

## Energy

Monday November 2 2015

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## Oil market slides out of control

Bouts of profound disequilibrium in the market are the historic norm, writes *Ed Crooks*

For most of the Age of Oil, groups of producers have tried to control its price. From the 1920s, that strategy was coordinated by the Railroad Commission of Texas, supported by other US states and federal authorities. Then from the 1970s it was Opec, the producing countries' cartel.

The plunge in the price of crude since the summer of 2014 has made it clear that the market has escaped anyone's ability to control it.

A combination of technological progress, in the shape of the spectacular success of US shale oil production over the past five years, worries about the slowdown in China and other emerging economies, and a shift in strategy by Saudi Arabia, the world's largest oil exporter, has caused a global glut of oil that sent prices tumbling by more than 50 per cent.

For now, at least, prices are being driven more by market forces than by political decisions and it is an unnerving experience for everyone concerned, from the boardrooms of Houston to the palaces of Riyadh. It is not, however, wholly unprecedented.

In the words that are apocryphally attributed to Mark Twain, "history does not repeat itself, but it does rhyme". So, while there are no exact precedents for today's markets, the past can provide some clues to the future.

The most recent oil price collapse came just seven years ago. The downfall of Lehman Brothers in 2008 and the subsequent financial crisis toppled crude prices from a higher peak than in 2014 to its lowest trough. That episode turned out to be shortlived. Having dropped below \$37 per barrel in December 2008, internationally traded benchmark Brent crude was back above \$70 by June 2009.

On the demand side, 2015 looks quite like 2009. Six years ago, the swift resumption of strong growth in China, after a brief wobble in late 2008 and early 2009, provided important support



All fired up: tankers weighed down with oil sit and wait off the coast of Fujairah in the Gulf of Oman — Justine Kase/Alamy

to prices. This year, similarly, growth in China's oil demand has been strong, though forecasters expect it to slow. It is the supply side that is different.

In 2008, there was decisive action by Opec, which cut its agreed output by 4.2m barrels per day in three steps from September to December, culminating in the largest single reduction in its history that helped stabilise prices.

The cartel's ability to control oil markets is often exaggerated, but it is clear that its intervention in 2008 had a very significant impact. When its ministers met in Vienna on November 27 last year, as the latest price slide was in full swing, they suggested their influence had reached its limits.

Their decision to leave their official production level unchanged set the seal on a policy that had already been signalled for months by Saudi Arabia, the

group's most influential member. As Ali al-Naimi, Saudi Arabia's oil minister, explained later in an interview with the Middle East Economic Survey, a cut in Opec production, meaning principally Saudi production, would have merely allowed more "marginal barrels" from US shale and other higher-cost sources to fill the gap.

The clearest precedent for Mr Naimi's strategy of turning on the taps is the policy adopted by Sheikh Ahmed Zaki Yamani, his famous predecessor, who boosted production in 1985-86 after cutting back over the previous half-decade to support prices. Crude plunged in 1986 and the world entered a period of low prices that stretched into the 2000s.

Another parallel with today was the preceding surge in non-Opec production. The equivalent of this decade's shale boom was the opening of two

important new oil provinces: the North Sea and Alaska.

The development of those areas, which were relatively high-cost compared to oilfields in the Middle East, was made possible by Opec moves that forced up the price of oil in the 1970s, just as shale was made viable by the high prices of the first half of the 2010s.

Although low prices hit investment, prompting cost-cutting from western oil companies including the mega-merger wave at the end of the 1990s, production took a long time to respond. The UK, Norway and Alaska continued to produce in large volumes through the turn of the century.

Eventually, though, as those regions went into decline, and demand from China and other emerging economies began to grow strongly, the stage was set for the steep rise in prices of the 2000s.

The question today is how quickly a similar adjustment of supply will materialise. At the beginning of this year, many expected that the US shale industry would head quickly into a downturn.

So far, it has not turned out like that. Production companies have been able to squeeze out further efficiency gains and cut the prices they pay suppliers. They have also been "high-grading" their operations: focusing on the most productive areas. US production has proved more resilient than some had expected.

However Trisha Curtis, of the Washington-based Energy Policy Research Foundation, says oil at under \$50 is causing "quite serious" problems for the industry. Blithe assertions that everything seems fine ignore the fact that there is always a lag before production reflects the number of rigs drilling for oil, which has dropped 63 per cent in the past year. "It's going to take a while," says Ms Curtis. The shale industry is not dying, she adds, but it may be going "into hibernation".

