

Zero harm;  
thinkSAFE;  
Sustainability

# About us

Morgan Advanced Materials is a global materials business. We apply world-class materials science and manufacturing expertise to solve technical challenges that our customers face everyday.

We work in the electronics, energy, healthcare, industrial, petrochemical, security and transport markets, forming close collaborative relationships with our customers. Morgan is a global leader in materials science and application engineering.

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## Our strengths

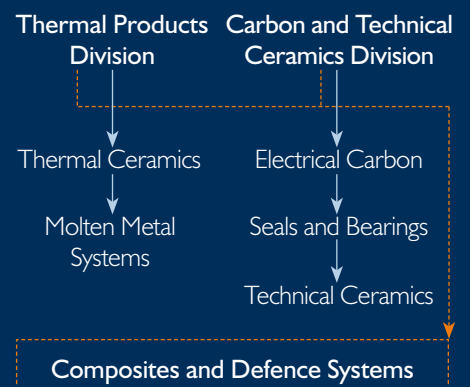
- Leading technology and materials science capability and process know-how
- Application engineering
- Customer focus, reputation and brand
- Strong market positions
- People and culture
- Selling into 100 countries
- Manufacturing in 30 countries
- Approximately 8,800 employees

## Our products

Morgan Advanced Materials manufactures an extensive range of products, satisfying a variety of applications across numerous end-markets.

The Group's products sit in two global Divisions and six global business units which Morgan operates.

## Our structure



## About us continued

Our engineered solutions are developed to exacting specifications and deliver ever greater performance through materials and production process innovation.

The Group's highly experienced scientists and application engineers are constantly engaged with our customers to find new solutions for complex and technologically demanding problems.

This work is underpinned by a passion to develop the next generation of skilled materials scientists and application engineers, coupled with a commitment to the environment, to health and safety, and operating to high ethical standards.

### Generating, capturing and sustaining value

Our business model is fundamental to our ability to create value and build a sustainable competitive advantage.

## Our markets

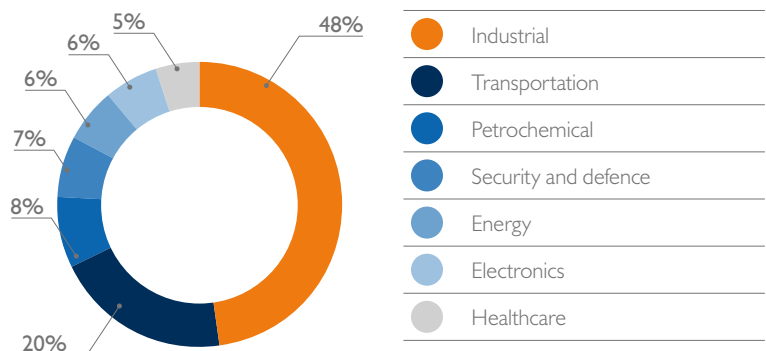
The Group operates in a number of market sectors.

**£1,021.5m**

Total global sales

- Selling into **100** countries
- Manufacturing in **30** countries
- Approximately **8,800** employees

% of revenue 2017



# About us continued

## How we differentiate ourselves

As the world strives to make better use of limited resources, the demands on our materials, and on our materials science capabilities, are rapidly increasing. We are producing materials that can work at higher temperatures, higher pressures, in more corrosive and abrasive applications, at more precise tolerances and in smaller form factors than ever before.

We use two fundamental sets of materials: Ceramics and Carbon.

### Industrial

#### 1 Thermal Ceramics

Thermal ceramics to protect critical components

Our high temperature fibre, refractory and microporous insulation provide thermal management in manufacturing.

#### 2 Molten Metal Systems

Crucibles for casting of industrial components

We produce crucibles which are used in manufacturing large components in a variety of industries.

#### 4 Seals and Bearings

Seals for industrial applications

Our carbon, graphite and silicon carbide seals possess superior wear characteristics, making them ideal for industrial use.

#### 3 Electrical Carbon

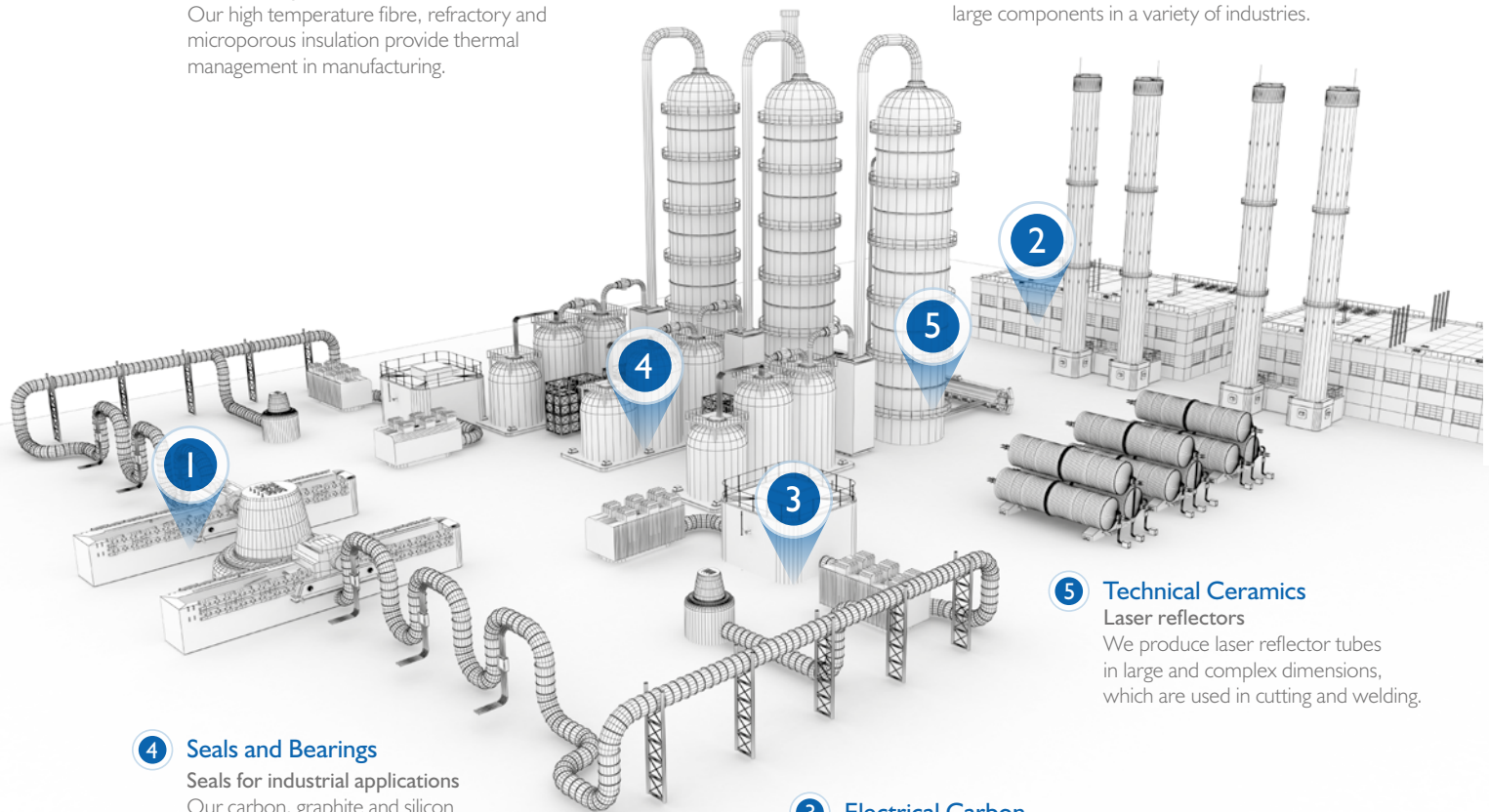
Carbon brushes for industry

We are the leading manufacturer of carbon brushes for a range of industrial applications and power generation.

#### 5 Technical Ceramics

Laser reflectors

We produce laser reflector tubes in large and complex dimensions, which are used in cutting and welding.



# Group strategy

Our strategy is to build a Group with distinctive capabilities and performance in three areas:

- materials science capability and technology.
- application engineering capability.
- customer and end-market focus.

We will apply these capabilities to solve difficult problems for our customers where they value our differentiated products and support, and we will apply these capabilities ethically and safely in line with our high Group standards.

Driving sustainable growth and ensuring our value is shared across all our stakeholder groups

### Investors

Delivering sustainable returns.

### Customers

Creating world class solutions that build competitive advantage.

### Employees

Developing and nurturing talent.

### Communities

Delivering a positive contribution to the local communities in which we work.

To support the strategy, the Group has set six execution priorities:

<p><b>1</b></p> <p><b>Move to a global business structure</b></p>	<p>The reorganisation to six global business units was completed in 2016. It has led to improved global co-ordination across the Group and strengthened accountability within each global business unit, simplifying the approach to customers and markets and increasing operational focus.</p>
<p><b>2</b></p> <p><b>Improve technical leadership</b></p>	<p>Research and development investment continues to be increased to extend Morgan's technical lead and to accelerate new product development. Our research and development Centres of Excellence allow for the concentration of development efforts in those areas which can deliver the greatest benefit globally to the Group.</p>
<p><b>3</b></p> <p><b>Improve operational execution</b></p>	<p>There are a number of opportunities across the global business units to improve operational execution. Resource and capital are allocated to target specific improvements to efficiency and effectiveness on a business-by-business basis.</p>
<p><b>4</b></p> <p><b>Drive sales effectiveness and market focus</b></p>	<p>The Group is focused on improving a number of aspects of its sales capabilities and process: sales processes and their efficiency, the management of key customer accounts and distribution channels, and deeper understanding of end-markets and faster-growing segments.</p>
<p><b>5</b></p> <p><b>Increase investment in people management and development</b></p>	<p>The Group aims to strengthen its leadership capability and deepen functional capabilities across the business, including in sales and engineering. Senior leaders will be benchmarked externally, new talent introduced and future leadership candidates identified from within the business. Performance management will be enhanced for the Group's top management and the structures and targets for incentive schemes will be reviewed. The Group will invest more in executive training and create clear career paths for its technologists and engineers.</p>
<p><b>6</b></p> <p><b>Simplify the business</b></p>	<p>Two divestments were completed in 2017 and a further business, Composites and Defence Systems is in process to exit the portfolio.</p>

# CEO's introduction



Doing business the right way, delivering on our EHS and ethical commitments, is the top priority for the Group.

**Pete Raby**  
Chief Executive Officer

## Introduction

We are committed to being a leader in safety, business conduct and ethical behaviour. Along with our leadership behaviours, these are all fundamental elements of what makes Morgan Advanced Materials a company we can be proud to work for.

We set this tone from the top, working to engage all of our people and we monitor and manage the Group's performance to ensure we do business in the right way.

We have two group programmes to support the this: The Responsible Business Programme which defines our standards, provides training against them, and monitors our compliance; and our Environment, Health and Safety (EHS) programme. This includes Morgan 'thinkSAFE' and the programme sets the Group standards for EHS, defines Group-wide improvement priorities, delivers training and supports the monitoring and management of our EHS performance.

