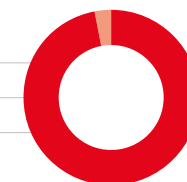
We seek to develop outstanding people. We ensure our people managers have what they need to lead their diverse, engaged and high-performing teams for business and personal growth. These goals are strongly underpinned by a values-driven, winning culture that embraces diversity of thinking and continuous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

Distribution of Vesuvius employees by category

	2022	2022 (%)
Direct employees	10,837	97%
Agency employees	297	3%

In addition to the headcount figures above, Vesuvius employed the services of 191 contractors and consultants in 2020, 134 in 2021 and 222 in 2022 to work on specific short-term projects.



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

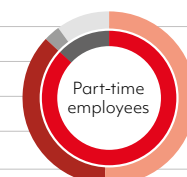
	Full-time employees	Full-time employees (%)	Part-time employees	Part-time employees (%)
Permanent salaried	4,391	99%	48	1%
Permanent hourly	5,939	100%	12	0%
Total Permanent	10,330	99%	60	1%
Temporary salaried	86	97%	3	3%
Temporary hourly	649	99%	6	1%
Total Temporary	735	99%	9	1%



2022 Distribution of Vesuvius employees by gender

	Full-time employees	Full-time employees (%)	Part-time employees	Part-time employees (%)
Permanent female	1,481	98%	35	2%
Permanent male	8,849	100%	24	0%
Total Permanent	10,330	99%	60	1%
Temporary female	160	99%	2	1%
Temporary male	479	99%	7	1%
Agency generic group ¹	96	100%	–	0%
Total Temporary	735	99%	9	1%

1. Gender information not available.



People and Culture

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.

40
countries

71
nationalities

11,000
employees



People and Culture

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

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

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

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

People and Culture

Living The Values Awards 2022

Our CORE Values are central to the culture we are building at Vesuvius. By living these values, we will create a truly entrepreneurial culture that focuses on the needs of our customers. One of the ways we encourage and recognise colleagues who display our values is our annual regional and global Living The Values Awards. Winners of each of the regional categories are nominated for the Global Awards. The results of the 2022 awards were announced at a special online ceremony in December 2022. Chief Executive, Patrick André, paid tribute to all the finalists, noting that they each provide a remarkable example of what can be achieved by being true to the CORE Values.

People and strategy

Outstanding business

Critical skills and capabilities to win

Outstanding people

Capable managers leading diverse, engaged and high-performing teams

Outstanding function

Teaming up with the business to solve their biggest people issues

Winning culture

Embracing diversity of thinking and continuous innovation to achieve high levels of performance and growth

Global Living The Values Awards winner:

Courage

Kateryna Vovchenko, Serhii Pavlov, Roman Klimenko, Oleg Zalivako, Yuri Sutormin
Cross Business Unit Team, Dnipro

The whole of our team in Ukraine were nominated for the courage they showed during the first months of the conflict, taking care of each other alongside continuing to assist our customers.

Global Living The Values Awards winner:

Ownership

Lawrence Qi
Advanced Refractories, Bayuquan, China

When COVID-19 broke out again in March 2022 in Bayuquan, the city was locked down. Laurence lived in the plant with 33 employees for the duration of the lockdown. Under his management, he ensured the safety of our staff and maintained the running of the plant, ensuring we were able to continue to supply our customers.

Global Living The Values Awards winner:

Energy

Jenny Danker
Assistant HR Manager, Flow Control, Kolkata

Jenny has been working for Vesuvius Malaysia for more than 20 years and in that time has recruited most of the current 98 colleagues at her site. Everyone looks up to her for her wisdom, motivation and sense of humour, and appreciates her calm and trustworthy nature.

Global Living The Values Awards winner:

Energy

Moisés Miranda, Eduardo Duarte, Paulo Teixeira, Danilo Pinheiro, Thiago Pereira, Flávio Vignoli, Lucio Macarenhas, Hebert Gabri, Pedro Cardoso, Jeremy Wanlin, Laurent Criquillion, Matthieu Lhoir, Vincent Leroux and Leandro Cesar
Flow Control, Rio de Janeiro, Ghlin and Pittsburgh

During the commissioning of a critical robot ladle shroud manipulation in Brazil, an accident caused damage to the robot cables. The team demonstrated a huge sense of energy in pulling out all the stops to get the robot working as quickly as possible.

People and Culture

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 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.

20%

Women now represent 20% of our senior leadership group compared with 15% in 2019. We aim to reach 25% by the end of 2025

People and Culture

Case study

Diversity makes better business

Vesuvius wants to increase the proportion of women at all levels of our organisation.

As a company, we believe that a diverse workforce strengthens an organisation in many ways, including a wider talent pool, greater innovation and creativity and a better understanding of our customers. Our ambition is to increase women's access to more varied roles and remove barriers to career advancement.

Change starts at the top. In the past three years we have made visible progress in gender diversity in our senior leadership. Women now represent 20% of our senior leadership group compared with 15% in 2019. We aim to reach 25% by the end of 2025.

It's not just about the numbers. It is also about making it work. At the beginning of 2022, our team in Skawina, Poland, set out to identify the challenges our female colleagues were facing in their current roles and career development.

The team organised workshops that focused on a range of topics including:

- Recognising discriminatory situations and behaviours
- Increasing the ability to assertively react to discriminatory behaviour
- Increasing the ability to provide support to other women in the organisation

The workshops were a huge success, with participants becoming Diversity Ambassadors to lead the ongoing discussions about the value of diversity in our business.

While the proportion of women in our company has been growing, in 2022, women represented only 15% of our total headcount. It will take time, but we are determined to keep growing the proportion of women at every level of our company.



People and Culture

In 2022, various local training initiatives were launched to support diversity and inclusion. Examples include assertive communication and anti-harassment training programmes held in Brazil and the USA, sexual harassment awareness town halls in Malaysia, unconscious bias awareness training in Australia and New Zealand, and gender inclusion workshops in Poland.

A wide range of actions are being launched around the world, including flexible working arrangements (Germany, USA), improved maternity and paternity leave provision (China, India), gender pay gap reviews (Malaysia), and a diversity ambassadors programme (Poland).

As a part of community engagement to encourage girls into STEM, Vesuvius Poland and Vesuvius India have been actively engaging with local schools and colleges, presenting career opportunities in engineering and technology. Vesuvius France successfully attracted 20 candidates of all genders following their young engineer forum entitled 'Forum Industrie Emploi'.

Our actions for the promotion of diversity and inclusion were recognised through various awards. Amongst them, our plant in Suzhou (China) received an award for being the best employer for caring for female employees, and the programme developed in Wurtland (USA) to support people re-entering the workforce after various hardships also received recognition.

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 Managers²	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.

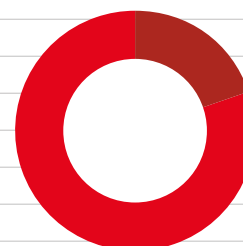
2. Senior Managers as defined for the purposes of Section 414C(8)(c) includes directors of the Company's subsidiaries.

	Women	Men	Women	Men
Americas	509	2,835	15%	85%
Asia-Pacific	344	3,204	10%	90%
EMEA	823	3,419	19%	81%
Total	1,676	9,458	15%	85%

Senior Leadership Group %

■ 20 Women

■ 80 Men

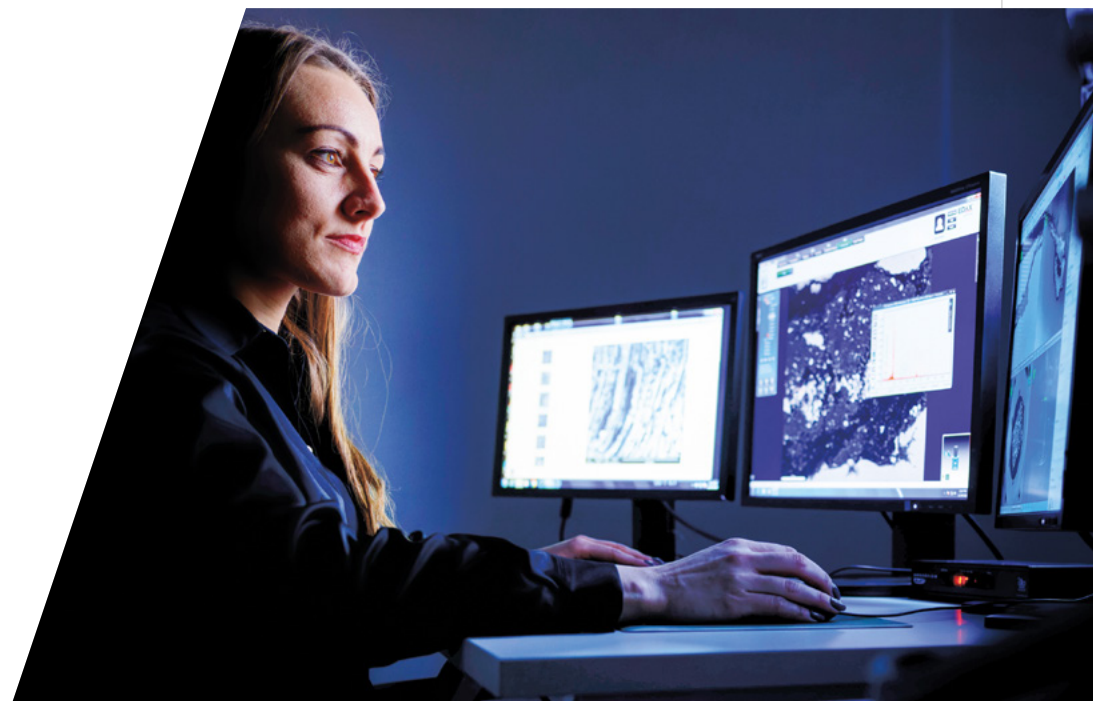


People and Culture

Supporting women and girls in STEM (Science, Technology, Engineering and Mathematics)

Vesuvius is focused on supporting women and girls to advance in engineering, technology and other highly technical fields. In 2022, the Group launched the following initiatives and partnerships:

- Vesuvius India developed a scholarship programme for underprivileged girls to pursue a Bachelors degree in Engineering from the National Institute of Technology. The programme currently sponsors nine students studying Chemical, Metallurgy and Mechanical Engineering.
- Vesuvius India partnered with CRY (Child Rights and You) to implement the 'Educate the Girl Child' project which encourages and motivates girls to pursue higher education in technical fields. The project is sponsored by Vesuvius in Kolkata and was successful in reducing the number of school drop-outs by 545 in the local area. 25 students recently visited our Kolkata plant to understand our organisation and products. Due to the overwhelming response, it is planned to expand the project in 2023 to six customer location sales sites, with an aim to support a further 600 students.
- Vesuvius Poland partnered with the Faculty of Materials Science and Ceramics of the University of Science and Technology in Krakow, to host workshops with a local high-school to inspire students in education and career opportunities in STEM. Vesuvius Poland also sponsored ten female interns for 12-month internships in technical departments at our plant in Skawina.



