The Fall of the Oil Curtain

What would a sketch of the global landscape of reserves and production look like? No doubt, its most salient features would be the growing appetite for oil and gas and the drive for reserves replacement from frontiers and mature fields. In the background, would lie the cycles of 'feast or famine' and the long lead times that govern investment and returns. Yet, tantalizingly hidden away is the essence of the industry—petroleum reserves.

The Oil Curtain neatly symbolises resource sovereignty and separates the hydrocarbon 'haves' from the 'have-nots'. It has led to the major part of proved global oil reserves being booked by National or State Oil Companies (NOCs). To illustrate the change of ownership, in 1971 NOCs held 30% of total reserves while International Oil Companies (IOCs) held 70%. Today, NOCs have increased their share to 93% while IOCs hold 7%[1]. What could have caused such a dramatic reversal in fortune?

Since the early 1900s, the importance of oil in financial, political and strategic matters has been bubbling up to the surface. Eventually, this led to a pressing need for producing states to control oil. Mexico was first to 'shut' the Curtain by nationalising its oil assets and forrning the wholly state-owned Pemex (Petróleos Mexicanos) in 1938[2]. By 1960, resource sovereignty had fully matured into a global force and the Central Bank of Oil[3]—OPEC (Organisation of Petroleum Exporting Countries)—was created.

The effects of the Oil Curtain have been a blunting of IOC access to oil and a partial blurring of the distinction between NOCs and IOCs. As the spheres of action of both types of companies increasingly overlap, the industry has become more geographically dispersed and institutionally fragmented. Not least, the Oil Curtain has driven certain IOCs to metamorphose into energy companies.

The Oil Is Ours

'The oil is ours' reads a sign as you leave Rio de Janeiro on the road to the oilfield city of Macaé. That sign is not a historic throwback or juvenile street graffiti, but a modern official billboard paid for by the Brazilian government. Its nationalistic message is that oil, and oil wealth, are too important to be left to foreigners and external market forces. This message is a recurrent one found worldwide. It is just the language and symbolism that changes; Russia's Shtokman field, jobs for the boys; Niger Delta, moralists decrying the excesses of ex-pats; PdVSA and Bolivia; gringo go home.

Consider Shtokman and the decision of the Russian government to develop it alone —this is a clear message that the gas reserves could and would be developed without outside help which could otherwise be perceived as 'dependence' on foreign oil companies. Continuing unrest in the Niger Delta points to a different dynamic between regional and federal revenue sharing but nonetheless still nationalism. Bolivia's nationalisation of its gas industry sends the same clear message. What is interesting is that both fully privatised and part-privatised companies were affected. StatoilHydro bid for Shtokman and was seen as the front runner, and Petrobras invested heavily in Bolivia from Exploration and Production (E & P) to pipelines to marketing. In Venezuela and the Niger delta, the effects were felt by IOCs Exxon Mobil and Shell[4].

Figure 1 - President Lula Commemorates Brazil's Self-Sufficiency

Humble Oil

Oil has come a long way from its humble roots. Until the early 1900s, it was just a cheap fuel for lamps and heaters. How then could it be transformed into a strategic resource and military necessity within a decade? This rapid change was due to the convenience with which oil could be stored and transported, coupled with its high energy density. It was the most efficient fuel that mankind had discovered—the perfect fuel for the internal combustion engine and mechanised transportation. By 1911, it had replaced coal as the preferred fuel for the British Royal Navy. By 1918, other navies had quickly followed suit, creating a speed and logistics advantage that ultimately led to victory to those that used it. Accompanying the new-found status of diesel oil and gasoline as the fuels-of-choice for the war machine was the struggle to secure supply amidst the geopolitical upheaval of the times. In fact, it has been postulated that fuel shortages, not the Allies' military prowess, led to the ultimate demise of the Axis powers in World War II. The race had begun[5].

Makeover

Principally driven by the British, French and American governments, numerous oil companies were set the task of securing oil supply for their countries' needs. It was through ownership of concessions in developing countries, and predominantly in the Middle East and Far East, that the IOCs grew.

Known as the 'Seven-Sisters*,'—a term coined by the Italian oil tycoon Enrico Mattei referring to Exxon (Esso), Shell, British Petroleum (BP), Gulf, Texaco, Mobil and Socal (Chevron— plus an eighth, the Compagnie Francaise Des Pétroles (CFP-Total)[6]—these companies raced to find 'the prize'[7].

During this growth period, the IOCs made huge strikes in oil and rapidly drilled the wells and built the pipelines and refineries that were needed to turn the flow of oil into revenue. This was undoubtedly the golden period of the IOCs but, despite expert negotiations and justifications, the geopolitical manoeuvering was being noticed by the producing countries.

Seeds of Discontent

In the period between the two world wars, more and more countries began realising their futures were contingent on controlling their own resources, oil especially. At the vanguard of this realization was President Cardenas of Mexico[8,9].

* Today, there are 'Five sisters' ExxonMobil, BP, Shell, Total and Chevron. In terms of reserves, the sisters have gradually seen an erosion of oil reserves which contrasts with gas reserves which have increased. This trend looks likely to continue.

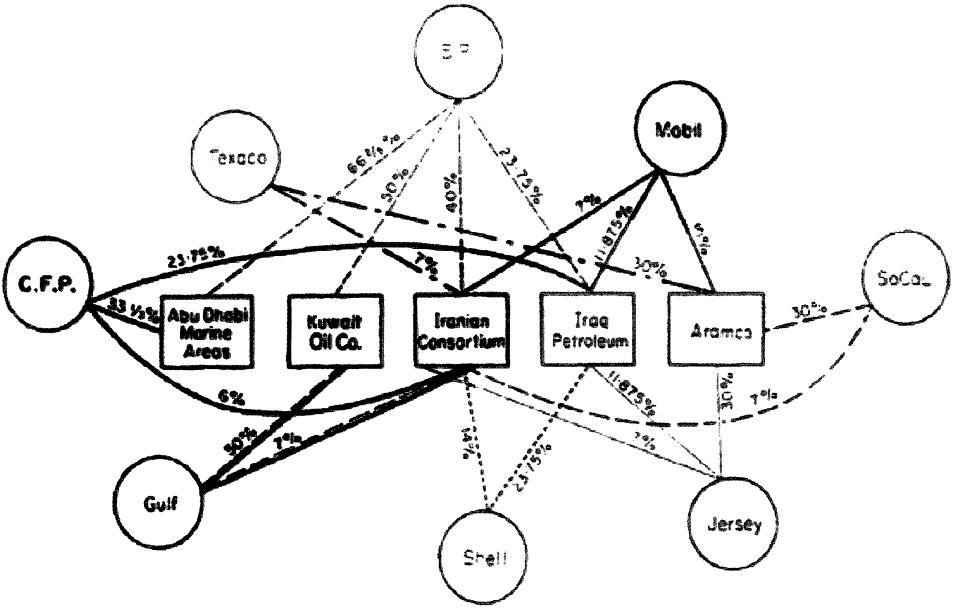


Figure 2 - Ownership Links Between Major IOCs (including Compagnie Française des Pétroles) and the Major Producing Companies in the Middle East after Edith Penrose, 1966

The seeds of nationalisation had been sown by Mexico in 1934 when it forcibly took over the shareholdings of foreign oil companies operating in Mexico resulting in the creation of Pemex which became the first 'nationalised oil company'*. Venezuela and Iran soon joined Mexico by re-nationalising their hydrocarbons.

Winds of Change

By the end of the Second World War in 1945, the knowledge that oil was of great commercial and strategic importance was commonplace. Oil was associated with vast revenue flows as well as having kept the 'war-machine' running. Consequently, colonial powers sought to control oil supplies.

In the post-war period, however, the winds of political change had swept aside the old colonial order whose political leaders acquiesced to foreign clients and replaced them with vocal nationalists who advocated sovereignty and independence. Exemplifying this were the strong voices of Gandhi in the Indian subcontinent, as well as Nasser and the Ba'ath party in the Arab states.

* It can be said that BP or Anglo Persian was the first NOC, but this company was taken over by the British government from British shareholders rather than from foreign ownership.