## Health & Safety

2017 was a disappointing year from a safety perspective. Although total accident rates were down, our lost time accident rate increased from 0.27 per 100,000 hours worked in 2016, to 0.39 in 2017. In part this was the result of a road traffic accident in the USA, when a minibus carrying members of our Thermal Products operations team to our plant in Augusta, GA was hit from behind by another vehicle. Eighteen employees were injured with 11 suffering Lost Time Accidents. However, we have also seen increased accident rates in several businesses beyond this one serious accident, and we have further work to do to improve.

The Morgan 'thinkSAFE' programme, launched in 2015, is the vehicle for us to do this. At the end of 2017 the Board adopted a safety improvement plan to refresh 'thinkSAFE'. This will see us increasing the breadth and intensity of our activity on safety further in 2018.

## Environment

In 2017 we made headway on reducing our water use and waste intensity, and increased recycling rates. However, the disposals made during the year had an impact on our reported environmental performance, resulting in our energy and CO<sub>2</sub> figures increasing over the year (although it did improve on an organic basis). With much of Morgan's production involving the use of high-temperature processes we will be intensifying efforts to increase energy efficiency and to reduce the carbon footprint of our business.

Morgan 'thinkSAFE' has engaged and motivated employees in the safety arena and we will use the same approach to help drive our approach to environmental performance and operational improvements. In the coming year we will be looking at how we develop a Morgan environmental programme.

## Going forward

Whilst 2017 was a mixed year for the Group's EHS performance I want to reaffirm the commitment at every level of Morgan to conducting all the Group's activities in a manner consistent with our high ethical, safety and environmental standards and to driving improved performance.

Beyond our direct environmental impact, many of our products also help to enhance the efficiency of our customers' businesses. Products where we see growth opportunities for Morgan support higher levels of end-product performance and efficiency. This helps provide a resilient and distinctive source of differentiation and is an enduring strategic goal for the Group.

**Pete Raby**  
Chief Executive Officer

31 May 2018

# What Morgan does

Morgan provides advanced materials solutions to a variety of end-markets, we work collaboratively with customers worldwide to provide engineered products that satisfy technically challenging requirements in demanding environments.

## About us

Morgan Advanced Materials uses its deep knowledge of material science to produce technically differentiated components, assemblies and systems that deliver significantly enhanced performance in a multitude of industries.

Our engineered solutions are developed to exacting specifications and deliver ever greater performance through materials and production process innovation.

The Group's highly experienced scientists and application engineers are constantly engaged with our customers, to find new solutions for use in complex and technologically demanding environments.

This work is underpinned by a passion to develop the next generation of skilled materials scientists and application engineers, coupled with a commitment to the environment, health and safety, and to operate to highly ethical standards.

Morgan's 2017 revenues of £1,021.5m were up 3.3% on 2016 at reported exchange rates including the impact of disposals made during the year. On an organic basis, excluding the disposals and at constant currency, revenues were up 1.4%. Group headline operating profit was £119.7m in 2017 up from £116.9 million in 2016.

Additional information on all areas of Morgan Advanced Materials' corporate responsibility-related programmes, activities and performance can be found on pages 45-53 of the Group's 2017 Annual Report.

Further information about Morgan Advanced Materials is available on the Group's website at [www.morganadvancedmaterials.com](http://www.morganadvancedmaterials.com)

## Business structure

Operating from approximately 80 manufacturing facilities in 30 countries, supported by a network of sales offices, and employing approximately 8,800 people, Morgan Advanced Materials has a significant operational presence in all the world's major regions, serving customers in more than 100 countries.

The Group reports through two global Divisions and six global business units:

→ Thermal Products Division, organised in two global business units:

- Thermal Ceramics: 42% of Group revenue in 2017 – insulating fibre, board, paper, bricks and monolithics – an extensive range of high-temperature insulation products used to reduce energy consumption in industrial processes and provide fire protection.

- Molten Metal Systems: 5% of Group revenue in 2017 – crucibles for metals processing – a comprehensive range of crucibles for optimum performance in non-ferrous metal and alloy melting in foundries, die-casters and metal processing facilities.

→ Carbon and Technical Ceramics Division, organised into three global business units:

- Electrical Carbon: 15% of Group revenue in 2017 – electrical carbon and graphite products – primarily used for transferring electrical energy in motor and generator applications within the mining, transportation and power generation markets, and in semiconductor processing.

- Seals and Bearings: 11% of Group revenue in 2017 – carbon, graphite and silicon carbide components which deliver improved performance, reliability and extended life to pumps and similar equipment used in petrochemical, automotive, aerospace and water applications.

- Technical Ceramics: 25% of Group revenue in 2017 – ceramic cores for investment casting – consumable products used to create intricate internal cooling cavities in aero-engine and industrial gas turbine blades; structural ceramics – advanced ceramic components which demonstrate exceptional properties in harsh environments.

→ Composites and Defence Systems:

- 2% of Group revenue in 2017 – ballistic protection in the form of personal body armour or vehicle armour, utilising the Group's advanced ceramics for lightweight armour systems.

# About this report

Morgan has published an annual Environment, Health and Safety (EHS) Report since 2004. This report summarises the Group's EHS performance in the year ended 31 December 2017.

Morgan's 2017 EHS Report details the progress made in the past year and focusses on the material EHS issues for Morgan's business and stakeholders. The report covers the available data for the whole business.

Morgan's Environment, Health and Safety Policy and implementation programmes support its strategy and Core Values Statement. EHS performance has a direct and significant effect on operating performance and is therefore a key focus for risk assessment and operational management across the Group.

Morgan Advanced Materials is committed to conducting all its activities in a manner which achieves high standards of health and safety for employees and others affected by its operations. This commitment is continuous and on-going.

The Group is also committed to minimising the impact of its business on the environment and to maximising the positive environmental benefits of its products. Examples of Morgan's products which help enhance the environment-related performance and efficiency of the products and operations of the Group's customers are included in pages 25 to 28 of this Report.

The health and safety data in this report covers 100% of Morgan's employees and the environmental data covers 100% of its production sites.

The Group engaged ERM CVS to provide independent external assurance on its 2017 energy, CO<sub>2</sub>e<sup>1</sup>, waste, recycling and water related environmental data and on its lost time accident frequency. The independent assurance report from ERM CVS is set out on page 24.

As required by The Companies Act 2006 (Strategic Report and Directors' Report) Regulations 2013, the Group reports its greenhouse gas emissions in its Directors' Report. This information is included on page 51 of the Group's 2017 Annual Report and is reproduced in the Appendix on page 31 of this Report.

1. CO<sub>2</sub>e, Carbon Dioxide Equivalent – the amount of carbon dioxide or the amount of non-CO<sub>2</sub> greenhouse gas with the equivalent global warming potential.



# 2017 EHS highlights

Whilst the Group's EHS programmes helped reduce total accident numbers in 2017, the proportion of cases which resulted in lost time was up in the year with a single non-fault road traffic accident resulting in lost time injuries to 11 employees. Reported environmental performance was also mixed, although on an organic constant currency basis, performance improved in all key areas.

## Management highlights

- Morgan 'thinkSAFE', the Group's safety performance improvement programme, was ongoing during the year. Quarterly focus topics included Machine Guarding, 'Take 5 for Safety' (5S), Bright, clean and 'thinkSAFE' and Industrial vehicle safety.
- At the end of 2017 the Group adopted a new, Board approved safety improvement plan for 2018 and beyond. This is centred around the five key 'C-themes' of: Consistency, Compliance, Clarity, Communications and Competency.
- The safety improvement plan will refresh 'thinkSAFE' and strengthen the Group's safety capabilities. Each 'C-theme' is owned by a member of the Executive Committee with specific business unit and specialist EHS support.
- Morgan participated in the Carbon Disclosure Project (CDP) 2017 and achieved a score of B which places the Group in the top third of the CDP's FTSE 350 Industrial sector. This ranking testifies to the Group's climate change and energy related disclosure and performance.

## Health and Safety performance highlights

- The total number of accidents reported in 2017 was 678, down from 767 in 2016 and total accident frequency was down 10.4% in the year.
- Whilst the total number and frequency of accidents continued to fall, a higher proportion of these were lost time cases in 2017. Thus Lost Time Accident performance in 2017 was behind that achieved in 2016, although it represented an improvement on 2015.
- As mentioned in the CEO's Review, the deterioration in LTA performance was in part due to a serious incident when 19 employees travelling on Company business were involved in a non-fault road traffic accident. Eighteen of the employees were injured with 11 suffering Lost Time Accidents.

## Environmental performance highlights

- On a reported constant currency basis, environmental performance was mixed in the year. The Group exceeded its water intensity and recycling targets but did not achieve its waste intensity or its CO<sub>2</sub>e and energy intensity targets.
- On an organic, constant currency basis, excluding the impact of disposals made during 2017, performance improved in all key areas. The Group achieved a 0.7% reduction in CO<sub>2</sub>e intensity, a 5.9% reduction in water use intensity and a 2.6% reduction in waste intensity. The proportion of total waste recycled improved by 11 percentage points.
- On this organic basis the Group exceeded its targets to reduce water and waste intensity and to increase the proportion of waste recycled. Although CO<sub>2</sub>e emissions intensity was reduced in the year, it was by less than the target.

# EHS Policy

Morgan Advanced Materials' EHS Policy applies to all Group businesses and sets out the Group's commitment to protect the environment and the health and safety of employees, contractors and visitors across all Morgan companies worldwide.

Morgan's EHS Policy seeks to provide continuous improvement in environmental, health and safety performance in support of the Group's strategy.

The Policy forms the basis for Executive and management oversight of EHS matters, requiring high standards of EHS management at all Morgan facilities worldwide.

As summarised below, the Policy is made available to all employees and published on the Group's website and intranet.

All employees have responsibility for EHS policy and related matters:

- The Chief Executive Officer has overall accountability for corporate responsibility matters.
- The Chief Executive Officer is responsible for EHS policy, strategic direction and performance monitoring.
- The operational management teams have responsibility for EHS performance and reporting and for implementing this Policy and ensuring compliance.
- The General/Site manager of each operation has operational responsibility for EHS.
- Employees at all levels are responsible for implementing EHS rules and guidance, avoiding potential and actual hazards, for warning others accordingly and for identifying opportunities for improvement.

It is the Group's EHS policy that all Morgan businesses:

- Pursue the objective of zero harm by implementing the Morgan 'thinkSAFE' programme and by improving our safety culture.
- Comply with EHS legislation, regulations and other applicable legal requirements as a minimum standard.
- Conduct operations so as to minimise the impact on human health, to prevent pollution and to reduce hazards.
- Include EHS and climate change related considerations in our business decisions, promote efficiency programmes across the Group and minimise the environmental impact of historic, current and future operations.
- Supply products that, when used in compliance with product safety communications and common safety practices, will not present an unacceptable risk to human health and safety.

- Set objectives and targets for the continuous improvement of EHS performance and monitor and report progress internally and externally as appropriate.
- Ensure competence in EHS matters through training and education at all levels of the organisation.
- Conduct periodic reviews of the Group's Environmental and Health & Safety management systems.
- Maintain communications with stakeholders on EHS matters to help ensure alignment with their needs and expectations.

