

Oil & carbon revisited

Value at risk from 'unburnable' reserves

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- ▶ **Lowering carbon emissions could put future oil and gas developments at risk**
- ▶ **Demand effects may mean lower oil and gas prices, a greater value risk**
- ▶ **Statoil's 'unburnable' reserves amount to 17% of market capitalisation; low costs mean BG has little value at risk**

Unburnable reserves: The IEA's World Energy Outlook (2012 edition) estimated that in order to have a 50% chance of limiting the rise in global temperatures to 2°C, only a third of current fossil fuel reserves can be burned before 2050. The balance could be regarded as 'unburnable'.

Oil could deliver efficiency gains: Although coal reserves have significantly more embedded carbon than other fuels, we believe that oil demand could be reduced relatively quickly given the inefficiency of personal transport.

Gas growth slows: In a low-carbon world, defined as limiting future CO₂ emissions until 2050 to 1,440Gt, oil demand would fall post 2010. Gas demand would continue to grow but at a slower rate than currently. This means some potential oil and gas developments would no longer be needed.

Ceiling tests to assess value at risk: To assess the risk for the sector, we assume the world is already low carbon. We undertake a ceiling test on the future projects of the larger European majors we cover to assess the potential value at risk. We use USD50/b for oil and USD9/mmBtu for gas for our ceiling test. Oil and gas volumes at risk range from under 1% (BG Group) to 25% (BP). However, as a percentage, the value of reserves at risk is lower than this because they are largely undeveloped. The value impact ranges from under 1% (BG Group) to 17% (Statoil).

Price risk a material threat: Although not directly related to 'unburnable' carbon, a greater risk to the sector would be if lower demand led to lower oil and gas prices. In that case, the potential value at risk could rise to 40-60% of market cap.

Low costs are the key: Because of its long-term nature, we doubt the market is pricing in the risk of a loss of value from this issue. We think investors should focus on low-cost companies like BG; a gas bias is preferred, which would favour Shell.

Summary

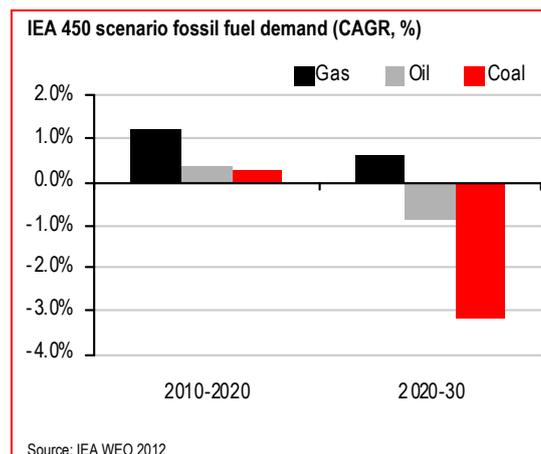
- ▶ We look at how a low-carbon world might affect European oils
- ▶ Loss of potential value from developments no longer needed would range from almost none (BG Group) to 17% of market capitalisation (Statoil)
- ▶ Focus on low-cost players with a gas bias in such a scenario

Unburnable carbon

Our first note on carbon and the oil sector ([‘Oil and carbon. Counting the cost’](#), 23 September 2008) looked at the potential cost of carbon pricing for the industry. This note revisits this theme but looks at the risk to the oil sector were carbon policy to lead to lower demand for oil and slower growth in demand for gas.

The IEA, based on research by Meinhausen et al (*Nature*, 40 April 2009), estimated that to have a 50% chance of limiting the rise in global temperature to 2°C, the world can only emit 1,440Gt over the first half of the current century. With around 400 Gt emitted from fossil fuels and other sources so far this century, only around 1,000 Gt or a third of current proven reserves can be ‘burned’. This would mean that a material proportion of the world’s coal, oil and gas reserves may be ‘unburnable’ over the next 40 years.

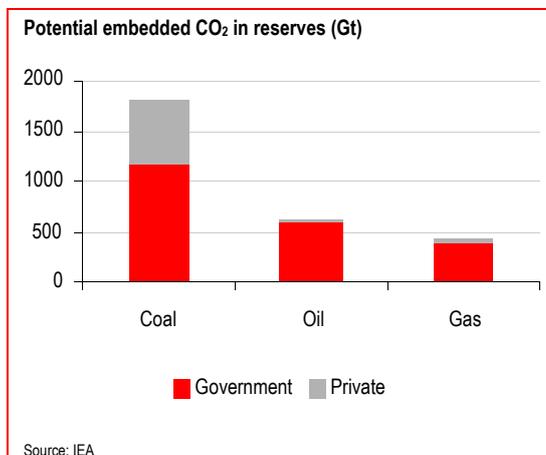
In the IEA’s ‘450 ppm’ scenario (‘450’), which limits global warming to 2C, the aim is to reduce carbon concentrations to 450 ppm, the level it believes is necessary to have a 50% chance of limiting the long-term temperature rise to 2°C. It assumes that between 2010 and 2035, coal consumption falls by 30% and oil by 12%.



Looking at how the carbon in proven reserves is split between fossil fuels, it is clear that oil can only play a modest role in reducing emissions.

Embedded ‘carbon’ in coal is three times the amount bound in oil and over four times that in gas (see [“Coal and Carbon, Stranded assets: assessing the risk”](#), 21 June 2012, for our analysis of the risks to coal).

It is clear that reduced usage of coal is the key to stabilising and eventually reducing annual carbon emissions. However, we believe that reductions in oil demand, although smaller, can be delivered more quickly than coal through improvements in transport fuel efficiency.



Natural gas would be less affected in a low-carbon world. Although demand is likely to grow more slowly than in a ‘business as usual’ (BAU) scenario, it should continue to gain market share.

The gain in market share by natural gas is crucial to reducing emissions because of its lower carbon content relative to oil and especially coal. It is the only IEA scenario where the world has stable/modestly rising energy demand and falling carbon emissions. So new gas developments would go ahead but at a slower rate.

European sector implications

So quoted oil companies could face pressure on future developments, especially of oil. But the problem for quoted oil is that according to the IEA, 90% of the world’s oil and gas is in the hands of governments or state oil companies. This means that the activities of even the majors are largely irrelevant in terms of carbon emissions. The behaviour of governments and state oil companies will be far more relevant.

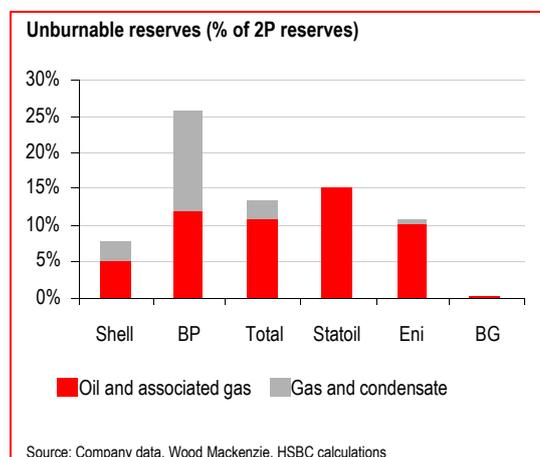
Around 70% of these ‘government’ reserves are in the hands of OPEC, where quoted oil has limited exposure in volume – and even less in terms of value. It seems to us the main threat to the majors will come from the behaviour of governments, especially that of OPEC states.

We assume that in a low-carbon world, the projects that would be deferred or cancelled by the majors would be those with high costs. To assess those at risk, we have run these projects using Wood Mackenzie. For oil projects, we use a Brent price of USD50/b as a ceiling test. (This compares with our present Brent assumption for 2014e of USD90/b and the ICE futures strip of USD102/b.)

For gas projects we use a price of USD9/mmBtu. This is around USD55/b in oil parity terms. (Our present assumption for European oil-linked gas prices is USD10.9/mmBtu.)

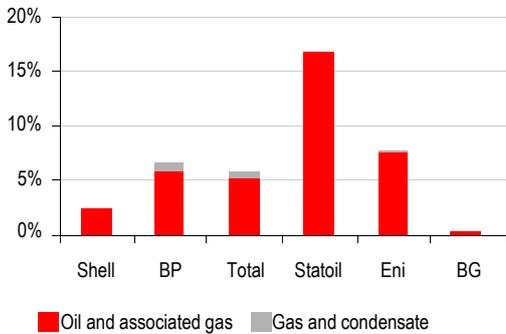
Unburnable oil and gas reserves

The volume of reserves at risk of being undeveloped in a low-carbon world varies markedly between the companies. At the high end, around 25% of BP’s proven and probable (2P) reserves would fall into our ‘unburnable’ category, whereas virtually none of BG’s would.