People and Culture

Case study

Celebrating diversity on International Women's Day

In March 2022, colleagues from around the world came together to celebrate International Women's Day and the achievements of women everywhere.

International Women's Day is a globally celebrated event recognising the social, economic, cultural and political achievements of women and the positive impact of diverse perspectives in the workplace.

The campaign theme for International Women's Day 2022 was #BreakTheBias. Whether deliberate or unconscious, bias makes it difficult for women to move ahead. Knowing that bias exists isn't enough. Action is needed to level the playing field.

Our Flow Control EMEA team ran a virtual event covering several subjects, including various areas of women's health and well-being at work.

In Mexico, our Monterrey site celebrated with a special lunch, talks on various subjects and gifts.

In Poland, our Skawina site produced a superb video highlighting the strength, determination and intelligence of women on site.

In Australia, our Port Kembla colleagues recognised the incredible contribution of women at the site with some special gifts and thank-you cards.

In London, colleagues raised funds to support women and girls in STEM education and elsewhere there were talks, breakfasts and testimonials on social media.

Global ambition, local actions

Around the world, initiatives are taken by our teams to develop gender diversity.



People and Culture

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%	49	1%
Permanent hourly	5,939	100%	12	0%
Total Permanent	10,330	99%	61	1%
Temporary salaried	85	97%	3	3%
Temporary hourly	649	99%	6	1%
Total Temporary	734	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.

Permanent employee turnover per region

	2022 turnover (%)	2022 voluntary turnover (%)	2021 turnover (%)	2021 voluntary turnover (%)	2020 turnover (%)	2020 voluntary turnover (%)
Americas	20%	10%	20%	10%	18%	6%
Asia-Pacific	11%	9%	16%	14%	12%	10%
EMEA	11%	7%	12%	9%	14%	6%
Total	14%	9%	16%	11%	14%	7%

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.

People and Culture

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 made up of representatives from the 13 European countries in which we operate. The new EWC Agreement will be registered in and operated under Polish law, as the representative country of Vesuvius plc, following the departure of the United Kingdom from the European Union.

When a new EWC Agreement is signed, and the Council constituted, European management will expect to meet the EWC formally at least once a year. At this meeting, management will provide an update on the performance of the business, with a focus on the developments likely to impact European employees.

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.



73%
of employees represented
by Collective Agreements

People and Culture

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. Of these external hires, 30% were female. 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, and 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. Compliance, Data Protection and Cyber Security training are all accessible via the LMS. In 2022, we continued to expand the available courses held on the LMS.

During the course of our activities, we may collect, store and process personal data about our staff, customers, suppliers and other third parties and our Data Protection Policy recognises our commitment to treating this data in an appropriate and compliant manner. Specific data protection training through e-learning is a mandatory training course for all employees with email access.

28%
 of middle and top
 management vacancies
 filled by internal candidates

People and Culture

Case study

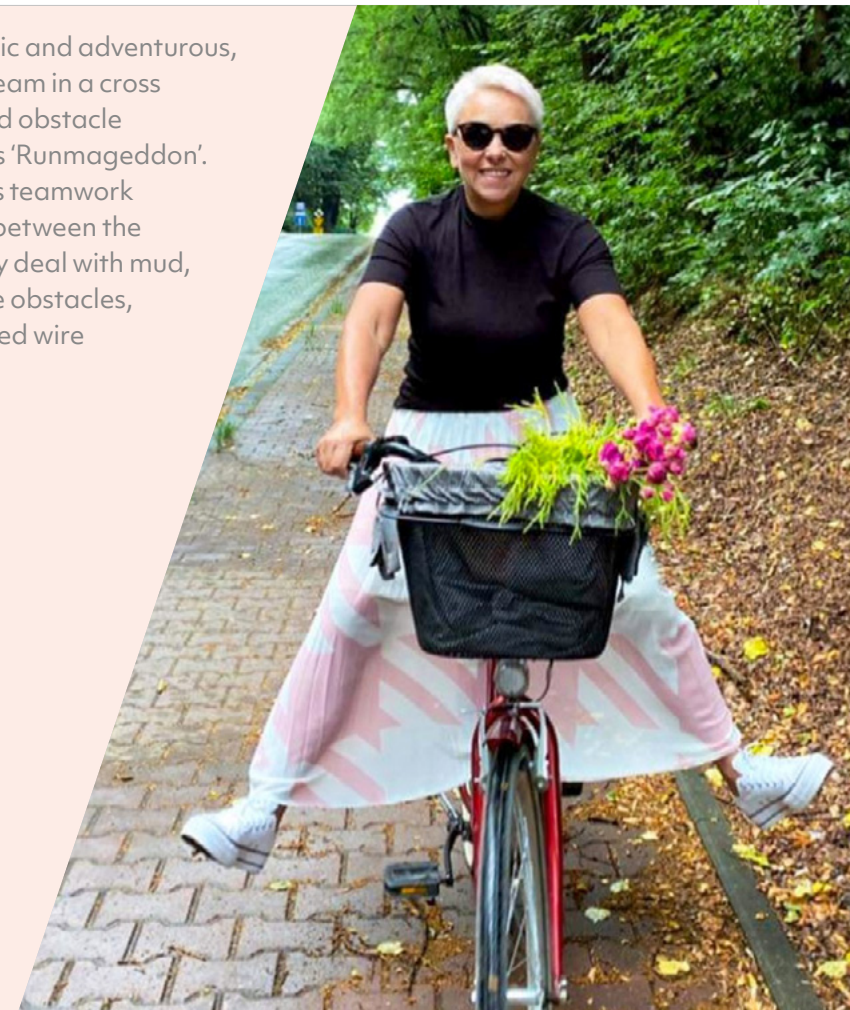
Promoting health and well-being among our colleagues

Vesuvius is committed to promoting health and well-being among our colleagues and our teams around the world organise a range of initiatives to support this objective every year.

Our site in Skawina, Poland, has chosen to focus on our colleagues' fitness in 2022, developing a wide range of initiatives to support active and healthy lifestyles.

One of the most popular and effective activities was a cycling challenge with colleagues encouraged to both ride to work and use their bicycles more in their everyday lives. Colleagues recorded their distances on a shared database, and those who cycled the furthest and most often received some cycling-related prizes.

For the more athletic and adventurous, the site entered a team in a cross country running and obstacle challenge known as 'Runmageddon'. The course requires teamwork and collaboration between the participants as they deal with mud, icy river water, rope obstacles, vertical walls, barbed wire and trenches.



People and Culture

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 any time, anywhere.

In 2022, our main focus was to increase the understanding of our products and business across all levels of the organisation and increase our commercial capabilities.

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.

HeaTt module 2 was launched on the LMS in October 2022, comprising 23 chapters of training material. The course is divided into three sections; the first explains the process of producing iron and steel, the second explains the different refractory products and the third section details how these products are applied in the iron and steel manufacturing processes. Module 2 encompasses products from Advanced Refractories, Flow Control, and Sensors and Probes.

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.

People and Culture

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.



Compliance training provided during 2022 included:

- An annual mandatory e-learning module for Anti-Bribery and Corruption, available in 22 of our functional languages
- Webinar and face-to-face training hosted by the Compliance team to staff at several sites covering Anti-Bribery and Corruption, Speak Up and trade sanctions
- Updated face-to-face training for senior management on the overall compliance framework and process for policy and procedure implementation and monitoring
- New Senior Manager compliance induction training – all new senior leaders receive dedicated training from the Compliance Team. This induction contains training and guidance on all relevant Compliance policies and procedures.

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.

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. Supported by our online people management platform, 'myVesuvius', annual performance reviews and subsequent reward decisions are based not only on how employees have performed against their individual objectives but also on assessments of behaviour and commitment to our CORE Values.

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.

Currently 444 employees participate in the global Annual Incentive Plan (AIP). Eligibility for participation is based on job grade and is subject to approval by the Chief HR Officer. The AIP structure is based 80% on Company performance and 20% on performance against employees' personal objectives. In addition, 243 of these employees participate in various forms of share-based incentives.

98%

of salaried permanent employees undertook an annual performance review

People and Culture

53% of our permanent employees worldwide, both salaried and hourly, have a variable performance-based component to their pay through various local incentive schemes. The BU Presidents and Regional VPs are responsible for the target setting and the pay-out approval of these local plans.

Non-compensation benefits including retirement benefits are managed locally in accordance with local laws.

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

53%

of permanent employees have a variable performance-based component to their pay

A responsible company	92 ➤
Community engagement	97 ➤
Responsible sourcing	99 ➤

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



Our communities



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. We are particularly conscious of the need to support the communities in which we operate.

Governance and policies

The Board is responsible for setting the culture and values of the organisation. The Group Executive Committee is responsible for implementing the culture and values, including ethics-related matters.

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.

Child labour and forced labour were included in the Group Safety Audit team's scope in 2022. These inspections are carried out on site. If any breach is suspected, the VP HSE is immediately informed for further investigation. All manufacturing sites are included within the scope of these audits, with an aim to audit them once per year. 65 audits were carried out in 2022, with no breaches being identified. 48 manufacturing and R&D sites (79%) were covered by these audits.

