

Research Paper

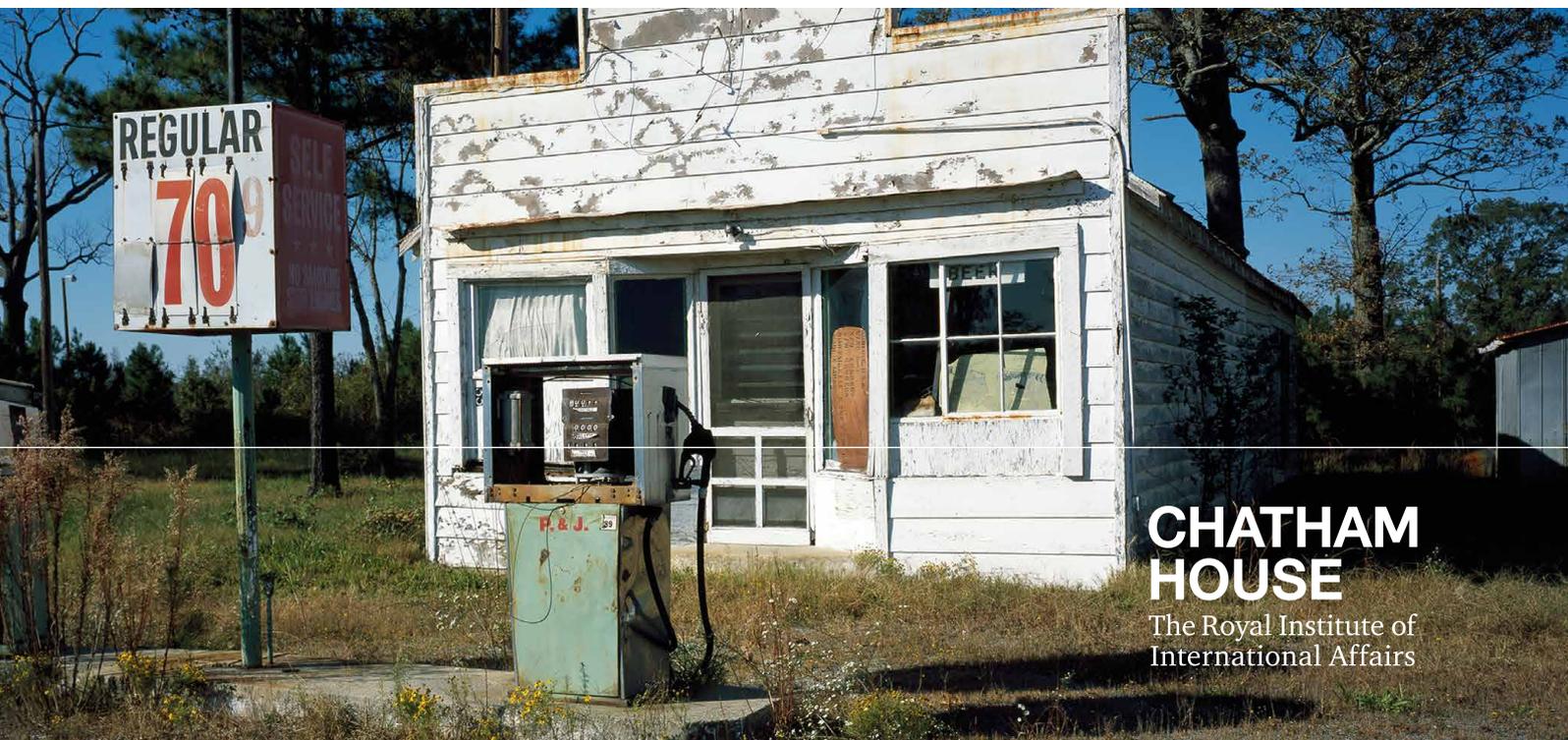
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# International Oil Companies

## The Death of the Old Business Model



**CHATHAM  
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# Contents

	Summary	2
1	Introduction	4
2	What is the Old IOC Business Model?	9
3	What are the Signs That the Old Model is No Longer Working?	12
4	Why Has the Old Model Been Failing?	14
5	Would the Failure of the IOCs' Business Model Matter?	30
6	What are the Possible Solutions Available to the IOCs?	32
7	Conclusion	37
	Bibliography	38
	Acknowledgments	43
	About the Author	44

## Summary

The future of the major international oil companies (IOCs) – BP, Chevron, ExxonMobil, Shell and Total – is in doubt. The business model that sustained them during the 20th century is no longer fit for purpose. As a result, they are faced with the choice of managing a gentle decline by downsizing or risking a rapid collapse by trying to carry on business as usual.

Most commentary on the IOCs' problems has focused on the recent fall in oil prices and the growing global commitment to tackle climate change. Important though these are, the source of their predicament is not confined to such recent developments over which they have no control. Their problems are more numerous, run deeper and go back further. The prognosis for the IOCs was already grim before governments became serious about climate change and the oil price collapsed.

The most recent iteration of the IOCs' business model emerged during the 1990s and was built upon three pillars: maximizing shareholder value based on a strategy that provided benchmarks for financial returns, maximizing bookable reserves and minimizing costs partly based on outsourcing. This model began to face serious challenges as the operating environment changed. It is the accumulation of these challenges, on top of those evident since the 1970s, and the failure of the IOCs to adapt to them that indicates that their old business model is gradually dying.

The IOCs have been able to survive over the last quarter of a century, but signs that their business model is faltering have recently begun to show. As well as poor financial performances, the symptoms include growing shareholder disillusion with a business model rooted in assumptions of ever-growing oil demand, oil scarcity and the need to increase bookable reserves, all of which increasingly lack validity.

There are, however, options that might allow the IOCs to improve their situation, namely:

- Squeezing costs in the hope oil prices will revive
- More mega-mergers
- Playing vultures with remnants of the US shale gas revolution
- Reshuffling their portfolios
- Diversification
- Becoming a purely OECD operation
- Rebuilding in-house technology

However, none alone is sufficient to solve the fundamental challenges, and even if implemented together they would amount only to fiddling around the edges while the model threatens the companies' survival. In particular, the IOCs cannot assume that, as in the past, all they need to survive is to wait for crude prices to resume an upward direction. The oil market is going through fundamental structural changes driven by a technological revolution and geopolitical shifts. The old cycle of lower prices followed by higher prices is no longer applicable.

In this new world, the only realistic option for the IOCs lies in restructuring and realizing many of their current assets to provide cash for their shareholders. Inevitably, this means that they must shrink into the remaining areas of operation, functionally and geographically, where they can earn an acceptable return. This would require a major change in the corporate culture of the IOCs. It remains to be seen whether their senior management could handle such a fundamental shift. If they can, the IOCs will be able to slip into a gentle decline but ultimately survive on a much smaller scale.

# 1. Introduction

For the first 70 years of the 20th century, private IOCs dominated the global oil industry outside North America and communist countries. This was the case in each of the main segments of the industry: the upstream (crude oil production), the downstream (refining and marketing of products) and the midstream (oil transportation).

After 1970, this dominance was gradually replaced by the growing role of national oil companies (NOCs) established by the major exporting countries, which took control of their own oil and gas reserves. Beginning in the early 1990s, the IOCs responded by developing a more sophisticated business model aimed at maximizing shareholder value by finding and proving more reserves, while minimizing costs. In the last 15 years, however, this business model became increasingly ineffective. This has been reflected in the generally poor performance of the IOCs' shares relative to global stock markets over this period, and in their financial performance in terms of profits and return on capital. As a result, their long-term prospects have become more uncertain. They are also threatened by two more recent developments: the 'unburnable carbon' issues, whereby to limit climate change some hydrocarbons need to be left in the ground, and the collapse in oil prices since June 2014. This paper will consider the evidence for concern over the demise of the IOCs, as well as how they might adapt their business model in order to revive their fortunes.

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The IOCs under consideration here include the remnants of the so-called 'seven sisters' that, until the 1970s, dominated the international oil industry.<sup>1</sup> They include Exxon, Mobil and Chevron – the successor parts of the Standard Oil Trust after it was broken up by the US Supreme Court in 1911.<sup>2</sup> The other four were the US-headquartered Gulf Oil and Texaco, British Petroleum (BP) and Shell, an Anglo-Dutch company. After the Second World War, Compagnie Française des Pétroles (now Total S.A.) was added to this group to make up what became known as the 'majors' (Penrose, 1969; Sampson, 1975). The diversification of oil supply since the price shocks of the 1970s has brought other private-sector companies into the international arena.<sup>3</sup>

Between 1945 and the 1970s, outside of the United States and communist countries, the majors controlled virtually all crude oil production, 70 per cent of refining capacity, every important pipeline and about two-thirds of the privately owned tanker fleet (Penrose, 1969). In this period, international crude oil trade moved almost entirely within their integrated operations or through long-term contracts between them. There was no commodity market in the modern sense. The IOCs were,

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<sup>1</sup> The 'seven sisters' was a term first used by Enrico Mattei, the first CEO of ENI, the Italian national oil company. He used it as a term of abuse since he felt they worked to exclude access to upstream acreage for companies such as ENI.

<sup>2</sup> This paper uses the modern names of the companies as many have used a variety of company names since their establishment.

<sup>3</sup> Where the term 'majors' is used, it refers to the large private companies before the mid-1970s and the widespread nationalization of their upstream assets by the producer governments.

in regard to finance and operations, vertically integrated until the 1980s, when they began to move towards the use of markets and away from operational vertical integration (Stevens, 2003).<sup>4</sup> The companies used their interlocking shares in the upstream joint ventures of the major exporting countries to regulate the competition, so as to supply ever-increasing quantities of oil to the market as a substitute for coal and to meet the energy demands of economic growth in the OECD countries (Penrose, 1969). Markets for oil products were divided between the ‘majors’ by the Achnacarry Agreement, also known as the ‘As-Is’ Agreement of 1928 (see Box 1). Subsequently, crude prices were set by the posting of prices for purchasing crude (see Box 1), while commercial transactions within each company’s integrated system were governed by transfer prices.

The first serious blow to this model came in the 1970s. With the rise of resource nationalism and weakening influence in the Middle East of the majors’ home governments, most oil-exporting countries expropriated the majors’ reserves and upstream operating affiliates (Stevens, 2012a; Stevens et al., 2013). At the same time, the effect of the first and second oil price shocks on demand left refineries with significant over-capacity, which seriously damaged their downstream profitability (Ibid.). The separation of the exporting-country NOCs’ upstream production from the majors’ downstream markets shifted the oil trade out of the closed system of the majors and into a global commodity market for crude oil. This led to the development of crude oil paper contracts on commodity exchanges in New York and London, at the end of the 1980s.

The IOCs have also lost the very considerable influence they had over the rules of the game for oil markets. These were initially set in 1928 as a result of the Achnacarry Agreement whereby they arranged that the oil markets would be administered based on the Gulf basing point pricing system (see Box 1).

In the 1980s, in response to their loss of production affiliates following the nationalizations in the previous decade, the IOCs sought new sources of crude oil by means of concession and production-sharing agreements in new areas. They also began to develop their gas businesses. For crude oil production, the results can be seen in Figures 1 and 2.

### Box 1: The Achnacarry Agreement and the majors’ control of oil markets

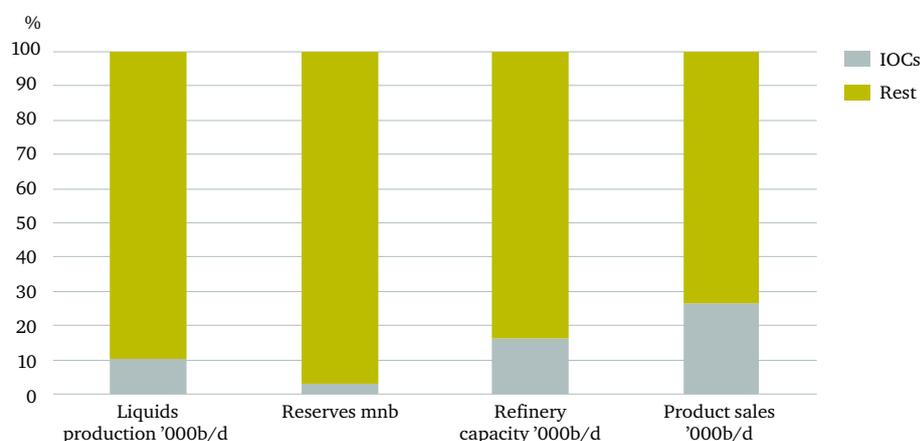
There was a fundamental problem facing oil markets in the early decades of the 20th century. How were they to allow the low-cost supplies from the Middle East to enter the various regional markets that constituted the ‘international’ oil markets without threatening the price structure? In a competitive market, Middle Eastern oil would gain market share but this would result in successive price wars. This is precisely what happened, culminating in a vicious price war in India between Exxon and Shell in 1928 (Penrose, 1969). That year, following a meeting of the big three majors – Standard Oil of New Jersey (Exxon’s precursor), Shell and the Anglo-Persian Oil Company (BP’s precursor) – at Achnacarry Castle in Scotland, an agreement was drawn up that governed the oil markets up until the 1950s. The other majors quickly signed up to the agreement.

