Energy

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Balance of power shifts in changing world of oil

Guy Chazan finds views of political landscape are rapidly altering as the US moves towards self-sufficiency and China's crude demand rises

Golden states: oil wells in California – the US is now the fastest growing oil producer in the world Getty

A bridge is being built between the Far East and the Middle East that could change the world of oil.

It links two countries that are not natural bedfellows – China and Iraq. The ties between them have been quietly strengthening in recent years, as state-owned Chinese energy companies move in to rehabilitate the giant oilfields in the south of Iraq, such as Rumaila and Halfaya.

China is also importing more of the crude those fields produce. According to the International Energy Agency, the western nations' oil watchdog, a quarter of Iraqi oil, about 2m barrels a day, will be heading for China by 2035.

"A new trade axis is being formed between Baghdad and Beijing," says Fatih Birol, the IEA's chief economist.

This relationship is part of a shift that is tipping the balance of power in the energy world. As its oil demand grows and its own reserves deplete, China is becoming increasingly dependent on crude imports from the Middle East. That is coinciding with an equally historic process in the western hemisphere – North America's gradual transition towards self-sufficiency in energy and its waning reliance on imported oil.

For decades, one of the US's key strategic imperatives has been to protect the vital sea lanes linking oil suppliers in the Middle East to the rest of the world.

The policy found expression in the Carter Doctrine of 1980, which stated that the US would use military force if necessary to defend its national interests in the Gulf.

But the US is changing. Its exhausting wars in Afghanistan and Iraq, the 2008 financial crash and the resulting recession, and alarm about fiscal deficits, have engendered a mood of introspection. The reduced public appetite for an aggressive foreign policy is prompting some to even speak of a new isolationism.

This has coincided with the shale revolution, a development which, in the view of some observers, is only reinforcing the disengagement of the US from the outside world.

The mass rollout of hydraulic fracturing and horizontal drilling to unlock vast reserves of shale gas and tight oil that was once considered uneconomic has turned the gas deficit in the US into a surplus and heralded a homegrown industrial renaissance. It will have a huge effect on the way the US sees its role in the world.

Robert McNally, head of the Rapidan Group energy consultancy and a former White House policy official, says: "The prospect of energy self-sufficiency is going to reinforce calls to reduce the expenditure of US blood and treasure to protect the Middle East and the sea lanes that link it to its main consuming markets."

The future results of reduced import dependency are key in this. The shale boom has mainly affected gas production, but the effect it is now having on US oil output is equally staggering. The United States is now the fastest-growing oil and gas producing country in the world: during the past five years it has added 2.59m barrels a day to total supply, an average growth rate of 500,000 b/d per year, according to Citigroup.

> 'A new trade axis is being formed between Baghdad and Beijing'
> **Fatih Birol, IEA chief economist**

The bank also says growth in deepwater projects in places such as the Gulf of Mexico and a surge in shale liquids production will drive a 6.6m b/d increase in US oil output by 2020. That, combined with rising production from Canadian oil sands and tight oil, and an expected resurgence in Mexico's oil industry, could make North America self-sufficient in energy in a couple of decades.

US output has increased at a time

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Argentina's Dead Cow could revive the economy – if allowed

Shale oil & gas

Investors will wait and see in a market full of uncertainty, says *Jude Webber*

Flat and parched, with scrubby vegetation, red earth and little else, the world's hottest energy prospect is not much to look at.

But if Argentina's state company YPF has its way, within a few years a vast area beyond the western city of Neuquén will be studded with rigs and wells, pumping shale oil and gas from the Vaca Muerta or "Dead Cow" rock formation round the clock.

The company, expropriated six months ago from Repsol of Spain, has as CEO Miguel Galuccio, a savvy oilman, and a smart plan to ramp up production of the world's third-biggest shale reserves.

Vaca Muerta is considered as exciting as Eagle Ford, Haynesville, Barnett and Marcellus in the US and far more advanced than China's vast prospects.

But YPF and others will need to spend billions to extract oil and gas from the formation and many still consider Argentina risky a decade after its default on nearly $100bn in debt.

Instead of a shale rush, investors are biding their time – and those already present are executing, but not expanding, plans as they wait for domestic gas prices and policy conditions to become as attractive as Argentina's prospects.

"At the moment, shale in Argentina is like an aeroplane on the runway. The turbines are turning, but the aeroplane has got the brake on," says one senior industry figure who asked not to be named.

With some 774tr cubic feet of gas and 741m barrels of oil, according to the US Energy Information Administration, the shale is not only big enough to turn it into a hydrocarbons producer but also an exporter.

But state regulation of the sector is tightening, low gas prices are a longstanding disincentive to investment, foreign exchange restrictions make it hard to repatriate profits, a government clampdown on imports delays the arrival of equipment, there is political uncertainty and inflation around 24 per cent.

Moreover the expropriation of YPF without compensation in May and the lingering threat of legal action from Repsol mean Argentina's credentials have taken a belting.

One oil executive eyeing shale says: "I haven't taken a cent out of Argentina in 10 years, everything I've made I've reinvested. But we aren't reinvesting any more because we aren't making any money."

Besides YPF, majors including ExxonMobil, Apache, Chevron, EOG, Shell, Total and juniors such as Americas Petrogas and Madalena Ventures have targeted Vaca Muerta.

YPF has drilled some 60 wells and others around 15. "But there are a few different factors stopping people jumping in with both feet," notes the industry figure.

They include import hurdles. The rigs are imported, as is the proppant – a kind of special sand – used to blast the underground rocks with water and chemicals in hydraulic fracturing, or "fracking".

Proppants are currently imported from Brazil and the US and YPF is also looking at China.