Morgan's commitment to this Policy is considered as fundamental to its business success and this Policy must be implemented by all Morgan operations worldwide. The Company has systems of training, monitoring and accountability in place in order to reinforce the implementation of this Policy.

This Policy applies to:

- All Morgan Directors, Officers and employees;
- All Morgan operations, including all legal entities and business units, and to Morgan joint ventures over which Morgan is able to exercise control over policies and procedures; and
- Any other person or entity to the extent that they act on behalf of Morgan in any way, including consultants, contractors, suppliers, agents or intermediaries.

The Company shall take such disciplinary action as it deems appropriate in enforcing this Policy, including dismissal.

In addition to the Group EHS Policy, Morgan businesses are required to ensure that they are aware of and take account of national, regional and local EHS laws and regulations and best practice, including the standards and guidance set out in the Group's EHS Framework.

Where appropriate the Group's operations have supplementary environmental and health and safety policies, key performance indicators and targets according to the risks, opportunities and needs of each particular business.

# EHS Policy implementation

Governance of Morgan's EHS Policy is achieved through performance monitoring, risk assessment and the management and mitigation of identified risks to help deliver continuous improvement in EHS performance in support of the Group's strategic priorities.

The Group's operations involve the normal environmental and health and safety risks associated with manufacturing and other activities in the countries in which Morgan operates. EHS management processes are designed to be forward-looking in the identification, management and mitigation of EHS risks and opportunities that could impact the Group's short- and long-term performance and value.

The governance structure for EHS places responsibility for EHS performance with the Chief Executive Officer and the operational management team, with each site having a point of accountability. There are EHS leaders in each of the Group's global business units who report to their respective management teams and are responsible for improving the standards of EHS management and performance across the Group's businesses

EHS performance is reported regularly to the Board by the Chief Executive Officer who has specific responsibility for EHS policy, strategic direction and performance monitoring. He is supported by the Group's Director, Environment, Health and Safety who is responsible for Group direction and oversight of the Group's EHS programmes.

Morgan's Group level EHS management processes include:

- Monthly review of performance and progress in the implementation of our improvement plans by the Executive Committee and business leaders.
- Regular review of EHS performance by the Board.
- The EHS Compliance Audit Programme conducted against the Morgan EHS Framework with a focus on high-risk items. The programme also covers the EHS management systems and the EHS KPIs reported by each site and helps ensure compliance with local regulations and good management practice.
- All the Group's manufacturing facilities are reviewed on a three-year rolling cycle. Accordingly, 24 sites were audited during 2017 (2016: 24). The audit reports are reviewed by the Director, Environment, Health and Safety and by members of the Executive Committee and Divisional Executive teams. Action items are tracked through a formal follow-up process.
- Formal training is an integral part of the implementation of the Group's EHS Policy. This is undertaken at a regional level and tailored to business-specific risks and opportunities, with Group-level support and oversight.
- External assurance of selected EHS data by ERM Certification and Verification Services (ERM CVS). The Assurance Report from ERM CVS is on page 24.

Taking site openings and closures into account, in 2017 environmental management systems were in place at 90 sites worldwide, including 38 sites certified to ISO 14001. Worldwide, 102 sites have health and safety management systems in place, with 15 sites certified to, or working towards, OHSAS 18001.

# EHS Policy effectiveness

Morgan Advanced Materials monitors the effectiveness of its EHS Policy through the external EHS Compliance Audit Programme, the internal EHS audit programme, the review of performance against a series of Group-wide KPIs, the external assurance programme and by participating in external initiatives.

The charts in this report summarise the Group's EHS performance in real terms, covering all production sites and all employees during the year. Environmental intensity KPIs are reported at constant currency and, where necessary, historic data has been restated to reflect changes to the business, in reporting methodology and to ensure year-on-year consistency.

The Group has commissioned independent external assurance of its EHS KPIs since 2011. In 2017 the independent assurance performed by ERM CVS covered the Group's Lost Time Accident Frequency rate, CO<sub>2</sub>e intensity, energy intensity, waste intensity, water intensity and the waste recycling rate. The Assurance Report from ERM CVS is set out on page 24.

The Group also participates in a number of external initiatives that help to benchmark policy effectiveness and progress. These include the Carbon Disclosure Project in respect of the Group's climate-change related strategies, risks, management and performance. In 2017, Morgan achieved a score of B, placing the Group in the top third of CDP's FTSE350 Industrials sector. This reflects the Group's performance and the depth and quality of climate change data the Group has disclosed to investors and the global marketplace through CDP.

Morgan Advanced Materials has also made filings in respect of the Group's UK facilities under the UK government's Carbon Reduction Commitment (Energy Efficiency) Scheme.



## Task Force on Climate-Related Disclosures (TCFD)

The Task Force on Climate-related Financial Disclosures (TCFD) was established by the Financial Stability Board (FSB) at the request of the G20 Finance Ministers and Central Bank Governors.

The TCFD report was published in June 2017 with objectives including promoting more informed investment decisions and enabling stakeholders to understand exposure to climate-related risks. The report includes recommendations for more effective climate-related disclosures.

Morgan has conducted initial assessments of its climate-related disclosures in the Annual Report, in its EHS Report, on the Group website [www.morganadvancedmaterials.com](http://www.morganadvancedmaterials.com) and in its annual submissions to the Carbon Disclosure Project, available from [www.cdp.net](http://www.cdp.net)

Whilst work will be ongoing on scenario planning in particular, the initial assessment indicates that Morgan's disclosure around climate change-related governance, strategy, risk management and metrics and targets are largely in line with or ahead of the recommendations from the Task Force.

# EHS Policy effectiveness continued

Morgan Advanced Materials is committed to environmental responsibility, to minimising the impact of its business on the environment and to maximising the positive environmental benefit of its products.

## Environment

The Group monitors the material impacts of its operations on the environment as measured by its Scope 1 CO<sub>2</sub>e and Scope 2 CO<sub>2</sub> emissions, energy, waste and water intensity per £ million of revenue and the proportion of total waste that is recycled. Environmental key performance indicators (KPIs) are reported by all sites on a monthly basis with the Executive Committee and the Board receiving regular reports.

The Group also sets targets for key aspects of its environmental performance. These are summarised in the table on pages 29 and 30 with performance against target reviewed by KPI below. Each production site also sets specific internal targets for improvement which are reviewed as part of the annual budget process to ensure they are aligned with and contribute to the Group's targets.

During the year, the Group undertook a series of projects and environmental programmes focused on the sites identified as having the greatest environmental impact. These are subject to regular review and follow-up by the executive team to ensure key opportunities and risks are addressed. In addition, Divisional programmes covering topics such as energy awareness help to enhance business and environmental performance and competitiveness. Additional details and examples are included in the case studies within this report.

## 2017 environmental performance

Morgan sets targets for the reduction of the impact of its operations on the environment, as measured by CO<sub>2</sub>e emissions, energy, waste and water intensity and the proportion of total waste which is recycled.

Excluding the impact of disposals made during 2017, environmental intensity was reduced in all key areas in the year. On an organic basis, the Group achieved a 0.7% reduction in CO<sub>2</sub>e intensity, a 5.9% reduction in water use intensity and a 2.6% reduction in waste intensity. The proportion of total waste recycled improved by 11 percentage points. Thus, on an organic basis the Group exceeded its targets to reduce water and waste intensity and to increase the proportion of waste recycled. However, although CO<sub>2</sub>e emissions intensity was reduced in the year, it was by less than the target.

As further detailed below, including the impact of the disposals, the Group exceeded its water intensity and recycling targets but did not achieve its waste intensity or its CO<sub>2</sub>e and energy intensity targets.

# EHS Policy effectiveness continued

## Energy use and emissions intensity

Much of Morgan's production involves the use of high-temperature processes. The Group reports the environmental impact of the energy used in these process and elsewhere in its facilities as CO<sub>2</sub>e emissions, indexed to revenues at constant currency. This takes into account the use of all sources of energy. Business performance is assessed on the basis of energy and emissions intensity i.e. energy use and emissions relative to revenue.

In absolute terms, including businesses disposed of during the year, total CO<sub>2</sub>e emissions due to energy use in 2017 were 332,600 tonnes, similar to the 332,200 tonnes reported for 2016 but 6.3% lower than 355,100 tonnes in 2015. Energy use was some 1,154 GWh, up by 1% from 1,145 GWh in 2016 but 6% down against the 1,224 GWh reported for 2015.

CO<sub>2</sub>e intensity<sup>1</sup> was up by 1.6% compared to 2016 but was 3.3% lower than in 2015. Energy intensity<sup>1</sup> in 2017 was up by 2.3% compared to 2016 but down by 2.6% compared to 2015. On this basis, Morgan did not achieve its 2017 target for a 1% reduction in CO<sub>2</sub>e emissions intensity in the year.

However, on an organic basis, excluding the impact of the disposals made in the year, 2017 CO<sub>2</sub>e intensity was down by 0.7% and energy intensity was down 0.1%.

As shown in the five-year performance charts, energy and CO<sub>2</sub>e intensity has been reduced since 2013 and the Group continues to have a number of production improvement projects which include energy efficiency programmes. These are planned to help reduce energy and CO<sub>2</sub>e intensity in 2018 and beyond and to help deliver continuous performance improvement.

In addition to improving energy consumption and emissions performance through increased efficiency, changes in Morgan's business and product mix influence the Group's energy and emissions when indexed to revenue. Emissions are also affected by changes in national electricity-CO<sub>2</sub> conversion factors. More details on Morgan Advanced Materials' carbon management can be found in the Group's submissions to the Carbon Disclosure Project. See [www.cdp.net](http://www.cdp.net) for further details.

## CO<sub>2</sub>e<sup>5</sup> intensity due to energy use<sup>1,2</sup>

### Tonnes CO<sub>2</sub>e/£m revenue<sup>3</sup>



## CO<sub>2</sub>e<sup>5</sup> due to energy use<sup>1,2</sup>

### Tonnes<sup>3</sup>



## Energy intensity<sup>1,4</sup>

### MWh/£m revenue<sup>3</sup>



## Energy use<sup>1,4</sup>

### GWh<sup>3</sup>



1. The 2017 CO<sub>2</sub>e intensity and energy intensity information has been subject to assurance by ERM CVS. For further details of the assurance provided see the Independent Assurance Report on page 24. Further details of the 2016, 2015, 2014 and 2013 assurance are included in the Independent Assurance Reports on page 47 of the 2016 Annual Report, page 32 of the 2015 Annual Report, page 30 of the 2014 Annual Report and page 31 of the 2013 Annual Report.
2. Scope 1 CO<sub>2</sub>e emissions from fossil fuel usage and Scope 2 CO<sub>2</sub> using market-based methodology and country specific CO<sub>2</sub> factors as CO<sub>2</sub>e factors are not consistently available for electricity use in all countries.
3. Calculated on a constant currency revenue basis, including disposals. Updated to reflect changes in reporting methodology to ensure year-on-year consistency.
4. Energy from all sources.
5. CO<sub>2</sub>e. Carbon Dioxide Equivalent – the amount of carbon dioxide or the amount of non-CO<sub>2</sub> greenhouse gas with the equivalent global warming potential.