A key element of the agreement was the Gulf basing point system (Bamberg, 1994). International oil prices were set initially by the price in the Gulf of Mexico, effectively the domestic price in the United States. On top of which was added the freight rate to wherever the oil was bound. However, this was then further adjusted by a ‘phantom’ freight rate, which was intended to ensure that the landed price at the destination was the same, irrespective of where the oil was loaded. Those companies that had access to oil at a lower cost than in the United States then pocketed this ‘phantom’ freight rate. Thus oil markets were able to absorb increasing amounts of low-cost Middle Eastern oil without threatening international prices.

<sup>4</sup> There are two kinds of vertical integration. Financial vertical integration is when a company owns, and controls the finances of, affiliates in different stages of the value chain. Operational vertical integration is when crude and related products physically move between affiliates in different stages of the value chain.

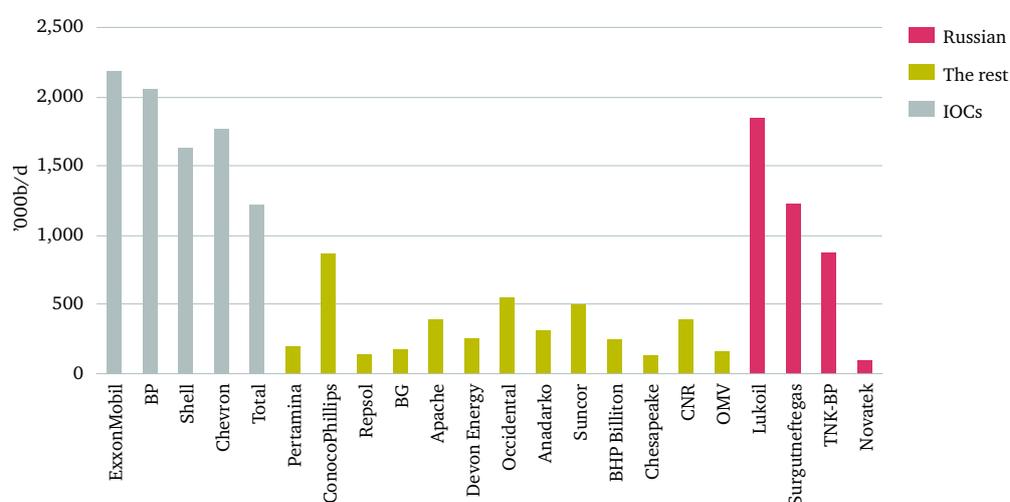
The Achnacarry Agreement governed oil markets until the 1950s and it remained a secret until 1952. In the 1950s, in order to calculate revenues owed to producer governments based on profit rather than a fixed royalty, the majors introduced the concept of the posted price. The vertical integration of the majors meant very little crude oil was bought and sold on an arms-length basis. Most of the oil moved within the majors' vertically integrated chain, which meant there was no crude 'price' that could be used to calculate profits. The setting of these posted prices was a unilateral right that the majors jealously guarded until, in 1970, a new government in Libya forced them to negotiate their setting with the producer governments. This sort of influence over prices, wielded by the majors, has long since disappeared, with OPEC taking over the determination of the administered price from the early 1970s (Stevens et al., 2013).

Figure 1: The IOCs' control of global oil, 2013



Source: The data for the IOCs is taken from Energy Intelligence (2013). The data for the rest is taken from BP (2015).

Figure 2: Major private oil companies ranked by liquids production, 2013



Source: Energy Intelligence (2013).

Note: 'Private' is defined as having more than 50 per cent of equity held privately.

In the 1990s, the IOCs believed that they could bring three key benefits to any upstream project: risk capital for exploration and development, technology for upstream operations and an ability to manage the risk of large projects. In the following decade, all three factors began to look less relevant. Given the rise in oil prices after 2002, capital became less of a constraint for existing producer governments, although it could still be important in developing countries yet to establish production.<sup>5</sup> The service companies to whom the IOCs outsourced much of their technical capacity in the past 20 years can now supply much of the technology required by NOCs. The IOCs' reputation for managing large projects came into question as a result of failures such as the Kashagan Field in Kazakhstan and the Deepwater Horizon spill in the Gulf of Mexico. Thus, despite their best efforts, their contribution to global crude supplies began to shrink, leaving them today as fairly minor players compared to the NOCs as can be seen from Figure 1.

Given that their record on delivering capacity growth has been poor and that the NOCs control access to so many projects, the IOCs have been forced to look at increasingly higher-cost and more technologically challenging projects. This was driven by the belief that oil demand would continue to grow and that oil prices would reflect an ever-rising long-run marginal cost curve for supply.<sup>6</sup> However, as will be developed below, this was at a time after the financial crisis of 2008 when financial markets were not looking favourably at large, high-risk, long-term projects. At the same time, the Deepwater Horizon spill in 2010 meant such projects became much more expensive and also carried significant reputational risk.<sup>7</sup>

The IOCs play a larger role in the downstream sector than in the upstream, as can be seen from Figure 1. That said, this role is much reduced compared to their dominance in the 30 years after the end of the Second World War. This diminished role in the supply of products reflects two things. First, the collapse in refining profitability following the large excess capacity that developed in the 1970s (see Box 3, page 20). Second, the higher than expected growth of demand in Asia and developing countries where, in general, the IOCs have a smaller presence than in the OECD countries. The lack of growth in OECD demand and the refinery surplus mean that refineries and retailing in OECD markets are not attractive to IOCs. Therefore they have been limiting their exposure to loss-making in the downstream by reducing refinery capacity. The economics of refining operations and their cost structure (see Box 3) mean refineries have struggled to make an adequate rate of return ever since the oil price shocks of the 1970s, which generated significant amounts of surplus primary distillation capacity. Thus there have been efforts by the IOCs to eliminate poorly performing downstream assets.

Following their loss of access to low-cost crude oil as a result of nationalization, the IOCs also began to expand their interest in gas production. This was, in part, as a consequence of efforts to replace sequestered oil reserves, as through their explorations they often discovered gas. Gas became increasingly important in many of the IOCs' portfolios but there were problems associated with this. First, there is much less economic rent in gas than oil because there is no OPEC to restrict supply and maintain high prices. Second, the culture of gas companies is very different from that of oil companies. In an oil company, the strategy and underlying culture is driven by the geosciences being used to discover crude oil, with a market for the resultant oil taken as a given. By contrast, gas is concerned with securing markets and customers, which is outside the expertise of much of the

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<sup>5</sup> Given the very high risks involved in oil exploration, it made sense for governments to ensure this risk was carried by the private company. Upstream agreements were designed to do precisely this.

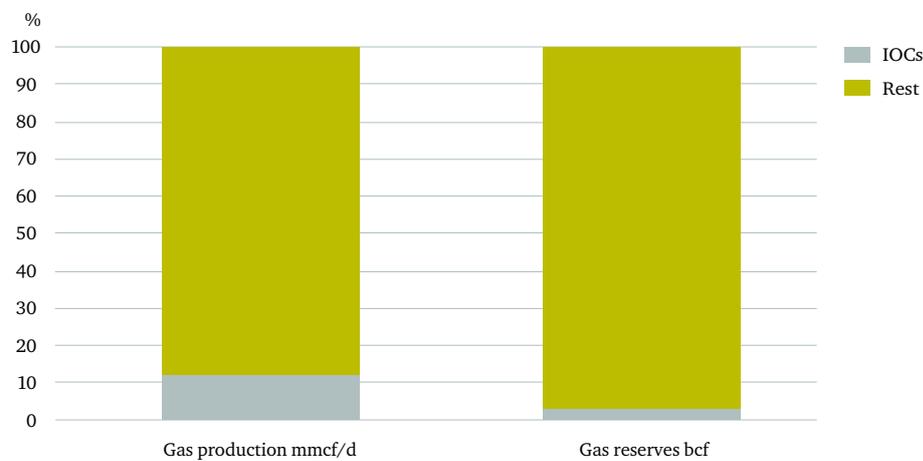
<sup>6</sup> In the author's experience, this was well illustrated by the way ideas about 'peak oil', in which supply would reach a peak and then decline, were taken on board with great enthusiasm by many in the upstream of the IOCs.

<sup>7</sup> In future, such deep-water prospects would require two wells to be drilled simultaneously to provide back-up if one failed.

senior management in the IOCs. As might have been expected following their experience with oil, the IOCs' involvement in gas worldwide did not lead to their significant control of production or reserves, as can be seen from Figure 3.

While all these developments were being pursued by the IOCs in the 1980s a new business model was developed. In part this was out of necessity as nationalization had undermined the previous model. However, at the same time, a raft of new ideas began to emerge from universities and business schools. These morphed into the IOCs' business model that is currently under threat.

**Figure 3: The IOCs' control of global gas, 2013**



Source: The data for the IOCs is taken from Energy Intelligence (2013). The data for the rest is taken from BP (2015).

## 2. What is the Old IOC Business Model?

The IOCs business model that emerged in the early 1990s was based upon maximizing shareholder value. The strategies to achieve this were increasing bookable reserves<sup>8</sup> and trying to reduce costs.<sup>9</sup>

### Value-based management and maximizing shareholder value

The financial strategy of ‘value-based management’ became increasingly popular in the 1990s and became associated with the capital asset pricing model (CAPM) (see Box 2).

Since at least the 1970s, the IOCs had based their strategy on maximizing shareholder value. However, this was seen as a rather vague concept with little underlying analysis. Value-based management and CAPM took off in the industry because they gave an apparently scientific basis for measuring what the return on capital should be, thereby providing a benchmark on project returns below which money should be returned to the shareholders rather than invested in the project.<sup>10</sup> In short, they appeared to give scientific respectability to what had for some time been a key element of the IOC business strategy. It also gave a quantitative method to determine the cost of capital and hence the discount rate that should be applied to a project’s cash flows to generate the net present value (NPV), a key parameter in determining the financial viability of a project. This was seen as very useful as previously the discount rate used to compute NPV tended to be subjected to ‘fudge factors’ at the whim of whoever was creating the discounted cash flow for the project. This gave opportunities to ‘product champions’ who were in the business of promoting their pet projects within the companies. At this time an increasing number of bright, young IOC executives were returning from completing MBAs at top-class business schools and beginning to rise up the executive ladder. The spread of what was essentially a mathematically based model of risk gave them an advantage over many of the older managers, who lacked the technical skills and could be dazzled by the mathematics.

All of these ideas coalesced into trying to increase returns to shareholders by encouraging higher share prices through good performance and paying out as high and stable a dividend as could be sustained. This perfectly good objective of maximizing shareholder value within the IOCs was strongly reinforced in the 1980s, as all large corporations began as a matter of course to offer shares to senior management as part of incentive packages to encourage better performance. The oil sector was no exception and thus the IOCs’ senior management had an increasingly strong interest in rising share prices.<sup>11</sup>

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<sup>8</sup> Reserves of oil and gas recognized by the US Securities and Exchange Commission as owned by the company, proved by drilling and technically capable of development at current prices. The definition was eased somewhat to recognize that, because offshore reserves could not be proved by extensive drilling in the same way as onshore reserves.

<sup>9</sup> Given the discussion covers a number of companies, generalization is inevitable and there will be differences and exceptions. But, as the industry has always followed consensus, it is not surprising that there was a strong element of commonality as the business model developed and was generally adopted.

<sup>10</sup> The 1990 Nobel Prize for economics was awarded to Harry Markowitz, Merton Miller and William Sharpe for their contribution to financial economics, which underlay CAPM. This helps explain the explosion of interest among the drivers of financial strategy in the IOCs who wanted to be seen to be at the cutting edge of economic thinking.

<sup>11</sup> CAPM had another rather esoteric advantage for the IOCs. It could be used to justify the use of very low discount rates on specific projects. This was important for companies claiming compensation for expropriated assets in arbitration disputes with governments. The lower the discount rate, the higher the value of the projects and hence the higher compensation claimed. This was particularly relevant in the cases associated with the US–Iranian Claims Tribunal (Joffe et al., 2009).

### Box 2: The capital asset pricing model

The capital asset pricing model was developed in business schools in the 1960s in the context of managing portfolios of financial assets, whereby risk is managed as the standard deviation of the portfolio. It was based upon Harry Markowitz's 'modern portfolio theory'.

Two types of risk were identified. The first was 'market risk', also known as systematic risk, to which all operations of the company were subject. The second type observed was 'unique risk', also known as unsystematic risk. The significance of this second risk is that it could in theory be diversified away. Thus 'the risk of a well-diversified portfolio depends on the market risk of the securities included in the portfolio' (Brearley and Myers, 1988: p. 134).

The systematic or market risk can be measured by the deviation from the market portfolio given a beta value of 1. Thus the beta value measures how strongly the stock prices of a sector move with the overall stock prices. For example, a company stock with  $b = 2$  will on average go up 20 per cent when the market goes up 10 per cent, and the company stock will go down by 20 per cent if the market goes down by 10 per cent. For example, according to the Merrill Lynch Beta Book (2007) based upon the end of 2006, crude and gas companies had a beta of 1.07, refining companies a beta of 0.95, electric utilities a beta of 0.46 and gas transmission companies a beta of 0.52. The Merrill Lynch Beta Book gives the adjusted betas for the IOCs as follows: Total 0.74, BP 0.72, ExxonMobil 0.85, Shell 0.80 and Chevron 0.81. From this the discount rate and hence the required return on capital is equal to the risk-free rate of interest, which should represent the time value of money – often taken as the US Treasury bond rate – plus the market risk premium adjusted for the beta of the sector.