However, BP’s value at risk from unburnable reserves is equivalent to only 6% of its market value as most of the ‘lost’ reserves are low margin. We also look at the value of reserves at risk as a percentage of market capitalisation.

Unburnable oil & gas reserves (% of market cap)



Source: Company data, Wood Mackenzie, HSBC calculations

Statoil has the highest value of reserves at risk of becoming unburnable, equivalent to 17% of its market capitalisation. BG has virtually no value at risk.

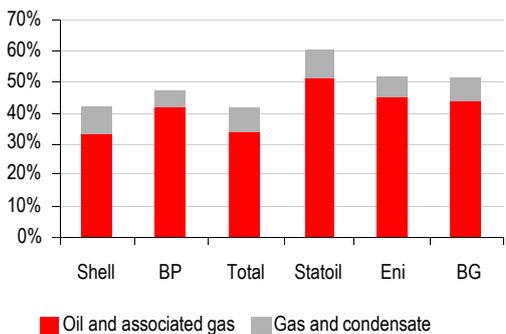
Loss of value on viable oil and gas portfolio

We believe that such a large fall in demand would almost certainly lead to lower oil prices.

All of the companies would lose material amounts of value were oil and gas prices to fall to the level we used for our ceiling test. (Some may feel that a USD50/b oil price is not realistic, but we would remind readers that a 3m b/d fall in demand in 2009 caused the Brent oil price to fall to USD40/b).

Adding this to the value at risk from unburnable reserves would be equivalent to 40-60% of the market capitalisation of affected companies.

Unburnable reserves and price effect (% of market cap)



Source: HSBC workings, Wood Mackenzie data

All companies would see a material loss of value under this scenario, but Total and RD Shell have slightly lower exposure; Statoil has the highest.

Unburnable reserves and price effect (value/share)

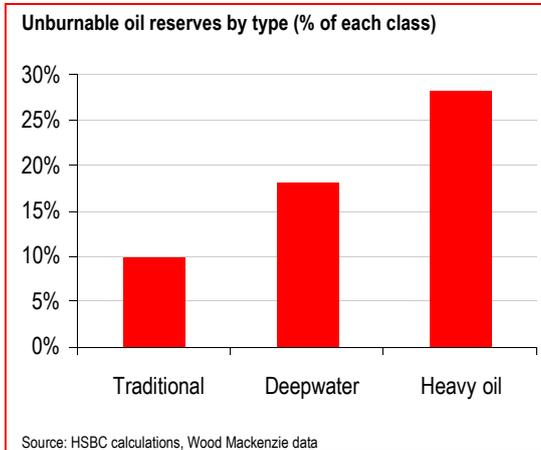
	Price (21/1/13)	Unburnable effect	Price effects
BG (p)	1,120	2.6	578
BP (p)	459	31	189
ENI (EUR)	19.3	1.5	9
RD Shell A (EUR)	26.3	0.0	0
RD Shell B (p)	2,264	51	909
Statoil (NOK)	144	24	63
Total (EUR)	39.4	2.2	14

Source: Company data, Wood Mackenzie, HSBC calculations

We believe that investors have yet to price in such a risk, perhaps because it seems so long term. And we accept that our scenario probably exaggerates the risk as we assume a low-carbon world today rather than beyond 2020. However, we believe it does give an indication of the potential impact on the sector. Apart from BG, the level of unburnable carbon within the European oil sector is relatively high in terms of volumes of reserves (7-25%). As these are future developments, yet to incur development costs, the value impact is rather more modest (0-17%).

The main risk for the oil sector, however, is whether a low-carbon future would lead to lower fossil fuel prices. Under the IEA '450' scenario, this becomes a growing risk beyond 2020. Our analysis probably overstates the value at risk as we assume an efficient world today. Nevertheless, our analysis shows that the impact of lower prices on value could be material.

In our view, investors should focus primarily on companies with low-cost future projects. Capital-intensive, high-cost projects, such as heavy oil and oil sands, are most at risk under our scenario.



A focus on gas would be preferable but even the gas-focused companies within the sector have a relatively heavy oil focus.

We would like to acknowledge the contribution from Priyankar Biswas, Associate, Bangalore, to this research report. Priyankar is employed by a non-US affiliate of HSBC Securities (USA) Inc., and is not registered/qualified pursuant to FINRA regulations.

Unburnable carbon

- ▶ In a low-carbon environment, a material proportion of the world's undeveloped reserves of fossil fuels could become 'unburnable'
- ▶ After coal, we believe that oil would be most exposed, particularly because of the potential to improve transport efficiency
- ▶ Gas demand would be less affected as it benefits from a lower carbon profile and a greater ability to capture emissions

Curbing carbon

This report assesses how the European oil sector could be impacted if we were to move to a low-carbon world. Global greenhouse gas (GHG) emissions continue to rise, putting the world potentially on track for long-term warming approaching 4°C. This is far above the 2°C target that governments have set themselves. However, governments begin serious negotiations this year to deliver a global climate agreement in 2015. The aim is to intensify efforts to reduce emissions between now and 2020, and then take strategic action in the 2020s and beyond.

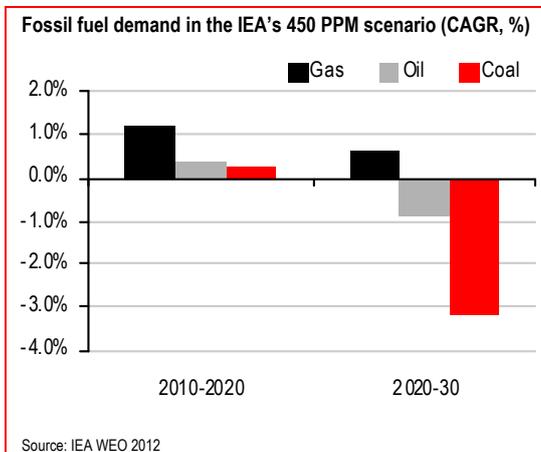
In our report, '[Energy in 2050](#)' (22 March 2011), we explored how to deliver a threefold expansion of the global economy whilst achieving climate security. In our low-carbon Solution scenario, we estimated that global demand for energy in 2050 would need to be 37% below our business-as-usual scenario (BAU). The supply mix would also need to shift from an 81% reliance on fossil fuels today to just 43% by 2050. Fossil fuel use would be 34% lower than at present and 66% lower than the BAU scenario. In this scenario, the share of oil would fall from 32% today to 13% by 2050, and gas would also decline from 21% to 16%.

Living within a carbon budget

Tomorrow's carbon emissions are embedded in today's reserves of coal, oil and gas. To have a 50% chance of limiting global warming to 2°C, scientists estimate that around 1440Gt of CO₂ can be emitted between 2000 and 2050 (Meinhausen et al, Nature, 40 April 2009). Based on this research, the IEA estimated in its World Energy Outlook 2012 (WEO) that remaining proven reserves of fossil fuel contained 2,860 Gt of potential carbon emissions. With around 400 Gt emitted so far this century, only around 1,000 Gt or a third of current proven reserves can be commercialised without significant deployment of carbon capture and storage (CCS). A tougher carbon budget giving an 80% chance of keeping warming below 2°C would cut this allowance still further.

Shifting the energy mix

Most conventional assessments project rising energy consumption and fossil fuel use. The IEA's central New Policies scenario, for example, estimates that global energy demand will grow by over 17% from 2010 levels by 2020 and by 29% by 2030. Fossil fuel's share would decline from 81% to 76%, but overall in absolute terms its consumption should still grow.



In its low-carbon 450 PPM ('450') scenario, the IEA estimates that demand for fossil fuels would still grow up to 2020. Oil demand, for example, is forecast to grow at 0.4 % annually. However, from 2020 onwards, the IEA projects that oil demand would decline, though not as much as coal (see Chart above). Demand for gas is projected to continue to grow in the 2020s, but not as much as in the 'New Policies' scenario. Overall, the '450' scenario estimates that between 2010 and 2035, coal consumption would fall by 30% and oil by 12%.

Oil in a low-carbon world

We believe that reductions in oil demand could be delivered more quickly than coal (and probably more quickly than gas as well) through better transport efficiency. Historically, personal transport has accounted for around 60% of oil demand, equivalent to 21-23m b/d. The rate of annual fuel efficiency is already improving by 1.7% on average per year – and cost-effective technologies could deliver much more. By 2035, the IEA projects that road transport demand for oil could be 9m b/d or 18% lower than under its 'New Policies' scenario, split evenly between freight and passenger vehicles.