# EHS Policy effectiveness continued

## Reducing natural gas use and CO<sub>2</sub> at MMS Sao Paulo

The MMS site in Sao Paulo, Brazil supplies customers across South America with premium crucibles and accessories for the melting, holding, treatment and casting of ferrous and non-ferrous metals.

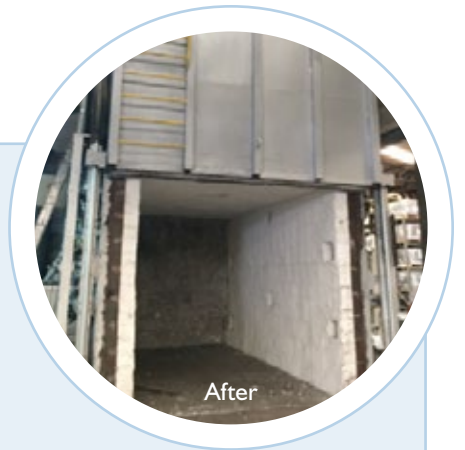
In September 2016, led by the Operations Manager, the site team conducted a brainstorming session with support from the MMS technical team in Germany. This identified the site's kiln #2 as a significant opportunity to enhance environmental performance, reduce safety risks and to improve business performance.

This large, 10 tonne, 62m<sup>3</sup> capacity natural gas-fired after-burner kiln operates at up to 1,350°C. It is used to fire and glaze clay-graphite and silicon carbide crucibles.

A detailed survey of kiln was completed. This identified damaged and ineffective insulation along with out of date kiln-controls and wiring. This was compounded by manual controls, leading to high energy consumption due to sub-optimal gas burners settings though the firing cycle, high maintenance costs and high rates of product re-work and scrap.

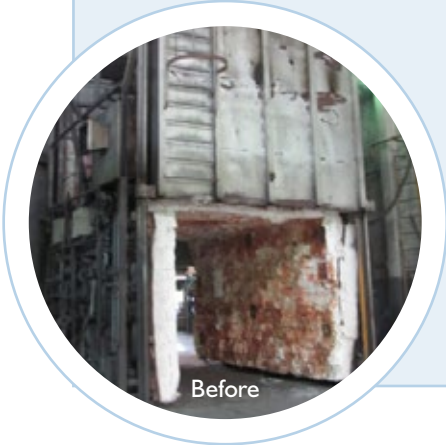
The project team put together a plan to overhaul the kiln to improve product quality, reduce scrap and re-work rates, reduce health and safety risks and to optimise energy use.

The overhaul involved the total refurbishment of the kiln including new insulation, programmable logic controls and the specialist training of operators with real-time monitoring of gas consumption. The improved efficiency will be sustained with new operation and safety procedures and a preventative maintenance programme.



The refurbished kiln was commissioned in December 2016. As a result of the team's efforts, kiln through-put was increased by 15% in 2017 and the natural gas use per tonne of output was cut by 43% contributing to an overall 19% reduction in natural gas use per unit of sales for the site and reducing CO<sub>2</sub> emissions by some 170 tonnes. Payback on the £100k refurbishment cost was less than 12 months.

Following the success of the kiln #2 refurbishment project, the Sao Paulo team has already identified other improvement opportunities including the potential to fit servo-motors to control the gas and air valves and a damper system to retain heat in the kiln, further reducing energy use. They are also sharing the learning from the project with other sites world-wide.



## Thermal Ceramics India: cutting CO<sub>2</sub> emissions with solar PV

The Thermal Ceramics site in Ranipet, Tamil Nadu, India, produces high-temperature Superwool® and other insulating fibres for thermal management in the petrochemical, power generation and other industries for the local market and across the region.

To produce the high-temperature insulating fibre the site uses an electric arc which operates at 1,500-1,800°C, depending on the chemistry of the products. Thus energy is a significant input cost for the Ranipet site.

During 2017, with the support of the regional EHS team, the site put together a plan to install roof top solar photo-voltaic panels at the site with the objectives of reducing costs and cutting CO<sub>2</sub> emissions due to the site's use of electricity. This will make use of the 2,800-3,000 hours of sunshine the site receives each year.

The panels were installed in two phases on different buildings on the site, with a total capacity of 90 kW. This will help the site reduce CO<sub>2</sub> emissions due to electricity use by some 80 tonnes per year at grid-average rates.

Based on the success of the installation at Ranipet, the Thermal Products team in Asia is now looking at opportunities to install solar panels at other sites, including in China.



# EHS Policy effectiveness continued

## Increasing energy efficiency and cutting CO<sub>2</sub> at Technical Ceramics Jiangsu

The Morgan site in Jiangsu, China was newly established in 2015 to supply Technical Ceramics products, including ceramic cores, to the aerospace industry in Asia.

The plant was commissioned in early 2016 and in 2017 a team lead by the Operations Manager worked to implement a series of continuous improvement projects to optimise the production processes and to enhance efficiency.

One project focussed on the gas-fired kilns at the site (pictured below). These operate at temperatures of up to 1,250°C and their efficiency is key to the environmental performance of the site. Following a review of the ways in which the kilns are loaded and used, a series of improvements were implemented to improve yield, change kiln-pressure management to reduce heat loss and to fine-tune the firing cycle, which allowed the use of after-burners to be reduced.

As a result of these initiatives, natural gas use per unit of output was reduced by 11% in 2017 with the associated CO<sub>2</sub> emissions cut by some 50 tonnes. The team is looking to implement further continuous improvements in the coming year.



## Technical Ceramics, Hayward, CA, USA: reducing CO<sub>2</sub> emissions by cutting electricity use

During 2017 the Technical Ceramics site in Hayward, CA, USA focused on a series of projects to reduce electricity consumption.

The Hayward team enlisted the support of their utility supplier and their landlord and also worked with a third-party specialist to help identify and evaluate energy reduction opportunities.

Specific electricity saving projects undertaken during 2017 included:

- Upgrading all the fluorescent lighting in the site's office and production areas to energy-efficient LEDs. In total, 418 fixtures were changed with each new fixture reducing energy consumption by 46%. The LED lights are also more rugged and durable with a lifespan of 100,000 hours compared to 4,000 hours for the fluorescent bulbs. This has helped to reduce maintenance costs and to reduce hazardous waste from the site.
- Air-compressor rationalisation. Previously the site had separate air compressor and refrigerated air-dryer systems for the Ceramics and the Braze Alloys business units on site. The team identified the opportunity to rationalise this to one system with a trim unit to handle demand fluctuations through the working day.

These initiatives, combined with other energy savings measures across the site, helped to reduce electricity use by 28% with the associated CO<sub>2</sub> emissions down by over 800 tonnes in the year.

The initiatives to reduce electricity use followed on from the Hayward team's successful work in 2016 to reduce water consumption by 41% compared to 2015. Water consumption in 2017 was down a further 30% compared with 2016.





# EHS Policy effectiveness continued

## Waste and Recycling

Waste management is a key area of focus for the Group with opportunities to reduce the use of raw materials, packaging and other consumables. As well as saving money through waste reduction, by recycling certain waste streams including scrap metal, cardboard and other materials, the Group can turn costs into revenue.

Hazardous and non-hazardous waste is monitored according to waste stream and disposal route, with performance assessed on the basis of waste intensity (i.e. waste quantities indexed to revenue) and the proportion of total waste which is recycled.

Including businesses disposed of during the year, total waste reported in 2017 was 45,500 tonnes, down by 2.2% from 2016 and 6% lower than in 2015. Waste intensity<sup>1</sup> was down by 0.9% compared to 2016 and down by 3% compared with 2015. On this basis, Morgan did not achieve its 2.5% waste intensity reduction target for the year.

Consistent attention to waste management helped improve rates of recycling. As a result, 25,300 tonnes of waste material was recycled during the year. This included some 970 tonnes of paper and cardboard, 290 tonnes of plastic, 1,500 tonnes of wood and 1,280 tonnes of metal. The remainder of the recycled material included scrap, dust, slag and other process by-products which were used by others as raw materials for their processes and for other purposes.

The proportion of total waste which was recycled<sup>1</sup> was 56% in 2017, an increase of 11 percentage points from 2016 and 13 percentage points from 2015. Thus the Group exceeded its target to increase the proportion of total waste which is recycled by one percentage point in the year. A significant part of the improvement since 2014 is due to the identification of an opportunity for a third party to re-use a significant waste stream at the Group's site in Augusta, GA, USA (see case study on following page).

On an organic basis, excluding the impact of the disposals made in the year, 2017 waste intensity was down by 2.6% and the proportion of total waste recycled was up by 11 percentage points.

## Waste intensity<sup>1,3</sup>

### Tonnes waste/£m revenue<sup>2</sup>



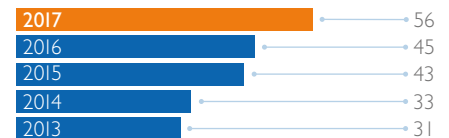
## Waste<sup>1,3</sup>

### Tonnes<sup>2</sup>



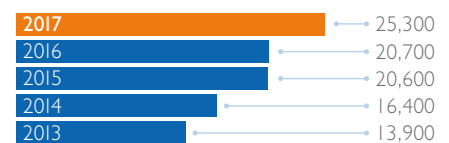
## Recycling %<sup>1</sup>

### % of total waste recycled



## Recycled waste<sup>1</sup>

### Tonnes



- The 2017 waste intensity and recycling rate information has been subject to assurance by ERM CVS. For further details of the assurance provided see the Independent Assurance Report on page 24. Further details of the 2016, 2015, 2014 and 2013 assurance are included in the Independent Assurance Reports on page 47 of the 2016 Annual Report, page 32 of the 2015 Annual Report, page 30 of the 2014 Annual Report and page 31 of the 2013 Annual Report.
- Calculated on a constant currency revenue basis, including disposals. Updated to reflect changes in reporting methodology to ensure year-on-year consistency.
- Hazardous and non-hazardous waste, including recycled material.

# EHS Policy effectiveness continued

## Increasing recycling at Thermal Ceramics Augusta

The Morgan site in Augusta, Georgia, USA is the Group's largest world-wide, producing a full range of Thermal Ceramics products, including insulating fibre, fire bricks and fired refractory shapes.

These are used to manage heat and to reduce energy use in a variety of industries such as petrochemical, iron and steel, energy, ceramics and cement production.

During 2017, the team at Augusta worked to increase employee engagement on environmental matters in a similar way as is done through 'thinkSAFE'. As a result, 'environmental conversations' are now included in meetings and briefings and during site tours, helping to improve communication between shop floor employees and supervisors and to benefit environmental performance.

One area of focus for these conversations has been waste and recycling. An onsite recycling centre has been installed along with a network of recycling bins in 20 key locations across the site. These have helped segregate paper, aluminium and plastic for recycling, much of which would previously been included in mixed waste to landfill. Other measures include the installation of an on-site bailer to improve management of recyclable materials and to reduce volumes for transportation, thus reducing costs and enhancing the value of recycled materials.

Work with the site's waste contractors to identify opportunities for waste to be re-used or recycled is also ongoing. This includes partnerships with local companies who collect, reuse and recondition wooden pallets, plastic tanks and purchase scrap metal from the site for recycling. In addition, during 2017 the Morgan team was able to extend their work with the local landfill-site to



increase their use of aggregate-like waste material such as furnace rock and hard refractory material to construct temporary roads at the landfill site, replacing the use of purchased gravel.

