

Customers

Collaboration and strong relationships with our customers are crucial in providing a high quality tailored service. Together, we put our inspiring science to work to enhance life.

We work closely with them, applying our science and technology to develop solutions which enable them to bring their products to market faster, improve the performance of their products and reduce their environmental impact. This creates value for them; and it creates value for JM – through high margin products from which we generate strong returns.

Our Commercial Excellence programme (page 35), launched in 2017/18, is a key enabler of our strategy. Through it we will deliver an enhanced experience all round for our customers and at the same time, create more value for JM.

In serving our customers, we also contribute to making the world a cleaner, healthier place. Through our new sustainable business goal 5, we are quantifying the positive impact our products and services have and aim to double that between now and 2025.

Sustainable business goals

Sustainable products

5

Putting our inspiring science to work for our customers

The markets we serve are directed by our science and are driven by our technology. As a result, we create leading technology positions, often in niche global sub-markets that form part of larger markets.

The markets we serve aggregate into four main global economic segments, each crucial to the development of prosperity and wellbeing. They are:

- **Transport** (principally automotive, with some marine and aerospace).
- **Energy** (fuels and electricity generation).
- **Chemicals** (including agrochemicals, food and beverage).
- **Healthcare** (both pharmaceuticals and medical).

Beyond these we also think about the critical raw materials and commodities used in these spaces.

Segment trends and dynamics

Transport

The automotive industry continues to grow. Light duty vehicle (LDV) production reached almost 95 million units in 2017/18¹ and is expected to pass 100 million units in the early 2020s (~2.4% compound annual growth (CAGR))¹. Asia is fuelling this expansion, with Europe and America growing at a more subdued pace. Heavy duty vehicle (HDV) production was 3.3 million units in 2017/18¹. This remains a cyclical market with growth in Asia underpinning current expansion. Whilst vehicle production is a growth driver for JM, next generation, tighter emission control legislation in the European, North American and Asian markets is an additional, more significant opportunity for us.

Beyond current evolution pathways, the emergence of new powertrain technologies, innovative vehicle ownership and access models, along with a rising degree of connectedness and automation, is transforming the mobility landscape. Analysts expect a move away from pure internal combustion engine (ICE) vehicles over time, with hybrid, battery electric and / or fuel cell vehicles becoming more common.

This transition is not expected to be quick, with most market evolution studies showing a gradual uptake of alternative powertrains in LDVs through the 2020s. The transition for HDVs is expected to be more gradual. Alternative powertrains are also starting to appear in other forms of transport (e.g. trains) and industrial applications (e.g. fork-lift trucks). For JM, this means expanding our offering, applying our science to develop solutions to enable and deal with the expected uptick in demand and a potential shift into new applications.

Energy

Fossil fuels remain the dominant global energy source today (~85% of primary energy²), but the rise of renewables, the drive for energy efficiency, along with the possibility of cost effective energy storage is changing that dynamic. Most analysts expect natural gas to become the fastest growing fossil fuel (~1.5% CAGR for piped gas and ~3.0% CAGR for liquefied natural gas²), with the share of coal and oil in the world's energy mix falling. This implies growth in renewables and other low carbon fuels (including nuclear). For JM, this evolution touches our applications in the stationary energy space across several other products and services. We remain focused on this market as it will also potentially inform us about changes in the interconnected transport and chemicals markets.

Chemicals

Oil demand is predicted to grow by around 0.7% between 2015 and 2035², with production rising from ~96 million barrels per day (mmbbls/d) to ~106mmbbls/d in 2035². Growth in natural gas is expected to be stronger, rising at around 1.6%². This would take gas demand from 336 billion cubic feet per day (Bcf/d) in 2015 to around 462 Bcf/d in 2035².

Downstream products have benefited from these low input prices, but those advantages are beginning to pass and the perception about overcapacity / low utilisation rates remain. Petrochemical end markets are expected to grow over the coming years with compound annual growth rates of between 2% (fertilisers) and 7% (engineered polymers)³. New capacity additions in the US (gas price advantage), Middle East and Asia are expected over the coming years. Associated pricing changes linked to demand shifts may also impact the chemicals markets in which we play (e.g. methanol, ammonia).

These evolutions impact the profitable pathways and catalytic transformation routes that we try to serve. As a business, we will continue to target the highest growth and most profitable segments to ensure that critical raw materials are used and transformed in the most efficient manner possible.