These audits, along with the feedback from the Speak Up whistleblowing process, inform the Group of potential human rights risks within its operations.



A responsible company

Prevention of slavery and human rights 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 ➔

Case study

Supporting underprivileged children in India

As part of their ongoing Corporate Social Responsibility programme, colleagues from our Foseco Puducherry site in India devote time and energy to supporting children from underprivileged backgrounds.

As schools started their new year, our colleagues took the initiative to support the local Indira Gandhi Government School with their anti-COVID-19 measures, as well as some much-needed building work.

This included the renovation of the school toilets and the installation of a 3,000 litres per hour capacity water treatment plant to provide clean and hygienic water to the children and staff.

The school was also provided with hygiene equipment including a foot-operated hand sanitiser dispenser, thermal scanners and liquid sanitisers.



A responsible company

Conflict minerals

It is Vesuvius' policy to prohibit the use of conflict minerals in its products. This policy, over which the Group Executive Committee has oversight, covers 100% of Vesuvius' operations, as well as its suppliers. It is available to view at: www.vesuvius.com.

We routinely review our purchasing portfolio to check for conflict minerals. In 2021, we verified that we did not purchase any conflict minerals. Supplier compliance is included in the scope of supplier sustainability assessments carried out by a third-party independent provider.

Mica, graphite and child labour

Vesuvius is committed to working only with suppliers that respect the UN Global Compact's ten principles, and in particular do not employ child labour. We have engaged in a process of verifying our supplier base of mica and graphite as these industries have been widely recognised as a risk in this respect.

In 2021, we contacted all our suppliers of mica, asking for written confirmation that they are not using child labour. Upon analysis of their replies, we asked suppliers to undergo sustainability

assessments, including a strong focus on human rights. By the end of 2022, suppliers representing 99.4% of our mica spend had already confirmed that they did not employ any child labour and had completed, or were in the process of undergoing, a Sustainability Assessment. We have since exited our relationships with those suppliers not willing to undergo a sustainability assessment.

In 2022, we initiated a similar process with our suppliers of graphite. By the end of 2022, suppliers representing 69% of our graphite spend had already confirmed that they did not employ any child labour and had completed, or were in the process of undergoing, a sustainability assessment.

Working hours

In accordance with our Human Rights Policy, the Group seeks to ensure that workers do not exceed reasonable working hours to ensure their physical and mental health and safety. We are committed to the elimination of excessive working hours and respect local regulations on working hours in every country in which we operate. Vesuvius maintains a working hours policy and monthly reporting of headcount and hours worked. This allows us to identify

if maximum working hours are being exceeded which can then be investigated by management.

The verification of working hours is included in the scope of the Group Safety Audit. In 2022, verifications were carried out in 48 sites representing 79% of manufacturing and R&D locations, with no issues being reported.

Whistleblowing

Vesuvius provides a whistleblowing channel (Speak Up) for all employees, customers, and suppliers of the Group. The Speak Up Policy is under the responsibility of our Board, and is included in our Code of Conduct. Details of it are provided on the internal and external Vesuvius websites, and communicated by local language posters in all our locations. A third-party operated confidential Speak Up helpline is available 365 days per year, 24 hours per day, to anyone wishing to raise concerns anonymously or in situations where they feel unable to report directly. This independent facility supports online reporting through a web portal and reporting by phone or by voicemail. Ensuring global accessibility, employees can speak with operators in any of our 29 functional languages.

All reports received are reviewed and, where appropriate, investigated and feedback is provided to the reporter via the helpline portal. Vesuvius' Speak Up helpline is highlighted during internal compliance training and new joiner inductions. No Vesuvius employee will ever be penalised or disadvantaged for reporting a legitimate concern in good faith. Reports received via Speak Up channels are managed by the General Counsel and Compliance Director. When received, reports are assessed for risk and category of concern. All reports are considered in line with a protocol for review, investigation, action, closure and feedback, independent of management lines where necessary, and involving senior Business Unit or HR management as appropriate. For complex issues, formal investigation plans are drawn up, and support from external experts is engaged where necessary. Feedback is recognised as an important element of the Speak Up process and we aim to provide an update on all reports within 28 days of receipt.

A responsible company

The Group monitors the volume, geographic distribution and range of reports made to the Speak Up facility to ascertain not only whether there are significant regional compliance concerns, but also whether there are countries where access to this facility is less well understood or publicised.

During 2022, the Board received updates on the nature and volume of reports received from the confidential Speak Up helpline, key themes emerging from these reports and the results of any investigations undertaken. Further details on specific issues were provided where requested. In 2022, the Group received 141 reports (2021: 93) through the Speak Up facility and 38 walk-in reports (2021: 94). Each one of these

was reviewed and, where appropriate, investigated. Similar to 2021, a substantial majority of these reports related to HR issues which indicated no compliance concerns, nor serious breaches of the Code of Conduct. Of the small number of reports received that contained allegations of a breach of our Code of Conduct, thorough investigations were performed and, where appropriate, disciplinary action was taken.

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.

Risks and applicable rules are outlined in our Anti-Bribery and Corruption Policy. The Group Executive Committee has responsibility for the Policy, which is available to view at: www.vesuvius.com.

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.



4,917
employees received
Anti-Bribery and Corruption
training in 2022

A responsible company

Working with trade associations, lobbying and political expenses

Vesuvius does not allow contributions to political candidates or political parties and does not incur political expenditure. Vesuvius shall comply with all applicable laws that require reporting on lobbying and related activities. Similarly, Vesuvius does not have any direct involvement and prohibits any direct lobbying expenditures or spend of any corporate funds on political advocacy.

Advocacy on non-political topics relevant to the business is permitted. These policies apply to all Vesuvius operations (owned and joint ventures).

Vesuvius is committed to openly declaring business interests and ensuring information provided is up-to-date, complete and not misleading. Vesuvius employees are prohibited from obtaining or trying to obtain information, or to make any decision dishonestly.

Around the world, we participate in government and industry working groups, are members of industry associations, and engage in direct contact with independent bodies on key business issues. This ensures that we can help in shaping new policies, regulations and standards, and ensure compliance with existing requirements.

Vesuvius has established long-term relationships, either directly, or through some of its employees with several national and international trade associations directly related to our activities and to those of our customers. These trade associations advocate on major public policy issues of importance to Vesuvius, and are helpful for networking, building industry skills, civic participation and monitoring of industry policies and trends. They also provide information and perspectives on legislative matters of significance to the Group and our lines of business. Vesuvius' participation as a member of these associations comes with the understanding that we may not always agree with all the positions of an association or its other members.

Vesuvius is a member of the World Refractory Association, CerameUnie, the European Refractory Association, the Association for Iron & Steel Technology, the Confederation of Indian Industries, and the British Ceramics Association. These trade associations have all made climate change a clear focus area, with a variety of resulting actions such as engaging with regulators and policymakers, awareness and capability building within the industry, promotion of best available practices and technologies, and management of collaborative research projects.

Other topics we engage in include safety, the development of recycling, environmental regulations, training and upskilling of the workforce, and non-financial reporting and disclosures.

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. Cash donations to registered not-for-profit organisations amounted to £760K in 2022 (£189K in 2021 and £248K in 2020).

£760K

cash donations to registered not-for-profit organisations

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.

Community engagement

Case study

Supporting better health in our communities

How to make a meaningful contribution to the communities in which we operate? An initiative to support community health near our Suzhou operations is a great example of this commitment.

In August 2022, Vesuvius China joined the Commonwealth Partnership Plan to support the volunteer association in Suzhou Industrial Park.

The community project, 'Caring for the Heart' seeks to improve the residents' awareness of heart disease and their ability to deal with emergencies through cardiopulmonary resuscitation and family first aid training.

Vesuvius provided sponsorship funding and residents of nine communities were provided with the training in 2022. The project was rated among the top five best initiatives within the Suzhou Industrial Park and Vesuvius was rated as a Caring Enterprise by SIP.



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.

Vesuvius predominantly purchases raw materials, comprising unprocessed and processed mined materials, and chemicals. We source materials globally, with important sources in China, North America, Europe and India. Our supply chain also includes capital equipment and specialist services.

£213m

spend with suppliers having formally agreed to comply with our Sustainable Procurement Policy

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 CO₂ 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.

The Group Executive Committee has overall responsibility for supply chain management. Selected categories of raw materials requiring global coordination are managed by the Group Procurement Organisation, which reports into the President Operations and Technology, whilst others are managed locally in the Business Units and Regions.

Supplier development programmes are coordinated between these functions and the Compliance Sustainability teams. These programmes include supplier training, assessments and auditing on various topics covered by the Sustainable Procurement Policy.

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.

Responsible sourcing

Case study

Supporting education in technical fields

Vesuvius is a company of engineers and scientists. We strongly believe that our contribution to diversity and equality must be aligned with our own identity.

Accordingly, in recent years, our Business Units have been increasingly focused on community work that promotes and supports the education of women and girls in technical fields.

For example, together with the Faculty of Materials Science and Ceramics of the Krakow University of Science and Technology, a team of Vesuvius colleagues partnered with a local primary school to engage with Year 3 students around some fun projects in STEM (Science, Technology, Engineering and Mathematics).

The students took part in a range of activities, including making biodegradable milk cartons and an ecological medical dressing. This was also a good opportunity for students to ask Vesuvius professionals about life studying STEM, and career options and prospects after graduating from this field of study.



Responsible sourcing

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.

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. The average overall score of Vesuvius suppliers was 50.6 against an industry benchmark of 44.8 across the critical themes.

