



The oil company of the future

What does the future eco-system look like, and what are the potential business models to succeed?

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Executive summary

What are oil companies going to look like in the future?

The oil industry is shifting towards NOC hegemony, peak oil is arriving from the demand side, and the energy mix is changing. Oil companies' profiles are in constant evolution, and they are already adapting their business strategies to the forthcoming era. However, will they know how to leverage their core competences to survive and even benefit from such new challenges?

1. NOCs' hegemony over global resources

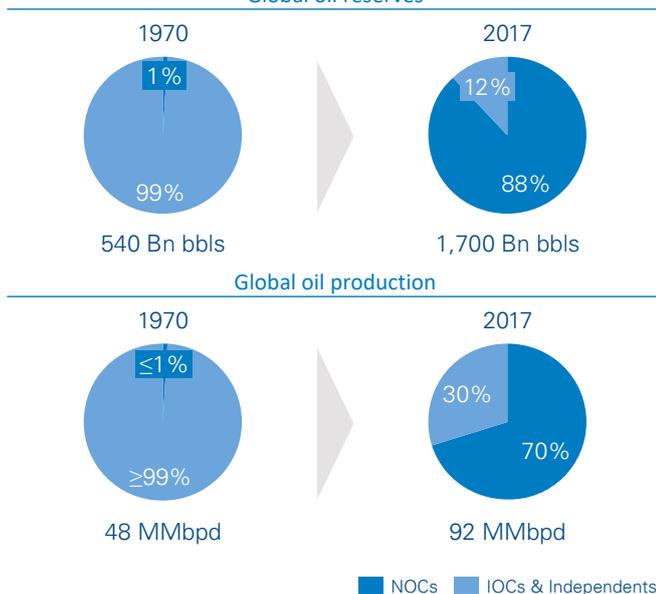
The dynamics of the oil industry have been historically impacted by the key role and the increasing scale and influence of national oil companies (NOCs).

NOCs emerged in developing countries to monetize their access to vast oil resources, leveraged by states' strong financial muscle and supported by national resources protection policies, self-sufficiency and supply security concerns. In many cases, said NOCs ended up becoming economy engines and foreign-policy tools to foster strategic relationships with developed countries.

International oil companies (IOCs) have fallen from full access to reserves in the 1970s to 10–15 percent in present times, and access to large prospective resource opportunities has been an increasing challenge.

With 85–90 percent of global proven resources and around 70 percent of total production, NOCs' expansion has affected the entire industry, which has resulted in a highly concentrated resource base, with the top-five NOCs accounting for more than half of global oil-proven reserves. Such reserves are mostly located in OPEC member countries (72 percent), with Venezuela and Saudi Arabia at the top of the list.

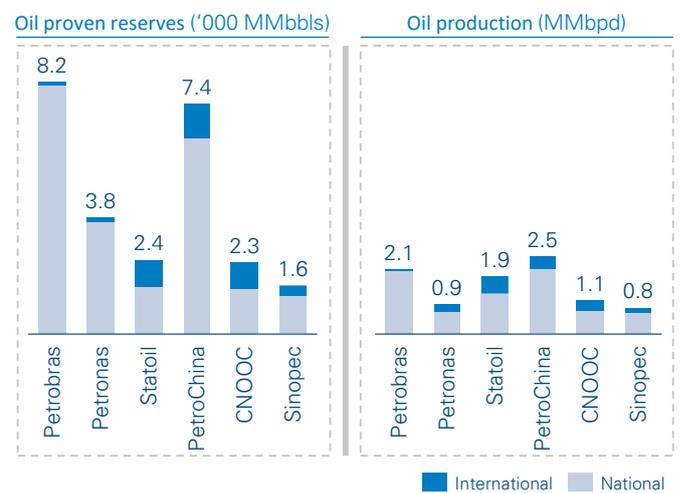
Figure 1: Oil reserves ownership and production



Source: Arthur D. Little

Many national oil companies have expanded their visions and stepped outside their countries, some to ensure energy security for their own nations or take advantage of their financial positions and industry know-how in developing international investments in E&P, thus becoming “international NOCs”.