Some of the logistical hurdles have been tackled. YPF has built a giant reservoir to fill with water from a nearby river to supply the 1,800 cubic metres used for every frack stage – and there can at least 10 per well. But the shale revolution will also need new roads and an army of trucks and drivers.

> Vaca Muerta would balance the country's energy deficit and stop the need for imports

In addition, companies face a Catch 22. YPF has gained a valuable headstart on securing rigs. Later entrants will face delays unless they plan ahead, but forward planning can be tough in Argentina.

YPF is optimistic that the sheer importance of shale for Argentina, which cannot continue spending nearly as much as its annual trade surplus on energy imports, will be a catalyst for the government to provide the incentives to calm investor qualms.

The company is negotiating a partnership with Chevron, and hopes the US major will sign on the dotted line by the year-end to allow it to launch its first intensive shale "cluster".

Within YPF, the excitement at the opportunity is palpable and the company exudes a can-do professionalism, despite some market doubts about how easily it will raise financing.

It is budgeting $1.5bn to launch a 132-well pilot shale oil pilot in the Loma La Lata and Loma La Campana fields and 16 shale gas wells at the nearby El Orejano field next year, to test well spacing and other technical factors.

According to an investor roadshow, YPF then wants to ramp up to "factory-mode" from 2014-17, investing some $12bn – half from Chevron or partners – to drill 2,000 shale oil wells and about $1bn for more than 100 shale gas wells.

"Just developing 15 per cent of Vaca Muerta would balance the country's energy deficit and stop the need for imports," says Juan Garoby, head of YPF's unconventionals business.

The area's emptiness today is a boon, limiting the impact on the country's thriving fruit and wine industries. But environmental opposition is growing and one leftist politician has submitted a bill to outlaw fracking nationwide.

Can Vaca Muerta fail? Argentina will find it hard to look a gift cow in the mouth, but one fund manager, whose stake in one company has fallen 60 per cent since February, says the government has "shot itself in the foot".

Oil executives understand the risk reward trade-off. But as Bernard Weinstein of the Maguire Energy Institute at Southern Methodist University's Cox School of Business in Texas notes: "No company is going to bet the farm on Argentina."

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Petrobras must show it knows how to turn the ship around

Brazil Oil company has ambitious plans handicapped by government, says *Joe Leahy*

When Petrobras celebrated its 59th anniversary in October, the Brazilian national oil company hired the local singer known simply as Lenine to pluck out a catchy jingle to mark the occasion.

The result is an acoustic guitar number whose lyrics associate nationalism with the strivings of the state-owned petroleum giant. "We are Brazilians . . . let's show how it's done, people who dream and make it happen, we are Petrobras." Lenine croons.

With nearly six decades of history, Petrobras has plenty to crow about – production has risen from 2,700 barrels per day in its original Recôncavo Baiano field in 1953 to around 1,000 times that number in terms of oil and equivalent today in Brazil and abroad.

In the past 20 years reserves have increased by 164 per cent and Brazil has become a leader in deepwater exploration, one of the most difficult frontiers in the industry.

Dilma Rousseff, Brazilian president, has appointed Petrobras veteran Maria das Graças Foster as the first woman to run the group.

But Petrobras's proud history highlights the rough patch it is going through today. Thanks partly to government interference, the company's financial performance and share price are taking a battering.

In spite of discovering in the past three years one of the biggest fields to have been found in the world in recent decades – the giant deepwater "pre-salt" reserves off the southeast coast – Petrobras stock has fallen from a high of $44 in 2009 to $22.10 at the end of October, underperforming the Bovespa index. In a report after the company released disappointing third-quarter results in October, Credit Suisse said: "There is not much to like or say: it will take time to turn the Petrobras ship around, and investors are paying dearly for it."

Net profit in the three months to end-September fell 12 per cent compared with a year earlier to $5.57bn, taking the total fall for the first nine months of the year to 52 per cent.

The third quarter result, however, was better than the three months to the end of June. The company reported its first quarterly loss in 13 years, citing the effect of adverse foreign exchange movements on its external debt. Brazil's currency, the real, has weakened significantly against the dollar this year.

"The 52 per cent reduction in net income . . . was due to the depreciation of the real, higher operating expenses (especially from the write-off of dry and economically unviable wells in the second quarter of 2012) and the increased share of imported oil products in sales volume," Petrobras said.

For investors, this last point is particularly vexing. In an effort to keep petrol prices low and curb inflation, the government is suppressing Petrobras' sale price ex-refinery.

This keeps petrol cheap at the pump for consumers but means that Petrobras runs a loss because it must import fuel at international prices.

The volume of imports has risen because of growing demand from the middle-classes and a strong economy.

Budget deal: Filling up at a Petrobras station in Rio AFP

An ethanol shortage which led the government to reduce the proportion in standard fuel exacerbated the trend towards imports.

"Imports moved up 7 per cent year-on-year in the first nine months to meet growing domestic demand, primarily for gasoline and diesel," Petrobras said.

During the third quarter, the government did allow Petrobras to increase the price of petrol by 7.83 per cent and diesel in two phases by a total of 9.94 per cent. Capacity utilisation in the company's refineries was highly efficient at 98 per cent.

Yet the improved prices, which were still below international levels, did little to lift profits or reduce net debt, which remained at about 2.5 times earnings before interest, taxation, depreciation and amortisation.

"We patiently await on the sidelines while management rightfully implements efficiency and cost optimisation programs," said Credit Suisse.

Indeed, waiting may be the name of the game as Petrobras slowly seeks to reinvent itself. The company has the largest corporate capital expenditure programme in the world. Between now and 2016, it is seeking to invest $236.5bn in 980 projects, many related to the pre-salt fields, an undertaking that would stretch any company.

