UNLOCKING EFFICIENCY IN MINING

Shell Fuels and Lubricants
LUBRICANTS

1. PRODUCT AND SERVICES RANGE
   1.1 Wide range
   1.2 Technical support and tools

2. PROFESSIONAL EXPERTS
   2.1 Experience in industry

3. LOWER COST OF OPERATION

FUELS

1. SHELL COMMERCIAL FUELS
2. TRANSPORT FUELS
3. SHELL GTL FUELS
   3.1 Shell GTL fuels benefits
   3.2 Shell GTL fuels applications

FOOTNOTES
At Shell, we understand that the mining industry faces daily challenges, exacerbated by volatile economic environments. You need to see immediate value from your supplier. Our team of specialists can help you get the most out of your equipment, extending Oil Drain Intervals (ODIs) and lowering costs, with results sooner than you think.

With our wide range of lubricants, you’re sure to find the right product for your business.

**SHELL RIMULA**
The engine oil that works as hard as you do

**HARD-WORKING TECHNOLOGY**
You need to know that your oil will protect your engine under all conditions.

Shell Rimula heavy-duty diesel engine oils provide protection in three critical areas:

- **Acid control**
  Protection against corrosion from acids formed as fuel burns

- **Deposit control**
  Engine cleanliness for optimum performance and long life

- **Wear control**
  Moving metal engine surfaces kept apart for long engine life

Shell Rimula R4 X technology is designed to adapt and protect under the full range of conditions found in modern engines. From the high-pressure contacts in the valve train to the extreme temperatures of the pistons and rings, Shell Rimula R4 X can help you control your maintenance and operating costs by providing a versatile one-oil solution for modern fleets.

**PROTECTIVE POWER**
Shell Rimula R4 X contains a specially optimised combination of performance additives and chemicals that is designed to provide the right level of engine cleanliness, wear and oxidation protection under the tough conditions in engines equipped with exhaust gas recirculation (EGR).

**SHELL RIMULA R4 X – APPLICATION GUIDE**
With its excellent protection against wear and deposits, Shell Rimula R4 X is suitable for a wide range of high-power, heavy-duty diesel engine applications.

Its wide range of approvals and specifications from many of the world’s leading engine makers makes Shell Rimula R4 X an excellent choice for mining operations. It is suitable for all pre-US 2007 engines, most Euro 4 and 5 engines (without diesel particulate filters), as well as earlier engine types.
WEAR PROTECTION
Protecting machine gears from wear and corrosion is important for prolonging asset life and preventing breakdowns. The Shell Omala range of industrial gear oils offers protection across a wide range of applications. It includes Shell’s latest synthetic oils such as Shell Omala S4 GXV, which offers exceptional long-life performance under extreme loads and temperatures.

OIL LIFE
The longer an oil’s life, the less fluid maintenance your equipment requires, so it can continue to operate without interruption. The Shell Omala range enables you to match oil life to your operational needs. Customers using Shell’s standard products, such as Shell Omala S4 GXV, are extending oil-drain intervals by up to 200% for some applications. Customers are trading up to synthetic oils, such as Shell Omala S4 GXV, for even longer oil life and other benefits.

SYSTEM EFFICIENCY
Shell Omala oils can help to maintain or improve system efficiency by protecting against the impact of oil ageing and contamination for efficient lubrication. Advanced synthetic oils such as Shell Omala S4 WE can offer additional benefits by providing improved energy efficiency compared with conventional oils.

REAL-WORLD VALUE DELIVERY
Users of Shell Omala oils across a wide range of industries are benefiting from proven, robust and reliable lubrication that adds value to their operations. For instance, by switching to Shell Omala S4 GXV, some customers are:
- increasing equipment protection: one customer reports virtually eliminating gearbox failures and saving over $50,000 a year,
- extending oil-drain intervals; some equipment manufacturers approve Shell Omala S4 GXV for four-year drain intervals, and some customers have extended their oil-drain intervals by up to five times.
WEAR PROTECTION
Protecting axles and gears from wear can help to reduce maintenance costs, extend vehicle life and maximise your return on investment. The Shell Spirax range of axle and gear oils offers proven protection, including the latest synthetic oils that deliver exceptional wear, pitting, bearing-failure and corrosion protection for heavy-duty axles, transmissions and gears operating under highly stressed conditions. This can help to reduce your costs.