In other oil-producing regions, where project developments are typically multi-year and multibillion-dollar commitments, production will be slower to react to the fall in price of crude.

Philip Verleger, an energy economist, suggests Venezuela, a leading oil producer now in the grip of a severe financial crisis, could crack first, with mounting chaos in the country putting its entire 2.4m b/d of production at risk.

For those reasons, while the oil market will for a while be weighed down by near-term pressures, including the prospect of additional Iranian supply, the longer-term price trend still seems likely to be upwards, with the potential for spikes if crises erupt in Venezuela or elsewhere. Edward Morse, analyst at Citigroup, suggests a range of \$60-\$80 per barrel would bring supply and demand back into balance.

The idea that supplies of fossil fuels will grow ever tighter as demand increases, pushing prices inexorably higher, has been put on ice, perhaps forever. The lesson of the past decade is that so long as the right technology, capital and legal frameworks are in place, oil and gas will flow. If the world is to shift away from fossil fuels, therefore, governments will need to take deliberate policy actions to make that happen.

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## Harsh realities finally push champions of shale into retreat

## Fracking

Falling crude prices have finally arrested growth of US output, says *Gregory Meyer*

Prolific output from US shale formations in recent years have thrown the world oil market off balance. But a long market slump is now forcing shale producers to retreat.

US crude oil output hit a 44-year peak of 9.6m barrels a day in April then began to decline. By summer next year it will have fallen by a tenth, the US Energy Information Administration forecasts.

It took months for US supplies to finally reverse in response to the tumble in oil prices that started in mid-2014. If prices creep higher again, any rebound in shale production will come with a similar lag, analysts say.

The US shale energy industry has made a stunning contribution to the oil market glut. Of the nearly 5m b/d in net global crude oil supply added between 2009 and 2014, 3.3m b/d was from the US, EIA data show. World supply stood last year at 93m b/d. Most new US supply flowed from states such as North Dakota and Texas, where drillers used improved drilling techniques to extract oil from previously difficult shale rocks.

After the rapid fall in the price of crude from mid-2014, analysts were at first surprised that US shale operators did not immediately capitulate by cutting production. Output continued to climb towards its peak in April this year even though drillers began to stop some rigs the previous October, according to Baker Hughes, the oilfield services com-

pany. There were several reasons for this state of affairs. Some investors betting on an oil price rebound were content to extend capital to beleaguered drillers on advantageous terms. Some shale producers had also managed to hedge their revenues to protect against declines in revenues caused by a fall in the price of crude.

Frackers also extracted more oil out of each well they drilled, with innovations including the funneling of more sand into drilling holes to prop open rocks. In North Dakota's Bakken shale region, new oil production per rig has risen by 43 per cent in the past year, according to EIA.

James Volker, chief executive of Whiting Petroleum, a leading Bakken producer, told a conference in early October: "So while we're slamming on the brakes here and while we've reduced our drilling rig count from 24 in the middle of last year to eight today, we were nevertheless able to set production records."

The fate of shale, with its promise of self-sufficiency, lies in hands of foreigners

Finally, shale companies' costs have declined between 20-30 per cent as they negotiate better terms with contractors keen to keep their equipment in use.

This has kept some operators afloat despite lower oil prices. However, the longer the slump persists, the tougher life has become for operators. While wells in the best areas can break even with oil at \$30 a barrel, some marginal



Jack, crack and frack in California

ones require prices of \$70 or higher. As a result, producers are turning away from marginal areas and leaving some drilled wells uncompleted for now. Producers under financial pressure have in some cases decided to reduce capital spending. As a result, shale production is now falling.

The next victims of lower prices in North America will be projects with longer investment timescales than shale, such as those in the Gulf of Mexico and the oil sands of Canada. Billions of dollars of cutbacks in these areas will be felt later in the decade, analysts say.

Should there be a sudden rise in the price of crude, the shale industry could once again be spurred into increasing supplies. The question for oil analysts is how quickly this might happen.

In the short term the backlog of drilled but uncompleted wells — known as Ducs — could be brought into service fairly quickly. However, it takes months to drill new wells. Given this time lag and the unpredictability of supply disruptions across the world, a smooth return of shale output is not guaranteed.

Much will depend on the path of supply elsewhere, including Iran as it returns to the market after reaching a deal on its nuclear programme with western powers. Also uncertain is whether the Opec cartel will sustain its current policy of supplying unlimited volumes to put pressure on higher-cost producers such as US shale.

In spite of offering a path to energy self-sufficiency, the fate of the shale sector lies in the hands of foreign rivals.

