

CREATE



THERE IS MORE TO CREATE

These pages contain augmented reality. Use your smartphone or tablet to discover it.

1. Download the **Discover View** app from the [App Store](#) or [Google Play](#).
2. When you see this icon on an image, scan the image to unlock extra content.





**“THE BEST WAY TO PREDICT
THE FUTURE IS TO INVENT IT.”**

— ALAN KAY, AMERICAN COMPUTER PIONEER

Modern cities can act as powerful engines for economic development and prosperity, but they require energy.



CREATING A BETTER FUTURE

At Shell, we believe it's possible for the world to have a future based on sustainable energy – one where everyone can enjoy abundant energy without harming the environment. We also believe it's our job to help create this future. In fact, we're working on it now.

Shell is known as an oil and gas company. But we generate energy from wind and produce sustainable biofuel from Brazilian sugar cane. We also operate demonstration filling stations where drivers can refuel with hydrogen.

These activities represent the first baby steps toward a world where almost all our energy comes from renewable sources. A world where people can travel to work, light their homes and cook their food with virtually zero carbon dioxide emissions.

Getting there won't be easy. By 2050 the earth will have added the combined population equivalent of another China and another India. One billion more motor vehicles will crowd the roads. Renewable energy alone will not be enough to meet everyone's needs. Our latest research suggests that only 30% of the world's energy – at most – could come from renewables by 2050. So despite everyone's best efforts to find alternatives, people will continue to depend on crude oil and natural gas.

Crude oil is the raw material for everything from the gasoline in our cars to the plastic in our toothbrushes. Natural gas – the cleanest-burning fossil fuel – generates the electricity to power homes and hospitals, factories and schools. It also heats buildings and serves as the basis for fertiliser and petrochemicals. It is hard to imagine life without these products.

And so Shell's immediate priority is clear: continue producing and processing oil and gas, but in ever more efficient, ever less wasteful ways while supporting a smooth transition to alternative energy sources.

The oil and gas projects that make this possible are some of humankind's largest, most complex works of engineering. From the icy reaches of the arctic to the darkest depths of the oceans, these projects map out the frontiers of technology. But even there they must respect global imperatives: Consume less freshwater. Emit less CO₂. Cost less money. Taming those frontiers requires vision, commitment and trust. Most of all, it requires collaboration and innovation.

Large energy projects are the crowning jewels of nations. To governments, they power the economy. To industry, they supply raw materials. To consumers, they hold the hope of prosperity. To shareholders, they yield a return on investment.

To Shell, oil and gas projects are simply missions to be accomplished. Safely. Cost-efficiently. Responsibly.



**“SOMEWHERE, SOMETHING INCREDIBLE
IS WAITING TO BE KNOWN.”**

— CARL SAGAN, AMERICAN ASTRONOMER AND WRITER, 1934–1996

Some moons in our solar system are thought to be covered with oceans of methane – liquefied natural gas, in other words.



FINDING THE RIGHT ROLE FOR NATURAL GAS

Many people see the oil and gas industry going the way of the dinosaurs – soon to become extinct as renewables grow to meet all the world's energy needs. This misconception overlooks the vitality of natural gas, the cleanest-burning fossil fuel.

Natural gas packs an energy potency that few other resources can match. Yet it burns so cleanly that switching from coal to natural gas for power generation improves local air quality and reduces global CO₂ emissions per unit of electricity. Natural gas also complements the power of renewables, providing energy on demand to fill the gap when the sun goes down or the wind stops blowing.

This versatile fuel touches the world in other ways. As the raw material of choice for manufacturing fertilisers, it helps feed the world's growing population. As a building block of petrochemicals, it helps produce the plastics in modern artifacts, appliances and apparel. Natural gas is also emerging as a low-emission transport fuel. Millions of cars, trucks, busses and ships worldwide already run on it.

The world needs this abundant, affordable and acceptable energy source. Unfortunately, it is not always *where* we need it.

