



06 BOB DUDLEY

BP CEO discusses
safety and risk

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Key dates in oil
spill response

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Major milestone
for gas project



THE INTERNATIONAL MAGAZINE OF THE BP GROUP

ISSUE 1 2011

BP MAGAZINE

40 SPOTLIGHT: CHINA

PERFECTING THE BLEND

BP Magazine reports from China, where a 30-year partnership
is helping the country address its energy needs.

Welcome. A year has passed since the tragic accident at the Deepwater Horizon oil rig in the Gulf of Mexico, in which 11 men lost their lives. The subsequent oil spill lasted 87 days and required an unprecedented response. As BP pauses to mark this difficult event, its chief executive, Bob Dudley, talks to *BP Magazine* (page 6) about how the company continues to meet its obligations in the Gulf Coast region, the changes being made in BP and the challenges it still faces. We've also created a timeline of last year's events (page 12) and we examine one of the graphics that helped explain the scale of the subsea challenge (page 18). The events of 2010 have left BP with a series of commitments, not least to continue putting safety and risk management at the heart of its operations. We meet the team at the SECCO petrochemicals plant in China who has achieved 88.6 million manhours without a fatality or major process safety incident as a consequence (page 44). Turning to other parts of the BP business, we report on developments in Oman to bring tight gas reserves online and we find out about one of BP's new biofuels businesses (page 50).

Lisa Davison > Editor

BP MAGAZINE

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Photography by Harrison McClary, Graham Trott, Stuart Conway and Tim Campbell

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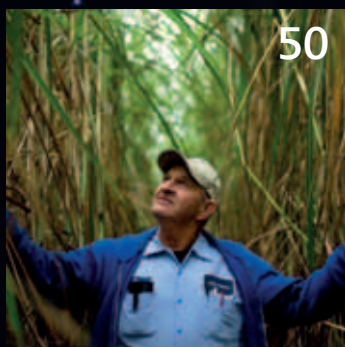
62 Parting shot Firefighters perform drills at the Abadan refinery in the 1920s and 30s. Photography by BP Archive

12 GoM timeline

The response to the Gulf of Mexico oil spill involved thousands of people working round the clock to clean the beaches and Gulf of oil, treat affected wildlife, handle claims and stop the flow of oil. *BP Magazine* documents the key moments.



06



50

For the record

Highlights from around the globe > Spring 2011



**the quarter
in numbers**

7

The number of cents per share BP paid as a dividend for the fourth quarter of 2010

\$4.6 billion

BP's replacement cost profit for the fourth quarter of 2010

\$30 billion

The total amount of divestment activity BP has pledged to complete by the end of 2011

\$40.9 billion

The total pre-tax charge related to the Gulf of Mexico oil spill



New faces: from left to right, Brendan Nelson, Frank L 'Skip' Bowman and Phuthuma Nhleko

Global: Board appointments

BP has made three new appointments to its board in the past six months. Phuthuma Nhleko joined as a non-executive director in February 2011. He is the vice president of MTN Group, the mobile

telephone multinational company, based in South Africa. Meanwhile, Brendan Nelson, a director of the Financial Services Skills Council since 2008, and Frank L 'Skip' Bowman, a former head of the US

Nuclear Navy, joined as non-executive directors in November 2010. Each of these appointments are regarded as the next step in continuing to strengthen BP's board to meet future challenges.



Argentina

Pan American sale

Bridas Corporation has agreed to purchase BP's interests in Pan American Energy, the Argentina-based oil and gas company. Bridas already owns 40% of the company, and will buy BP's remaining 60% for a total of \$7.06 billion cash. The transaction is expected to be completed in 2011.

Australia

New licences

BP has been awarded four deepwater offshore blocks in the Ceduna sub-basin, off the coast of south Australia. "This is a material and early move into an unexplored deepwater basin," said BP's executive vice president of Exploration Mike Daly. Exploration activity will be phased over six years and subject to detailed environmental assessment.

UK

Asset sale

A number of BP-operated oil and gas fields in the UK have gone up for sale. The assets involved are the Wytch Farm onshore oilfield in Dorset and all of the company's operated gas fields in the Southern North Sea, including associated pipeline infrastructure and

the Dimlington terminal. The divestments will allow BP to focus resources and investment on its diverse Central North Sea, Northern North Sea, West of Shetland and Norway assets, and on successful delivery of its new major projects. Meanwhile, BP has been awarded licence interests in seven UK offshore exploration blocks – its largest award in the UK for a decade.

Global

Lubricants sale

BP is looking for buyers for its world-famous Duckhams and Veedol lubricant brands. Both have been in existence since the invention of the motor car around the start of the 20th century. The successful buyer will get global rights to a wide portfolio of registered trademarks for the respective master brands, as well as the associated product sub-brands and iconic logos.

Iraq

Production milestone

The Rumaila Operating Organisation (ROO) has increased production by more than 10% above the 1.066 million barrels a day initial production rate agreed in December 2009.

It marks a major milestone in the redevelopment of the super-giant field in Southern Iraq.

Egypt

Gas discovery

BP Egypt has made a significant gas discovery in the deepwater West Nile Delta area. The Hodoa discovery is located some 80 kilometres (50 miles) northwest of Alexandria. The well was drilled to a depth of 6,350 metres (20,830 feet) and is the first Oligocene deepwater discovery in the West Nile Delta area.

Indonesia

Licence awarded

The government of Indonesia has awarded BP a 100% interest in the North Arafura oil and gas production sharing contract (PSC) in onshore Papua province. The field is located 480 kilometres (300 miles) southeast of the BP-operated Tangguh gas plant.

Azerbaijan

New deal

BP has signed a new production sharing agreement (PSA) with

SOCAR (State Oil Company of Azerbaijan Republic). The two organisations will conduct joint exploration and development of the Shafag-Asiman structure in the Azerbaijan sector of the Caspian Sea.

Brazil

Biofuels expansion

BP is to acquire majority control of the Brazilian ethanol and sugar producer Companhia Nacional de Açúcar e Alcool (CNAA) for approximately \$680 million. When CNAA's assets are fully developed, this is expected to increase BP's overall Brazilian production capacity to around 1.4 billion litres of ethanol equivalent per year (9 million barrels).

US

Refining divestment

BP is to halve its US refining capacity with the sale of two of its US refineries. The company plans to complete the sale of Texas City refinery and Carson refinery (below), together with its associated integrated marketing business in southern California, Arizona, and Nevada by the end of 2012.





Snapshot: Bob Dudley addresses the media in Biloxi, Mississippi, 30 July 2010.



Interview> **Lisa Davison**

Photography> **Harrison McClary, Graham Trott, Stuart Conway, Tim Campbell**

→ interview

IN THE SPOTLIGHT

AN INTERVIEW WITH BP'S CEO BOB DUDLEY

The tragic events of 20 April 2010, in which an explosion on the Deepwater Horizon drilling rig in the Gulf of Mexico led to the deaths of 11 men and oil leaking into the Gulf for 87 days, have left an indelible mark on BP and its people. Not least its new chief executive.

L

ike a number of BP's American staff, Bob Dudley grew up along the Gulf Coast, spending childhood holidays swimming and fishing in its waters. It was these close ties with the region that brought him into the response early on, and made him the ideal choice to head up BP's Gulf Coast Restoration Organization, an entity that was created in June 2010 to manage all aspects of BP's spill response. It was a role he was to carry out for just three months, before replacing Tony Hayward as BP's chief executive.

Dudley took on the top job in one of the most challenging periods in BP's 100-year history. As well as the complex engineering that was needed to physically stop the oil leak, the spill required a massive onshore and offshore response, with some 48,000 people playing a role at its peak (see pages 12-21). Within a few days of the accident, BP began paying claims to those whose livelihoods had been affected, and later pledged \$20 billion to a trust fund, to continue meeting those claims, as well as the cost of Natural Resource Damages claims. As efforts to cap the well were repeatedly unsuccessful, costs continued to rise, while the company's share price fell sharply and its credit rating was downgraded.

Dudley says BP needs to take the lessons of the tragedy "deeply into the fabric of our

organisation", with a more intense focus on risk management. "BP has a choice," he says. "It can step away from risk, or it can learn from the incident and focus on risk management to an accelerated degree. We need our people to think about potential low-probability, high-impact events, and then plan for them."

New steps to strengthen safety and risk management are top of Dudley's priorities for BP. These will help fulfil the next priority – to earn back trust – and provide the foundation for the third – to build shareholder value in a safe and sustainable way for the long term.

To help put safety and risk management at the heart of the company, BP has restructured the way it rewards performance, encouraging individuals to think about their personal legacy to the company and its assets. Under the new structure, staff are being asked to set out priorities in the areas that the company wants to see strengthened. Those priorities include their personal commitments to promoting safety, risk management, compliance, teamwork and, crucially, how they will work towards long-term as well as short-term goals.

"I saw people work like this during the Gulf of Mexico response. BP employees from all the over the world played their

part, either directly, down on the beach or in a crisis centre, or indirectly, stepping up and filling in, making sure the rest of the business ran safely, reliably and performed well. There was this strong desire to act as stewards for the wider business. That is the spirit we need to capture and replicate right across the organisation.

"If everyone has a sense of long-term stewardship over our assets every day," he continues, "then people will also start to speak up more if they have concerns. I want us to sharpen our everyday attitude to operational and technical risk, to ensure it is the norm for people on the frontline to speak about risk, and for managers to listen."

This 'sharpening' of attitudes has been embodied by the creation of a new safety and operational risk (S&OR) division. Headed by Mark Bly (see page 22), the organisation will have its safety experts embedded within BP's operating divisions to guide, scrutinise and, if necessary, intervene. It will also have a central team of specialists who will establish and update BP's safety and risk management standards.

"For the most part, BP was making steady progress on safety before the incident," says Dudley. "However, we must now accelerate that and make sure it applies everywhere. My expectation is that S&OR will not only look at day-to-day operations, but also how we design our facilities for the future."


Another major organisational shift is occurring in the upstream business, now divided into three divisions – Exploration, Development and Production. The changes are a further evolution of work started before the oil spill and, says Dudley, will help BP focus on the capabilities it needs to manage its risks. "This is a necessary adjustment to the approach that was

»



"I want us to sharpen our everyday attitude to operational and technical risk, to ensure it is the norm for people on the frontline to speak about risk, and for managers to listen."

Diverse roles: Dudley addresses an audience of employees at the company's offices in Sunbury, UK (below). Opposite, on the podium with Admiral Thad Allen at the Southern Governors' Association conference in August 2010.

A man with light hair, wearing a dark suit jacket over a light blue button-down shirt, stands in front of a large window, gesturing with his right hand while holding a small black object. He is addressing a group of people whose heads are visible in the foreground, out of focus. The setting appears to be a modern office or conference room with large windows in the background.

“If everyone has a sense of long-term stewardship over our assets every day, then people will also start to speak up more if they have concerns.”



instituted in 1992, when the company took action to recover from financial trouble. At that time, we created a series of business units and we basically said to the heads of those units: 'You are your own CEO'. That planted a drive for performance within the DNA of this company, and empowered people to do amazing things in a difficult period, but it also meant that systems and processes became less standardised. I don't want BP to lose that entrepreneurial sense – or its very good relationship management – but by putting in place this new structure, we can apply those qualities at the same time as having the rigour, consistency and standardisation we need to operate safely and responsibly everywhere.

The consequences of the Gulf of Mexico incident are far-reaching, and, says Dudley, "they leave BP a different company from the one we were a year ago." This is certainly true in the financial sense, with the company posting its first full-year loss in 18 years. The ongoing costs of the oil

spill had already been anticipated back in summer 2010, with the temporary suspension of the dividend and the announcement that BP would divest \$30 billion in assets by the end of 2011.

It is also true that the shape of BP will never quite be the same again. In the drive to create shareholder value in a safe and sustainable way, Dudley and his team are 'resetting' the portfolio to create a company that plays to its core strengths and moves with the currents in the global energy market. One such trend is the expectation that energy demand in the mature industrialised countries will remain fairly flat, while soaring in Asia and other emerging economies. Consequently, as well as divesting non-strategic assets in the upstream, BP has announced it will halve its US refining capacity, with the sale of Texas City and Carson refineries. Dudley pays tribute to the work done in these operations while acknowledging that they now offer more value to others than to BP.

The rationale behind these announcements is to retain the positions that offer the greatest competitive advantage, including a series of new upstream projects, and create a portfolio that has the potential for stronger growth from a smaller base.

"It's about ongoing value as much as current production volumes. It's about quality over quantity and it's about choices for the future, rather than the legacy of the past," says Dudley. "We're focusing not so much on short-term outputs – today's barrels and dollars – but on inputs that drive long-term value – safety, compliance, relationships, capability and technology. The BP of the future will be smaller, but it will also be safer, more agile and stronger. It will be a company that is committed to rebuilding value and trust for the long term, by doing the right things and doing them well."

The most tangible sign of progress for shareholders is the reinstatement of a



Team player: Dudley meets employees who have made it through to the finals of BP's internal recognition programme, October 2010.

"The BP of the future will be smaller, but it will also be safer, more agile and stronger. It will be a company that is committed to rebuilding value and trust for the long term, by doing the right things and doing them well."

All this seems to point to the fact that the world is still willing to do business with BP. "Over the past few months, I've travelled to China, Brazil, Russia, Trinidad, India and Azerbaijan, and the message I'm getting is that the governments in these countries have been watching the response in the Gulf of Mexico very carefully," says Dudley. "They believe we responded in the way they hoped any company would respond in their own country. They tell me that they would like us involved in their country because we know more about this than anyone. Indeed, we're sharing what we've learned very widely as people ask us to do so."

Much will depend on the company's future relationships with the US; relationships that are the focus of a lot of work. "BP continues to do the right thing in the US," Dudley says. "We're working with the regulators in Washington, meeting our obligations on the Gulf Coast, we're funding various programmes. So, I feel pretty good about those relationships at the moment." Dudley continues to make frequent trips to the region to meet with local people affected by the spill, with officials and BP employees.

"I'm very proud of the dedication of people across BP," Dudley says, believing the staff's continuing commitment was reflected in strong third- and fourth-quarter results, despite the year's overall loss. "There's no doubt 2010 was a very difficult year for BP, yet we delivered strong underlying performance, once you strip out the costs associated with the Gulf incident. To a degree, this reflects higher oil prices, but that's not the only factor. It also

shows how BP's people all over the world delivered strong performance in challenging circumstances and it shows their dedication to doing the right thing." He includes the several-hundred-strong group of retirees who came back to help the company during the crisis.

Ultimately, as a result of the changes he is implementing, Dudley believes people will look at BP in a very different light. "I'd like people to say BP really 'gets it', that it appears to be wanting to help lead the frontiers of risk management, as well as operating safely on the frontiers; that it's got a new way of working with contractors and suppliers; and that it's lived up to its commitments in the Gulf. That's a tough agenda, but only then do I think we can get back on the right path.

"This year is going to be one of consolidation, as we focus on completing our divestment programme, continue to meet our obligations in the US and bring new rigour to the way we manage risk," he continues. "None of those things is easy, so it's important to have leaders who really listen to their people.