We believe that this is achievable with existing technology. India has the best average fuel efficiency at 6 litres per 100km compared with 9L/100km in the United States. Many passenger vehicles appear to have been designed to be deliberately inefficient. This is because in some cases, power and speed sells more cars than efficiency. For example, the Bugatti Veron, so beloved of some motoring shows, emits over 600 g/km of carbon, six times that of the average car in the mini class. (There is hope though. For example, the Ferrari Enzo emits 545g but the new hybrid version lowers this by 40%.)

There has been a material improvement in the efficiency of the internal combustion engine over the past few decades. But much of this has been offset by increased weight and engine size. According to Christopher R. Knittel's 2009 report "*Automobiles on Steroids*", if US auto weight and horsepower had been held at 1980s levels, fuel efficiency would have increased by nearly 50%.

Steps are being taken to improve the fuel efficiency of new vehicles. In the US, the EPA and transport department have announced new economy standards for light-duty vehicles (LDVs) set at 54.4 mpg (4.3L/100 km) for 2025. The Chinese government is considering a new fuel economy target for 2020, targeting 5.0L/100km. In the EU, regulators are targeting carbon directly, aiming for 95g CO₂/km (4.1L/100km) by 2020. India's standards were already at 6L/100km in 2008, and proposed standards would take this 5.14L/100 km in 2020.

On a demand-weighted basis, we think that a 40% improvement in mileage per gallon is achievable by 2020, equivalent to a near 30% or 6-7m b/d reduction in demand.

Gas in a low-carbon world

Gas continues to have growth potential in a low-carbon world on the back of its much lower share of embedded carbon in fossil fuel reserves. Gas is already displacing coal in US power generation based on the cost advantages of shale. The emissions from gas-fired power can also be reduced further through CCS, although currently, no large-scale integrated projects are in place.

But in a low-carbon world, the growth rate for gas is forecast by the IEA to be less than half that of the current decade. In the IEA's low-carbon '450' scenario, global gas demand would be 20% below its central scenario in 2035. This is equivalent to a fall of 16m b/d in oil-equivalent terms (the equivalent decline in oil is 27m b/d). Even so, we believe that the world would still need new gas developments to offset declines in existing production. New developments would go ahead but there would be fewer of them.

Global implications

Some observers have suggested that oil companies should cut back investments in order to reduce carbon emissions and avoid stranded assets. The problem for quoted oil is that, according to the IEA, 90% of the world's oil and gas is in the hands of governments.

This means that the activities of even the majors are marginal in terms of global carbon emissions; the

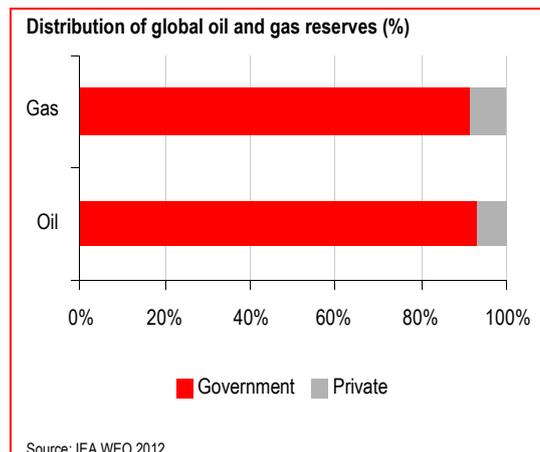
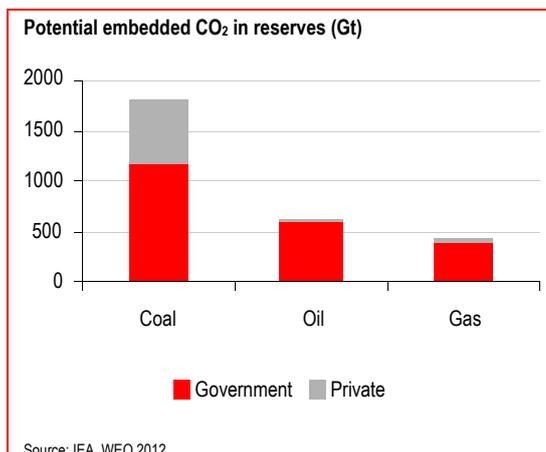
behaviour of governments and state oil companies will be far more relevant. The bulk of the remaining carbon emissions in the world's proven oil reserves is tied up in four regions (in order of importance):

- ▶ The Middle East
- ▶ Latin America (predominantly Venezuelan heavy oil)
- ▶ Canada (predominantly tar sands)
- ▶ Africa (predominantly Nigeria and Angola)

Around 70% of these reserves are in the hands of OPEC, where quoted oil has limited exposure in volume – and even less in terms of value. It seems to us the main threat to the majors will come from the behaviour of governments, especially that of OPEC states. As discussed later, lower demand tends to lead to lower prices. For small movements in demand, OPEC can normally act as a buffer zone. However, a fall in demand for oil of up to 10m b/d would likely overwhelm OPEC, leading to significantly lower oil prices.

The threat to the majors therefore is twofold:

- ▶ First, future projects being deferred or cancelled owing to lack of demand ('unburnable' projects); and
- ▶ Second, loss of value from their portfolios because of lower oil prices.



European stocks

- ▶ European oils face two potential threats, future developments becoming unnecessary and lower demand leading to lower prices
- ▶ The threat from 'unburnable' future reserves is relatively small: Statoil has the most potential value at risk, 17% of market cap
- ▶ However, the threat from lower prices would have an impact on all stocks, equivalent to 37-52% of market cap

Unburnable carbon

For this analysis, we assume we are already in an efficient world with lower demand for oil and slower future growth for oil and gas. With lower demand, fewer future projects will be needed. We analyse the companies' oil and gas developments to see which are high cost and therefore at risk of cancellation.

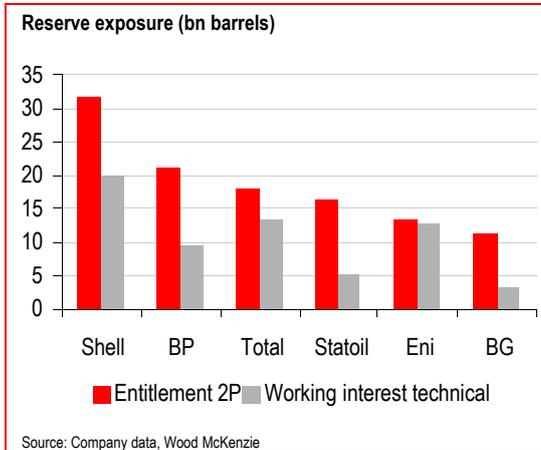
For oil projects, we use a Brent price of USD50/b as a ceiling test. (This compares with our Brent assumption for 2014 of USD90/b and the ICE futures strip of USD102/b.) At USD50/b, many high-cost oil projects in non-OPEC, including oil sands, some deep-water plays and some US shale oil projects, would not be economical.

For gas projects we use a price of USD9/mmBtu. This is around USD55/b in oil parity terms. Oil-linked gas prices normally trade at a discount to oil and this gas price would be consistent with a Brent price of around USD75-85/b for European and Asian oil-linked gas contracts. This means we assume that in oil-equivalent terms, natural gas in many parts of the world would see a narrowing of the price discount with oil to reflect its better 'green' credentials. Unlike oil, gas demand is

likely to continue to rise but at a slower rate than under 'New Policies'. The world will continue to need new gas projects and USD9/mmBtu is a price that we estimate would support greenfield LNG plants (our assumption for 2014 is USD10.9/mmBtu for European contract prices).

Reserve exposure

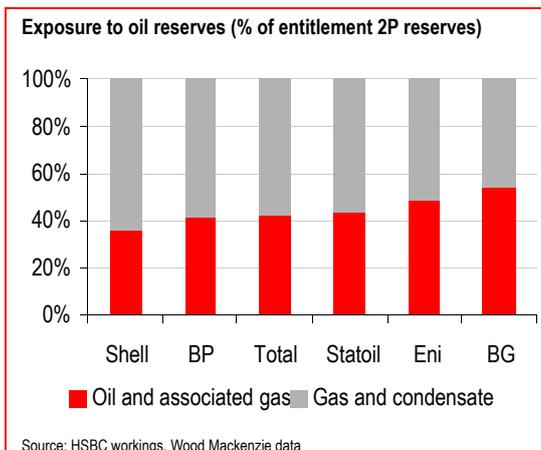
We use proven and probable (2P) to assess the exposure to unburnable carbon for the European majors. We believe this is more realistic than using the proven reserves reported by the oil majors (normally half the 2P level). This is because US SEC definitions of proven reserves are overly conservative and understate the majors' fossil fuel exposure relative to some state oil companies.