The potential prize is enormous. Petrobras estimates the pre-salt area holds recoverable potential nearly equivalent to existing proved reserves of 15.7bn barrels of oil equivalent.

It has placed orders for 21 production platforms and 30 drilling rigs to be built by 2020 plus 49 oil tankers and hundreds of other vessels. Oil production is expected to climb from 2m barrels per day to 4.2m in 2020.

As always, the challenge will be in the execution.

Much of this production must be achieved using locally made equipment for which the manufacturing capacity does not yet exist and which is expected to cost much more than the foreign-made equivalent.

For Petrobras, the pressure is on. As Lenine says in his song, the time has come for the company to show the world how it is done.

Synthetic diesel heralds a new era for coal

Gasoline alternative

This fuel's time may have arrived, writes *Michael Kavanagh*

It was a major plank – as well as bottleneck – in Nazi Germany's war effort, and also formed part of apartheid South Africa's attempt to bypass an international oil embargo. But synthetic diesel could be coming to a fuel pump near you.

Altona Energy, the Australia-based company, is one of a number of companies arguing the case for relying on coal to supply liquid transport fuel as the world struggles to replace its diminishing reserves of exploitable oil stocks.

The Aim-traded junior has some way to go to see its ambitions achieved.

However, it has received early stage backing from Chinese state-controlled energy group Cnooc to develop plans for its coal-to-liquids project north of Adelaide in South Australia. The project, near other mining prospects in the state, aims to produce 30,000 barrels a day (b/d) of diesel alongside the coal-fired power supply to the grid by exploiting reserves in the Arckaringa basin.

Meanwhile, on the other side of the world, DKRW Advanced Fuels, based in Houston, is co-operating with Chinese energy group Sinopec on plans to exploit large coal reserves in the US state of Wyoming.

Although opposed by environmentalists on a number of grounds, the venture, supported by local politicians, aims to develop a coal gasification plant capable of producing 11,600 b/d of gasoline.

The plant is set to be built in Medicine Bow, in the appropriately named Carbon County in the Rocky Mountain state.

Backers of both ventures argue they can help tackle the reliance of consumers on imports of petroleum-derived transport fuels in a period of persistently high oil prices.

Both also argue carbon capture schemes can largely mitigate a key effect of coal-to-liquids production – its large carbon footprint.

While both these projects remain at the planning stage, energy hungry China is pressing ahead, however tentatively, with coal-to-liquids production as its state-controlled companies continue to compete in attempting to buy more of the world's oil reserves.

Shenhua, China's leading coal producer, has led the charge with the development of a coal-to-liquid plant, built in the city of Ordos in Inner Mongolia, which is capable of producing 20,000 b/d.

The venture, the largest so far outside South Africa, began retail distribution in September and has plans to widen sales of its synthetic fuels in the future.

But plans by the Chinese government to expand coal-to-liquids production have been held back in part because of concerns over the large water consumption required in coal liquefaction's chemical processes – estimated by some to be as much as eight gallons for each gallon produced.

Though synthetic fuels for both aviation and land transport have won increasing levels of approval from regulators across the world, South Africa remains the only large-scale producer of coal-derived liquid fuels.

Sasol, the Johannesburg-listed energy producer, has built upon its apartheid-era expertise in synthesising both fuel liquid fuels and chemical feedstock based on the Fischer-Tropsch process since the country's transition to majority rule.

Tariff protection and fuel levies to protect against downturns in imported crude oil were needed to allow Sasol to lead the development of a synthetic fuel industry that now supplies a third of South Africa's fuel requirements. Two plants at its Secunda site in Mpumalanga province have a production capacity of 160,000 b/d.

Sasol has signalled its intention to develop its production of domestic output of synthetic fuels still further, based in large part on South Africa's abundant coal reserves. It has also pursued joint ventures abroad in countries including India, Canada, China and Qatar – where natural gas is used instead of coal-derived synthetic gas to create liquid fuel.

If the development of coal-to-liquids production continues to be contentious – based both on its generation of carbon dioxide and heavy water requirements – economics at least could cause this generally shunned source of transport fuel to be looked at again.

Chris Lambert, executive chairman at Altona Energy, says his project enjoys strong political support in South Australia based on both narrow economic arguments and grounds of energy security.

> 'When oil was at $10-$15 a barrel, no one needed it [synthetic diesel]'

"With oil at $10-$15 a barrel, no one needed it," he says. But with oil trading at $90-$110 a barrel, Mr Lambert argues that diesel can be produced – including the costs of tax and carbon dioxide sequestration – and delivered to Adelaide for about 80 cents a litre. That compares with a prevailing retail price of $1.40.

Previous studies have suggested that coal-to-liquids projects being uneconomic unless the oil price remains above the level of $45-$50 a barrel, according to the American Association for the Advancement of Science. That level would increase further if the costs of carbon dioxide sequestration were included.

But Peter Fagiano, technical director at Altona, who has followed the development of the coal liquefaction market, says: "The technology has vastly improved from that which the Germans and South African originally based their operating systems on last century."

He argues that advances in technology together with improved methods of mitigating environmental effects – along with the persistence of high oil prices – could yet push this unfashionable fuel source to the fore.

Green agenda prompts pricing concerns

Low-carbon power

Bills set to rise as industry seeks to recoup capital costs, writes *Sylvia Pfeifer*

Revolutions come at a cost, never more so when the world's energy mix is at stake. Governments around the world, from China to Saudi Arabia, are engaged in a wholesale reform of their energy markets, formulating policies that will provide energy security and low-carbon forms of supply that are affordable.

Concerns are rising, however, that consumers will have to foot the bill for low-carbon power. Politicians are wrestling with whether advances in renewable technology can keep those bills down, or at least low enough for the increase to be balanced by meeting climate change targets.