Viewed through the lens of political independence, control over natural resources had become an urgent necessity and, despite geographic and ethnic separations, a unified and growing chorus emerged with Mossadegh in Iran, Qasim in Iraq, Perez Alfonso in Venezuela and Tariki in Saudi Arabia all seeking to review oil contracts[10,11,12].

Initially, these individuals and countries acted alone, but as events unfolded affecting them all, they became increasingly united. The nationalist's central message was clear; oil was too important to leave in the hands of foreigners[13]. There was a need to regulate 'oil-rents' and end arbitrary payments from foreign oil companies.

Nationalist thinking was shaped threefold. Firstly, deals favoured foreign oil companies and foreign governments, not producing states. Foreign oil companies also controlled an outward flow of profits which were often the greater part of the producing countries' Gross Domestic Product (GDP). Generally, beneficiaries were foreign governments either directly through shareholder dividends or indirectly through taxes. Secondly, foreigners took vital political decisions affecting the sovereignty of producing countries. Oil production, foreign exchange earnings through oil sales, and ultimately, national debt were unilaterally dictated by foreign oil companies. Lastly, the military and naval campaigns of the Second World War, combined with the utility of oil in general transportation, left no doubt that oil was a primary strategic asset.

These factors created resentment among the political elites and the disenfranchised in producing countries leading to the conviction among producing states that oil profits should be shared equally between producing states that had territorial ownership of resources and IOCs who conducted E & P activities for oil[14]. Producing countries became united; the old deals had to be undone. New deals would treat territorial owners of resources and the IOCs as equals.

Sovereignty Over Resources

Financial, political and strategic factors acted as a catalyst for resource nationalisation, most notably with Iran and Venezuela taking their first steps toward sovereignty during the fifties. In Iran, the government nationalised the oil assets of Anglo-Persian (the precursor to British Petroleum). In Venezuela, the government established the famous '50/50' petroleum legislation that split oil revenues affecting US oil companies. Shortly after, Saudi Arabia, Algeria, Iraq and Libya followed suit[15].

Nationalisation in Teheran and the reformulation of oil revenues in Caracas were pivotal events that directed the founders-to-be of OPEC—Juan Perez-Alfonzo, the Venezuelan Oil Minister, and Abdullah Tariki, the Saudi Arabian Oil Minister—to seek a mechanism that would stabilise prices. They found the solution in a global equivalent of the Texas Railroad Commission, which had successfully controlled US over-supply of oil to stabilise prices[16].

The Compacto

During the Arab Oil Congress meeting in Cairo, Egypt in April 1959, Tariki and Perez-Alfonzo met to discuss what had been pressing so heavily on their minds. The two gentlemen had both reached the conclusion that the 50/50 principle should be replaced by a 60/40 split in favour of the producers. Within a year, the two men created the 'Compacto Petrolero'—an 'Oil Commission' that would permanently tip the balance of power in favour of producers. In some ways, this was the precursor to the Oil Curtain —the Compacto reshaped NOCs by aiming for a 60% share of profits. In due course by integrating their E & P, distribution, refining, transportation and retail operations, the NOCs would learn to compete with the IOCs[17].

Birth of OPEC

Of course, the IOCs were avidly paying attention to the 'Compacto'. Despite feigning disinterest in events, they turned to the spot markets and cut oil prices. Anglo-Persian (BP) had cut prices on the eve of the Arab congress meeting. Then, Standard Oil of NJ (Exxon) unilaterally cut the posted price of oil. Such a Machiavellian move would immediately affect the pockets and pride of producers, facts that were not lost on the decision makers who elected to keep the producers in the dark.

Rude words could have been a fitting response and perhaps, moves such as those that the oil companies had taken would have caused Alfonzo to use such words to describe oil politics[18].

In any event, the cuts prompted a united response and a different kind of swearing. Iraq invited several major petroleum exporting countries namely Iran, Venezuela, Saudi Arabia and Kuwait to Baghdad for a historic meeting which led to the birth of OPEC on September 14, 1960.

OPEC's first resolution pointed to the oil companies as the culprits: 'That members can no longer remain indifferent to the attitude heretofore adopted by the oil

companies in affecting price modifications; that members shall demand that oil companies maintain their prices steady and free from all unnecessary fluctuation; that members shall endeavour, by all means available to them, to restore present prices to the levels prevailing before the reductions'[19].

The Princes Taught a Lesson

After the Second World War, the independence of former colonies sent out a shockwave —resource nationalisation. This in turn, created OPEC which signaled a decline in the hegemony of IOCs globally. By 1970, the oil companies were still enjoying a princely existence but only just. Between 1960 and 1966, their share of oil production outside North America and the Former Soviet Union (FSU) countries, had increased from 72% to 76%, leaving 24% for the NOCs[20].

Oil company profits, despite complex justifications to OPEC and despite falling prices, were still high compared to most other industries. Rates of return for most IOCs were higher in 1966 than in 1960[21], and IOCs were able to finance most E & P as well as refining, retail and petrochemicals out of crude oil profits made abroad. The IOCs argued with OPEC that the retailing network was needed to create markets for OPEC oil, which would otherwise go unsold; however, it was the scale of repatriated profits that were ultimately responsible for unraveling the IOCs' concessions[22].

Sleeping Giant

The potency of OPEC remained dormant for a decade. In November 1962, OPEC was registered with the United Nations Secretariat[23]. Yet, it was not until the mid-1970s that a growing group of countries nationalised (or in some cases re-nationalised) their hydrocarbon industries. In 1973, it was the combination of Libyan radicalism and an Arab oil embargo precipitated by US support for Israel in the Arab-Israeli war, that within a ten-month period in 1974, culminated in the price of a barrel of oil rising by 228 per cent[24].

The old order had given way to the new.

Between 1970 and 1976, nearly 20 countries asserted national sovereignty over their operations[25]. In February 1971 after acrimonious disputes about prices, Algeria nationalised all French interests within its territory[26]. Shortly after, Libya announced the nationalisation of all BP's assets. This has continued to the present period where, most recently, Venezuela and Bolivia have nationalised IOC oil assets[27].

Driven by the need to develop gas reserves (to meet growing national and international demand for gas and to keep oil for exports), many countries had slowly relaxed national controls and through joint ventures, contracts with service companies and, exceptionally, ownership licences, larger oil companies were allowed to return to previously nationalised oil markets[28].

Modern national oil policy has come full circle (see Figure 3). It has evolved from seeking equal treatment to maximising royalties to stipulating local content to full re-nationalisation and now to partial privatisation for gas developments.