LONGER OIL AND COMPONENT LIFE
Shell Spirax S6 CFD ME 60 is a dedicated final drive and axle oil that offers significantly improved protection for gears and bearings in bevel gears, differentials, final drives and axles. It meets the Caterpillar FD-1 final drive axle oil specification. Shell Spirax S6 CFD ME 60 has been developed for continuous use in extreme ambient temperatures in off-road vehicles.

EFFICIENCY
Shell Spirax oils are designed to help keep your transmission components protected so that they can go on working efficiently. For instance, Shell Spirax S6 AXME and Shell Spirax S6 GXME have special frictional properties and high fluidity that reduce power loss, lowering the operating temperature and offering higher mechanical efficiency. These properties can help to deliver fuel efficiency and savings.

PERFORMANCE YOU CAN COUNT ON
Shell Spirax S6 CXME 5W-30 is recommended for use in heavy duty off-highway equipment. It is designed for long oil life with excellent oxidation stability. It is formulated with a premium synthetic base oil, contains inhibitors to reduce oxidation and deposit formation, and is designed to protect against corrosion. All other factors remaining equal, longer oil life would extend oil drain intervals, helping reduce equipment downtime and, therefore, cost of maintenance.
WEAR PROTECTION
Equipment wear can reduce system efficiency and service life. Protecting components from wear is fundamental for getting the most out of your investments through prolonging asset life and preventing production losses through breakdowns. The Shell Gadus range of greases offers protection across a wide range of applications.

SYSTEM EFFICIENCY
To help your equipment perform to its design standards, you need a grease that stays in place and provides effective protection and lubrication where you need it. Shell Gadus greases are designed to help maintain or even improve the efficiency of your systems. From greases that offer reliable performance for standard applications to specialist low noise, high-temperature and heavy-load greases, there is a Shell Gadus product that can help to optimise your system’s efficiency and costs of operation.

GREASE LIFE
The longer your grease lasts, the longer your components last and the less lubrication maintenance your equipment needs. Shell Gadus greases are designed to help your equipment continue to operate without interruption. The comprehensive product range enables you to select a grease with a life that meets your operational needs. Customers using Shell Gadus extra-long-life synthetic technologies are doubling grease life for some applications. Others prefer to take advantage of cost-effective, reliable, multi-purpose Shell Gadus greases for standard life applications.

PERFORMANCE YOU CAN COUNT ON
The way a grease is made has a significant impact on its performance. Shell manufactures grease in a highly controlled and systematic way. This quality process ensures that every batch you receive, no matter where in the world it is made, gives you the same high performance levels.

Shell Gadus is a comprehensive family of greases designed to meet your needs. The Gadus range include multi-purpose greases that are designed to help simplify your product inventory, as well as speciality greases, including advanced polyurea synthetic products designed for the most severe extreme-temperature and long-life applications, and a range of open-gear lubricants. Whether you need greases for steel production, mining, construction, power generation, general or automotive manufacturing, other applications or your vehicles, Shell has a grease designed to best meet your challenges. The Shell Gadus range has been developed to deliver optimum value through enhanced wear protection, long grease life, system efficiency.
WEAR PROTECTION
The hydraulic pump is the heart of your hydraulic system. Any wear can reduce efficiency and system service life. The Shell Tellus range of hydraulic fluids offers a range of options, including the latest synthetic ash-less technology designed to help extend pump life, even under the most severe conditions, through to proven, cost-effective, zinc-based additive technology for general use.

OIL LIFE
The longer the oil life, the less fluid maintenance is required to help your equipment operate for longer, without interruption. The Shell Tellus range of hydraulic fluids enables you to match the oil life of the fluid to your operational needs. It includes extra-long-life synthetic technologies capable of up to four times standard life¹, through to cost-effective, reliable products for less-demanding applications.

SYSTEM EFFICIENCY
To help your equipment perform to its design standards, the hydraulic fluid needs to protect, lubricate and help transmit power in the most effective way possible. Shell Tellus hydraulic fluids are designed to help maintain or even improve the efficiency of hydraulic systems.