"I don't assume that I always know the answer to something. I can draw on years of experience and intuition, but we need to be constantly enquiring and learning and listening to everyone – including the quietest voice in the room. We have to keep thinking the unthinkable – be it operational, financial or compliance risk. Nobody has all the answers. Only by working together and making the most of everyone's capabilities will we begin to move the company forward." ■

dividend and this, says Dudley, reflects the company's stronger underlying performance. However, it has been lowered since the last payment in recognition that BP still needs to continue to meet its obligations in the Gulf of Mexico and maintain financial flexibility.

One thing that has not changed, as far as Dudley is concerned, is BP's distinctive ability to look for oil, and, at a presentation to investors in February, he announced that the company would increase its investment in exploration. Indeed, even before February, BP announced a swathe of new access deals covering the UK, Australia, Azerbaijan, Egypt and China. Then later in February, it announced a major partnership with Reliance Industries Limited of India, that will see BP taking a 30% stake in 270,000 square kilometres (104,000 square miles) of offshore exploration and production contracts as well as creating a joint venture to market natural gas in the country.

Source: bp.com and restorethegulf.gov

RESPONSE TO A CRISIS

20 APRIL-01 OCTOBER

20 April

An explosion and fire occur on the Deepwater Horizon (DWH), Transocean's semi-submersible rig in the Gulf of Mexico. Eleven of the 126-member crew are missing. Transocean had been drilling an exploration well for BP.



24 April

Oil spill response effort gets under way, including skimming of oily water from the surface and deployment of protective boom.



APRIL

21 April

The DWH continues to burn. Eleven people remain missing. Search and rescue effort is coordinated between Transocean's emergency and family response team, BP and the US Coast Guard.

22 April

The DWH sinks. BP activates an extensive oil spill response that includes a flotilla of response vessels, protective boom and dispersant. Plans for drilling a relief well are initiated.

23 April

The search for the missing 11 crew members is suspended, after covering 12,950 square kilometres (5,000 square miles).

25 April

Efforts begin to activate the blowout preventer (BOP), using submersible remotely operated vehicles (ROVs). Ultimately, these prove unsuccessful and the BOP does not seal the well.

Field operations are co-ordinated from Houma, Louisiana, with almost 500 people deployed.

27 April

US Secretary of Homeland Security Janet Napolitano and Secretary of the Interior Ken Salazar set out details of a joint investigation of the incident.

28 April

First controlled burn is carried out.

On 20 April 2010, tragedy struck in the Gulf of Mexico. An explosion and fire on the Deepwater Horizon rig led to the deaths of 11 men and a major oil spill. While the leaking well was finally capped on 15 July 2010, BP continues to play an active role in the affected communities, with offices in the four Gulf states of Louisiana, Alabama, Mississippi and Florida. The company is paying the legitimate claims of individuals, businesses and government entities impacted by the accident, is working with federal and state trustees to assess the environmental impacts of the spill and supporting efforts to promote tourism. Here, *BP Magazine* charts some of the key dates of an unprecedented response to an unprecedented event.

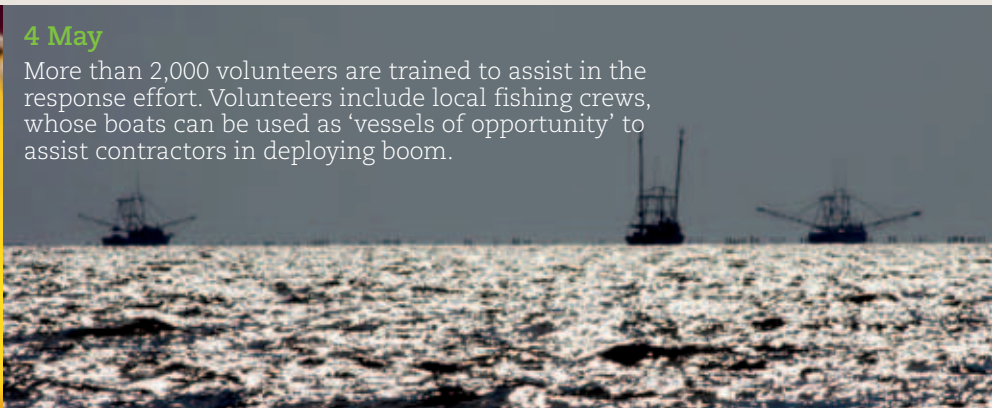


30 April

The first oiled bird – a northern gannet – is captured and treated by TriState Bird Rescue and Research, in Venice, Louisiana, contracted by BP to rehabilitate wildlife.

4 May

More than 2,000 volunteers are trained to assist in the response effort. Volunteers include local fishing crews, whose boats can be used as 'vessels of opportunity' to assist contractors in deploying boom.



4 May

BP begins paying claims to those with losses caused by the spill.



MAY

30 April

Staging posts for boom and other equipment are set up in Venice, Louisiana; Pascagoula and Biloxi, Mississippi; Mobile, Alabama; and Pensacola, Florida.

1 May

Former head of the US Coast Guard Admiral Thad Allen is designated National Incident Commander for the US Government's coordinated response.

2 May

Drilling begins on a relief well designed to intercept and permanently seal the leaking oil well. The Development Driller III (DDIII) is drilling the well.

5 May

BP makes \$25 million block grants to each of the states of Louisiana, Alabama, Mississippi and Florida, to help them implement oil spill contingency plans.

9 May

Efforts to place a containment dome over the main leak point are suspended, after a build-up of hydrates prevents successful placement.

16 May

The Development Driller II (DDII) begins drilling a second, back-up relief well.



17 May

BP announces grants to help Gulf Coast states promote tourism – \$25 million to Florida and \$15 million each to Alabama, Mississippi and Louisiana.



26 May

'Top kill' operations begin in an effort to stop the flow of oil by injecting heavy drilling fluids into the well.



24 May

BP commits \$500 million to the Gulf of Mexico Research Initiative (GRI) – a 10-year open research programme to study the impact of the spill and response on the environment.

29 May

Plans begin for the deployment of a containment cap – known as the lower marine riser package (LMRP) – from the *Discoverer Enterprise* vessel, from which oil and gas can be piped to the surface.



MAY

18 May

A riser insertion tube tool (RITT) begins collecting an estimated 2,000 barrels of oil a day. Gas is flared onboard the *Discoverer Enterprise*.

25 May

BP's internal investigation team says it is focusing on seven mechanisms, including the well casing, pressures tests, procedures to detect hydrocarbons in the well, and the failed BOP.

29 May

BP announces the suspension of the top kill procedure. It has not been able to overcome the flow of oil, despite 30,000 barrels of heavy mud being pumped into the well.

JUNE

4 June

BP announces second advance payments of claims for those with losses caused by the spill.

The *Discoverer Enterprise* begins receiving oil and gas following the successful installation of the LMRP cap.

8 June

The LMRP cap is now collecting 15,000 barrels of oil a day.

10 June

BP provides additional \$25 million grants to Florida, Alabama and Mississippi.



16 June

A second containment system is operational, carrying oil and gas from the MC252 well to the Helix Q4000 vessel. The gas is flared on board.



22 June

Net revenue from the sale of recovered oil is to be donated to the National Fish and Wildlife Foundation. \$5 million is donated immediately.



6 July

Vessels of Opportunity programme enhanced to make better use of local commercial and charter fishing vessels and crews.

JULY

15 June

Fast-track funding of \$25 million is announced as part of the environmental GRI – to support studies at Louisiana State University, Florida Institute of Oceanography, and the Northern Gulf Institute consortium.

16 June

Following a meeting with President Obama, BP agrees to create a \$20 billion trust fund to meet obligations arising from the spill. It is also announced that individual and business claims will be administered by Ken Feinberg, known for his handling of prior claims facilities.

BP suspends dividend payments for the rest of 2010.

17 June

BP chief executive Tony Hayward testifies to US Congress.

19 June

Claims payments top the \$100 million mark, with 31,000 cheques issued in seven weeks.

23 June

BP sets out the role of the Gulf Coast Restoration Organization, including clean-up and remediation, liaising with public officials, communicating with the public and implementing the compensation fund.

10 July

The LMRP cap is removed in preparation for its replacement with a sealing cap, capable of increasing containment capacity or potentially shutting in the well.



3 August

BP begins injectivity testing in advance of static kill operations.



5 August

Claims payments top \$300 million. More than 40,000 individuals and businesses have been affected by the spill.



15 July

Oil ceases to flow into the Gulf of Mexico, as a well integrity test begins and the 'three ram capping stack' is closed, shutting in the well.

JULY

12 July

Sealing cap is put in place with the installation of the three ram capping stack.

16 July

Claims payments top \$200 million. To date, 32,000 claimants have received one or more payments.

27 July

BP announces that Bob Dudley will take over from Tony Hayward as BP's group chief executive from 1 October.

BP also announces it has taken a \$32.2 billion pre-tax charge for the spill, including the \$20 billion claims fund, and will sell up to \$30 billion worth of assets as part of prudent approach to managing its finances.

AUGUST

4 August

The National Oceanic and Atmospheric Administration and Department of the Interior announce that the vast majority of the oil from the spill has either evaporated or been burned, skimmed, recovered from the wellhead or dispersed.

Tests show the MC252 well appears to have reached a static condition after eight hours of pumping mud in the 'static kill' operation.

5 August

BP carries out cementing operations to seal the well.

16 August

BP announces \$52 million of funding for support and outreach on behavioural health across the Gulf Coast region.

18 August

BP flushes drilling mud and hydrocarbons from the MC252 well in advance of a pressure test to ensure the well is secure.

SEPTEMBER

21 August

Forty-eight-hour ambient pressure test is deemed successful.

23 August

Thad Allen announces that 90% of the hard boom deployed has been removed.

Claims payments reach almost \$400 million. The Gulf Coast Claims Facility (GCCF), headed by Ken Feinberg, begins handling individual and business claims.

2 September

The capping stack on top of the DWH BOP is removed by the drillship *Discoverer Enterprise*.

3 September

The DWH BOP is successfully removed from the well by the *Helix Q4000*. The DDII installs a new BOP.



26 August

After almost two months of work to translocate sea turtle nests on Florida's Northwest coast and Alabama's coast, the operation is suspended as surveys find healthy, uniled Sargassum available for hatchlings entering the Gulf. This type of seaweed is the main habitat for hatchlings.

OCTOBER

7 September

BP announces it is providing \$10 million to the National Institutes of Health (NIH) under the GRI, to support a study of potential public health issues relating to the oil spill and other spill-related health research.

8 September

An investigation led by Mark Bly, BP's head of Safety and Operations, concludes that no single factor caused the MC252 tragedy, but that a sequence of failures involving a number of different parties led to the explosion and fire. The report was conducted independently by a team of more than 50 technical and other specialists, drawn from inside BP and externally.

16 September

Relief well drilled by the DDIII intercepts the annulus of the MC252 well. Total measured depth of the annulus intercept point is 5,479 metres (17,977 feet).

19 September

Admiral Thad Allen confirms that well kill operations on the MC252 well in the Gulf of Mexico are complete, with both the casing and annulus of the well sealed by cement.

29 September

BP announces it will create a new safety division with sweeping powers to oversee and audit the company's operations around the world. BP also reveals plans to re-structure its Exploration & Production segment from a single business into three divisions – Exploration, Developments and Production.

1 October

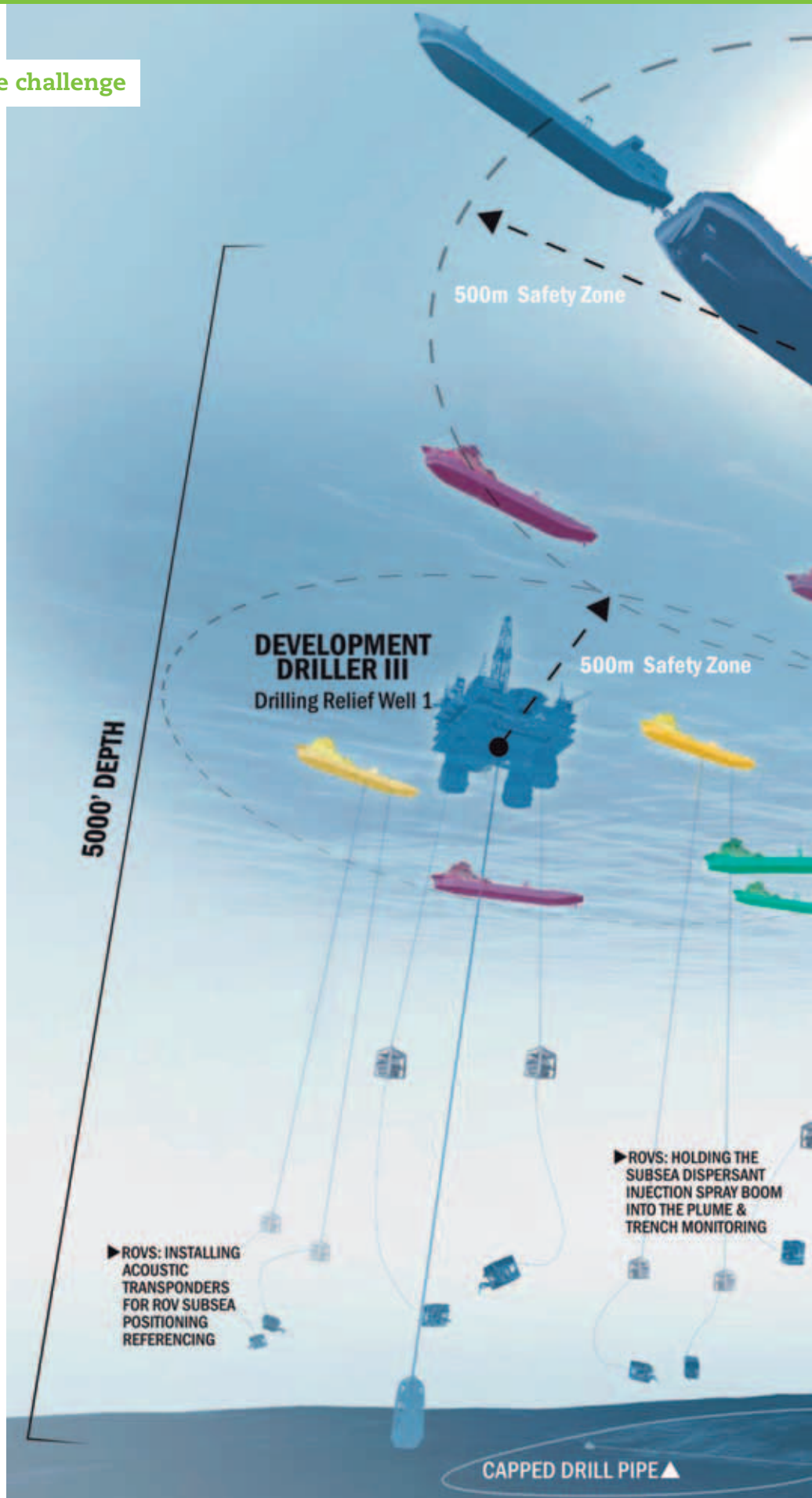
Bob Dudley becomes chief executive officer of BP.