## Coal left unloved as natural gas and fossil-free drives bite

## Solid fuel

Patchy demand and climate concerns crimp miners' fortunes, says *James Wilson*

The bad news for the coal industry has seemed relentless throughout 2015.

While campaigners against fossil fuels have kept up a steady drumbeat of calls to disinvest from companies producing coal, prices and share values of producers have continued to head south. The year may end with more moves against coal and other fossil fuels at global climate change talks next month in Paris.

Thermal coal prices from Australia, a widely used global benchmark, are down about 60 per cent from 2011. In the US, some well-known coal miners including Walter Energy and Alpha Natural Resources have entered bankruptcy, unable to cope with the price drop.

Not all miners of this abundant but increasingly unloved fuel are ready to throw in the towel. But all are having to adapt to wrenching change in the shape and importance of a global industry as some key markets enter what seems inexorable decline.

Consider the US, where the latest figures from the Energy Information Administration show coal production at the lowest level since at least 2009: output in the three months to the end of June was 14 per cent lower than in the same period last year.

Consumption is declining as the power sector turns to cheap natural gas, while more coal-fired power plants are expected to close in response to tougher emissions rules.

In April, the US generated more of its electricity from gas than from coal for the first time.

By 2019, US coal demand will be back to levels last seen in the early 1980s, according to the International Energy Agency. US coal exports are also at their lowest level in five years, while the average export price is down from \$150 per ton in 2011 to \$80.

Given such forecasts, it is easy to understand the gloom over US miners. Shares in Peabody Energy, the largest US coal miner, are down 97 per cent over the past five years.

In China, which the Paris-based International Energy Agency calls "the centre of the coal world", coal use is also changing fast. The country accounted for more than half of global coal demand in 2013. But China's demand is slowing as the economy cools and switches to less energy intensive forms of growth.

China is also waking up to environmental concerns over air pollution. China's use of coal was "essentially flat in 2014", according to the US EIA. Its data suggest imports are down 30 per cent so far in 2015 compared with last year.

Yet there are other areas of the world where coal use is expected to grow quickly. Focusing last month on Southeast Asia, the IEA said coal demand would expand at the fastest rate among all energy sources over the next 25 years, overtaking oil in the region's energy mix. Contrary to the trend in other parts of

the world, coal's share in power generation in the fast-growing region is expected to increase — from less than one-third today to about 50 per cent over the next quarter century.

India, the world's second-largest coal importer, is expected to see further strong growth in coal demand and an overall shift in coal use from the Atlantic to the Pacific basin is well entrenched.

"For many countries the energy choice for years to come will be coal," says Benjamin Sporton, chief executive of the World Coal Association.

For supporters of coal, this implies a greater need for technology that enables the fuel to be used with less environmental cost — from more efficient power stations to carbon capture and storage techniques.

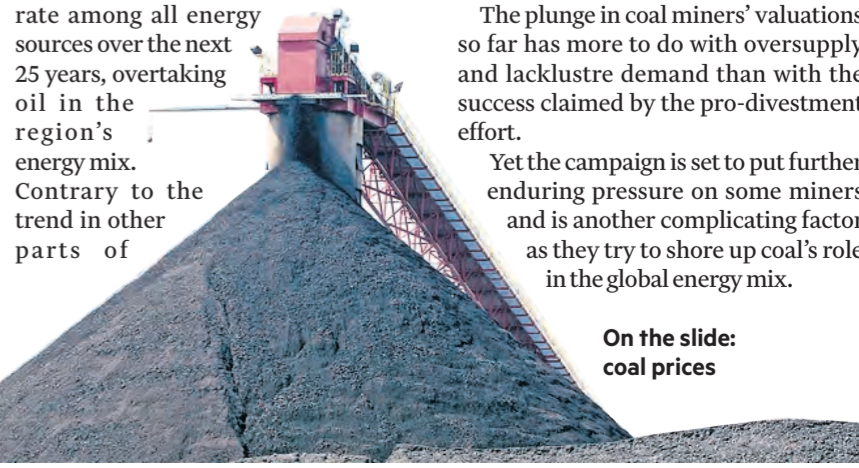
Yet other voices would rather put more pressure on the coal industry at a time of financial distress to curb output.

Divestment campaigners claim success in prompting a host of investment funds to agree to reduce or end investments in fossil fuels, although many of the commitments made will only affect "pure play" coal miners and not the larger diversified miners, where a smaller percentage of profits stems from coal.

The plunge in coal miners' valuations so far has more to do with oversupply and lacklustre demand than with the success claimed by the pro-divestment effort.