The scale, and cost, of the transformation should not be underestimated. According to the International Energy Agency, the western nations' industry watchdog, global investment in the energy sector will need to reach $38tn between 2011 and 2035. Almost $17tn of this will be in the power sector, covering generation, transmission and distribution.

While renewables are forecast to make up 50 per cent of additional power output capacity by 2035, they will cost $5.9tn, against $3.9tn for conventional sources, Citi analysts said in a report in September.

"This reflects the extra capital costs required to build renewable plants, compared to conventional plants, though . . . there are no fuel costs, and only minimal operating and maintenance costs for the life of the renewable asset," the analysts said.

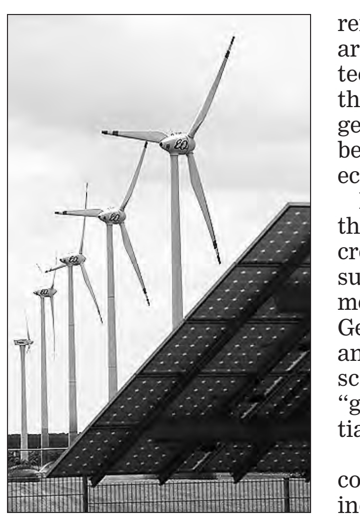
One of the most radical transformations is taking place in Germany, where the government has committed to phasing out nuclear power stations and switching to renewable energies within a decade. But the proliferation of subsidised wind and solar will mean a sharp increase in electricity prices next year.

Generous guaranteed prices for electricity from renewable sources have encouraged investors to build new capacity, to the extent that consumers will have to pay green energy generators €20.4bn in generous feed-in tariffs in 2013.

As a result, the country's grid operators announced last month that the mandatory surcharge on units of electricity would rise next year to a record 5.3 cents per kWh from 3.6 cents. For a typical household using 3500 kWh per year, this surcharge would rise from €125 to €185. The move is all the more contentious as many businesses are exempted, to protect their international competitiveness.

In the UK, where the government is introducing reforms to the electricity market to encourage £110bn of investment in low-carbon energy, environmental campaigners have criticised support for new nuclear power as a massive subsidy.

At the heart of the reforms is a system of long-term contracts that give power companies a guaranteed price for clean electricity in the hope this will reduce the investment risk for projects with high upfront capital costs, such as nuclear reactors or offshore wind farms.



Renewables: high price

Under these "contracts for difference", if wholesale power prices fall below a strike price set by the government, nuclear and renewable investors will be compensated. If prices rise above that level, generators will repay the difference to consumers.

How the public will accept government low-carbon agendas remains to be seen. Market experts stress renewable sources of power are getting cheaper as the technology improves and they are deployed on a bigger scale. There are also benefits of job creation and economic stimulus.

In the US, for example, the popular production tax credits have helped drive a surge in wind energy investment. In countries such as Germany, Spain, Portugal and Australia residential-scale solar has reached "grid parity" with residential electricity prices.

"The renewables sector is coming of age. There is an increased focus by governments to get the right balance between security of supply, the green agenda and stimulating economic growth," says Ben Warren, energy and environmental infrastructure leader at Ernst & Young.

"Onshore wind and solar [power] are cost-competitive with conventional energy in an increasingly large number of applications."

In Germany, for example, there is now so much renewable power available at certain times of day that it meets a significant part of demand. But the bigger this share grows, the more problematic it can be for utilities as they will be required to keep conventional sources of electricity generation, such as gas, operational as back-up.

"[They] will expect a capacity payment mechanism from regulators to compensate them for the low utilisation rates," says Jason Channell, alternative energy and cleantech analyst at Citi.

More renewables also means the energy infrastructure will have to change.

"There is now more of a focus on embedded generation, produced on site where you can control your own energy costs," says Mr Warren. "We also have a lot of incumbent infrastructure and traditional asset players. We will still need some form of centralised infrastructure to help provide back-up generation."

Most experts believe energy storage is key, and would take subsidies for renewables out of the equation. National psyches will also help determine whether higher bills are worth it if the electricity is from a low-carbon source.

Balance of power shifts in the fast-changing world of oil

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when domestic oil demand is in structural decline, so imports have been falling substantially. Indeed, the US is now a net exporter of oil products.

But as US dependence on imports declines, China's is rising. Already, more than half the oil consumed in the Asia-Pacific region is imported from the Middle East. That is exposing China more and more to the risk of potential disruptions in Gulf oil supplies. So far, with China "freeriding" on the US security role in the Gulf, it has not had to worry too much about the threat of such interference. But that might change.

"With almost all the oil that is going through the Strait of Hormuz heading for Asia, it means continuity of supply from there is not an issue for the US any more," says John Mitchell, an energy expert at UK think-tank Chatham House. "It is an Asian problem."

So if the US retreats from the role of guarantor of the sea lanes, who will replace it? Can China fill its shoes?

Most analysts believe it will be a long time before Chinese warships are patrolling the Strait of Hormuz. Beijing's military power – and ability to project it beyond its own borders – remains puny compared to that of the US. Its great geopolitical rival has 11 aircraft carriers, whereas China launched its first in September.

Some think the issue of energy security could become a bargaining chip in the broader US-China relationship. For example, says Mr Mitchell, in the event of some future Gulf crisis the US might agree to protect oil deliveries to Asia at the price of concessions from Beijing.

"The US could say to China – we'll look after your shipping lanes, but only on condition you behave yourself in the various territorial disputes involving American allies in east Asia, such as Taiwan, Japan and the Philippines," he says.

