INTERNATIONAL ENERGY FORUM

NOC - IOC partnerships

General guidelines for successful cooperation

Report for the 13th IEF Ministeral

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1. Executive Summary

In the last few decades the oil and gas sector has evolved considerably. No strangers to innovation and change, oil and gas companies have proven time and again their willingness and ability to adapt to changing circumstances.

Risk management is an area which energy companies have by necessity become expert in tackling. Geological or "below-ground" risk is the traditional bread-and-butter of successful oil and gas companies, with "above-ground" risk (e.g. market volatility, politics, regulation, taxation, licensing, environment, and the like) also lying within their daily purview.

However, multiple and complex above-ground factors now increasingly overshadow the traditional geological and technological challenges and hamper the industry's ability to plan, invest and meet future energy needs within historical parameters of affordability, timeliness and sustainability.

At the time of writing, the world is recovering from the greatest economic shock in more than 75 years, and there is still considerable uncertainty regarding the sustainability and pace of the recovery. The Gulf of Mexico oil spill and the Fukushima accident may lead to more stringent regulation and operational procedures, and the development of hitherto unconventional resources may also act as a game changer.

These dramatic changes have forced stakeholders, industry and governments to reassess their business plans and policies. The multidimensional and complex nature of the challenges faced by the industry (technological, economic, environmental and political) and the often global reach of their effects combine to make a strong case for collective study and response to common challenges. Long-term sustainability will to a great extent be dependent on the sector's ability to mitigate the effects and influence the development of above-ground circumstances over which it currently holds little control.

IEF Ministers have been frequent advocates of the notion that cooperation between NOCs and IOCs holds significant potential to address key challenges facing the industry as a whole, to secure and better optimise investment in the oil and gas industry, help ensure its development, and by inference, improve global energy security of supply and demand.

In this vein, the IEF identified a number of guidelines and principles for successful NOC-IOC cooperation, with collaboration of the host governments, on the following areas:

- Build long-term partnerships in agreed-upon areas based on mutual trust and respect;
- Where applicable, align the interests of all parties.
- Facilitate whenever appropriate cross-investment throughout the whole value chain in host countries, partners' home countries and in third party countries;
- Establish long-term partnerships that are sustainable under any economic situation;
- Favour as much as possible dialogue, re-negotiations or mediation to resolve conflicts or disputes;
- Build long-term cooperative programmes on joint R&D, training, education, technology development and commercialisation, safety and best practices;
- Build long-term partnerships on environmental and operational safety issues;
- Undertake joint analysis and studies on producing and consuming countries' regulations, activities and policies related to energy supply and demand.

2. Background

In response to the Ministers' call, the IEF established an NOC-IOC Forum which now provides a biennial platform for senior decision makers from National and International Oil Companies, service companies and experts, to discuss the changing business environment and its impact on stakeholder relationships. The IEF Forums provide opportunities for participants to highlight successful examples of long-term cooperation between NOCs and IOCs, to assess the key issues and common challenges facing the oil and gas industry, exchange views, and identify ways and means to enhance cooperation and partnership. The IEF NOC-IOC Forum is now firmly established in the calendars of industry leaders and is recognised as an integral part of the global energy dialogue which enhances our collective energy security, i.e. security of supply and demand.

Energy Ministers and industry leaders gathered at the 12th IEF Ministerial in Cancun (March 2010) welcomed the establishment by the IEF of the NOC-IOC Forum, expressed satisfaction with the key findings of its first event and stressed the importance of developing innovative models for cooperation and value-driven, long-term partnerships between NOCs and IOCs. They also suggested that the IEF should attempt to draw up a set of general principles or guidelines on NOC-IOC cooperation, based on best practices around the world, as a possible concrete tool to facilitate this cooperation.

In response to this call, the IEF Secretariat, in cooperation with the companies of the IEF Industry Advisory Committee (IAC), has developed a set of general principles intended to serve as the basis of a framework for successful cooperation between NOCs and IOCs.

This paper prepared by the IEF Secretariat, intended as background to the proposed guidelines, presents the evolving role of NOCs and IOCs and attempts to identify the potential for cooperation among these stakeholders in response to common challenges. The paper has been discussed by the IEF Industry Advisory Committee and benefits from the input of IAC members. The **set of general principles and best practices defining successful schemes for NOC - IOC cooperation** laid out in this paper will be presented to the 13th IEF Ministerial and 5th IEBF meetings in Kuwait in 2012 for discussion and endorsement.

3. Evolving role of NOCs, IOCs

Traditional roles, spheres of influence and areas of competence of NOCs and IOCs are changing as they strive to develop sustainable business models capable of withstanding the general vagaries of the global economy and myriad associated uncertainties.

In the early years of the sector's development, IOCs dominated the oil business. They owned much of the oil and gas infrastructure and to a great extent controlled trade in oil. The creation of NOCs and the nationalisation process in many producing countries in the second half of the 20th century challenged the role of IOCs, and the major geopolitical events and market disruptions that occurred in the 1970s and 1980s further eroded their traditional dominance. However, NOCs still looked to IOCs to provide the technology, financial and human capital to develop their resources, and the relationship between NOCs and IOCs remained relatively conventional, based on the same economic considerations and the same motives - NOCs offering access to reserves, with IOCs providing the much needed experience, technology and capital.

In the 1990s, a low price environment led the oil and gas industry to a period of consolidation and reduced upstream investment. Mergers and acquisitions among the major oil companies resulted in many IOCs outsourcing part of their R&D activities. Service companies responded to the upheavals during this phase of the sector's development by seizing the opportunity to develop and market technology and subsequently technical services, with NOCs developing their own capabilities as well.