A cool solution

Building pipelines to distant markets can be expensive and might damage the natural environment. The solution is to pipe the natural gas to nearby facilities, where it is cooled into a liquid. This shrinks its volume for easier, safer storage and shipping. Once the liquefied natural gas (LNG) arrives at its destination, it is warmed up so that it returns to its original gaseous form, ready for piping to homes, factories and power plants.

Shell introduced this gas-liquefying technology to the industry 50 years ago with the world's first commercial LNG plant. Since then, our projects have helped several nations to reap the wealth of their resources.

But some natural gas is found so far offshore that piping it to a liquefying plant on the mainland would be too costly or environmentally disruptive. So now Shell is pioneering another game changer to unlock these resources as well: *Prelude*, a floating LNG facility.

A tiny giant

Prelude will be the biggest man-made object that ever went to sea. When complete, it will serve as a production platform for the *Prelude* and *Concerto* gas fields off the northwest coast of Australia. But that is only part of its job. *Prelude* is also a facility that can liquefy, store and transfer the LNG to ocean-going carriers for delivery to far-off destinations. Each year, it will produce more LNG than Hong Kong can use.

Despite its size, *Prelude* is actually very small relative to other LNG plants. It packs the capacity of a comparable land-based LNG plant into less than 1/20th the surface area. This feat of miniaturisation required the ingenuity of more than 600 engineers. They shrank the processing and cooling equipment. They stacked pieces of equipment on top of each other. And they managed to achieve the most important reduction of all: the safety risks.

The *Prelude* project illustrates what Shell does best: combining design, engineering, stakeholder engagement and supply-chain management to deliver an unprecedented project.





**"WE NEED TO OUTLINE WHAT IS POSSIBLE
AND WHAT IS IMPOSSIBLE..."**

— JACQUES-YVES COUSTEAU, FRENCH OCEANOGRAPHER, 1910–1997



ENTERING AN ALIEN WORLD

In the perpetual night of the deep ocean, creatures drift like shimmering stars and ghostly planets. But something else is hiding at these depths: oil and gas.

The relentless quest to meet the world's growing demand for energy has driven Shell to operate in some of this planet's most remote locations. Nowhere is this mission more difficult than in oceans. They cover more than two-thirds of the planet and hold almost half of the world's conventional oil resources.

When other companies drilled from piers anchored to the southern US shoreline in the 1930s, we broke free from land with movable barges to reach oil. When astronauts orbited the earth in 1962, Shell launched the industry into 91 metres (300 feet) of water with a new type of drilling platform. And when NASA's Mars Pathfinder began its expedition in 1996, Shell deployed its Mars platform in 896 metres (about 3,000 feet) of water to harvest one of the largest oil fields ever discovered in the Gulf of Mexico.

From the arctic waters of Norway to the tropical waters of Brazil, Shell has ruled the waves with a procession of milestones: the largest discovery... the tallest platform... the fastest production... the first of its kind. And the deepest: Perdido.

Perdido

When we began working on the Perdido project, our subsea cameras showed us that we were entering a world as strange as any glimpsed by the Hubble space telescope. We were venturing into one of the planet's most formidable seascapes: the ocean depths called the "Midnight Zone," where not even sunlight can penetrate.

The Perdido platform produces oil and gas from wellheads lying 11 kilometres (7 miles) away and under 2,934 metres (9,626 feet) of water. Working at this depth takes creative engineering and

innovative technologies. The Perdido platform bobs in the water like a cork, with most of its weight kept below the waterline. This reduces its size and cost. Yet the smaller top part contains advanced safety features. For instance, two helipads instead of one can evacuate the crew more quickly for the 90-minute ride back to shore.

On the seabed, Perdido's facilities withstand two times more pressure than hydraulic crushers use to flatten cars. Pipelines snake up and down steep underwater canyons and around reefs of protected species. Special additives keep the oil flowing through near-freezing temperatures. Powerful electrical pumps push the oil to the surface. And miles of conduit allow electric power and control signals to flow between the platform and subsea facilities. We had to use remote-controlled vehicles with robotic arms to install most of this equipment.