A COMPLEX OPERATION

Throughout the response, BP kept the public informed of its operations via a series of illustrations. The one opposite is perhaps the most recognisable, due to its fish's eye view of subsurface activities. With the large vessels sometimes having to move within 12 metres (40 feet) of each other, this diagram shows the complexity of the operation. It also reveals the level of activity on the seafloor and the need for care when moving any vessel, no matter its size, since many were supporting tethered remotely operated vehicles or were connected to the seafloor via pipes. For this reason, the dedicated simultaneous operations (SimOps) team was crucial in keeping the subsurface response running.



Aerial view: the MC252 well site on 10 July 2010. The *Discoverer Enterprise* sits at the centre, with the *Discoverer Inspiration* arriving to the right. On the left sit the DDII and DDIII and just in front of the *Enterprise* sits the *Helix Q4000*.





SIMULTANEOUS OPERATIONS OVERVIEW

**DISCOVERER
ENTERPRISE**
Containment

500m Safety Zone

Q4000
Top Kill Vessel

**DEVELOPMENT
DRILLER II**
Drilling Relief Well 2

TYPES OF VESSELS:



MAJOR VESSELS



CONSTRUCTION VESSELS



SUPPORT BOATS



SKIMMING, BOOMING
& DISPERSANT VESSELS

► PREPARING FOR
TOP KILL OPERATION

► ROVS: PRESSURE
MEASUREMENT &
VISUAL MONITORING
OF LEAK PLUME

► ROVS: AT PLUME
MONITORING & ON
RIT INTERFACE PANEL

MANIFOLD ▲

▲ WET PARKED TOP HAT

◀ RISER INSERTION TOOL

THE ONGOING RESPONSE

A massive response was mounted along the Gulf Coast in the hours and days following the oil spill, and while the well is now capped, BP remains committed to meeting its obligations in the region.



COMMUNITY COMMITMENT

Ayana McIntosh-Lee is one of the BP employees who have moved to the Gulf Coast to provide assurance to local and state stakeholders that the company will live up to its obligations. She talks to BP Magazine about a typical day and why it's important BP maintains this permanent presence.

What does your role involve?

As the general manager for external relations, my role involves leading and managing all aspects of the BP Gulf Coast Restoration Organization's (GCRO) external relationships in Alabama at the local and state level, including community, government and media relations. Along with a dedicated team of professionals, who

work tirelessly to help BP live up to its commitments, I see myself as a liaison between the company and key stakeholders. It's my job to manage risk, to identify opportunities and to ensure the lines of communication remain open.

Why is it important that BP maintains a permanent presence in your region?

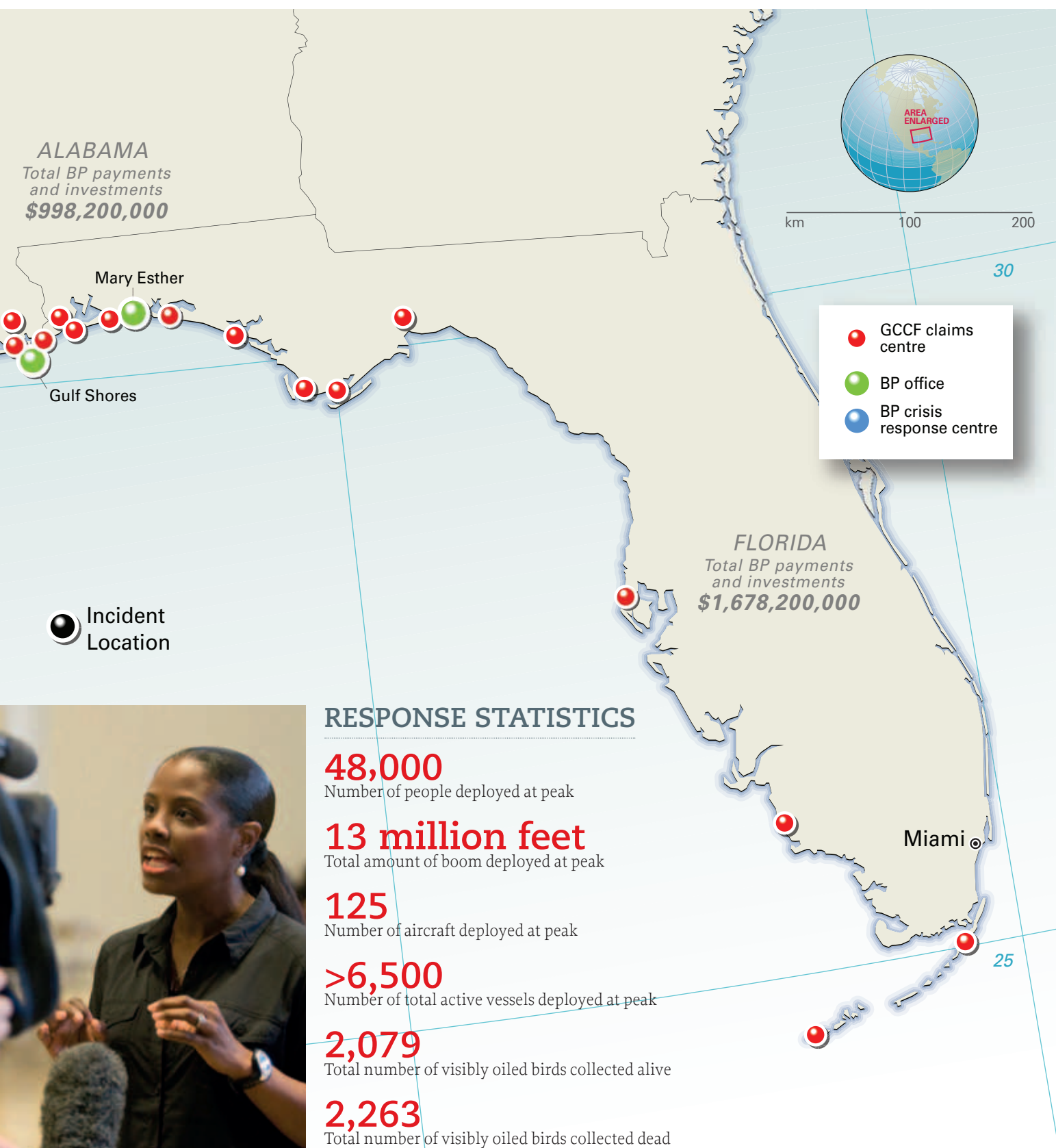
There are some in the community who believe that BP will pack up and leave any day. However, in December, we opened the BP GCRO's Alabama office in Gulf Shores, which currently has more than 100 employees and contractors overseeing beach clean-up operations and external relations activities. This accident was a reminder that the people along the Gulf Coast are our neighbours. They are the fence line community to our Gulf of Mexico operations, and it's important that we build and maintain a long-term, mutually-beneficial relationship with them, just as we

do around the world. In Alabama, maintaining a strong local presence and living up to our commitments is part of the journey toward recovery.

Why did you agree to be that representative?

I visited coastal Alabama years ago and was struck by its beauty and home-town feel. During the response, I was deployed to Mobile and was saddened to return under the circumstances. Despite the challenges presented by the spill, I found the people welcoming and appreciative of any assistance that could be provided. It didn't take long to realise that this was more than a job. It was an opportunity to make a difference for BP and the impacted community. Fortunately, I'm surrounded by a talented, committed team that is determined to make a positive difference. They understand, as I do, that our neighbours are counting on us.

As of 17 March 2011, the state payments include payments to government entities for contingency planning, response and removal advances and other damages; claims payments to individuals and businesses by BP (through 23 August 2010) and by the Gulf Coast Claims Facility (since 23 August); payments to Vessels of Opportunity participants, tourism, Natural Resource Damage Assessments, research, behavioural health, and community contributions.



Sources: BP Annual Report; Deepwater Horizon Response Consolidated Fish and Wildlife Collection, 25 January 2011.

AN INTERVIEW WITH BP'S
HEAD OF SAFETY & OPERATIONAL RISK

MARK BLY

Six months since the release of the Bly Report, BP's internal investigation into the causes of the Deepwater Horizon explosion and subsequent oil spill, its author, Mark Bly talks to *BP Magazine* about the company's new safety and operational risk division and what lessons the company can learn from other industries.





“Our deployed S&OR teams provide an extra set of eyes and ears with respect to safety and operational risk on the frontline. They also provide tailored coaching and support, coordinating expert advice and input from the central teams as appropriate.”

What is the role of the new Safety and Operational Risk (S&OR) organisation?

Our role is to drive safe, compliant and reliable operations across BP. We do this in four ways. First, we set and update the requirements that are used across the business for safety and operational risk management. Second, we provide expert scrutiny of safety and risk, independent of line managers, advising, examining and auditing what our operations do. Third, we provide deep technical expertise to the operations. Fourth, we have the ability to intervene if needed to cause corrective action. We have a central team of specialists, as well as more than 500 people who are deployed in BP's businesses, providing guidance and scrutiny, and examining how risks are being assessed on rigs, at refineries and across BP's operations.

What is the difference between the central team and the deployed staff?

The central team is the source of BP's subject matter expertise. They are the custodians of group requirements, as well as audit and capability programmes. They include many of BP's top engineers and safety specialists, several of whom have experience of other industries where major hazards have to be managed.

Our deployed S&OR teams work with the line businesses – ranging from upstream oil and gas development and production to refineries, petrochemical plants and retail networks. They help the businesses apply BP's standards in their own situations and they report back to the group on how operational risks are being managed business by business. In other words, they provide an extra set of eyes and ears with respect to safety and operational

risk on the frontline. They also provide tailored coaching and support, coordinating expert advice and input from the central teams as appropriate.

How does S&OR relate to the line management in each operation?

A key part of our role is to provide an expert view on risks and how they are managed that is independent of the line management. But I must emphasise that this does not mean that business leaders hand over safety to us. It is absolutely clear that the people who run operations – the line managers – are accountable for managing safety and compliance in those operations. They have the responsibility to manage risks and bring together people with the right skills and competencies. But they need advice and scrutiny from people who are specialists in safety and risk. Our teams will have the authority we need to intervene if that becomes necessary, but our aim is to have all risks managed in such a way that we don't have to use that authority.

BP had a safety organisation prior to the Gulf of Mexico oil spill, so what is new about this?

Several things. First, we have more authority than before. S&OR has a seat at the top management table, and we have also put in place specific decision rights, veto rights and intervention rights. Second, the 500-plus S&OR specialists who are deployed locally to work alongside our businesses worldwide report to my organisation through the deployed S&OR teams. They are independent of line management and this creates stronger checks and balances. Third, S&OR will be



much more active in working with the operations, to understand the risks and how they are being managed.

Can you give any examples of where S&OR is already in action?

The greatest measure of the S&OR organisation's success is when we work collaboratively with the line to drive safety and risk reduction. There are several cases of this. For example, shutting down a production platform to repair fire water pumps, instead of continuing to let them run while maintenance work was carried out. It is a costly thing to do, but it is the right thing to do. There are already a number of recent cases where drilling rigs have either been turned away or we are negotiating modifications before we are prepared to use them.



What lessons can BP learn from other industries?

We have to realise that other sectors had other experiences and have developed safety and operational risk management in different ways. Good examples are the civil nuclear industry, the nuclear navy and the aerospace industry. We can learn from these perspectives. Those who have excelled have demonstrated a systematic approach, an ability to learn and that they honour their standards.

What sort of experience do members of your leadership team have?

We have some very experienced people in S&OR, with a wide variety of backgrounds, including nuclear, petrochemicals and the military. For example, John Baxter, our group head of engineering and process

safety, is a former director of the UK's Dounreay nuclear power plant and previously served as a naval engineer on a Polaris submarine. John will take on responsibility for BP's standards being clear, coherent and simple to use. He acts as head of profession for all engineers across the BP Group. John Sieg, BP's group head of operations and the Operating Management System, has 37 years of operations leadership in DuPont and BP. We also have people, such as Robert Riley and Jeanne Johns, who have been named into senior S&OR positions because of their track records in safety within BP. Under Robert's leadership, BP Trinidad and Tobago transformed its safety performance from being bottom of the league in the upstream business to top of the league in just four years, a significant part of which was

achieved through strong engagement with suppliers and contractors to achieve alignment between operating standards and safety management procedures. As a member of the board of SECCO – our petrochemicals joint venture in China (see page 44) – Jeanne oversaw a focus on safety that led to a remarkable 88.6 million hours worked without a single fatality or major process safety incident.

It's been six months since BP's internal investigation was released – what progress has been made in the upstream specifically to respond to the incident and implement the recommendations?

The first thing that BP did was to accept all 26 recommendations. Implementing them requires detailed work. Members of the »

investigation team have provided input to the project team that is working on implementation of the recommendations. And I see solid progress in many other ways. For example, a centralised wells organisation has been created to manage drilling activities to consistent standards across the globe. Independent third-party certification of our drilling contractors' subsea blowout preventers has been completed to check the testing and maintenance of their emergency systems. The auditing of the rigs that drill our wells has moved across into my S&OR audit team. Work is also underway to enhance the standards for cementing and well integrity testing, including a new approvals process and stringent contract laboratory quality audits. In the North Sea, the team is building a next-generation capping stack, based on what we learned from the one

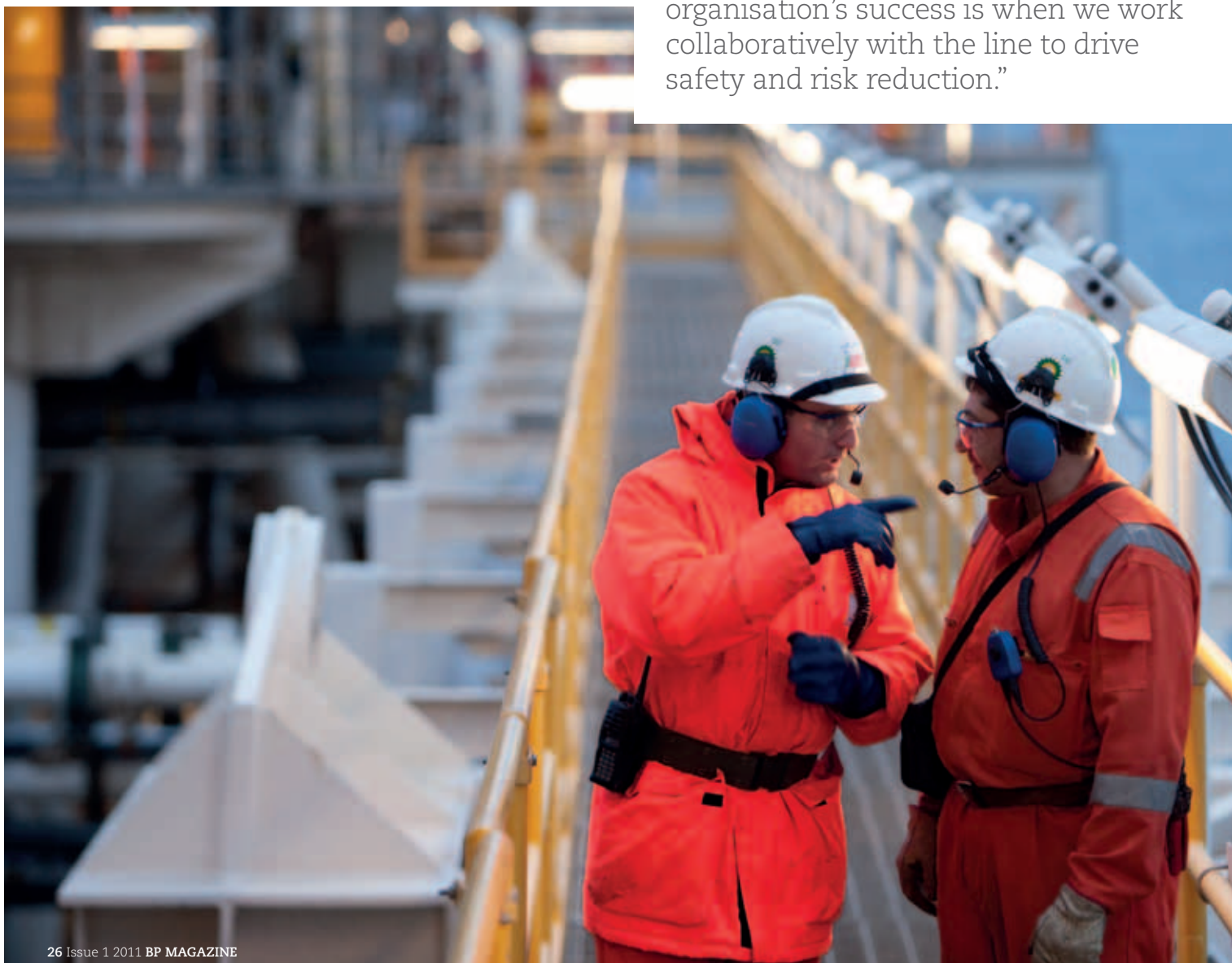
used to shut in the Macondo well. We also continue to enhance the 'ranging' technology that saved time during the relief well operation by enabling us to use sensors to detect the location of the target well without removing the drill bit being used to drill the relief well.