These measures have helped the site to increase the proportion of waste that is recycled up from 44% in 2016 to 65% in 2017, an important contribution to the Group's overall increase in recycling rate.

## Electrical Carbon South Africa – improving waste management

The Morgan Electrical Materials business in Johannesburg, South Africa provides the mining, industrial and railway industries across Southern Africa with the carbon brushes, brush holders, slip rings, pantograph carbon strips and mechanical graphite products which are critical to their smooth and efficient operation.

Over the past five years, the site has worked to reduce waste and to improve waste management.

Following a site clean-up in 2015 these initiatives were accelerated with the appointment of a new EHS officer and a change to a waste management contractor with a focus on recycling. As a result, waste is now segregated with designated areas and colour-coded bins so that cardboard, plastic wood, steel scrap and other materials are recycled where as previously they were sent to landfill.

As well as reducing waste and increasing recycling, the Morgan team has been working with local businesses to identify alternative uses for by-products from the site's production processes.

As a result, waste carbon dust which was previously disposed of as hazardous waste, now goes to a local company to be reprocessed for use in their paint manufacturing process. A pallet supplier also collects and repairs pallets from the site for re-use.

Over the past five years the site has reduced total waste by over 50% and has increased recycling from zero to 38% of total waste.

During 2018 the site will be undergoing a planned renovation and whilst total waste is expected to increase in the year, the team will be working to increase the proportion of this that is reused or recycled.



# EHS Policy effectiveness continued

## Water Use and Intensity

The Group reports water use for potable, sanitary, irrigation and process purposes. A significant proportion of the Group's water usage is in production processes, approximately 60% of which is subsequently discharged. The Group monitors use of water from both on-site extraction and from local authority and similar sources and assesses performance on the basis of water intensity.

Total water use in 2017 was 2.32 million m<sup>3</sup>, a reduction of 4.9% compared to 2016 and of 1.3% compared to 2015. Water use intensity<sup>1</sup> at constant currency was reduced by 3.4% compared with 2016, exceeding the target to reduce water intensity by 2.5% in the year. Many sites around the world and particularly in Asia, where water is a limited resource, continued to deliver strong improvements in water use over the period.

On an organic basis, excluding the impact of the disposals made in the year, 2017 water intensity was down by 5.9%.

## Water intensity<sup>1,3</sup>

m<sup>3</sup>/£m revenue<sup>2</sup>



## Water use<sup>1,3</sup>

million cubic metres<sup>2</sup>



1. The 2017 water intensity information has been subject to assurance by ERM CVS. For further details of the assurance provided see the Independent Assurance Report on page 24. Further details of the 2016, 2015, 2014 and 2013 assurance are included in the Independent Assurance Reports on page 47 of the 2016 Annual Report, page 32 of the 2015 Annual Report, page 30 of the 2014 Annual Report and page 31 of the 2013 Annual Report.
2. Calculated on a constant currency revenue basis, including disposals. Updated to reflect changes in reporting methodology to ensure year-on-year consistency.
3. Water from all sources, including process, irrigation and sanitary use.



## Cutting water use at Seals & Bearings, St Marys, USA

Within Morgan's Carbon and Technical Ceramics Division, the Seals and Bearings business specialises in performance-critical components for the pumps and compressors used in challenging applications and extreme environments in the process industries and for aerospace and nuclear power applications.

The St Marys, PA, USA facility uses high-temperature processes to produce Silicon Carbide flour and Carbon/Graphite materials and components. These are produced with the right combination of hardness, thermal conductivity, low friction and thermal shock resistance.

St Marys' kilns and continuous ovens, moulding presses, gas crackers, spray-driers, vacuum pumps and other equipment operate 24/7 at high temperatures and require cooling, as do the components and materials as they exit the hot zone, prior to further processing and machining to shape. Cooling requirements across the site include air-conditioning during the summer months and without sufficient cooling the site cannot operate.

Previously cooling was achieved with a water intensive one-pass open loop system using water from the municipal water supply. After use, the clean but warm water was discharged to the sewer or a local water course, depending on temperature and the time of year. Cooling capacity was also dependent on the temperature of the incoming water supply.

During 2016 the site's engineering team developed a \$340k capital expenditure project to upgrade the system to a bespoke closed-loop re-circulating system with cooling towers (pictured), and variable frequency drive pumps and fans. The system was designed to allow for expansion of the site and with redundancy to allow continuous operation during maintenance.

As well as dramatically cutting water use and discharge the new system will also reduce energy use on the site.

Implementation work commenced in late 2016 and the system was successfully commissioned in mid-July 2017. As a result, the site's 2017 water use was reduced by some 35,000m<sup>3</sup> or 45% compared with 2016. With a full year of operation in 2018, water use is forecast to be down by a further 80% taking St Marys from one of the Group's most water intensive sites to one of the most water efficient.

# EHS Policy effectiveness continued

## Environmental Regulatory Compliance

Morgan Advanced Materials received no reported prosecutions in relation to environmental compliance matters during 2017. However, three sites reported environmental enforcement notices as follows:

A site in the UK received a notice of violation relating to particulate emissions in excess of the permitted level. The issue was rectified and retesting confirmed compliance with no financial penalties imposed. A site in China received two environmental protection notices and paid a penalty of £8,000 in respect of dust emissions and fugitive emissions of volatile organic compounds. The source of the dust was removed and the site installed new VOC treatment equipment to address the issues. A site in Brazil received a notice in respect of noise pollution and this was resolved by amending operating procedures and times.

The Group has a small number of ongoing remediation programmes to address historical soil and groundwater contamination issues.

## 2018 Environmental Priorities

- Explore opportunities to further the Group environmental strategy through the development of a Morgan environmental performance improvement programme.
- Continue the focus on environmental improvement projects at sites with the biggest environmental impact.
- Extend the benchmarking of sites with similar production technologies to encourage implementation of best practice and improvement plans.
- Focus on robust ownership and delivery of environmental targets at site, business and Divisional levels.
- Review and develop opportunities to increase the use of renewable energy.
- Report Morgan's carbon footprint on the basis of market and location-based methods to further reflect efforts to de-carbonise our business.



## Water reductions at Thermal Ceramics, UK

The Morgan Thermal Ceramics Site in Bromborough UK, is a sales and distribution site as well as an R&D Centre of Excellence for fibre with laboratories, product development lines and test rigs for insulating materials and related products.

The site uses water for domestic and sanitary purposes and in the laboratories, development machines and test facilities on site. During 2017, led by the site engineer, the Bromborough team reviewed the daily water use across the site. Although the site operates five days they found that water use was broadly consistent seven days per week and appeared inordinately high for the work being performed and the number of staff on site.

Further investigation identified that a number of the toilet cisterns on site were constantly overflowing whilst urinals were on constant feed and discharge. Further, a corroded and leaking feed pipe was identified and various water-fed steamers, humidifiers and other machines in the R&D facility did not have solenoid valves to switch off the water when the machines were not in use.

By modifying operating procedures to minimise water use, fitting solenoid valves, fixing leaks and faulty cisterns the team was able to dramatically reduce water use by 62% in 2017.

With constant vigilance and increased awareness, the site is looking to maintain and better the improvement in the coming year.

# EHS Policy effectiveness continued

The Group's long-term objective is 'zero harm' and it seeks to achieve year-on-year improvements in performance as it progresses towards this objective.

## Health and Safety

With the long-term aim of an injury-free workplace, Morgan is committed to its health and safety core values and to conducting all its activities in a manner that achieves high standards of health and safety for all employees and stakeholders. The Group's long-term objective is 'zero harm'. We aim to deliver year-on-year improvements in performance as we progress towards this objective.

Morgan's health and safety policy statements are clear and communicated throughout the Group. The policy statements are supported by site-level assessment and monitoring of risks. Leading and lagging health and safety metrics are reported by all sites world-wide and receive a high degree of focus at all levels of the business.

The Group Health and Safety core values are available in the 17 working languages used across the Group and have been communicated and adopted Group-wide:

- We are committed to creating a culture and environment that is 'zero harm' with no related accidents or illness due to our activities.
- We will encourage and expect our employees and contractors to be passionate about safety.
- We are dedicated to creating a positive safety culture based on openness, transparency and responsibility.
- We support a safe working culture through investment and training.
- We will engage with our people to continuously improve safety knowledge, reporting and performance through our 'thinkSAFE' programme.

Focus is increasingly placed on leading indicators as well as on those sites with below-average performance, as measured by their health and safety KPIs and through the EHS Compliance Audit Programme. The Executive Committee and the Board receive reports and review health and safety matters on a regular basis.

In the fourth quarter of the year the Board approved a new safety improvement plan and strategy. This will refresh the Morgan 'thinkSAFE' programme with additional training, further employee engagement on safety and clearer local communication of progress. The improvement plan will be reinforced with a review of leading and lagging indicators and improved incident management combined with a review of skills, competencies and resources.



## Gas safety at Electrical Carbon, Swansea, UK

As part of the gas safety program of the Morgan EHS Framework, the Electrical Carbon site in Swansea, UK reviewed the provision of highly flammable process gas to their sintering furnaces.

The furnaces are part of the process used to produce the metal-graphite collectors which to transfer electrical current in highly technical and safety critical applications including lifts, cranes, robotics and wind-turbines.

The sintering furnaces, which operate at over 600°C, are supplied with a blanketing gas mixture of nitrogen and hydrogen to create an inert and slightly reducing atmosphere which minimises oxidation of the collectors.

Historically the gases were supplied to individual mixing cabinets adjacent to the furnaces. This required long pipe runs of flammable and potentially explosive hydrogen gas through the building from the externally located gas storage tanks and cylinders.

As part of the safety review of the installation, the Swansea EHS and Facilities teams undertook a hazard analysis, considering the hierarchy of risk control. The use of hydrogen could not be eliminated for technical reasons, so the team looked at alternative options.

The solution selected was to install a new gas mixing system located adjacent to the external gas storage tanks. The gases are then fed to the furnaces at a mixture outside the lower explosive limit for hydrogen, eliminating the explosive risk from transported gas within the building.

Safety systems include real time analysis of the hydrogen levels within the gas stream. This automatically shuts-down the system if the gas mixture reaches explosive levels. Other critical parameters are also controlled to ensure a safe and efficient process. The installation is approved for use in a potentially hazardous environment and is located within the secure gas compound. The main control panel is easily accessible from outside the compound with secondary controls adjacent to the furnaces.

The new system has resulted in many benefits beyond safety including ease of use, easier fault finding and significant space savings.

# EHS Policy effectiveness continued

## 2017 Health and Safety performance

The Group's health and safety KPIs include accident frequencies, causes and related lost working time. These are used to monitor the effectiveness of the Group's Health and Safety Policies and related systems on a monthly basis. The independent external assurance performed by ERM CVS covered the Group's 2017 Lost Time Accident (LTA) frequency rate. The health and safety KPIs in this report cover 100% of employees.

In 2017, the Group's accident prevention and training programmes focused on reducing accident occurrence through an emphasis on leading indicators supported by behavioural safety initiatives and training as part of the 'thinkSAFE' programme.