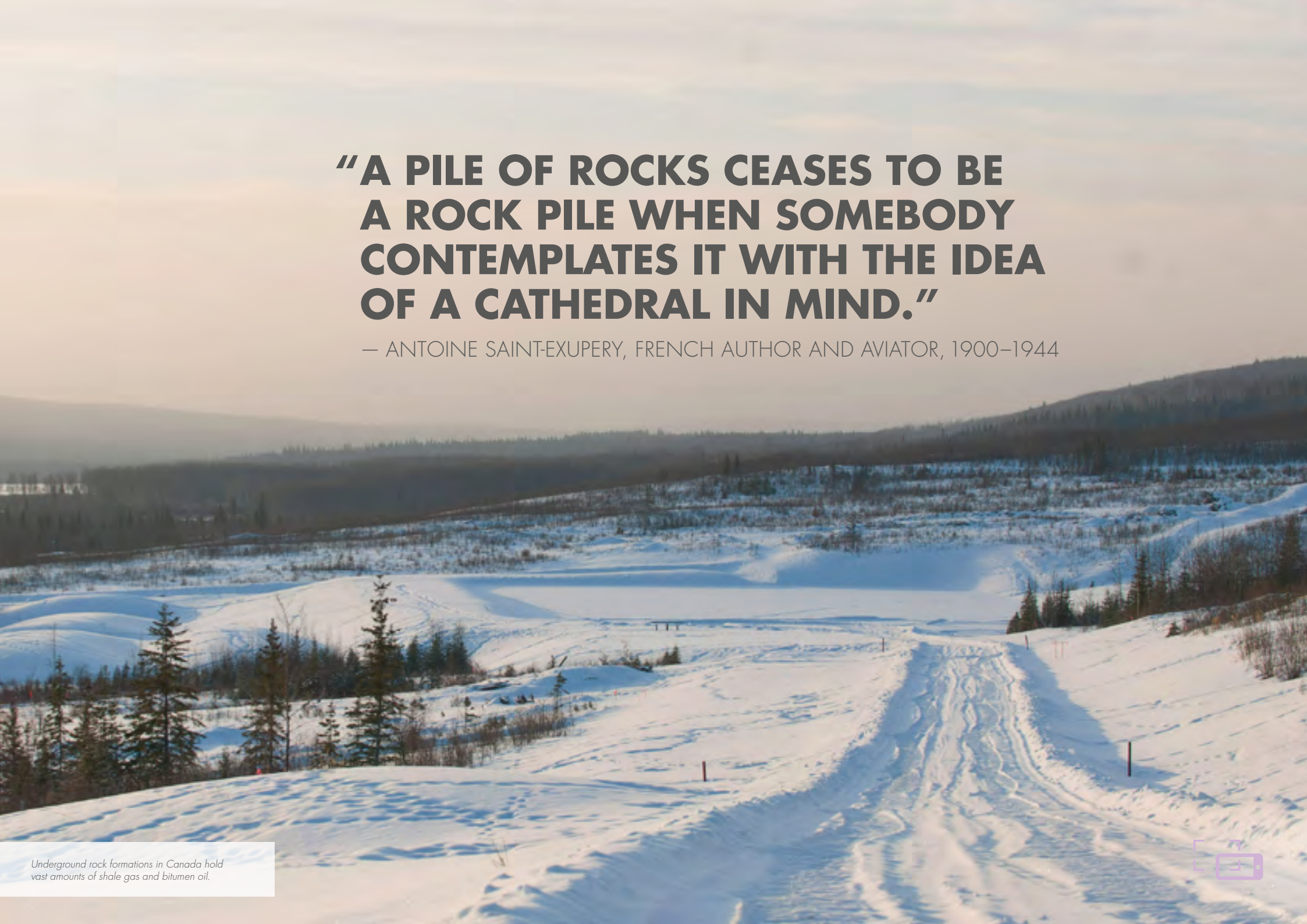
And beyond

Another project is taking us into an even more punishing environment. The Stones oil field lies in 2,919 metres (9,576 feet) of water. Its production wells are expected to tunnel at twice that depth under the ocean floor.