Oil versus gas

Clearly, given the differing outlook the IEA has for the demand growth of oil relative to gas, exposure to the latter should tend to lower the threat of unburnable carbon.

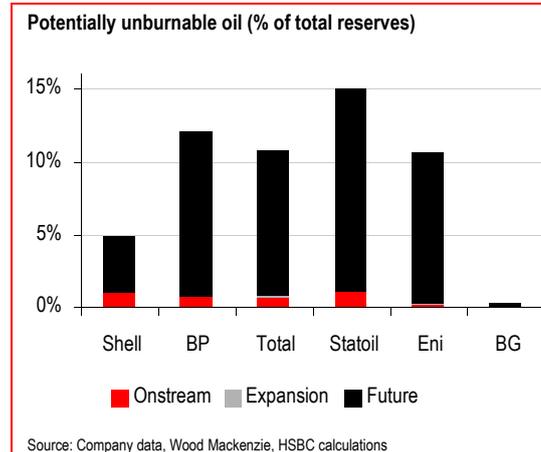
On the basis of entitlement 2P reserves, oil makes up 36% of RD Shell's total reserves, the lowest of the six companies. Ironically, BG Group (BG), which is perceived to be a gas company, has the highest exposure to oil. This is because BG's exposure to oil has increased significantly over the past four years as it has established a massive resource base in Brazil.



Which oil can't be burned?

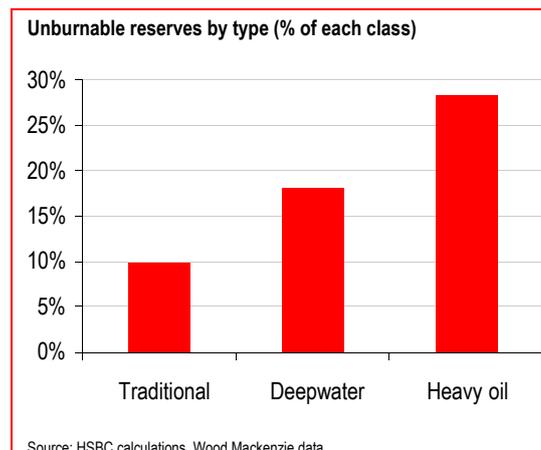
Using Wood Mackenzie, we grade each company's projects using our ceiling price to see which are high cost and so could be at risk in a

low-carbon world. In volume terms, there is a wide range of exposures to 'unburnable' carbon between the companies.



Most reserves in the at-risk category are future developments. Existing projects enjoy the benefit of sunk costs and so tend to have low cash operating costs. New projects need to incur capex in addition to operating costs giving them a higher cash cost per barrel (capex plus operating cost).

In terms of type of future development, we think heavy oil projects (including oil sands) are most at risk.

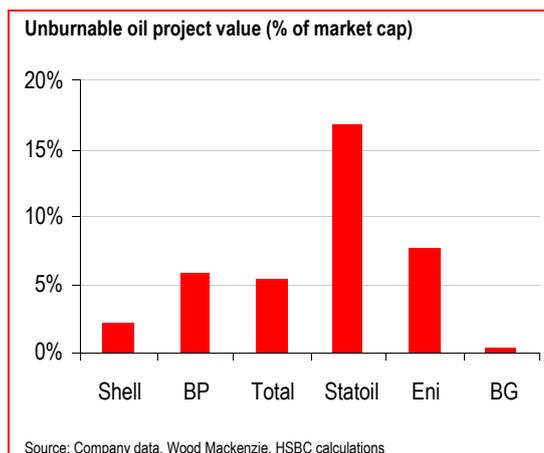


In aggregate, close to 30% of heavy oil reserves, around 20% deepwater reserves and around 10% of traditional reserves, would be at risk of not being developed at USD50/b and so fall into the high-cost category.

Value at risk

To calculate the value of the reserves potentially at risk, we aggregate the value of these ‘unburnable’ projects using our USD90/b assumption for 2014. The loss of value for the companies from these ‘unburnable’ projects is relatively low. This is because most are in the yet-to-be-developed category and so there are no sunk costs to be ‘lost’.

The companies we analyse in this report have quite different levels of value at risk with developments that may well not proceed because they are high cost (defined as non-economical at USD50/b Brent prices).



This probably overstates the value at risk as we believe most companies trade at a discount to the discounted cash flow value of their assets. If this is true, we would expect the share price reaction to such a loss of value to be less than the percentages above. For example, BG and BP trade at around a 40% discount to our published SOTP valuations.

Statoil

Statoil has the highest exposure to potentially unburnable oil reserves. These make up 15% in volume terms and 17% of market value. We attribute this relatively high value at risk to its exposure to high-cost traditional projects in Norway. Of the reserves at risk, 55% are traditional projects, 25% are deepwater projects in Angola and the US Gulf of Mexico, and 20% are heavy oil projects.

Statoil’s exposure to heavy oil is spread across the UK, Canada, Brazil, Norway and Venezuela, and amounts to around 9% of its 2P reserve base. Nearly 30% of these reserves would not be viable, including Mariner and Bressay in the UK.

Statoil’s exposure to deepwater oil reserves amounts to around 10% of its 2P reserve base and is dominated by Angola and the US Gulf of Mexico. More than a third of these reserves would not be commercial.

Eni, BP and Total

In terms of value, ENI, BP and Total have similar levels of oil reserves at risk of becoming unburnable.

Eni’s oil reserves at risk make up around 11% of its total reserves, equivalent to 8% of its market value. The oil reserves at risk mainly lie in the deepwater and heavy oil categories, which account for a third of its oil reserve base. We believe around 60% of these may be unburnable. Its heavy oil assets at Junin 5 in Venezuela and Mariner in the UK would not be commercial at USD50/b and so are in the high-cost category.

BP’s potentially unburnable oil reserves make up around 12% of its total reserves. This is equivalent to 6% of its market capitalisation. Around half of the group’s unburnable oil reserves are in the deepwater category with the balance in heavy oil. Within the deepwater oil category, the projects at risk are predominantly in Angola and the US Gulf of Mexico. Within heavy oil, BP’s Sunrise project would be sub-commercial at USD50/b.

For Total, we estimate that oil at risk makes up 10% of its volumes, equivalent to 5% of its market value. Most of these reserves are in the heavy oil category with its Canadian oil sands projects (Fort Hills, Joslyn, Surmont) and a project in Gabon (Ayol) sub commercial below USD50/b.

BG and RD Shell

BG and RD Shell have relatively low exposure to oil assets that could be sub-commercial at our ceiling test assumption.

BG's oil reserves are dominated by the future developments that tend to make up the bulk of the unburnable projects. But BG sees few projects turn uneconomical under a USD50/b scenario. This is because the economics of its Brazil assets are so resilient that they are commercial even below a USD40/b oil price.

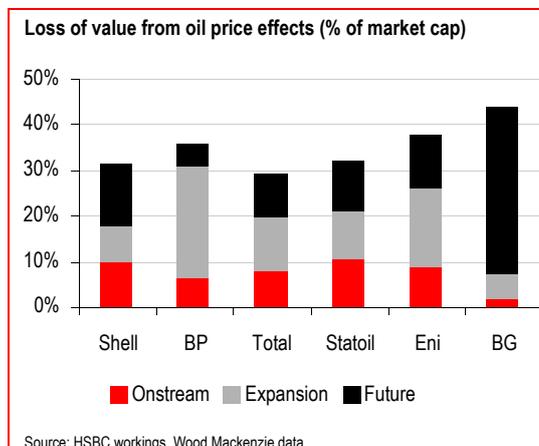
We estimate RD Shell's oil reserves at risk make up around 5% of total reserves, equivalent to around 2% of market value. RD Shell has significant exposure to Canadian oil sands, but more than 60% of these are already considered non-commercial by Wood Mackenzie. This means they do not influence our analysis. Its exposure to commercial heavy oil reserves makes up around 25% of its oil reserve base, of which 20% would be at risk. (Oil makes up around 36% of Shell's total reserve base, the lowest of the companies in this study.)

RD Shell also has lower exposure to high-cost deepwater oil reserves than its peers. Within the deepwater oils category, which is around 20% of its oil reserve base, only 14% is at risk.