REAL-WORLD VALUE DELIVERY
While many other companies design their fluids for the individual components of a hydraulic system, such as the pump, Shell Lubricants looks at the system more broadly. For instance, Shell Tellus S4 ME has been designed to benefit the complete system. The result is a fluid that:

- Is statistically proven to help improve the energy efficiency of the system in which it is used. In a carefully controlled test cycle, one injection moulding equipment maker measured energy savings of up to 6.4%² in the hydraulic systems in which Shell Tellus S4 ME was used.
- Can help to increase oil life by up to four times compared with conventional oils in the field range.
- Can help to prolong equipment life through excellent hydraulic pump wear protection.

SHELL TELLUS HYDRAULIC FLUIDS
Designed to perform under the toughest conditions

The Shell Tellus range of hydraulic fluids has been developed to enable equipment operators to select the oil that can help deliver optimum value to their operations through enhanced wear protection, long oil life and high system efficiency.
DELIVERING BUSINESS VALUE THROUGH LUBRICATION SERVICES

Drawing upon our innovative services and technical expertise, we are constantly looking to adapt our offer to our customers’ evolving needs; to hone in on exactly those “extra” or “added” services which makes all the difference to their businesses.

With a dedicated team of technical experts at both country and Pan-African level, we offer a range of specialised services and technological innovations, as well as technical assistance, relating to fuels and lubricants, and to the optimal usage of machinery. By doing so, we give our customers peace of mind and help them reduce their Total Cost of Ownership.

**SHELL - LUBEADVISOR**
Identifying and seizing value opportunities

Specialised Shell Lubricant Technical Advisors (LTAs) conduct site surveys to help customers identify areas for improvement in lubrication. All stages of the lubrication process are addressed, including product selection, delivery, storage, distribution across the site, product application and disposal of used lubricants. Changes are implemented and measured through ‘Value Improvement Projects’.

**SHELL - LUBEEXPERT**
Monitoring performance

Dedicated teams of highly-trained technicians - Lubricants Service Experts (LSEs) - spend most of their time at customer sites, inspecting critical machinery like excavators, draglines, shovels, mills and kilns, and identifying potential lubrication issues. This alerts customers to the need for preventive maintenance, which can lead to savings of millions of dollars by helping to avoid major breakdowns.

**SHELL - LUBECOACH**
Upskilling employees

A customised training programme, led by Shell technical experts with substantial in-field experience, which offers practical coaching to customers’ staff on lubricant management techniques.

**SHELL - LUBEANALYST**
Lubricant analysis

A global oil and equipment monitoring service that helps customers assess lubricant condition, identify potential problems, and benchmark equipment performance against comparable oil samples from around the world. Available in 95 countries and in 28 languages, it has more than 60,000 users worldwide, and analyses over 750,000 samples a year. The service allows customers to monitor equipment without interrupting operations and provides guidance on interpretation of results.

**SHELL - LUBEANALYST LITE**
Rapid on-site analysis

Shell LubeAnalyst Lite on-site analysers deliver fast, comprehensive test results for machine lubricants, including engine and gearbox oils, hydraulic fluids and power steering and transmission fluids. Maintenance staff can test lubricants on site at any remote location and get results within 15 minutes. The service can help limit downtime and lower maintenance costs by capturing early signs of abnormal wear and helping extend oil-drain intervals.
2 PROFESSIONAL EXPERTS

Selecting the right lubricant helps reduce Total Cost of Ownership (TCO) – case studies

Over the last five years, Shell Lubricants has documented projects that delivered over $139 million in customer savings – $43 million of which was achieved by mining companies. These savings represent only a portion of the real-world total, which could be as much as 10 times higher. This indicates great potential for TCO reduction and productivity increases across the industry through lubrication excellence.

2.1 EXPERIENCE IN THE INDUSTRY

The following case studies demonstrate how Shell Lubricants has worked together with mining companies to support them in selecting high quality lubricants and greases to help generate substantial cost savings.

CASE STUDY 1
Upgrading oil portfolio lowers cost of lubrication saves USD $100,000 annually

THE CHALLENGE

One of Russia’s largest gold producers operates four mine sites located in mountainous, arctic conditions. Equipment on the site includes a fleet of 50 CAT 777F dump trucks. Due to the extreme climate conditions, the company used a range of transmission lubricants meeting Caterpillar TO-4 specification, with different viscosity grades.