48%

of Group raw material spend was with suppliers having joined the sustainability assessment programme

Responsible sourcing

Supplier sustainability assessment criteria

Environment

Energy Consumption & GHGs
Water
Biodiversity
Local & Accidental Pollution
Materials, Chemicals & Waste
Product Use
Product End-of-Life
Customer Health & Safety
Environmental Services & Advocacy

Labour & Human Rights

Employee Health & Safety
Working Conditions
Social Dialogue
Career Management & Training
Child Labour, Forced Labour & Human Trafficking
Diversity, Discrimination & Harassment
External Stakeholder Human Rights
21 criteria based on international standards

Ethics

Corruption
Anti-competitive Practices
Responsible Information Management

Sustainable Procurement

Supplier Environmental Practices
Supplier Social Practices



Supplier sustainability assessment methodology and criteria

Vesuvius has partnered with an independent third-party service provider – EcoVadis – to rate our raw materials suppliers using a detailed set of criteria.

The supplier sustainability assessment methodology complies with international standards (e.g. ISO 26000, GRI, ILO, UN Global Compact). It includes the assessment of policies, measures, certifications, and reporting, along with the endorsement of external CSR initiatives and principles.

Supplier assessments are carried out via a combination of questionnaires completed by suppliers, the collection of supporting documents and evidence, and the monitoring of a large number of sources (government agencies, compliance databases, sustainability networks, international organisations, NGOs, trade unions and specialised press). Supplier assessments cover a wide range of topics, covering four themes and 21 criteria based on international standards: Labour & Human Rights, Ethics, Environment, and Sustainable Procurement.

Supplier development

Vesuvius is very proud of the close relationships we have with our suppliers around the world. We work with them to ensure that the highest-quality materials and products enter our supply chain. The process entails an extremely comprehensive review including research and development to ascertain compatibility of suppliers' products.

Responsible sourcing

Case study

Supporting our colleagues' charitable work

All over the world our colleagues are engaged in community and charitable programmes, and Vesuvius is proud to support many of these grassroots initiatives.

For the past eight years, the team at Vesuvius Monterrey have supported a programme that provides treatment for children and young people with cancer.

Operated by an association called AMANEC AC, the programme involves collecting bottle caps that are eventually recycled. For every 1,000 caps, AMANEC can fund a chemotherapy treatment for a child whose family cannot afford it.

Mexico consumes the most plastic of any country in Latin America, but it also recycles the most plastic, making it a material that is very much in demand. With the resources that the association obtains from this recycling, it delivers various programmes to help children and young people with cancer.

Diego, a 3-year-old boy, who is part of one of these programmes, visited the plant to meet our colleagues and accept a donation and to see the giant heart-shaped container full of caps that will fund part of his treatment.



Responsible sourcing

Supplier CSR and Quality audits

Vesuvius conducts a Supplier Audit programme targeting our suppliers' 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.

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 customers, 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 main areas of attention are environmental and social practices. A particular emphasis is also being placed on child and forced labour. Any observation of such practice would be immediately escalated to the Group's senior management, and the supplier barred from doing business with Vesuvius.

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 (0.7% of suppliers audited) received grades below threshold. Where suppliers fail to meet the required standards, either action is taken to support them to improve or our relationship with them is terminated.



139

CSR and Quality audits carried out at supplier facilities

Responsible sourcing

Supplier Corrective Actions Requests

To ensure the integrity of our products, we have a rigorous approach to issues relating to the quality of raw materials and other inputs to our processes. When a supplier does not meet expectations, we issue a formal Supplier Corrective Action Request. Our proven 8D methodology is then used to investigate the root cause of the issues and define corrective actions. A web-based portal is available for suppliers to document the containment actions implemented and outcome of the investigation, to enable review by us.

In most cases, issues are identified and resolved quickly. Suppliers with repeat issues and poor problem-solving are required to undergo a Supplier Quality Audit.

Supplier CO₂ emissions

In 2022, we evaluated our Scope 3 emissions (using the GHG approved Scope 3 Evaluator). It was estimated that the CO₂ emissions from purchased goods and services represented 1,137 thousand metric tonnes of CO₂ in 2022, 76% of Vesuvius' Scope 3 emissions and 62% of Vesuvius' total CO₂e emissions.

We are progressively building a more precise knowledge of these emissions, including data per raw material and supplier, to properly establish and drive improvement plans. We are using our RFQ process to gain a better understanding of these upstream CO₂ emissions and collect supporting data. This requires participating raw material suppliers to provide information on their energy sources, CO₂ emissions and improvement plans.

In 2022, we started engaging directly with the largest suppliers of some of the most CO₂ intensive and high-volume raw materials to provide training and further improve the quality of data collected.

Since the launch of our programme in 2021, 165 supplier sites (representing a total spend of £133m) have responded to the request for information on their energy sources and CO₂ emissions. 72 (representing a total spend of £81m) reported that they had set emissions reductions targets and established action plans.

62%

of Vesuvius total CO₂ emissions are from purchased goods and services

Further information



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 CO₂ 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 CO₂ emissions, a reduction in the Lost Time Incident Frequency Rate and an improvement in the gender representation in senior management.

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 President 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.

Sustainability governance structure

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.

United Nations Global Compact

United Nations Global Compact

In October 2020, Vesuvius became a signatory to the United Nations Global Compact. We have committed to base our business approach on its ten Principles, including its precepts on human rights, labour, environment, and anti-corruption, and to engage in activities which advance the development of the UN Sustainable Development Goals (SDGs).



Communication on progress

Vesuvius reports annually on its sustainability activities, commitments and progress in the Annual Report and also in a separate Sustainability Report published each year. This covers the environmental, social and governance issues defined in the four dimensions of the Group's Sustainability Charter: our planet, our customers, our people, our communities. In particular, we include updates on key performance indicators and progress against targets. Vesuvius also reports progress in the United Nations Global Compact online platform.

Human rights

Principle 1

Businesses should support and respect the protection of internationally proclaimed human rights within the scope of their influence

Principle 2

Businesses should make sure that they are not complicit in human rights abuse

Labour standards

Principle 3

Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining

Principle 4

Businesses should uphold the elimination of all forms of forced and compulsory labour

Principle 5

Businesses should uphold the abolition of child labour

Principle 6

Businesses should uphold the elimination of discrimination in respect of employment and occupation

Environment

Principle 7

Businesses should support a precautionary approach to environmental challenges

Principle 8

Businesses should undertake initiatives to promote greater environmental responsibility

Principle 9

Businesses should encourage the development and diffusion of environmentally friendly technologies

Anti-corruption

Principle 10

Businesses should work against corruption in all its forms, including extortion and bribery

Sustainable Development Goals

Vesuvius has identified the practices within its operations that can directly or indirectly contribute to the SDGs. We focus our efforts on the following seven SDGs – four priority goals and three supporting goals – and targets which are particularly relevant to our business and where we believe we can make the most meaningful contribution.

Priority SDGs and targets



Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

- 8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors
- 8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalisation and growth of micro-, small- and medium-sized enterprises, including through access to financial services
- 8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead
- 8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value
- 8.8 Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment



Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation

- 9.2 Promote inclusive and sustainable industrialisation and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries
- 9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities
- 9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending



Ensure sustainable consumption and production patterns

- 12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimise their adverse impacts on human health and the environment
- 12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse
- 12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle



Take urgent action to combat climate change and its impacts

- 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
- 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

Supporting SDGs



Ensure healthy lives and promote well-being for all at all ages

- 3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents
- 3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination



Achieve gender equality and empower all women and girls

- 5.1 End all forms of discrimination against all women and girls everywhere
- 5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life
- 5.b Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women
- 5.c Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels



Ensure availability and sustainable management of water and sanitation for all

- 6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
- 6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

Vesuvius materiality assessment

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.

Our materiality assessment is informed by our risk management processes, which not only consider immediate risks to the Group, but also longer-term emerging macro trends such as the electrification of light vehicles, accelerating growth in demand for renewable energies, technological developments in iron and steel making and policy changes impacting the cost of CO₂ emissions, all of which could profoundly affect our markets.

Our assessment is informed by the principles of reporting articulated within the Global Reporting Initiative (GRI) Standards 2021. The GRI content index can be found on pages 131-136 of this report.

In preparing our assessment, and developing our Sustainability initiative, we engage with various stakeholders, formally and informally. Details of these engagements and the parties involved are described in our s172 disclosures on pages 22-26 of our 2022 Annual Report. We undertake regular surveys of Vesuvius' operational teams to collect data on management approaches, systems, and performance relating to environmental, safety, and human resource management.

The material topics have been validated as material by the Board; they apply in our own operations and to varying degrees in those of our suppliers. No change in the relative prioritisation of topics was recorded in 2022. The exclusion of topics from this list does not mean that they are not considered important to Vesuvius or are not being managed, but only that we have chosen not to address them in detail in this report. Where appropriate we have incorporated some commentary on these additional topics into our report. Details of water stress and water consumption, biodiversity, conflict minerals and environmental compliance are all included.

Materiality assessment process

Step 1

- Survey of key internal and external stakeholders
- Review of external agency ratings
- Benchmark of current policies, targets, reporting practices vs peers and customers
- Interviews with senior managers and experts

Step 2

- Evaluation of current activities and reporting
- Selection and definition of a broad set of metrics
- Assessment of capabilities
- Selection of key KPIs covering the most important objectives

Step 3

- Identification of metrics and setting of targets by Group Executive Committee
- Approval by Board of Directors

Step 4

- Strategy launch with Senior Leadership Group
- Constitution of Sustainability Council
- Deployment throughout the Group

Step 5

- Ongoing dialogue with internal and external stakeholders
- Building action plans and monitoring progress
- Reporting of performance against targets and review of objectives
- Monitoring events and trends within and outside the Company
- Peer analysis

Task Force on Climate-related Financial Disclosures (1/3)

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 investment 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.