### Maximizing bookable reserves

A key strategy of the IOCs' business model was to maximize bookable proved reserves. This could be done either by exploration drilling and assessment to 'prove', with varying probability, that stated volumes of oil in a reservoir are recoverable with known technology and at current prices,<sup>12</sup> or through the purchase of other companies with proved reserves on their books.<sup>13</sup> In theory, more bookable reserves meant two things. First, it created expectations of future revenue. Second, it allowed companies to add the capital costs (including capitalized exploration expenditure) to their financial balance sheet. The value of oil or gas in the reserves is declared as supplementary information under US Securities and Exchange Commission rules under a notional formula, but does not appear as an asset in the company's balance sheet.

During the 1960s and 1970s, the financial markets based on the Anglo-American model became more sophisticated. In particular, investors, whose income and bonuses depended upon their quarterly financial results, began to look for what they saw as reliable and timely metrics by which to judge the performance of companies.

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<sup>12</sup> For years these were taken to be year-end prices; now average prices over the preceding year are used by the US Securities and Exchange Commission.

<sup>13</sup> For example, Shell's acquisition of BG will increase the company's reserves of oil and gas by 25 per cent (*Economist*, 2015).

<sup>14</sup> Put simply, the Anglo-American financial model was based upon institutional shareholders becoming increasingly concerned with short-term gains on stock prices and dividends. This was opposed to the German–Japanese financial model where the shareholders were dominated by the banks and tended to take a longer-term view of what constituted success.

performance of companies. Net changes in booked reserves or the reserve-replacement ratio became key indicators of a company's future. This put huge pressure on the IOCs to increase their bookable reserves.<sup>15</sup> It also meant that, for senior management, production growth (with reserve replacement acting as something of a lead indicator) became an obsession to the exclusion of almost everything else. Subsequently, this meant that they were allowed to remain in their cultural comfort zone with little need to give serious consideration to other business models.

### Trying to reduce costs

The final strand of the IOCs' business model was trying to reduce costs. There was nothing particularly new in this. So-called 'time and motion studies' had long been part of any corporation's armoury for seeking greater efficiency. The difference was that academics in the 1970s argued that an effective measure of cost cutting was to outsource as many of the services required by the company as possible.<sup>16</sup> It was reasoned that the resulting competition among service providers would lower costs. The IOCs believed there was huge scope for outsourcing, given the very large number of diverse activities associated with what were vertically integrated companies.

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<sup>15</sup> In 2004, Shell was involved in a serious dispute over the reserves it had booked as 'proved' and eventually was forced to adjust its bookable reserves of oil and gas equivalent, reducing them from 19.4 billion barrels to 15.5 billion. As a result Shell's share price fell by 10 per cent and the company was fined £17 million by the United Kingdom's Financial Services Authority.

<sup>16</sup> One of the first uses of the term outsourcing was in a 1981 *Business Week* article on the automobile industry.

### 3. What are the Signs That the Old Model is No Longer Working?

It is difficult to produce definitive evidence showing the demise of the IOCs' old business model, as it has been a gradual process of deterioration without a terminal crisis. One symptom has been the failure of the IOCs to continually grow reserves, an objective at the heart of their business model. For example, in 2014, oil reserve additions were the lowest they had been since 2010 (US Energy Information Agency, 2015).

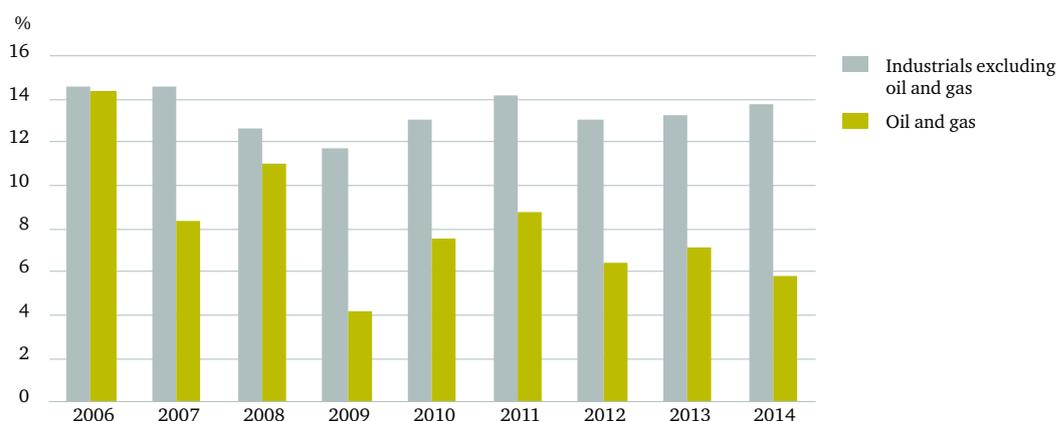
Another symptom of the decline is the relatively poor performance of the IOCs on stock markets. As one analysis found, 'the mid-2012 ratings of IOC shares indicate that investors do not believe that the companies in which they can invest, as currently constituted, offer the prospect of an attractive rate of growth or of positive change' (Mitchell et al., 2012: p. 56).

Furthermore, it is difficult to assess investor sentiment in terms of share value since the IOCs have tried to inflate dividends and raise share prices, by means of share buybacks, to stave off growing shareholder dissatisfaction.<sup>17</sup>

The IOCs' poor stock market performances have got worse with the fall in oil prices since June 2014. Thus, 'The stock prices [of ExxonMobil, Chevron, Shell, ConocoPhillips and BP] dropped by as much as one-third in the first eight months of 2015' (Shapiro, 2015).

All this raises questions over whether the IOCs will be able to protect their dividend payments and, if they cannot, how quickly will investors desert them?

**Figure 4: S&P 500 companies' return on investment, 2006–14**



Source: Who owns big oil, 2015.

<sup>17</sup> For example, over the past decade, Exxon has paid out 46 per cent of operating cash flow as buybacks compared with just 18 per cent as dividends (Jakab, 2015). In 2005, the six largest IOCs invested \$54 billion but returned \$71 billion to their shareholders (Stevens, 2009). It should be noted here that returning money to the shareholders is a perfectly reasonable response to shrinking investment opportunities.

Another symptom of their atrophying business model relates to profitability and return on capital, as illustrated in Figure 4. Even before the recent collapse in oil prices, upstream oil profits were losing their appeal over manufacturing. In 2014, at 8 per cent the returns to shareholders of energy companies were at their lowest since 2007, well below those for manufacturing at 15 per cent (US Energy Information Agency, 2015). Furthermore, between 2011 and 2014, energy companies had to sell assets and increase their debt to maintain their dividends and share repurchases (US Energy Information Agency, 2015). According to one report:

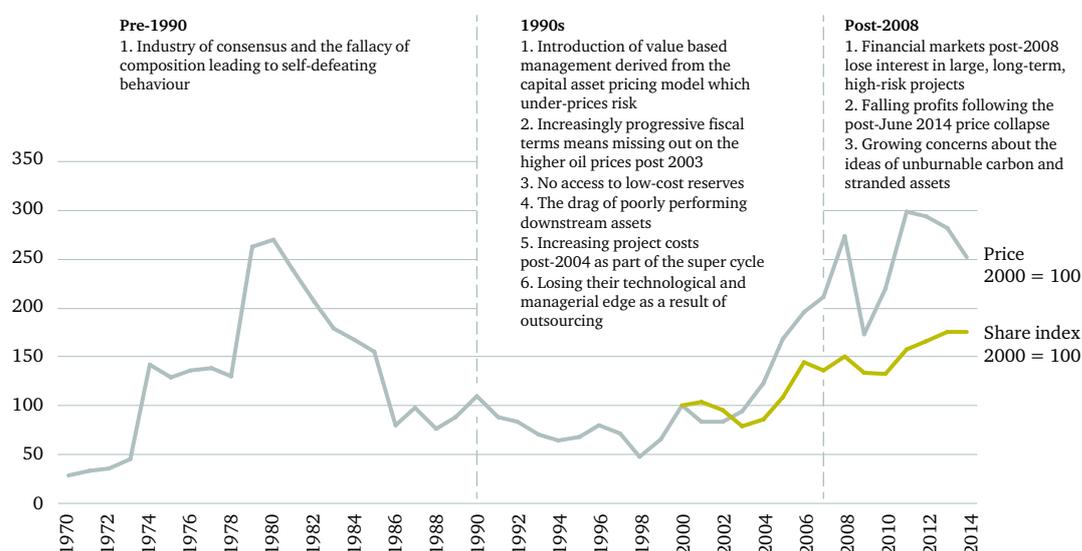
The average return on capital of the largest European and US oil companies dropped from 21 per cent in 2000 to 11 per cent in 2013, even though the average price of benchmark Brent crude rose from \$29 to \$109 in the same period... Even when crude was at those higher levels the financial performance of the large international oil companies was unimpressive (Crooks and Adams, 2015).

Overall, there can be little doubt that, from an investor's point of view, the IOCs have been failing to perform.

## 4. Why Has the Old Model Been Failing?

Many of the disparate and often unconnected failures of the IOCs' old business model that seem to presage its death have been accumulating since the early 1990s. They can be divided into three main categories: fundamental flaws, problems with the upstream and downstream, and difficulties with finance. There are also two more recent challenges from issues associated with 'unburnable carbon' and the new low-price oil context, since June 2014. Figure 5 below summarizes these long-standing and more recent problems.

Figure 5: A summary of problems faced by the IOCs' business model<sup>18</sup>



### Long-standing fundamental flaws

#### An industry of consensus

One apparent source of difficulties for the IOCs, present before the 1990s, was their strong tendency to follow a consensus.<sup>19</sup> They have long tended to pursue similar strategies and make similar decisions. In the early 1990s, the industry decided that in future the product barrel would get lighter and the crude slate – the choice of crudes used in refineries – would get heavier. The refinery industry around Singapore invested billions of dollars in upgrading its capacity. However, while the product barrel got lighter, the crude slate also became lighter, causing the price differential for light crude to fall, which wiped out profitability from the investments in upgrading capacity. Part of the reason for the lighter slate was that, as OPEC quotas forced IOCs to cut production, governments also reduced the production of heavier, less valuable crudes and increased the production of lighter, higher-value crudes.

<sup>18</sup> The share index refers to the average monthly share prices of BP, Chevron, ExxonMobil and Shell converted to an index with January 2000 = 100. Share data was downloaded from Yahoo Finance. This was prepared with the help of Felix Preston.

<sup>19</sup> This may not necessarily be a problem if the consensus is based on a perfectly good model.

Another reason for lower differentials than expected arises from the concept of the ‘fallacy of composition’, which helps explain why consensus thinking can be seriously damaging. If players in a market all act in the same manner, this can lead to results contrary to expectations. The classic example in economic textbooks relates to agricultural products. A high price for, say, wheat this harvest encourages farmers to plant more wheat in anticipation of high prices, but the result is that at the next harvest there is an over-supply of wheat and prices fall. With many in Singapore in the 1990s upgrading capacity to run on heavy crude, the demand and price for heavy crude rose, cutting refining margins. In a similar vein, 8 million barrels per day of new refinery capacity is currently being built in Asia. This is premised on a world of less light crude, however, the shale technology revolution in the United States is increasing the supply of light crude and again the IOCs’ investors will likely lose out.

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Another example came in the early 1980s when the consensus developed that oil, as a mature industry, could no longer provide viable investment opportunities and that the future lay in a strategy of conglomerate integration. This led to a spree of buying companies active outside of the oil industry. These acquisitions often began with companies involved in other energy sources such as gas, coal and nuclear. It then extended into mining and later into even more diverse activities, such as supermarkets and hotel chains. Eventually the realization that the IOCs lacked the managerial skills for such diverse operations hit home. A major problem with much of this diversification was that it required understanding of consumer products and marketing, a skill set distinctly lacking in the IOCs with their upstream orientation.<sup>20</sup>

In the 1990s, as a result, there was a reversal of large-scale divestment and the IOCs returned to their core business.<sup>21</sup> This might be described, somewhat cynically, as their senior management reverting to type and retreating into their comfort zone.

A more recent example of consensus thinking is that, as one observer argues, ‘oil company managements have believed with quasi-religious fervour in perpetually rising oil demand. Therefore finding new reserves seemed more important than maximizing cash distributions to shareholders’ (Kaletsky, 2014).

Other examples of consensus thinking abound. It is worth pointing out that in an oligopoly such as the international oil industry, where only a few firms dominate the supply, any consensus view will quickly bring the fallacy of composition into play unless challenged by investors and analysts. The IOCs have always been extremely vulnerable to this.<sup>22</sup>

One can speculate as to why this tendency to consensus persists. One explanation suggests that corporate decision-makers faced with similar information will tend to engage in similar behaviour. This is reinforced by the IOCs’ inclination to use the same consultants. At the same time, there tends to be safety in numbers and corporate planning departments are generally reluctant to view a future outside of an industry consensus.<sup>23</sup>

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<sup>20</sup> This is a similar story to their moves into gas discussed earlier.