BP has changed the way it rewards its employees and has asked all staff to include safety-specific priorities when they set their priorities for the year ahead. Why is that important?

We want to reward the right things, and top of the list is safety and risk management. So, in our performance management system for 2011, we've asked everyone to say how they will contribute to safety, risk

management, compliance, teamwork, capability-building and long-term goals – as well as this year's goals. We're also making it a priority for managers to be good listeners – and one reason for this is that you may not realise you have a problem unless you listen to everyone. The other side of that coin is that we are reinforcing the encouragement for everyone to speak up more if they have a concern. Everyone must feel able to raise their hand. We're asking people to state explicitly how they will demonstrate these qualities in their work, and rewarding them according to how well they do so. This very directly incentivises people to promote safety, to act as one team and to work to build sustainable long-term value. ■

“The greatest measure of the S&OR organisation's success is when we work collaboratively with the line to drive safety and risk reduction.”





LEADING BY EXAMPLE

Randy Fletcher & Brad Byczynski

Randy Fletcher and Brad Byczynski have five days to make a room full of experienced BP emergency responders (fire fighters) think of leadership in a new way. That means five days to challenge the participants' existing notions of what leadership is and help them build on their existing skills. In their day jobs, Brad is discipline leader for crisis management at Naperville, Illinois, while Randy is HSSE manager at Toledo refinery's reformer project in Ohio. The goal of the bi-annual, voluntary course is to plant the idea that managing and leading people require very different skills. "In a crisis, you need a leader," says Randy. "We try to ensure they're out there in BP." Brad: "First, we have to earn their trust and confidence in our experience-based knowledge." Randy: "Then, we have to guide them in rebuilding a stronger vision of what makes a leader." Brad: "Plus, help them become a leader that people will follow in a crisis." Randy: "It's a pretty intense five days. Ultimately, it's up to the individual to decide to re-create themselves into a valuable leader." ■

→upstream

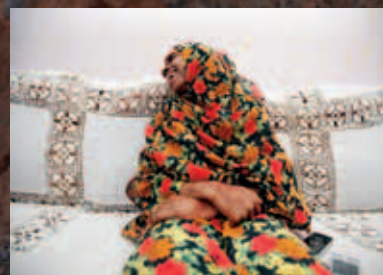
Gas development> **Oman**



Team spirit workers (main image) lay power cable to the new gas facility to connect it to the existing power supply. The work has to be carried out in this way due to the soft sand terrain. Below, an Omani lady shows off her hennaed hands. This traditional art involves painting intricate patterns; workers out in the field; and 60% of BP Oman's staff are now Omani nationals.

OMAN LAYING THE GROUNDWORK

Four years after signing an exploration and production sharing agreement with Oman, gas has begun to flow through a BP test facility. The achievement marks a major milestone in what could become a flagship project for BP and a chance for Oman to underpin its energy reserves for years to come.





Work and play: personal safety is crucial in this inhospitable environment, so a reflective jacket and parasol are important tools for the man charged with alerting drivers to upcoming roadworks. Below, street kids practise their cricket strokes near the Muttrah souk in Muscat.



When Oman's minister for oil and gas needs to put his country's demand for natural resources into perspective, he chooses a striking image. "I tell people that we drink gas here and breathe it, too," says the man who is charged with ensuring that the oldest independent state in the Middle East has enough gas to keep the water desalination plants pumping and the air conditioners whirring.

The Sultanate only need look to its neighbours to witness what happens when there's even a temporary blip in the energy supply; in 2010, extreme summer temperatures prompted spikes in power demand that resulted in high-profile electricity outages across the Middle East, from Amman to Sharjah. It's not a scenario that Oman wishes to face as well.

But just maintaining the needs and comforts of today is not the only concern for the minister, Dr Mohammed bin Hamad Al Rumhy; Oman also has big plans for the future. In its latest five-year development plan, the Gulf state pledged to spend \$78 billion, through to 2015, with the majority to be invested in infrastructure, including roads, hospitals and education.

Not to say that this country on the southeastern corner of the Arabian peninsula has been left behind in terms of modernity; it has come a long way in the 40 years since Sultan Qaboos bin Said came to power. Omanis can now expect to live more than a quarter of a century longer than their predecessors in 1970, thanks to improved healthcare. The economy has also boomed, with gross domestic product growing from \$256 million in the 1970s, to an estimated \$62.25 billion in 2010, according to the International Monetary Fund.

Such prosperity is much in evidence on the ground, where, in a nod to the significance of both tradition and innovation, old and new sit comfortably together: abandoned forts and watchtowers overlook the sleek, multi-lane highways of the capital, Muscat. White-washed low-rise buildings, with their domes or arabesque windows, co-exist with grand, beachside hotel complexes, while the shaded alleys of the Muttrah souk, crammed with everything from bright white dishdashas to framed khanjars, provide an alternative to the gleaming shopping malls that house Gap and Subway.

To continue this economic growth, though, Oman needs to be self-sufficient in its energy supply. With declining oil production – and reserves that are not comparable to its Gulf neighbours – accessing the proven natural gas deposits buried deep beneath the desert has become a priority.

Recovering some of those resources is now also becoming a reality, as BP Oman's six-year project to appraise and develop two gas fields – Khazzan and Makarem – in Block 61 has reached a significant milestone. Four years after the company signed an exploration and production sharing agreement with the government, gas is now flowing into a test facility that records vital data from the reservoirs.

"This really is a challenging project, but we're finding that by applying the right technology, it is possible to open up these reserves," says Jonathan Evans, vice president for BP Oman.

»





Field operations: more than 500 people are at work out in the desert, helping to construct new gas facilities. Opposite, engineers work at the fracturing site.

Discovered in the late 1990s, Khazzan and Makarem proved hard to develop at the time, as they contain what is known as ‘tight’ gas. This is held in reservoirs where the permeability of the rocks is so low that hydrocarbons cannot easily flow into production wells without help.

In its North American gas business, BP has proven adept at accessing such ‘tight’ reservoirs, and it is this expertise that has been brought to bear in Oman. Techniques such as hydraulic fracturing stimulation mean that BP is achieving more than double previous flow rates.

“We’ve seen encouraging results so far from some of the appraisal wells,” Evans says, “and now we’ve brought the extended well testing [EWT] facility online, gas is flowing into the compressor station. This phase is about acquiring production data for up to nine months, to understand how the wells decline, and what that means in terms of how much gas could be delivered from the entire field.”

The newly-constructed EWT site was inaugurated by the UK Prime Minister David Cameron and Minister Al Rumhy (see page 34). This year, five appraisal wells will be tied into the site and the

monitoring of flow rates, reservoir decline and gas composition will paint the big picture of the fields’ potential. Rather than flaring the tested gas, once compressed, it runs through export lines to a government-owned processing facility, 33 kilometres (20 miles) away, to prepare it for the national market.

The introduction of hydrocarbons into a new facility has its risks, meaning the BP Oman team has focused on rigorous start-up procedures. Gary Campbell, BP health and safety manager for the Middle East and Pakistan, says, “Once the system is operating, there are high pressures, high temperatures and electricity flowing through, so our main concern is implementing the right processes so the plant can work as it is designed to, safely and efficiently.

“We take a multi-disciplinary approach to start up the equipment, what we call a ‘Go-No Go’ process. That’s essentially a checklist for all areas of the operation – from testing the emergency response plan, to ensuring the right people have completed the appropriate training – so that everyone is satisfied we are ready to go.”

More than 500 people are at work in the field operations, and improving safety

standards among local contractor companies became a priority soon after the project began. To protect the workforce from the hazards associated with seismic surveys, drilling operations or pipeline construction, BP increased its number of HSE advisors in the field to oversee safe practices, and determine that jobs were carried out with properly certified equipment. “It’s been a learning curve for some contractors to understand that we’re willing to stop the job if they’re not doing it safely,” Campbell says.

Personal safety also requires attention in this inhospitable and isolated desert setting. Block 61 is located around 400 kilometres (250 miles) southwest of Muscat, but the five-hour drive – prolonged by the need to negotiate the graded roads on the latter part of the journey at a careful speed – may as well deposit you on a different planet.

It’s a place where miles of dusty terrain, combined with the sun’s bleached haze, induce an hypnotic effect and where protection from the elements is always a concern. It seems reasonable then to spot a man in a reflective jacket, indicating the start of road works, with a red flag in one hand and a garden parasol in the other. Or to witness a group of drivers taking a break on a rug laid out beneath the enormous undercarriage of their transporter trucks, to make the most of the only shade. Conditions can change rapidly, too; late afternoon sandstorms suddenly whip up to create near-zero visibility, with gusting winds that feel as hot as a hairdryer.

Keeping people safe here means taking into account all the environmental factors – while workers are accustomed to facing summer temperatures of up to 50°C (120°F), food and water quality needs to be maintained in such circumstances to prevent contamination.

Oman in numbers

| | |
|---|----------------------------|
| Land area | 309,500 km sq |
| Population total (2009) | 2,845,415 |
| Adult literacy rate | 87 % (of people 15 years+) |
| Urban population (2005) | 72 % |
| Travel & tourism contribution to GDP (2010) | 7.6 % or \$4,359 million |

Source: World Bank, World Travel & Tourism Council

Then and now

| | 1970 | 2008 |
|--------------------------|---------------|-----------------|
| Life expectancy at birth | 49.4 years | 75.9 years |
| Hospitals | 2 | 58 |
| Schools | 3 | 1,283 |
| Telephone subscribers | 557 | 3,493,527 |
| Gross domestic product | \$256 million | \$59.94 billion |

Source: National Economy Ministry, International Monetary Fund

Continued on page 36 »



> TECHNOLOGY

GETTING GAS OUT OF A TIGHT SPOT

In Block 61, gas lies buried under rock so hard that drilling, in places, can only progress at around half a metre every hour. Four stacked reservoirs are found at 5-5.5 kilometres (3.1 and 3.4 miles) deep, where temperatures range from 140-160°C (280-320°F).

The first step in appraising the reservoirs was to reprocess existing seismic data, as well as conduct a new survey in 2008 covering 2,800 square kilometres (1,080 square miles). This subsurface data helps to pinpoint natural fractures in the rock that can indicate the best locations to drill appraisal wells.

Seven of a planned nine wells are now complete, including one horizontal well that targeted the third reservoir down, the Amin. What was anticipated to be a difficult exercise, given the hardness of the rock at a depth of 5,200 metres (17,000 feet),

produced some surprises for BP's drilling team.

"We were able to drill the horizontal section both faster and farther than we had originally anticipated," says John O'Neill, BP's vice president for drilling and completions for the Middle East. "We had planned for 500 metres [1,640 feet], but were able to progress out to 750 metres [2,460 feet], which was very encouraging. We are now planning to extend out to 1,000 metres [3,280 feet] on the next horizontal, and possibly further test our capacity to do so for future field development."

That achievement is attributed to two factors. Firstly, a thorough understanding of the subsurface environment allows the drillers to direct the drilling path along the axis of stress in the rocks. Selecting the most appropriate down-hole equipment was also important;

the drill bit and turbine assembly that power through the rock were carefully chosen, along with the drilling fluid that maintains good hydraulics in the borehole, important for cleaning out the drilled hole and avoiding any hole collapse and allowing continued drilling.

Once complete, all the wells need to be stimulated for gas to flow. Hydraulic fracturing operations – or 'fracking' – in the Khazzan/Makarem vertical wells have achieved significant results so far. This technique sees fluids and gels pumped into the well, under pressure, and down into the reservoir to create cracks in the rocks to improve permeability. Materials known as proppants – man-made sand-like products with tremendous crush resistance – then hold these cracks open. The gas then flows through the fissures.

In 2010, BP completed the largest-ever gel frac operation in Oman, pumping 1 million pounds of proppant into the Khazzan-6 well. BP's bespoke, multi-disciplinary approach to stimulating each well has made all the difference, according to Martin Rylance, senior petroleum engineer and advisor, who leads the fracking operations.

"Every well is different, and each is studied in detail to make sure we take the optimum approach. Our use of downhole gauges to read pressure and temperature, and bespoke chemistry to improve the flow-back and clean-up are also proving vital.

"At this stage, we want to learn the most we can from these wells, as they are like huge data surveillance engines that allow us to construct some more general approaches for full-field development."



> INTERVIEW

OMAN'S MINISTER FOR OIL AND GAS DR MOHAMMED BIN HAMAD AL RUMHY

His Excellency Dr Mohammed bin Hamad Al Rumhy has served as Oman's minister for oil and gas since 1997. Previously, he was assistant dean of Engineering at Sultan Qaboos University and worked for Petroleum Development Oman in the 1980s. He gained his PhD in petroleum engineering from the Royal School of Mines, Imperial College London.

Can you explain why Oman is so in need of gas?

Our power needs are ever-increasing; we have very ambitious programmes to build new towns and cities – like Duqm, which is an industrial city with a new airport and railway system. Anytime that you start thinking about development, you can smell gas – either it will fuel the growth or there is a lack of it. When we talk about tourism, we want to build hotels and resorts. Every time I hear these ambitious plans, I worry whether we have enough gas to provide the energy and water needed. That's why I say we drink gas here, because it powers our water desalination plants. So, for us, in the Ministry, we do not want to be the reason why we don't develop. BP is making headway in helping us solve this uncertainty.

Why does technology have such a big part to play in the Khazzan/Makarem project?

We know there is gas in these reservoirs, but we are not sure how we can succeed in releasing it and making it flow. Dealing with the subsurface, there are always unexpected factors beyond our control to consider. However, with the knowledge and technical know-how that exists in BP, the results from the wells and fracturing programme are very encouraging.