With oil prices rising from the mid 2000s onwards, NOCs benefitted from improved access to capital which presented opportunities not only to build financial strength, but also to develop in-house technical expertise. This period also witnessed the renegotiation of contract terms and conditions for many projects which signalled a shift in the balance of the relationship between NOCs and IOCs. Contracts between NOCs and services companies grew in size and importance over the same period.

Today the IOCs' share of oil and gas reserves has fallen considerably. NOCs now control more than 90% of the world's oil and gas reserves while the six major international integrated oil companies currently control less than 5% of the world total. Three countries control more than half of the world's natural gas reserves. Over the last couple of years, the surge in the volumes of "unconventional" gas entering markets, especially in North America – chiefly from tight sandstone and shale formations – has changed the pattern of gas production and distribution – not only in the US but also throughout the world.

According to PIW's ranking of the top 50 oil and gas companies[1], there are more NOCs in the top 50 than IOCs and 10 NOCs produce 40% of global oil production while the production of the six major IOCs amounts to less than 14%. In the top 25, NOCs dominate the landscape, with 17 positions. NOCs also comprise four of the five top ranked companies. NOCs are not necessarily Most NOCs in the top 50 have overseas operations and some NOCs operate as and have effectively evolved into quasi IOCs or INOCs (International National Oil Company).

4. Challenges facing the industry and potential avenues for enhanced NOC-IOC cooperation

The challenges facing the energy industry today are **numerous, varied in nature, extend along the supply chain and have effects in the short, medium and long term.** There are often interdependencies of cause and effect which mean that even short-term issues cannot be dealt with in isolation from the mid- to long-term outlooks. Maintaining an optimal investment profile over time can be very hard when the industry is facing so many variables and often unforeseen risks. Unprecedented economic and political uncertainty coupled with high volatility serve to undermine interest in expenditure on new capacity and the human resources necessary to secure supply and demand, reasonable prices and fair returns for investors.

Governments, NOCs, IOCs and other stakeholders should strive to come together to promote cooperation and collectively recognise the interdependent nature of the industry and its importance to the global economy. Transparency of data and market operations, interlinkages between physical and financial markets, and consistency and thoughtfulness of regulation all are areas of growing and common concern. There is a need for better understanding of the many above-ground factors that exert influence over the sector and a requirement for a more global approach by all stakeholders (governments, NGOs, technology providers, banks, legal experts, etc.) to issues of common concern.

[1] PIW, December 2010.

4.1 Growing demand and shifting geographical structure

Levels of energy needs and economic development are strongly related to and driven by growing world population, industrialisation in emerging economies and urbanisation.

There is a broad consensus among energy experts that **global primary energy demand is set to grow in the future,** although perhaps at a slower rate than in recent decades. Under most mainstream scenarios, **fossil fuels are expected to remain the main source of energy** in the primary energy mix over the coming decades with oil remaining the dominant fuel, albeit with a declining share over time. Natural gas is expected to grow at a higher rate than other fossil fuels, increasing its share in the overall energy mix. This being the case, it is rational for the industry and other stakeholders to allocate financial and research resources to ensuring cleaner and more efficient fossil fuel use.

The significant future growth in global energy consumption gives strong additional motivation to efforts to promote **energy efficiency**. Energy efficiency meets major objectives of both developed and developing countries, whether importers or exporters of energy, and is often found at the top of the list of energy-policy proposals. Like many other energy challenges, one of the keys to increasing energy efficiency is technology. And the key to successfully developing and deploying that new technology is disciplined investments and incentive non-discriminatory energy related policies.

The geographical structure of global energy demand is shifting, with non-OECD countries (predominantly in Asia and the Middle East) expected to account for 90% of projected incremental demand. This represents a continuation of the faster pace of growth in primary energy demand that has already occurred in non-OECD countries over the last few years. Demand from the OECD region is expected to plateau or decline.

Lack of access to modern energy services still burdens nearly 2.7 billion people. The UN has labelled 2012 as the “Year of Universal Energy Access for All”. Achieving universal energy access will require coordinated action especially by the government and private sectors. Collaboration between energy companies, development banks, local authorities and other stakeholders is a necessary step towards improving living conditions, promoting economic growth and creating business opportunities for local communities. The economic uplift that will result from deployment of required energy and investment financing for clean energy technology such as CCS can be expected to contribute to global stability and by inference to improved working environments for the IOCs and NOCs.

4.2 Evolving business environment and call for new models of cooperation

Capital, technology and know-how have been the historical key drivers of NOC-IOC partnerships. In the past, IOCs have leveraged their financial strength and technological advantages to gain access to oil reserves throughout the world.

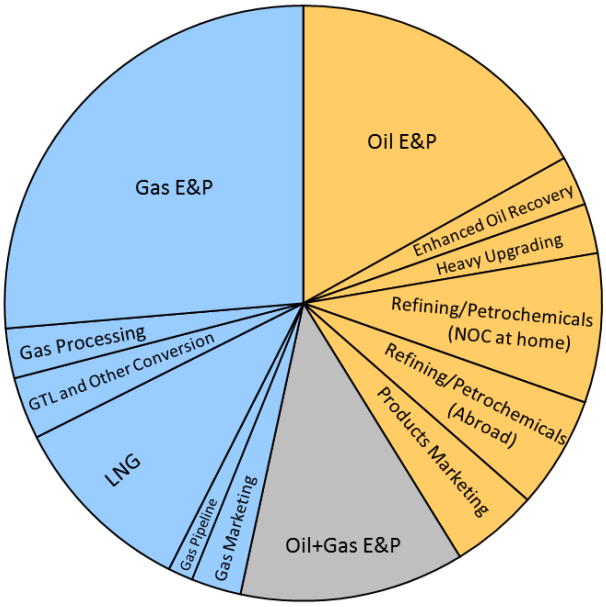
Evolution of market fundamentals in recent years has altered the respective roles of NOCs, IOCs and service companies and changed their business models and relationship. With resource potential and financial strength, producer NOCs have increased their influence, reassessed their motivation and adapted their behaviour in line with a more market-oriented approach traditionally associated with the IOCs.