<sup>21</sup> Investors do not like conglomerates, which can combine different industries in their portfolios and change the mix much more effectively, hence the existence of what is known in the City of London as the ‘conglomerate discount’.

<sup>22</sup> The only way to solve this problem is for the IOCs to talk to each other and compare plans. In most jurisdictions, however, this would be illegal under competition legislation.

<sup>23</sup> This is what ‘scenario planning’ is supposed to prevent, but in practice there remains a tendency to follow the conventional wisdom. This is apparent from the various long-term energy outlooks produced by the IOCs.

There are examples of IOCs breaking from the pack, however, and thereby gaining a ‘first mover advantage’. A good example of this was when, having anticipated the 1998 collapse in oil prices, BP bought Amoco in December 1998. This move kick started the rush to mega mergers between Exxon and Mobil in 1999 and Chevron and Texaco in 2001. Amoco’s purchase was part of BP’s strategy to bolster its gas credentials and in apparent preparation for the energy source’s bright future. Before the acquisition, gas accounted for 12 per cent of the company’s hydrocarbon production (mainly associated gas); post acquisition it rose to 47 per cent. The company’s CEO, John Browne, also wanted to import a ‘gas culture’ into BP as Amoco was more of a gas than an oil company. The difference between the two cultures, as noted earlier, is that gas is rooted in markets and customers whereas oil is all about geosciences with monetization of the hydrocarbons being an inevitable given and with the assumption that if oil is found, customers will follow.<sup>24</sup>

### CAPM undervalues risk

As outlined earlier, during the 1990s, a value-based management strategy based upon CAPM became prevalent in the IOCs’ decision-making. The problem is that CAPM grossly underprices risk. For example, in its pure form, because wildcat drilling is a diversifiable risk, drilling on the dark side of the moon would mean taking the same financial risk as buying a US Treasury Bond.<sup>25</sup> This derives in part from flaws in the theory.<sup>26</sup> Thus ‘the market portfolio at the heart of the model is theoretically and empirically elusive’ (Fama and French 2004, p. 41). It is therefore claimed that ‘the problems are serious enough to invalidate most applications of the CAPM’ (Fama and French 2004, p. 43). The result was that use of CAPM often became whimsical. Consequently, ‘corporate executives and investment bankers routinely fudge their CAPM estimates... because experience and intuition tell them the model produces inappropriate discount rates’ (McNulty et al., 2002). Despite the growing view that CAPM was an inappropriate method of evaluating risk, the legacy of its ideas lingered in the IOCs. Project champions saw its value when needing to fight their corner against sceptics who suggested projects were being oversold. A good example was the IOCs’ willingness to drill more and more wells in frontier areas, irrespective of the consequences if things went wrong and of the rising costs of such wells. To be sure, inability to access low-cost reserves contributed to this behaviour but CAPM’s influence was always in the background.

### Losing the technical and managerial edge

Over the last 25 years the IOCs have lost their edge in terms of technology and management. A key consequence of the outsourcing of activities throughout the value chain in the 1990s was a reduction of in-house research and development. Subsequently, the extensive capacity that the IOCs had built to develop technology began to erode. As a result, service companies, especially in the upstream, gained this technological edge. Producer governments no longer had to depend on the IOCs for their technology; they could simply bring in the service companies. This effectively neutralized a major advantage the IOCs previously had when bidding for upstream acreage.

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<sup>24</sup> A classic example of the attitudes to ‘customers’ was told to the author regarding when a new lube oil was launched by a large IOC. The post-project evaluation concluded it had failed because the consumers were too stupid to realize the better quality of the lube.

<sup>25</sup> This was the view taken at a hearing (in the author’s presence) by an expert witness on finance for a US oil company in the US–Iranian Claims Tribunal hearings in The Hague.

<sup>26</sup> For example, ‘a portfolio’s return variance misses important dimensions of risk’ (Fama and French, 2004, p. 37). Specifically, the assumption that the variance of returns is a valid method of risk is only applicable if the returns are normally distributed (Fama and French, 2004, p. 37).

Large mature corporations are frequently associated with management that has lost its competitive edge.<sup>27</sup> In economic theory, diseconomies of scale are usually associated with managerial limitations. These arise from problems with communication in large organizations, lack of coordination, Leibenstein's X inefficiency<sup>28</sup> and problems associated with principal-agent relations.<sup>29</sup>

Such accusations could be laid at the door of the IOCs. A good example was the way in which they missed out on the shale technology revolution in the United States. It was only after this was well underway that the IOCs began trying to acquire acreage and went into a buying frenzy after ExxonMobil bought XTO for \$36 billion in 2009. The general consensus is that in doing so the IOCs grossly overpaid for assets.<sup>30</sup> Since the fourth quarter of 2014, 38 US oil and gas companies have recognized capital impairments on their US operations of \$84.6 billion on property and equipment alone (Young, 2015).<sup>31</sup>

## Long-standing problems upstream

### Progressive fiscal terms

During the 1990s, faced with weakening oil prices, many governments opened their upstream acreage to exploration and development by the IOCs. This was generally based on some form of production-sharing agreement. In this period, there was a fear among the IOCs (yet another consensus) that oil prices could fall, which did eventually happen in 1998. Consequently, during the negotiations with governments over fiscal terms, the IOCs pushed for more protection on the downside in the event of lower prices. Typically revenues from early production were allocated first to recover costs, according to a formula, and then the balance (sometimes with a minimum) went to the government of that particular oil-exporting country. This was in return for ceding more to governments on the upside in the event of higher prices. The result was that the fiscal terms of upstream agreements became increasingly progressive, a trend that, in reality, had been apparent since the oil price shocks of the 1970s (Stevens, 2012a). In the 1990s, as IOCs ceded the upside in return for protection on the downside, the progressivity of agreements increased. The outcome was that when oil prices began to rise after 2002, as shown in Figure 6, the IOCs missed out on increased profitability from higher prices due to the nature of their production-sharing agreements, although they gained on equity oil in OECD production. Aside from any other impact, this caused significant frustration among IOC shareholders as rising oil prices did not translate into higher share prices.

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<sup>27</sup> Often this might be associated with cost cutting as management becomes increasingly squeezed in terms of its capacity to lead simply because of pressures of work.

<sup>28</sup> This is when technical efficiency is not achieved as a result of the absence of competition (Leibenstein, 1966).

<sup>29</sup> In this case, the agent is the management of the company and the principal is the owner. The agent is able to employ the resources of the company (i.e. rent seeking) for its own benefit. This happens because information asymmetry means the owner is unaware of what is happening. In large corporations, information asymmetry is deepened by virtue of the size of the operation allowing greater rent seeking by the management.

<sup>30</sup> A commonly heard joke among shale gas operators in the United States was that the best way to make real money out of shale gas was to buy a lot of acreage very cheaply and then find someone (in this case the IOCs) to pay over the odds to acquire this acreage. This view was strongly reinforced by the large and frequent capital impairment adjustments that were made subsequent to acquisitions (Young, 2015). See also Carbon Tracker (2015).

<sup>31</sup> Investors hate write-downs because not only do they destroy shareholder value they also allow management a 'get out' clause for poor decisions as they can benefit from subsequent results flattered by the write-downs.

Figure 6: Weekly spot price WTI, 2000–15



Source: US EIA website.

### Access to low-cost reserves

A key feature of the old business model is booking reserves to increase the value of the company. However, since the loss of their upstream affiliates in the 1970s, the IOCs have struggled to get access to low-cost reserves.<sup>32</sup> This has partly been the result of continued resource nationalism in many producing countries, but also due to increased competition for acreage from NOCs seeking to operate outside their own countries (Stevens et al., 2013). The IOCs have lost out as a result of the imperial legacies of their respective host countries but also because of their loss of technological edge.

The 2000s began to see a revival in resource nationalism (Stevens et al., 2013). By the end of 2014, 57.3 per cent of global proved oil reserves were in five countries: Saudi Arabia, Iraq, Iran, Kuwait and Venezuela (BP, 2015). Saudi Arabia was closed to IOC upstream investment in oil. Iraq was open but on extremely unattractive terms.<sup>33</sup> Iran faced sanctions, which forced the IOCs out of what had in any case been unattractive terms, under the regime of ‘buyback’ agreements.<sup>34</sup> Kuwait was in theory open but its ‘Project Kuwait’ was bedevilled by domestic politics. Venezuela was seen as having an extremely unreliable host government following numerous unilateral changes to earlier contracts. This lack of access has seriously undermined the whole basis of the IOCs’ previous success in the era of the ‘seven sisters’. Thus ‘upstream costs in the oil industry have risen threefold since 2000 but output is up just 14 per cent... The damage has been masked so far as big oil companies draw down on their cheap legacy reserves’ (Evans-Pritchard, 2014).

The failure to gain access to low-cost reserves also forced the IOCs to look for ever more expensive oil. In the words of one observer, ‘This inherent flaw in the oil companies’ business model was disguised for the past 40 years by the fact that oil prices rose even faster than the costs of exploration and production’ (Kaletsky, 2014).

<sup>32</sup> For example, in 2014, Shell replaced only 26 per cent of the oil and gas produced, compared with an average of 67 per cent for the previous three years (Butler, 2015).

<sup>33</sup> In 2009, a number of IOCs signed upstream agreements on unfavourable terms (effectively as service companies) in anticipation of a new petroleum law that would open the Iraqi upstream to production-sharing agreements. The new law never materialized.

<sup>34</sup> Following the agreement on Iran’s nuclear programme, sanctions are being lifted and the country is expected to offer new, attractive terms to encourage the IOCs to invest – but it remains to be seen how this might play out.

Another aspect of securing reserves concerns a variation on consensus thinking around another buzzword from the business schools – ‘materiality’. This relates to a growing obsession within IOCs with size and scale. At this time, they were only really interested in, and only willing to commit human resources to, large upstream projects. Many profitable projects were ignored simply because they were viewed as too small. The strategy was to increase the reserve base by large additions rather than a collection of small additions. This was reinforced by the IOCs’ obsession with cost cutting, which meant that skilled labour was becoming increasingly a major constraint on their ability to operate rather than capital scarcity. The result was that the IOCs ignored possible upstream projects that collectively could have improved their reserve-replacement record.

### Long-standing problems downstream

The IOCs have always been vertically integrated. However, in the aftermath of the oil price shocks of the 1970s and the collapse in refinery margins, as explained in Box 3, the downstream elements of their balance sheets failed to perform. While they have been trying to sell off as many of these poorly performing assets as possible, given their relatively unattractive economics, they have found few buyers in recent years.<sup>35</sup> There is also the argument that having downstream assets on the balance sheet can hedge against crude oil price risks. So, if crude prices fall and damage upstream profitability, this might be offset by rising refinery margins as the crude slate becomes cheaper. This was reported to be the case for BP and Total in 2015.<sup>36</sup>

**The IOCs have always been vertically integrated. However, in the aftermath of the oil price shocks of the 1970s and the collapse in refinery margins, the downstream elements of their balance sheets failed to perform.**

The IOCs tend to view the downstream as more of a liability than an asset. Indeed, given the orientation of their senior management that tended to come from the upstream, their corporate culture was always negative towards the downstream.<sup>37</sup> Taken to the extreme, this led ConocoPhillips to split its business into an upstream company and a downstream company in 2012.<sup>38</sup>

The IOCs’ strategy of divestment faced a number of problems. First, given the unattractive economics, who would buy these assets? There were many examples of refineries being sold by the IOCs for one dollar. However, refineries purchased at knockdown prices can generally afford to maintain production and do not reduce the surplus of product on the market. This may not matter to the IOC seller if it is withdrawing from the market completely, as in some African countries and Australia. Second, physically closing refineries in most OECD countries requires expensive clean-up expenditure, and therefore many refineries are kept notionally in service as storage facilities. Third, in many countries refineries are still seen as an issue of security of supply and closure attracts considerable political attention.<sup>39</sup>

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<sup>35</sup> In the 1980s and 1990s, it was the NOCs that often bought up the IOCs downstream assets in an effort to become vertically integrated. However, with the oil price collapse after June 2014 this option looks increasingly less likely as the NOCs are starved of cash as their governments scramble to secure revenue for now grossly over-stretched budgets.

<sup>36</sup> For example, in the second quarter of 2015, while BP’s upstream earnings fell by 89 per cent year-on-year, the company’s adjusted downstream earnings increased by 154 per cent (Forbes, 2015). The story for Total was similar (Bousoo and Rose, 2015).

<sup>37</sup> A view often expressed to the author over the years from the upstream part of the IOCs was ‘we make the money and the downstream wastes it’.