With the opportunities opened up by our offshore production technology, Shell is turning to new seismic technologies to "see" where oil fields may still be hiding under deep water. Our findings led us to redevelop the Mars field with the new Olympus platform. These technologies also enabled us to find additional resources for our Cardamom project.

Incidentally, the Cardamom project was the first approved by the US government after the Deepwater Horizon oil spill. Part of the reason for the approval was Shell's record of leadership in offshore safety and environmental protection. This is always our first priority in the ocean. No matter how deep it is. No matter how alien it seems.





**“A PILE OF ROCKS CEASES TO BE
A ROCK PILE WHEN SOMEBODY
CONTEMPLATES IT WITH THE IDEA
OF A CATHEDRAL IN MIND.”**

— ANTOINE SAINT-EXUPERY, FRENCH AUTHOR AND AVIATOR, 1900–1944

Underground rock formations in Canada hold vast amounts of shale gas and bitumen oil.



UNLOCKING THE EARTH'S ENERGY

All the energy that exists on earth originated the moment the universe was born. For energy can neither be created nor destroyed. Shell project teams make the most of this legacy.

Some crude oil and natural gas flows freely from underground reservoirs into wells. But much is locked tightly in the microscopic pores of shale or other “tight” rock. Some oil is so thick that it does not flow at all.

But this is energy that the world needs. So Shell is helping to make its production safer and more economically viable.

According to the US Energy Information Administration, the earth holds enough gas in tight formations to power the world for almost 100 years. Much of this is in North America, where Shell projects are helping consumers spend less on fuel as their countries become more energy independent. Shell is also helping China meet its growing energy demand with tight gas.

Many wells, small footprints

The key to making tight-gas projects profitable is to develop them quickly, efficiently and inexpensively without compromising safety. That's why Shell is working with China National Petroleum Corporation to replace conventional, multi-purpose drilling rigs with smaller alternatives. Each designed for a specific task, these highly manoeuvrable and computer-controlled rigs will deliver speed and precision. They also improve safety and reduce environmental impact.

To free the gas from the rock, engineers often need to place cracks in the rock by pressurising the well with water-based liquid. The gas can then flow through these cracks. This technique – hydraulic fracturing, or “fracking” – is one of the major public concerns about shale and tight gas. We take such concerns seriously.

In an effort to raise industry standards, we published a set of Operating Principles for tight sand and shale oil and gas operations. These Principles are specifically designed to protect water, land, air and communities. For us, adhering to them is an important part of building trust.

To minimise the consumption of fresh water, for example, we use waste water in our projects whenever possible. At our Groundbirch project in Canada, we are reusing sewage water (treated, of course) from the neighbouring city of Dawson Creek. At our Pinedale project in the US state of Wyoming, we have halved our water use by reusing water from our drilling operations.

Freeing an oil, capturing a gas

We also work hard to gain the trust of communities in Canada, where one of the world's largest oil resources is found. The oil is in the form of bitumen, a sticky crude that is so thick it's almost solid. Using giant mechanical shovels that could scoop out a backyard swimming pool in one stroke, we mine bitumen that is near the surface. To access deeper bitumen, we drill conventional wells, and sometimes inject steam into the reservoir to help it flow. After we remove the sand and water, we dilute the bitumen and pipe it to a processing plant, where it is converted into synthetic crude.

Shell shares the world's concern about the greenhouse gas emissions that arise from these and other oil-production operations – and we are doing something about it. We have been a strong advocate of carbon capture and storage technology, which captures CO₂ before it enters the atmosphere and stores it safely underground. So we are moving forward with Quest, the first project to remove CO₂ from oil-sand operations.

The First Law of Thermodynamics states that energy can neither be created nor destroyed. But with the right technologies, we can liberate it. Shell projects are freeing oil or gas from stone prisons and transforming them into the energy products that the world needs.