Partnering in upstream projects with IOCs is no longer a must for most NOCs. The production sharing agreement that was the main contractual structure of the upstream partnerships between NOCs and IOCs is becoming less attractive to producers. The service-type contact has become an attractive structure from the standpoint of NOCs as it sidesteps controversial policy issues such as booking of reserves and production management. Service companies are willing and able to perform many of the specialist tasks previously considered the sole domain of the IOCs. The major service companies with advanced technology and skills have fully benefited from this new situation and increased their share of the business with NOCs at the expense of the IOCs. As IOCs account for much of the traditional client-base of service companies this recent trend adds an interesting twist to historical customer-client relationships and enhanced energy producers' performance.

On the other hand, IOCs remain the preferred partners for long-term ventures particularly as development becomes more challenging. In addition to technology and finance, IOCs bring a package of operational expertise and project management capabilities as well as market knowledge and access.

Successful examples of long-term NOC-IOC partnerships exist across the globe, in the upstream, midstream and downstream segments of the industry. Figure 1 illustrates the diversity of NOC-IOC partnerships that have flourished over the last 20 years. The relationship between NOCs and IOCs remains important regardless of the partnership structure or the fiscal regime governing the project. Analysis of the industry press shows many examples of successful oil and gas projects involving IOCs, producer NOCs and/or consumer NOCs, in E&P, transport, refining, liquefaction, etc.

Figure 1: Breakdown of large NOC-IOC joint projects by segment, 1991 to 2011

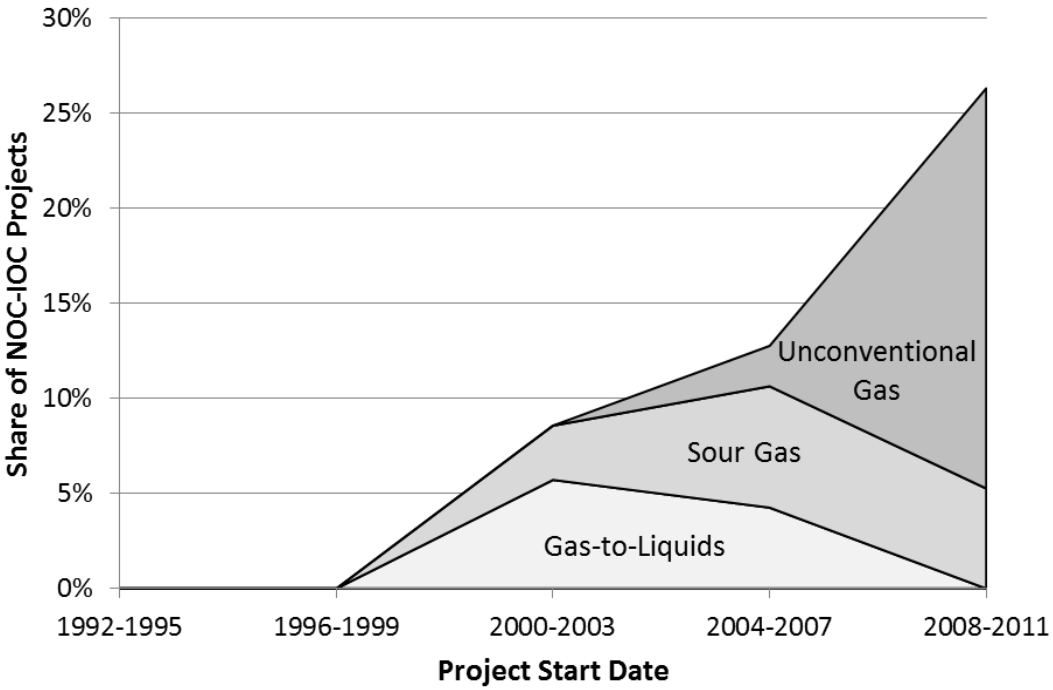


Source: Stanford University / PESD

The potential for innovative contract structures – that go beyond simple resource development – is largely dependent on the good-will of the parties involved and ready acceptance that their respective needs are not necessarily mutually exclusive. The most successful long-term partnerships will be those that are built on a platform of trust and a common understanding that the basic needs of all parties must be respected and given thoughtful and adequate consideration.

As natural gas demand is increasing, gas will play a larger part in the evolving business environment; and NOC-IOC partnerships based on gas are expected to grow. Such evolution is favoured by the discovery of substantial resources of shale gas which are now being developed across the globe with a significant impact on the global gas industry and its players. Figure 2 shows how frontier activities in natural gas are an emerging focus area for NOC-IOC collaboration.

Figure 2: Share of large NOC - IOC partnerships involving "gas frontiers," by project start date



Source: Stanford University / PESD

The present challenges facing the industry could provide new opportunities for NOCs and IOCs to partner in long-term sustainable partnerships, sharing the operational and financial risks, particularly for mega-projects or in difficult environments. NOCs and IOCs have specific, but often complementary skills and expertise, and are likely to have different strategic objectives. However, there are significant benefits to be reaped by those that recognise and leverage the synergies presented by their unique skill-sets and choose to focus on shared interests that can underpin successful long-term partnerships.