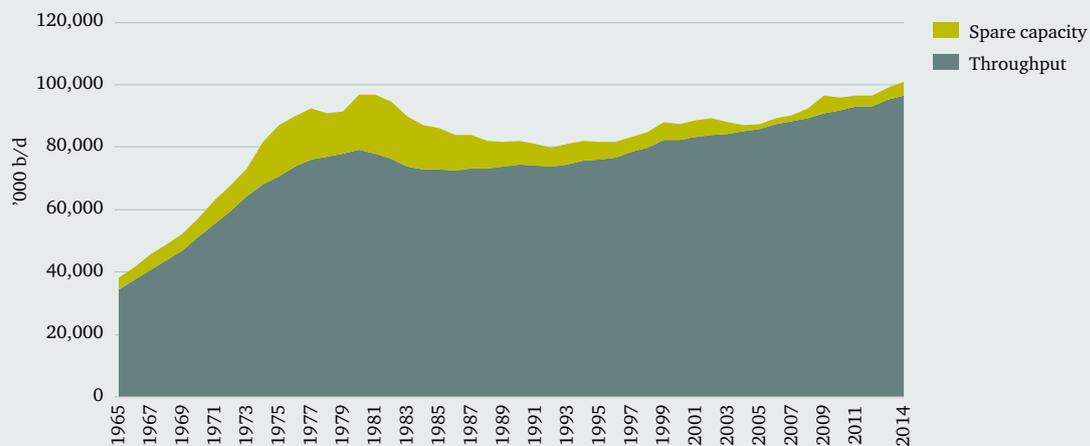
<sup>38</sup> At the time the company was the third-largest oil company in the United States. The downstream company was called Phillips 66 (Helman, 2012).

<sup>39</sup> A good example of this is provided by Australia where there has been much discussion over the security implications of refinery closures (House of Representatives Standing Committee on Economics, 2013).

**Box 3: Why refineries struggle to make adequate returns**

Refineries' problems stem from their underlying economics and cost structure. In essence, they are a collection of tanks and pipes, which allows large technical economies of scale. Thus, the capital cost of building a tank is determined by the surface area, which denotes how much steel and welding is required. The 'output' of a tank is a function of its capacity or volume. An exponential relationship exists between surface area and capacity. Doubling the size of a storage tank halves the average cost of storage, while the capacity of a pipeline is the square of the radius. In refining, in terms of the unit size, it pays to build large. Once built, to maintain profitability, it is essential to run these units at full capacity even, if possible, above full capacity by means of de-bottlenecking. Operating below capacity exponentially increases fixed costs, which rapidly eats into profitability. Pushing for full-capacity operation means refineries naturally oversupply the market, which reduces refinery margins, given that most product markets are intensely competitive.

Consequently, refineries end up operating at a loss. Normally this might be expected to lead to closures, thereby reducing supply and restoring margins to acceptable levels. However, this process runs afoul of the economists' 'bygones rule'. This argues that if a producing unit runs at a loss, there is a choice to shut it down or maintain operation. The decision depends upon whether the variable costs of production are being covered by the revenue, thereby making some contribution to the fixed costs. The fixed costs must be paid even if the unit is closed. The structure of refinery costs is very much dominated by fixed costs, not least because of the large capital investments required to gain economies of scale. Thus, refineries can run at a loss for quite some time until costs that are fixed, as a result of contracts, become variable costs when the contracts expire. Therefore refining is an industry with a tendency to oversupply with limited automatic adjustment to account for subsequent losses.



Source: BP (2014).

The figure above illustrates another problem with the economics of refining: the fact that creating capacity has relatively long lead times. In the late 1960s and early 1970s, the consensus among the majors was that the strong oil demand growth seen in the 1960s, as a result of the 'OECD Economic Miracle', would continue. Plans were laid to ramp up refining capacity. However, the oil price shocks of the 1970s meant that demand growth failed to materialize and, as more capacity emerged despite the fall in demand (reflecting the long lead times on the new capacity being built), the industry suffered the consequences of excess capacity shown above. This seriously damaged refinery profitability. As fixed costs morphed into variable costs, some capacity was closed.

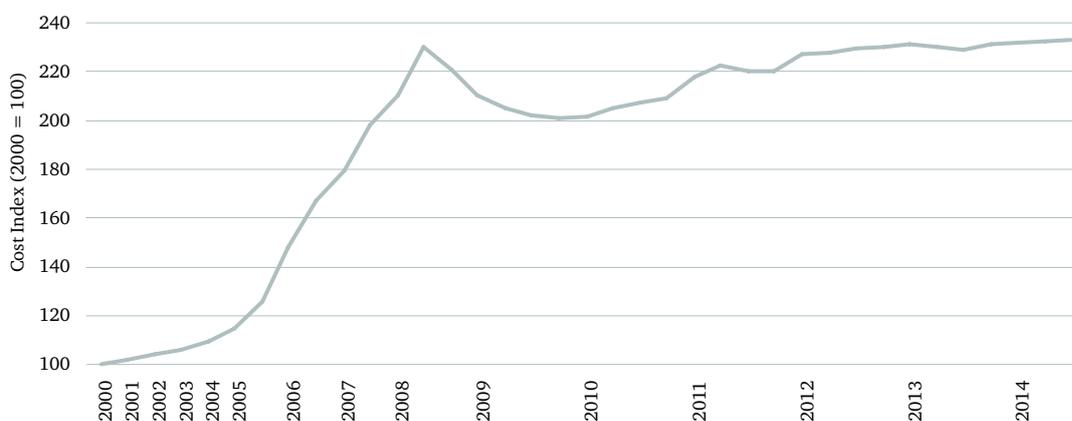
Despite the poor economics of refining, companies have continued to invest in it, but this had tended to be the result of being forced to invest to meet changing environmental regulations on fuel specifications. Of course, not all refineries make losses and those in certain advantageous locations make money. Investment can also be profitable if it involves cheap acquisitions. Profitability also tends to improve when crude oil prices fall. Overall, however, refineries have tended to be a drag on the financial performance of IOCs.

## Long-standing financial problems

Since the 2007–08 financial crisis, financial markets have changed fundamentally. There has been growing disillusion with large long-term, high-risk projects. Since these are precisely the sort of projects undertaken by IOCs, it is not surprising that their shareholders are becoming increasingly disenchanted. The first sign of this came in October 2013 when the big five IOCs (BP, Chevron, ExxonMobil, Shell and Total) announced their capital expenditure plans for 2014, among them only Total announced a cut while the others announced increases. As a result, Total’s share price rose and that of the others fell, reflecting the market’s discontent with IOC upstream plans. More recently, the markets have been increasingly uneasy about Shell’s purchase of BG Group plc.

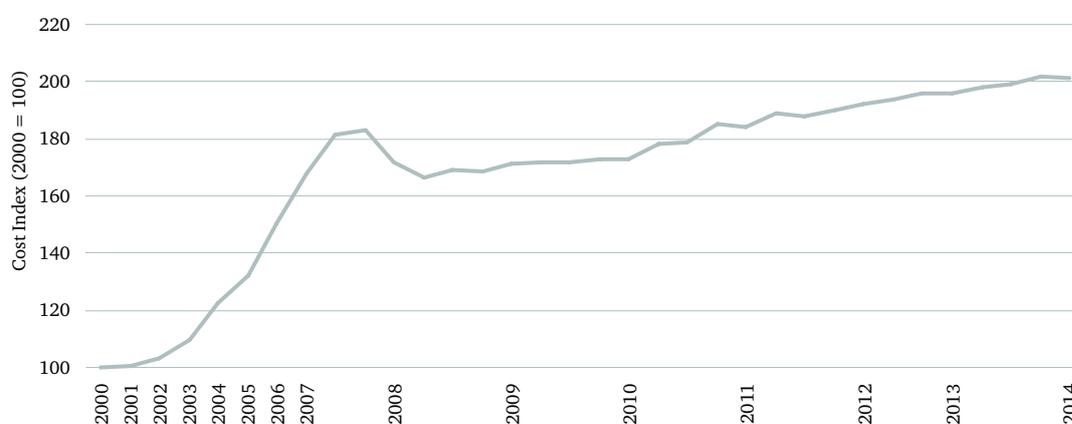
As indicated, a key element in the IOCs’ business model was reducing costs in order to increase shareholder returns. However, in the 2000s, there was a period of severe project-cost inflation, as can be seen from Figures 7 and 8. This, in part, was driven by rapid economic growth, notably in Asia, and by the start of a super-cycle in commodities, both of which pushed up project costs for items such as steel, concrete, labour and shipping. These items all have cost pass-through clauses in supply contracts with service companies. This inflation was also aggravated by a shortage of skilled labour. In addition to rising project costs, a pattern began to emerge when oil prices rose after 2002: lowering costs seemed to be less of an imperative and inefficiencies became common. In particular there was little or no pressure to standardize equipment. For example, in one company, there were apparently more than fifty shades of the colour yellow used for sub-sea purposes.

**Figure 7: Upstream capital cost index, 2000–14 (2000 = 100)**



Source: IHS CERA.

Figure 8: Upstream operating cost index, 2000–14 (2000 = 100)



Source: IHS.

## Recent difficulties: ‘Unburnable carbon’

Climate-change policies have evolved since the establishment of the Intergovernmental Panel on Climate Change in 1988 and the UN Framework Convention on Climate Change in 1992. The Paris agreement of 2015 (see Box 4) consolidated the Framework Convention as a hybrid mechanism with a ‘bottom-up’ concerted effort to reduce greenhouse gas emissions through nationally determined plans (the Intended Nationally Determined Contributions – INDCs) rather than a set of quotas or obligations or a global carbon price determined at the UN level. This is then combined with a ‘top-down’ legal framework that requires countries to review and set ever more ambitious plans every five years. Although the majority of INDC policies focus on demand, some countries may use emission-trading permits to establish a carbon price, and others may introduce carbon taxes. The World Bank estimates that carbon-pricing mechanisms currently cover 12 per cent of global emissions,<sup>40</sup> and this number may rise significantly in 2017 when China launches a national emissions-trading scheme.<sup>41</sup> All of this suggests that demand-driven ‘peak oil’ is a serious possibility.

### Box 4: The Paris Agreement 2015

Meeting in December 2015, the 196 parties to the UN Framework Convention on Climate Change established the Paris Agreement. This creates a legally binding framework coming into force in 2020 once 55 countries accounting for over 55 per cent of global emissions have acceded to it. The agreement includes the long-term goal of holding ‘the increase in the global average temperature to well below 2°C above pre-industrial levels, and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels’, and of achieving ‘a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century’. In pursuit of this goal, parties are obliged to submit INDCs setting out their pledges for climate action and to review them every five years.

Current estimates are that the collective impact of the INDCs covering 146 countries, submitted as of 1 October 2015, would have a 50 per cent probability of limiting the global forecast temperature rise to 2.7°C by 2100, with

<sup>40</sup> World Bank Group (2015).

<sup>41</sup> To see which jurisdictions use carbon-pricing mechanisms or plan to implement them, see the Carbon Pricing Leadership website at <http://www.carbonpricingleadership.org/who/> (accessed 8 Jun. 2015).

a range of 2.2°C to 3.4°C<sup>42</sup> (subsequent submissions take the total number of INDCs to 160 covering 187 countries). They would slow global emissions growth by approximately one-third for 2010–30 compared to 1990–2010.<sup>43</sup> To increase the likelihood of maintaining global warming below 2°C over the 21st century (with CO<sub>2</sub>-equivalent concentrations in the atmosphere in 2100 of about 450 parts-per-million or less) would require a global reduction of 40 to 70 per cent of greenhouse-gas emissions by 2050, which would require much deeper emissions cuts than most countries are planning.<sup>44</sup> To address the gap between current action and what is necessary to stay below 2°C, a ‘facilitative dialogue’ will be held in 2018 to give parties the opportunity to confirm or update their INDCs when the agreement becomes effective in 2020. The first formal review will then begin in 2023 leading to new INDCs being established in 2025.

The prospect of a peak in demand for oil and gas undermines the main strategy of the current and historical business models for oil and gas companies to maximize value for shareholders by preparing to meet increased demand. One consequence of the foreseeable decline in demand for oil, gas and coal means that the issue of ‘unburnable carbon’ has been moving rapidly up the agenda.<sup>45</sup> The concept is a very simple idea. There exists a level of hydrocarbon resources in the world, made up of coal, oil and gas.<sup>46</sup> If these reserves were burnt, they would produce 2,795 gigatons of carbon, with 65 per cent coming from coal, 22 per cent from oil and 13 per cent from gas.

**The scientific consensus reflected at the Intergovernmental Panel on Climate Change suggests that to achieve a 50 per cent probability of limiting global warming to 2°C, emissions should be limited to 3,000 gigatons of CO<sub>2</sub>. Before 2014, 1,970 gigatons had been emitted.**

The scientific consensus reflected at the Intergovernmental Panel on Climate Change suggests that to achieve a 50 per cent probability of limiting global warming to 2°C, emissions should be limited to 3,000 gigatons of CO<sub>2</sub>. Before 2014, 1,970 gigatons had been emitted. Taking account of changes in land use, deforestation and non-energy use, this leaves a ‘budget’ of 980 gigatons (in the range of 882 to 1,180) for post-2014 emissions. This means that only 565 gigatons of carbon can be added by 2050 (IEA, 2015).<sup>47</sup> Unfortunately, estimates suggest that at current rates this figure will in fact be reached by 2028.

It is in this sense and in this context that the balance of hydrocarbon resources becomes ‘unburnable’. The global excess of proved reserves over the ‘budget’ is so large that the uncertainties on both sides of the calculation do not undermine the possibility that companies hold reserves and resources that will not be developed. This has always been the case: reserves have increased steadily and, despite production, still stand globally for oil at around 60 years of current production. In relation to Figure 9, one study estimates that 340 billion barrels of oil resources will be produced and added to reserves that are not burnt by 2050 because of their higher cost.