Figure 2: NOCs' reserves and production, domestic versus foreign (2016)



Source: Arthur D. Little, based on Rystad and companies' public information

Several cases serve as good examples of internationalization in NOCs:

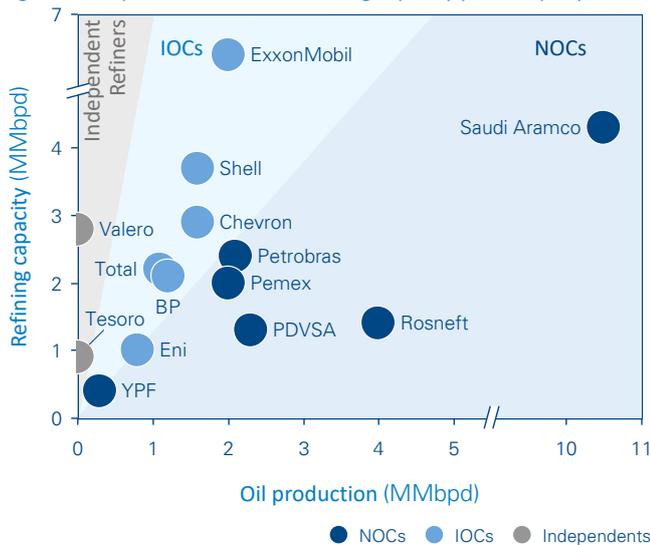
- The Norwegian company Statoil has been involved in projects in the US, LATAM, Africa and the Middle East.
- Chinese companies CNOOC and CNPC – with approximately one-third of foreign production – driven by oil-supply requirements to cover the vertiginously growing Asian demand, have been implementing overseas strategies since the early 1990s, mainly in Asia and Africa.
- Malaysian Petronas' internationalization started in 1991 with upstream investments in Vietnam, and it is now present in more than 20 countries.
- From Latin America, Petrobras expanded internationally after the Brazilian oil-sector deregulation in 1997, and now has assets in almost 20 countries, but it has started to refocus its international scope. Colombian Ecopetrol launched its internationalization process after Colombia's energy reform in 2001, with a more limited expansion today.

Refining ownership lags resource transition

Historically, most investments in the refining industry came from IOCs because they possessed the capital and technology required, and were mainly located in developed countries, where demand was highly concentrated. Most refining capacity has been installed close to such high-demand regions, with much of the processed crude oil imported from distant NOCs.

Over the past two decades, the downstream sector has started to change due to the expansion of NOCs and the emergence of independent and merchant refiners, both of which have influenced the competitive landscape for the refining segment. Nonetheless – and despite having lost predominance in upstream – IOCs still possess most of the global refining capacity. This is partly because refineries' operations could last for more than a century, and new, large refineries have mostly been built to replace relatively small, low-conversion refineries that were shut down.

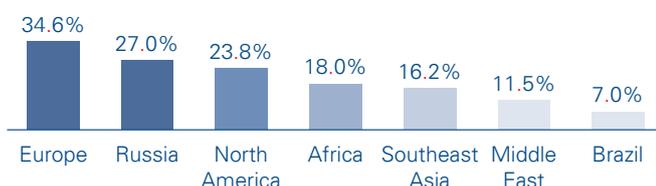
Figure 3: Oil production versus refining capacity per company



Source: Arthur D. Little, based on Rystad and companies' public information

Nowadays, many OECD countries – particularly in Europe – are facing shrinking demand for refined products, which is leading to a refining-capacity surplus. IOCs have been shutting down refining capacity, and increasing levels of spare refining capacity are expected in developed regions since most capacity additions are now proceeding from NOCs in order to process increasing shares of their own crude oil.