In this changing and more demanding environment, NOCs and IOCs may explore **new models of cooperation** that go beyond simple resource development, and integrate host nation's expectations, such as economic development, environmental protection, joint development of technology, development of NOC capabilities and skills of the local workforce, infrastructure development and support of the local economy.

Cross-access to markets, technology, capital and resources can offer mutually beneficial opportunities for cooperation. Cross-investment throughout the value chain, based on mutual trust and respect, vertical and horizontal integration whenever feasible and access of NOCs to consuming countries' markets may serve to strengthen long-term relationships between NOCs and IOCs.

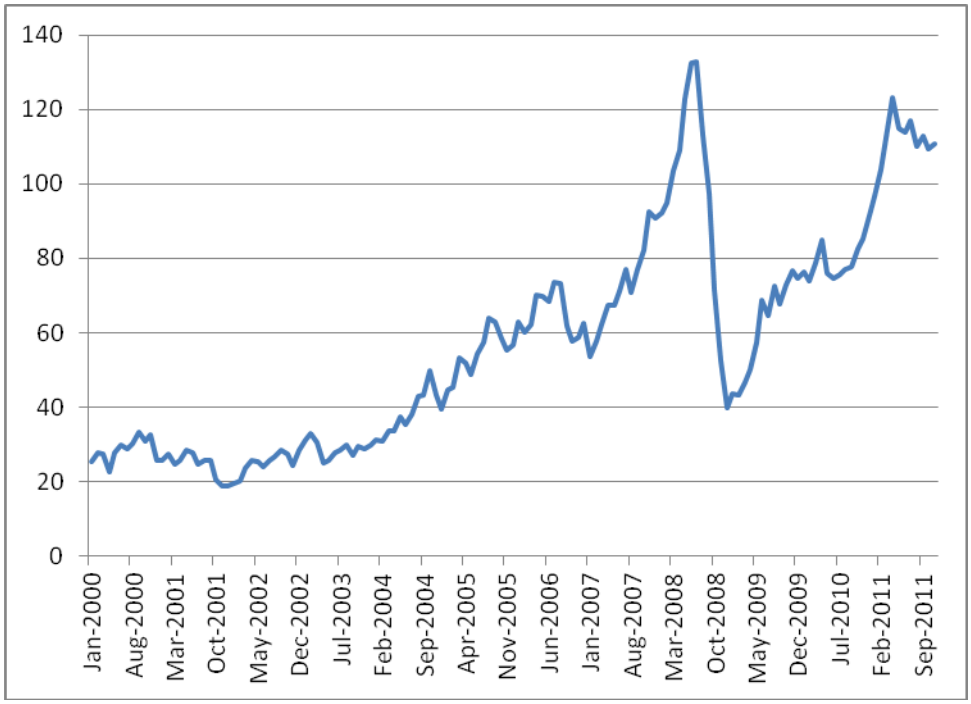
NOC-IOC partnerships that operate outside the NOC home country with a focus on specific projects and alliances can also generate added value for all stakeholders. Operating on neutral ground may prove to be of benefit in building understanding and trust which may underpin a longer-term relationship.

Integrated gas projects provide examples of successful long-term relationships between NOCs and IOCs. The relationship covers the whole value chain from resource development to gas transportation and transformation (LNG) to downstream, marketing and high-tech training centres to develop local skills. Another example is the development of domestic refineries in host countries through NOC-IOC joint investment.

4.3 Energy market volatility

Over the last decade, the energy market has witnessed significant volatility. Market developments pushed oil prices to unprecedented levels of nearly $150 per barrel in July 2008; they then slipped back below $40 in January 2009 before climbing again. The combination of the financial crisis and the macroeconomic slowdown affected global energy demand in general, and oil in particular.

Figure 3: Oil price movement January 2000 - November 2011



Source: EIA/DOE.

Such **excessive levels of market volatility are potentially detrimental to the interests of the majority of stakeholders**, governments of both producing and consuming countries, NOCs, IOCs and service providers, and end consumers. Volatility intensifies uncertainty and makes it more difficult for oil and gas companies to plan investments, and for governments to plan budgets. In the short term, most stakeholders have a genuine interest in improving market data transparency in order to help achieve better stability of the energy market.

Long term outlooks play a key role in shaping the perceptions of policy makers and industry alike; they also have an impact on near-term decisions. In its role as neutral facilitator the IEF is working with the IEA, OPEC and others to help determine the key drivers of energy markets and to clarify uncertainties evident in the multiple scenarios presented in the preeminent energy outlooks. The objective of IEA-IEF-OPEC joint work on short, medium and long-term energy outlooks is to improve the insight of market players into the key factors underlying the divergence in outlook projections, suggest areas of harmonization of definitions and data reporting and contribute to diminishing the volatility caused by uncertainty associated with such differences in outlooks.

This trilateral cooperation initiative on the **interactions between physical and financial energy markets** seeks to address the key challenges related to commodity price formation, price reporting agencies and regulatory reform in the energy derivatives markets. The concept is to reduce the potential for volatility by helping stakeholders better understand the complexities of the present oil market and the influences that operate on it.

One of the tools available to address market volatility through improved market data transparency is the **Joint Organisations Data Initiative**, **JODI**. This is a collaborative effort involving seven international organisations (APEC, Eurostat, IEA, IEF, OLADE, OPEC, UNSD), as well as the administrations of participating countries and companies. The Oil component of the initiative, which celebrated its 10th Anniversary in 2011, is a concrete outcome of the producer-consumer dialogue and is co-ordinated by the IEF. The 10th anniversary was marked with an extension of the data set provided to users.