A man with a short beard and mustache, wearing a light blue long-sleeved shirt, is looking into the open door of a white front-loading washing machine. He is holding a white cloth or piece of fabric. The background is a brightly lit laundry room with other washing machines visible in the distance.

**“OTHERS HAVE SEEN WHAT IS AND
ASKED WHY. I HAVE SEEN WHAT
COULD BE AND ASKED WHY NOT.”**

— PABLO PICASSO, SPANISH ARTIST, 1881–1973

*Laundry detergent is made from petrochemicals
derived from crude oil or natural gas.*



MAKING THE PRODUCTS OF MODERN LIFE

In times past, creating gold from common materials was the impossible dream of alchemists. Today, refineries routinely do the reverse: create common materials from gold – black gold, that is. Petrol, diesel, detergents and plastics – all come from crude oil. And now Shell is even making similar products from gases as thin as air.

Crude oil is one of the world's most versatile resources. It is the basis for the liquids that fuel nearly all of the world's cars, trucks, ships and aeroplanes. It is also the basic building block of everyday plastics, which are found in our mobile phones and our office computers, our home furnishings and our children's toys. It's in the detergents that clean our clothes. Oil turns the wheels of global commerce and influences national policies. In short, crude oil has created modern life.

Meeting the world's ever-increasing demand for new products from this "black gold" requires innovative solutions.

From crude oil to refined products

Light crude has always been the top raw-material choice of refiners. But the crude that is available these days is more likely to be thick and laden with smelly sulphur-containing substances. Shell technologies turn these disadvantages into opportunities. They can "crack" long-chained molecules into lighter components and "sweeten" the hydrocarbons by removing sulphur impurities. In so doing, they upgrade the oil into valuable products that can meet growing demand – and comply with stringent environmental regulations.

Drawing on our experience in designing, building and operating complex processing plants, we have also developed ways to make petrochemicals more efficiently. For instance, our OMEGA process produces mono-ethylene glycol, which is used to make antifreeze and polyester textiles.

An OMEGA plant uses 20% less steam, produces 30% less wastewater and costs less to build than traditional plants. It also produces virtually no chemical by-products, which eliminates the need for handling and storage facilities.

The OMEGA process is only one of the ways that Shell can extract more value from crude oil. Our proprietary gas-to-liquids (GTL) technology lets us do the same from natural gas.

From natural gas to synthetic products


Shell's Pearl GTL plant in Qatar is the largest source of GTL products in the world. It is the culmination of 40 years' research in laboratories and pilot plants, and 20 years' experience in operating the world's first commercial GTL plant (in Malaysia) – which we also designed.

The Pearl GTL project taps one of the world's largest gas fields through two offshore platforms. The gas flows through a pipeline to the huge processing plant onshore. The plant turns natural gas into a mixture of two other gases, then pumps the mixture into one of 24 reactors. These contain patented catalyst particles. Although each is only about the size of a grain of sand, their combined surface area is 18 times the size of Qatar. The catalysts speed up a chemical reaction that converts the gaseous mixture into a waxy liquid. This, in turn, is converted into a variety of products.

The Pearl GTL plant yields products that burn cleaner than their oil-derived counterparts. These include diesel and jet fuels. Pearl also makes enough synthetic oil to lubricate 225 million cars each year. Its paraffin goes into the detergents you might use in your laundry room. Naphtha becomes the feedstock for plastics.

Whether starting from crude oil or natural gas, Shell's plants supply products that are clean and safe. We think this modern-day alchemy makes good use of the world's non-renewable resources.





**“THE DIFFERENCE BETWEEN WHAT WE DO
AND WHAT WE ARE CAPABLE OF DOING
WOULD SUFFICE TO SOLVE MOST OF THE
WORLD’S PROBLEMS.”**

— MAHATMA GANDHI, INDIAN CIVIL LEADER, 1869–1948

The free provision of healthcare is just one of the ways an oil or gas project can improve the life of local communities.