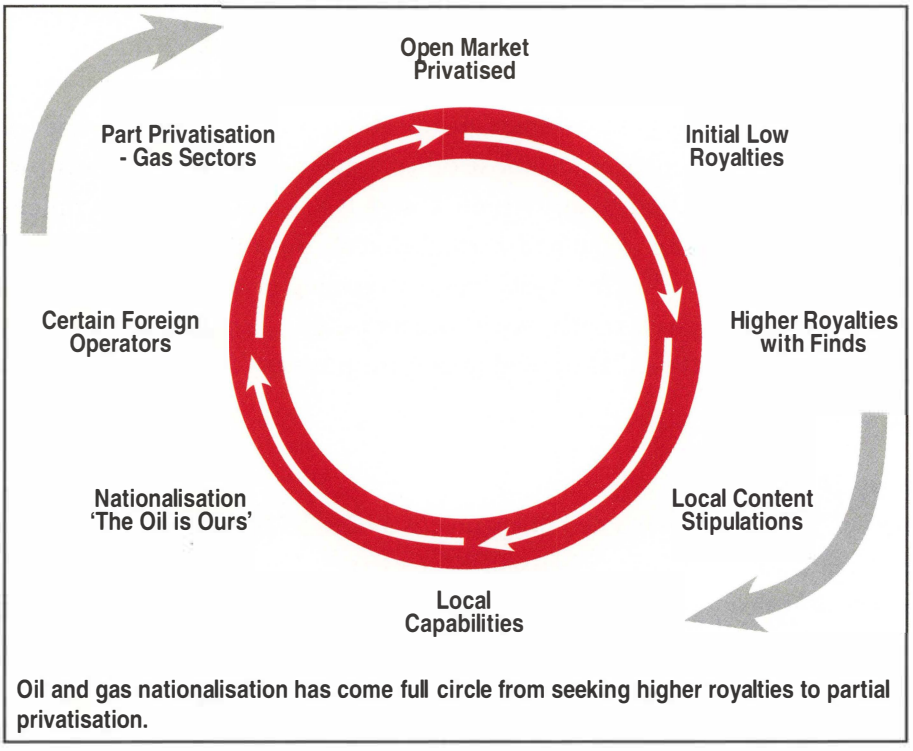


Figure 3 - Modern National Oil and Gas Policy

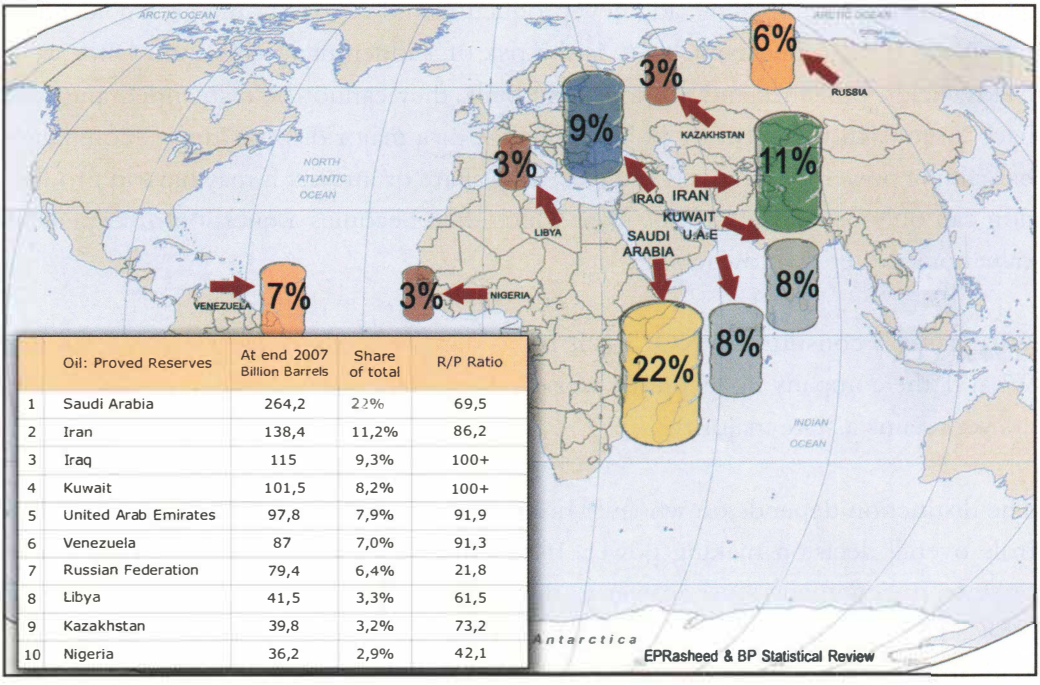
Yet in the latest period, nationalisation has resurged and this can be seen clearly in Russia's decision to develop the Shtokman field alone and remove certain IOCs from the Sakhalin development, while in Bolivia and Venezuela oil companies have had their licences revoked and lost production. Nationalisation has even surfaced in the North Sea with Norway's government-controlled Statoil conducting a reverse takeover of NorskHydro. The Oil Curtain has spread.

As modernity spreads, lifestyles that were once confined to wealthy classes in wealthy countries are now found up and down social classes and across the globe. Think China and India. Together this relentless demand for oil and gas, which was already a strategic resource, has meant that oil and gas have become the world's most desired commodities.

In 2008, oil prices broke through the US $125 per barrel level peaking at a ceiling of US $147 before tumbling back to US $35 all within a six month period. Nevertheless, it is easy to forget that oil is cyclical and therefore it is only a question of time before it goes up. The only question is whether the present down cycle has a prolonged hard landing from the peak[29].

New Seven Sisters

Nowadays, OPEC decisions get as much ink as those of major central banks[30]. Yet beyond the paparazzi flashes and news-wire headlines, how important will OPEC and NOCs be for future oil supply? Realistically, the production of OPEC and certain NOCs will be vital for several generations to come. To understand that reality, simply look at (see Figure 4) the top ten reserve holders worldwide: Saudi Arabia, Iran, Iraq, Kuwait, UAE, Venezuela, Russia, Libya, Kazakhstan and Nigeria. Seven



	Oil: Proved Reserves	At end 2007 Billion Barrels	Share of total	R/P Ratio
1	Saudi Arabia	264,2	22%	69,5
2	Iran	138,4	11,2%	86,2
3	Iraq	115	9,3%	100+
4	Kuwait	101,5	8,2%	100+
5	United Arab Emirates	97,8	7,9%	91,9
6	Venezuela	87	7,0%	91,3
7	Russian Federation	79,4	6,4%	21,8
8	Libya	41,5	3,3%	61,5
9	Kazakhstan	39,8	3,2%	73,2
10	Nigeria	36,2	2,9%	42,1

Figure 4 - Top Ten Global Oil Reserves 2007

of these countries—the first six and Libya—are all OPEC members. To see how important these new Seven Sisters are to future oil supplies, consider the reserves to production column (Figure 4) to see how many of today's top ten global reserve holders are likely to be producers in the US Energy Information Administration (EIA) Energy Reference Case year of 2030[31].

At that time, I will be 60 years old and probably writing about the world's next 25 years of oil production. More to the point of today's top ten oil reserve holders, Russia will have dropped off the list while the new seven sisters and OPEC will still be producing away. What about the other current major producers? Canada has 22.9 years, the US has 11.7 years and Mexico has 9.6 years of oil reserves left at current production rates. Upshot: OPEC and the new Seven Sisters will grow both home and abroad. NOCs may not become global household brands, but they have set the trend that restricts IOC access to oil, and lately, the dividing line between the two is not so clear.

Fuzzy Logic

The fuzziness between private and state oil companies stems from the NOCs that have 'gone global'. On the one hand, for certain companies the logic and returns of going global are compelling; add new production and export 'home-grown' technology. Yet, on the other hand, there is the risk of sudden nationalisation. Once wellheads, fields, pipelines and refineries are built, they cannot be dismantled and sent back 'home'. In the event of political change or a major dispute, the oil company's bargaining power is effectively reduced. Any share or interest it may have in production can only be sold off to the state which then becomes a question of expedient valuations rather than ownership.

What actually constitutes a NOC? Is it 100% state ownership or just a state majority? What if the company floats on the world's stock markets and has private shareholders yet retains a state majority?

The distinction depends on whoever holds 51% or more of voting shares and controls overall decision making power. If the majority shareholder is a government or state, the company must answer to them; therefore, such a company is defined a NOC. The opposite also applies. If the company's 51% voting majority is privately held or listed, it would be defined an IOC.

Shareholder distinctions shed light on the responsibilities of each company too. NOCs have a strong responsibility to steward oil wealth to meet the needs of a given nation and its population in a sustainable way. IOCs focus primarily on maximising returns; social responsibility is important, but not to the same degree as NOCs. Most people in the industry accept that profits must be balanced with social responsibility. Private shareholders generally accept this too. Corporate Social Responsibility (CSR) programmes within IOCs are abundant and this type of social spending does raise investors' eyebrows as long as returns are healthy. Part-privatised NOCs fall into this category also. Just how much social responsibility is deemed healthy depends on the shareholders.

We Speak Your Language

Notable NOCs such as Petrobras and CNPC operate well beyond their home territories. Both companies not only retain majority government stakes, but also raise capital using a canny combination of state finance and international financial markets to develop domestic and foreign reserves. Where they really excel is by competing internationally for capital and upstream acreage and applying their unique technologies and know-how.

Accessing reserves or holding on to them is the producer's top challenge. Consumption is a given. Subsequently, finance, Human Resources (HR), technology and processes can be acquired.

Undoubtedly, production is one end of a transaction; consumers are needed too. Both depend on each other for the respective stability of demand and supply. Whatever affects the economies of oil consumers ripples through to producers and vice versa. The ultimate interests of oil producers and consumers, therefore, always converges in promoting stability of the worldwide economic framework and minimising economic shocks.

The upshot is that reserve holders or producers, rather than retailers, determine rules. In this way, accessing reserves or holding on to them has become the producer's number one challenge—HR, technology, vertical integration and process efficiencies can all be subsequently acquired.