JODI-Gas, a response of the international partner organisations to IEF Ministerial requests, is well on track and should be available to data users during the course of 2012.

Industry plays a dual role in JODI. It is both a primary data provider to the initiative and an active user of the JODI World Database. Industry support for the IEF and partner organisations' work on the JODI plays a key role in improving energy market transparency, and industry's ongoing participation is essential to the sustainability of the initiative.

The industry cannot eradicate price volatility and it has limited ways to counteract its detrimental effects, but NOCs and IOCs can combine their efforts to identify the key areas of data deficiency and explore ways to overcome such deficiency.

4.4 Uncertainty surrounding investment

There is a dominant understanding within the energy industry that **oil and gas resources are sufficient to meet projected demand for the coming decades**. However, huge investments are required to produce, transform, transport and deliver the end-products to consumers. Timely and accurate investment along the supply chain is important for an efficient and secure functioning of energy markets and crucial for global energy security.

The most recent estimates (IEA WEO 2011) indicate that the required cumulative investment to enable the replacement of reserves and production facilities as well as the expansion of production and transport capacity to meet projected energy demand over the period 2011-2035 amounts to $38 trillion, equal to $1.5 trillion per year on average. Out of this total, the oil sector needs $10.0 trillion (26% of total investment), with 87 % of this amount to be directed to the upstream.

The gas sector is expected to account for $9.5 trillion (25 %). Two-thirds of the total investment is needed in non-OECD countries where production and demand are expected to increase most. Over the same period, OPEC's estimate of upstream investment requirements for additional capacity amounts to $3 trillion [2]. OPEC also sees substantial capital investments being required to expand and provide maintenance to the global refining system – around $1.2 trillion over the period 2010-2035 [3].

In the face of unprecedented uncertainty around key market drivers, **mobilising such a huge level of investment is a major challenge** not only for NOCs and IOCs, but for the oil and gas sector as a whole. The rate of economic growth in the coming decades is a crucial determinant of incremental energy demand. Moreover, energy and environmental policies, upstream costs, adequacy of human resources, access to new and more difficult reserves, oil price path, and technological development are all likely to **play significant roles in affecting the level of investment** in an industry characterised by long payback periods.

The amount of investment required to meet future demand varies among the many scenarios being contemplated. This fact alone may hamper appropriate and timely investment. Underinvestment or delays in investment raise the prospect of shortfalls in incremental capacity and increased likelihood of price hikes. Conversely, overestimates of investment requirements may lead to over-capacity and a subsequent price collapse. Overall, demand uncertainty equates to a significant perceived risk which discourages investment and constrains capacity development.

Despite the many uncertainties related to the changing global economic landscape and a volatile business environment, the challenge facing the industry is to continue to take the long term view and invest in the oil and gas value chain to ensure that both new and discovered resources can be produced in an economically and environmentally sound manner to meet additional demand and offset natural field decline.

Energy policies aimed at demand curtailment of one energy source for the benefits of another in consuming countries and taxation regime with preference to highly subsidised sources of energy in consuming/host countries are the main obstacles for sustainable partnership between NOCs and IOCs as well as for market fundamentals. A desire to impose taxes, provide subsidies (direct or indirect) that constitute discrimination among energy sources, modify taxation rules to reflect structural changes in the business environment is undesirable and expected to have adverse impacts on investments and cooperation.

[2] 2010 US dollars; excludes investment in additional infrastructure such as pipelines
[3] Reference Case.

Industry partners share a common interest in persuading their respective host counties that short term solutions do not provide the best environment to address long term challenges, and that commercial ties and agreements can be made more robust even in the face of a persistently volatile business environment. Industry effort to secure energy supplies in the short, medium and long term is crucial, but it may be jeopardised by discriminatory regulatory frameworks amongst available sources of energy both locally and globally.

4.5 Human resource adequacy and skill management

The **oil and gas sector has long been characterised as a boom-bust industry**. In boom periods companies have traditionally boosted their capital expenditure and recruited more staff. In bust times, the situation is normally reversed. Human resource management in the oil and gas industry is a structural issue and is therefore a real cause of concern and a major challenge to NOCs, IOCs and services companies alike.

During the 1980s and 1990s, in response to low oil prices and reduced capital expenditure, the industry laid off a huge number of skilled workers. Over the same period universities cut back their petro-technical programmes as industry was faced with over capacities both upstream and downstream. Recruitment of new employees dropped drastically and fewer university students entered petroleum engineering programmes.

Job security is a major concern among employees, and the oil and gas industry's reputation for vulnerability to "boom and bust" cycles is not a positive factor in this regard. Graduates are keenly aware of the sector's periodic shortcomings and the industry has been ineffective in countering this viewpoint.

Looking forward, the industry will explore, develop and produce oil and gas in increasingly severe conditions. Its ability to plan and execute large-scale, complex development projects requires a highly qualified and experienced workforce with the ability to find, extract and deliver more "technical oil" using an increasingly complex skill-set to innovate and deploy the necessary technology in a timely, efficient and environmentally sensitive manner. Shortages of experienced personnel may have an impact on expansion plans of both NOCs and IOCs.

One of the main challenges facing the industry is to find new approaches and identify sustainable long-term solutions to manage workforce demographics, both in boom and bust times.

Partnership between NOCs and IOCs can contribute to addressing the sector's human resource challenge. Education and training can offer a valuable avenue for cooperation between NOCs and IOCS, through which they share fixed costs of educating young graduates and training more experienced professionals. Collective collaboration and coordinated cooperation between government, academia and industry on the various issues related to curricula, employment and social policies, and programme financing will achieve more in the long-term than isolated initiatives.