Oil price impact

Although not directly linked to the need to restrict carbon emissions, companies could also see a loss of value from a price effect. Even though some existing assets may be still commercial, their value would fall if weaker demand led to lower oil and gas prices. This effect is significantly more important than the loss of value from future projects that are sub commercial.

On our estimates, under an oil price of USD50/b, the companies could see a loss of value from their oil reserves equivalent to 29-44% of their market value.



The value of 'Future' reserves tends to have higher sensitivity to price movements than existing projects because capital expenditure is yet to be incurred.

High impact – BG, Eni and BP

Although BG saw only a small loss of value from unburnable projects, it has the highest loss of value from oil price effects. This is because of its high exposure to projects yet to be developed, especially in Brazil.

Eni and BP also have above-average sensitivity, with oil price effects amounting to around 38% and 36% of market value, respectively.

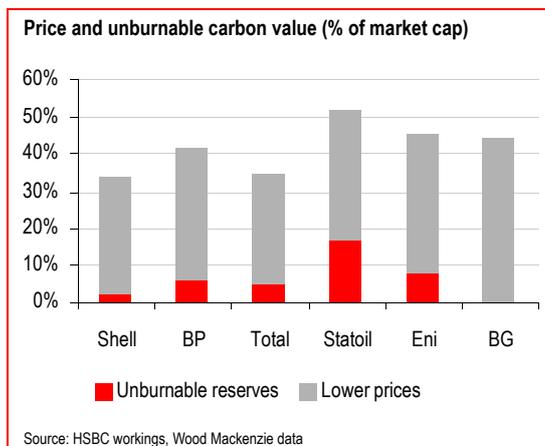
Low impact – Total, Statoil and RD Shell

We estimate that Total has the smallest loss of value from lower oil prices, equivalent to 29% of its market capitalisation. This reflects the lower sensitivity of Total's portfolio to oil price changes and is mainly attributable to its assets in Africa, Asia Pacific, Middle East and Latin America.

RD Shell and Statoil also exhibit relatively low sensitivity with oil price effects, equivalent to around 32% of market capitalisation. RD Shell has above-sector-average exposure to low-cost onshore oil, which helps lower its price sensitivity. Although Statoil has relatively high exposure to undeveloped oil projects, the high tax nature of some of its assets helps lower oil price sensitivity.

Combined oil impact

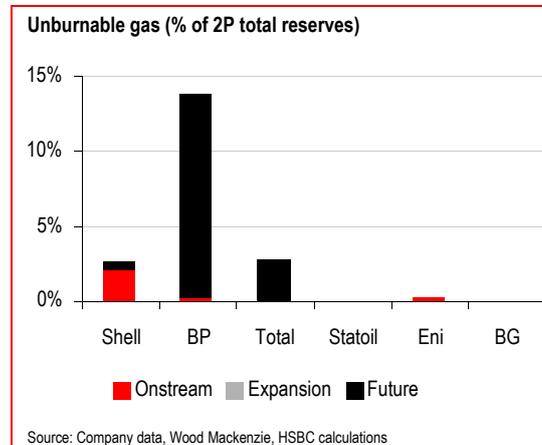
Together, the oil price and the unburnable carbon effects are equivalent to between 34% and 52% of market capitalisation. It is clear from this that the main risk to the oil sector is oil price effects rather than the loss of reserves should they become unburnable.



Statoil and Eni have the highest potential loss of value of the companies we have analysed. Shell and Total have the lowest potential loss of value. The share price impact of such a scenario would probably be less than this as most majors trade at a material discount to the value of their assets, in our view.

Gas exposure

We take a similar approach for each company's gas reserves. As our threshold price of gas is higher than for oil and similar to our existing assumption, there is less potential loss of value for the companies.



The gas in BP's portfolio that would become sub economic at USD9/mmBtu makes up around 15% of its total oil and gas reserves.

The main assets that could become unburnable include the tight gas field in Oman (Khazzan-Makarem PSC) and some of its deepwater and LNG projects, including North Alexandria in Egypt and Point Thomson in Alaska.

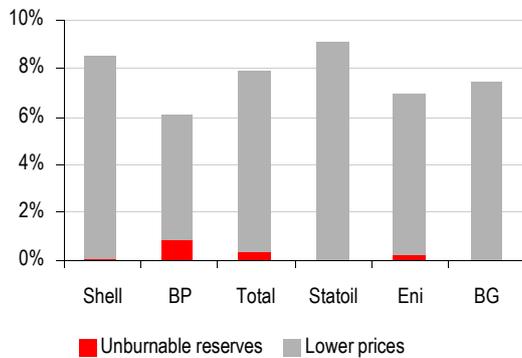
Apart from BP, no company sees a large value effect under our scenario. Even with BP, the loss of value is limited to 1% of its market value owing to the low-margin nature of its gas assets.

Gas price effect

As with our analysis of the oil price effect, the lower gas price also reduces the value of the companies' portfolios. The fall is less than we saw with oil as the price movement is smaller. The potential value at risk is equivalent to around 0-1% of market capitalisation.

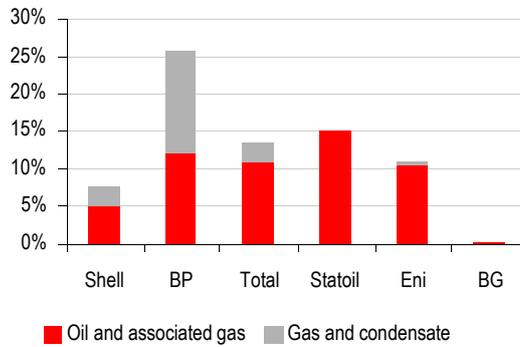
The combination of both effects works out at between 6% and 9% of market capitalisation.

Gas: Unburnable reserves and price effect (% of mkt cap)



Source: HSBC workings, Wood Mackenzie data

Unburnable reserves of oil & gas (% of 2P reserves)



Source: Company data, Wood Mackenzie, HSBC calculations

Virtually all the potential loss of value is from the price effect rather than from projects becoming unburnable owing to lower gas prices.

Combined impact

Unburnable oil and gas reserves

Unburnable reserves and price effect (value per share)

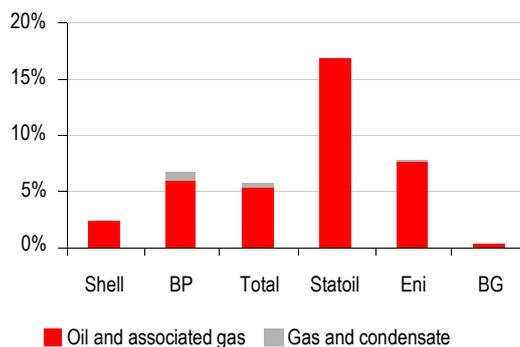
	Price (21/1/13)	Unburnable effect	Price effects
BG (p)	1,120	2.6	578
BP (p)	459	31	189
ENI (EUR)	19.3	1.5	9
RD Shell A (EUR)	26.3	0.0	0
RD Shell B (p)	2,264	51	909
Statoil (NOK)	144	24	63
Total (EUR)	39.4	2.2	14

Source: Company data, Wood Mackenzie, HSBC calculations

The volume of reserves at risk of being undeveloped in a low-carbon world varies markedly between the companies. At the high end, 26% of BP's 2P reserves would fall into our 'unburnable' category, whereas virtually none of BG's would.

However, BP's value at risk from unburnable reserves is equivalent to only 7% of its market value.

Unburnable reserves (% of market capitalisation)

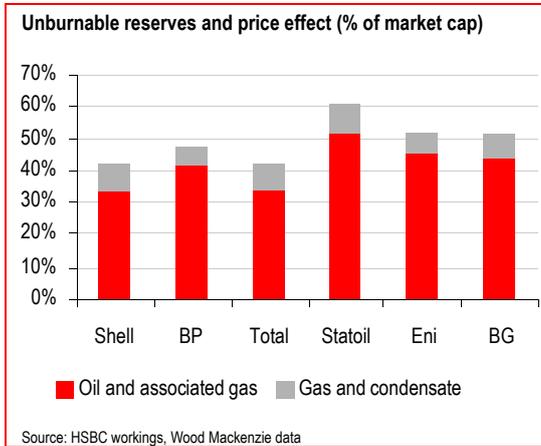


Source: Company data, Wood Mackenzie, HSBC calculations

Statoil has the highest value of reserves at risk of becoming unburnable, equivalent to 17% of its market capitalisation. BG has virtually no value at risk.