NOCs Go Global

Naturally then it is a 'no-brainer' for NOCs with global ambitions to compete for foreign reserves and production. Entering this competition makes sense for those

NOCs such as Petrobras or the China National Petroleum Corporation (CNPC) that have limited reserves or high production costs at 'home' or where they can export 'home-grown' technologies abroad. It does not make sense for the new Seven Sisters who have abundant domestic reserves at relatively low production costs. In the latter, it makes more sense to stay 'home' and develop national reserves.

In the old days, it was fair to say that the IOCs conferred access to reserves. They had the technology, know-how and capital to create wealth from a natural resource. Naturally, they bargained hard and got the lion's share. Those 'old ways' show that oil reserve holders used to recognise IOCs as equals, perhaps even as holding the upper hand as IOC participation was required for revenues to be realised[32].

But Where Do the IOCs Fit Into All of This Today?

Much has been written on IOCs and our focus is on the growth of the NOCs which is far less documented; however, as the two are inextricably linked, it is worth briefly extracting pivotal events that are common denominators. It is widely accepted that the oil industry's fate was sealed by growing demand for transportation (military and consumer) and the steady supply of oil from refineries, pipelines and fields worldwide.

Numerous discoveries were made by geologists and drillers made production possible by always finding a way. In fact, the vertical integration and camaraderie of an inter-disciplinary approach positioned IOCs so well that it was almost as if each had its own principality of petroleum production[33].

Original Seven Sisters

A decade ago the price of a barrel of oil languished at US $10. This triggered 'mergeritis' and reformed the original Seven Sisters. During the 1990s, the new 'prize' for these companies was finding synergies and economies of scale. Management consultants were set the task of merging these great disparate entities and analysts evaluated the mergers in terms of restructuring and costs.

In the corporate cost-cutting that ensued, locations and operations were rationalised. Many IOC's consolidated their international operations in Houston. Research and Development (R & D), technology activities and technical disciplines were seen as unnecessary fixed costs that could be more profitably outsourced. At that time, only a handful of voices questioned rationalisation especially that related to technology

R & D; it made sense financially and operationally. Ironically, technical outsourcing would strengthen the Oil Curtain and return to haunt IOCs.

Metamorphosis Begins

As the Oil Curtain fell, the IOCs became accustomed to a gradually shrinking pool of accessible oil reserves that were ever more difficult and costly to produce. This initiated the metamorphosis of the IOC with progressive companies such as BP and Shell repositioning themselves for the future, not just because they had seen 'beyond petroleum' but because they had felt 'the Oil Curtain' fall. This, however, does not imply the fall of the IOCs; there are still plenty of global E & P opportunities around, albeit tempered by lower margins due to higher cost and technical challenges.

Oil companies' future profits (and share prices) depend on production and reserves. As older fields decline, companies must find new production and decommission older structures. Our earlier look at the global reserves base shows the true significance of NOCs. Where reserves are institutionally* accessible by IOCs, they are accessible only at considerably higher costs typified by technically challenging projects in ultra-deepwaters or the Arctic. In this way IOC 'replacement' costs tend to rise faster than NOC replacement costs. However, this is not always true as certain NOCs that have deepwater or heavy oil reserves may have comparable costs to those of IOCs.

The metamorphosis of more progressive IOCs into energy companies are clear trends for the future of the industry. Natural gas emerges as a bridge to alternates with certain IOCs quietly stacking up an impressive array of gas technologies and know-how. Here, BP has distinguished itself in LNG and solar know-how, while Shell has done the same in Gas-to-Liquids (GTL) and hydrogen (see *Chapter 13: Renewable Energy*).

Houston, We Have a Capital

As the industry consolidated, Houston emerged as its capital city and its downtown skyline became synonymous with the global oil business. Today, Houston represents the oil consumption capital of the world. The oil production capital lies elsewhere. Characterised by a modest skyline and towering reserves, Dhahran takes that title. Moscow becomes the natural gas production capital and Doha that of Liquefied Natural Gas (LNG). Almaty, Baku, Bushehr, Lagos, Macae, Maracaibo are other emerging oil cities as the industry realigns. The combination of oil technology as a commodity, ascendant oil prices and the realignment of cities has strengthened the

Figure 5 - Downtown View of Houston (EPRasheed)

Oil Curtain. Ironically, as oil production technology becomes freely available on the market, access to oil reserves becomes more restricted.

Consolidation

Whenever the price of crude oil falls below a certain cut-off point, operators cut budgets and work orders, and oil service and supply companies enter into a period where revenues drop sharply. For many oil-related companies, this means a fall in their share yields and ultimately a drop in stock prices. This increases the likelihood of takeover in two ways. First, asset rich companies with poor liquidity or cash flow difficulties find themselves financially exposed and become prime targets for takeovers and asset stripping. Second, product or concept rich companies who have often borne high R & D costs are swallowed up by larger organisations seeking to add value to their operations and increase market shares[35].

In this way, during the '90s low oil price environment (US $10/bbl)[36], many upstream companies looked to the stock markets to increase oil and gas revenues effectively, by acquiring listed companies whose share price belied their reserve values. For this

reason, cost reduction was an imperative[37] and 'performance optimisation' and 'well-cost reduction' became strategic. Nowhere was this strategy more relevant than in high-cost environments such as the North Western European Continental Shelf. Ever since the late 1980s, this area has been characterised by the need to cut costs and to advance technology. In the 1990s, the scale of cost-cutting was widespread and was exemplified by the shedding of labour, outsourcing, contractual terminations and 'mergeritis'. The industry even institutionalised cost reduction through the creation of initiatives such as Cost Reduction in the New Era (CRINE) in the UK sector and NORSOK in the Norwegian sector[38].

Mergeritis

This gave rise to 'mergeritis' which re-formed* the world's largest oil companies—Exxon and Mobil, Chevron and Texaco, BP, Amoco and Arco. Management consultants were set the task of merging these great entities by generating synergies and economies of scale. Analysts evaluated the mergers in terms of restructuring and cost-cutting to justify the acquisition costs and remain competitive against the low oil price[39].

In the corporate cost-cutting that ensued, locations and operations were rationalised. This led to Houston's growth and importance within the oilfield. Many IOCs consolidated their international operations in Houston and it was the prevalent wisdom that R & D technology activities could be cast-off as unnecessary fixed costs that could be more profitably outsourced. At that time, the oil company rationalisation made sense financially and operationally.

Outsourcing Technology

Technological advancement and innovation is typical of high-cost industries where saving time and money is vital to the commercial success of companies and the industry itself. These factors have played a crucial part in the advancements made in well trajectories—such as seismic, multilateral, Extended Reach Drilling (ERD), horizontal and designer wells—and the enabling technologies to optimise production, and in so doing, increase profitability.

As operators became leaner, well profiles followed suit and the requirements for competitive tenders, data simulation and risk analysis increased. The bottom line was that service companies were being asked to contribute more value than ever before, in order to reduce well cost and optimise performance. In this way, the IOCs

* See Seven Sisters by Anthony Sampson.

outsourced more and more, not just technology niches, but certain technical disciplines such as drilling or production engineering as well[40].

Service Sector Grows

Service companies grew in the interim. Simultaneously, they kept a watchful eye on US and international projects being planned out of Houston and carefully noted cast-off R & D projects with a view to commercialisation. In this way, Houston evolved as the E & P capital of the oil industry and its downtown skyline characterised worldwide operations.

Ironically, it has been the convergence of technology outsourcing and ascendant oil prices that have strengthened the Oil Curtain. This is the self-fulfilling prophecy; as production technology becomes easier to get on the open market, oil access becomes more restricted.

Corporate Social Responsibility (CSR)

There was always a constant suspicion amongst producing countries that the IOCs were extensions of foreign governments, acting out colonial policy as required. This suspicion may have contributed to oil companies engaging in social programmes. It is unclear which IOC started wider social engagement such as education, hospitals and the development of local skills. What is quite clear is that such engagement gave rise to a wide ranging set of IOC initiatives such as sustainable development or CSR which were designed to ameliorate a series of sore issues that were rooted in inequalities between the producers and the IOCs. These ranged from the setting of volumes of oil exports, the repatriation of profits, the heavy dependence on imported goods and services to the princely lifestyle of foreigners posted to poor countries.