The total number of accidents reported was 678, down from 767 in 2016. Thus the Group's total accident frequency per 100,000 working hours was 3.49, a reduction of 10.4% on 2016 and of 28% on 2015.

However, a higher proportion of accidents resulted in lost working time in the year. This was in part due to a non-fault road traffic accident which involved 19 Morgan employees from around the world who were travelling to a management meeting at the Thermal Ceramics site in Augusta, GA, USA. The mini-bus and car in which the Morgan employees were travelling were stationary at a red traffic light when they were struck from behind by a third-party travelling at speed. Eighteen Morgan employees were injured with 11 incurring Lost Time Accidents. The Lost Time Accidents resulted in 532 working days lost in the year.

Including this road traffic accident, LTA performance deteriorated in the year, with a total of 75 LTAs were reported in the year, up from 53 in 2016 (91 in 2015). Accordingly, 2017 LTA frequency<sup>1</sup> was 0.39 per 100,000 working hours (2016: 0.27, 2015: 0.45).

In 2017 LTA frequency rates increased in several businesses beyond this one serious incident and we have further work to do to improve our performance. The Board endorsed a plan to refresh 'thinkSAFE' to further increase the focus on safety and to keep safety front of mind for our employees.

Reported lost time due to accidents and work-related illnesses as a percentage of working time increased to 0.13% in 2017 (2016: 0.06%; 2015: 0.08%). The number of days lost during 2017 was 3,040 (2016: 1,422, 2015: 2,135). The average number of days lost in 2017 per LTA reported in the year increased to 40.5 days (2016: 26.8; 2015: 23.5).

Accidents are reported in the year in which the accident actually occurs with the lost time reported in the year in which the individual is away from work. Thus accidents which occur in a prior year which result in lost time the following year can impact the lost time as a percentage of total working time and the lost time per LTA key performance indicators and the increase in the average days lost per LTA in 2017 was in part due to days lost in 2017 due to accidents which occurred in 2016.

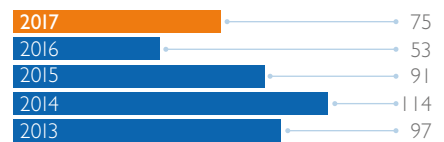
## Lost-time accident frequency<sup>1, 2</sup>

### LTA's/100k hours worked<sup>1</sup>



## Lost-time accidents<sup>2</sup>

### Number of LTAs<sup>1</sup>



## Health and safety-related lost time

### % of total working time



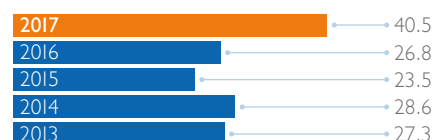
## Health and safety-related lost time

### Days lost due to LTAs<sup>1</sup>



## Lost-time per LTA<sup>1,2</sup>

### Days per LTA<sup>3</sup>



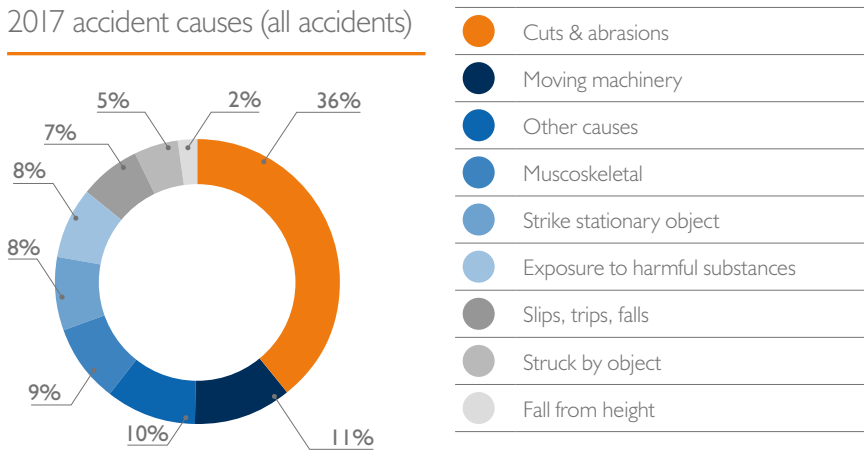
1. Morgan's 2017 lost-time accident frequency information has been subject to assurance by ERM CVS. For further details of the assurance provided see the Independent Assurance Report on page 24. Further details of the 2016, 2015, 2014 and 2013 assurance are included in the Independent Assurance Reports on page 47 of the 2016 Annual Report; page 32 of the 2015 Annual Report; page 30 of the 2014 Annual Report; page 31 of the 2013 Annual Report.

2. A lost-time accident (LTA) is defined as an accident or work-related illness which results in one or more days' lost time.

3. Total time lost due to health and safety in the year divided by the number of lost time accidents reported in the year.

# EHS Policy effectiveness continued

2017 accident causes (all accidents)



A total of 678 accidents were reported in the year, including lost time and non-lost time incidents. This was down from 767 in 2016 and 977 in 2015.

Manual handling related cuts and abrasions remain the most common causes of accidents and the Group continues to address this, with attention being focussed through the regional EHS management team to targeting the main causes of accidents in each region.

## Morgan's EHS framework: identifying, managing and reducing safety risks

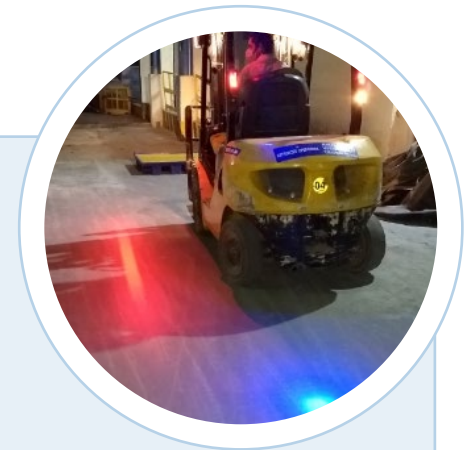
Many Morgan sites around the world use powered industrial vehicles (PIVs) to carry, push, pull, lift or stack materials. PIVs include rider operated and other vehicles and the most common are forklift trucks.

PIVs are identified as a high risk in the Morgan EHS framework with hazards for pedestrians, operators and others in the workplace as well the potential for asset damage.

As sites worldwide have been rolling-out the Morgan EHS Framework, they have been reviewing and upgrading their safety systems and training relating to PIVs as well as modifying equipment to implement best practice.

For example, as pictured above, forklift trucks at the Thermal Ceramics site in Ranipet, India have been upgraded with additional safety features including 'halo' lights which project ahead, behind and along-side the forklift, making the truck more noticeable and warning pedestrians and other drivers of approaching traffic. Other safety upgrades include interlocking the ignition system with the seatbelt alarm, blind spot sensors and operator training and eyesight testing, including for colour blindness.

At the Thermal Ceramics site in Augusta, GA, USA PIVs include golf carts are used to provide access around the site which is Morgan's largest site worldwide. Safety updates include modifications to improve visibility at junctions to help prevent collisions and golf carts and forklifts have been fitted with projecting blue halo lights, as pictured below.



Also in North America, the site in Elkhart, IN has improved loading dock safety for PIVs, installed barriers to help protect pedestrians and uses halo lighting on the sites forklifts, as does the site in Pachuca, Mexico where column-protectors have been installed to protect the building and to increase visibility for operators. At the Thermal site in Emporia, KS, pedestrian walkways have been re-laid to reduce hazards and the site in Burlington, ON, Canada has installed traffic indicator lights to help separate forklifts and pedestrians and to prevent collisions.



# EHS Policy effectiveness continued

## Health and Safety Regulatory Compliance

Morgan Advanced Materials received no prosecutions in relation to health and safety compliance matters during 2017. However, two sites in China received an improvement notices, one regarding an occupational health evaluation and the second with regard to the storage of chemicals on site. Both issues have been addressed and resolved.

## 2017 Health and Safety Priorities

- Implement the new safety improvement plan and strategy for 2018 onwards.
- Strengthen and refresh 'thinkSAFE' as the platform for safety performance improvement Group-wide with a particular focus on employee engagement and interaction through each site's safety corner.
- Drive a consistent approach to safety at all sites through 'thinkSAFE'.
- Update the Group's safety framework to ensure compliance and to focus on key risk identification and management taking account of scale and opportunities for simplification.
- Increase the use of safety data and information to support performance improvement, to inform decision-making and to ensure accountability.
- Develop a Safety Technical Leadership Committee to help implement safety strategy and to provide tactical support to site management to embed the culture of 'zero-harm'.
- Focus on reducing the time lost by each lost-time accident through appropriate return-to-work initiatives.

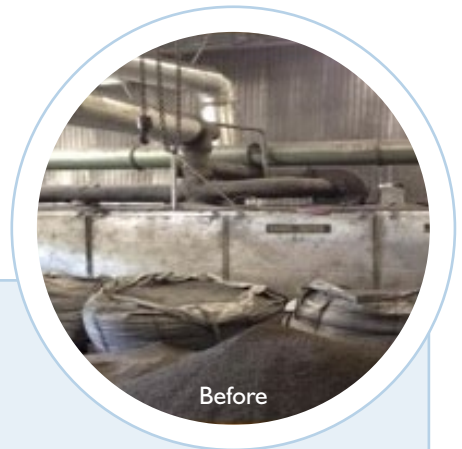
## Implementing 'thinkSAFE' and improving operations at MMS Mehsana, India

The Morgan MMS plant in Mehsana, Gujarat, India produces crucibles for the non-ferrous metals industries, specialising in metal-melting applications including zinc, precious metals, aluminium, copper, brass and bronze.

The site has not had a lost time accident since 2015, but there were 10 non-lost time accidents, including first aid only cases, in 2016. To make progress towards the Group objective of 'zero-harm' during 2017, the MMS team focussed on reducing first aid-only and other less severe injuries.

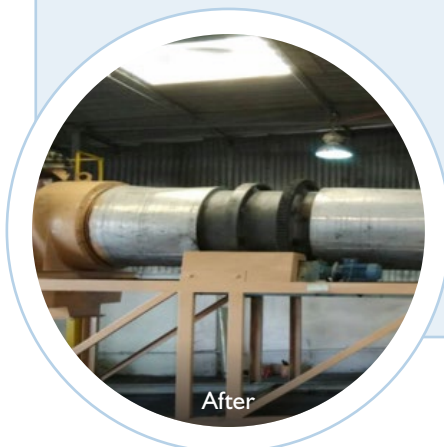
This formed part of the implementation of Morgan 'thinkSAFE' at the site and included:

- 'thinkSAFE' refresher training for all employees.
- Ensuring that safety 'tool box' talks are held at the start of each shift in each section of the plant. This is complemented by the 'Take 5 for safety' checks conducted before a task is undertaken to reduce risk and provide a last line of defence to eliminate accidents.