PAVING THE WAY TO THE FUTURE

Shell's project teams find creative ways to deliver more than just oil and gas: better health, new infrastructure and community services are just a few more benefits that our projects have brought. More important, however, is the peace of mind that comes from their responsible operation.

The potential for danger is ever present in the oil and natural gas industry. After all, oil and gas are flammable – that's what makes them such good fuels. Flowing from the ground and through pipelines at high pressures, they require expert handling to prevent an accident. Irresponsible operations – worker injuries, noxious fumes or unabated noise – make a project an unwelcomed neighbour.

At Shell, we think that we have an obligation to operate projects safely and to alleviate the inconvenience they may cause. A safe, respectful, well-operated project is what people rightfully expect from a vital member of their community. After all, projects provide employment and government revenue for many generations. So it's important for our neighbours to feel comfortable with our activities.

Listening for clues

Take Malampaya, the Philippines' first natural gas project, for example. Since 2001, it has produced clean, reliable energy to support the country's rapid development. The project is a cornerstone of the Philippine economy, providing billions of dollars of revenue to the government while reducing the country's dependence on imported fuel.

But the project was not always so welcome. By listening to people's concerns, we learned that many local residents were afraid that the project would damage the environment and cause injuries. Fishermen thought that they would be unable to work in the vicinity of the drilling area. Members of the indigenous Tagbanua tribe worried that a pipeline, which carries the natural gas to power plants for electricity generation,

would cross sacred waters where their ancestors' remains lie. But, building on broad collaboration with the community, we managed to satisfy concerns and develop Malampaya after all.

We rerouted the pipeline to protect the biodiversity of an ecologically sensitive area, and at the same time we avoided the ancient Tagbanua funeral site. We launched training programmes to help local people gain new livelihoods. We also funded a micro-finance programme to help start businesses. This deepened the supply chain for goods and services that Shell uses there while enriching the national economy.

One of the community's oldest and deepest concerns at Malampaya was malaria – a devastating disease that struck our own employees as well. So we launched an anti-malaria programme that has since been replicated in four other provinces. Similarly, we expanded road-safety awareness beyond our company drivers by taking our training methods into the community.