Loss of value on viable oil and gas portfolio

All of the companies would lose material amounts of value were oil and gas prices to fall to the level we used for our ceiling test. Adding this to the value at risk from unburnable reserves would be equivalent to 40-60% of their market capitalisation for the companies.



All companies would see a material loss of value under this scenario, but Total and Royal Dutch have slightly lower exposure. Statoil has the highest.

Carbon and pricing

- ▶ In a low-carbon world, lower demand for oil and falling demand post 2020 would likely put pressure on oil prices
- ▶ We assume in the longer term that OPEC would defend market share rather than price
- ▶ Oil prices may need to fall to as low as USD50/b to achieve this

Break-evens for selected high-cost oil projects

Technology	Country	Project name	Breakeven USD/b	2P reserves Million b
Oil sands	Canada	Joslyn SAGD_MINE	75.5	874
Heavy oil	Venezuela	Junin 5	54.7	1,526
Deepwater	Angola	Kizomba Satellites Phase2	51.6	471
Deepwater	Angola	Block 1506 Eastern Hub	49.3	350
Deepwater	US	Tiber (KC 102)	64.0	566
Deepwater	US	Gunflint (MC 948)	49.4	250
Traditional gas and condensate	Norway	Valemon	60.7	211
Traditional gas and condensate	Norway	Dagny	57.0	216
Liquids-rich shale gas	US	BP ALT Cotton Valley Hz TGS TX Fee	71.5	35
Liquids-rich shale gas	US	BP AKM Woodford Hz SHG OK Fee	65.9	456

Source: Wood Mackenzie data

Under our low-carbon scenario, demand for crude oil would be significantly lower than it is today. This could put downward pressure on crude prices. Even the IEA '450' scenario, which shows demand falling in the longer term, would also lead to downward pressure, in our view. To maintain market share in a weak market, OPEC would need to let prices fall to a level that makes some non-OPEC's projects sub-commercial. Non-OPEC's highest-cost production currently is probably oil sands given the high cost of energy (gas) needed to separate the oil and the need for capital-intensive upgrading equipment.

The IEA gives quite a wide range of estimates for the breakeven price for different technologies. At the low end, oil sands projects have a breakeven price of USD65-55/b. We believe this applies to expansions rather than green-field projects, which would more likely be at the top end of the range (USD85-105/b).

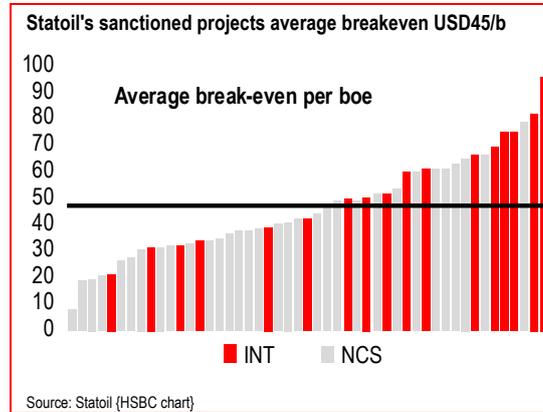
Breakeven estimate (USD/b) for different technologies

	Wood Mackenzie 2012	IEA 2008
US tight oil	45-105	50-100
Oil sands thermal	55-85	40-80
Oil sands mining	65-105	(combined)
Ultra-deepwater	35-105	40-65
Deepwater	30-85	(combined)

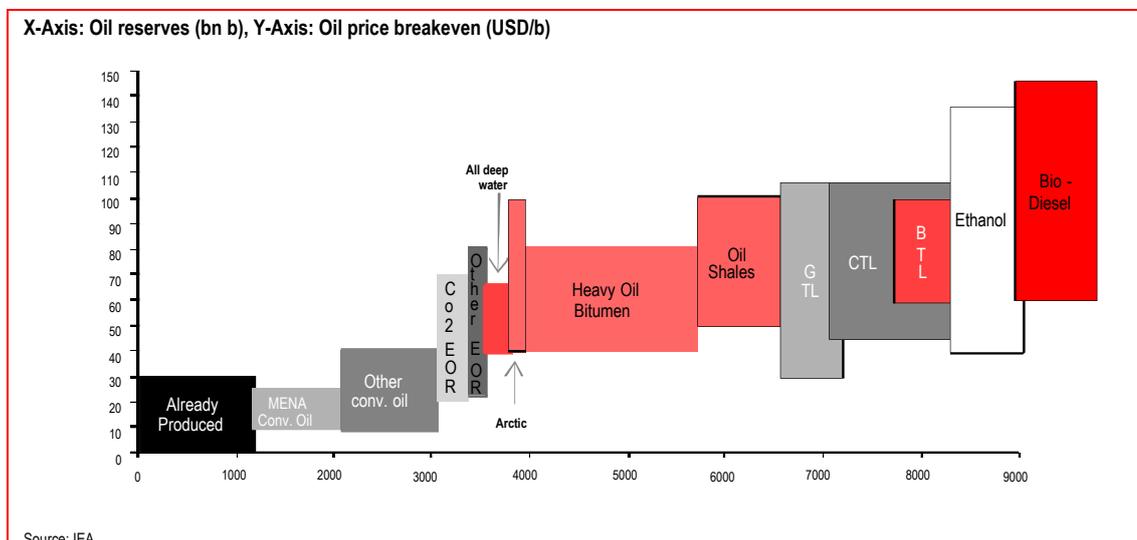
Source: Wood Mackenzie, IEA

We see US shale oil (tight oil) production as relatively high-cost production, although probably lower cost than oil sands. From OPEC's perspective, US shale oil would probably be an important target because of its short-term nature – fast drill times and fast declines. A low oil price would have a more rapid impact on drilling and development of shale oil reservoirs than on most conventional projects. Wood Mackenzie estimates that US shale oil production is viable at an oil price range of USD45-105/b with an average of USD70/b.

Statoil's chart of average breakeven level for its sanctioned projects, shared at its site visit to Brazil in September 2012, also supports our USD50/b oil hypothesis. Nearly half of its potential projects would be marginal or non-commercial at a price of USD50/b.



Based on this, we believe USD50/b is an acceptable oil price for a ceiling test to assess the potential of value at risk in a low-carbon world.



Gas prices

Unlike oil, gas is sold using a wide range of pricing mechanisms, the three main types being free-market, oil linked and regulated.

Wide range of gas pricing mechanisms (2010)

	Wholesale gas price formation, 2010
Oil escalation	23%
Gas-on-gas competition	38%
Bilateral mechanisms	4%
Netback	1%
Regulation: Cost of service	12%
Regulation: Social and political	10%
Regulation: Below cost	11%
No price	1%

Source: IGU, 2012

At present, most European and Asian LNG gas prices are linked to oil prices in some way. Unlike oil, the IEA assumes that gas demand will continue to rise in a low-carbon world. This is partly because of a necessary shift in the fossil fuel mix from oil/coal to gas. It is also because gas is more of an 'economic' fuel than oil. Most oil is used for road transport with around 60% being used for personal transport. Only 15% of oil is used in direct industrial processes (including power). For gas, the figure is nearly 60%.

Lower growth in gas demand could put pressure on gas pricing. However, with many major consumers of gas in Asia relying heavily on LNG for imports, we believe prices would be supported at the level needed to justify a new-build LNG scheme.

We estimate that most LNG projects need a gas price of around USD8-11/mmBtu. At its 2012 management day (15 November 2012), Shell indicated that US-based LNG projects would need a landed price of USD12/mmBtu in Asia and USD10/mmBtu in Europe to be commercial.

We have used a gas price of USD9/mmBtu. This is around USD55/b in oil parity terms. Oil-linked gas prices normally trade at a discount to oil and this gas price would be consistent with a Brent price of around USD75-85/b for European and Asian oil-linked gas contracts.

Valuations

- ▶ Overweight ratings are Total, BG and BP
- ▶ Underweight rating is Statoil
- ▶ ENI and Royal Dutch Shell A & B have Neutral ratings

Valuation and risks

Multiples-based approach

For all the companies except BG, our valuation methodology uses a weighted average of two different approaches based on the EV/DACF (25%) and EV/NOPAT (75%) target multiples. We adjust our valuation components to account for our estimate of the likely future cost of carbon, arrived at by using a cost of carbon of USD20/tonne. This includes cost of the companies' operations in the upstream (production) and downstream (refining and chemicals.)

We have included this in our valuation methodology for the European oil sector since 2009. (See '[Oil and carbon. Counting the cost](#)', 23 September 2008, for a more detailed methodology).