Task Force on Climate-related Financial Disclosures (2/3)

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: Annual Report		Vesuvius disclosure: Sustainability Report	
Governance	Disclose the organisation's governance around climate-related risks and opportunities.	a Describe the Board's oversight of climate-related risks and opportunities.	<i>Risk, viability and going concern</i>	p27–31 ➔	TCFD	p15, 107–108 ➔
		b Describe management's role in assessing and managing climate-related risks and opportunities.	<i>Directors' Remuneration Report</i>	p116–143 ➔		
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.			Our planet	p22–26 ➔
		b Describe the impact of climate-related risks and opportunities on the organisation's businesses, strategy and financial planning.	<i>Our external environment</i>	p14–15 ➔	Our planet Our customers	p22–30 ➔ p51–60 ➔
		c Describe the resilience of the organisation's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario.			Our planet	p27–29 ➔
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.	<i>Risk, viability and going concern</i>	p27–31 ➔	Our planet	p22–26 ➔
		b Describe the organisation's processes for managing climate-related risks.	<i>Risk, viability and going concern</i>	p28–29 ➔	Our planet	p22–26 ➔
		c Describe how processes for identifying, assessing and managing climate-related risks are integrated into the organisation's overall risk management.	<i>Risk, viability and going concern</i>	p27–31 ➔	Our planet	p22–26 ➔
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	p10 ➔
		b Disclose Scope 1, Scope 2 and, if appropriate, Scope 3 GHG emissions, and the related risks.			Our planet	p37–41, 116–122 ➔
		c Describe the targets used by the organisation to manage climate-related risks and opportunities and performance against targets.			Our planet	p10, 37–41, p44, 116–122 ➔

Task Force on Climate-related Financial Disclosures (3/3)

Climate-related risks and opportunities – 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.

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) CO₂e. We report in metric tonnes of CO₂ equivalent (CO₂e). 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 emissions, reported as carbon dioxide equivalents (CO₂e), include direct emissions of the three main GHGs (carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O)).

Process-related emissions of the following in CO₂ equivalent and in metric tonnes are not significant:

1. Direct methane CH₄ emissions
2. Direct nitrous oxide N₂O emissions

Emissions of the following in CO₂ equivalent and in metric tonnes are not significant.

1. Direct sulphur hexafluoride (SF₆) emissions
2. Direct HFC emissions
3. 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 Vesuvius Refractory Company Ltd 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.

Energy consumption and GHG emissions

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

The absolute values of the energy consumed and the location-based CO₂e emissions reduced in 2022, however energy intensity and emission intensity per metric tonne of product packed for shipment showed a small increase.

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 CO₂e per metric tonne product packed for shipment (2021: 0.419) and market-based emissions increased by 4.8% to 0.38 metric tonnes CO₂e per metric tonne product packed for shipment (2021: 0.40).

A significant reduction in CO₂e 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 CO₂ 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).

Location-based statutory reporting of global GHG emissions (metric tonnes CO₂e) and energy consumption ('000 kWh) by type of fuel and emission.

Fuel and emission category	Energy used '000 kWh 2022	Energy used '000 kWh 2021	% change	CO ₂ e '000 metric tonnes 2022	CO ₂ e '000 metric tonnes 2021	% change	CO ₂ metric tonne per metric tonne of product 2022	CO ₂ e metric tonnes per metric tonne of product 2021	% change
Coal	202,272	224,846	-10%	65.7	72.8	-10%	0.073	0.074	-1%
Electricity	202,010	207,238	-3%	98.2	101.5	-3%	0.109	0.103	6%
Ext. Heat	3,849	3,177	21%	1.2	1.0	23%	0.001	0.001	0%
LPG	64,932	77,379	-16%	13.9	16.6	-16%	0.016	0.017	-8%
Natural Gas	605,421	641,168	-6%	110.5	117.4	-6%	0.123	0.119	3%
Other Fuels	5,132	5,643	-9%	1	1	-8%	0.001	0.001	1%
Total Fuels	1,083,616	1,159,451	-7%	291	311	-6%	0.324	0.315	3%
Non-Fuel Process Emissions				91.3	101.1	-10%	0.102	0.103	-1%
Fugitive Emissions				2.2	1.4	58%	0.002	0.001	73%
Grand Total	1,083,616	1,159,451	-7%	384	413	-7%	0.428	0.419	2%

Notes:

1. All fuel consumption is converted to '000 kWh for reporting.
2. In 2022, the Group consumed 55,038 thousand m³ of natural gas (2021: 58,288).
3. Vesuvius does not use any alternative fuels (% used zero).
4. Heat from biomass 0.02% (2021: 0.01%).
6. Fugitive emissions are leaks of greenhouse gases, for example from refrigeration and air-conditioning units. See Further information for details.
7. Location-based Statutory Reporting of Global GHG emissions (metric tonnes of CO₂e) and energy consumption ('000 kWh). (Operational Control Boundary).

Energy consumption and GHG emissions

Energy consumption and Energy intensity (re-baselined using pre-acquisition data for the business of Universal Refractories, Inc)

	2022	2021	2020	2019	2022 v 2019
Total Energy consumption (million kWh)	1,084	1,187	1,054	1,204	
Energy Intensity per metric tonne of product packed for shipment (kWh/MT)	1,207	1,172	1,235	1,284	-6%

Global electricity and energy from renewable sources usage

	2022	2021	2020	2019
Total electricity consumption ('000 kWh)	196,346	207,238	194,441	214,336
Electricity from non-renewable sources ('000 kWh)	64,271	105,424	122,256	138,004
Electricity from non-renewable sources (% of total)	32%	50%	61%	63%
Electricity from non-CO ₂ emitting sources ('000 kWh)	137,740	107,478	77,850	81,997
Electricity from non-CO ₂ emitting sources (% of total)	68%	51%	39%	37%
Electricity from renewable sources ('000 kWh)	117,699	85,759	56,991	56,506
Electricity from renewable sources (% of total)	58%	40%	29%	26%
Energy from renewable sources ('000 kWh)	117,855	85,914	57,129	56,682

Five-year evolution of Scope 1 and Scope 2 CO₂e emissions (market-based) – (re-baselined using pre-acquisition data for the business of Universal Refractories, Inc)¹

	2022	2021	2020	2019	2022 v 2019
CO ₂ e '000 metric tonnes	339	398	370	437	
CO ₂ e metric tonnes per metric tonne of product packed for shipment	0.378	0.393	0.433	0.466	-18.8%
CO ₂ e metric tonnes per million £ revenue (Scope 1 & 2)	166	243	254	255	

1. Does not include fugitive emissions.

Energy consumption and GHG emissions

Only 1.3% of the total energy requirements across the Group are consumed in the UK, producing 0.7% of the Group's CO₂e location-based emissions.

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

Emissions and energy sources	UK and Offshore CO ₂ e '000 metric tonnes 2022	Global CO ₂ e '000 metric tonnes 2022	Proportion relating to the UK and Offshore Area	UK and Offshore CO ₂ e '000 metric tonnes 2021	Global CO ₂ e '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%					
Vesuvius' chosen intensity measurement (location-based statutory reporting)	Metric tonnes CO ₂ e per metric tonne of product packed for shipment					kWh of energy per metric tonne of product packed for shipment							
	UK and Offshore 2022	Global 2022		UK and Offshore 2021	Global 2021		UK and Offshore 2022	Global 2022		UK and Offshore 2021	Global 2021		
	CO ₂ e emissions intensity and energy intensity	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%				
Normalised GHG emissions per unit of revenue	Metric tonnes of CO ₂ e per £m revenue												
	UK and Offshore 2022	Global 2022		UK and Offshore 2021	Global 2021								
	23	188		27	251								
	Change	-15.9%	-25.4%										

Note: No cooling or steam is purchased. No electricity, heat, cooling or steam is sold commercially. Electricity generated from our solar panels is exported to the network and reimported where it is accounted for as electricity purchased; the amounts are insignificant, and not material.

Energy consumption and GHG emissions

Scope 1, Scope 2 and Scope 3 emissions

Metric tonnes CO ₂ e	2022		2021		2020		2019	
	Metric tonnes	%	Metric tonnes	%	Metric tonnes	%	Metric tonnes	%
Scope 1 Process CO ₂ e emissions	91,276	5.0%	101,121	5.4%	88,516	5.9%	106,737	6.0%
Scope 1 Energy CO ₂ e emissions ¹	193,603	10.6%	209,592	11.2%	183,741	12.2%	215,836	12.0%
Scope 1 CO ₂ e emissions	284,879	15.6%	310,713	16.6%	272,257	18.0%	322,573	18.0%
Scope 2 CO ₂ e emissions (market-based)	56,517	3.1%	82,519	4.4%	92,145	6.1%	106,681	5.9%
Scope 3 CO ₂ e 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.

Scope 1, Scope 2 and Scope 3 emissions (re-baselined using pre-acquisition data for the business of Universal Refractories, Inc)

Metric tonnes CO ₂ e	2022		2021		2020		2019	
	Metric tonnes	%	Metric tonnes	%	Metric tonnes	%	Metric tonnes	%
Scope 1 Process CO ₂ e emissions	91,276	5.0%	101,121	5.4%	88,516	5.9%	106,737	5.9%
Scope 1 Energy CO ₂ e emissions ²	191,396	10.5%	212,297	11.3%	186,779	12.4%	218,963	12.2%
Scope 1 CO ₂ e emissions	282,672	15.4%	313,418	16.7%	275,295	18.2%	325,700	18.1%
Scope 2 CO ₂ e emissions (market-based)	56,517	3.1%	85,062	4.5%	94,414	6.2%	110,821	6.2%
Scope 3 CO ₂ e emissions	1,490,055	81.4%	1,483,530	79.0%	1,147,608	75.9%	1,364,104	76.0%
Total	1,829,243	100%	1,882,010	100%	1,517,318	100%	1,800,624	100%

2. Does not include fugitive emissions.

	2022	2021	2020	2019	2022 v 2019
Total Energy CO ₂ e emissions in metric tonnes	247,912	297,359	281,194	329,783	-25%
Energy CO ₂ e intensity in metric tonnes per metric tonne of product packed for shipment	0.276	0.294	0.329	0.352	-21%
Process CO ₂ e intensity in metric tonnes per metric tonne of product packed for shipment	0.102	0.100	0.104	0.114	-11%