NOCs, IOCs and service providers in collaboration with educational institutions could implement training programmes that are tailored to their particular needs. Internally, proactive measures could include mentoring programmes to attract, motivate and retain talent as well as facilitation of succession planning and transfer of knowledge. In host countries, NOC-IOC partnerships, in cooperation with local universities and vocational training centres, can contribute to the development of local and regional talents.

Commonly held negative perceptions of the industry should be challenged by better communication of the reality of the modern oil and gas sector as a high-tech, diverse, and environmentally conscious entity. Clear and reliable long-term recruitment and retention policies must be developed if the industry is to regain the trust of labour markets. NOC-IOC cooperation could contribute to positive reinforcement of the image of the sector, through co-ordinated efforts and employment and social policies.

While profitability and efficiency are legitimate objectives for NOCs, IOCs and service companies, the loss of competencies due to large lay-offs of personnel in low business cycle periods make it difficult for the industry to respond to sudden changes in the business environment on the upswing of the next cycle. This is one of the causes of the project cost escalation witnessed in recent years, with human resource shortfalls resulting in salary inflation. NOCs, IOCs and service companies should therefore explore ways to resist short-term economic pressures and avoid cuts in workforce.

4.6 Public awareness and energy industry image

Social reaction to environmental issues is another increasingly important challenge facing the industry. While the energy industry is familiar with the well-known NIMBY ([4]) syndrome, the attitude of the general public towards the energy industry as a whole is increasingly shaped by negative perceptions arising from specific incidents relating to infrastructure (safety / environment), governance, and interaction with local communities.

The public's perception of the energy industry is fairly negative despite the wide consensus that the quality of life depends upon the availability of energy. Although it is widely accepted that there is no industry with zero risk, accidents associated with the energy industry hold the potential to have a major impact on the environment. As headlines tend to be driven by bad news the industry most commonly features in the public consciousness

[4] Not In My Back Yard.

for all the wrong reasons and long-standing negative perceptions are reinforced every time an incident occurs.

Public attitude towards the energy industry and energy projects often results in project delays and sometimes cancellation. While impediments to a single project may not unduly harm global energy security, the cumulative effect is that project risks are raised with the long-term effect of reduced investment in the sector.

The wealth generated by the energy sector, the jobs it creates, the way it implements its projects, its interaction with host countries and local communities, its quest for safer infrastructure and cleaner products—all are positive messages, but they are currently over-shadowed by negative perceptions reinforced in part by the messages of others. The public learns about energy industry mostly through other parties (media, NGOs, etc.), which do not always give balanced or fair information. Oil and gas industry in particular, and energy industry in general, may benefit from developing more direct communication with the public to overcome misinformation.

The issue of industry image and public perception may vary among regions and differ from one country to another. The extent to which industry activities are scrutinised by public and media, the level of focus of NGOs on the energy industry, history of accidents and their local impacts (deaths, damage to environment, loss of property, etc.), engagement of industry with local communities (IOCs) and its role in the domestic economy (NOCs), can significantly affect public attitude towards the energy industry in quite different ways and therefore require different solutions to preserve (or to restore) industry's image.

4.7 Safety and operating procedures

Supply disruptions exact a heavy economic penalty and highlight the importance of ensuring continuity of supply in an increasingly interdependent global energy system. Safety of operations throughout the whole supply chain is a key concern for energy-related industries. The Macondo accident in the Gulf of Mexico in April 2010, the earthquake and the subsequent tsunami that triggered a nuclear crisis in Japan in March 2011, and the high casualty count in coal mining all serve to underline the need for stakeholders to come together, to learn lessons from history and to set out on a new course to strengthen the global governance of the energy industry in all its aspects.

Offshore oil and gas production now contributes close to 30% of global petroleum supply [5] and this share is set to grow in the medium to long-term period. The **risks to the global marine environment** will increase as offshore oil and gas exploration and development expand geographically, including to areas with more extreme conditions and more technologically complex operations, and as more players get involved in offshore oil and gas exploration and development.

[5] IEA.

Accidents can lead to significant changes in energy **regulation and operating procedures**, with the potential to drive up costs and thereby impact the investment framework. Industry will have to factor even more uncertainty into its equation. A slowdown in the issuance of permits, regulatory delays in exploration and production operations and the possible increase in the liability cap for economic damages from oil spills will collectively drive up costs. Deepwater exploration and development costs are expected to increase by up to 20-25 %, according to some estimates. Excessively stringent regulation can also increase operating costs to the point that some companies find it uneconomic to drill in the deepwater Gulf.

These major accidents have also damaged the **reputation of the energy industry**, contributed to reduced public confidence in the sector and affected contractual relationships between companies and their partners.

Because accidents affecting supply, conversion and delivery facilities harbour the potential for serious consequences (damage to the environment, interruption of supply affecting all stakeholders, resulting financial liabilities, etc.), NOCs, IOCs, Service companies and other stakeholders can benefit from enhanced cooperation in sharing relevant best practices.

While industry players see room for self-regulation where possible and effective, industry and regulators need to work together to address safety issues through appropriate regulation. Sharing best practices among industry players complements the web of existing legal frameworks for protection of the global marine environment.

Early engagement and sustained dialogue between regulators, stakeholders, and the oil and gas industry is required in order to foster a corporate culture of continuous improvement. Involvement at an early stage of all relevant international organisations and other stakeholder groups generally leads to the best technical outcomes, not least because participation in the process promotes adoption and implementation of agreed-upon practices by the parties involved.