Sources

1 LMC Automotive.

2 BP Energy Outlook, 2018 (www.bp.com/en/global/corporate/energy-economics/energy-outlook.html).

3 IHS Chemicals.

Strategic Report

Healthcare

The global population continues to rise with people living to an older age. To service this trend, a range of interventions are being requested. Additional medications are required to keep people healthy for longer, additional pressure is put on scarce food and water resources, more devices are being used to improve quality of life. However, the pressure to deliver these interventions at a low cost is growing.

The global pharmaceuticals market is expected to grow at 6% per annum, from \$650 billion today to more than \$820 billion by 2020⁴ and with growth in that market outstripping global GDP growth (of ~3% per annum over the period⁵). The largest markets remain the US and Europe, which together account for about two thirds of the global market. The market for generic pharmaceuticals accounts for about one third of the total pharma market today and is forecast to experience equivalent or higher growth rates than the pharma industry overall (ranging from 5 to 9% between forecasts⁴).

JM will continue to focus on how we can serve this growing market through our differentiated science and technology, helping to deliver the products that our growing population requires.

Critical raw materials

Within the evolving market dynamics described above, commodity prices will play an important role. We already see the commodity cycle starting to turn with higher metal prices seen during the 2017 calendar year. Oil prices are starting to rise (moving beyond \$70 per barrel for the first time since late 2014), while gas prices, especially in North America have remained subdued at around \$3/mmbtu (US Henry Hub). Beyond these traditional commodities we are also seeing upward pressure on the key inputs to battery cathode materials (e.g. lithium in 2017, cobalt and nickel more recently). These prices and their movements will impact decisions about how our key end markets evolve and which technologies / pathways come to dominate over time. JM will continue to focus on the most efficient use and transformation of critical raw materials and we will position our business (including our refining expertise) to respond and react to these trends.

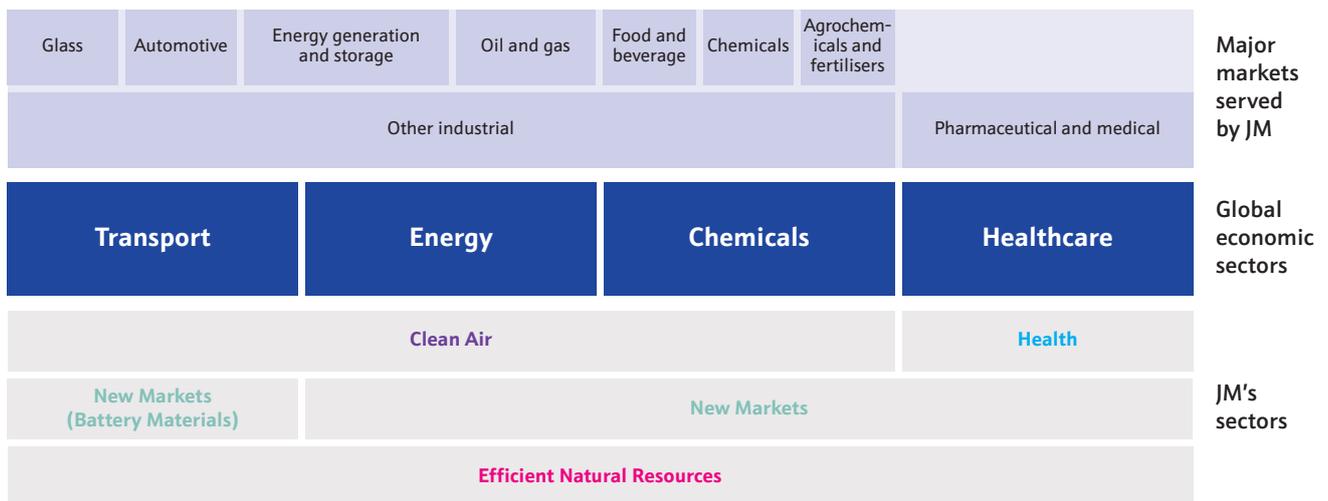
Sources

⁴ EvaluatePharma.

⁵ BP Energy Outlook, 2018 (www.bp.com/en/global/corporate/energy-economics/energy-outlook.html).