Energy consumption and GHG emissions

Scope 1 Direct emissions by GHG type

Energy/Emission type	Scope 1 emissions in metric tonnes CO ₂ e	2022	2021	2020	2019
Industrial Coal	Total	65,666	72,764	65,584	76,351
	of CO ₂	64,960	71,982	64,882	75,550
	of CH ₄	186	207	266	214
	of N ₂ O	518	576	436	589
Diesel FLT	Total	710	846	636	937
	of CO ₂	700	833	627	925
	of CH ₄	0	0	0	0
	of N ₂ O	10	12	9	12
Diesel Cars	Total	37	38	43	107
	of CO ₂	37	37	42	106
	of CH ₄	0	0	0	0
	of N ₂ O	1	1	1	1
Fuel Oil	Total	523	498	393	559
	of CO ₂	521	496	392	557
	of CH ₄	1	1	1	1
	of N ₂ O	1	1	1	1
LPG	Total	13,927	16,597	13,213	14,206
	of CO ₂	13,908	16,574	13,195	14,187
	of CH ₄	11	13	10	9
	of N ₂ O	8	10	9	9
Natural Gas	Total	110,514	117,436	102,785	117,929
	of CO ₂	110,302	117,218	102,590	117,711
	of CH ₄	151	160	140	154
	of N ₂ O	61	64	56	64

Energy/Emission type	Scope 1 emissions in metric tonnes CO ₂ e	2022	2021	2020	2019
Petrol Cars	Total	18	13	4	5
	of CO ₂	18	13	4	5
	of CH ₄	0	0	0	0
	of N ₂ O	0	0	0	0
Petrol FLT	Total	–	–	0	3
	of CO ₂	–	–	0	3
	of CH ₄	–	–	0	0
	of N ₂ O	–	–	0	0
Coke Oven Gas	Total	–	–	–	4,745
	of CO ₂	–	–	–	4,745
	of CH ₄	–	–	–	–
	of N ₂ O	–	–	–	–
Process CO ₂	Total	91,276	101,121	88,516	106,737
	of CO ₂	91,276	101,121	88,516	106,737
	of CH ₄	–	–	–	–
	of N ₂ O	–	–	–	–
Total	Total	282,672	309,312	271,174	321,577
	of CO ₂	281,721	308,273	270,248	320,524
	of CH ₄	349	381	416	378
	of N ₂ O	599	664	511	678

Energy consumption and GHG emissions

Fugitive emissions – Coolants and refrigerants

Metric tonnes CO ₂ e	2022	2021	2020	2019
HCFC-141b	–	–	–	39
HCFC-22/R22 = chlorodifluoromethane	1,108	815	579	653
HFC-134	2	1	–	38
HFC-134a	11	305	179	92
HFC-32	4	4	2	2
Nitrous oxide	–	–	–	5
R401A	31	–	–	–
R404A	46	27	68	53
R407A	4	4	–	–
R407C	160	37	12	20
R410A	398	149	128	90
R422B	442	59	111	–
Grand Total	2,207	1,398	1,080	992

Emissions of the following in CO₂ equivalent and in metric tonnes are not significant:

1. Direct sulphur hexafluoride (SF₆) emissions
2. Direct HFC emissions
3. Direct PFC emissions

Energy consumption and GHG emissions

Scope 3 emissions

	2022		2021		2020		2019	
Metric tonnes CO ₂ e	Metric tonnes	%	Metric tonnes	%	Metric tonnes	%	Metric tonnes	%
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 CO₂e emissions	1,490,055	100.0%	1,483,530	100.0%	1,147,608	100.0%	1,364,104	100.0%

Raw materials and waste

Raw materials and waste

Manufacturing site raw materials & waste/(metric tonnes)	2022	2021	2022 v 2021	2020	2019	2022 v 2019
Raw materials						
Recycled materials used (from external sources)	66,137	76,482	-13.5%	57,035	68,373	-3.3%
Recovered materials used (from external sources)	0	0	0.0%	0	0	0.0%
Raw materials and intermediates used excluding recycled (from external sources)	1,021,029	1,144,917	-10.8%	954,991	1,082,227	-5.7%
Total raw materials and intermediates used	1,087,166	1,221,399	-11.0%	1,012,026	1,150,600	-5.5%
% Recycled materials (from external sources)	6.0%	6.2%	-3.1%	5.6%	5.9%	2.1%
% Recovered materials (from external sources)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Waste (solid waste, by-products and wastewater)						
Solid waste and by-products	65,854	58,688	12.2%	59,168	78,608	-16.2%
Ratio of solid waste and by-products in metric tonnes per tonne of product packed for shipment	0.073	0.060	23.1%	0.072	0.086	-15.1%
Total non-recycled waste (solid waste, hazardous and sent to landfill)	30,981	30,498	1.6%	26,105	36,406	-14.9%
– Non-hazardous waste	26,207	26,478	-1.0%	22,499	31,603	-17.1%
– Tailings waste	0	0	0.0%	0	0	0
– Hazardous waste	4,774	4,020	18.8%	3,605	4,803	-0.6%
– Toxic waste	20	51	-60.4%	32	7	175.2%
– Other hazardous waste	4,753	3,969	19.8%	3,573	4,796	-0.9%
– Ratio of hazardous waste to total solid waste	15.4%	13.2%	16.9%	13.8%	13.2%	16.8%
Ratio of solid waste per tonne of product packed for shipment (in metric tonnes)	0.035	0.031	11.5%	0.032	0.040	-13.8%
By-products (recycled waste)	34,873	28,190	23.7%	33,063	42,202	-17.4%
Ratio of by-products per tonne of product packed for shipment (in metric tonnes)	0.039	0.029	35.7%	0.040	0.046	-16.3%
Wastewater¹	236,093	264,363	-10.7%	239,885	262,810	-10.2%
Ratio of wastewater per tonne of product packed for shipment (in metric tonnes)	0.263	0.268	-2.0%	0.290	0.289	-9.0%
Total solid waste, by-products and wastewater	301,974	323,051	-6.5%	299,053	341,418	-11.6%

1. 1 m³ wastewater = 1 metric tonne.

Reporting includes 100% of Vesuvius operations and joint ventures excluding the business of Universal Refractories, Inc acquired in 2021 (Vesuvius Penn Corporation) and BMC (Yingkou YingWei Magnesium Co., Ltd) acquired late 2022, whose integration is ongoing. For 2019 and earlier the management joint venture with Anshan Angang Vesuvius Refractory Company Ltd is not included as this was outside the operational control boundary.

Water

Water stress

Location of manufacturing sites	Number of main manufacturing sites	Percentage of revenue				Manufacturing sites fresh water use (m³)			
		2022	2021	2020	2019	2022	2021	2020	2019
Very high water stress	4	4%	4%	4%	4%	65,643	56,393	48,529	58,507
Moderate to high water stress	20	40%	42%	41%	39%	237,767	262,836	280,314	289,120
Low to moderate water stress	33	56%	54%	55%	56%	366,527	374,986	361,011	420,577

This data covers 100% of our manufacturing sites. Water stress classification based on World Resources Institute Aqueduct Water Risk Atlas.

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 consumed per £million revenue	-33.8%	330	454	513	499	499

Water storage does not have a significant impact. We provide data in cubic metres (1 cubic metre = 1,000 litres = 1 metric tonne = 0.001 megalitre). Data is collected quarterly in submissions from all operations globally under the operational control of Vesuvius.

ISO 14001:2015 certifications

ISO 14001:2015 certifications

Country	Company name	Site
Australia	Foseco Pty Ltd	Sydney
Belgium	Vesuvius Belgium N.V.	Ostend
Brazil	Foseco Industrial e Comercial Ltda	São Paulo
China	Vesuvius Advanced Ceramic (China) Co., Ltd	Suzhou
China	Vesuvius Advanced Ceramics (Anshan) Co., Ltd	Anshan
Czech Republic	Vesuvius Česká Republika, a.s.	Trinec
Germany	SIR Feuerfestprodukte GmbH	Siegen
Germany	SIR Feuerfestprodukte GmbH	Kreuztal
Germany	Vesuvius Mülheim GmbH & Co.KG.	Mülheim an der Ruhr
Germany	Vesuvius Europe GmbH & Co.KG.	Mülheim an der Ruhr
Germany	Vesuvius GmbH	Grossalmerode
Germany	Vesuvius GmbH	Borken
India	Foseco India Limited	Puducherry
India	Foseco India Limited	Pune
Indonesia	P.T.Foseco Indonesia	Jakarta
Japan	Foseco Japan Limited	Toyokawa
Republic of Korea	Foseco Korea Limited	Gyeonggi-do
Netherlands	Foseco Nederland BV	Hengelo
Poland	Vesuvius Poland Sp. z o.o.	Skawina
Republic of South Africa	Vesuvius South Africa (Pty) Limited	Olifantsfontein
Sweden	Vesuvius Scandinavia AB	Amal
Taiwan	Foseco Golden Gate Co. Limited	Ping Tung
United Kingdom	Vesuvius UK Limited	Tamworth

Vesuvius Sustainability Policies and Standards

Vesuvius Sustainability Policies and Standards

Health and Safety Policies and Standards

Accident & Incident Reporting	Reviewed 2022
Anti-Bribery and Corruption Policy	Reviewed 2019
Biodiversity Policy	Issued 2022
Business Continuity Planning	Issued 2018
Business Continuity Policy	Issued 2018
Code of Conduct	Reviewed 2020
Conflict Minerals Policy	Issued 2022
Control of Contractors	Reviewed 2022
Customer Location	Reviewed 2021
Crisis Management & Crisis Communication Policy	Issued 2019
Data Protection Privacy notice	Reviewed 2021
Data Protection Policy	Reviewed 2019
Diversity and Equality Policy	Issued 2020
Drug and Alcohol Policy	Reviewed 2021
Environmental Policy	Reviewed 2021
Ergonomics	Reviewed 2022
Executive Safety Tour	Reviewed 2020
Explosive Dust and Powder Process Safety	Issued 2022
Gas Safety	Issued 2015
Health and Safety Policy	Reviewed 2021
High-Risk Activities	Issued 2019
Housekeeping	Issued 2022
Human Rights and Labour Policy	Reviewed 2022