Yet the campaign is set to put further enduring pressure on some miners and is another complicating factor as they try to shore up coal's role in the global energy mix.

On the slide: coal prices





## Energy

## China's slowdown casts shadow over oil states

## Global demand

Slower growth in the world's largest energy consumer is hurting other countries, writes *Lucy Hornby*

"You have made miracles happen," China's former energy tsar Zhou Yongkang told Chinese oil workers in 1999. They had just finished work on an oil pipeline in Sudan at a time when the idea of crude oil costing over \$100 a barrel seemed unbelievable.

Viewed from the other side of the commodities boom, the miracle seems more like a mirage. Oil prices are back below \$50 a barrel and global investment in resources is falling as expectations for Chinese growth cool. Mr Zhou, who rose to head China's security services, is now in jail for corruption. Violence in Sudan has cut the flow of oil that his teams worked so hard to develop.

Still, Mr Zhou was right in many respects. He was one of the few to anticipate that China's hunger for resources would require a global footprint. China is now the world's largest crude importer and its invest-

ment decisions affect every continent.

China's hunger for oil, steel and chemicals was just roaring to life at the beginning of this century.

Its buying spree extended not just to physical barrels but to oilfields and metals mines, as Chinese policymakers led by Mr Zhou sought energy security and a place to invest a growing pile of foreign exchange reserves. China's willingness to pay above market rates helped inflate asset prices and led to rapid growth of investment and receipts in countries rich in oil and other commodities.

Now, a sea change in the Asian giant's willingness to spend overseas is rippling out to the countries that benefited the most from the surge in Chinese demand and investment over the decade-long commodities boom.

From Angola to Australia, from Venezuela to Zambia, growth rates are slowing as a result of lower prices for resource exports and stalling foreign investment.

Lin Boqiang, dean of the China Institute for Studies in Energy Policy at Xiamen University, says: "We used to buy a lot, but now we have reduced purchases. Therefore it will influence the equation of demand and supply in a huge way."

China's official figures show GDP

growth sliding to 6.9 per cent in the third quarter, the slowest quarterly growth rate since the first quarter of 2009. This slower growth is prompting multinationals to scale back investments.

A year ago, Chinese state oil group Sinopec ordered a wide-ranging audit of its overseas assets to see which fields were still profitable after an expensive buying spree during the years when Mr Zhou was one of China's most powerful men, sources told the FT. The audit showed Sinopec spent billions on under-producing fields in Angola.

Africa is taking a particular hit as the boom turns into bust. Governments that found common cause with China during the boom times are now seeing foreign direct investment plummet.

Angola, China's second-largest crude supplier, has had to reduce its budget for the year by about \$15bn. Nigeria, Africa's largest oil producer, is cutting back on infrastructure spending. Both countries are struggling with sharply weaker currencies. "They have really got the squeeze with lower revenues, not necessarily volumes, because of the price collapse," says David Humphrey at Standard Bank.

Less revenue from oil and mining exports means African governments are

also slowing the pace of tenders for new road and power projects. These were often funded by loans from Chinese banks and built by Chinese construction companies. But now, with lower prices on the horizon, African governments are reluctant to sign up to new commitments. "Everything is 10 times slower," said one African sales manager for a multinational equipment maker.

Back at home, the oil companies who brought Chinese largesse to far-off continents are struggling themselves.

Cnoc has been the most aggressive of China's three national oil champions in making plans to cut spending, but rivals Sinopec and China National Petroleum Corp are also easing back on foreign and domestic projects while being careful to maintain a public commitment to high-profile projects abroad.

"Those who invest in commodities are also producers, and the downward price hurts their finances," says Prof Lin, of Xiamen university. "Short term, the pace of investment will slow, but the ongoing projects will continue."

However, despite the doom and gloom, Chinese demand for oil remains high. Crude imports in the year to October rose by nearly 9 per cent.

*Additional reporting by Owen Guo*

China's willingness to pay above market rates helped inflate asset prices

## Russians tax brains over oil's contribution to state coffers

**Kremlin conundrum** Operators now face tougher demands from finance ministry, says *Jack Farchy*

Until a month ago, the Russian oil industry was getting along fine.

Despite western sanctions against them, Russian oil companies were producing 10.7m barrels of oil a day, a post-Soviet record.

And, compared with many counterparts elsewhere in the world, they were relatively unaffected by the 50 per cent collapse in world oil prices. Thanks to the sharp fall in the rouble, and a tax system on the oil sector that sees the government take a higher share of profits as prices rise, cash flows for Russian producers remained strong.