However, there are plenty of industry experts who reject the view that the US could retreat from its security role in the Gulf. For them the issue of reduced US dependence on crude imports is overplayed. What really matters is price.

"Even if our imports went to zero, that's not going to reduce our vulnerability to a price shock," says David Goldwyn, head of Goldwyn Global Strategies, a consultancy. Oil prices will remain volatile, he says, as long as there are global price benchmarks and no easy substitute for petrol as a transport fuel. To prevent that volatility, the US will need to stay engaged in the Middle East, defending the sea lanes and guarding crucial choke points such as the Strait of Hormuz.

"We're probably looking at a period of greater rather than less instability among oil-producing countries," he says. "While oil remains a strategic commodity, the US is going to be concerned with trying to redress potential supply disruptions."

He cites the events of the past two years as an example. US oil supply increased, exports of products rose and crude oil imports dropped. But prices still rose to painful levels for consumers, driven last year by the Libyan uprising and this year by the sanctions on Iran. "Despite the increase in US production, we still had . . . to use the Strategic Petroleum Reserve [US emergency oil stocks] to offset the loss of Libyan oil," says Mr Goldwyn.

> 'We're probably looking at a period of greater rather than less instability'

He says US engagement with other oil producers has historically not just been about procuring oil supplies but advancing broader national security interests. For example, in the Caspian Basin, the US seeks to promote the independence of littoral states such as Kazakhstan and Azerbaijan, even though it does not import any of their oil. Lower dependence on oil imports makes the US less vulnerable in the event of a conflict in the Gulf that could cut off the 35 per cent of ship-borne crude oil that passes through the Strait of Hormuz. But the idea that the US move to energy self-sufficiency will lead to a new isolationism has few takers among oil and US foreign policy analysts.

"From a security perspective – in a world of global terrorism and cyberwarfare – the borders of the US are effectively global anyway," says Ed Morse, head of commodities research at Citi.

Energy

Risk of conflict over resources in deep water

China The 'South Sea' could hold reserves of oil and gas to rival the largest deposits anywhere in the world, writes *Leslie Hook*

When Chinese admiral Zheng He sailed the oceans in the early 15th century, he found unexpected treasure in distant lands such as India, Iran, Indonesia and Somalia.

But he had no idea of the vast resources that lay closer to home, under the seabed itself, thousands of metres below his ships as they sailed out across the South China Sea at the beginning of each voyage.

Today some scientists estimate the South China Sea, which at 1.4m square miles is more than five times the area of France, is home to reserves of oil and gas that could rival the largest deposits anywhere in the world, although estimates vary widely.

Unlike Zheng He's time, when few ships ventured far out to sea, the area is now crossed by a third of world shipping routes, making it a strategic thoroughfare.

The sea has also become a critical diplomatic issue, particularly as China's economic growth, combined with rising energy needs, make it more assertive around its borders.

China lays claim to a huge area of water that stretches from the Singapore and Malacca Straits to the Strait of Taiwan: and Vietnam, the Philippines, Taiwan, Malaysia and Brunei have competing claims on overlapping areas.

In the past decades these differences have led to conflict – even war – and analysts believe there could be further hostilities over the South China Sea.

Exploration for oil and gas in the deeper parts of the waters, which cover a continental shelf, has so far been limited, leaving geologists divided over whether the seabed contains rich deposits that could intensify the diplomatic disputes.

David Thompson, head of upstream in Asia for Wood Mackenzie, the energy and resource consultancy, says: "One of the key question marks in the future of the oil business is, 'how big is the South China Sea?' At this point no one really knows."

Chinese estimates for potential resources in what it calls the South Sea are high: more than 40bn tonnes of oil equivalent in China's total offshore waters, according to estimates from the Ministry of Land and Resources, of which the lion's share is in the region.

Most of that is believed to be natural gas, and one Chinese estimate puts the Sea's gas reserves at 2,000tn cubic feet, according to the US Energy Information Administration. That would be enough to meet China's gas needs for more than 400 years based on 2011 consumption levels, although resources that are actually recoverable are likely to be lower than the total amount.

Offshore investment: Cnooc 981, the first deepwater drilling rig built in China, 200 miles southeast of Hong Kong AP

China is already the world's largest energy consumer and imports a growing share of its oil and gas, so the question of how much oil and gas is under the South China Sea is hardly an idle one.

Beijing is keen to make the country more self-sufficient in energy and to this end has encouraged domestic sources of power, including hydropower, nuclear energy, wind and solar. Analysts say this is part of the reason why Cnooc, China's biggest offshore oil company, is investing heavily in developing its capacity to drill the type of deepwater wells that will be require to exploit resources in the contested area.

Lin Boqiang, energy economist at Xiamen University, says: "China basically has no other choice because its resources are scarce, so in future China must head offshore. Once China gets started [in the deepwater South China Sea], exploration will really speed up."

In the past year, Cnooc has markedly stepped up its exploration efforts in the deepwater areas of the sea.

In May the state-owned company launched its first home-built deepwater drilling rig, the "Cnooc 981", which enables Cnooc to carry out independent in-house exploration, without renting foreign rigs.

Cnooc aims to produce 500m barrels of oil equivalent a day from the deepwater South China Sea by 2020, up from nothing today, and Zhong Hua, chief financial officer of the listed company, said the 981 rig had increased Cnooc's exploration abilities.

"Deepwater is a strategic target for our company, and it has great potential and future prospects," he told journalists during a quarterly earnings call on October 24.

Although China has not yet explored for oil and gas in contested waters – most of Cnooc's current wells are in shallow waters close to Hong Kong – Cnooc has become more aggressive with the locations of exploration blocks it puts up for auction to foreign oil companies.