The complexity of the portfolio caused logistical issues and led to errors in product selection during scheduled oil changes. The official CAT recommendation is for a gearbox to be overhauled every 15,000 hours, but the company’s equipment only achieved 10,000 hours. Likewise, CAT recommended Oil Drain Intervals (ODIs) for the transmission be 2,000 hours, but the company only achieved 1,000 hours.

THE SOLUTION

Shell Lubricants was in the final stages of developing a new synthetic transmission oil, Shell Spirax S6 CXME 5W-30, designed to operate in all climate conditions and help extend ODIs. The company agreed to trial the new product, with the aim of increasing ODIs from 1,000 to 4,000 hours and extending the lifespan of the transmission through improved wear protection. The company tested the product for 1 year in some of the world’s most extreme operating conditions, with temperatures ranging from -40°C in winter to 30°C in summer.

THE RESULTS

Working together with Shell Lubricants technical experts enabled the company to:

- ODI from 1,000 hours to 4,000 hours. Four times longer oil life significantly reduced the number of oil changes and lubricants consumption.
- Achieve estimated savings of USD $100,000 annually from reduced spend on lubricants and lower associated maintenance cost.

Note: The saving estimate does not include potential life extension of the transmission
THE CHALLENGE

A South African mining company was experiencing high wear rate to pins and bushes on its fleet of 25 Sandvik Load Haul Dumpers and 13 Sandvik Roof Bolters. Over 1 year the company had 10 pin and bush failures, and 3 drill boom failures. Shell Lubricants technical experts supported the company’s maintenance staff by conducting an analysis into the root cause, which showed that daily high pressure washing was removing grease from vital components.

THE SOLUTION

Shell Lubricants recommended changing to Shell Gadus S3 V460D 2 grease, which has excellent resistance to water washout and shock load resistance as a result of a formulation including lithium complex thickeners and shock resistant solid additives. The product has a proven track record in performing in similar conditions in other mining operations.

THE RESULTS

- Shell Gadus S3 V460D 2 was implemented across the entire fleet of haul trucks and drill rigs and results were monitored for 2.5 years.
- The field trial confirmed that Shell Gadus S3 V460D 2 delivered improved resistance to water washout. The grease was not removed during washing, providing effective lubrication of the pins and bushes. Combined with the superior shock load protection properties, this resulted in an 80% reduction in annual number of pin and bush failures (from 10 to 2) and 67% drop in boom failures (from 3 to 1).
- The customer estimated savings of US$189,800 per year due to the reduction in parts and maintenance costs.
- Further benefits included reduction in lost production due to downtime and potential lower levels of grease consumption, but these are not included in the above savings estimate.

OPEN GEAR INSPECTION CASE IN A GOLD MINE IN BURKINA FASO

APPLICATION:  
SABC grinding and carbon-in-leach gold plant

LUBRICATION SYSTEM:  
Farval Single Line Progressive

SHELL PRODUCT:  
Shell Gadus S4 OG Clear 20000

SERVICE:  
Vivo Energy LubeExpert

VALUE ADDED TO CUSTOMER:  
Annual Savings of US$279,260

OPERATIONAL UNIT:  
Vivo Energy Burkina Faso
SHELL LUBRICANTS’ SIX STEPS TO GOOD LUBRICATION MANAGEMENT

1. **RIGHT STORAGE & HANDLING**
The lubricant must be stored in the right conditions and handled correctly to avoid contamination and preserve its key characteristics.

2. **RIGHT PLACE**
For the oil or grease to reach the right surface it must be properly applied to the equipment.

3. **RIGHT TIME**
The correct frequency of oil change or re-greasing ensures the lubricant reaches the surface at the right time.

4. **RIGHT AMOUNT**
The correct volume of lubricant or grease should be applied and topped up to protect moving parts effectively.

5. **RIGHT MONITORING**
Regular sampling and analysis to ensure the lubricant remains fit for purpose and check for early indications of equipment wear. Inspections also ensure the consistent application of the first four steps.