"We expect the Russian majors to generate the highest free cash flow yields globally," said Goldman Sachs in an August report, advising clients to invest in the sector.

Then the government threw a spanner in the works.

Faced with a sharp fall in its own revenues and pressure to preserve spending on the Kremlin's military adventures abroad as well as on social benefits, the Russian government turned its focus to the oil industry. In September, the finance ministry proposed to raise the tax take from the sector by 600bn roubles, or nearly \$10bn, a year.

President Vladimir Putin endorsed the move, instructing the government "to work on channelling to the budget additional revenues of export companies, which they received thanks to the rouble devaluation".

The final version of the budget – submitted to the Russian parliament in late October – was significantly watered down after lobbying from the oil industry. But the message was clear: in tough times, the oil industry should expect the government to come knocking.

"This ad hoc approach to tax collection removes the best argument for investing in the Russian oil sector: the cash flow resilience to oil price declines," say Alex Fak and Valery Nestorov, analysts at Sberbank CIB.

Other analysts – and many government officials – agree. Alexei Ulyukayev, the economy minister, recently warned an investment forum that the new tax would cause companies to cut investment at Soviet-era oilfields in west Siberia and the Volga region, which account for the bulk of government tax revenues from the sector. "Do we want budget revenues this year alone or do we want budget revenues for the coming years as well?" he asked.

Igor Sechin, chief executive of state-controlled Rosneft, Russia's largest oil company, predicted the new measure would lead to a drop in production of 25-30m tonnes of annual production – equivalent to 550,000 barrels a day or about 5 per cent of Russia's total – within three years.

The compromise position agreed by the finance ministry envisages an additional 200bn roubles in taxes from the oil sector next year rather than the 600bn initially proposed.



Vladimir Putin in discussions over next year's budget  
*Sasha Mordovets/Getty Images*

The additional tax will be imposed by maintaining export duties at 42 per cent next year. It had previously planned to lower them to 36 per cent in 2016 under the so-called "tax manoeuvre" designed to shift the focus of taxation of the sector from levies on exports to production in general.

The direct impact of the tax change is relatively minor. Alexander Nazarov, an analyst at Gazprombank, estimates that the move will cut bitida across the sector by about 5 per cent on average. But he warns the fear of further tax changes will hurt investment. "The problem is the manner it was done, there is a huge potential risk that this trick can be done on an annual basis," he says.

The battles over tax come on top of other challenges. While Russian oil companies have been relatively insulated from the fall in oil prices thanks to the rouble decline, western sanctions in

response to Russia's actions in Ukraine have caused more pain.

As ageing assets in west Siberia are depleted, the Russian oil industry needs to develop new fields to prevent a sharp fall in production. Arctic work is now on hold, due in part to sanctions, and projects to tap Russia's enormous shale reserves have also been delayed.

Other investments are at risk from a squeeze on financing. Western capital markets have been almost entirely closed to Russia since the annexation of Crimea in March 2014. Faced with \$41bn of debt maturing between July 2015 and the end of next year, the sector is reviewing its investment plans.

Mr Sechin of Rosneft has told prime minister Dmitry Medvedev that Russia's oil champion would shift its focus to existing fields – a tacit admission that it would struggle to fulfil ambitious plans for new projects.

## How to bridge the rhetoric gap

## COMMENT

Nick Butler

In a month's time world leaders will gather in Paris and make solemn commitments to achieve radical reductions in carbon emissions over the next two decades.

What does that mean for existing energy businesses whose products generate those emissions? Are they entering their final phase as viable companies as the world slowly begins to decarbonise? Will the reserves they hold end up stranded and left unusable in the ground? Or will they dismiss the commitments as political rhetoric and carry on as normal?

Contrary to most of the noise from the campaign groups, there are now very few climate deniers left in the industry. Many will say that the science remains uncertain and provisional but most would say that the broad promises to be made in Paris are inadequate to meet the stated goals.

Almost none will claim that climate change is anything other than a real and serious risk and that precautionary action is necessary. Most, after all, are engineers and scientists who can read the evidence in detail.

Strategically most of the companies are playing for time. Decarbonisation on this view will be a very long term process, especially in the absence of a carbon price that is sufficient to change behaviour. In the meantime, which amounts to at least the next 40 years, oil, gas and coal will still be needed in increasing volumes.

The latest projections from the International Energy Agency suggest that in 2040, even on positive assumptions, the world will still depend on hydrocarbons for 74 per cent of its total energy needs. In those circumstances there is still much business to be done.