<sup>42</sup> Carbon Tracker Initiative (undated).

<sup>43</sup> UN Framework Convention on Climate Change (2015).

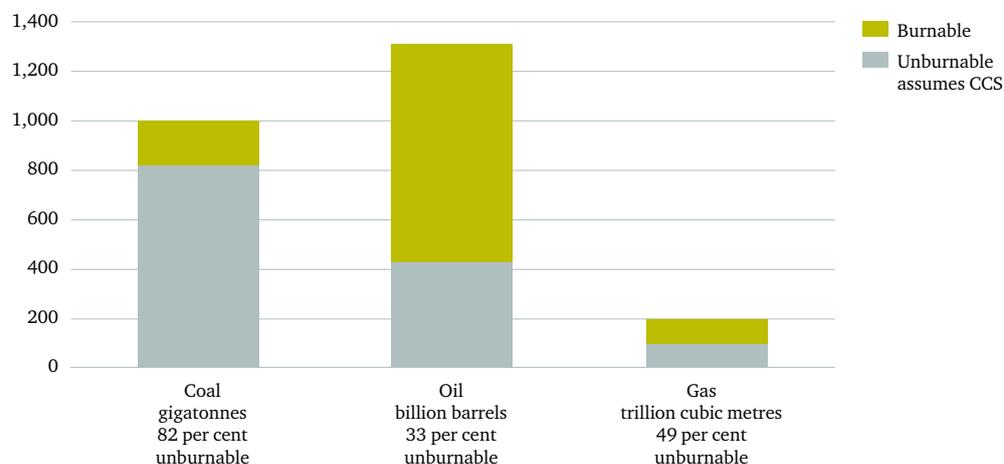
<sup>44</sup> For a wider summary, see Waskow and Morgan (2015).

<sup>45</sup> Possibly the most influential article that brought the subject to public attention was by McKibben (2012). The debate has further been fuelled by work from Carbon Tracker (undated) and other sources such as McGlade and Ekins (2015).

<sup>46</sup> Published estimates for oil and gas classify resources and reserves, according to the level of certainty about recoverable volumes and the likelihood that they can be exploited profitably. They have a wide range. The ‘reserve’ figures commonly used in climate-related discussions amount to a company’s proved resources as well as those with a probability of being proved of more than 50 per cent, the so-called ‘probable reserves’.

<sup>47</sup> Models suggest that if we stopped increasing carbon emissions today temperatures will still rise by 0.8°C. Therefore, we need to limit the temperature rise to 1.2°C.

Figure 9: Estimates of unburned hydrocarbons in 2050



Source: McGlade and Ekins (2015).

The relevance of unburnable carbon for the IOCs' prospects is obvious. A key pillar of their old business model is to maximize bookable reserves on the grounds that this will increase the value of the company in terms of book value and of expected future cash flows. This increased value is then expected to translate into higher share prices. However, the 'unburnable carbon' argument implies the value of these reserves could be overstated. This has given rise to much discussion about a 'carbon bubble' and the dangers of stranded assets, which carries important implications for the financial markets. It has been estimated that the top 100 coal and top 100 oil and gas companies had a combined value of \$7.42 trillion as of February 2011 (IFAC, 2013). In March 2014, the chair of the Environmental Audit Committee of the UK House of Commons, Joan Walley, said that 'Financial stability could be threatened if shares in fossil fuel companies turn out to be over-valued' (Walley, 2014). In a similar vein, the governor of the Bank of England, Mark Carney, warned in September 2015 about the dangers to financial stability from climate change if it implies an over-valuation of assets.<sup>48</sup>

While the stranded-asset argument has appealing simplicity, it is potentially flawed in the context of providing a threat to the IOCs' business model and should therefore be analysed carefully. In particular the interaction between reserves held by the NOCs and those held by the IOCs will be critical. A stranded asset can be defined as an asset that has lost value because circumstances have changed, or a potential asset that cannot be monetized because of circumstances beyond the owner's control. The carbon-bubble argument suggests the IOCs' assets will be stranded because policies designed to prevent climate change will prevent the reserves from being burnt.<sup>49</sup> However, the time frame over which this is assessed is vital. Mark Carney has noted 'the tragedy of the horizon', whereby impacts beyond 10–15 years into the future are not considered by investors and central bank regulators.<sup>50</sup> On average, the IOCs have a reserves-to-production ratio of 13 years<sup>51</sup> whereas that ratio is higher for NOCs.<sup>52</sup> It is therefore debatable that, over such a short period in terms of policy actions, much will be done to prevent the burning of current IOC

<sup>48</sup> Carney (2015).

<sup>49</sup> There must be a distinction between loss of value because of climate-change policies and loss of value because prices have fallen. Helm (2015) makes this distinction.

<sup>50</sup> Carney (2015).

<sup>51</sup> The reserve/production ratio (r/p) takes the physical level of hydrocarbons on a company's books and divides this number by the company's production. The result is the 'life' of the booked reserves.

<sup>52</sup> At the end of 2014, OPEC's r/p ratio was 60.1 years (BP, 2015).

oil and gas reserves. This is especially relevant for gas, which many regard as a transition fuel to a lower-carbon economy. Arguably, climate-change policies may encourage greater use of gas in the next five to 10 years, if not for longer.<sup>53</sup>

The IOCs, unlike the NOCs, also have options to manage future climate regulation, such as a managed decline whereby capital is returned to shareholders as existing reserves are used up (although this implies the eventual closure/transformation of the company). New technology could also impact future demand. The rapidly falling price of renewable energy and the development of electric vehicles could disrupt fossil-fuel markets. For NOCs, their much larger reserves and ties to national governments arguably imply a greater risk of stranding. In addition, what matters is the present value of reserves. On any realistic financial assumptions, the present value of money expected in 13 years is relatively low.<sup>54</sup> Thus the financial basis underpinning the carbon-bubble argument as applied to the IOCs requires further consideration.<sup>55</sup>

However, there is a weakness with this essentially ‘financial’ argument. It is based on a purely private-project-appraisal approach to the problem. This approach is very different from project appraisal based upon social cost-benefit analysis (see Box 5).

### Box 5: Private project appraisal versus social cost-benefit analysis

Project appraisal refers to assessing the financial viability of an investment project. There are many different ways of doing this but the generally accepted method is through discounted cash flow. In a private project appraisal, which would be used by a private investor concerned with maximizing returns on investment, all the various cash inflows and outflows accruing over the life of the project are identified, normally on an annual basis. Subtracting the outflows from the inflows gives the net cash flow associated with the project. These can then be discounted to a net present value by the application of a discount rate or converted into an internal rate of return (the discount rate, which gives a net present value of zero). Reducing the project to a single number, in theory, allows a comparison between it and other projects or the cost of capital.

In social cost-benefit analysis, which should be used by governments or public bodies concerned with maximizing social returns on investment, the method is similar to private project appraisal but with some significant differences. The first difference is what is included in the cash flows. Transfer payments – payments that do not involve any good or service in return for the payment – should be excluded. A good example would be sales taxes on inputs to the project. Externalities – costs or benefits arising from the project but not reflected in the private costs or revenues associated with the project – should be included in the cash flows. An obvious example would be environmental damage arising from the project but that is legal, such as greenhouse-gas emissions in the absence of any price or regulatory control on carbon. The second difference is that the discount rate used in a social cost-benefit analysis would be different from that used in a private project appraisal, reflecting different perceptions of risk.

The differences and approaches are far more complex than outlined above. However, in the context of ‘unburnable carbon’ the difference results in the following observation. A private company considering investment and thinking purely in terms of financial return would not concern itself with CO<sub>2</sub> emissions in the absence of any price on carbon. This leaves aside any issue of reputation and damage to brand, which will be considered below when the so-called ‘moral’ argument is considered. Thus carbon on the books of private companies would be burnt unless this is prevented by regulation or government-induced pricing changes. However, governments and society deciding on investment projects must be concerned with the costs associated with burning CO<sub>2</sub> to name but one externality. In that sense and context, the ‘unburnable carbon’ arguments are extremely important and should lead to the ‘unburnable carbon’ being left in the ground.

<sup>53</sup> This view is controversial (Ekins et al., 2014; McGlade and Ekins, 2014).

<sup>54</sup> At a discount rate of 10 per cent, \$100 expected in 13 years is worth \$29 today. At 15 per cent it is worth \$16 today.

<sup>55</sup> However, it is highly relevant for countries with large reserves.

The IOCs should be using private project appraisal. As private companies, they are entitled to do what is legal and within regulations, and they are entitled to realize the value of their booked reserves by burning them. In that sense, the carbon on the books of the IOCs remains an asset<sup>56</sup> in the absence of government action to inhibit burning it. Although the issue of unburnable carbon is worth further consideration in relation to IOCs – especially its impact on investment decisions to replace current depleted reserves and their business model beyond a 15-year horizon – it may ultimately be the NOCs that face the greatest risk of stranding.<sup>57</sup>

However, this ‘financial’ argument ignores what might be termed a ‘moral’ one.<sup>58</sup> It can be argued that the IOCs have a moral responsibility to ensure the burning of their carbon does not produce catastrophic results in terms of climate change, although to be fair this argument applies to everyone in every form of activity. However, given the business the IOCs are in, they are in a stronger position to make a difference than most.<sup>59</sup>

However, this ‘financial’ argument ignores what might be termed a ‘moral’ one. It can be argued that the IOCs have a moral responsibility to ensure the burning of their carbon does not produce catastrophic results in terms of climate change.

This moral argument goes beyond philosophical debate because it is beginning to gain significant traction in terms of people’s perceptions in a way that has relevance to the IOCs’ business model. There has been a growing divestment campaign aimed at pressuring investors into moving away from companies with carbon on their books. Norway’s parliament is in the process of forcing the Government Pension Fund, i.e. the country’s sovereign wealth fund, to divest itself of shares in companies that derive more than 30 per cent of their revenues from coal and power companies that base more than 30 per cent of their activities on coal (Carrington, 2015). The Rockefeller Trust has announced that it is in the process of divesting itself of shares in companies with hydrocarbon assets on their books (Schwartz, 2014). On top of this, there are a growing number of movements on university campuses and elsewhere throughout the world opposed to companies burning hydrocarbons.<sup>60</sup> The result is that the IOCs are increasingly seen as the latest ‘pariah’ companies on a par with tobacco companies and arms manufacturers.<sup>61</sup> How important such public relations problems are for the IOCs is debatable. One aspect that is of direct concern is in their efforts to attract talent to their workforces. The IOCs were always very proud of the fact that they were able to attract very high-quality graduates. However, in the last 20 years or so, it appears that the ‘best and brightest’ have been switching their interest to greener forms of energy.

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<sup>56</sup> The value of these assets, however, will depend upon the vagaries of the oil markets, specifically oil prices.

<sup>57</sup> There will always be an argument for replacing ‘burnable’ high-cost reserves with new discoveries or technologies if they lower the costs of available oil or gas.

<sup>58</sup> The term ‘moral’ is used here in a rather loose way in the sense of what is ‘right’ and what is ‘wrong’.

<sup>59</sup> Many of the IOCs have publicly accepted this as part of their responsibility and have introduced measures to assess their carbon footprints with targets to reduce them. These include a carbon price – often quite a high one – in their project evaluations. They have created lobby groups to try to reduce greenhouse gas emissions. Some have also reduced their involvement in lobby groups that, by effectively denying the existence of climate change, have been pushing in the opposite direction. It can be argued that all this is an attempt by senior management to convince itself on scientific and rational grounds that the business model is still fit for a new world dominated by climate-change concerns.

<sup>60</sup> For details of these various movements and campaigns, see the website of Fossil Free UK at <http://gofossilfree.org/uk/>.

<sup>61</sup> Arguably, targeting just IOCs is somewhat unfair. Logic and equity dictate that those that also consume energy on any scale should also be targets.

Shareholders have also been encouraged to table motions at annual general meetings requiring companies to state their exposure to the risks of climate change and (implicitly) of climate-change policies. Resolutions to this effect have been accepted by Shell and BP, but rejected by ExxonMobil and other American companies. This movement is based on a less controversial rationale than that of the divestment campaigns and, since undoubtedly there are risks to companies, shareholders are entitled to know what they are and how companies intend to deal with them.

Between the financial and the moral arguments, litigation has the potential to play an increasing role in holding governments and businesses to account for actions on climate change. As seen in other sectors, such as the tobacco industry in relation to cancer, wilful negligence in the face of scientific evidence can have legal consequences. In 1998 the largest US tobacco companies and 46 US states entered into the Tobacco Master Settlement Agreement, in which manufacturers agreed to pay an estimated \$206 billion over the first 25 years of the agreement.<sup>62</sup> While it is important to note that there are significant differences between climate change and tobacco-related diseases, there has been a recent increase in litigation related to climate change inaction. In June 2015, a court in the Netherlands ordered the government to cut emissions by at least 25 per cent over the next five years after a civil action was brought by campaigners.<sup>63</sup> In November 2015, the New York state attorney general began an investigation into ExxonMobil to determine whether the company lied to the public about the risks of climate change, or to investors about how such risks might impact the oil business.<sup>64</sup> Following the recent Paris Agreement, it will be difficult for any country or business to credibly claim that they were unaware of potential climate impacts, including in relation to the long-term goal of holding global average temperature increases to ‘well below 2°C’.