Health and Safety Policies and Standards

Inspection, Maintenance and Testing of Fixed Electrical Installations	Reviewed 2018
Isolated and Lone Working	Issued 2019
Isostatic Presses	Reviewed 2020
Legionella	Reviewed 2021
Lifting and Handling	Reviewed 2019
Lock, Tag and Try	Reviewed 2020
Machine Safety	Reviewed 2020
On-site Vehicle Operations	Issued 2020
Overtime Policy	Issued 2014
Permit to Work	Issued 2019
Personal Protective Equipment	Reviewed 2021
Process Safety	Issued 2020
Purchasing Policy	Issued 2018
Road Safety	Issued 2020
Risk Assessment	Issued 2020
Safe Storage of Bulk Bags and Pallets of 25kg Bags	Issued 2018
Speak Up Policy	Issued 2020
Sustainability Charter	Issued 2020
Sustainable Procurement Policy	Issued 2021
Warehousing and Racking	Issued 2019
Working with Third Parties Policy	Issued 2018
Working Safely with Fibres	Revised 2020

Vesuvius safety training programmes

Vesuvius safety training programmes

Training activities routinely undertaken for our employees and contractors include:

- Arc Flash Hazard
- Bike Safety
- Control of Contractors
- Crane Operation
- Defensive Driving
- Electrical Testing
- Environmental Waste Reporting
- Ergonomics
- Executive Safety Tour Leader
- Exoskeleton
- Fire Fighting
- First Aid
- Forklift Truck
- Gas Safety
- General Health and Safety and refresher training
- Hand Hazard and Protection
- Hazard Perception
- Hazardous Goods
- Health and Safety Representatives
- ISO 45001:2018
- Legionella
- Lock, Tag and Try
- Incident and Performance Reporting
- Machine Safety
- Permit to Work
- PPE Safety
- Practical Safety in Steel Customers
- Radiation
- Road Safety
- Safe Stacking
- Safety and Environmental Auditing
- Steel Mill Orientation
- TurboS Safety and Safety Leadership
- Warehouse Material Stacking and Handling
- Welding Certification
- Working at Height

Safety performance

Safety performance five-year table with main performance indicators

All employees, contractors and visitors

Performance Indicators	2022	2021	2020	2019	2018
Work Related Death	1	0	0	0	1
Severe Injuries	6	3	4	0	2
Lost Time Injuries (LTI)	30	29	28	40	39
LTI Frequency Rate (LTIFR) per million hours	1.08	1.06	1.16	1.54	1.42
Recordable Injuries	113	123	126	144	125
Recordable Frequency Rate (RFR) per million hours	4.0	4.5	5.2	5.5	4.5
Medically Treated Injuries (MTI)	184	200	164	198	202
MTI Frequency Rate (MTIFR) per million hours	6.6	7.3	6.8	7.6	7.3
Total Number of Injuries	512	629	419	520	491
Injury Frequency Rate (IFR) per million hours	18.3	23.0	17.3	20.0	17.8
LTI Lost Days	1,642	1,778	2,094	1,811	1,824
LTI Severity Frequency Rate (Lost Days) per million hours	59	65	86	70	66
Dangerous Occurrences (DO)	2,536	1,200	779	734	650
Dangerous Occurrence Frequency Rate (DOFR)	91	44	32	28	24
Safety Audits (number)	120,307	108,992	95,290	113,438	121,117
Safety Audits per 20 Employees per month	16	14	14	16	16
Employees participating in monthly Safety Audits	10,237	10,047	8,559	8,804	9,973
Employees participating in monthly Safety Audits %	80%	78%	73%	75%	80%
SIOPA	113,879	94,447	81,101	92,061	92,778
Other IOPA	27,668	26,099	29,241	30,614	36,436
IOPA Total	141,547	120,546	110,342	122,675	129,214
SIOPA per Employee	9	7	7	8	7
Other IOPA per Employee	2	2	2	3	3
IOPA Total per Employee	11	9	9	10	10
Hours Worked (thousands)	27,905	27,297	24,211	26,053	27,533

All frequency rates (FR) are per million hours worked.

There were no Visitor injuries in 2018 to 2022.

Minor restatements of safety statistics and environmental metrics have been made, with no significant effect on reported outcomes. These are due to error corrections and final updates of estimated data, for example.

Includes all sites under Vesuvius' operational control including joint ventures.

Safety performance

Safety performance in 2022

Performance Indicators	Employees and directly supervised contractors	Third-party contractors and visitors	All employees, contractors and visitors
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
Recordable Injuries	109	4	113
Recordable Frequency Rate (RFR) per million hours	4.0	4.1	4.0
Medically Treated Injuries (MTI)	178	6	184
MTI Frequency Rate (MTIFR) per million hours	6.6	6.1	6.6
Total Number of Injuries	504	8	512
Injury Frequency Rate (IFR) per million hours	18.7	8.2	18.3
LTI Lost Days	1,642	0	1,642
LTI Severity Frequency Rate (Lost Days) per million hours	61	0	59
Dangerous Occurrences (DO)	2,532	4	2,536
Dangerous Occurrence Frequency Rate (DOFR)	94	4	91
Safety Audits (number)	120,307	0	120,307
Safety Audits per 20 Employees per month	16	0	16
Employees participating in monthly Safety Audits	10,237	0	10,237
Employees participating in monthly Safety Audits %	80%	0%	80%
SIOPA	113,879	0	113,879
Other IOPA	27,668	0	27,668
IOPA Total	141,547	0	141,547
SIOPA per Employee	9	0	9
Other IOPA per Employee	2	0	2
IOPA Total per Employee	11	0	11
Hours Worked (thousands)	26,925	980	27,905

Includes all sites under Vesuvius' operational control including joint ventures.

Distribution of Vesuvius employees by category

	2022	2022 (%)	2021	2021 (%)	2020	2020 (%)
Direct employees	10,837	97%	10,657	96%	10,016	97%
Agency employees	297	3%	419	4%	338	3%
Total	11,134	100%	11,076	100%	10,354	100%

Notes:

Employee numbers exclude employees joining Vesuvius as a result of the acquisition of the Universal Refractories, Inc business.

In addition to the headcount above, Vesuvius employed the services of 191 contractors and consultants in 2020, 134 in 2021, and 154 in 2022 to work on specific short-term projects.

Vesuvius employee distribution

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

	2022				2021				2020			
	Full-time employees	Full-time employees (%)	Part-time employees	Part-time employees (%)	Full-time employees	Full-time employees (%)	Part-time employees	Part-time employees (%)	Full-time employees	Full-time employees (%)	Part-time employees	Part-time employees (%)
Permanent salaried	4,391	98.9%	48	1.1%	4,086	99.0%	43	1.0%	3,905	98.7%	53	1.3%
Permanent hourly	5,939	99.8%	12	0.2%	5,878	99.9%	6	0.1%	5,647	99.9%	7	0.1%
Total Permanent	10,330	99.4%	60	0.6%	9,964	99.5%	49	0.5%	9,552	99.4%	60	0.6%
Temporary salaried	86	96.6%	3	3.4%	90	98.9%	1	1.1%	64	97.0%	2	3.0%
Temporary hourly	649	99.1%	6	0.9%	966	99.4%	6	0.6%	674	99.7%	2	0.3%
Total Temporary	735	98.8%	9	1.2%	1,056	99.3%	7	0.7%	738	99.5%	4	0.5%
Total	11,065	99.4%	69	0.6%	11,020	99.5%	56	0.5%	10,290	99.4%	64	0.6%

2022 Distribution of Vesuvius employees by gender

	Total				Male				Female				Agency generic group ¹
	Full-time employees	Full-time employees (%)	Part-time employees	Part-time employees (%)	Full-time employees	Full-time employees (%)	Part-time employees	Part-time employees (%)	Full-time employees	Full-time employees (%)	Part-time employees	Part-time employees (%)	
Permanent salaried	4,391	98.9%	48	1.1%	3,262	99.6%	13	0.4%	1,129	97.0%	35	3.1%	0
Permanent hourly	5,939	99.8%	12	0.2%	5,587	99.8%	11	0.2%	352	100.0%	0	0.0%	1
Total Permanent	10,330	99.4%	60	0.6%	8,849	99.7%	24	0.3%	1,481	97.7%	35	2.4%	1
Temporary salaried	86	96.6%	3	3.4%	54	96.4%	2	3.6%	32	100.0%	0	0.0%	1
Temporary hourly	649	99.1%	6	0.9%	425	99.1%	4	0.9%	128	98.5%	2	1.6%	96
Total Temporary	735	98.8%	9	1.2%	735	98.8%	6	1.2%	160	98.8%	2	1.2%	97
Total	11,065	99.4%	69	0.6%	9,328	99.7%	30	0.3%	1,641	97.8%	37	2.3%	98

1. Gender information not available.

GRI Content Index

Statement of use	Vesuvius plc has reported in accordance with the GRI Standards for the period 1 January 2022 to 31 December 2022.
GRI 1 used	GRI 1: Foundation 2021
Applicable GRI Sector Standard(s)	None applicable.