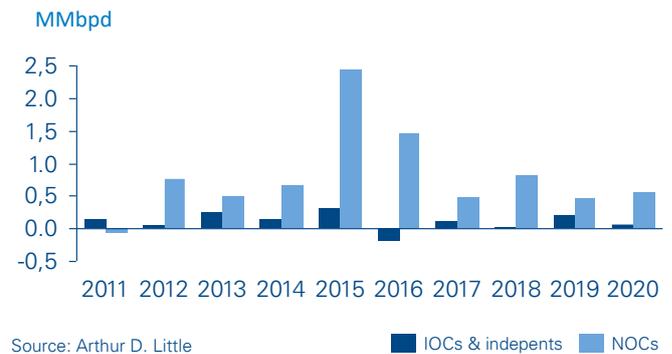
Figure 4: Expected spare of refining capacity* by 2040



*Spare refining capacity = capacity – refinery runs
Source: Arthur D. Little, based on IEA

Limited growth is expected for the refining sector, mainly concentrated in non-OECD regions. NOCs will keep expanding their market shares in developing countries, while IOCs' refining capacity shutdowns will continue in developed regions.

Figure 5: Historic and expected refining capacity additions by company type



Source: Arthur D. Little

Investments will most likely focus on operational efficiency, quality-based capital improvements – e.g., to meet regulations about sulfur specs – and/or acquisitions under the visions of synergistic operations.

NOCs' advantageous positioning over IOCs will contribute to their further development in the oil and gas industry – at least in the medium-term. Their easier access to hydrocarbon resources, the national commitment to capturing as much value from the barrel to industrialize their countries, and, in some cases, the financial muscle from the state, will be key drivers for NOCs' expansion in the refining industry.

The increasing integration between NOCs and the refining and petrochemical industry indicates how strongly these companies are looking beyond exploration and production (E&P) to find more value-added, diversified business. Growing investments on the petrochemical side to export more intermediate goods can be seen, for example, with Qatar Petrochemical Company – one of the world's largest polyethylene producers – which is linked to Qatar's NOC. At the same time, in East Asia, Shanghai Petrochemical, a Sinopec subsidiary, has been increasingly active in ethylene, fiber, resin and plastics production.

While some capacity might be at risk in the future, NOCs from developing countries – primarily in Asia and the Middle East – are investing in additions to their refining capacities. Some NOCs are even investing in refining assets outside their home countries to ensure access to markets with still-increasing demand.

In a relatively volatile segment in which minor changes in the demand-supply ratio impact margins heavily, the number of independent refiners is still limited, with Valero as the largest player.

2. Demand-driven peak oil calls for change

Oil industry maturity

Last century, access to resources and major technological improvements in oil E&P and refining activities provided relatively cheaper hydrocarbon energy products that partially displaced wood and coal as top sources of energy. Combined with firm market penetration of internal combustion engines and, to a lesser extent, increasing development of the petrochemical industry, these facts led to sustained growth in world oil consumption.

The main long-term concern derived from the oil boom was that if demand for oil were to sustain its upward trend, the supply would reach a peak followed by a significant production decline due to geological resource constraints, forcing markets, economies and industry players to readapt.

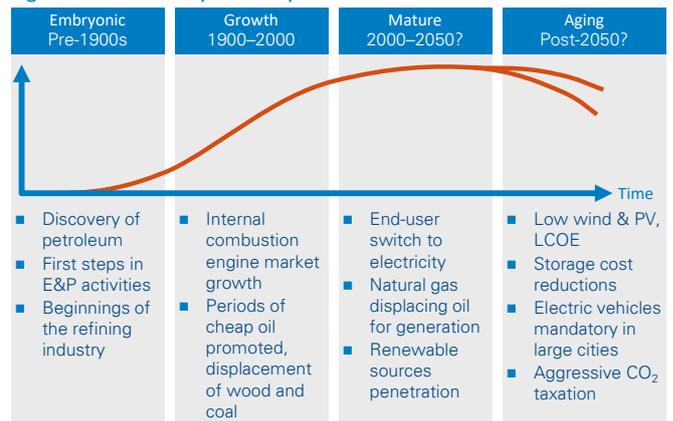
However, after decades of discussing a peak-oil scenario from the supply side, this now seems to be coming from the demand side. Under the current moderate-prices scenario, the historically accepted notion that limited crude oil supply would lead to shortages and high prices has been replaced with the prospect of declining oil demand in the mid-term. The world's dependence on oil will end, although this may not happen as soon as it seems.