Assets will only be stranded by either high production costs, which make them uneconomic, or if development is ruled out by regulation – which is the case for the huge volumes of shale gas and tight oil that exist in France.

Almost every company has a few stranded assets in its portfolio. But in a sector where technology continues to reduce development costs, few believe that any significant proportion of their reserves base will be undeveloped.

That view is entirely accurate. But this strategic approach, while understandable, does sit uneasily with companies' statements of belief about climate change. To many, they appear to be walking and talking in different directions.

The rhetoric about stranded assets worries some investors. The companies themselves, while accustomed to being unpopular, will be concerned that the focus of climate lobbying will turn further against them.

Corporate executives are paid to have thick skins. But they also have families, and sustained attacks by a coalition that now ranges from the Pope and Hillary Clinton to activist and sometimes violent campaign groups are not fun.

What, then, can be done? Can anyone match the walk and the talk? The logic is that one or more will now differentiate themselves by adopting an approach that takes them, to coin a phrase, "beyond petroleum".

There is now sufficient progress on costs and technology to justify the creation of some large global renewables businesses centred on wind and solar. Solar in particular has seen dramatic reductions in costs in the past two years. There are also possibilities to create business opportunities out of improvements in efficiency and energy management. To that base can be added a strong research component focused on areas such as advanced materials and storage technology.

The companies have the advantage of steady cash flow from existing business and global market reach. If they lack the technology and the specialist research capabilities, they have the capital to buy them in.

So, rather than waiting for politicians to define the future, the companies will take the initiative and define it for themselves. So far the climate change debate has focused overwhelmingly on public policy. Now the moment seems right for the private sector to take up the reins.

Such a transition would not satisfy the campaigners, or produce an instant transformation of the energy market. But it could demonstrate – again – that when faced with apparently insurmountable challenges such as war or expropriation, the energy business survives and thrives through adaptation.

*Nick Butler is visiting professor and chair of The Policy Institute at Kings College London*

Companies, while accustomed to being unpopular, will be concerned that the focus of climate lobbying will turn further against them

## Battery storage is set to transform renewables industry

## Power

Solar and wind systems are often very reliant on the grid, writes *Clive Cookson*

About half of the 50 homes in the rural Bavarian village of Moosham have a solar panel on the roof. As in many other communities in the photovoltaic belt of south Germany, the PV panels generate more power when the sun is shining than can be consumed locally, while at other times residents have to draw in electricity from the grid.

Indeed the local grid transformer in Moosham, which handles the imbalance between intermittent PV generation and fluctuating demand for electricity, is operating at its limit – blocking further development of solar systems in the village.

Moosham exemplifies a global problem as the world seeks to make the most of renewable energy sources: how to

convert the intermittent and often unpredictable output of solar and wind generators into a reliable and affordable supply for consumers.

Part of the solution will involve managing demand to minimise electricity use when supply is scarce. But the largest contribution is likely to come from storing energy in batteries when supply is plentiful – when the sun is shining and wind is blowing – and releasing it when needed.

Moosham is a test bed for community-based energy storage. Its "Energy Neighbor" project, developed by the Technical University of Munich's EEBatt programme in collaboration with battery manufacturer Varta and with funding from the Bavarian government, is about to go online.

The eight-tonne Energy Neighbor, containing 192 lithium-ion battery cells, has 250 kilowatts of electrical power and 200 kilowatt-hours of storage capacity. "In our field test we intend to gather insight from actual operation," says Andreas Jossen, project leader.

As a community scheme, Moosham occupies the middle ground between battery storage for individual households and businesses, exemplified by the Powerwall produced by Tesla, and large grid-based systems installed by utility companies, which range in output from 100kW up to 100MW.

Lux Research estimates the installed base of grid storage in October 2015 to include 841 projects worldwide, with a total of 1,788MW in power – equivalent to a large nuclear station – and 3,460MWh in stored energy. Annual growth rates since 2011 have been 33 per cent in power and 20 per cent in energy.

"Although there is still one quarter left in the 2015 calendar year, it has already been a monumental year for energy storage," says Dean Frankel, analyst at Lux Research.

Complementary research by Frost & Sullivan values the global market for utility-scale, grid-connected storage at \$460m in 2014 and estimates that it will reach \$8.5bn in 2024. "Battery storage has the ability to import flexibility to the

grid in a variety of applications," says Ross Bruton, analyst at Frost & Sullivan.