Sustainable development has grown to encompass the building of local capacity that may export technology and know-how, and the savings and investments of oil profits into non-oil related industries. Essentially, it means enfranchising locals in most aspects of the oil company's business either locally owned or managed[41].

It can be argued that the geopolitical tension that lies at the heart of certain disputes results from the uneven distribution of oil-wealth. If that were not enough, the fact that oil is a finite wealth generator makes things worse. This ultimately highlights the undoing of any CSR initiative or investment. As long as disparities in the distribution of oil-wealth exist, CSR programmes are constantly in peril of being

perceived at best as arbitrary acts of philanthropy or at worst empty exercises in public relations[42].

The politics of revenue distribution can be a potential minefield for oil companies. They must satisfy the powers that be—state governments—and reconcile the valid needs of local groups, whether these are communities that have right-of-way over pipelines or those that live in the state that produces oil or gas. If there are competing ethnic groups or self-perpetuating elites co-existing with poverty stricken masses, the oil company is sitting on a time-bomb. Paradoxically, sometimes it is the case that even if oil companies keep locals happy and build local industries, the government may still nationalise.

NOC/IOC—Corporate Transparency

Transparency or the lack of it was also a major influencer in the changing behaviour of IOCs. The IOCs saw that they were being targeted by savvy lobbyists and environmental activists that could impact their image (and share price) in their home countries. This coupled with anti-corporate demonstrations even led some IOCs (BP) to publish sensitive figures regarding tax payments abroad made to foreign governments in regard of operating agreements. Further, some oil companies aligned themselves to protecting human rights by joining the UN World Compact (Petrobras). Legislation that prevents corruption and emphasises due diligence has tightened up and defined the limits of ethical behaviour for companies acting abroad, and this influence has permeated the industry as a whole which has high levels of corporate governance[43].

We have seen that the real challenge facing the IOCs is that they face increasingly difficult operating conditions in E & P activities, not just regarding the physical landscape but rather a much more wide-ranging panorama of challenges. These include decommissioning, booking new reserves in a narrowing opportunity base, a socio economic and occasionally politically hostile landscape, a lack of E & P technology as a differentiator and environmental lobbyists. Perhaps, most of all, nationalisation has made operations more difficult. Here we trace the transformation of the NOC from quiet man to international giant[44].

NOC/IOC Distinctions

The distinction between NOCs and IOCs hinges on whether the NOC majority shareholder is the state, and therefore must ultimately answer to the state as opposed to a privately held IOC which answers to majority private shareholders only. This

distinction explains why NOCs have a responsibility to meet the needs of the nation and the population that owns them, while maximising profit.

Nowadays, the industry recognises that profits must be balanced with social responsibility and private shareholders generally accept this. Most major IOCs have CSR programmes and this type of spending is not generally questioned by investors, as long as returns are healthy. Part-privatised NOCs fall into this category also. In the case studies below, we look at NOC concepts of sustainability and social responsibility from two major oil exporters—Saudi Aramco and PdVSA. Two further case studies look at the part-privatised StatoilHydro and Petrobras as they compete internationally in the US Gulf of Mexico (GOM) and apply the technical respective differentiators of deepwater E & P technology[45].

Saudi Aramco

Considered by many to be the world's largest oil company and the world's largest NOC, Saudi Aramco controls one-quarter of all world hydrocarbon reserves and plays a vital role in fuelling Saudi Arabia's socio economic growth. In this context, Saudi Aramco routinely evaluates its development decisions on a combination of corporate and national contributions; for example, a petrochemical project with a Japanese chemical company contributes at both these levels by seeking to transform

Figure 6 - Rabigh Refinery (Courtesy of Saudi Aramco)

the Rabigh Refinery in Saudi Arabia into an integrated refining and petrochemical complex.

The evaluation showed that although Rabigh would be profitable, it was not the most profitable investment opportunity that Saudi Aramco was considering. What Rabigh provided, however, was 'the most combined value to the company and the nation'. The national component means that Saudi Arabian society will benefit from the foreign investment, the new jobs created and additional revenues[46]. The corporate component means that Saudi Aramco will extend its petroleum value chain, upgrade oil processing and make its portfolio more profitable[47].

In the area of Key Performance Indicators (KPIs), Saudi Aramco's approach is to use IOC yardsticks in order to be best-in-class in areas such as finding and lifting costs, corporate governance and financial discipline[48].

Venezuela

For Venezuela's PdVSA, sustainability is stated as being central to its existence[49]. Its definition of sustainability considers oil and gas resources from both a production and consumption perspective. PdVSA's stated policy is to regulate production of oil and gas so that E & P processes are optimised, while certain blocks are conserved for the benefit of future generations of both consumers and producers. Its central belief is that because oil is a finite natural resource, producing countries must exercise the sovereign right to regulate production levels so that benefits accrue to current and future generations of indigenous people.

PdVSA also sees its role as educational and to show consumers that oil is not a commodity that operates according to free market rules. It contends that energy markets do not operate in a free market fashion.

PdVSA recognizes that stability should exist in the market, but this can only occur if there is political, economic and particularly social stability. It also asks consumers to consider whether they are consuming energy in an efficient way.

For PdVSA, sustainability must include policies of integration that allow poorer countries to have access to oil and gas. This has been the reasoning behind the Petrocaribe initiative by which Venezuela supplies 200,000 barrels of oil per day (bbl/d) to more than 20 of the smallest countries of Latin America and the Caribbean under special financing[50].

For PdVSA, 'unrestricted access to (the) energy is not the same thing as sustainable access'. The company views the current model as consumers demanding unrestricted access to natural resources, but not allowing resource holders to improve the socio-economic standing of their people. According to the company, this model is characterised by infrastructure bottlenecks resulting from decades of under-investment caused mainly when IOCs held unrestricted access to reserves. PdVSA's view is that sustainability of access must mean that poor countries should be able to access sustainable energy sources[51].

Petrobras

During 2006 and Lula de Silva's successful re-election campaign, Petrobras and self-sufficiency featured prominently. Even before the election, Petrobras was participating in the Brazilian government's 'No Hunger' program. The part-privatised NOC has been playing a greater role in curing Brazil's social ills. As Brazil's largest company, the logic is understandable. Over the years, Petrobras has added tens of billions of US dollars to government coffers in the form of taxes, fees and social contributions. It is also helping by generating thousands of jobs and boosting the local economy by giving Brazilian companies preference for offshore projects[52].

This swing towards nationalism is also accompanied by a skepticism that the opening of the Brazilian E & P sector resulted in little or no gain for Brazil as production or employment increases have been minimal. Brazil, however, has certainly benefitted from technology transferred by IOCs from other areas and this would not have occurred had Petrobras' monopoly not been broken.

The arrival of the IOCs brought knowledge gained from international offshore operations and diverse basins, knowledge that was limited in Brazil. Many techniques that have been proven elsewhere—for example, ERD—are only just emerging on the Brazilian oilfield. IOCs were also accompanied by a raft of suppliers and service companies keen to offer specialised technology. Without an initial hand from IOCs to enter Brazil, many service companies would be put off by the monolithic appearance of Petrobras[53].

Appealing on the one hand, and dangerous on the other, the logic of nationalism can be difficult to counter. Part of the explanation why offshore vessels on the international market are competitively priced is because foreign governments grant

favorable loans to their shipyards. Given similar credit terms, Brazilian companies can compete too. That's clear enough but the danger is that, although nationalism can boost the economy, it can also stifle new ideas.

With a 'people before profit' attitude, Guilherme Estrella (Petrobras E & P Director) has made no secret of being more concerned with generating stable and long-term oilfield employment than opening up the Brazilian E & P market further. This is good news for the offshore industry as a whole because Petrobras is the major employer and trainer of petroleum engineers in Brazil.

The tightrope that Petrobras must walk is balancing the interests of two very different kinds of shareholders. The Brazilian government still owns a majority 51% of ordinary shares while the remainder is held privately. This kind of balancing is ultimately made easier because from both a medium and long term perspective, Petrobras is in an enviable position. It has helped the country reach self-sufficiency and added reserves, while growing its operations in the international arena, especially the US.