In June, Cnooc put on offer nine blocks in the western South China Sea, an area also claimed by Vietnam, marking a departure from Cnooc's usual practice of offering up blocks in undisputed waters. The move sparked an angry protest from the foreign ministry in Hanoi, which said the blocks were within Vietnam's exclusive economic zone.

Such conflicts have been a huge deterrent for the global oil majors with the most experience in drilling deepwater wells.

Beijing has already successfully applied pressure to several international companies that drill offshore from Vietnam, near China's claimed waters, to abandon their exploration projects there.

Diplomatic disputes aside, the economics of extraction are also set to play a big role in the development of the disputed areas.

The South China Sea is full of deep canyons and ridges, making it difficult and expensive to build the pipelines necessary to develop natural gasfields.

Some analysts question whether its oil and gas reserves would be economically viable at current energy prices.

Zha Daojiong, an energy security scholar at Peking University, says: "The costs are quite high for getting that oil out of the ocean."

He also argues that oil is a "peripheral factor" in the diplomatic dispute between the countries laying claim to the South China Sea.

Low prices fire demand for coal across Europe

Fossil fuels

Surge unlikely to be long-term as EU carbon rules kick in, writes *Sylvia Pfeifer*

The old shipyards have long gone but the Port of Tyne in northeast England still evokes memories of the country's industrial heritage. The port dominated the UK's coal export trade for centuries until the mid-1800s.

Changes in the mining industry during the 1990s prompted the port to diversify into other cargoes, but the coal trade has been making a comeback. The difference today is that the flow of cargoes is reversed: Tyne has become an importer of coal, bringing in just over 2m tonnes last year.

The phenomenon is evidence of a wider turnaround for coal, not just in the UK but in the rest of Europe. Demand for coal from power generators has soared over the past two years as that for cleaner natural gas has shrunk, the reason being price.

In Europe, natural gas is generally sold on contracts linked to the oil price, which is still relatively strong. Meanwhile, coal usage has been encouraged by low prices for burning carbon under the EU's carbon-trading scheme as the eurozone crisis has led to a fall in demand.

Ample supplies of coal on the back of exports from North America – where the shale gas boom has pushed natural gas prices to 10-year lows this year – have also lowered prices, making coal much more competitive.

Further, a drought in Spain hit the country's hydropower generation, forcing utilities to import more coal. Spain and the UK have seen the most active fuel switching in Europe.

"We are seeing a bonanza this year, with coal burn in the UK up 36 per cent compared with 2011. Indigenous coal simply can't respond to big changes in demand like this, so imports are making up the balance," says Nigel Yaxley, managing director of CoalImp, the Association of UK Coal Importers.

The big winners have been US coal miners. US coal exports rose 24 per cent, hitting a record high of 66.2m short tons in the first half of this year, according to the US Energy Information Administration.

More than half of the US exports, which represented about 13 per cent of US production, went to Europe. Overseas sales have since slowed, but the US is still on course to exceed the previous annual export record of 112.5m tons in 1981.

> In Europe, natural gas is generally sold on contracts linked to the oil price, which is still strong

UK imports of thermal coal from the US had already been rising sharply, nearly doubled from 2.54m tons in 2010 to 4.92m tons in 2011, according to UK government figures.

Overseas sales have been a boon for companies such as St Louis-based Arch Coal, which has a London sales team to help fulfil demand in Europe, its largest export market. Export shipments reached a record of 7m tons in the first half of 2012, it says

The resurgence of coal, the dirtiest fuel for making electricity, has raised concerns among environmental campaigners. The shift is also a disaster for efforts by European governments to reduce carbon emissions and refocus their energy supplies on low-carbon forms of energy.

In the UK, the move by generators to run their coal-fired plants at full capacity has raised fears of an energy supply crunch.

Ofgem, the energy regulator, warns that electricity margins – the spare generation capacity in the system – could fall from 14 per cent today to 4 per cent in 2015-16. Coal-fired generation, it says, is likely to close earlier than expected under EU environmental legislation as companies rapidly burn through their remaining production allowances, and the risk of a shortfall in electricity is highest in 2015-16.

Andrew Horstead, risk analyst at Utilyx, the energy consultancy, says investors need certainty on the government's electricity market reforms to encourage investment in back-up generation for renewables.

"With coal out of the running and questionmarks about nuclear, gas is our only viable short-term option to provide that baseload supply. Unfortunately there are only plans for one gas-fired plant and that won't be ready until 2016."

The question for the energy industry is how long coal's resurgence will last. Mr Yaxley says the recent comeback "is not the start of a long-term trend".

"Generation from existing coal-fired stations in the UK will be increasingly driven out of the mix by environmental policies, before it can be replaced by new coal capacity with carbon capture and storage," he adds.

Mark Lewis, managing director of commodities research at Deutsche Bank, says gas could become more competitive with coal as early as next year.

"It could change by the first quarter of next year if the EU reaches agreement to remove a significant portion of carbon allowances, a move that could increase carbon allowance prices."

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Waiting game: figures from Anthony Gormley's art installation 'Another Place' stand in front of Burbo Bank wind farm on the Mersey Getty

Turbulence in offshore wind

Renewables UK investors face economic and political uncertainty, writes *Pilita Clark*

At first glance, the UK offshore wind market could hardly be more appealing to potential investors.

Britain's commitment to meeting its share of EU clean energy targets means it will probably have to get about 30 per cent of its electricity from renewable power sources by 2020 – up from just 9 per cent in 2011.

Much of that extra energy is expected to come from wind farms, and, given the growing opposition to onshore parks, that means a large chunk should be generated offshore.

The UK's seas are home to about 800 turbines, thanks to the relatively shallow waters, strong winds and generous subsidies. This has produced 2.7GW of offshore wind capacity, more than the rest of the world combined.