Maintaining transparency in the development of best practices is an important way to build and uphold credibility.

4.8 Technological development

The nature of the industry is changing with more “technical oil” to extract, requiring advanced technology and specific project management expertise. To meet future energy demand, the industry will explore, develop and produce oil and gas in increasingly harsh environments and severe conditions while containing operational costs at a level compatible with the economic environment. Technological advances will be increasingly essential to drive work in the deep offshore, smart drilling technologies, better characterisation of reservoirs, unconventional resources, and other cutting-edge activities. These developments will require highly qualified and experienced personnel to execute

increasingly complex projects; the industry will thus depend even more on training to create a highly technical and competent workforce.

Technology has always been a fundamental force driving the oil and gas industry and will continue to be an important factor in meeting the challenge of securing future energy supplies in an environmentally responsible way. **Technology plays a key role** in the industry's ability to bring into production resources that were out of its reach; it helps push the boundaries of production, improves production rates, extends projected field life and increases ultimate hydrocarbons recovery.

Technology is also important as a **key contributor of solutions to sustainability concerns**. It holds promise for the abatement of greenhouse gas emissions, notably through carbon capture and storage, and can help in the development of alternative energy sources and enhanced efficiency in the production and use of energy.

During the last two decades, there has been a **shift in the locus of technology development and ownership** from IOCs toward service companies. In the 1990s, IOCs concentrated on core businesses and competencies and outsourced various other work to service companies, particularly technology development. Most current technology is developed by service companies, and their role as technology providers has increased over the years. Major NOCs have developed their own R&D centres and have become more active players in technological development, particularly in the upstream sector.

Instead of concentrating on in-house development, oil companies (NOCs, IOCs and service providers) are now more likely to collaborate with other stakeholders as well as technology developers to pool resources.

Expanded cooperation between NOCs, IOCs, service companies, universities and research centres to develop human resources and encourage the R & D that produces technological advances should help to reduce costs, improve efficiency and increase output. Renewed partnership within the oil and gas industry and collaboration with governments to support R & D efforts and speed up technology advances will benefit all parties.

Operational and production costs are expected to rise, on the back of potential new regulation on safety. Increased collaboration in technology development, safety and best practices, and human resources development will contribute to risk sharing and cost reduction.

No single company has the resources to overcome all technology challenges or to support the required R&D efforts. A collaborative approach between NOCs, IOCs and service companies will help sustain R&D efforts and accelerate innovation and technology dissemination. When shared between partners, technological innovation resulting from well-focused R&D programmes will contribute to cost containment in increasingly complex projects, to the benefit of all stakeholders.

Partnership between NOCs, IOCs and service companies in technological development and implementation is a win-win situation. NOCs, IOCs and service companies are encouraged to promote exchanges and cooperation between R & D centres to identify potential synergies.

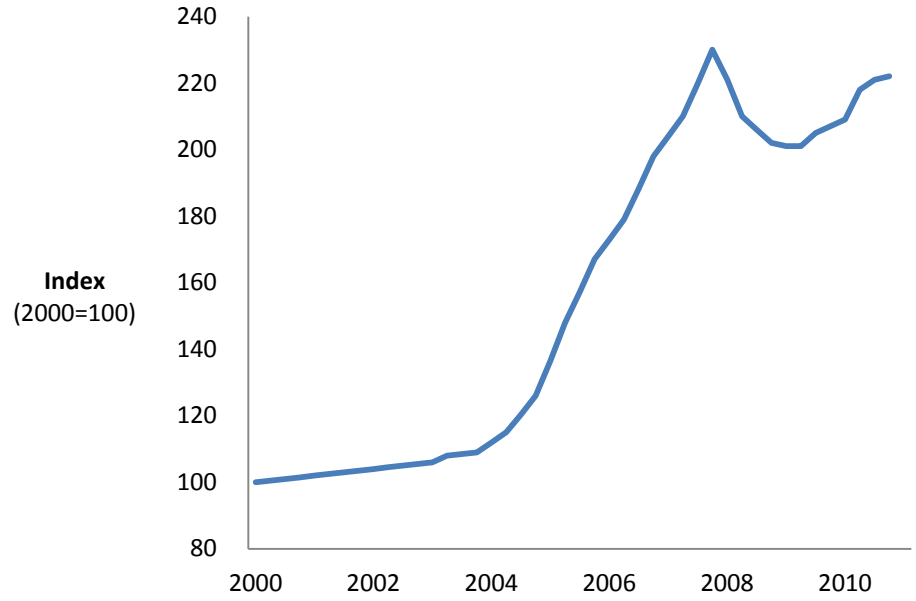
4.9 Cost containment

Cost management has always been a key challenge for the industry. Controlling costs helps improve cash flow, and in an uncertain economic environment, this has become a key strategy for many companies in order to sustain profitability.

It is increasingly costly to find and produce oil and gas as the industry is moving to more technical oil and more severe operational environments. Increased and constantly changing safety and environmental reporting requirements are causing a substantial increase in compliance costs.

Most NOCs, IOCs and service companies have long-term cost control programmes, with the objective of greater capital efficiency and competitive cost advantage. Industry is constantly making organisational changes to improve its cost structure and maintain capital expenditure on long-term projects. Cost reduction objectives are achieved through a myriad of tools such as the introduction of new technology to enhance operational efficiencies and the outsourcing of non-revenue-generating services.

Figure 4: IHS CERA Capital costs index



Source: IHS CERA.

4.10 Environmental challenges

The oil industry is one of the most global business sectors today, and its activities and products are directly linked with rising greenhouse gas emissions. Oil companies control substantial technological, financial, and organisational resources that could be mobilised to help address the problem.