The Ministry of Oil & Gas is working closely with BP to develop these reservoirs. What do you believe are the foundations for a successful partnership?

Personally, I like to understand our partners and for them to understand us. We have a strong relationship with BP; if we get good results for the project, we will be pleased, but even if we don't, we want to keep that friendship and understanding. We think Oman has a lot to offer international companies and a good partnership is something we can create. Can we create a good reservoir? Probably not – that's down to Mother Nature – but in terms of things we can do, I think we are being successful.

Why is it important to build a local business with local staff?

The oil and gas industry in this country has a reputation for developing not only hydrocarbon resources but people, too. It's another extremely important part of our business: it is necessary to build good relationships, to develop people and to develop resources.

How can BP contribute to this ongoing skill development?

It is good for the country and for our partners, such as BP, to be successful in creating talent, particularly among locals. We now have sources where we can turn for the right people and then develop them through different initiatives, such as BP's Challenge programme, as well as our own.

People here have tended to associate themselves with one employer for a long time. But that is changing. We now see people in Muscat moving from one company to another, which is healthy. So, I'm sure that BP, as a good corporate citizen, will contribute to this progress and continue to nurture talent in Oman.

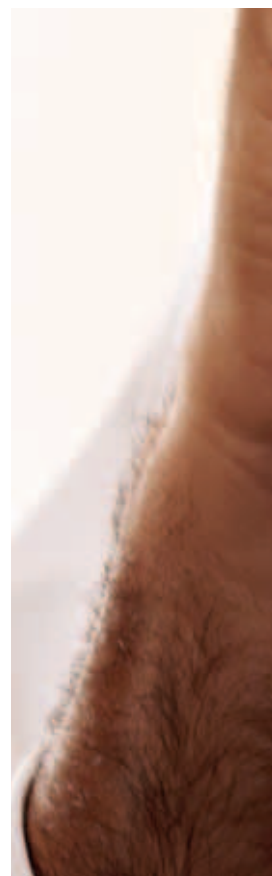
What are some of the ministry's expectations for this project in 2011?

With gas flowing into the receiving facility, this is a big milestone for the Khazzan/Makarem development. The question now is how long these wells can flow, what their rate is and all the technical aspects that come along with that. We will start to put all those pieces together, as it is extremely important for us to understand the behaviour of the reservoir.

If the project is deemed commercially viable, and full-field development goes ahead, what would it mean for Oman in terms of the provision of additional hydrocarbon resources?

It could be huge. If this project turns out as we hope, it will change the way we think of our energy needs in this country. I hope the opportunities we've had in recent years will come again; we missed some because of fear of gas availability. If we can produce certain volumes of gas for the next 20 or 50 years, we can do a lot. And that, for a country of our size, will change things – I'm looking forward to that change.

“We now see people in Muscat moving from one company to another, which is healthy. So, I'm sure that BP, as a good corporate citizen, will contribute to this progress and continue to nurture talent in Oman.”







Desert setting: Block 61 is located around 400 kilometres southwest of Muscat in the middle of the desert. Below, the souk at Muttrah is packed with traditional Omani goods.

Continued from page 32 »

Leaving the residential camps behind, long distances and variable road conditions make driving challenging. Vehicle inspections and the use of in-vehicle monitoring systems to track behind-the-wheel behaviour help to manage this risk.

Road safety initiatives have also put the issue in the spotlight. Kamil Al Lawati, HSE team leader, says, “We launched an educational campaign, together with major contractors in Block 61, where participants used simulators to experience a vehicle rollover and show why mobile phone use while driving is banned in BP. Around 800 people took part, and it was well-received. Our focus now is to make sure our driving policies are well-communicated and enforced through regular monitoring.”

Such lessons about the everyday challenges of operating in Oman are invaluable for BP in formulating plans for the future, when net production in the fully-developed field could yield up to 1 billion cubic feet of gas a day. If the project is given the green light in late 2012, gas could flow by 2016.

In the meantime, the company is making a substantial investment, not just in financial terms – although that will amount to \$750 million in this appraisal phase alone – but in terms of people and talent to run the business in the years ahead.

What started with a handful of expatriate staff based in a Muscat hotel room has already transformed into an organisation of around 100 people, 60% of whom are Omani nationals. That headcount will potentially increase to around 700 by 2016; it is a figure that represents a huge recruitment challenge, one that will need to be met predominantly by the local population.

With that in mind, BP is turning to the graduate market in Oman, to attract university-leavers into its Challenge training programme. “We hired our first four Omani Challengers in 2010, in drilling and engineering disciplines, and we’re

looking to significantly increase that recruitment this year by raising our profile locally,” says Evans, adding that technicians – who undertake four years training in their chosen field – will also be hired in 2011.

BP has already surpassed its initial government target for the proportion of national staff within the organisation. The undersecretary at the Ministry for Oil and Gas, Nasser bin Khamis Al Jashmi, who chairs the joint management committee of government and BP representatives that oversees the project’s activities, is pleased with the progress so far.

“For BP to reach a level of 50% Omanisation, as we call it, within four years, is a very good achievement,” he says. “The Ministry of Manpower has set a target for all oil and gas companies operating here to reach 90%; that is achievable, but we also have to allow new companies to meet that level within a realistic timeframe.

“It needs to be done in the proper way, without compromising the project’s objective, which is to produce gas in a safe and reliable manner. That requires skilled, well-trained people and we wish to see some of BP’s knowledge and experience transferred to locals.”

With a 50-year-old oil and gas industry, Oman has a highly-skilled workforce in the sector. BP is benefiting from this talent, as

local staff are progressing rapidly in the company. Khalid Al Kindi, who joined the procurement and supply chain management team with nine years’ experience, is one such example.

“I arrived with plenty of industry exposure, but I’ve learned so much in a short period; most importantly I think are the leadership skills and international perspective,” says Al Kindi, who advanced to become team leader, and has now taken on a managerial role in BP’s business in Jordan, in less than four years. For their part, national staff offer vital local context to the business, thanks to their deep understanding of the market in which the company operates.

Sharing expertise like this – between local and international colleagues, and on a broader scale between country and company – is a natural outcome of working together in partnership. Of course, the ultimate objective of this co-operation is to secure future gas production from the Khazzan and Makarem fields, a result that would bring mutual benefit.

For BP, it would mean establishing a flagship project in the Middle East, where the company took its first pioneering steps more than 100 years ago. While for Oman, developing these gas reserves at full scale would represent an opportunity to underpin its energy supply for years to come.





> EXHIBITION> BRITISH MUSEUM, LONDON

TREASURES OF OMAN

Silver jewellery and traditional costumes from Oman's diverse regions hold greater significance than mere aesthetic appeal, a new exhibition at London's British Museum reveals.

To mark the 40th anniversary of the accession of Sultan Qaboos bin Said, BP approached the museum with the idea to create the display, with support from Oman's Ministry of Tourism. The resulting exhibit features items of personal adornment that offer insight into the country's rich history.

From a set of 10 finger rings, worn together on special occasions, to ceremonial weaponry, the artefacts highlight the country's varied metalworking traditions from the past century. Some of these are increasingly rare; for example, the modern preference for gold has resulted in a steady decline in demand for the silversmith's skills.

The display includes intricately decorated bracelets, head ornaments and earrings. It is complemented by brightly-coloured, traditional outfits that have been donated by the Ministry of Tourism.

Among them is a woman's shimmering, indigo-dyed cotton *abuthail* (dress) from the southern Governorate of Dhofar. The use of indigo is another vanishing custom, particularly in urban centres, as the blue stains that transfer to the wearer's skin or hair are no longer considered desirable, despite the belief that indigo has talismanic properties.

Fahmida Suleman, the display's curator, says, "Omani jewellery and costume is not only ornamental, but is considered to have protective functions. We didn't want to show these objects simply as works of art, but bring them together to display them as a living culture with different purposes.

"Adornment acts as a means of identification, too; for example, a pair of chunky anklets would be worn by women from the north, or the interior. Oman is a mosaic of different ethnicities and cultures, each with their own tradition of costume and jewellery."

The exhibited objects also reflect Oman's historical trade links with the wider world. Necklaces dating from the 1950s are adorned with imported coins, such as Indian rupees or Austrian thalers, from previous centuries.

Scientists at the British Museum are using X-ray technology to analyse the metalwork to produce further research on the techniques of craftsmanship. ■

» *Adornment and identity: jewellery and costume from Oman* is on display at the British Museum until 11 September.



On the level

While vertical wells remain at the heart of the oil and gas business, increasingly, the industry is turning to horizontal drilling in order to extract more unconventional sources of hydrocarbons in a more environmentally sensitive manner.

Think drilling for oil and gas, and the first image that comes to mind is usually one of carving out a long, straight vertical section through the Earth's surface to reach the fossil fuels that lie buried deep below. Such conventional, upright wells are obviously a mainstay of the industry, but the technique of horizontal drilling is commonplace, too.

In fact, statistics show that, in the US, the number of rotary rigs drilling horizontal holes in February 2011 was almost double that of those working on the vertical equivalent. So, why does the industry turn to horizontal drilling?

The main advantage of a horizontal well is that it allows producers to make contact with more of the reservoir, so more resources can be recovered from a single well. A vertical borehole is drilled first, then 'kicked off' at around a 90-degree angle, through the subsurface formation. On its own, a vertical well may only access a vertical slice of the

so-called 'pay zone' typically around 30 metres (100 feet) wide, whereas a horizontal well may run through, say, 900 metres (3,000 feet) of that same zone. Accordingly, production rates may increase by orders of magnitude.

In accessing hydrocarbons such as 'unconventional' gas – difficult to extract as it lies in reservoirs with low permeability – the technique of horizontal drilling comes into its own, since it generates higher production rates and makes extraction more economically viable. Horizontal drilling has its environmental benefits, too; not only are fewer wells required on the surface, but

their location can avoid sensitive areas, thanks to the ability to reach reservoirs that are not located directly beneath a rig.

Subsurface and drilling teams need to consider a number of factors when deciding whether a horizontal well is appropriate for a reservoir. First and foremost is the geology; in a very hard, deep rock formation, the length of time it takes to drill horizontally may make it counter-productive, when a number of vertical wells could be completed in the same timeframe. Producers, therefore, need to weigh up the time and cost of developing a horizontal well, versus the improved productivity it will yield.

To help plan for fracture stimulation in horizontal sections, geologists analyse data carefully to determine the stress lines in the rock, where drilling will also proceed with greater momentum and speed. Once the operation is underway, measurement while drilling (MWD) systems measure downhole and formation conditions, relaying precise, real-time information back to the surface, to allow safer, more accurate drilling.

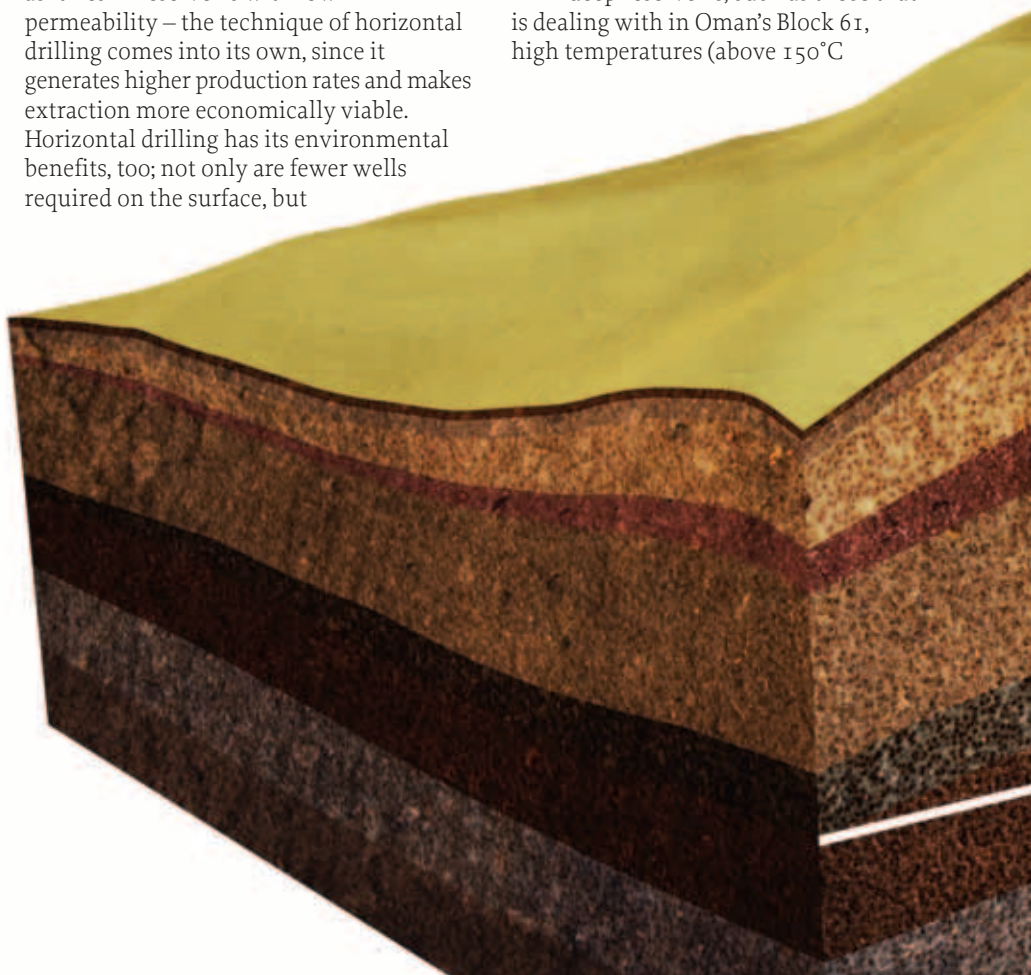
In deep reservoirs, such as those that BP is dealing with in Oman's Block 61, high temperatures (above 150°C

Horizontal stats

Rotary rig count in United States (11 February 2011)

| | |
|--------------------|---------------------------|
| Directional | 225 |
| Horizontal | 980 (up 48.94% from 2010) |
| Vertical | 516 (up 12.42%) |

<http://www.energydigger.com/rig-counts/us-rig-counts.aspx>



or 300°F) can provide a challenge, as they may cause the deterioration of downhole equipment, particularly the electronic components of the MWD tools. However, this aspect can be managed by circulating fluids around the drill assembly to keep the wellbore cooler.

Hole-cleaning becomes more difficult in horizontal wellbores. In a vertical scenario, mud is pumped down the drill pipe to circulate the cuttings up and out of the well – any that are not swept out immediately, fall back into the flow of the ascending fluid. That process is not so straightforward in a horizontal alignment, but techniques such as rotating the pipe while drilling and optimising the flow rate of mud can help.

BP has developed its expertise in horizontal drilling over the past two

decades. In North America, drilling horizontal wells has become routine practice to access unconventional gas resources. Last year, BP's North America Gas business drilled 63 horizontals in four different fields, with the horizontal sections taking anywhere from five to 30 days to complete, at average depths of 4,570 metres (15,000 feet). Deeper still, at around 5,200 metres (17,000 feet), BP Oman completed its first horizontal well in Block 61 last December, drilling out to 750 metres (2,460 feet).