Our target prices are set on a 12-month timeframe by uplifting by our estimate of companies' cost of equity and rounded.

We use our 2013 estimates, which assume a Brent price of USD90/b.

Target price derivation

	TP	EV/NOPAT value	EV/DACF value	Cost of carbon/share
BG.L	1,820	NA	NA	25
BP.L	530	552	460	17
ENI.MI	19	18	22	0.6
RDSa.AS	30	31	27	0.9
RDSb.L	2,400	2,469	2,191	75
STL.OL	150	137	186	1.4
TOTF.PA	45	44	48	1.5

Source. HSBC estimates

For our multiples-based valuation of the oil majors, we use a target EV/DACF ratio of 5.0x and a target EV/NOPAT ratio of 9.0x, which are based on the average ratios for the European sector over the past 12 months. We adjust these targets for our estimate of WACC (used as a measure of risk) for each company. Please note that the cost of carbon share is not related to the cost of unburnable carbon discussed in this note.

Valuation summary as on 21 January 2013

Company	Price	RIC	TP	Potential Return	Rating	PE (2013e)	IBES PE (2013e)	EV/NOPAT (2013e)	EV/DACF (2013e)	Div yield (2012e)	FCF yield* (2013e)	PB (2012e)
BG (p)	1,120	BG.L	1,820	63%	OW	13.7	12.6	17.1	9.2	1.4	-7.3	1.9
BP(p)	459	BP.L	530	15%	OW	8.1	7.7	9.6	6.4	4.5	1.7	1.1
ENI (EUR)	19.3	ENI.MI	19	-2%	N	9.6	9.1	11.0	5.0	5.6	6.0	1.2
RD Shell A (EUR)	26.3	RDSa.AS	30	14%	N	8.3	7.8	8.4	5.2	4.9	5.4	1.2
RD Shell B (p)	2,264	RDSb.L	2,400	6%	N	8.5	8.3	8.6	5.3	4.8	5.3	1.2
Statoil (NOK)	144	STL.OL	150	4%	UW	9.4	8.7	11.0	4.6	4.7	-2.6	1.4
Total (EUR)	39.4	TOTF.PA	45	14%	OW	7.6	7.4	9.4	5.0	5.9	2.4	1.2

*Free cash flow yields exclude exceptional items and working capital movements that result from commodity price movements
Potential return equals the percentage difference between the current share price and the target price, including the forecast dividend yield when indicated
Source. Thomson Reuters Datastream, HSBC estimates, consensus from IBES

It is our estimate of the cost each company would have to bear if carbon pricing were introduced globally to cover all of their operations, upstream and downstream.

HSBC CoE and RFR

HSBC uses a risk-free rate of 3% for all companies under its coverage. The equity risk premium is 4.5% for the UK, 6.0% for the eurozone and 8.0% for Norway, which gives costs of equity of 7.5%, 9.0% and 11.0%, respectively.

Company cost of capital

For valuing companies, we use a US cost of capital because oil companies are largely dollar-denominated businesses. For US companies, HSBC uses a risk-free rate of 3% and an equity risk premium of 4%. We arrive at company-specific cost of capital by using company-specific beta, leverage and debt cost.

Cost of capital

	RFR	ERP	Beta	Debt	WACC
BG	3.0%	4.0%	1.1	3.5%	7.0%
BP	3.0%	4.0%	0.9	3.2%	6.3%
ENI	3.0%	4.0%	1.0	3.5%	6.6%
RD A & B	3.0%	4.0%	0.9	3.2%	6.2%
Statoil	3.0%	4.0%	1.1	3.2%	6.3%
Total	3.0%	4.0%	0.9	3.2%	6.1%

Source. HSBC estimates

Rating

Under our research model, for stocks without a volatility indicator, the Neutral band is 5ppts above or below the hurdle rates of 7.5% for UK stocks, 9.0% for eurozone stocks and 11.0% for Norwegian stocks.

HSBC Neutral band derivation

	Risk-free rate	Equity risk premium	Cost of equity	Neutral band
UK	3.0%	4.5%	7.5%	2.5% to 12.5%
Eurozone	3.0%	6.0%	9.0%	4.0% to 14.0%
Norway	3.0%	8.0%	11.0%	6.0% to 16.0%

Source. HSBC estimates

Potential return equals the percentage difference between the current share price and the target price, including forecast dividend yield when indicated.

Please note this means that companies with quotes in different countries, such as RD Shell, may have different neutral bands and so may have different ratings.

BG Group (OW, TP 1,820p)

Valuation. For BG, we use a sum-of-the-parts (SOTP) approach to derive our target price as a large part of its upstream asset base does not contribute to earnings yet. Our valuation for the upstream assets is based on the company's FAS69 disclosures of the value of its proven and probable reserves, adjusted to our oil and gas price assumptions. For BG's Brazil and Australian assets, we use DCF from HSBC's field models. We value sustainable LNG earnings on a PE of 11x of our 2013 forecast. We adjust our target price for our forecast of potential cost of carbon, which we estimate at 25p/share.

BG SOTP valuation (p/share)		
	USD90/b Brent	USD100/b Brent
Core assets		
Proven reserves	372	406
Probable reserves	164	225
Resources	76	104
Growth assets		
Brazil resources	717	854
Australian CSG	152	170
Tanzania resources	73	73
US Shale	43	43
Total growth assets	986	1,140
LNG & T+D	285	285
Net debt	-177	-177
Carbon	-25	-25
Total	1,608	1,885
Implied TP (12m uplift)	1,820	2,120

Source: HSBC estimates, BG data

Catalysts. Delivering on its key projects in Brazil and Australia is essential to restore confidence in BG's growth potential. If the group can convince investors that its longer-term growth is intact, it should start to restore its premium rating. Evidence that production at its two problematic Brazil FPSOs is building during 2013 could help this process.

Risks. The generic risks to our Overweight stance include failure to deliver projects on time, disappointing exploration and appraisal wells, and materially weaker oil and gas prices or dollar exchange rates than those assumed for our long-term forecasts. The value of its Brazilian and Australian finds is highly sensitive to oil prices and the US dollar. BG's above-average exposure to Brazil and Kazakhstan also exposes it to country-specific risks.

BP (OW, TP 530p)

Valuation. Our 530p target price is set on the basis of target multiples for 2013e, which are based on USD90/b Brent. As we have excluded the contribution of TNK-BP Holding from our forecasts but not yet included the benefit from the Rosneft stake, our component valuations include the transaction value (USD12.3bn cash and the current market value of its 19.75% stake in Rosneft (ROSN LI, price USD8.69, UW, TP USD6.50).

Catalysts. BP remains a risky investment, in our view, given the uncertainties surrounding the costs associated with the oil spill. The key catalyst is an acceptable conclusion to the Macondo lawsuit, which goes to trial at end-February 2013. A decision that BP was not 'grossly negligent' and a reasonable settlement with the DoJ are possible positive catalysts. After the completion of its announced divestment plan, BP's next operational focus is likely to be on delivering its guidance of "50% plus" growth in cash flow by 2014 under an oil price assumption of USD100/b. BP is also accelerating its exploration efforts from 2013. The delivery of its project pipeline and exploration success could restore investors' confidence that BP can deliver longer-term growth.

Risks. Downside risks to our Overweight rating are that oil and gas prices, refining margins and the US dollar are materially weaker than our long-term assumptions. Apart from the spill liabilities, which are difficult to quantify, BP-specific risks include an above-sector-average exposure to US gas prices and above-average exposure to Azerbaijan, which expose it to country-specific risk.

ENI (N, TP EUR19)

Valuation. Our EUR19 target price is set on the basis of target multiples for 2013e, which are based on USD90/b Brent. Our target price assumes the sale of the entire 52.53% stake in Snam and the sale of its residual stake in Galp Energia at current market value.

Catalysts. We believe that a possible catalyst for the stock is the sanctioning of future projects needed to sustain growth in its upstream production. Specifically, approving a development plan for its Mozambique gas discoveries should be a positive for sentiment. ENI is set to increase its exploration for 2012-15. Further resource upgrades in the Skrugard/Havis area in the Barents Sea or success in its West African drilling programme are possible positive

catalysts. ENI's gas business has been affected by the weak Italian economy. A recovery in the macroeconomic environment in Italy could also help investor sentiment.

Risks. Generic upside and downside risks to our Neutral view are oil and gas prices, refining margins or the US dollar are materially different from our long-term assumptions.