Petrobras in the GOM

Petrobras America is currently involved in four business areas which are upstream, trading, procurement and refining. Over the last four to five years, Petrobras has implemented a strategy which looked for specific core areas where it could apply its technology and expertise. These elements have proven critical to success; in frontier opportunities and also 'hard to access areas', as well as four core areas in the GOM (US Waters). One of the options for developments is a phased Floating Production Storage Offloading vessel (FPSO) programme similar to Brazil where a FPSO could sail away in case of a hurricane and reconnect after storms.

According to Petrobras its goal is 'to concentrate in key areas, certain trends and certain plays where Petrobras is bound to be a significant player'[54].

By spreading risk, Petrobras plans to build a portfolio through exploration and not acquisitions. This means testing concepts such as Early Production Facilities (EPF) to get a better idea of the reservoir/production profile before going into full production. The innovative approach of Petrobras has been applied to the western part of the US GOM. This area had not seen a single well drilled for at least a decade as the industry's general understanding was that there was no merit in drilling. During the past decade, however, major technology improvements and better geological

data have changed this. These areas are gas prone with most production coming from the very shallow formations and the Great White Shell development in deepwaters, but with nothing in between.

Seismic has highlighted interesting features, although these prospects have not been properly tested. For Petrobras, two key characteristics are repeatability and having options. Prospects which have similar characteristics, are important because they allow geologists to make inferences from one area to the other. This helps Petrobras to decide whether to drill more wells or not. Options are important too, i.e. where the oil company has eight or ten prospects, there is an option to drill and that limits risk[55].

Petrobras is using technologies and new ideas to build a successful portfolio by using deepwater knowledge, but also geologic modelling from other international areas, i.e. Colombia and the deepwater US GOM.

Petrobras Trading can be seen as a set of services for the group rather than a trading floor presence. It involves finding and developing markets for surplus production. Price oscillations allow Petrobras to access production and optimise its production profile. Increasing production of Marlim crude, which has an API of 19° to 22°, means that the demand for Marlim to be processed in Brazilian refineries is set to go up as is Brazilian refining production; however, there is still a sufficient surplus of Marlim beyond that which can be handled by Brazilian refineries. This allows Petrobras America to sell and capture the best margins in the market.

Market surveys, intelligence and transactions are done by Petrobras Brazil but Petrobras America is the broker. Petrobras America gains title for certain products, i.e. gasoline and fuel oil, and sells these on. Petrobras America started a new refining business through the purchase of 50% of a refinery in Pasadena, Texas. The current capacity of 100,000 bbl/d is being increased through substantial investments that will allow for a further 70,000 bbl/d. Petrobras continues looking to both upstream and downstream opportunities within the US, which is the world's largest consumer and a strategic market[56].

StatoilHydro

StatoilHydro is the Norwegian oil company and views its introduction to the stock exchange in Norway and in the US as a favourable move. According to StatoilHydro, it has the same requirements and terms for operation as any IOC while having the

Norwegian government as its main owner gives it unique advantages, as it is not up for sale[57].

When many IOCs were cutting their R & D functions to reduce costs, StatoilHydro invested more in its R & D facilities and pioneered aspects of subsea and deepwater production. This has helped the company develop certain technology inventions. Part of this is due to the close relations all operators on the Norwegian Continental Shelf have with government authorities, who challenge operators to overcome new obstacles. The company's goals are for the US GOM to become a core area for StatoilHydro by 2012 with production of 100,000 bbl/d. It cites a favourable fiscal regime, stable government and yet-to-find resources as key elements to meeting growth targets in the US GOM.

StatoilHydro's development strategy for the US involves a combination of farm-ins and acquisitions. This started in 2006 with the Chevron farm-in within the Perdido Fold Belt, which resulted in the Tiger discovery. This was followed by the acquisition of Encana assets. At the same time, StatoilHydro farmed-in about 70 leases in the Walker Ridge area with ExxonMobil. This strategy continues with participation in the lease sales in the deepwater GOM area.

It also has a growing business feeding LNG from the Snøhvit field in Norway and from its Algerian assets to the Cove Point LNG terminal in Maryland.

The company has imported a lot of Norwegian offshore technologies that may be applicable for use in deepwater GOM; however, further tests are needed to prove that usage in Norwegian offshore water depths of 982-1640 ft (300-500 m) are suitable for much deeper US GOM waters of 6561-8200 ft (2000-2500 m). Increased recovery may be possible by using a subsea processing, subsea boosting and injection system and FPSOs with risers that have the ability to disconnect. This may be a good solution to secure equipment during extreme weather conditions like hurricanes. Ultimately, StatoilHydro has a wide variety of technologies at its disposal and those are likely to provide its international operations with a competitive edge.

China National Petroleum Corporation (CNPC)

CNPC, China's flagship oil company, plays an important role in China's oil and gas production and supply. Its oil and gas production accounts respectively for 57.7% and 78.3% of China's total output. CNPC is also a global player with E & P

projects in Azerbaijan, Canada, Indonesia, Myanmar, Oman, Peru, Sudan, Thailand, Turkmenistan and Venezuela.

CNPC has bet heavily on R & D to increase E & P production and reduce risk in complex basins. It has developed solutions to improve recovery factors as well as reduce development costs. It has a strong sense of innovation and has technologies in reservoir characterisation, polymer and chemical-flooding. Other technologies include high-definition seismic, under-balanced drilling, ultra-deep well drilling rigs and high-tensile steel pipes. According to the company, by the end of 2007, CNPC had acquired 7,010 patents out of its 9,693 patent applications.

It holds proved reserves of 3.7 billion barrels of oil equivalent. Other relevant data include:

- Oil production: 2.75 million barrels of crude oil/day (MMbbl/d)
- Gas production: 5.6 billion cubic feet/day
- Oil reserves: 3.06 billion metric tonnes, and
- Gas reserves: 2,320.1 Bm^3.

Metamorphosis of IOCs

In the old days, IOCs conferred access and monetised oil reserves. IOCs alone had the technology, capital and know-how to tap the wealth of an unknown hidden natural resource. Naturally, they bargained hard and got the lion's share. Those 'old ways' show that oil reserve holders used to recognise IOC as equals, perhaps, even as holding the upper hand as the IOC was required for revenues to be realised[58].

Even before the Oil Curtain, some IOCs noted that the pool of accessible oil reserves would one day shrink. Progressive IOCs repositioned themselves for the future; some seeing 'beyond petroleum' and others shut out by the 'Oil Curtain'. This, however, does not imply the fall of IOCs. Some are perfectly adapted to evolve and there is still a healthy global E & P environment for them to adapt to.

The drawback is that this environment of extreme E & P has high replacement costs as margins are squeezed by technical challenges. Extreme E & P opportunities exist in ultra-deepwaters, Arctic, unconventionals and in a dazzling array of gas-related technologies. These include: LNG which mobilises and commercialises stranded reserves; biogas which is renewable through biologically produced methane;

Compressed Natural Gas (CNG) and LPG, that provide fuel for the transport and power-generation sectors; and, GTL which offers high quality gasoline fuel (see *Chapter 14: Exits from the Hydrocarbon Highway* for more information).

Of the original seven sisters, most have already adapted to an extreme E & P environment. Going further, BP has distinguished itself in LNG and solar power, while Shell has distinguished itself in Gas to Liquids (GTLs) and hydrogen.

Undoubtedly, IOCs face increasingly challenging operations—extreme E & P. Additionally, there are a wide-ranging set of challenges such as decommissioning, booking new reserves in a narrowing opportunity base, a lack of E & P technology as a differentiator and environmental lobbyists. Perhaps, most of all, nationalisation and resource sovereignty, has made business more difficult.

Despite this, IOCs retain refineries, retailing networks, brands, and direct access to international consumers. Certain IOCs, for example BP and Shell, have continued to be early adopters of new technology. That is praiseworthy, because by supporting innovative new ideas and signposting applications[60], these IOCs have significantly contributed to many E & P innovations, i.e. rotary steerables and expandables across the industry. Those IOCs took risks to prove tools downhole and the benefits have been reaped by all types of oil companies.

Black Blessing

We have seen within a century how oil and gas have become the world's preferred energy source. Consequently, certain countries with the oil and gas wealth or the black blessing have benefitted. So which countries have made oil wealth a true blessing[60]?