The breadth of JM is a source of strength

The four economic segments we serve are undergoing major change; change that is driven and enabled by technology. We apply our scientific skills, via our sectors, into markets within these segments to create new products and services that improve lives, improve efficiency and reduce environmental impact.



- Our Clean Air Sector abates emissions from the transport, energy and chemicals segments.
- Our Efficient Natural Resources Sector has businesses supplying products and processes that conserve scarce resources, enabling the manufacture of chemicals, fertilisers, fuels and glass using less energy and fewer raw materials.

- It also has our platinum group metal recycling business.
- Our Health Sector draws on core capabilities in complex chemistry, manufacturing and scale up to create solutions for niche areas within the pharmaceutical industry.
- Our New Markets Sector applies our science into emerging opportunities across all segments.

This breadth is a source of strength for JM. The markets and segments we serve are amongst the most important in the world economy, are universal and supported by strong macro drivers. Maintaining this broad market exposure and managing the balance of our business across these segments of the world economy is part of our strategy.

The four segments are complementary. Many of the customers we serve operate in two adjacent segments: for example, fuel companies also have chemical operations; chemical companies manufacture pharmaceutical ingredients. We bring market, technical and regulatory insights from each segment and apply it to the adjacent segments. These insights drive business development.

What we sell and how we work with our customers

Across all our markets, we have two fundamental customer offerings.

1. **Functional components** that our customers incorporate into the products they manufacture. These components are fundamental to the performance of our customer's product. Examples are: electrode tips for cardiac ablation, emission control catalysts for engines, active pharmaceutical ingredients for pain treatment, protective coatings for automotive glass, cathode materials for batteries.

For these types of product, most of what we sell we have developed and formulated specifically for an individual customer's application, in collaboration with our customer.

2. **Process technologies** that our customers use to enhance the efficiency, economics and sustainability of their manufacturing processes. In these cases, our technology is used to make the customer's product rather than being part of the finished product.

We develop manufacturing processes, including the catalysts that enable them, both for customer-proprietary products (e.g. pharmaceutical actives) and for chemicals and fuels (e.g. methanol, ethylene glycol). For processes we develop ourselves, we either licence to our customers or operate them ourselves in our own facilities. When we develop processes for customer-proprietary products we work under contract development agreements.

Our Pgm Refining and Recycling business uses a JM-developed and operated process. We provide a service for our customers (including other JM businesses) where we transform their materials to produce high value product.

Across these offerings, our customers, in the most part, value the performance of our technology in their applications. The performance of our products delivers different advantages to our customers by:

- Translating directly into the performance of their product.
- Enhancing the reliability of their production.
- Increasing their efficiency.
- Enabling them to reduce the overall cost of their product.

Maximising this performance advantage through codevelopment is the basis of the way we work with our customers. This collaborative development requires strong, long term relationships based on mutual commitment, risk sharing and trust.

In addition to performance, customers also come to JM for additional sources of value: speed and efficiency in development, reliability, responsiveness in problem solving, security and flexibility.

We work with our customers across a range of markets, understanding the needs of each sector and customer. This approach gives us a business that is balanced and robust. Through serving broad markets, the opportunities to apply our science and technology are greater and our contribution to a cleaner, healthier world is increased.

Driving commercial excellence

We have distinctive scientific and technical capabilities which we translate into solutions for our customers. It is important that, together with providing them high quality products and service, we capture our fair share of the value we create for customers.

Our Commercial Excellence programme is focused on doing just that. It is a key enabler of our strategy and was launched in 2017/18. The overall objective of the programme is to deliver value by building the commercial capability across JM; enhancing our ability to make value based data driven decisions; measuring and responding to customer satisfaction; improving our sales and marketing processes and leveraging digital technology where appropriate.

The programme has made good early progress. We are investing in growing our people and our commercial function. We will be launching our commercial academy this coming year to support the development of our commercial people across JM. We are also improving the consistency of our data analytics to inform our commercial decisions.

We have started work to establish a consistent measure of customer satisfaction across JM so that we can enhance the experience our customers have when buying from us. The programme is on track to deliver benefits over the coming year.

Measuring our impact beyond customer value

The value we create for our customers drives growth in our business and returns for our shareholders. But our products and services have a much broader positive impact, making our air cleaner, improving people's health and conserving the world's natural resources. We want that positive contribution to grow.

As part of our new sustainable business framework we have set a goal to double the positive contribution of our products by 2025. This, our sustainable business goal 5, has two streams by which we will track our progress.