Company-specific risks include an above-sector-average exposure to North Africa, Nigeria and Kazakhstan. A perceived deterioration or improvement in political risks in these regions could be the downside or upside risks. ENI also has below-sector-average exposure to refining.

RD Shell B (N, TP 2,400p)

Valuation. Our 2,400p target price is set on the basis of target multiples for 2013e, which are based on USD90/b Brent.

Catalysts. The growth in cash flow from RD Shell's Pearl GTL and AOSP developments is likely to continue through 2013 and should comfortably pave the way for further increases in dividends. Improving global economic growth could lead to a tightening global gas market, a potential positive catalyst given the group's growing gas bias. The refining industry faces a challenging longer-term outlook given rising costs and soft demand. If the refining margins were to fall back to below mid-cycle levels, this could be seen as a negative by investors given RD Shell's downstream bias.

Risks. Generic upside and downside risks to our Neutral ratings are long-term oil and gas prices, refining margins or the dollar are materially different to our assumptions. RD Shell-specific risks include an above-sector-average exposure to refining. It also has above-average exposure to Nigeria and Qatar.

Statoil (UW, TP NOK150)

Valuation. Our NOK150 target price is set on the basis of target multiples for 2013e, which are based on USD90/b Brent.

Catalysts. Exploration failures in East Africa or the US Gulf are key drivers to the downside.

Risks. The generic upside risks to our Underweight rating are that long-term oil and gas prices or the USD/NOK rate are materially stronger than our assumptions. Further exploration success in its East African exploration portfolio, new successes in the Gulf of Mexico and a continued improvement in the European gas market could also be risks to our rating. Company-specific risks include an above-sector-average exposure to Norway.

Total (OW, TP EUR45)

Valuation. Our EUR45 target price is set on the basis of target multiples for 2013e, which are based on USD90/b Brent.

Catalysts. In the short term, a successful ramp-up in Elgin could be a positive catalyst. The delivery of the project pipeline could increase investors' confidence in the company's growth target. Material discoveries in its frontier exploration areas could also help sentiment. In 2013, the company will be drilling key wells in Angola (pre-salt), Gabon (pre-salt), Kenya, the Ivory Coast, Libya, French Guyana, Mauritania and Indonesia.

Risks. The generic risks to our Overweight rating are long-term oil and gas prices, refining margins or the US dollar are materially weaker than our long-term assumptions. Total has above-average exposure to Angola, Nigeria, and Kazakhstan, bringing in country-specific risk.

Notes

Disclosure appendix

Analyst Certification

The following analyst(s), economist(s), and/or strategist(s) who is(are) primarily responsible for this report, certifies(y) that the opinion(s) on the subject security(ies) or issuer(s) and/or any other views or forecasts expressed herein accurately reflect their personal view(s) and that no part of their compensation was, is or will be directly or indirectly related to the specific recommendation(s) or views contained in this research report: Paul Spedding, Kirtan Mehta and Nick Robins

Important disclosures

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HSBC believes that investors utilise various disciplines and investment horizons when making investment decisions, which depend largely on individual circumstances such as the investor's existing holdings, risk tolerance and other considerations. Given these differences, HSBC has two principal aims in its equity research: 1) to identify long-term investment opportunities based on particular themes or ideas that may affect the future earnings or cash flows of companies on a 12 month time horizon; and 2) from time to time to identify short-term investment opportunities that are derived from fundamental, quantitative, technical or event-driven techniques on a 0-3 month time horizon and which may differ from our long-term investment rating. HSBC has assigned ratings for its long-term investment opportunities as described below.

This report addresses only the long-term investment opportunities of the companies referred to in the report. As and when HSBC publishes a short-term trading idea the stocks to which these relate are identified on the website at www.hsbcnet.com/research. Details of these short-term investment opportunities can be found under the Reports section of this website.

HSBC believes an investor's decision to buy or sell a stock should depend on individual circumstances such as the investor's existing holdings and other considerations. Different securities firms use a variety of ratings terms as well as different rating systems to describe their recommendations. Investors should carefully read the definitions of the ratings used in each research report. In addition, because research reports contain more complete information concerning the analysts' views, investors should carefully read the entire research report and should not infer its contents from the rating. In any case, ratings should not be used or relied on in isolation as investment advice.

Rating definitions for long-term investment opportunities

Stock ratings

HSBC assigns ratings to its stocks in this sector on the following basis:

For each stock we set a required rate of return calculated from the cost of equity for that stock's domestic or, as appropriate, regional market established by our strategy team. The price target for a stock represents the value the analyst expects the stock to reach over our performance horizon. The performance horizon is 12 months. For a stock to be classified as Overweight, the potential return, which equals the percentage difference between the current share price and the target price, including the forecast dividend yield when indicated, must exceed the required return by at least 5 percentage points over the next 12 months (or 10 percentage points for a stock classified as Volatile*). For a stock to be classified as Underweight, the stock must be expected to underperform its required return by at least 5 percentage points over the next 12 months (or 10 percentage points for a stock classified as Volatile*). Stocks between these bands are classified as Neutral.

Our ratings are re-calibrated against these bands at the time of any 'material change' (initiation of coverage, change of volatility status or change in price target). Notwithstanding this, and although ratings are subject to ongoing management review, expected returns will be permitted to move outside the bands as a result of normal share price fluctuations without necessarily triggering a rating change.

*A stock will be classified as volatile if its historical volatility has exceeded 40%, if the stock has been listed for less than 12 months (unless it is in an industry or sector where volatility is low) or if the analyst expects significant volatility. However, stocks which we do not consider volatile may in fact also behave in such a way. Historical volatility is defined as the past month's average of the daily 365-day moving average volatilities. In order to avoid misleadingly frequent changes in rating, however, volatility has to move 2.5 percentage points past the 40% benchmark in either direction for a stock's status to change.

Rating distribution for long-term investment opportunities

As of 24 January 2013, the distribution of all ratings published is as follows:

Overweight (Buy)	45%	(28% of these provided with Investment Banking Services)
Neutral (Hold)	37%	(27% of these provided with Investment Banking Services)
Underweight (Sell)	18%	(22% of these provided with Investment Banking Services)

Information regarding company share price performance and history of HSBC ratings and price targets in respect of its long-term investment opportunities for the companies the subject of this report, is available from www.hsbcnet.com/research.

HSBC & Analyst disclosures

Disclosure checklist

Company	Ticker	Recent price	Price Date	Disclosure
BG	BG.L	11.49	23-Jan-2013	2, 4, 6, 7, 11
BP PLC	BP.L	4.63	23-Jan-2013	1, 2, 4, 5, 6, 7, 11
ENI	ENI.MI	19.37	23-Jan-2013	1, 2, 5, 6, 7, 11
REPSOL	REP.MC	17.08	23-Jan-2013	1, 2, 4, 5, 7, 11
ROYAL DUTCH SHELL A SHS	RDSa.AS	26.36	23-Jan-2013	2, 4, 5, 6, 7, 11
ROYAL DUTCH SHELL B SHS	RDSb.L	22.71	23-Jan-2013	2, 4, 5, 6, 7, 11
STATOIL ASA	STL.OL	145.30	23-Jan-2013	11
TOTAL	TOTF.PA	39.42	23-Jan-2013	1, 2, 4, 5, 6, 7, 11

Source: HSBC

- 1 HSBC* has managed or co-managed a public offering of securities for this company within the past 12 months.
- 2 HSBC expects to receive or intends to seek compensation for investment banking services from this company in the next 3 months.
- 3 At the time of publication of this report, HSBC Securities (USA) Inc. is a Market Maker in securities issued by this company.
- 4 As of 31 December 2012 HSBC beneficially owned 1% or more of a class of common equity securities of this company.
- 5 As of 30 November 2012, this company was a client of HSBC or had during the preceding 12 month period been a client of and/or paid compensation to HSBC in respect of investment banking services.
- 6 As of 30 November 2012, this company was a client of HSBC or had during the preceding 12 month period been a client of and/or paid compensation to HSBC in respect of non-investment banking securities-related services.
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- 9 A covering analyst/s or a member of his/her household has a financial interest in the securities of this company, as detailed below.
- 10 A covering analyst/s or a member of his/her household is an officer, director or supervisory board member of this company, as detailed below.
- 11 At the time of publication of this report, HSBC is a non-US Market Maker in securities issued by this company and/or in securities in respect of this company

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* HSBC Legal Entities are listed in the Disclaimer below.

Additional disclosures

- 1 This report is dated as at 25 January 2013.
- 2 All market data included in this report are dated as at close 22 January 2013, unless otherwise indicated in the report.
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