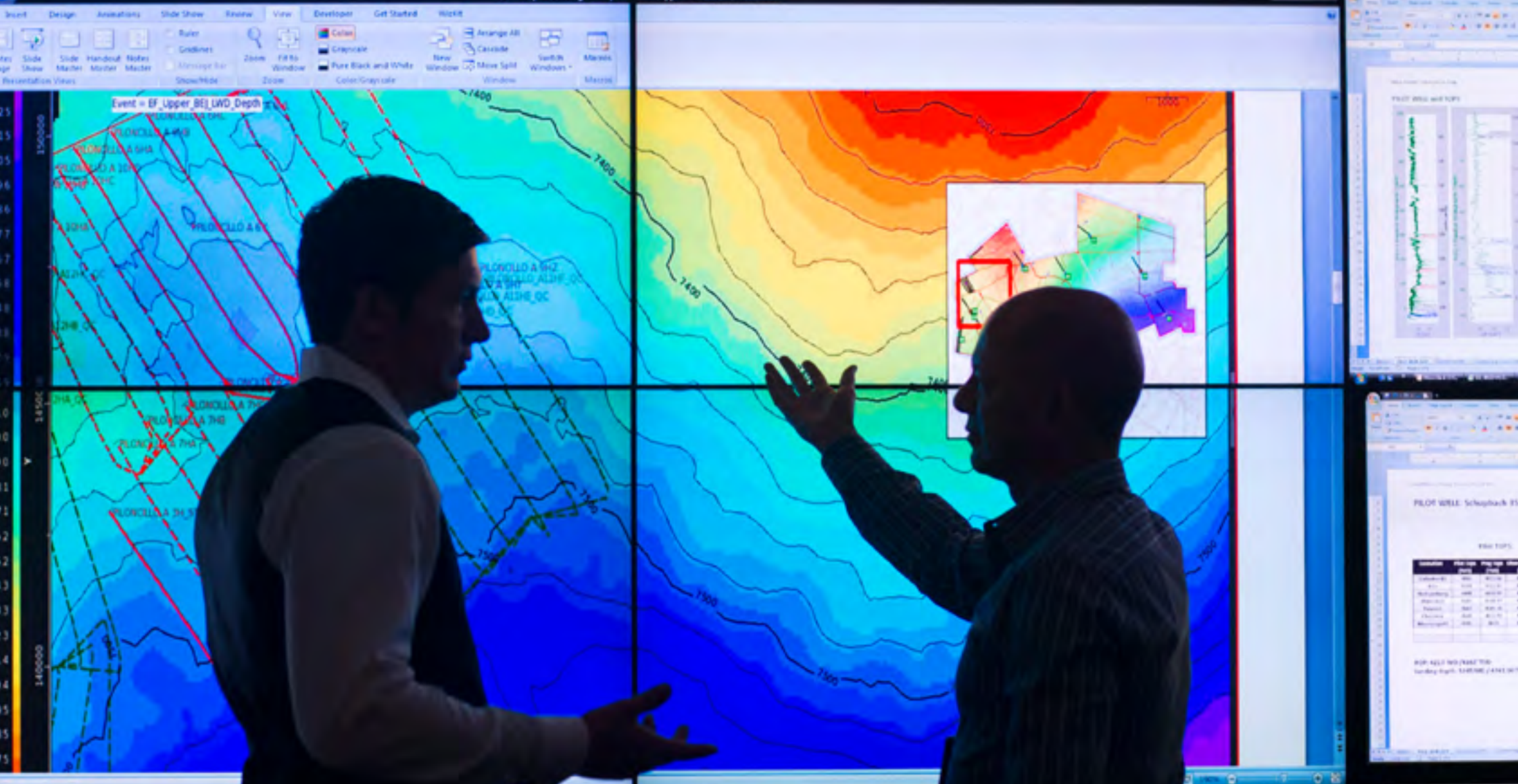
Sharing the benefits

Our efforts were rewarded. The area now has healthier residents and a more vibrant local economy. Everywhere you look, you see signs that our internal safety culture is taking root outside the project boundaries. Now even schoolchildren learn the rules of the road on their tricycles. And we even improved the profitability of our operations.

Everyone wins with programmes like these. Such strong engagement with the community helps people accept our projects so we can move forward without costly delay. And this is not unique to Malampaya. Programmes with the same aims have been launched in Brazil, Malaysia, Nigeria and other countries – wherever we have projects underway.

Our big-picture approach to responsible project management has been shown to bring lasting value for all stakeholders in an oil or gas project.





**“WHEN NOTHING IS SURE,
EVERYTHING IS POSSIBLE.”**

— MARGARET ATWOOD, CANADIAN AUTHOR

The display of “live” data at operation centres enables experts there to give well-engineering advice to distant drilling rigs.





INVENTING TOMORROW'S WORLD TOGETHER

Even a large, resourceful company like Shell can't presume to solve all of the world's energy problems. Sometimes the most creative solutions come from unexpected sources, and they require many participants to put them into practice.

Tomorrow's projects cross unexplored frontiers. They depend on technologies that don't yet exist. And even if a technology is available, it can take decades to commercialise and deploy on a large scale.

But future energy projects meet critical social and economic needs. So they have to be built. Whether they capture CO₂ emissions, free trapped hydrocarbons or make higher-quality products from lower-quality raw material, they compel engineers to overcome monumental barriers. That's why innovation is so important.

To us, innovation simply means doing things differently, better than before. And the most innovative ideas happen when brilliant people from different disciplines work together to solve problems. In short: collaboration.

Innovation and collaboration are so important to Shell that we are reaching out to creative people – no matter who they might be, no matter where they might work. They include: thinkers at research institutes; experts from non-governmental organisations; visionaries with high-tech start-up companies; and our own contractors, of course.