The home storage market is growing particularly fast, says Lux Research, with nearly 14,000 battery units installed in the first nine months of 2015 – more than double the annual number of residential units deployed in 2014. Tesla will begin to ship its Powerwall before the end of this year, and Lux expects Tesla to overtake all other residential storage suppliers, with 29,000 home units to be installed during 2016.

Australia will be one of the biggest markets for battery storage, according to the country's Climate Council, due to its high cost of electricity and the large number of households installing solar panels. It expects half of all Australian homes to adopt PV systems with battery storage, on the basis of battery systems costing A\$10,000 each, with a payback of 10 years. That could result in the market eventually growing to A\$24bn, says the Climate Council, an independent non-profit organisation.

Lithium-ion batteries dominate the

market today and are likely to remain dominant for the next few years, as the electric vehicle and consumer electronics markets help to propel their development and cut their costs.

But analysts also see niches for competing technologies such as molten salt, lead-acid and flow batteries, as well as supercapacitors and flywheels.

Meanwhile Sara Bell, chief executive of Tempus Energy, an innovative UK electricity supplier, points out that flexible demand management can also help to accommodate fluctuations in supply.

An example is a seafood processing plant in Scotland. It uses cheap electricity, when the local wind generators are in action, to overchill its freezers. This builds up a cold reserve for release when the wind drops.

There is a lot of scope for using "innate thermal storage" in this way in both heating and cooling applications, Ms Bell says. "It is sensible first to make the most cost-effective changes by managing demand and then move to battery storage."

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## Energy

# Saudi role as 'central banker' for oil is eroded

**Swing producers**  
Opec's reduced ability to cushion shocks to supply is causing concern, says *Anjli Raval*

For close to a year, Saudi Arabia and its Opec peers have maintained a stance of deploying spare oil production capacity to hobble outside rivals. Rather than pursue short-term revenues through maintaining the price of crude, the cartel embarked upon a strategy of protecting long-term market share last November.

Since then, the Kingdom has raised production to as high as 10.6m barrels a day, compared with an average of 9.7m b/d in 2014, while its Gulf allies are also running at full pelt.

Iraq is pumping at a record and Libya is back above the 500,000 b/d mark. Additional Iranian barrels loom on the horizon.

Collectively Opec is producing 30.6m b/d, according to the cartel's latest figures, well above its 30m b/d target. As market observers assess Opec's role in

keeping the market in a state of persistent oversupply, they are also putting a spotlight on how this extra output of crude is compromising the world's spare production capacity. The US government defines "spare capacity" as the volume of production that be brought on within 30 days and sustained for at least 90 days.

Saudi Arabia, Opec's largest producer and the world's biggest exporter, has historically been the only country with significant flexibility in its systems to ramp up and draw down output depending on market needs. By acting as the world's safety cushion in helping to rebalance the market during sudden disruptions in global production, the country has regularly wielded this spare capacity for influence on the world stage and has helped set oil prices.

But by drilling at high rates in order to export more and meet growing domestic needs, oil analysts say Saudi Arabia now has a limited capacity to increase production if there is a sudden shortfall elsewhere. In the absence of the Kingdom, there are few alternatives, which could leave the market vulnerable to a price shock, analysts say.

"Current spare capacity is far lower than the 2.1m b/d . . . the Kingdom held



Central role: Saudi oil minister Ali al-Naimi at Opec meeting in June — Reuters

in 2009, when the oil market last demonstrated a significant imbalance in supply and demand," says Nadia Martin, senior analyst at Rystad Energy.

Saudi Arabia traditionally kept in the region of 2m b/d on hand for market management. Rystad has said this is now as low as 1.1m b/d. Should global output fall as operators cut future investment in high-cost projects and Saudi Arabia has more limited capacity to ramp up output to meet the market needs, who takes on this role instead?

Some analysts, looking at today's market glut and seeing a new world order of high supplies and low prices for a some considerable time, are not so concerned.

With Russia's limited capabilities, US shale could stand as the new swing provider. Goldman Sachs says shale turnarounds could take only 14 days while the Saudis themselves have noted shale's flexibility. Even if the US shale does not replace Saudi Arabia completely in this role, it acts as a "shock absorber for the global oil market," says Spencer Dale, BP's chief economist.

Others, though, believe operators are storing up trouble. "The flexibility of shale seems to be believed by everyone with the important exception of the

shale oil producers themselves. Shale cannot balance the global market quickly in response to a supply or demand shock," says Paul Horsnell, head of commodities research at Standard Chartered. He argues hundreds of independent US producers that have individual financing needs and drilling capabilities may not be able to let more oil flow when it is most needed.