As drilling techniques and equipment continue to evolve, horizontal wells are likely to reach farther than ever before, and in doing so, unlock the planet's more challenging hydrocarbon reservoirs that will help meet future energy demand. ■



Glossary

Cuttings: small fragments of rock cut by the drill bit and brought to the surface by the flow of drilling mud.

Hole-cleaning: the process of clearing solids from the wellbore, during drilling.

Kick-off point: the depth in a vertical hole at which a horizontal hole is started.

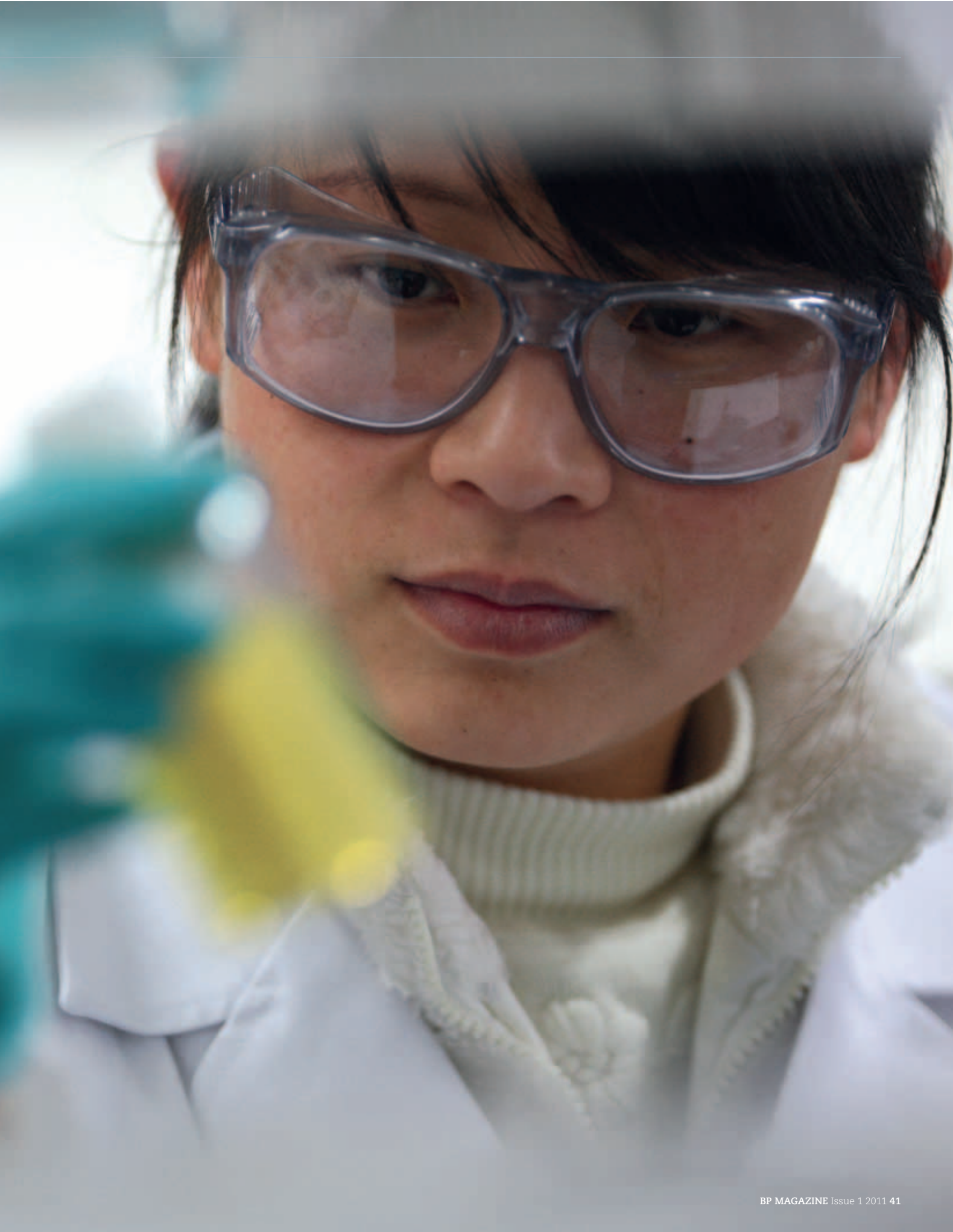
Pay zone: a productive area in a formation, which is sufficiently thick and contains a high enough concentration of oil or gas to make production commercially viable.

Report> Jaclyn Clarabut
Photography> Simon Kreitem

CHINA THE FUEL FOR GROWTH

To some, the phrase when East meets West depicts what happens when two cultures collide. For BP and China, there is no such clash, rather a 30-year history of teaming up to share common interests in areas such as safety, sustainable growth and solving the energy needs of the future.

Recipe for success: lubricants mixed specially for the Chinese market at the Castrol technology centre.





Liming Chen's life changed the day he learned he had passed the national university entrance exams, when his results were announced over his village's loud speaker system. Born in poverty on a farm in the middle of the Junger basin – an area surrounded by mountains in the far northwest of China – Liming's schoolwork consisted more of cotton picking than multiplication tables. Today, he heads up BP's \$4.7 billion business investment in China.

"I always say to young people 'if you believe that you can learn only what they teach you in school, then I should be a farmer today,'" he says.

Liming and millions like him have raised themselves out of poverty, as China has transformed. With double-digit growth over the past 30 years, it is now the world's second largest economy, and its car market outstrips the US, with 18 million vehicles sold last year, compared to 11 million sold in the US.

But as China looks to a future that many predict will see it replace the US as the world's largest economy, Liming doesn't forget the lessons of the past.

"The harsh environment taught me the important lesson of teamwork," he says. It is a sentiment that pervades BP's work in China. "Our focus is not just on BP's needs, but on China's needs and finding overlapping interests and room for co-operation."

"You have to be willing to learn, but you also have to be humble enough to learn from others," he adds. The work to implement the

best safety measures at SECCO (see page 44), BP's petrochemical joint venture with state oil company Sinopec, is proof of this belief. BP has also shared its experience of responding to the Gulf of Mexico oil spill, and the lessons it has learned, with state oil companies such as Sinopec.

BP has a long history with China, and is partnering the country in some major areas. It is working with Chinese companies on building safer operations; teaming up with Chinese companies looking for global expansion; and helping China find ways to meet its growing energy needs, which includes developing alternative forms of energy.

It is also supporting the country's growth – in February 2011, BP's petrochemical plant at Zhuhai announced plans for a hike in production of purified terephthalic acid (PTA) to 1.7 million tonnes a year, making it one of the largest PTA plants in the world.

And BP is playing a supporting role as China increases its presence on the international stage, partnering Chinese companies to access new resources. In fact, these partnerships are proving successful in Angola, Indonesia and Iraq. Liming says, "Iraq is a big deal that combines BP and CNPC capabilities and strength together."

These joint projects are important as China looks to increase its energy security. BP's *Energy Outlook 2030* projects China's oil consumption will grow by 8 million barrels of oil a day (mb/d), to reach 17.5 mb/d by 2030, overtaking the US as the world's largest oil consumer. "I believe multinational companies like BP can play an important role in China's energy security," Liming says.

To this end, BP has joined in alliance with the China National Offshore Oil

Corporation (CNOOC) to explore for and produce gas from the South China Sea, as the country attempts to reduce its heavy dependence on coal, which now makes up 70% of its energy mix. As China cleans up its skies and polluted cities, cleaner fuels such as gas are experiencing strong growth.

"BP could be a strong supporter of the Chinese desire for transformation from today's energy and pollution-intensive pattern of growth, to a cleaner and more sustainable future," says Xavier Chen, BP's vice president of policy and integration in China.

Liming agrees. "China knows it can't repeat the model that industrialised countries have gone through, with high energy consumption and environmental damage. The central government has implemented tough measures that include reducing the energy intensity of gross domestic product by 20% in just five years. »



Vital statistics:

Name: China
Total area: 9,596,961 square kilometres
Population: 1,336,718,015
Life expectancy: 74.68 years
Capital city: Beijing
Climate: extremely diverse; tropical in south to subarctic in north
Religion: Daoist (Taoist), Buddhist, Christian 3%-4%, Muslim 1%-2%



Night and day: Shanghai's famous strolling spot, The Bund, by night (above) and a new dawn in making fuels of the future at the Dalian Institute of Chemical Physics.



MAKING PROCESS SAFETY PERSONAL

Report > Lou Craig

With its mass of grey steel set against an imposing skyline, SECCO is a giant of a petrochemical plant. The figures speak for themselves: it is BP's single largest investment in China, producing 3.5 million tonnes of petrochemicals – essential ingredients in resins, fibres, plastics and synthetics. It employs up to 10,000 people, at peak maintenance, and straddles 200 hectares (500 acres) – large enough to house around 200 full-size football pitches. It is also home to one of the world's largest olefins crackers – the equipment necessary to turn longer chain hydrocarbons into smaller olefins, such as ethylene.

But away from the formidable exterior, inside the main building is where this behemoth takes on a distinctly personal feel, with a brightly coloured display of posters plastered across the walls. One shows a SECCO employee and her child playing ball, with text that talks about her love for her daughter and the importance of family. Far from decoration, these posters have proved a key step in creating an unrivalled safety record in China and helped SECCO achieve something remarkable – 88.6 million hours worked without a single fatality or major process safety incident. This record earned SECCO the main accolade in 2010 in BP's internal recognition programme, which attracts more than 1,000 entries every year.

Working to embrace the very best BP and Sinopec standards, SECCO has built a unique safety culture, one that leadership and employees alike have embraced. At its heart lies a programme called 'incident and injury free' (IIF) – dubbed locally 'we care' – that seeks to make safety personal to every employee.

BP's Mark Wilson oversaw the programme. He says, "It was hard work, but we changed people's thinking from 'I'll work safely because I have to', to 'I want to work safely because it's good for me and it means I can go home to my family.'"

Formed in 2001, SECCO is BP's \$2.7-billion 50:50 joint venture with Sinopec and its subsidiary, the Shanghai Petroleum Company. From the beginning, the idea was to set the standard in safety practices, in a country that has seen more than 1 million industrial fatalities in the previous nine years.

"We wanted to bring the best international BP safety standards to this project," says Jeanne Johns, who sat on the SECCO board. "We

weren't going to accept that just because it was China it wasn't going to be done this way."

Changing mindsets is often challenging, but it was the appeal to people's values that made the difference. "Bringing home money and a smiling face to the family means everything," says Xiaoping Yang, SECCO's director of HSSE and quality, "and that's how people's understanding shifted. It wasn't about being safe because they had to – they wanted to."

One example of this shift is the way in which product is moved safely to customers in China, whether by road, rail, ship or pipeline.

"Road transport, especially, is a daily risk," says Hee Teik Tan, SECCO's commercial director. "So, we've trained the trainers to do in-cabin observation and pick up basic issues, such as putting on seat belts and obeying the speed limit. They've taken real ownership of the issues, which means we can meet customers' orders and get our people home safely, too. There's no magic formula. It's a matter of engaging people to show them the merits of getting it right safety-wise."

That engagement extends to treating contractors as partners and equals, with training for thousands of rural migrant workers, the implementation of personal and process safety procedures, auditing and inspection, and sharing knowledge with the contractors' leadership.

The link between personal and process safety is an important one, and the SECCO leadership has deliberately tried to pay more attention to process safety, because a failure there, however small, could lead to personal safety issues at scale. And that's where an emphasis on safety pays off.

As a consequence, SECCO has helped build BP's credibility as a partner for the future. SECCO is now considered a 'force for good' by local communities and government agencies – and by BP.

Presenting SECCO with the internal 'BP at its Best' award in 2010, group chief executive Bob Dudley described the team as the one that "best represents everything that BP wants to be – living out all of our values in a very clear way."

For the SECCO team, the recognition comes at a point in their safety journey when they have good reason to reflect on their success.

"We've been on this journey for so long," says Wilson. Does he feel the pressure to maintain the safety record? "No," he says. "The pressure comes from wanting the people who work here to go home safely – I don't need any more pressure than that."





Inside out: cycling is the way most workers get around the 200-hectare SECCO site (above). In the control room, monitors help staff keep a close eye on the safety of the site.



“There’s no magic formula. It’s a matter of engaging people to show them the merits of getting it right safety-wise.”

Hee Teik Tan

” These targets provide an opportunity for BP to work with car manufacturers to improve efficiency and lower emissions, when the desire to own a vehicle is a key aspiration for the new Chinese middle class.

One example of that desire is the popularity of the first-ever live television draw for a licence plate. Thousands of Beijingers watched and waited, hopeful that their number would come up. But the odds were stacked against them, with a one in 10 chance of winning. Figures suggest 200,000 people had applied online that month for the chance to ‘win’ one of only 20,000 new plates that would allow them to take to roads so congested that they sometimes resemble a car park rather than a highway.

Designed by the Beijing city government to ease congestion, the lottery-style system began in January 2011, with a new batch of plates released each month. The plan is to limit the number of new cars to 200,000 a year.

With the number of cars on the capital’s roads almost doubling in five years, to 4.76 million, the gridlock has become the stuff of legend. In Shanghai, where BP’s lubricants team has built a technology centre, the locals ask visiting Beijingers, “Is the traffic really that bad?”

Curbs on new vehicles are already in place in Shanghai, revealing just one example of some environmental brakes being applied to the more unsustainable parts of China’s economic boom. Complex emission standards exist, too, to clean up the air in the cities.

For car manufacturers, the challenge is to meet new standards on vehicle emissions and curb fuel consumption, by designing greater engine efficiency. Another challenge exists – to build engines appropriate for the local environment, where traffic congestion means the engine and its lubricants must work harder.

This is where BP’s lubricants brand, Castrol, is playing a role, partnering with the local car makers. In Europe, the company already works with manufacturers such as BMW and Ford to co-engineer lubricants that work together with the new engines to improve fuel efficiency.

Castrol is a relative newcomer in the Chinese market, having only been in the country for 16 years. It was the first international lubricants manufacturer, however, to set up a technology centre in China.

The centre is not only designed to provide deep expertise in the development of lubricants, with state-of-the-art analysis, blend science and friction-testing laboratories onsite, but also as a place to work closely with car manufacturers.

“Chinese manufacturers want to work with people to improve their technology, and if they see a local option to work with an international brand, that’s an attractive proposition,” says Paul Turner, China and North Asia sales director for Castrol. “For us, it’s not about flying in and saying I’ll see you in six months time. Instead, we can now have a weekly conversation and really work on a project together.”

He adds: “Having a technology centre here means we can get in on the ground and help the manufacturers meet new complex emission standards and work with them as their business grows.”

According to Zhi Min Liu, technology manager at the Castrol centre, the challenge for the car manufacturers is to build a smaller but more powerful engine. As the concentration becomes smaller, so does the necessity for thinner oil to flow through the engine, while still cooling and protecting the engine against wear and keeping it clean. “We’re designing tailor-made products rather than general ones. The oil is treated as a key part rather than a general part,” he says.

While the centre seeks to formulate lubricants that will work with the fuels of today, across the country, BP is also looking to find the fuels of the future.