Collaborative engineering

Take the Olympus production platform, which is expected to extend the life of deepwater fields in the Gulf of Mexico for at least 35 more years. Designing and building it involved a cast of hundreds of Shell people and thousands of contractors. These were scattered among design offices, construction yards and factories around the world. Coordinating this intertwined activity could have been a nightmare. But our design offices enabled this collaboration by adding a fourth

dimension – time – to the usual 3D computer-aided design. This helped us track and re-adjust activities to keep the project on schedule – even when an earthquake in Japan disrupted steel deliveries or a typhoon in South Korea threatened the hull construction.

This "4D" approach to project management also helps us better address safety. We first let design teams from all over the world get a good view of the model on screen – if need be, through stereoscopic glasses to appreciate its full three dimensions. They can look at it closely from the side and from above; they can even look at it from inside out. This helps them catch design flaws that could lead to problems once the project is up and running.

When we then add the dimension of time to the 3D design model, we can link the model to the execution of construction plans. This way, for instance, if welding on an overhead structure is initially scheduled for the same week that workmen are painting below, those incompatible activities can be rescheduled.

Shell uses similar collaboration tools to summon its vast engineering expertise for every project, even at the very start – when drilling exploration wells, for example. Rich data sources combine with advanced 3D visualisation technology to create a virtual hyper-reality – an underground world highlighting the subtle clues that point to hydrocarbon hiding places. Working collaboratively from wherever they are in the world, project-team members can quickly trace out the best place to drill. And when the work actually begins, engineers around the world can remotely monitor drilling operations and provide immediate solutions when they're needed.

Changing the world

Shell unites an army of skilled engineers, reliable contractors, prudent bankers and insightful researchers. Drawing on unparalleled project-management expertise, we pull their collective effort together to deliver some of the world's most innovative energy projects. Safely. Cost-efficiently. Responsibly.



Cautionary note This publication contains forward-looking statements concerning the financial condition, results of operations and businesses of Royal Dutch Shell plc. All statements other than statements of historical fact are, or may be deemed to be, forward-looking statements. Forward-looking statements are statements of future expectations that are based on management's current expectations and assumptions and involve known and unknown risks and uncertainties that could cause actual results, performance or events to differ materially from those expressed or implied in these statements. Forward-looking statements include, among other things, statements concerning the potential exposure of Royal Dutch Shell to market risks and statements expressing management's expectations, beliefs, estimates, forecasts, projections and assumptions. These forward-looking statements are identified by their use of terms and phrases such as "anticipate", "believe", "could", "estimate", "expect", "goals", "intend", "may", "objectives", "outlook", "plan", "probably", "project", "risks", "schedule", "seek", "should", "target", "will" and similar terms and phrases. There are a number of factors that could affect the future operations of Royal Dutch Shell and could cause those results to differ materially from those expressed in the forward-looking statements included in this publication, including (without limitation): (a) price fluctuations in crude oil and natural gas; (b) changes in demand for Shell's products; (c) currency fluctuations; (d) drilling and production results; (e) reserves estimates; (f) loss of market share and industry competition; (g) environmental and physical risks; (h) risks associated with the identification of suitable potential acquisition properties and targets, and successful negotiation and completion of such transactions; (i) the risk of doing business in developing countries and countries subject to international sanctions; (j) legislative, fiscal and regulatory developments including regulatory measures addressing climate change; (k) economic and financial market conditions in various countries and regions; (l) political risks, including the risks of expropriation and renegotiation of the terms of contracts with governmental entities, delays or advancements in the approval of projects and delays in the reimbursement for shared costs; and (m) changes in trading conditions. Readers should not place undue reliance on forward-looking statements. Each forward-looking statement speaks only as of the date of this publication, November 28, 2014. Neither Royal Dutch Shell plc nor any of its subsidiaries undertake any obligation to publicly update or revise any forward-looking statement as a result of new information, future events or other information. In light of these risks, results could differ materially from those stated, implied or inferred from the forward-looking statements contained in this publication.

GET CREATIVE

Follow us on Facebook, on Twitter
or go to www.shell.com