Seth Kleinman, analyst at Citigroup, warns that the world has been left with "a very small buffer of spare capacity at a time when geopolitical risks to oil are running exceptionally high from Syria to Iraq to Russia and Venezuela".

"Bloated" inventories, he says, may be part of the new normal as they are the buffer the world will need. This also means that improving means to access emergency supplies of oil is essential.

"Rather than the US looking to sell oil from its SPR [Strategic Petroleum Reserve], it should be figuring out how to ensure it is prepared and accessible for when — not if — it will be needed," adds Mr Kleinman.

What is clear is that the longer Saudi Arabia sticks with its current strategy, the more it risks forfeiting its status as "central banker" of oil, despite being the most powerful low-cost producer.

## Tehran prepares to open up to western suitors

Iran

A deal to end sanctions has provoked dealmaking interest, reports *Anjli Raval*

It is customary in Iran to refuse an offer several times before agreeing to take it, whether it be an invitation to tea or a business deal. Foreign energy companies are gearing up to play the same game of manners during negotiations over the terms of their return to the country in a post-sanctions era.

This month, Iran is expected to outline the terms of new oil contracts that will allow foreign companies to take stakes in one of the last cheap and accessible oil and gas provinces in the world.

Mehdi Hosseini, the chief architect of Iran's new oil contracts, says the Islamic Republic will welcome feedback from international oil companies on these contracts, after which further adjustments could be made. "Nothing is perfect," he says.

One European oil executive counsels patience: "It seems that the announcement is not going to be as definitive as we had hoped. More discussions will be had and more changes will come to these contracts."

Executives of foreign oil companies, ranging from Italy's Eni and France's Total to Japan's Mitsubishi and Russia's Lukoil, were in Tehran in mid-October to rub shoulders with Iranian officials at the first large oil and gas conference since July's deal with world powers, aimed at limiting Iran's nuclear development and removing sanctions against the country.

Leaders of some of the world's biggest oil companies believe the prize of winning business in Iran is worth the effort, even as \$50 a barrel oil forces them to curb investment elsewhere.

European and Asian players stole a march on their American rivals at the conference by delivering pitches about their companies' prowess. Although

'Big European companies say they have talked to their banks and they are ready to work with us'

international sanctions remain in place, European oil majors have been able to speak to their Iranian counterparts and give feedback on draft contracts while the US has stricter laws preventing them from doing so.

Bijan Namdar Zanganeh, Iran's oil minister, has a vision of his country returning to export and production levels that existed before the imposition of sanctions by overhauling a sector starved of investment. Foreign oil companies are being invited to become partners across a range of exploration, appraisal, development and production activities. Mr Zanganeh says Iran could increase production by 500,000 barrels a day immediately after the lifting of sanctions and within seven months reach its pre-sanctions level of at least 3.4m b/d. Oil analysts, though, say



Making adjustments: an Iranian technician checks equipment

these targets are hugely ambitious. Iran aims eventually to increase oil production to more than 5m b/d and gas to 1.4bn cubic meters a day.

Rainer Seele, chairman and chief executive of OMV, which is looking to invest in oil and gas infrastructure, said "it will be a delicate undertaking" for the country. He adds that Iran will need vast sums of foreign funding and technological expertise to consistently produce at these levels.

Rokneddin Javadi, head of the National Iranian Oil Company and deputy oil minister, says the Islamic Republic needs \$100bn over the next five years to develop the upstream oil sector alone. The investment, he says, would be well worth the reward for international oil majors. Iran's cost of production is low, at between \$5-10 a barrel for offshore production and "even lower" for onshore, he adds.

Mahdi Kazemzadeh at Afraz Advisers, an energy consultancy, argues that Iran's political stability compared with neighbouring countries could prove attractive to big energy companies.

Iran's hydrocarbon reserves are owned by four state companies and their subsidiaries, which are controlled by the oil ministry. President Hassan Rouhani's government has sought to privatise some segments of the industry through asset sales and the transfer of shares.

Companies such as Eni and Total are keen to tout their ability to provide financing to Iran, as well as offer access to markets, technical know-how and competence at managing costs efficiently, particularly in a low oil price environment. Iran has identified nearly 50 projects available for licensing.

It is not just foreign oil companies that are on tenterhooks over the proposed terms of trade. Domestic players say they are waiting anxiously for the terms that might dictate their future.

Hossein Abbasi, a domestic services contractor, says: "Big European companies have already spoken with us saying they have talked to their banks and they are ready to work with us. Not only are they ready, we are ready too."

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