Sitting on the northeast tip of China, 500 kilometres (310 miles) from Beijing, is the port city of Dalian, home to cutting-edge laboratories that could hold the key to the country’s energy outlook.

The Dalian Institute of Chemical Physics (DICP) exists to develop hi-tech technologies in the fields of chemistry and catalysis, that could benefit the sustainable development of China. It houses the Dalian National Laboratory for Clean Energy, which targets efforts to build renewable and energy-efficient technologies.

On campus, there is an enthusiasm for technology, with students keen to exhibit



“I believe multinational companies like BP can play an important role in China’s energy security.”

Liming Chen

Transport options: Beijing’s roads can often resemble a car park (above, left). Above, pedestrians and roller skaters get away from the traffic.

advances in chemistry, catalysis and membrane technology, or use the latest kit to see right into the heart of chemical processes in real time.

BP has supported this approach over the past 10 years, working with the institute in these fields. And the partnership is not a distant one, with BP offices located on campus. As the close relationship has grown, so has the confidence that the partnership can yield cost-effective techniques for making fuels and chemicals through converting coal or biomass.

"I believe the work we're doing here could form the basis for the energy technologies of the future, maybe in clean coal or biomass conversion technology," says Professor Bao, who has worked with BP for a decade, and was recently elected one of the youngest of the 709 academicians of the esteemed Chinese Academy of Sciences (CAS). Academicians aren't rare at DICP – of the 124 chemistry members of CAS, Dalian is home to 12 of them.

For now, the success of the partnership is the partnership itself, according to Greg Searle. As BP's research manager, based at DICP, Searle is proud of the capability that both partners bring. DICP is stocked with talent, with 750 Master and PhD chemistry students on campus.

Searle says, "What you've got here is a world-leading research capability, with more post-graduate chemistry students and talent than anywhere else in the world."

He adds, "I believe key technical breakthroughs happen when you're

working at the boundaries. Here in Dalian, we are working at the boundaries of a large multinational company and a leading research institute, the boundaries of East and West and of fundamental and applied research – it is hugely exciting."

And the relationship is mutually beneficial, with give and take on both sides. "This is a place where ideas can be tested quickly, reliably and at relatively low cost, with the aim of turning great ideas into new global technologies," Searle says.

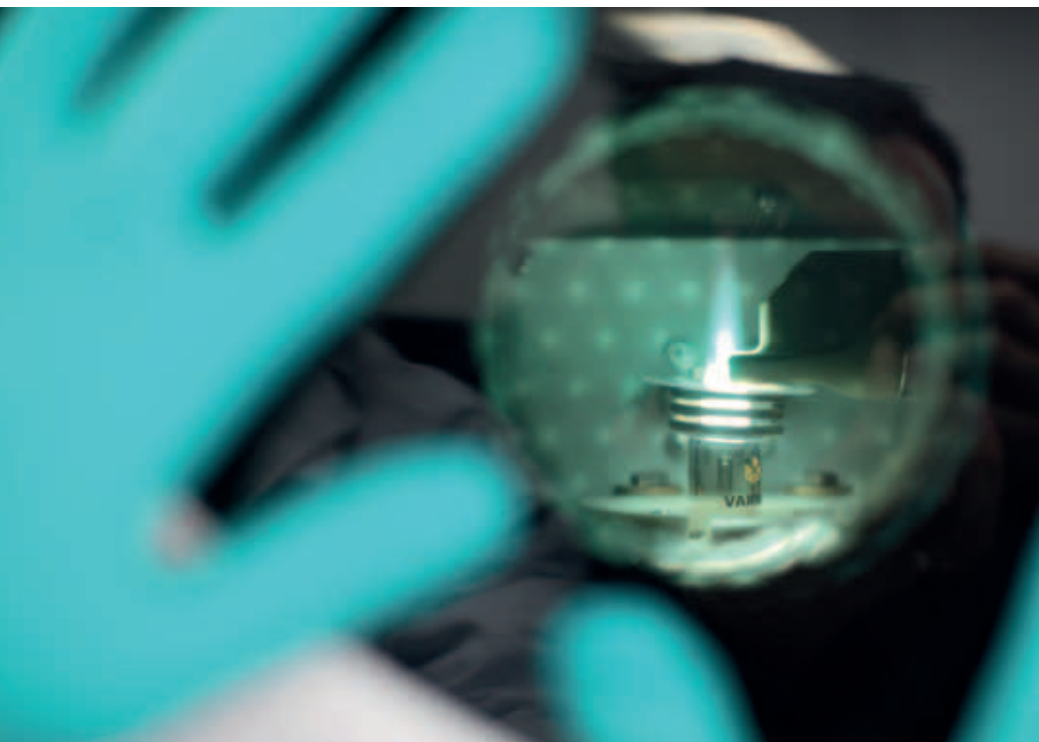
Professor Bao says, "BP has been very good at helping with our intellectual property, managing patents internationally and bringing patent experts here, so that our technology can have a more global reach."

Professor Li Wen Zhao was one of the initiators of the DICP and BP relationship, and is proud of how it has grown. He agrees that BP has helped the institute to see opportunities outside of the lab. "BP has the experience in the industrialisation of a process. We have many new ideas, but which ideas could be converted to industrial use? This is where BP has a strong team and much experience to help us," he says.

So when can we see a new process developed at DICP with BP that's ready to be industrialised for use in China? Searle says: "Technology development needs time and patience, but we really believe the current portfolio has the potential to deliver in the next few years." ■

"BP has been very good at helping with our intellectual property, managing patents internationally and bringing patent experts here, so that our technology can have a more global reach."

Professor Bao



New direction: cutting-edge equipment at the Dalian Institute of Chemical Physics that allows researchers to watch catalytic processes in action.



Historic partnership

British Chancellor of the Exchequer George Osborne (far right) talks to the press pool at Number 11, Downing Street, following a meeting with BP chief executive Bob Dudley (far left), BP chairman Carl-Henric Svanberg and Reliance Industries Limited managing director Mukesh Ambani. BP and Reliance had just signed an agreement to create a partnership that will see BP take a 30% stake in 23 oil and gas production sharing contracts in India. The two companies will also form a 50:50 joint venture to source and market gas in the country. The partnership will combine BP's deepwater exploration and development expertise with Reliance's skills in project management and operations. The 23 contracts will continue to be operated by the Indian company. The transaction constitutes one of the largest foreign direct investments into India. "This partnership meets BP's strategy of forming alliances with strong national partners, taking material positions in significant hydrocarbon basins and increasing our exposure to growing energy markets," said Svanberg. In the background is a portrait of the late British prime minister David Lloyd George, by Sir William Orpen. Look out for a full report on the deal later this year. ■

REPORT: **LISA DAVISON**



Delicate work: a BP scientist performs micro-tube reactions at the biofuels global technology centre, San Diego.



EXPERTS IN THEIR FIELD

BP's acquisition of Verenium's cellulosic biofuels business demonstrates the company's commitment to this alternative fuel. But, it's not just about laboratories and cutting-edge technology. Sometimes, it's the people and their know-how that are the greatest assets.

REPORT> PAULA KOLMAR **PHOTOGRAPHY>** JOSHUA DRAKE & FRANK HOM



“We all sat in the conference room – every Verenium employee – as we have done, regularly, for company meetings and major announcements. But that day, we did not know that we were waiting to find out which of us would become BP employees and which were to stay with Verenium,” says Gordana Djordjevic, senior scientist in the biofuels industry, and a recent addition to BP’s biofuels business. “Verenium employees left the room; the rest of us started a new future in BP.”

Purchasing a company’s assets doesn’t always just involve land, structures, rights and market share. Sometimes, it is experience and expertise that are the primary assets. When it bought a large part of the biotech company Verenium in September 2010, BP Biofuels’s global staff almost trebled: scientists, researchers, engineers, operators and project managers with advanced skills in developing biofuels joined the company, bringing with them cutting-edge technology, laboratories and an advanced demonstration plant.

Verenium’s technology centre in San Diego, California, is replete with research laboratories set up for designing and testing biofuel components. Jennings, Louisiana, is

home to its demonstration plant, where the new biofuel samples are run in large-scale quantities. In Florida, BP is growing and improving high-yielding energy cane (much like sugarcane, but not usable as a food product) and has begun growing more acreage in East Texas.

BP is now a big player in the global biofuels industry: the key is talented people, and their collective knowledge about how biofuels work and, more importantly, how to make them work more efficiently.

It’s challenging to integrate a group of experienced people from a small company into a major corporation, but, fortunately, everyone is motivated to meet an aggressive performance schedule, safely and successfully.

“The scientific biotechnology talent that now defines the BP biofuels group is substantial,” says Ken Jefferd, integration manager. “With this huge talent pool in San Diego, and the operational demonstration plant and its staff of 75 in Jennings, BP is launching our biofuels business onto a whole new level. During the transition period, our task has been to provide the resource support to enable focus on safety and business performance, as we simultaneously integrate Verenium into BP, allowing the new biofuels team to grow and deliver more than they ever have before.”

In tandem, the Jennings facility

underwent major upgrades to make it operational for the first time and investment in the operational side of BP’s US biofuels processing capacity will continue for years to come.

Philip New, head of BP Biofuels, knew early on that giving the new employees ownership of how the global technology centre and Jennings demonstration plant operated was central to success. “We discussed BP’s values in depth, agreed specific milestones for production, and listened for the things in Verenium’s ways of working that BP Biofuels should learn from, and reinforce in the future. It is having a major impact, and I am excited by how positive everyone is about the change. Our aim is to be one team – where you can’t see the join – I think we’re getting there.”

Building trust has been critical in getting the teams onboard. “People are seeing the resources behind the work we are expected to do, and are realising that if goals are met and technology packages delivered, BP will make biofuels a market reality in its portfolio of products,” says Nelson Barton, one of the key people joining BP as global head of research and development.

“For scientists and researchers, seeing research converted into a saleable product is a powerful motivation to push the boundaries. During and after the acquisition process, BP communicated and



“For scientists and researchers, seeing research converted into a saleable product is a powerful motivation to push the boundaries.”

Nelson Barton

Core components: researchers and a technician at work in the biofuels technology centre and demonstration plant (far left and middle). Below, by tapping into the energy locked in energy cane, biofuels can reduce the dependence on petroleum.

followed through with pledges to work together, listen and fulfill investment agreements. Trust has been earned from both directions.”

Carey Buckles, manager of the Jennings facility, recognised the positive impact of the acquisition immediately. “Resources have been critical to getting the plant to an operational level. Our demonstration plant is vital for generating data for large-scale assessment.” The technology centre develops the biotechnology and tests it in small quantities.

“Our value as the processing link is in revealing what works and what doesn’t. Only after that information is logged can the San Diego group refine the biotechnology with confidence,” says Buckles. “As part of the BP biofuels group, we are up and running at demonstration scale, directly as a result of the investment and leadership support of BP.”

Sue Ellerbusch is already seeing the results. As manager of BP Biofuels in North America, she has been involved with Verenium since the start, including with the BP joint venture that preceded the acquisition. “In a matter of weeks, after the companies announced that BP would acquire the biofuels segment of Verenium, the people transferring to BP clearly started to see themselves as BP employees. They recognised that we were serious about the

future of biofuels and planned to be a major part of it.”

Visibly encouraged by the smooth transition and enthusiastic new biofuels staff, Chicago-based Ellerbusch says, “We have a lot to accomplish over the next few months and it will be challenging. With the uplifting attitude of the creative biofuels experts now among us, I have confidence that we can and will succeed, while keeping BP values embedded.”

“It was difficult to separate from Verenium colleagues, and somewhat disquieting to move into a corporate structure,” says Djordjevic. “The fact of the matter is, with BP, we can look forward to an exciting, innovative future growing the biofuels business: we can seriously explore ideas and follow through at scale to create value; our research will be put to use.” As the senior biofuels scientist, Djordjevic is looking past tomorrow and on to making real progress in biofuels, so that it becomes a viable, everyday fuel. “To see our work become a reality motivates us even further to make inroads to practical biofuels.”

When asked what is pivotal in the integration and motivation of the global technology group, New and Jefferd agree: clear, truthful communication and respectful dialogue. According to Jefferd, “With it, BP will carve out a successful place in the biofuels industry. Without it, we would fail.”





"We're determined to do biofuels exceptionally well – using very efficient feedstocks grown and processed sustainably, and developing advanced technologies with the potential to make good biofuels even better."

Philip New

New growth: a farmer and energy cane supplier inspects his next crop.

NEW DEAL TO ACCELERATE BIOFUELS DELIVERY

What the Verenium deal means for BP:

- Purpose-built bioscience R&D facilities in San Diego, California.
- Intellectual property related to proprietary cellulosic biofuels R&D and conversion technology.
- 1.4 million-gallon-per-year demonstration facility in Jennings, Louisiana.
- Sole ownership of Galaxy Biofuels LLC, which holds the parties' jointly developed intellectual property.
- Sole ownership of Vercipia Biofuels, which is commercialising proprietary technology for cellulosic ethanol production.

Turning grass into fuel is a simple way of putting it, but that's precisely what BP is doing with its new US-based biofuels businesses. With the purchase of Verenium's specialist business, BP has taken a major position in cellulosic biofuels – fuels that are produced from non-edible grasses or woody crops, as opposed to the corn and wheat that provide most of today's ethanol.

"The acquisition demonstrates BP's intent to be a leader in the cellulosic biofuels business in the US, and positions us as one of the few global companies with an integrated end-to-end capability, from research and development through commercialisation to distribution and blending," says Philip New, chief executive of BP Biofuels.

"Our early partnership with Verenium has been fruitful, enabling the companies to develop a leading cellulosic ethanol technology package, driven forward by the skills and expertise of people from both companies. By acquiring Verenium's cellulosic biofuels technologies, BP Biofuels should be well placed to accelerate the delivery of low-cost, low-carbon, sustainable biofuels, at scale."

World leaders are pressing scientists and businesses worldwide to develop biofuel technologies and products that will relieve dependence on non-renewable fossil fuels, and meet the growing demand for cleaner fuel.

By tapping into the energy locked in energy cane, biofuels can reduce the dependence on petroleum, while successfully lowering carbon emissions. If produced well, they can also stimulate agriculture in marginal areas and produce far fewer greenhouse gas emissions than conventional gasoline. According to New, "We're determined to do biofuels exceptionally well – using very efficient feedstocks grown and processed sustainably, and developing advanced technologies with the potential to make good biofuels even better."

The US appetite and market for supporting biofuels is strong; it is the major consumer of fossil fuels globally and the Energy Independence and Security Act has spurred efforts to change the mix with commercially available alternatives. BP has taken up the challenge and its \$98 million Verenium acquisitions are proof of that commitment.

Since 2006, BP has announced investments of more than \$1.5 billion in biofuels research, development and operations, and has announced investments in production facilities in Europe, Brazil and the US. This includes partnerships with other companies to develop the technologies, feedstocks and processes required to produce advanced biofuels, and \$500 million over 10 years in the Energy Biosciences Institute (EBI), at which biotechnologists are investigating applications of biotechnology to energy.

With Verenium, BP believes it has access to a technology that can deliver commercially viable ethanol, at scale, and turn grass into fuel in a sustainable way, for the first time in the world.