- Updates to the plant layout including a change in layout of the Sigma Section to help improve safety following the move of a process to the MMS plant in Aurangabad, India. The revised layout was designed for safety and to improve working conditions. Open heating and conveying systems were replaced with closed heating and a rotary drier, as pictured. This has reduced operational complexity as well as employee exposure to dust and heat.
- Changes to equipment to implement improved and updated machine guarding with modifications where needed to include safety interlocks.
- Training on high risk items from the Morgan EHS Framework, as tailored to the risk profile of the site.
- The launch of 'Safety Hero' and 'Safety Champion' awards. These involve all employees at the Mehsana site with awards based on near-miss reporting, EHS improvement suggestions, safety challenges and tool box talks conducted. The awards are supported by audits and meetings involving executive team members.
- Detailed investigation of all accidents with 100% corrective and preventative action for all accidents that occurred in 2016 and 2017. This is supported by lessons learnt from the near-misses reported by the sites 140 employees.

As a result, the accident rate was reduced by 69% in the year to 0.93 per 100,000 hours worked with three accidents reported compared to 10 in 2016, 16 in 2015 and 27 in 2014.





# Independent assurance report

## Independent Assurance Statement to Morgan Advanced Materials plc

ERM Certification and Verification Services (ERM CVS) was engaged by Morgan Advanced Materials plc (Morgan) to provide limited assurance in relation to specified 2017 EHS performance data in Morgan's Annual Report for the year ended 31 December 2017 ('the Report') as set out below.

Engagement summary	
<b>Scope of our assurance engagement</b>	<p>Whether the following EHS performance data for the year ended 31 December 2017 are fairly presented, in all material respects, with the reporting criteria:</p> <ul style="list-style-type: none"> <li>→ GHG: Total Scope 1 and Scope 2 emissions due to energy use in tonnes CO<sub>2</sub>e; CO<sub>2</sub>e intensity (tonnes CO<sub>2</sub>e/£m revenue)</li> <li>→ Total Energy use (GWh) and Energy intensity (MWh/£m revenue)</li> <li>→ Water use (million m<sup>3</sup>) and Water intensity (million m<sup>3</sup>/£m revenue)</li> <li>→ Waste (tonnes) and Waste intensity (tonnes/£m revenue)</li> <li>→ Recycling rate; and</li> <li>→ Safety: Number of lost time accidents (LTAs) and Lost Time Accident Frequency (LTAs/100K hours worked).</li> </ul>
<b>Reporting criteria</b>	Morgan's own internal reporting criteria and definitions are set out in the Environment, Health and Safety section of the corporate website: <a href="http://www.morganadvancedmaterials.com/media/4632/mgam-ehs-reporting-criteria-2016.pdf">www.morganadvancedmaterials.com/media/4632/mgam-ehs-reporting-criteria-2016.pdf</a>
<b>Assurance standard</b>	ERM CVS' assurance methodology, based on the International Standard on Assurance Engagements ISAE 3000 (Revised).
<b>Assurance level</b>	Limited assurance.
<b>Respective responsibilities</b>	<p>Morgan is responsible for preparing the data and for its correct presentation in reporting to third parties, including disclosure of the reporting criteria and boundary.</p> <p>ERM CVS's responsibility is to provide conclusions on the agreed scope based on the assurance activities performed and exercising our professional judgement.</p>

### Our conclusions

Based on our activities, nothing has come to our attention to indicate that the EHS performance data for year ended 31 December 2017, as listed above, are not fairly presented, in all material respects, with the reporting criteria.

### Our assurance activities

Our objective was to assess whether the selected data are reported in accordance with the principles of completeness, comparability (across the organisation) and accuracy (including calculations, use of appropriate conversion factors and consolidation). We planned and performed our work to obtain all the information and explanations that we believe were necessary to provide a basis for our assurance conclusions.

A multi-disciplinary team of EHS and assurance specialists performed the following activities:

- Interviewed relevant staff to understand and evaluate the data management systems and processes (including IT systems and internal review processes) used for collecting and reporting the selected data.
- Reviewed the internal indicator definitions and conversion factors.
- Visited four sites (USA, India, China and Germany) to review local reporting processes and consistency of reported annual data with selected underlying source data for each indicator. We interviewed relevant staff, reviewed site data capture and reporting methods, checked calculations and assessed the local internal quality and assurance processes.
- An analytical review of the data from all sites and a check on the completeness and accuracy of the corporate data consolidation.

- Year-end assurance activities at corporate level including the results of internal review procedures and the accuracy of the consolidation of the data for the selected indicators from the site data.

### The limitations of our engagement

The reliability of the assured data is subject to inherent uncertainties, given the available methods for determining, calculating or estimating the underlying information. It is important to understand our assurance conclusions in this context.



**Jennifer Iansen-Rogers**  
 Head of Corporate Assurance Services  
 27 February 2018

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ERM CVS is a member of the ERM Group. The work that ERM CVS conducts for clients is solely related to independent assurance activities and auditor training. Our processes are designed and implemented to ensure that the work we undertake with clients is free from bias and conflict of interest. ERM CVS and the ERM staff that have undertaken this engagement work have provided no consultancy related services to Morgan Advanced Materials plc in any respect.

# Morgan Advanced Materials products: enhancing global sustainability

## Strategy in action

Morgan identifies opportunities in sectors where its materials science and applications engineering skills can solve technically demanding challenges. The Group chooses its markets carefully, focussing on those in which it can achieve leadership and then continue to refine its output to increase the proportion of differentiated products.



How energy efficiency needs are creating opportunities across Morgan Advanced Materials' sectors and markets



The development of materials science and engineering has a major role to play in the global drive towards energy efficiency.

In implementing its strategic priorities, Morgan is ideally placed to provide the technical support that its customers need to plan their own approach to improving energy management.

# How energy efficiency needs are creating opportunities across Morgan's sectors and markets

Energy demand is a crucial global issue. Advanced materials are increasingly playing a significant role in helping to develop greater energy efficiencies for a sustainable future.

As Global energy demand continues to rise, the solutions to the world's energy problems will include optimisation of a range of traditional and renewable energy sources.

The question of how to deal with rising energy demand will not be answered by a single solution. Energy efficiency improvements, clean energy initiatives and education to reduce consumption will all play a part. And in all these, materials science and developments in ceramics and carbon technology have a major role to play.

The Company works with customers in energy and industrial sectors all over the world, including in the expanding industrial economies in China, India and Latin America.

In well-developed markets and dynamic growth economies, innovation in carbon and ceramics is helping to improve efficiencies in fossil fuel energy generation and distribution systems, and is a key enabler in the new clean energy infrastructures including wind, solar and electric vehicle technology.

In the drive to reduce energy consumption, ceramic materials are being used to make energy efficiency improvements in a wide variety of existing industrial and transportation systems, for example by reducing friction and increasing reliability. Ceramic and carbon materials are also used to provide high performance insulation for use in buildings and in industrial processes.

Central to Morgan's strategy and vision are the first-class people that make it happen. The Group strives to attract, retain and develop the very best for every aspect of the business from engineering excellence and technical innovation to business management and customer service. This fundamental recognition of the contribution of the individual is apparent throughout the company's activities from its outstanding graduate and apprenticeship schemes to its development programmes.

In the energy sectors there are many examples of how Morgan's expert teams are making a contribution to the cumulative global effort to manage climate change now and into the future.

World-renowned for performance and reliability, Morgan's carbon brush technology is used in coal, gas, nuclear and wind power plants all over the world and is at the heart of electricity storage and distribution systems for applications from rail transport to electric vehicles.

Ceramic technology is contributing to the development of solar energy systems in the production of photovoltaic cells using silicon wafers and by thin film deposition.

For example, alumina/silica rollers are used to move the wafers through the high temperature (900°C) deposition furnaces without damage, and fully stabilised zirconia is used for high reliability thermocouples. Similarly, high purity aluminium oxide bars and locator pins are used for wafer lifting, stacking and transporting between furnaces. They provide greater strength at high temperatures and eliminate the buckling associated with metal equipment.

A specialist ceramic, Pyrolytic Boron Nitride (PBn) has been developed by Morgan for use in crucibles and boats used to hold materials for thin film deposition. It is chemically inert at high temperatures, has low wetting to alloys and is resistant to chemical shock. As a result, the crucibles remain dimensionally stable and do not react with the molten material.

# Enhancing sustainability



Crucible sustainability

Morgan materials and furnace technology is helping enhance metal melting and holding.

Through advances in foundry crucible technology and furnace management systems, Morgan Molten Metal Systems is introducing the concept of 'Green Operations' into the foundry industry. Morgan is working to raise awareness of foundry energy consumption patterns and is working with customers to minimise energy use and CO<sub>2</sub> emissions.

Through the development of new materials for use in metal holding & melting products and the employment of smart monitoring systems, Morgan has helped to reduce the energy consumption of a typical aluminium foundry by approximately 20%, with more potential savings to come.



Rail

Morgan materials ensure reliable and efficient operation of electric trains.

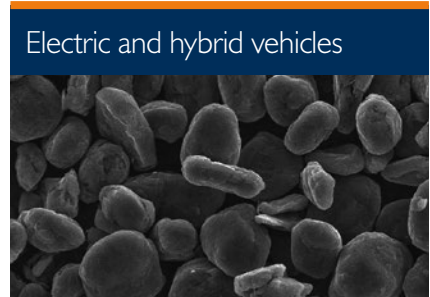
Rail is on average four times more energy efficient than road transport. It has huge potential to make a difference to fuel consumption globally. Carbon technology is at the heart of rail transportation with brushes and collectors used in overground and underground rail and tram systems all over the world.

Railway applications are exceptionally demanding on these components; they have to be able to cope with large current peaks, weak load operation, intermittent usage and aggressive environments and, especially in long distance networks, perform in high ambient temperature differentials and humidity.

Morgan's advanced technology components perform over a wide range of environments from sub zero to >40°C and at up to 2km above sea level. They are designed for high reliability on all types of rolling stock from high-speed trains to metro trains covering varying terrain, changeable loads, impact and vibration.

4x

Efficiency of rail vs road



Electric and hybrid vehicles

The development of new carbon materials holds the key to better performing electric and hybrid vehicles.

Advances in electric and hybrid vehicle battery technologies are driving the demand for increasingly tough thermal management solutions.

The exceptional properties of Morgan's carbon and ceramic materials are helping enable the manufacture of pump components robust enough to circulate the aggressive coolants used through Lithium-Ion batteries.

Components produced by Morgan are also offering additional benefits. Being up to 60% lighter than steel, their weight saving contributes to low noise running and the increased energy efficiency of modern electric and hybrid vehicles.

# Increasing efficiency



LED technology

Carbon and ceramic materials are key enablers for LED technology.

Morgan makes graphite felt which is used in LED sapphire production to provide a uniform thermal environment to support crystal growth. This highly stabilised, long-life insulation enables long process cycles and the high chemical inertness of the insulation minimises contamination of the sapphire ingot.



Insulation

Advances in ceramic insulation materials help industrial installations to reduce energy consumption.

Morgan's low bio-persistent Superwool® Plus fibre, designed for use in duct and chimney insulation, process heater linings, pipe wrap and automotive exhaust heat shields is 17% more energy efficient than traditional insulation products such as Refractory Ceramic Fibre (RCF).

High-temperature insulating fibre, bricks and monolithics are used to help optimise thermal efficiency in industrial applications from 500°C to 1,600°C.

**17%**  
Superwool® increase in energy efficiency



Pumping systems

Pumping systems account for nearly 20% of the world's energy demand.