6. **RIGHT PEOPLE**
The competence of those who lubricate equipment can greatly affect its positive impact, particularly when it comes to ensuring all of the above happens.
ONE OF THE WORLD’S LARGEST MINING COMPANIES WORKED WITH SHELL LUBRICANTS TO ACTIVATE A WELL-PLANNED APPROACH TO REDUCE TCO BY UPGRADING LUBRICATION PRACTICES.

**Step 1: Assessing potential**
- Expenditure on lubricants accounted for 5% and lubrication management accounted for 10% of the company’s annual maintenance budget.
- Using the Mine Lubrication Opportunity Survey Shell Lubricants identified that the lubrication impact represented 30% of the company’s annual maintenance budget.
- A series of projects that could deliver value by modifying the approach to lubrication was also identified.

**Step 2: Prioritising activation**
- Five projects were prioritised for the first phase, identified as relatively easy to implement but with the potential to deliver high impact in cost savings, equipment availability, security and environmental footprint.
- This included improving contamination control, reducing lubricant usage through extended ODIs, and extending the life of key components such as pins and bushes or industrial bearings.
- The five priority projects were only the start of the process but represented impressive potential:
  - Potential savings adding up to 4% of total annual maintenance budget (equal to 81% of total annual spend on lubricants)
  - Potential reduction of almost 1,000m³/year in amount of lubricant used, due to longer oil drain intervals and reduction in leakages
  - Potential reduction of 2,700 ton in CO₂ emissions
  - Potential reduction of 24 ton in metallic waste
  - Potential reduction > 20,000 man hours from maintenance and accident response

**Step 3: Realising value**
- As an example, one of the five priority projects – extending the life of pins and bushes - delivered impressive results:
  - **Savings** totalling USD $1.3 million in one year
  - 51% reduction in replacement parts, helping **lower costs**
  - 81% fewer interventions, meaning **reduced downtime**
  - 46% increase in time between **interventions**
  - Helping **improve productivity**

By continuing to follow the structured approach, the company will continue to realise cost savings over the coming years.
LOWER COST OF OPERATION

TOTAL COST OF OWNERSHIP: UNDERSTANDING THE POTENTIAL

Shell Lubricants believes that there is potential for lubrication to deliver significant business value by contributing to improved productivity and reduced costs. However, the potential impact of lubricants is often significantly underestimated.

Understanding how lubricants contribute to Total Cost of Ownership (TCO) is the first step to realising potential savings.

Total Cost of Ownership (TCO)

When evaluating the effect of lubricants on TCO, Shell Lubricants considers the end to end impact on maintenance budget and processes, but also any costs related to lost production during equipment downtime. Optimising lubrication can have a significant impact on component life, maintenance costs, and unplanned downtime, which mean that it can contribute to cost savings far higher than the price of the lubricant itself.

Seizing the opportunity

Lubricant product selection or management can impact many elements of a company’s maintenance budget. Seizing the cost-saving opportunity depends on addressing two equally important elements:

1. Selecting the right lubricant or grease - the right product
2. Effective lubrication management – including the right storage & handling, the right place, the right time, the right amount, the right monitoring and the right people.

THE IMPACT OF LUBRICATION IS UNDERRATED

60% of companies believe they can reduce costs by >5% through lubricant selection and/or management

Only 1 in 4 think savings could exceed 10%
EFFECTIVE LUBRICATION CAN HELP MINING COMPANIES LOWER TOTAL COST OF OWNERSHIP

COMPANIES RECOGNISE, BUT UNDERESTIMATE, THE COST-SAVING POTENTIAL OF EFFECTIVE EQUIPMENT LUBRICATION

60% of mining companies believe they can reduce costs by >5% through lubricant selection and/or management

But only 1 in 4 think savings could exceed 10%

In reality, lubricants can impact up to 30% of total maintenance budget

COMPANIES RECOGNISE, BUT UNDERESTIMATE, THE COST-SAVING POTENTIAL OF EFFECTIVE EQUIPMENT LUBRICATION

53% believe choosing higher quality lubricants will reduce maintenance costs

Only half are clear how lubrication can influence unplanned downtime or equipment

Only 4 in 10 businesses think they conduct staff training on lubricants as regularly as they should