### Recent difficulties: low oil prices

As Figure 6 shows, since June 2014, the price of crude oil has collapsed. However, while this may appear to be yet another threat to the IOCs’ business model, the issue is more complicated.

First, while crude prices have fallen in recent years, as can be seen from Figure 10, they are not low in historical terms. Between 1986 and 2004, prices averaged \$33 per barrel in 2014 dollars. Today’s prices, averaging around \$30–40 per barrel, can only be defined as low in the context illustrated in Figure 10 of post 2005 and especially post 2011.

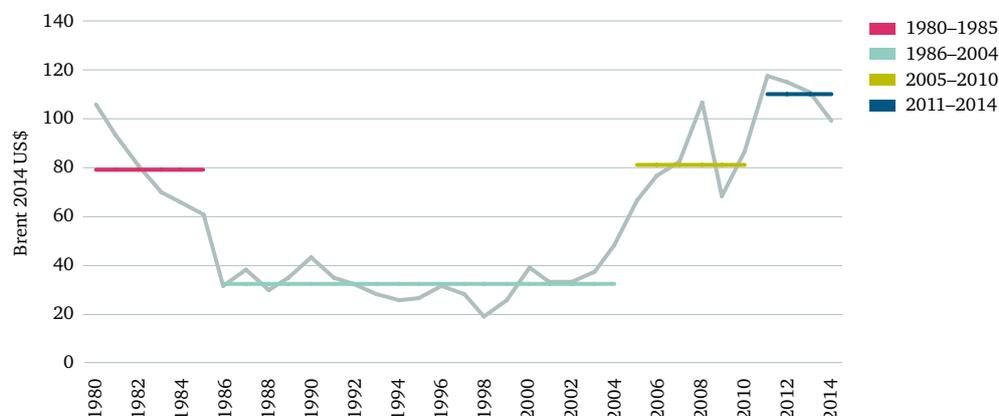
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<sup>62</sup> For details of the Master Settlement Agreement, see the website of the attorney general of the state of California at <https://oag.ca.gov/tobacco/msa>.

<sup>63</sup> Neslen (2015).

<sup>64</sup> Gillis and Krauss (2015).

Figure 10: Crude oil prices, 1980–2014 (Brent 2014 US\$)



Source: BP (2015).

Second, fiscal terms have become increasingly progressive since the 1990s, which means that it has been the producer governments that have taken the greatest hit from lower crude prices rather than the IOCs. Given that the IOCs are vertically integrated, to some extent the fall in the cost of the crude slate has arguably improved refinery margins and therefore helped retrieve profitability.

Third, there have been times over the last 25 years when prices have collapsed – in 1986, 1998 and 2008. On those occasions, the IOCs reduced their capital expenditure and sought to lower costs through improved efficiency. Their view was that oil prices are cyclical and therefore all they needed to do was to survive the period of lower prices in anticipation of higher prices to come – and events proved them to be correct. However, the current price collapse might be different and there are arguments that can explain why oil prices may be less subject to cyclicity in the future<sup>65</sup> and could remain at their current levels for much longer than many expect.

First, the shale technology revolution has changed the price elasticity of supply. Conventional oil projects have relatively long lead times of five to 15 years and sometimes longer. Production based on shale technology can be up and producing within months. Currently, in the United States there is a ‘fracklog’ of wells that have been drilled but not completed, i.e. fracked. They were drilled because the terms of their leases required the owners to drill or lose their rights, but prices were too low to justify fracking. If prices rise again, these wells will be fracked and production will flow fairly quickly, choking off this rise.<sup>66</sup> Supply is likely to respond to a price recovery much more quickly than in the past to limit the ability of oil prices to bounce back.

Second, with current prices many producer governments are desperate for revenues. If they cannot achieve them at current prices, one option is to increase production. This may well encourage governments to open up their upstream to IOCs and thus, even in a lower-price world, supply would

<sup>65</sup> It is important to distinguish between cyclicity and volatility of oil prices. Cyclicity reflects the fact that low or high prices generate market feedback loops. Thus low prices will increase the quantity demanded and decrease the quantity supplied, thereby increasing prices. High prices produce the opposite market reactions leading to lower prices. This latter cycle underlay ‘OPEC’s dilemma’, which resulted in the recent price collapse (Stevens and Hulbert, 2012). The producer governments needed higher prices to provide the revenues to stave off political unrest but these high prices sowed the seeds of their own destruction.

<sup>66</sup> The volumes involved are uncertain. Some estimates suggest around 3,000 wells are awaiting fracking. If an average production of 800 barrels per day is assumed (which may be on the high side) this amounts to an injection of 2.4 million barrels per day in a fairly short time.

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begin to increase.<sup>67</sup> This is precisely what happened in the 1990s when many producer governments previously hostile to the IOCs changed their policy and tried to attract investment (Stevens, 2008). Such an opening up has started in Mexico, through constitutional change, and other countries are also trying to attract the IOCs. At the same time Iran has returned to the market following the removal of international sanctions as a result of the deal regarding its nuclear programme. If Iranian production grows, this could also encourage Iraq to make its upstream more attractive to the IOCs. This strengthening of the supply side could keep prices low for a considerable time.

This raises an interesting proposition. Historically, an effective OPEC has been an important crutch to the IOCs' business model. By controlling supply, it ensured price levels well above any competitive equilibrium, which made the IOCs' higher-cost upstream projects viable. Now OPEC's (or rather Saudi Arabia's) strategy is to make sure the supply curve goes the right way<sup>68</sup> by pushing high-cost producers out of business, which effectively buries the old business model. By taking that position, OPEC has arguably abdicated any role in controlling the market. In so far as OPEC is no longer effective, so too is the old IOC business model.

Finally, there are questions over the demand response to lower prices in a post-Paris Agreement world, in which the contracting parties are committed to policies aimed at reducing emissions of greenhouse gases and therefore reducing fossil fuel consumption. This is reinforced by the fact that many governments realize that imposing sales taxes on oil products is a good way to raise revenue. Such sales taxes have large tax bases; inelasticity of demand means high rates can be imposed without reducing consumption; and they are relatively cheap to collect. Subsequently, many governments are absorbing some of the fall in crude-oil prices by increasing sales taxes. In a similar vein, many governments are removing or reducing subsidies on oil products. All of this implies the current lower crude prices may not produce lower product prices and hence the sort of demand response seen in the past. The oil price cycle described above may no longer be relevant.

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<sup>67</sup> As explained below, this could present the IOCs with an opportunity to mitigate the decline of their existing business model.

<sup>68</sup> Conventionally, supply curves showing the relation between price and quantity supplied rise from left to right. Thus low cost producers supply first leaving the higher cost producers to fulfil what demand remains.

## 5. Would the Failure of the IOCs' Business Model Matter?

The current contribution of IOCs to global crude and gas production is relatively minor (see Figure 1). This suggests that, should they disappear, the IOCs would not necessarily be missed in terms of supply. However, they do have importance in other areas.

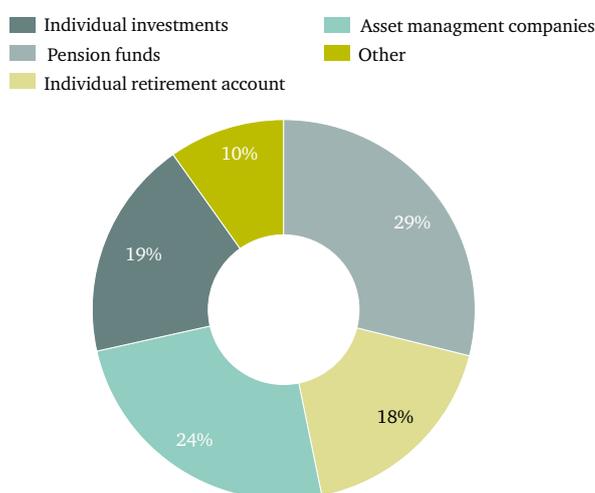
This is particularly true in regard to international financial markets. Table 1 shows their market value together with their ranking in the *Forbes* list of the world's biggest public companies. Together they have a market value of \$994.5 billion, which is larger than the 2012 GDP of the Netherlands and New Zealand combined. The IOCs are also a core concern for pension funds. For example, as seen in Figure 11, pension funds and individual retirement accounts make up 47 per cent of the share ownership of US oil companies in the S&P 500 index.

**Table 1: The IOCs and financial markets, 2015**

	Forbes rank	Market value (\$ billion)
ExxonMobil	7	357.1
Shell	13	195.4
Chevron	16	201.0
BP	35	120.8
Total S.A.	41	120.2

Source: Forbes (undated).

**Figure 11: Ownership of US oil and gas companies in the S&P 500 index, 2014**



Source: Who owns big oil, 2015.

The role of the IOCs in global politics has always been controversial. Some have seen them as tools of their host governments' foreign policy while others have seen them as drivers of foreign policy (Parra, 2004; Keating, 2006; Stevens, 2008). For many they are the symbols of capitalism, a legacy that has endured from the days of the 'robber barons' and the Standard Oil Trust in the United States. In many importing countries, and in the International Energy Agency, the IOCs' command of the distribution network and storage facilities has made them a key element of national security mechanisms to deal with disruptions of supply.

The IOCs have also been seen as a key part of the fossil-fuel lobby and climate-change deniers. Few of them now take this position, however. In 1997, in a speech at Stanford University, John Browne, then CEO of BP, broke the industry consensus and recognized climate change as a real problem that required a response. Ahead of the meeting of parties to the UN Framework Convention on Climate Change in Paris last December, large energy companies announced they would create a lobby group to support action to create a deal to limit climate change (Rascouet and Chmaytelli, 2015). This followed a call by many of the IOCs, in June 2015, to introduce carbon pricing (Rascouet and Chmaytelli, 2015). It is important to point out, though, that US companies were noticeable by their absence in both initiatives.

Historically the IOCs have also played a key role in developing technology for the oil and gas industry. In the integrated business model, research and technical services were often located within the company. As the industry fragmented in the 1980s, international service companies expanded to meet the needs of NOCs as well as those of private-sector companies that were outsourcing technical competence. IOCs and service companies drew on technical developments outside the industry (e.g. increasing computing power, communications, materials and sensors) to achieve incremental as well as step-change improvements in the technologies of oil and gas production, transportation and processing. The result has been a continuous reduction in the costs of exploration and development, reduction of environmental impacts, and a steady increase in the resources that can potentially be developed. Horizontal drilling and 'fracking' are the most recent and well-known examples of these technologies, but they are built on the legacies of the development of 3-D and 4-D reservoir modelling, measurement while drilling, coiled drill tubing, dynamic positioning of rigs and platforms offshore, and liquefaction and gasification of natural gas. The IOCs were crucially important in the development of offshore oil production (though they played virtually no part in the shale technology revolution that has been so important in recent gas and oil developments).

Many of these roles played by the IOCs would either not be missed or simply be taken up by service companies, NOCs and smaller non-integrated private companies. However, the financial dimension does raise grounds for concerns. In any case, the IOCs will certainly not accept the demise of their old business model and try to resist this. The question therefore is what options are available to them so that they might survive?

## 6. What are the Possible Solutions Available to the IOCs?

For some time, the IOCs have realized that all is not well with their old business model and have considered what might be done to remedy it. In a capitalist market economy it is difficult for them to avoid placing shareholder value, broadly defined, at the head of their business model. What has limited prospects now is their commitment to growing supply and demand. A major new strategy for the IOCs could be to shrink their capital base to match specific demand; shareholders will then benefit from the value released from their shares. However, strategies need to adapt as they have in the past. The following suggest a number of possible solutions that are not mutually exclusive. Nor are they necessarily applicable to all the IOCs. Many, while being necessary, are not of themselves sufficient.

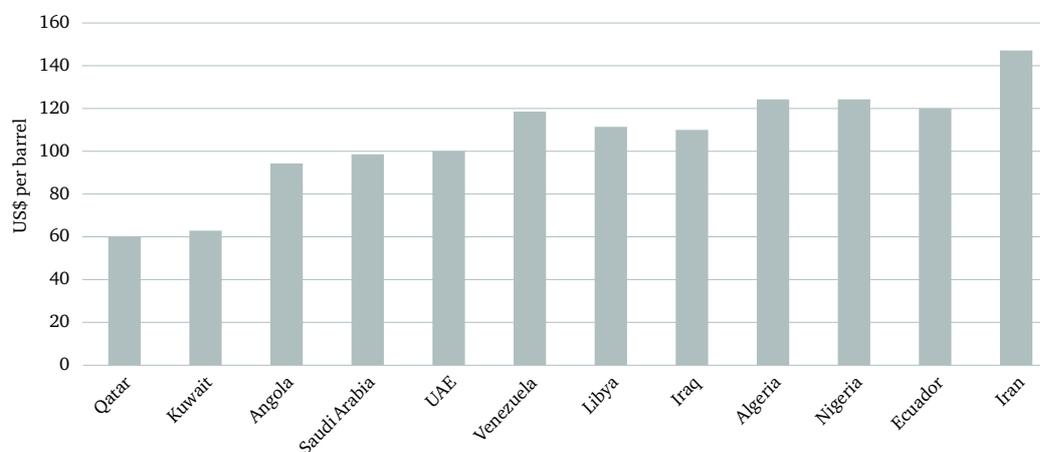
### **Squeezing costs in the hope oil prices will recover**

In the past, following price collapses, the strategy of the IOCs was to cut costs and cash outflows, and await rescue from the cyclical nature of prices. There are signs this is being repeated. Already since the price collapse in mid-2014, the major oil companies have shelved nearly \$400 billion of new projects, including 68 of significance and equivalent to 27 billion barrels of oil in reserves (Adams, 2016). This equals the levels of reserves of Norway, Brazil and Oman. The postponement is in the hope that prices will bounce back. Several factors could encourage such a development. Delayed projects could lead to shortages of crude if demand continues to grow, given the natural decline rate of conventional oil fields. As such, 'Decline rates will cut output by several million barrels per day each year in 2016 and 2017 unless oil producers invest to maintain production levels from existing fields and develop replacement fields' (Kemp, 2015).