Improvement in the efficiency of pumps and pump systems has the potential to impact global energy consumption significantly.

Morgan has developed a family of graphite-loaded silicon carbide materials based on the patented PGSI00 for hardwearing seals in long-life pumps for demanding processing applications such as those with extremely caustic environments, abrasive process fluids or high pressures and operating temperatures.

The material contains a free-graphite, which improves lubricity, for greater dry run survivability and better thermal shock resistance than conventional sintered materials. The graphite also gives it better pressure-velocity capability between hard-face mating pairs. As a result, it lasts twice as long as other materials in harsh field conditions.

# Group EHS targets

## Morgan Advanced Materials sets annual targets and objectives for EHS performance improvement.

In addition to Group targets, Morgan Advanced Materials' businesses set targets and undertake initiatives appropriate to their specific opportunities for improvement, as is highlighted in the case studies in this report.

Area	2017 Target/ Objective	2017 Progress	Future Objective
<b>Environmental and Health and Safety data reporting</b>	→ Keep the assurance programme under review to ensure ongoing added value.	✔ <b>Achieved &amp; ongoing:</b> Assurance of selected EHS KPIs achieved for 2017.	Keep the assurance programme under review to ensure ongoing added value.
<b>Environmental management systems</b>	→ Maintain and where appropriate extend ISO 14001 coverage.	✘ <b>Not achieved:</b> Allowing for disposals and site openings and closures the number of certified sites was down by two at the year-end.	Two sites further are planning ISO 14000 certification during 2018 which will help maintain and where appropriate extend ISO 14001 coverage.
<b>Reduction in CO<sub>2</sub> emissions intensity</b>	→ Focus on efficiency to deliver a 1% decrease in CO <sub>2</sub> emissions intensity due to energy use in 2017 vs. 2016.	✘ <b>Not achieved:</b> Excluding the effect of disposals emissions intensity was 0.7% lower, narrowly missing the 1% target. (Including disposals, emissions intensity was up by 1.6%.)	A 1% decrease in CO <sub>2</sub> emissions intensity due to energy use in 2018 vs. 2017.
<b>Reduction in waste intensity</b>	→ A 2.5% decrease in waste intensity in 2017 vs. 2016.	✔ <b>Achieved:</b> Excluding the impact of disposals, waste intensity was down by 2.6%. (Including disposals, it was down by 0.9%.)	A 2.5% decrease in waste intensity in 2018 vs. 2017.
<b>Increase recycling</b>	→ A 1 percentage point increase in the recycling rate in 2017 vs. 2016.	✔ <b>Achieved:</b> The proportion of total waste recycled in 2017 was up by 11 percentage points excluding disposals. (By 11 points including disposals.)	A 1 percentage point increase in the recycling rate in 2018 vs. 2017.
<b>Reduction in water use intensity</b>	→ A 2.5% decrease in water use intensity in 2017 vs. 2016.	✔ <b>Achieved:</b> Excluding the impact of disposals, water use intensity was down by 5.9%. (Including disposals, it was down by 3.4%.)	A 2.5% decrease in water use intensity in 2018 vs. 2017.
<b>Health and safety programmes</b>	→ Sustain the momentum of Morgan 'thinkSAFE' with the monitoring of visible safety leadership at all levels and a series of programmes focussed on high-risk H&S issues.	✔ <b>Achieved and ongoing:</b> Morgan 'thinkSAFE' was ongoing during the year. Quarterly focus topics included Machine Guarding, 'Take 5 for Safety' (5S), Bright, clean and 'thinkSAFE' and Industrial vehicle safety.	Refresh Morgan 'thinkSAFE' with additional training, further employee engagement on safety and clearer local communication of progress.

# Group EHS targets continued

Area	2017 Target/ Objective	2017 Progress	Future Objective
<b>Reduction in lost time accident frequency</b>	→ Reduce accident frequencies to make progress towards the long-term goal of zero harm.	❌ <b>Not achieved:</b> LTA frequency was up from 0.27 to 0.39 per 100,000 hours, in part due to the non-fault road traffic accident referred to on page 21.	Reduce lost time accident frequencies to make progress towards the long-term goal of zero accidents.
<b>Reduction in lost time</b>	→ Work to reduce the average time lost per LTA.	❌ <b>Not achieved:</b> Including the impact of the road traffic accident, the average number of days lost per LTA increased from 26.8 in 2016 to 40.5 in 2017.	Work to reduce the average time lost per LTA through appropriate return-to-work initiatives.
<b>External EHS compliance audit programme</b>	→ Continue to externally audit all manufacturing sites on a three-year rolling cycle and to leverage value from the programme.	✅ <b>Achieved: and ongoing:</b> Sites are externally audited on a three-year cycle with 24 external EHS audits completed during 2017.	Continue to externally audit all manufacturing sites on a three-year rolling cycle and to leverage value from the programme.
<b>Internal EHS audit programme</b>	→ Continue the new internal EHS audit programme with a focus on specific sites and issues to help drive continuous EHS improvements.	✅ <b>Achieved: and ongoing:</b> Internal EHS Audit Programme updated per learnings from the first year with a focus on best practice. 12 internal audits conducted across North America, Europe and Asia.	Continue to improve and enhance the programme. Appoint a new dedicated leader for internal EHS audit.
<b>EHS Framework</b>	→ Continue the implementation of the EHS Framework and complete follow-up actions on high risk items.	✅ <b>Achieved: and ongoing:</b> EHS Framework was refined with more emphasis on risk-assessment to ensure relevance by site.	Continue implementation and the identification and rectification of gaps. Include more strategic EHS elements within the framework.

# Appendix: Greenhouse Gas Emissions Disclosures

Under The Companies Act 2006 (Strategic Report and Directors' Report) Regulations 2013 (the 'Regulations') the Group is required to report its annual greenhouse gas emissions in tonnes of carbon dioxide equivalent ('CO<sub>2</sub>e') in its Directors' Report.

Morgan has published information on its emissions due to the combustion of fossil fuels and the electricity purchased by the Group for its own use in its annual EHS report since 2004 and in its Annual Report since 2005. Since 2011 the Group's CO<sub>2</sub>e emissions due to energy consumption have been externally assured (see the Assurance Report on page 24). The Group has participated in the Carbon Disclosure Project (CDP) since 2006 and in 2017 achieved a score of B, reflecting the Group's strong performance and the depth and quality of climate change data Morgan has disclosed to investors and the global marketplace through the CDP.

The Regulations require the Group to disclose its emissions due to the combustion of biomass and due to process and fugitive emissions which are in addition to the emissions due to energy use reported on page 13 of this Report.

As required under the Regulations, the above report includes the material emission sources from the operations and activities covered by the Group's Financial statements. As noted, the reports exclude emissions from Company-owned and leased vehicles and emissions relating to steam supplied by third parties to two sites in China and one in Europe, which are in total estimated to account for less than 1% of total emissions. The Directors consider that these sources of emissions are not material to the total of the emissions.

The Group's reporting methodology is based on the Greenhouse Gas Protocol with emission factors for standard grid electricity by country and year from the International Energy Agency together with other factors as published by the UK Department for Environment, Food and Rural Affairs used to calculate the CO<sub>2</sub>e emissions included in this Report.

	2017 Tonnes CO <sub>2</sub> e	2016 Tonnes CO <sub>2</sub> e
<b>Emissions from combustion of fuels and operation of facilities<sup>1</sup></b>		
Combustion of fossil fuels <sup>2</sup>	129,600	126,500
Operation of facilities, including process emissions <sup>3</sup>	34,700	29,100
<b>Electricity, heat, steam and cooling purchased for own consumption<sup>4</sup></b>		
Purchased electricity <sup>2,3</sup>	203,000	205,700
<b>Intensity measurement<sup>5</sup></b>		
Tonnes CO <sub>2</sub> e due to fossil fuels and purchased electricity per £m revenue <sup>2</sup>	326	321
Tonnes GHGs per £m revenue	360	346

CO<sub>2</sub>e is the amount of CO<sub>2</sub> and the amount of non-CO<sub>2</sub> greenhouse gas with the equivalent global warming potential.

Data is rounded to the nearest 100 tonnes of CO<sub>2</sub>e.

- Excludes emissions from Company-owned and leased vehicles estimated at circa 2,100 tonnes CO<sub>2</sub>e in 2017 (2016: 2,100).
- The 2017 information regarding CO<sub>2</sub>e due to energy use has been subject to assurance by ERM CVS. See the Independent Assurance Report on page 24 of this Report. See page 47 of the 2016 Annual Report for further details of the assurance of the 2016 information regarding CO<sub>2</sub>e.
- Calculated using the market-based method with electricity from renewable sources at zero tonnes CO<sub>2</sub> per kWh. Emissions increase by 2,600 tonnes at grid-average rates (2016: 4,400 tonnes).
- Excludes steam supplied by third parties to two sites in China and one in Europe.
- Constant currency basis and restated to reflect changes in reporting methodology.



# Notes

## 1. Data gathering and comparisons

Morgan Advanced Materials' EHS reporting processes are focussed on data that is of EHS and commercial value and are increasingly accurate. Thus, improvements in environmental and health and safety performance reporting and measurement may increase or decrease some reported figures and require historic data to be restated. Where possible, the Group ensures meaningful comparisons between annual performance indicators are available.

## 2. Verification

The Group engaged ERM CVS to provide independent external assurance on the Group's CO<sub>2</sub>e emissions and intensity; energy use and intensity; water use and intensity; waste generation and intensity; recycling and the proportion of total waste recycled; and the number of lost time accidents and the lost time accident frequency rate using international assurance standards. The report from ERM is set out on page 24.

In addition, all Morgan Advanced Materials manufacturing facilities are regularly reviewed under the Group's externally audited EHS Compliance Audit Programme and through the internal EHS audit programme. Those sites certified to ISO 9001, ISO 14001, OHSAS 18001 and other standards have regular external audits. The Group's Director, Environment, Health and Safety and the Divisional EHS teams also work with independent external consultants to review and where appropriate verify the Group's environmental and health and safety related key performance indicators.

The Board considers that these procedures provide a reasonable level of assurance that the Group's EHS disclosures are free from material misstatement whether caused by fraud or other irregularity or error.

## 3. Guidelines

A variety of guidelines, reports, standards and other authorities have been consulted and utilised in the compilation of this report. These include the Greenhouse Gas Protocol, the UK Government's Department for Environment, Food and Rural Affairs environmental reporting guidelines, the Global Reporting Initiative's G4 Sustainability Reporting Guidelines and relevant ISO standards.

## 4. External Assistance

Morgan Advanced Materials utilised the assistance of CSR Consulting Ltd. in the compilation and production of this report.

## 5. Feedback

The Group welcomes feedback on this EHS report and comments on ways reporting could be further developed at Morgan Advanced Materials. You can contact the Group by e-mail at [ehs@morganplc.com](mailto:ehs@morganplc.com) or write to Morgan Advanced Materials plc, Quadrant, 55-57 High Street, Windsor, Berkshire, SL4 1LP, United Kingdom.

Employees and others who have concerns regarding EHS or other matters which cannot be satisfactorily resolved locally may also use the Morgan Advanced Materials Ethics Hotline. Further details are available on the Morgan Advanced Materials website and on the Group's intranet.

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