GRI standard/ other source	Disclosure	Location	Requirement(s) omitted	Omission	
				Reason	Explanation
General disclosures					
GRI 2: General Disclosures 2021	2-1 Organisational details	Back cover Annual Report 2022 (AR) references, page 2			
	2-2 Entities included in the organisation's sustainability reporting	Sustainability Report 2022 (SR) page 4, 114			
	2-3 Reporting period, frequency and contact point	SR page 4 Calendar year 2022, annual reporting cycle.			
	2-4 Restatements of information	SR pages 4, 10, 32–34, 37, 114–117, 119, 128 1 January 2022 to 31 December 2022			
	2-5 External assurance	SR pages 41, 49			
	2-6 Activities, value chain and other business relationships	SR pages 4, 6–7, 18, 20, 40, 50–56, 68–69, 74, 94–96, 99–105			
	2-7 Employees	SR pages 75, 81, 130 No significant fluctuations in headcount.	b. iii non-guaranteed hours employees.	Information unavailable/incomplete.	Vesuvius does not employ non-guaranteed hours employees.
	2-8 Workers who are not employees	SR page 75 No significant fluctuations in worker numbers.			
	2-9 Governance structure and composition	SR pages 15, 80, 91, 106–107, 112	b. vi. under-represented social groups.	Information unavailable/incomplete.	No under-represented social groups included in governance processes to any significant degree.
	2-10 Nomination and selection of the highest governance body	AR page 110			
	2-11 Chair of the highest governance body	AR pages 91-92, 96			
	2-12 Role of the highest governance body in overseeing the management of impacts	SR page 15 AR pages 106–107			
	2-13 Delegation of responsibility for managing impacts	AR pages 50, 93, 98			
	2-14 Role of the highest governance body in sustainability reporting	SR page 111 AR pages 101, 103			
	2-15 Conflicts of interest	SR page 79 AR page 112			
	2-16 Communication of critical concerns	SR pages 2, 15, 25, 66, 113 AR page 94			
	2-17 Collective knowledge of the highest governance body	AR pages 88–91, 114–115			
	2-18 Evaluation of the performance of the highest governance body	AR pages 114–115			
	2-19 Remuneration policies	AR pages 91, 116			
	2-20 Process to determine remuneration	AR pages 36–37, 91–92, 95, 100, 116, 119	a. iii. Remuneration external advice.	Not applicable.	External adviser not used.
	2-21 Annual total compensation ratio	AR page 140			

GRI Content Index

GRI standard/ other source	Disclosure	Location	Requirement(s) omitted	Omission	
				Reason	Explanation
General disclosures continued					
GRI 2: General Disclosures 2021	2-22 Statement on sustainable development strategy	SR page 8 AR page 52			
	2-23 Policy commitments	SR pages 2, 10–14, 107–108, 126			
	2-24 Embedding policy commitments	SR pages 10–14, 107–108 AR pages 32–27, 93–94, 98			
	2-25 Processes to remediate negative impacts	AR pages 27–28, 32–27, 93–94			
	2-26 Mechanisms for seeking advice and raising concerns	AR pages 27–28, 32–27, 93–94			
	2-27 Compliance with laws and regulations	AR pages 93, 95–96, 98, 100			
	2-28 Membership associations	SR page 96			
	2-29 Approach to stakeholder engagement	SR pages 2, 16, 19, 76–79, 84–85, 91, 102, 111			
	2-30 Collective bargaining agreements	SR page 85			
Material topics					
GRI 3: Material Topics 2021	3-1 Process to determine material topics	SR pages 16, 111			
	3-2 List of material topics	SR page 16 AR page 54 Our list of material topics has been streamlined compared to our previous report, we identify material topics, supported by additional topics. Strategic consideration and performance for all topics is formally governed, managed and measured.			
Anti-corruption					
GRI 3: Material Topics 2021	3-3 Management of material topics	SR pages 2, 15, 79, 89, 97, 109 AR pages 37, 82, 106, 158			
GRI 205: Anti-corruption 2016	205-1 Operations assessed for risks related to corruption	SR page 95 AR page 82	a. Total number and percentage.	Information unavailable/incomplete.	Data collected relate to certain higher-risk categories of intermediary in various locations, and are not expressed as a percentage of a total number of assets.
	205-2 Communication and training about anti-corruption policies and procedures	SR page 95–96, 99–105 AR pages 33, 37, 82, 106 All employees and contractors receive communication; all and governance body members receive training on the related policies, across all regions.	a. to e. Total numbers and percentages.	Information unavailable/incomplete.	The Board set a target applicable to a specific group of permanent employees for the training; a regional breakdown is not available for this group. They comprised those with specific roles and interactions with third parties. Hourly workers are not included in the target group; data on geographic split is not collected. Percentages are unavailable – Vesuvius does not collect training data entirely in the breakdown required by this disclosure.
	205-3 Confirmed incidents of corruption and actions taken	AR page 98 No anti-bribery & corruption incidents recorded			

GRI Content Index

GRI standard/ other source	Disclosure	Location	Requirement(s) omitted	Omission	
				Reason	Explanation
Energy					
GRI 3: Material Topics 2021	3-3 Management of material topics	SR pages 2, 4, 19, 32, 36–41, 116			
GRI 302: Energy 2016	302-1 Energy consumption within the organisation	SR pages 116–122	c. iii. & iv. cooling & steam consumed. d. iii. & iv. cooling & steam sold.	Not applicable.	No cooling or steam is purchased. No electricity, heat, cooling or steam is sold commercially. Electricity generated from our solar panels is exported to the network and re-imported where it is accounted for as electricity purchased; the amounts are insignificant, and not material.
	302-2 Energy consumption outside of the organisation	SR pages 51–55, 116–122			
	302-3 Energy intensity	SR pages 116–122			
	302-4 Reduction of energy consumption	SR pages 116–122			
	302-5 Reductions in energy requirements of products and services	SR pages 116–122			
Emissions					
GRI 3: Material Topics 2021	3-3 Management of material topics	SR pages 2, 4, 19–20, 29–30, 32, 36–41, 112–116			
GRI 302: Energy 2016	305-1 Direct (Scope 1) GHG emissions	SR pages 116–122			
	305-2 Energy indirect (Scope 2) GHG emissions	SR pages 116–122			
	305-3 Other indirect (Scope 3) GHG emissions	SR pages 51–55, 116–122			
	305-4 GHG emissions intensity	SR pages 52, 116–122			
	305-5 Reduction of GHG emissions	SR pages 116–122			
	305-6 Emissions of ozone-depleting substances (ODS)	SR pages 116, 121			
	305-7 Nitrogen oxides (NOx), sulphur oxides (SOx), and other significant air emissions		All	Not applicable.	GRI Standard 305-7 not material.

GRI Content Index

GRI standard/ other source	Disclosure	Location	Requirement(s) omitted	Omission	
				Reason	Explanation
Supplier environmental assessment					
GRI 3: Material Topics 2021	3-3 Management of material topics	SR pages 99–105, 126			
GRI 308: Supplier Environmental Assessment 2016	308-1 New suppliers that were screened using environmental criteria	SR pages 99, 101			
	308-2 Negative environmental impacts in the supply chain and actions taken	SR pages 99, 101	c. d. & e. Significant negative impacts identified, with agreed improvements, and/or where relationships were terminated.	Information unavailable/incomplete.	We do not publish degree of significance of actual and potential negative environmental impacts. 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.
GRI 3: Material Topics 2021	3-3 Management of material topics				
GRI 401: Employment 2016	401-1 New employee hires and employee turnover				
	401-2 Benefits provided to full-time employees that are not provided to temporary or part-time employees				
	401-3 Parental leave				
GRI 3: Material Topics 2021	3-3 Management of material topics				
GRI 402: Labour/Management Relations 2016	402-1 Minimum notice periods regarding operational changes				

GRI Content Index

GRI standard/ other source	Disclosure	Location	Requirement(s) omitted	Omission	
				Reason	Explanation
Occupational health and safety					
GRI 3: Material Topics 2021	3-3 Management of material topics	SR pages 2, 4, 64–70, 102, 108–109, 126			
GRI 403: Occupational Health and Safety 2018	403-1 Occupational health and safety management system	SR page 68			
	403-2 Hazard identification, risk assessment, and incident investigation	SR pages 68, 72–73, 94–95 Code of Conduct page 14 vesuvius.com/en/sustainability/our-policies/code-of-conduct.html			
	403-3 Occupational health services	SR page 68 As part of the delivery of our safety management system, we provide occupational health services that are relevant to hazards and risks to which employees and others are exposed at our operations. Directly supervised contractors are treated the same as employees. Occupational health impacts are covered in the safety management risk identification. Occupational health and personal safety management is blended at all of our sites.			
	403-4 Worker participation, consultation, and communication on occupational health and safety	SR pages 67, 69–71, 74			
	403-5 Worker training on occupational health and safety	SR page 70			
	403-6 Promotion of worker health	SR pages 68–70 In line with our values, and our commitment to employee engagement, benefits including access to healthcare and medical support are managed locally in accordance with local laws. Directly supervised contractors are treated the same as employees. Also, site management are attuned to local impacts, and local approaches to worker health operate in accordance with the risk at a local level.			
	403-7 Prevention and mitigation of occupational health and safety impacts directly linked by business relationships	SR pages 65, 69, 92, 98, 102			
	403-8 Workers covered by an occupational health and safety management system	SR page 65			
	403-9 Work-related injuries	SR pages 72–73			
	403-10 Work-related ill health	SR page 68 No employees or other workers were reported as affected by recordable incidents or fatalities from work related ill-health.			

GRI Content Index

GRI standard/ other source	Disclosure	Location	Requirement(s) omitted	Omission	
				Reason	Explanation
Supplier social assessment					
GRI 3: Material Topics 2021	3-3 Management of material topics	SR pages 99–105, 126			
GRI 414: Supplier Social Assessment 2016	414-1 New suppliers that were screened using social criteria	SR pages 99, 101			
	414-2 Negative social impacts in the supply chain and actions taken	SR pages 99, 101	c. d. & e. Significant negative impacts identified, with agreed improvements, and/or where relationships were terminated.	Information unavailable/incomplete.	We do not publish degree of significance of actual and potential negative social impacts. 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.
Customer health and safety					
GRI 3: Material Topics 2021	3-3 Management of material topics	SR pages 57–62			
GRI 416: Customer Health and Safety 2016	416-1 Assessment of the health and safety impacts of product and service categories	SR page 59 All product categories are assessed for health and safety impacts and improvement where applicable.			
	416-2 Incidents of non-compliance concerning the health and safety impacts of products and services	SR page 61			

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The imagery included in this Sustainability Report aims to capture the many different aspects of Vesuvius and our team around the world. The photographer Samuel Dhote shot most of these images. www.samueldhote.com

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