If market supply begins to tighten it may encourage a price recovery. This could be reinforced if the current lower oil revenues lead to unrest in some producer countries as governments lack the necessary revenue to maintain the social status quo by offering the population jobs and subsidies. Figure 12 provides estimates of the budgetary break-even prices for the OPEC countries for 2014, shortly before oil prices began their collapse. At current price levels, most governments will be falling far short of the revenue levels needed to cover their expenditure. The resulting potential political upheaval could reinstate a political premium on price, even if it was only at the level of perception rather than through any real physical threat to supplies. A similar result could occur due to the general political instability in the Middle East and North Africa. The last time the region faced similar levels of political uncertainty and upheaval was at the end of the First World War in 1918 with the collapse of the Ottoman Empire. Political disruptions there have a very high probability of occurrence in the short, medium and long term.

A strategy of hoping for higher prices to rescue the business model is a high-risk one for the IOCs, however. As argued above, the oil price cycle may no longer have validity. A strong case can be made that lower prices could persist for several years. Also the gap between prices and costs for many of the fields under consideration is very large, so even huge efficiency gains would not fill the gap.

Figure 12: OPEC median budgetary break-even price



Source: Aissaoui (2014).

## More mega-mergers

Following the collapse in oil prices in 1998, the answer for IOCs seemed to lie in the takeover of relatively smaller companies, led by BP's acquisition of Amoco and Arco in 1999. What might be described as 'merger mania' followed. This was supposed to fulfil two of the fundamental principles of the old model. First, it increased bookable reserves arguably more cheaply than investment in upstream acreage and exploration of oil-in-place, given that the share price of many of the target companies had fallen following the collapse in oil prices. Second, it was supposed to lower costs through a process of reducing duplication, for example, at corporate headquarters and through other synergies that were supposed to come with company mergers.<sup>69</sup>

Currently, the idea of mega-mergers has lost its appeal. This is because the raft of mergers in 1999 were held up by competition authorities in the United States, the EU and some national jurisdictions. The result was that in terms of the downstream assets there was a degree of forced divestiture to gain approval. This tended to undermine the asset value apparently being acquired. Given that obstacles arose going from over 10 large IOCs to five, trying to reduce that number further could prove far more arduous. This does not rule out some takeovers, though. If the target involves rather different business streams, this may be less of a problem. A good example is Shell's takeover of BG, which was approved by the latter's shareholders in January 2016. BG had very limited assets in the oil downstream and on that basis would attract limited attention from competition authorities.<sup>70</sup>

Another option would be to seek middle-capitalization upstream companies so that competition authorities, concerned with the downstream, would not object.<sup>71</sup> There are problems with this option, however. Although oil prices are significantly lower than in recent years, in terms of historical trends they are not that low, as shown in Figure 10. Upstream acquisitions arguably would only make sense if prices were expected to be much higher.<sup>72</sup>

<sup>69</sup> The presence of synergies following company take-overs and mergers is controversial and much debated (Ismail et al., 2011).

<sup>70</sup> There were, however, concerns over competition with respect to BG's gas assets, particularly in terms of its LNG operations. For example, see Smyth and McGee, 2015.

<sup>71</sup> Depending on the level of overlap in terms of upstream operations, specific national authorities might be concerned if there was too much upstream concentration in their jurisdictions.

<sup>72</sup> For example, there has been much speculation that Shell's acquisition of BG only makes sense in a world with a much higher price. (*Business Day*, 2015).

### Play vultures with remnants of the US shale gas revolution

A variation on the mergers option relates to the US shale technology revolution. As already indicated, the IOCs were very late getting into this and grossly over-paid to do so. However, it is clear that many small and medium-sized companies operating in the shale sector in oil and gas are in serious financial trouble. Indeed, the whole revolution was built on a mountain of debt (Richter, 2015). Such is the leverage – i.e. the proportion of debt to equity on the balance sheet – of many of the operators that many will be effectively bankrupt when US interest rates rise.<sup>73</sup> This may present an opportunity for the IOCs to hoover up the remnants of the sector on a grand scale, although other bidders could also be interested.<sup>74</sup>

This could be a double-edged sword for the IOCs, however. In the US, the shale gas industry has had a relatively easy ride in terms of environmental opposition to its operations. The 2005 Energy Policy Act explicitly excluded fracking from the Environmental Protection Agency's enforcement of the Clean Water Act.<sup>75</sup> Also the various environmental NGOs in the United States have failed to generate the sort of opposition to shale seen in Europe and Australia. Widespread bankruptcies of operators in shale gas and tight oil would create a large number of 'orphaned wells'.<sup>76</sup> This could lead to a significant environmental backlash against the sector that could inhibit its future operations in the same way that has occurred in Europe. There are also doubts that the IOCs would have the management flexibility to buy up large numbers of very small operations in a cost-effective manner.

### Reshuffling the portfolio

Given the problems faced by the IOCs that have been driven by the 'drag of the downstream', reshuffling their portfolios appears to offer some assistance.

'The private-sector companies need to demonstrate to investors their strategies for managing the declining value of their downstream assets in 'no-growth' markets and accessing the diversity of opportunities upstream. This may lead to radical restructuring of companies and the industry' (Mitchell et al., 2012: p. xiii).

**The IOCs have been attempting to reshuffle their portfolios ever since the first oil shock wiped out much of the profitability in refining. The obvious problem has been who will buy the assets in question if they are unattractive.**

However, the IOCs have been attempting to reshuffle their portfolios ever since the first oil shock wiped out much of the profitability in refining (see Box 3). The obvious problem has been who will buy the assets in question if they are unattractive? This is especially relevant in what has become an industry strapped for cash in the current low-price environment. In the past, the producing countries have been an important source of potential buyers in the shape of their NOCs as the latter tried to become vertically integrated. These NOCs are now also short of funds as their governments seek to secure as much revenue as possible to avoid political discontent at home. Another option for the IOCs to change their

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<sup>73</sup> In December, the US Federal Reserve increased its short-term interest rates for the first time in almost 10 years. It also flagged that further increases can be expected in 2016.

<sup>74</sup> For example, 'Hedge funds and private equity groups armed with \$60bn of ready cash are ready to snap up the assets of bankrupt US shale drillers, almost guaranteeing that America's tight oil production will rebound once prices start to recover' (Yergin, 2016).

<sup>75</sup> This became known as the 'Cheney-Halliburton loophole'.

<sup>76</sup> An 'orphaned well' is an operation for which no one has responsibility for any environmental clean-up required.

portfolios would be to copy the ConocoPhillips example and split themselves into separate upstream and downstream companies, although it is not certain that this approach will improve overall returns to the shareholders. Many of the IOCs have made announcements in 2015 regarding their intention to reduce refinery capacity in the near future (Janssens and Fitzgibbon, 2015; Brelsford, 2015). One possible drawback to this strategy is that in shrinking the IOCs lose the advantages of scale that in part has underlay their success since the Second World War. Yet, arguably, they must shrink.

### Diversification

Another option for the IOCs would be to have another attempt at diversifying away from oil and gas. An apparently obvious area in which to diversify is renewables and green energy. To some extent this has already been tried, with Shell getting involved in offshore wind in the United Kingdom and BP entering the solar and biofuels sectors to cite a couple of examples. These efforts were relatively short-lived and many IOCs have subsequently pulled out of such ventures. A key reason is that the economics of renewables are very dependent upon the regulatory environment set by governments. A view was taken by the IOCs that this simply created too many hostages to fortune.<sup>77</sup> It is also not obvious that the IOCs would have the necessary technical or managerial skills to operate successfully in what is rapidly becoming a decentralized energy system.

### Become a purely OECD operation

The history of the international oil industry in the 20th century has often mirrored that of the international mining companies with about a ten-year lag (Mikesell, 1971; Humphreys, 2015). Since Andrew Mackenzie became CEO of BHP Billiton in 2013, the company has come up with a strategy to meet the challenges facing it (Wilson, 2015). This strategy is based upon owning and operating large, long-life, low-cost, expandable, upstream assets diversified by commodity, geography and market. Given the location of much of the company's current assets this is effectively to declare itself a predominantly 'OECD company' and to reduce operations in 'riskier' locations. While this has obvious attractions, notably reducing the political risk of upstream operations, such an option may not be realistic. The OECD, with the mineral resources of Canada, Australia and the United States, to name but three of its countries, has significant potential for large mining companies (Lee et al., 2012). However, for oil and gas the OECD countries offer comparatively little. At the end of 2014, they held only 14.6 per cent of global proved oil reserves (with 10.2 per cent in Canada) and 10.4 per cent of global proved gas reserves (with 5.2 per cent in the United States).

### Invest in rebuilding in-house technology

An important contribution to the death of the IOCs' old business model was that they effectively gave away their technological edge to service companies and some NOCs. A significant consequence was that the IOCs lost a major benefit. An obvious solution to this would be to invest in re-building a technological advantage. If they achieved this, they would be in a much better position to compete for acreage if producer governments begin to open their upstream to foreign direct investment, as some may in response to falling oil revenues as suggested earlier.

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<sup>77</sup> This is based upon the author's observations derived from many private conversations. Furthermore, the behaviour of the current UK government regarding renewables since the 2015 elections certainly makes such a view of regulatory uncertainty justified.

However, restoring such a competitive edge would be difficult, especially if the IOCs face challenges to employ the best and the brightest. One possible solution would be to seek a merger or takeover of service companies that have already developed that competitive edge.

A variation on this would be an alliance with NOCs that have developed an advantage in some technologies. One precedent is the strategy of Saudi Arabia's minister of oil and mineral resources, Zaki Yamani, during the debate and negotiations over 'participation' between 1968 and 1971 to create a 'catholic marriage' (because it would be indissoluble) between the IOCs and the producer governments. In this scheme the producer governments, as well as securing equity shares in the IOCs' upstream affiliates in their countries, would take an equity share in the IOC owners' downstream assets outside of their countries (Stevens, 1976). This was effectively to allow IOCs and OPEC governments to 'gang up' on smaller independent oil companies whose behaviour of competing for market share was threatening the price structure. The downstream dimension of the access got lost in the subsequent negotiations, though. Another problem with the approach is that IOC downstream assets in OECD countries are no longer attractive to exporters either for growth or profit.

Such investments could bring various benefits, however. They could give the IOCs access to growing downstream markets in Asia. Upstream they could also offer the possibility of access to low-cost reserves in different countries without requiring financial resources to initiate or expand their development. For the NOCs, such investments could bring the application of modern management methods, including ways of raising finance. While this is not needed for some of the more effective NOCs, for many it could present major benefits. This may also help many NOCs that would struggle to increase production by themselves.

## 7. Conclusion

The IOCs face major challenges. Since the early 1990s, a number of problems undermined their old business model. This has been aggravated by two more recent problems: issues associated with ‘unburnable carbon’ and the collapse in crude oil prices seen since June 2014. While the IOCs have been able to survive the last 25 years, more recently real cracks have begun to show. The symptoms are poor financial performances and growing disillusion on the part of their shareholders with a business model rooted in assumptions of ever-growing oil demand, oil scarcity and the need to increase bookable reserves. These assumptions increasingly lack validity. There are possible solutions for the IOCs. However, none alone is sufficient, and even together they would amount to fiddling around the edges while the model continues to undermine the companies’ prospects for survival. In particular, the IOCs cannot assume that, as in the past, all they need to survive is to wait for crude prices to resume an upward direction. The oil markets are going through fundamental structural changes driven by a technological revolution and geopolitical shifts. The old cycle of lower prices followed by higher prices can no longer be assumed to be applicable.

In this new world, the only realistic option for the IOCs lies in restructuring and realizing many of their current assets to provide cash for their shareholders. This means inevitably, however, that they must shrink into the remaining areas, functionally and geographically, where they can earn an acceptable return. This requires a major change in the corporate culture of the IOCs. It remains to be seen whether their senior management can manage such a fundamental shift. If they can, then the IOCs will be able to slip into a gentle decline but ultimately survive, albeit on a much smaller scale. If they do not change their business model, what remains of their existence will be nasty, brutish and short.

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