International climate talks are showing slow progress. Intergovernmental negotiations over climate change have failed to produce a new agreement with binding targets in order to replace the Kyoto Protocol that will expire in 2012. However, **oil and gas companies can still face pressure from many other stakeholders** such as civil society groups to address climate change concerns, and industry will increasingly be evaluated by public opinion on its policy regarding climate change.

At the local level, the exploitation of oil and gas, like any form of energy production, poses a degree of environmental risk. Oil spills, damaged lands, and incidents of air and water pollution have occurred at various times and places. The oil and gas industry has worked for a long time to meet the challenge of providing environmental protection. **Much has already been achieved, but the industry recognises that even more can be accomplished.**

While hydraulic fracturing technology[6] has been used since the 1940s in more than 1 million wells in the United States, it got a new impetus with the development of horizontal drilling. Environmental issues are however raising concerns among local communities and some NGOs, thus delaying if not cancelling development of shale gas in some countries. The industry need therefore to identify actions to address these concerns, while also enabling economically viable development of oil and natural gas resources.

Improved water management across the petroleum industry can potentially reduce the volume and cost of raw water used in operations. The petroleum industry has catalogued many 'best practices' and strategies that can be used to manage aqueous waste streams resulting from exploration and production operations (produced water, drilling fluids, cuttings and well treatment chemicals, process, wash and drainage water, sewage, sanitary and domestic wastes, leakages and cooling water) and to reduce water usage throughout the whole oil and gas chain.

5. Guidelines for successful NOC-IOC cooperation

There are many examples of NOC-IOC partnerships that have delivered positive results and served to add value to all stakeholders in many areas of the world (e.g. the MENA region, sub-Saharan Africa, Asia, North, Central and South America, Europe and FSU) and many segments of the industry (e.g. E&P, transport, conversion, and retail).

Looking at past and present NOC-IOC partnerships and assessing the factors behind successful ones, the following guidelines and principles for NOC-IOC cooperation are proposed. They are relevant for NOCs, IOCs and host governments:

- Build long-term partnerships based on mutual benefit, trust and respect. Integrate legitimate expectations with regard to economic development, environmental protection, technology transfer, skill development of the local workforce, infrastructure development, and support to the local economy.

- Respect the local culture and be actively involved in social responsibility programmes wherever possible and appropriate;

- Where applicable, align interests of parties in such a way that, on the one hand, host governments can achieve production and recovery goals while extracting the expected value from their hydrocarbon resources and, on the other hand, international companies receive a fair share of the rewards commensurate with the technical and economic risks they face;

[6] Uses water pressure to create fissures in deep underground shale formations that allow oil and natural gas to flow.

- Facilitate whenever appropriate cross-investment throughout the value chain, vertical and horizontal integration (investment in other sectors) in host countries and access to consuming country markets;

- Facilitate whenever appropriate partnerships and alliances on specific projects in third countries (outside the partners' home countries);

- Establish long-term cooperation that are sustainable in low as well as high oil price environments;

- Favour as much as possible dialogue, re-negotiations or mediation to resolve conflicts or disputes;

- Build long-term cooperative programmes of joint R&D to respond to common challenges and share costs;

- Develop training and education programmes to benefit joint venture projects as well as the industry more generally;

- Build long-term cooperation in technology development, safety and best practices;

- Make high levels of environmental protection and operational safety an integral part of the long-term partnership, meeting expectations of local communities;

- Cooperate closely (NOCs and IOCs) in providing policy makers in both producing and consuming countries with sound analysis and studies on consequences of regulations and policies under consideration for the energy industry, its activities, the cost of energy delivered, investment, and other important outcomes.

6. Conclusion

The energy sector is in a period of flux. The scale and complexity of the challenges that face nearly every element of the industry are daunting, but they are not without solutions. The industry has consistently demonstrated its ability to adapt and evolve to meet rising challenges. However, unlike previous tests, the uncertainties laid before the industry today demand ever greater cooperation from within the sector. Governments, NOCs, IOCs, and policymakers must come together to promote cooperation to address common issues.

As the industry faces an increasingly difficult environment, operational challenges will grow significantly. The industry will need to develop skilled personnel, manage costs and develop new technology. This situation creates new challenges and new uncertainty, but

also new opportunities for cooperation and partnership between NOCs, IOCs and services companies to share risks, R & D investments and technology advances.

Ensuring the acceptability of energy to communities by striking the right balance among natural resources, food, water, economic growth and—last but not least—environmental protection for the planet is one of the objectives that requires further attention from the energy industry as a whole.

Today, oil companies are called upon to go beyond simply supplying energy or paying taxes and royalties. They are asked to promote local manufacturing, maximise local content, help build national capacity, assist in industrialisation and economic diversification, and spur meaningful job creation. They are also expected to help raise local education standards and share general knowledge and specialised industrial and business expertise, as well as to drive scientific research and applied technology development.

Energy companies now collectively need to think about providing energy of all sorts, from all sources and for all kinds of end-use applications, for an indefinite period of time. NOCs, IOCs and service companies have their specific skills and expertise, and there exist successful models of cooperation that bring together these strengths and competencies. In today's demanding environment, NOCs and IOCs need to develop and maintain new models of cooperation that go beyond simple resource development. Innovative, multifaceted models for cooperation and long-term, integrated partnerships that encompass technology, capital and expertise can be "win-win" collaborations that yield successful outcomes for all involved.

While the strategic objectives of NOCs and IOCs vary, it is the ability of the two sets of organisations to recognise each other's aims and work together effectively that result in successful projects.