Only 4 in 10 have all the correct procedures in place to manage lubricants effectively

EFFECTIVE LUBRICANT SELECTION AND MANAGEMENT CAN HELP ENABLE COMPANIES TO ACHIEVE TOTAL COST OF OWNERSHIP (TCO) SAVINGS THROUGH LOWER MAINTENANCE COSTS, REDUCED EQUIPMENT DOWNTIME, AND PRODUCTIVITY IMPROVEMENTS

SHELL LUBRICANTS WORKS WITH CUSTOMERS TO HELP DELIVER TCO SAVINGS

At least $43 million savings delivered to mining companies (2011-2015)

260 Shell Lubricants technical specialists help customers maximise equipment productivity and reduce TCO through lubrication

OEM and customer collaborations enable Shell Lubricants to develop products that help improve performance, productivity and profitability

Shell Lubricants Services to help upgrade lubrication management:

Shell LubeAdvisor - Helping identify and enhance savings
Shell LubeAnalyst - Lubricant monitoring
Shell LubeExpert - Expert advice onsite
Shell LubeCoach - Staff training

This survey, commissioned by Shell Lubricants and conducted by research firm Edelman Intelligence, polled 181 decision makers in the mining industry in Brazil, Canada, China, Germany, India, Russia, UK, US from November to December 2015.

1. Total Cost of Ownership (TCO) is defined by Shell Lubricants as the total amount spent on industrial equipment, including cost of acquisition and operation over its entire working life, including costs of lost production during equipment downtime.

2. Potential impact calculated based on Shell Lubricants site surveys with mining customers.

3. Shell recommended lubrication management procedures include delivery and storage, oil change, oil dispensing systems, efficiency of grease lubrication systems, oil and training employees in lubricant selection or management.

Shell Commercial Fuels is the quality diesel fuel provider of choice for corporate and distributing companies in many industries worldwide including transportation, construction, manufacturing, power generation, mining, agriculture and home energy.

We provide transport fuels, heavy fuel oils, heating fuels, new fuels and other innovative energy solutions that add value to your business, helping to improve the efficiency of your operations and reduce your environmental impact.

We believe proper fuel can have a positive influence on a fleet’s efficiency and profitability.

ROLE OF ENGINE CLEANLINESS
Diesel engine technology is advancing, placing new and changing demands on fuels. Deposits in the injector nozzles of high precision diesel engines can lead to less efficient combustion, resulting in torque loss, higher fuel consumption and in turn higher exhaust CO₂ emissions.

NEW TECHNOLOGY FOR ENGINE EFFICIENCY
NEW Shell Fuel-save Diesel has been specifically formulated with our new, exclusive DYNAFLEX Technology. It is designed to help clean up the engine from injector deposits and help, provide better fuel economy and more load-pulling power when needed.

Get more out of your fleet with our most advanced cleaning formula.

BETTER FUEL ECONOMY
New clean-up effect: NEW Shell Fuel-save Diesel is designed to help provide better fuel economy and therefore help reduce your fuel and operating costs by helping clean up the engine from injector deposits and prevent further build-up.

MORE POWER TO YOUR WHEELS
Starts to work even after one tank: NEW Shell Fuel-save Diesel is designed to improve engine efficiency and give more load-pulling power when needed.

VEHICLE RELIABILITY
Improved fuel stability: NEW Shell Fuel-save Diesel can help you use fuels with bio components and reduce risk of fuel degradation and sludge build-up, therefore helping improve vehicle reliability.
Shell GTL Fuel is a cleaner-burning alternative fuel to diesel that can help reduce local air emissions. It can be used as a drop-in fuel in diesel engines without the need for vehicle modification or new infrastructure. It produces fewer local emissions (NOx, SOx, Carbon monoxide) and visible black smoke (particulate matter).

### 3.1 SHELL GTL FUEL KEY BENEFITS

**HELPS TO REDUCE LOCAL EMISSIONS**

GTL technology produces more consistent and uniform molecules compared to conventional crude oil refining, which results in improved combustion properties for Shell GTL Fuel in standard diesel engines. This helps to reduce emissions of air pollutants.