There are many more developments in the pipeline following the last two offshore wind licensing rounds, in which developers were awarded sites with 7GW of capacity in 2003 and about 31GW in 2010. Other sites awarded off Scottish waters in 2009 are expected to amount to a further 4.8GW of capacity.

"We are seeing a pipeline that is set to deliver another 6GW in the next four years, so we are trebling the capacity that is already there," says Nick Medic, director of offshore renewables at RenewableUK, the wind and marine energy trade body.

Some industry observers, however, say there are signs of a slowdown.

The sites awarded in the 2010 round are still some way from receiving final approval from planning authorities, but of the 16 sites awarded in 2003, eight have yet to take final investment decisions.

Tellingly, some developers are not committing to firm orders for equipment such as turbines or transmission cables, says Ian Temperton, head of advisory at Climate Change Capital, a London-based investment manager.

"It is clear that people are rowing back on early investments," he says.

"We won't see hard evidence of a slowdown for the next couple of years, when the next lot of final investment decisions are due to be taken. But the thing that is absolutely slowing down is pre-financial close commitments."

The weak economy is likely to be one reason why companies are hesitant to make firm commitments. Another is that there is growing uncertainty about the UK coalition government's support for a green economy.

Early tremors of concern arose last year when George Osborne, the chancellor, told the Conservative party conference: "We're not going to save the planet by putting our country out of business." Some interpreted this to mean the UK would water down its renewables targets if they made British businesses less competitive.

This year, Mr Osborne has stirred up even more controversy by writing to Ed Davey, Liberal Democrat energy secretary, to say he wanted the government to give "a clear, strong signal that we regard unabated gas as able to play a core part of our electricity generation to at least 2030 – not just providing back-up for wind plant or peaking capacity".

The comments infuriated many Liberal Democrats, who saw it as a rejection of the UK's low-carbon commitments.

Mr Davey, meanwhile, is about to bring to parliament a long-awaited energy bill that will phase out the existing subsidies for new wind farm entrants by 2017 and replace them with a system involving long-term contracts that guarantee generators a set price.

The trouble is that this price is unknown and is likely to stay that way for some time.

> Tellingly, some wind farm developers are not committing to firm orders for equipment

It is also unclear how much influence the Treasury will have on the final shape of the new support regime, known as electricity market reform (EMR).

That is one reason why seven of the world's leading wind turbine manufacturers, including Vestas Wind Systems of Denmark and Siemens of Germany, wrote to Mr Davey in October to say the reported disagreements within government and speculation over the future subsidy regime had "caused us to reassess the level of political risk in the UK".

"Historically the UK has benefited from being known as a country with low political risk for energy sector investments," the companies said. "Undermining that reputation would have damaging consequences for the scale of future investments in the UK energy sector."

The manufacturers' concern is understandable, says Paul Coffey, chief operating officer of RWE Innogy, the division of German energy group RWE that is building several UK offshore wind parks.

"Almost all the turbine suppliers have very significant overcapacity in their portfolio already. Against that background you need to tread carefully in investing in brand new production capacity," he says.

"To be confident to build that capacity, you have to believe in an overall government commitment to an energy policy that includes offshore wind. At the moment we have EMR and there is insufficient clarity about how offshore wind will be treated under EMR.

"It has created a bit of a delay in the plans of the developers, and that means the equipment manufacturers will also [have to] stand by and wait."

Climate change needs action but it has a cost

Global warming

Companies with assets in energy may be storing up trouble for investors, writes *Pilita Clark*

Money could go up in smoke

The plodding pace of global talks on curbing climate change is familiar to anyone with an interest in the issue.

Governments have spent nearly two decades trying to stem the carbon dioxide emissions scientists say are responsible for global warming, and yet they keep increasing.

But what if this changed? What if countries agreed to take more urgent action to cut back the carbon emissions produced by burning fossil fuels such as coal, oil and gas?

Or what if nations sped up the individual efforts many have taken in recent years, such as China's goal of reducing the carbon intensity of its energy supply or California's emissions trading scheme?

Few have bothered to spend much time on this question – which is hardly surprising given the pace of global action.

But one thinktank in London, Carbon Tracker, has studied the potential financial effects of serious climate action, which has more of an impact than some expected.

The report, "Unburnable Carbon", came out last year and concluded the world's financial markets were carrying a "carbon bubble", meaning investors are putting millions of dollars into hundreds of companies that could be in trouble if meaningful climate action were ever taken.

Its argument is based on estimates that to have an 80 per cent chance of limiting global warming to 2C – the level scientists say should be met to avoid potentially dangerous climate change – only 565 gigatons of carbon dioxide should be emitted between now and 2050.

The world's proven coal, gas and oil reserves already amount to nearly five times that amount, and the reserves held by the top 100 listed coal companies, along with the top 100 listed oil and gas companies, come to 745gt – still far more than the 565gt "budget" for the next 40 years.

The 2C target is not entirely fanciful: it was included in the outcome of the 2010 global climate talks in Mexico, though how it is to be achieved is unclear given countries are now aiming at finalising a climate deal by 2015 that would not take effect until 2020.

Still, if action is taken after 2020, at least one large bank says the impact could be significant.

"This has potentially profound implications for the natural resources sector, notably producers of coal, the most carbon intensive fossil fuel," analysts at HSBC wrote in a June 2012 research note that examined the issues raised in the carbon bubble report.

If constraints on carbon emissions were imposed after 2020, they could reduce coal asset valuations by as much as 44 per cent, HSBC said, and the impact would hit some companies harder, depending on how much they depended on coal for their revenues, and by extension, stock exchanges on which more of those companies were listed, such as London, where the mining sector makes up about 12 per cent of the FTSE 100 index.