The first shows our global impact by measuring the absolute and percentage of JM's sales that have a direct contribution to the UN Sustainable Development Goals. The percentage measure is a key performance indicator for the group as detailed on page 23.

The second relates to JM's vision for a cleaner, healthier world. Our goal is to at least double:

1. The tonnes of pollutants (oxides of nitrogen, carbon monoxide, hydrocarbons, particulate matter) removed by our products, thereby making the world cleaner.
2. The number of lives impacted by our pharmaceutical products, thereby making the world healthier.
3. The quantity of greenhouse gases removed or reduced (CO₂ equivalent) by our products, thereby taking climate action.

Our baseline measures are outlined on page 17.

We are excited to introduce our sustainable business goal 5. It will be a positive driver for our business performance and, crucially, provides a tangible measure of progress towards our vision for a cleaner, healthier world.



Long term view Technologies for clean transportation – JM brings insight as the powertrain evolves

Automotive powertrain technology has seen many developments in the 50 years that Johnson Matthey has been involved in, shaped largely by societal requirements for cleaner vehicles. The coming decades will see even bigger changes. JM is in a uniquely powerful position to understand these changes and to grow our business further by providing new technologies to enable them.

Our insights into these new demands are broad and deep. We understand the big trends in regulations, in driver expectations, in the strategies of vehicle manufacturers and in the capabilities of the new technologies available to the manufacturers. These trends determine the demand for our technologies.

Understanding our customers and their value chains

Johnson Matthey brings deep insight into how these market trends translate into performance requirements for all our automotive powertrain-enabling products and the technical support our customers need. We work from market needs, through system performance requirements and into the design of materials at the atomic scale. We can then scale our science from the lab, through vehicle testing, to production processes for millions of engines a year – which itself requires intimate understanding of our customers' preferences and their ways of working.

A key JM strength is our relationship with vehicle manufacturers, built on 50 years of collaboration at all stages of technology development from design, through application, scale up, testing and into mass production. We understand how they work, their time cycles and their technology needs.

Our relationships up the supply chain are equally important. Securing and managing reliable, ethical supplies of metals and other raw materials will be just as important for batteries as it is for our emission control catalyst and fuel cell businesses. The automotive supply chain is highly integrated, but is evolving, with more emphasis on lifetime stewardship and circular supply chains. JM has the experience and structures for this way of working from our precious metal businesses, including recycling emission control catalysts.

As the supply chain evolves, we stay aware of who is making the critical decisions and on what basis. Decisions on required performance standards, technology selection, supplier selection and system optimisation are made between different functions within companies and between companies and different stages in the supply chain. We maintain a broad set of contacts in order to participate fully in this decision making process.

An 'all options' approach to technology

As we plan for success in future powertrain markets, the experience that JM applies to technology road mapping is very broad. We supply all the transport applications currently using internal combustion engines, everything from scooters to the largest container ships. Thus, we know the performance demands and design cycles for the full range of land and water based transport. We combine this with our practical experience of all the options for clean energy storage and powertrains, across combustion engines, batteries and fuel cells. We believe that over time, everything will become electrified but in different ways, at different speeds and to different degrees. Internal combustion engines will remain important in all transport sectors for decades, increasingly in hybrid systems, and fuel cells will come in too – particularly for heavy and long haul vehicles. The world will need all options and all options represent opportunities for JM.

This 'all options' view shapes our strategic planning process. It determines the portfolio of technologies and businesses that we develop. It determines the way that we use our understanding of the various alternative technologies to develop and market the technologies. It determines the flexibility we maintain in resource planning to place bets on the most promising technologies and retain the options we need to maintain our strong position in the market regardless of the shape of future demand.