Cellulosic materials are found in the stems, stalks, and leaves of plants, as well as the trunks and branches of trees, and in agricultural wastes. Cellulosic materials are abundant worldwide – making up most of terrestrial biomass by weight. The fact that they are not needed for food or animal feed – unlike other biofuel feedstocks – explains why they have attracted so much scientific, political and commercial interest. ■

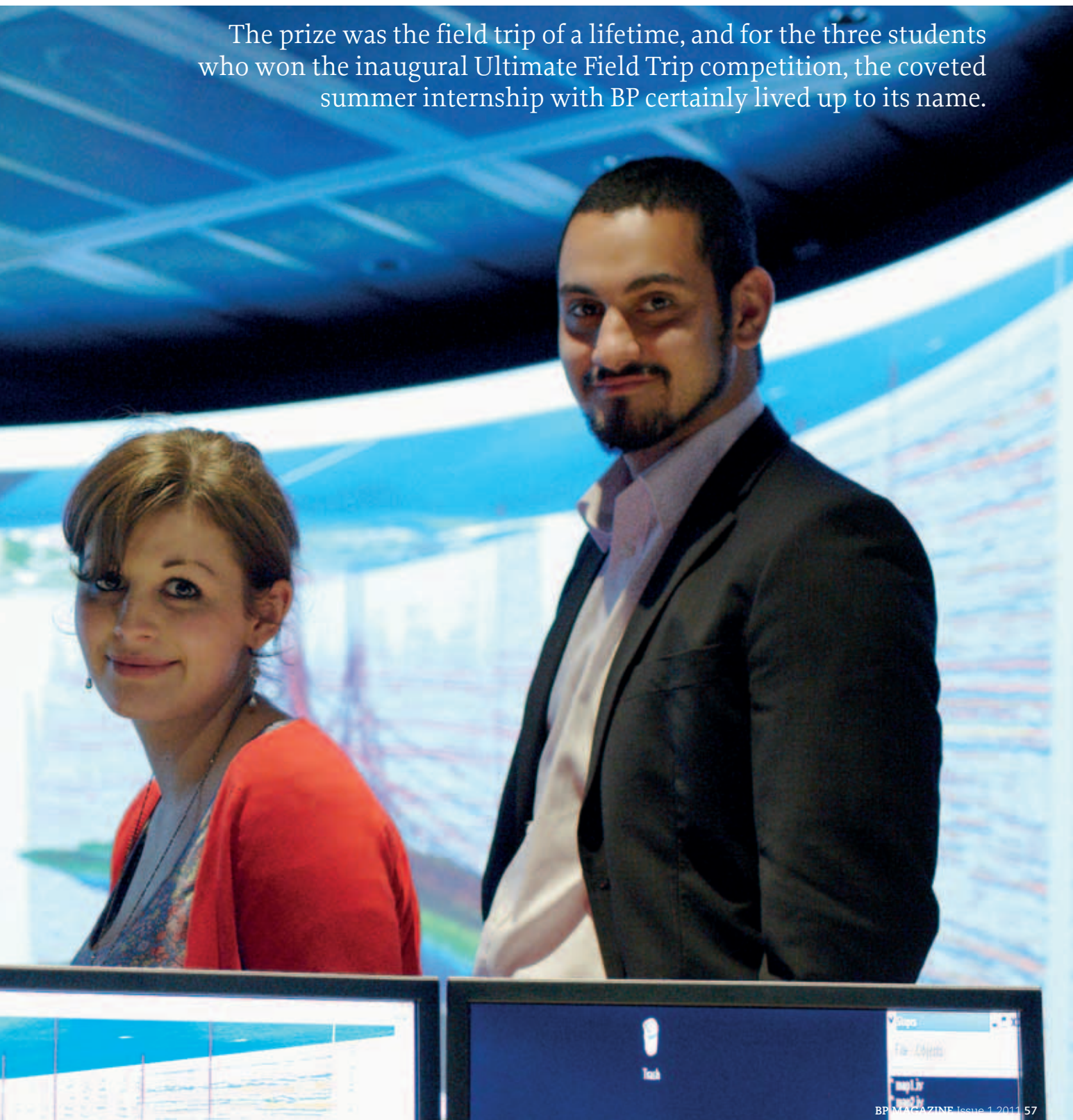
THE



Talented team: geology students Chris Hunter, Lizzie Riley and Ben Said spent six weeks working with BP in 2010. The trio are pictured here in one of BP's highly immersive visualisation environments (HIVE) in Sunbury, UK. HIVEs feature a series of three-dimensional computer screens around which teams can gather to study data and images.

ULTIMATE TEAM

The prize was the field trip of a lifetime, and for the three students who won the inaugural Ultimate Field Trip competition, the coveted summer internship with BP certainly lived up to its name.





Ultimate Field Trip 2011

This year's entrants were asked to form a team of three and submit innovative, scientific ideas for maintaining the UK continental shelf as a global centre of marine technology and engineering excellence, by extending the useful life of North Sea oil and gas infrastructure – and potentially, the oil and gas fields – as their economically productive activity comes to an end. The final is scheduled for April 2011. See www.bp.com/fieldtrip for more information.

A group of young people stand on stage in front of a live audience ready to take tough questions from a panel of experts. This is not the latest television talent show, but the grand final of the Ultimate Field Trip competition, where the brightest UK students pitch their ideas to a BP jury, who will decide which team will win a summer internship with the company.

The six-week internship gives the winners access to the full range of BP's North Sea operations, including a stay on an offshore platform, a trip to Norway and access to BP mentors. But the internship is no sightseeing holiday. The students must help BP address real-world problems on a project that gives them the chance to put their own ideas into practice.

The competition is now in its second year, and for BP, it exists to attract the best science, technology, engineering and mathematics (STEM) students, and to give them an insight into the exciting careers and opportunities offered by the energy industry.

The battle for places has been fierce, with interest from hundreds of students across the UK. Such was the standard of the students who made it to the 2010 final, that all 15 were guaranteed a first interview with the company after graduation. But, there could only be one team that ultimately won the trip and that prize went to Team Meltdown.

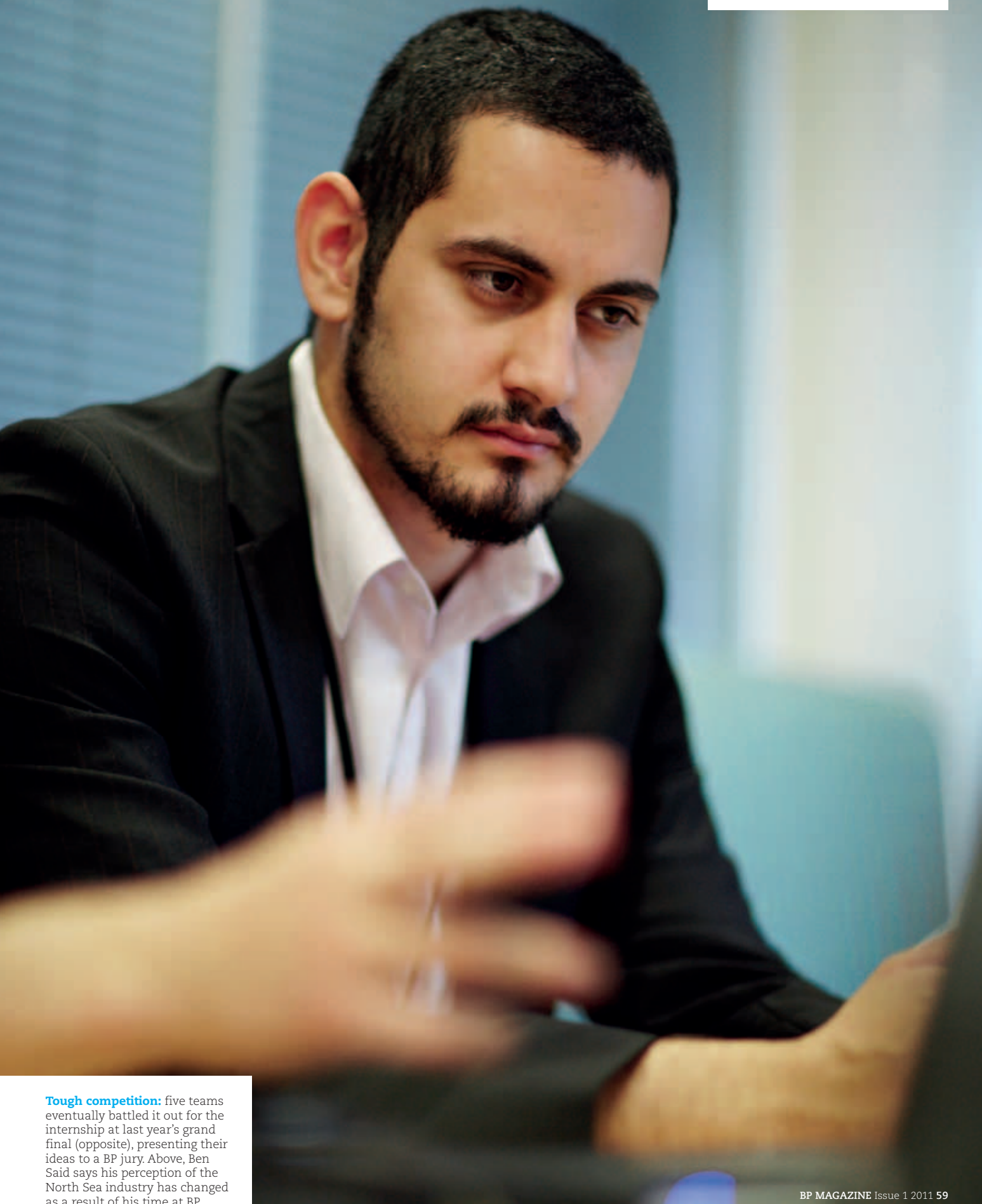
"We thought everyone would be better than us. But we put in a lot of hard work, and it really paid off." So says Chris Hunter, who alongside Lizzy Riley and Ben Said made up the members of Team Meltdown.

Although the competition is aimed at STEM undergraduates, that didn't stop the second-year geology students from Imperial College, London, entering. They were attracted by the chance to contribute to solving climate change – a topic familiar to today's undergraduates, who have grown up at the same time as climate change concerns have developed.

Fifty-two entries from teams of three were eventually narrowed down to five sets of hopefuls. At a grand final held at London's Natural History Museum in April 2010, Meltdown impressed the judging panel of senior BP executives with their answer to the question: what innovative, scientific ideas can your team come up with to address the carbon dioxide (CO₂) emitted from a typical power station, using natural gas from the North Sea to generate electricity?

Inspired by their studies of the Ice Age, Meltdown fought off stiff competition – and a tough BP panel – with their winning proposal for cutting carbon emissions by using photosynthetic single cell micro-organisms, such as algae and bacteria.

Crowned champions by BBC Radio 4 news presenter John Humphrys, the team joined BP during their summer break. One »



Tough competition: five teams eventually battled it out for the internship at last year's grand final (opposite), presenting their ideas to a BP jury. Above, Ben Said says his perception of the North Sea industry has changed as a result of his time at BP.

of their first tasks was to complete their basic offshore safety induction and emergency training, which includes helicopter submersion instruction – a key safety skill for anyone travelling offshore to an oil and gas installation – to teach helicopter passengers a safe escape route should the aircraft have to ditch at sea.

For all three students, the experience was worth it for the chance to go offshore to BP's ETAP platform. With its nine different reservoirs, BP's Eastern Trough Area Project (ETAP) is one of the largest North Sea oil and gas projects of the past 20 years.

Chris says, "Making our descent in the helicopter and then landing on the platform was amazing." Ben adds, "Looking down through the floor and seeing the ocean beneath your feet, that's a really impressive experience. We were there for a week, but we really wanted to stay longer."

Team Meltdown was there to assess the technical feasibility of adding a new technology to ETAP. Developed by California company Alphabet Energy, the technology is a waste heat recovery unit that can generate electricity from waste heat. The brief was to look at whether it was feasible to retrofit this technology to the power turbine exhaust system on ETAP. The trio had to verify both the operating and design conditions across various utility systems; perform a mass and energy balance, in addition to verifying the economic feasibility of each design.

BP's Geoff Noble mentored the students, who, he says, impressed him by wholeheartedly tackling process engineering, despite having geosciences backgrounds, "Credit to them for getting stuck in. They had the confidence to find the right people on the platform, and that's what we're looking for: people who have the confidence to do that."

Process engineer Raj Misra also played a role in guiding the team. He says, "Determining whether a retrofit of this magnitude is feasible is not always best achieved by pouring over heaps of design documentation in the office. In the appraise project phase, it is invaluable to survey the proposed offshore location identified for the modifications and discuss the project directives with the relevant platform-based operations personnel. While on the platform, an engineer can appreciate the equipment layout in accordance with the design drawings. Discussions with both onshore- and offshore-based personnel will help to



ensure that the design incorporates human factors and is inherently safe."

The research group tasked with studying the economic feasibility of the project also took Meltdown to Norway. Here, they travelled to Stavanger, home to part of BP's North Sea business, to assess whether the amount of carbon tax saved by the

technology would make the multi-million dollar investment worthwhile in Norway.

Taking a well-earned break, the group hiked to Pulpit Rock, a massive 604-metre (1,982 feet) high cliff above Lysefjorden. "This was definitely one of the highlights," says Lizzie.

At the end of the study, the team presented their findings to BP's North Sea executive team. As the technology was still unproven, the students advised that it was more prudent to await the results of industrial trials prior to installing the equipment in a harsh offshore environment.

Graham Howes, BP's Alternative Energy adviser, attended the presentation with interest. "I was impressed with the work they did, but I was disappointed with the results. But, now we have that information, we have a starting point and a lot of insight into how we could make it work. The team was looking at an early-stage technology that we think has a place in the future and could be significant for BP," he says.

The students from Meltdown could also have a place in BP's future, as all three have accepted further internships with the company. ■



QUICK FIRE Q&A WITH THE WINNERS

Lizzie

What did you learn about working in the oil industry? You have the opportunity to do whatever you want; you're not restricted. And most roles are inter-related.

What did you learn about yourself? I want to change my career path and go into environmental science.

Ben

What was your highlight? The final presentation of our project – that was a nice, satisfying feeling, particularly having someone say it taught them something.

What did you learn about working in the oil industry? I think the general perception is that the North Sea is a dying industry, but that's not the case! The technology we looked at (as part of the final project) showed that.

Chris

What did you learn about working in the oil industry? It's a lot more complex, with lots of different career options, and it's an industry I'd definitely like to get involved in.

Any advice for this year's entrants?

Anyone can enter it, we were geologists and we won. It wasn't because we were smarter, but we tried really hard. We had the most amazing summer. If we hadn't won, I would've spent the summer doing 12-hour shifts on minimum pay – or sleeping!



Bright futures: Lizzie (facing page), Chris (above) and Ben have all accepted further internships with BP. Opposite, BBC Radio 4 news presenter John Humphrys hosted the 2010 grand final.



Action stations

They were the Randy Fletchers and Brad Byczynskis (see page 27) of their day. These two images capture members of the Anglo-Persian Oil Company's fire brigade, based at Abadan refinery, at work. The top image was taken in 1935 outside the station, while the photograph to the right-hand side shows a fire drill being carried out in 1926.



The next edition of *BP Magazine* will be out in June 2011.

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