Dubai and Stavanger are synonymous with oil wealth, but these cities also subtly show that the black blessing has been managed responsibly with a vision for the future. For these and other thriving cities, there are countless other stories of squandered oil-wealth and cities that have ended up as ghost towns. Yet, no single country's approach to the management of oil and gas has been perfect; it has been learned.

What works in one country is not necessarily the solution in another, but parallels and lessons exist. We shall see how the forces and needs acting on the North Sea were very different to those of the Arabian Peninsula. Each country's profile is

Figure 7 - Dubai's Palm Island

unique but what emerges is a common lesson: oil revenues 'rollercoaster' and are subject to depletion.

Dutch Disease

Due to the highly specialised requirements of the petroleum industry, personnel and equipment are often imported. If you have a pressing deadline, it is easy to think 'don't reinvent the wheel, import'. This, however, is dangerous. Firstly, capital flows become wholly dependent on cyclical oil and gas revenues. Secondly, the creation of local jobs and local infrastructure is limited as workers and equipment are 'outsourced'. The few jobs that are created are fringe industries and are very much dependent on the migrant workers and can easily vanish. Thirdly, excessive imports and the petroleum industry itself can inflate costs so that locals are excluded from housing, social and other activities. This is a double-edged sword as the higher-paying-oil related activities push out other less lucrative activities. Without diversification, these negative factors expose a country's dependence on oil wealth. When oil prices fall, the consequences can be disastrous, i.e. Norway and UK in the 1986 crash.

Before Oil

When considering the North Sea—Stavanger, Norway, Aberdeen, UK and the Arabian Peninsula—Dhahran, Saudi Arabia and Dubai or Abu Dhabi UAE it is revealing to see how these countries existed before oil.

All of these countries had very different socio-economic profiles; healthcare, disposable income, education levels, transport links and indeed internal infrastructures were severely limited.

Yet, in each the black blessing has improved lives within the space of a single generation and has led to the creation of new industries (see Figures 7, 8 and 9).

Pilgrims

In the Saudi Arabian peninsula, oil was discovered in the 1930s. At that time, exploration contracts for oil were scorned; in scorching desert temperatures, exploration was for a more valued resource, water.

Saudi Arabia had already been guaranteed an annual source of revenue due to the Hajj—the pilgrimage Muslims make to the city of Mecca; however, the country's infrastructure was underdeveloped which led to a weaker bargaining position. When the first contracts were signed, the Saudis received less than the equivalent of 5% royalties. With the discovery of oil and its growing geo-political importance, the Saudis' bargaining power increased.

Figure 8 - Abu Dhabi View from Emirates Palace

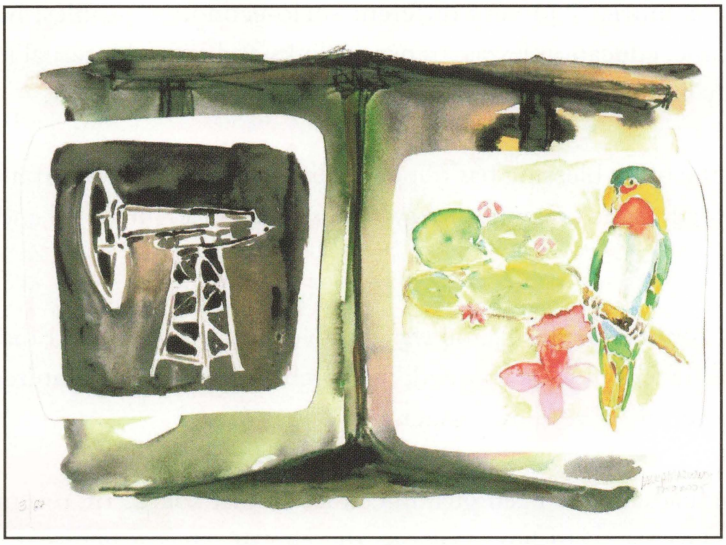


Figure 9 - Oil and Gas Wealth Is Not Necessarily A Trade-Off Against The Environment. There Are Wider Considerations (EPRasheed)

Royalties grew to 50%. Other stipulations such as the improvement of transportation and telecommunication links followed. By the 1970s, the Saudis had started to buy-back the privatised oil company leading to the full ownership of Aramco and the country's reserves of 264 billion barrels of oil.

In reality, national oil policy has come full circle. It has evolved from seeking maximum royalties to stipulating local capacity to full re-nationalisation and now to partial privatisation for gas developments. To illustrate Saudi Aramco's local content, as of 2007 it had a total of 52,093 employees of which 45,464 were Saudis and 6,629 were expats. It has also signed gas exploration contracts with foreign oil companies such as Shell.

Gold and Pearls

In the UAE, a union of seven Emirates, the situation was different. Dubai had long been a regional trading hub and had far fewer reserves than Abu Dhabi which meant it quickly realised its economic future lay beyond its scarce oil reserves. Dubai's souks were known worldwide for all manner of commodities, especially gold and Arabian pearls. Dubai continued to profit from trading until the cultivation of artificial pearls and world recession caught up in the 1930s.

Figure 10 and 11 - Developments along Sheikh Zayed Rd Dubai (EPRasheed)

The quality, size and quantity of artificial pearls could be controlled in such a way that demand for them grew quickly. Commerce dropped in Dubai and it was no wonder that, when news reached the ruling family in the UAE and Dubai that oil exploration licences were being sold in Saudi Arabia, negotiations quickly followed.

With the fullness of time, this led to the discovery of reserves of approximately 98 billion barrels of oil in the UAE. Presently, Dubai has developed a policy of cluster economies which have resulted in flourishing financial services, tourism and IT sectors.

A Tale of Two Cities

Before oil, Aberdeen and Stavanger were economically stable albeit sleepy fishing and maritime towns. During the early 1960s when gas was first discovered (oil came afterwards) in the Grönigen field in the Dutch Sector of the North Sea, Norway had high employment, a current account surplus and low inflation. From a socio-economic perspective, there was no pressing need to explore for and develop oil and gas.

With the 1973 oil crisis and accompanying embargo, geologists started scrambling for North Sea seismic. This instability in global geopolitics set the scene for the

Figure 12 - Drilling Rig in the Middle East (EPRasheed)

upper hand in negotiations with the IOCs. When the Norwegians and Scots asked for rewards beyond taxes and royalties, the oilmen obliged.

Differences Between the North Sea and Arabian Peninsula

The need to develop local knowledge was linked to the nightmarish operating conditions in Norway. In contrast, the Arabian Peninsula is an oilman's dream—punch a hole near a dome and chances are that oil will be struck. From the very start, these very different environments formed very different mindsets. This led to a historic laissez-faire approach to technology development in the Arabian Peninsula.

In contrast, Norwegian and British fields were located in the harsh North Sea, a dangerous environment where locating reservoirs was a costly, time-consuming business. Here the application of technology made a vital difference. With good seismic, directional and real-time data, well construction costs could be halved. This was a compelling reason for the development of North Sea technology. In parallel, the gradual introduction of terms such as the famous '50% local content' stipulation in exploration contracts helped develop local content.

Game-Changing or Incremental Benefits?

Technology of every type was necessary in offshore Norway and UK. The need for reducing risks and cutting costs was acute and technology could change the nature of the game, magically making uneconomic reserves profitable. In the Arabian Peninsula, the benefits of offshore technology did not apply. While other onshore technologies could be applied their technical and financial gains were insufficient. An incremental gain in production or cost-reduction was not compelling enough for such technology to be used in the Arabian Peninsula.

North Sea offshore operations, for example, routinely cost in excess of US $200,000 per day including rig rental and crew costs. By contrast, onshore operations in the Arabian Peninsula do not often exceed US $100,000. Additionally, the profile of Arabian reservoirs, i.e. their production rates and overall production size, are order of magnitude greater than North Sea finds which leads to lower overall finding, development and lifting costs in the Arabian peninsula.

By the 1980s, greater emphasis was placed on local content and local capacity building within the Arabian peninsula. This trend had its roots in the North Sea.

Build Locally

It is worth highlighting that prior to the early 1960s, there was no oil and gas industry whatsoever in the North Sea. Yet, today the industry is a prime mover in the Scottish and UK economy.