**CAN BE USED IN EXISTING DIESEL ENGINES WITHOUT THE NEED FOR ENGINE MODIFICATIONS, NEW INFRASTRUCTURE OR VEHICLE INVESTMENT**

Shell GTL Fuel properties allow it to be used as a direct replacement for conventional diesel fuels.

**FREE OF UNWANTED COMPONENTS SUCH AS SULPHUR, METALS AND AROMATICS**

Natural gas is a much cleaner fossil fuel compared to crude oil and so Shell GTL Fuel is free of unwanted components, making it non-toxic and less harmful to the environment.

**READILY BIODEGRADABLE**

Shell GTL Fuel is more biodegradable than conventional diesel.

**CAN REDUCE THE NOISE LEVELS IN SOME ENGINES**

Thanks to more uniform combustion.

**BETTER STARTING PERFORMANCE IN COLD CONDITIONS**

Due to higher cetane number.

**BETTER SAFETY, HANDLING AND STORAGE CHARACTERISTICS**

Due to a higher flash point.
OFF-ROAD VEHICLES

Shell GTL Fuel can also be used in off-road machinery such as construction cranes, diggers, power generators and trains. The engine technology in off-road vehicles tends to be less sophisticated than that found in on-road. Furthermore, the fuel specifications are less stringent and therefore the possibility for seeing emissions benefits with GTL Fuel is potentially greater.

3.2 SHELL GTL FUEL APPLICATIONS

In these applications, Shell GTL Fuel offers:

- **6-25%** NOx reduction range\(^\text{13}\)
- **10-90%** particulate matter reduction range\(^\text{13}\)
- Reported noise reduction of approximately **3-5dB**\(^\text{13}\)

The off-road trials have shown that Shell GTL Fuel can be used effectively as a ‘drop-in’ fuel in a wide range of applications under different operating conditions.
Compared with other oils in the Shell range.

The Shell LubeExpert service is not currently available in all regions.

Shell LubeAnalyst Lite complements the off-site, laboratory-based service offered by Shell LubeAnalyst. Shell Lube Analyst remains the recommended analysis service when extreme precision is more important than fast results. Shell LubeAnalyst Lite is not currently available in all regions.

Case study savings/benefits were reported by one customer. Actual savings/benefits will vary. More details available on request.

Less than 10% washout after 1 hour at 79°C in the ASTM D1264 water-washout test.

Company cannot be named for reasons of confidentiality.

This was in line with other mining operations in the region where savings estimates ranged from 20% to 40%.

This survey, commissioned by Shell Lubricants and conducted by independent research firm Edelman Intelligence, is based on 181 interviews with mining sector staff who purchase, influence the purchase or use lubricants/greases as part of their job across 8 countries (Brazil, Canada, China, Germany, India, Russia, UK, US) from November to December 2015.

Compared to our previous formulation.

DYNAFLEX Technology or DYNAFLEX formulation are our names for our latest generation of advanced formulations for gasoline and diesel fuels.

Compared to regular diesel without fuel economy formula. Actual savings may vary according to vehicle, driving conditions and driving style. Internal Shell tests and with our customers have shown a range of fuel savings depending on age of vehicle and type of operations.

New Shell Fuel-save Diesel is designed to help provide better fuel economy and therefore helps lower operating costs. It helps improve oxidation stability and keeps fuel more stable in presence of bio components. It is designed to help you use fuels with bio components and reduce risk of fuel degradation and sludge build-up – therefore helping improve equipment reliability. As experienced by some customers rather than Shell protocols. Benefits will vary according to type of operation, vehicle, driving conditions and driving style.

Ranges are used to account for the fact that benefits may vary from engines of different sizes, powers, manufacturers etc. This range is not exact: It represents the maximum variation in results observed in scientific experiments which compared emissions from Shell GTL Fuel with conventional diesel. These trials were conducted by both Shell laboratories and a variety of independent organisations: On-road data was gathered both from Shell in-house laboratories and in partnership with independent test partners including AVL, TNO, Millbrook UK, NREL USA, among others. Off-Road data was gathered from customers who performed their own independent tests and shared their detailed results with Shell. Marine data was gathered by external test houses such as SGS NL BV investigating vessels sailing on GTL, and from independent tests by marine engine manufacturers.