Following policy and regulation

In looking at where JM's scientific and manufacturing capabilities can create most value as powertrain technologies evolve, a vital perspective for us is regulations. Standards are set for new vehicles and limits on pollutant emissions have been the primary driver for JM. They will be in the future, too, but other regulatory and policy areas are becoming equally important. There are four aspects of policy that we follow and interpret:

1. Although our catalyst technology has enabled a 100-fold reduction in emissions from vehicles since the 1970s, many cities around the world still suffer from poor air quality caused in part by vehicle exhaust gases. Therefore, new vehicle emissions regulations will continue to tighten and will be a significant driver of demand for our products. The most important trend for the future is not the further reduction of the headline emissions limits, although this will continue, but in the shift to testing and compliance regimes that better reflect emissions in 'real world' use. These new tests require higher system performance across a wider range of conditions and as a result, demand more JM technology.
2. In recent years, regulations on the efficiency of new vehicles, as measured by CO₂ emissions, have become an equally important factor in powertrain design. More efficient engines demand more efficient emissions control – for example, exhaust gas temperatures are lower on more fuel efficient vehicles, so the catalysts need to work at these lower temperatures. Hybrid powertrains place new demands on the after-treatment system. Electric vehicle investment and introduction is being driven by fleet CO₂ limits, creating new demand for battery materials and fuel cells.
3. As well as the regulations on new vehicles, the market is shaped by incentives for drivers to buy low or zero emission vehicles. These may be financial, in the form of purchase grants or preferential tax rates. In some countries, drivers of low emission vehicles are granted perks such as access to bus lanes. These incentives shape demand in local markets and can be important in the early adoption of new technologies.

4. For the future, we see cities as increasingly important in driving and shaping demand for clean vehicles. In most parts of the world, city authorities are responsible for ensuring air quality. To meet legal requirements and the expectations of their citizens, they are increasingly offering incentives for cleaner vehicles and applying penalties or even bans to dirtier ones. We've been working with cities for decades to improve their air quality, retrofitting emissions control to buses and supporting Low Emission Zones.

Knowing where the greatest air quality problems are, where the political will to solve them is strongest and what the practical technologies are to address the problems efficiently, enables JM to see where the next market demand will be.

Total cost of ownership is key

We assess the regulatory landscape but we are careful not to lose sight of what technology can be practically and profitably incorporated in a vehicle and what the people who buy the vehicles most value. The market is constrained by two simple and related principles: people can't buy it if the manufacturers aren't offering it and manufacturers can't sell it if people don't want it. Consequently, we believe that the total cost of ownership will continue to be the primary criterion in vehicle purchases. As such, we assess the effect of each new technology on the cost of developing, manufacturing, fuelling and maintaining each class of vehicle.

When it comes to zero emission vehicles, we consider a third constraint: people won't buy it if they can't recharge or refuel it. As such, we are monitoring and participating in projects to develop infrastructure for charging battery electric vehicles and for refuelling fuel cell electric vehicles.

Seeing the whole system, from well to wheel

Our market view on transport trends is not confined to vehicle technology. JM has fuels related businesses and technologies too. These have an important part to play in reducing emissions from transport and, at the same time, give a perspective on the environmental impact of transport that greatly strengthens the view we have on vehicle technology.

JM has fuel processing expertise and our process catalyst technology is important for making the hydrogen that removes sulphur from fuel. By combining the views we gain from the fuels value chain with our vehicles knowledge, we understand the full impact – environmental, economic, consumer – of all the potential technical solutions. JM has technology for the manufacture of synthetic fuels, bio fuels, gaseous fuels and, particularly importantly, hydrogen. Uniquely, we have technology for all the major manufacturing paths for hydrogen. Being able to see the whole system, 'well to wheel', we can assess costs and trade-offs and we can see how these translate into the potential demand for our technologies.

Future mobility models

Finally, we make sure that we pay attention to the way that vehicles will be used in the future because this will affect the way they are bought and the way they are designed. Cars bought to be used in fleets of shared vehicles may be designed with the same considerations that now apply to commercial vehicles – cost per mile, durability, availability / up-time. It is important that we understand which aspects of our very successful heavy duty business we will need to apply to light duty. Autonomy will be an enabler of shared mobility and will also lead to a change in drive cycles and vehicle design, so autonomous vehicles will have different power requirements. Connectivity, as well as being an enabler of vehicle autonomy, provides new opportunities for monitoring and regulating vehicles and their emissions in use. In turn, this is likely to promote the adoption of more low emission technologies.

Our automotive facing businesses have been designed from inception to anticipate and respond to change. Change brings continuous demand for new technology, and it is in the development and application of new technology that JM creates value.

We cannot accurately predict the rate of growth in electric drivetrains but we foresee a period of fundamental transformation in the automotive market. It brings opportunities for us to advance our business and our vision for a cleaner, healthier world. And JM is embracing it, knowing that we are uniquely well placed to understand and deliver the technologies the market will require.