How did this transformation occur within a generation?

Building local capabilities was always a 'must-have' for the North Sea. Eventually, this led to the creation of the service sector hub which exports oil and gas technology globally. At first, technologies were invented, tested and proven in the North Sea before being exported worldwide.

We have seen that until the mid 1960s, neither Norway nor the UK had an oil industry, but within years the chorus to create one was loud enough to be heard. In the early 1970s, this led to the preferential use of local goods and services at times reaching 90% as required by law. At that time, the Norwegians created Statoil, the operational oil company and as policy maker the Norwegian Petroleum Directorate (NPD). Accompanying this was a preferred policy for Norwegian goods and services coupled with a clause of transfer of know-how and research cooperation.

Figure 13 - Old Stavanger Was Built On Fishing

The UK and Norway's success in achieving high local content is largely due to these policies which have encouraged partnerships between foreign and domestic companies and made research programmes mandatory. Research has helped create smaller companies which have exported technology worldwide and grown. The University of Aberdeen Oil Centre lists 175 small companies working in the oil and gas sector. These range from small independents to technology companies.

In terms of production, Norway and the UK are very different. Norwegian oil and gas production has increased over the past decade to 3.1 MMbbl/d. The UK's oil production has fallen by 30% over the same period to current levels of 2 MMbbl/d. Yet, through demand for UK oilfield goods and services, the oil sector continues to generate substantial economic activity.

Smaller independents have entered the UK sector but the oil and gas industry has developed far more due to the formation of mechanical and petroleum engineering, academic and vocational training and associated consultancy services.

Seeds of Knowledge

Licensing terms for oil contracts stipulated the transfer of skills and competence to Norwegian companies. Personnel from Norsk Hydro, Saga and Statoil (these companies have merged into StatoilHydro) received training in the IOC training programmes and overseas postings.

The situation was slightly different for the UK as BP had already had international oil and gas exposure. In fact, this helped it discover and develop Forties (the largest North Sea UK field).

These seeds grew into the commercial success of numerous oil technology companies that export goods and services worldwide.

Technology Greenhouses

Today, there is a strong culture of oil and gas R & D; several well test sites and research companies exist. Illustrating this is the Bridge of Don Test site in Aberdeen, Rogaland Research and its test well in Stavanger and SINTEF (a company specializing in R & D).

As major oil companies shed R & D internally to cut costs, more R & D has been taken up by the service companies. This is not to say that major oil companies do not use or test new technologies; they do so in low-risk developments such as mature onshore operations. For the most part, however, the development and ownership of proprietary oilfield technology no longer lies with oil companies. There are some exceptions; the development of rotary-steerable systems to access complex well trajectories and expandable-casing for well construction was initiated by oil companies. NOCs are somewhat different as can be seen by Petrobras' R & D centre which has grown to support Petrobras' deepwater needs and has become a world leader in deepwater technologies. Norway and the UK have helped develop subsea

Figure 14 - Modern day Stavanger, home of Norwegian Oilfeld Technology and the Norwegian FPSO

Figure 15 - Tension Leg Platform

technology and especially intelligent wells and real-time operations management. It should be noted, however, that the service side has played a crucial role in technology development in all cases.

Cluster Economies

It is recognised that the Arabian Peninsula's economies have been highly dependent on oil; it accounts for more than 75% of government revenues in the region. This made it crucial that the Peninsula diversify from oil dependence and open its markets to attract foreign capital. A good example of this is seen in Dubai which briefly had revenues in oil production but realised quickly that it could become a trading hub due to its location between Europe and the Far East and links within the Peninsula between Saudi Arabia, India and Iran.

Various initiatives were undertaken in Dubai; for convenience they can be classed as cluster economies. Dubai began experimenting with cluster economies through the development of Dubai Internet City in 2000. This has grown to house over 5,500 knowledge workers today, while Dubai's Media City houses most of the leading global media companies. Dubai's financial markets have also grown.

The opening up of Dubai's real estate sector has also helped diversification. Between 2004 and 2010, investments in Dubai's real estate sector are set at US $50 billion. This is serving to support Dubai's tourism industry as it aims to increase the numbers of foreign tourists.

Dubai first sought to consolidate the economy's major components of trade, transport, tourism and real estate sectors. It then moved on to promote aspects of a 'new economy': IT and multi-media activities and e-commerce and capital intensive, high-tech manufacturing and services (see Figure 16 aside).

Rainy Day Fund

After an economic rollercoaster that saw Norway with the highest debt ratio ever attained by any developed country, the Norwegian Parliament established the Petroleum Fund in 1990. It receives net cash flow from the oil industry as well as profits from investments. The fund is designed to protect the economy should oil prices or activity in the mainland economy decline, and to help finance the needs of an increasingly elderly population and to cope with declining oil and gas revenues. The idea is to use 4% of the fund in the annual budget, but in reality larger transfers are made.

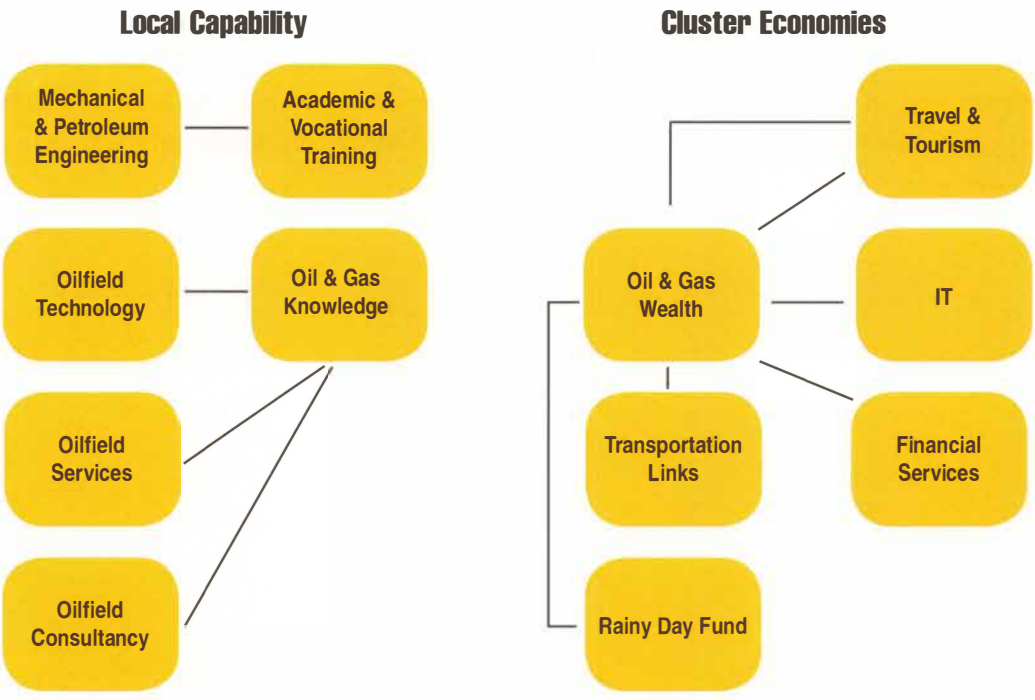


Figure 16 - Relationship of Oil and Gas in Economic Sustainability (EPRasheed)

Too Much Local Content?

Government departments provided incentives enabling operators and the private oil sector to identify technology needs and fill them. This led to a trial and error system where technologies were not always applicable; however, it is not so important to focus on any single research program that did not work because with time a local knowledge base and competence was created.

The preferential policy may have gone too far in some cases, leading to an introverted mindset. For example, in Norway in 1990 at least 80% new prospect content was domestic. The advantages were jobs and profits in Norway, but there was far too much dependence on the petroleum industry for Norwegian manufacturing while exports to markets in other oil producing countries were limited.

Undoubtedly, this shows that the black blessing has improved lives within the space of a single generation and has led to the creation of new industries. There are many ways to make the blessing last. We have seen how global power has shifted from IOCs to NOCs and how many NOCs want to compete in international markets.

We have also seen the metamorphosis of certain IOCs into Energy companies. What drives this shift is a growing awareness that, above all else, holders of the reserves determine the rules. The next question then becomes clear—who actually holds the petroleum reserves? Are they globally dispersed or centralised in a few major locations?