> 'There are a range of measures that all add up to making fossil fuel less competitive'

HSBC is not the only financial body to have taken an interest in the Unburnable Carbon report.

Pension funds in the UK, Australia and South Africa have also been looking at it, says its lead author, James Leaton, a consultant on sustainability issues.

One Australian pension fund manager, Local Government Super (LGS), has used its arguments to back a green shares option that excludes coal mining, an important industry there.

The report also led Carbon Tracker's chairman, Jeremy Leggett, and other financial sector figures with an interest in climate, to meet Andy Haldane, the Bank of England's executive director for financial stability, this year to discuss the idea that the carbon bubble could pose a risk to stability in the UK.

It is far from clear that the Bank will act on such warnings. A spokesman declined to comment when asked if any action had been contemplated since the Carbon Tracker meeting.

That is no surprise says Milton Catelin, chief executive of the World Coal Association, who argues that until there is evidence of a binding global agreement to limit carbon emissions, investors should not be concerned.

"It's a big 'if', isn't it," he says. "If there is concerted action on climate change, there may be repercussions.

"But you could just as easily say if there is concerted action on global poverty, companies that have shares in coal might actually be more valuable.

"So, I don't know why you would assume action on climate change is more likely than action on poverty."

Mr Leaton disagrees. "We're not hanging it all on a global climate deal," he says, explaining countries were taking actions of their own – such as the US Environmental Protection Agency's recent efforts to curb coal plant pollution – and technological advances in renewable energy also posed a risk to fossil fuel use.

"There is a range of measures that add up to making fossil fuel less competitive," he says.

But surely investors would be aware of such changes and have plenty of time to react?

Not necessarily, says Nick Robins the head of HSBC's climate change centre of excellence, who co-authored the bank's coal report.

This is a long term problem and markets have a very short-term focus, he says, "so the market is likely to be surprised".

"There's an impression people can trade out of these sorts of problems in time but one of the things we saw in the financial crisis in 2007 is that this is not always possible."

Consumers yet to see the light

Low-energy bulbs

Many households are clinging to old technology, writes *Michael Kavanagh*

How many people does it take to change a traditional incandescent lightbulb? Just the one, normally, but consumers still need to be cajoled to switch to energy-saving alternatives.

From September 1, the EU rolled out the final stage of its plan to stamp out the manufacturing and import of traditional bulbs for domestic use by extending its ban to bulbs rated 40W or less.

The scheme to wean consumers off traditional bulbs mirrors similar contested legislation in the US, where a federal ban was aimed originally at phasing out the sale of most incandescent bulbs by the beginning of this year.

The debate continues over the relative qualities of new low-energy alternatives to the traditional bulb, the technology of which remains essentially unchanged since it was developed in the 1870s by rival inventors Joseph Swan of the UK and Thomas Edison of the US.

But the prize of reduced bills and carbon footprint through the imposition of modern lighting in domestic, commercial and public settings is clear.

The UK's Energy Savings Trust has estimated phasing out 600m lightbulbs in UK homes, in line with EU regulations, could save UK consumers £1bn a year.

A report published by the trust with the UK's Department of Energy and Climate Change and the Department for Environment, Food and Rural Affairs in June shines further light on the benefits of switching to low-energy bulb alternatives.

The co-sponsored paper, "Powering the Nation: Household Electricity-using Habits Revealed", says lighting comprises 17 per cent – marginally less than refrigeration – of electricity consumption. Lighting accounts for £77 of the average annual household electricity bill of £530.

Yet compact fluorescent lamps (CFLs) use about 80 per cent less electricity than standard bulbs, according to the trust. Replacing fashionable halogen bulbs with LED (light-emitting diode) alternatives can save even more. Switching a typical 50W halogen downlighter with a 6W LED bulb would save around £4 a year, or £70 by the time the longer-lasting bulb needed replacing.

But although the costs of both types of bulbs, CFLs in particular, have fallen sharply in recent years, higher upfront costs of LED bulbs might deter buyers of energy-saving lights.

James Shortridge, managing director of the UK's specialist lighting chain Ryness, says improvements in the efficiency of the UK's domestic lighting components since the 1970s has largely been countered by installation of more lights in homes.

But he says most households could at least halve their lighting bills by adopting newer alternatives to traditional bulbs. He adds, though, that consumer worries about the reliability of LED bulbs are ebbing.

Ryness has opened its first LED-only store in London, anticipating an uplift in demand following a full EU ban on incandescent lighting and price drops for LED bulbs.

Changing lights: an LED bulb

Mr Shortridge says "compact fluorescent is on the way out" as sales of LED bulbs by his stores have overtaken the first commonly adopted alternative to the incandescent bulb.

He says Ryness's customers are prepared to pay the high price of LEDs – often based on their aesthetic merits rather than money-saving and environmental credentials.

But the greatest potential for saving money and reducing the environmental impact of lighting lies outside the home.

Electric lighting accounts for around one-fifth of electricity consumption, both in the UK and globally, according to a UK parliament research paper published two years ago. Global demand for artificial lighting was predicted to be 80 per cent higher by 2030.

In the UK, commercial use accounts for 70 per cent of electricity consumption for lighting, residential use 26 per cent and street lighting 4 per cent, according to DECC and Defra estimates.

As householders hold on to incandescent bulbs, business users appear to be more savvy on cost savings and hence environmental impact.

Commercial customers are "five years ahead" of many domestic users in their adoption of energy-saving lighting, Mr Shortridge says. Businesses can save thousands of pounds a month on illumination and floodlighting of premises and are willing to invest on the basis of quick payback on energy cost and maintenance savings.

So, how many accountants does it take to change a lightbulb? These days, more than you would think.