As there are multiple factors influencing it, there is not much consensus regarding when oil demand will peak. Most players expect it 15–20 years from today, others anticipate it before 2030, and some state that it will not take place in the foreseeable future.

The arrival of peak oil demand will depend on many factors, including GDP growth rate, mobility behavior, evolution of vehicle technologies, and competition between technology developments for oil production and non-traditional energy sources to achieve cheaper energy costs.

We predict that the oil industry will reach maturity soon due to new forces reshaping the market, but our estimation for peak oil demand is between 2040 and 2050. We base this on significant changes expected in the world's energy matrix mainly associated with technological improvements and environmental concerns, which will lead to oil gradually losing ground in the market.

Figure 6: Oil industry maturity curve



Source: Arthur D. Little

A period of transition has already started in the energy sector. As environmental concern rises globally, society is becoming aware of the urgent need to fight climate change, and new policies are being implemented to turn energy demand away from fossil fuels to reduce CO₂ emissions. This emergent impulse has combined forces with R&D, striving to develop and reduce costs of new technologies and thus forming a star-team that pushes to promote new concepts for power and transportation.

Key drivers for peak oil demand are:

- The environmental push
- The technological race
- The global electrification trend
- The evolution of urban mobility
- Energy self-sufficiency of oil-importing countries

The environmental push

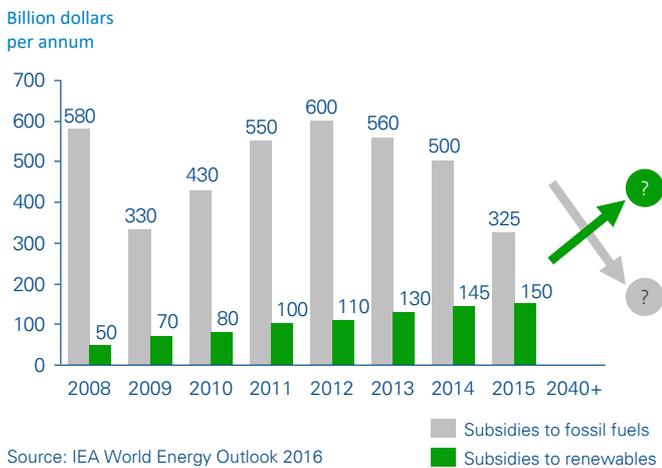
The world is increasingly showing concern about climate change, as demonstrated by the creation of multiple institutions, agreements, policies and regulations every year.

The Kyoto Protocol, established in 2005 for “common but differentiated responsibilities” for high levels of greenhouse gas (GHG) emissions, and more recently, the Paris Agreement in 2016, united most nations against climate change with a clear concern that global warming would have harmful effects on ecosystems, biodiversity and the livelihoods of people worldwide.

Strong evidence of the growing support for green energy is the shift in subsidies from fossil fuels to renewables. Due to moderate international oil prices, the need to subsidize fossil fuels has decreased, whereas renewable sources are emerging as a strategically and environmentally desired replacement. This is leading to some public funds being redirected to the developing non-traditional renewables sector.

In the long term, as technology developments continue conquering cost reductions and electricity and CO2 prices increase, renewable energy projects' competitiveness will grow, and the need for subsidies to obtain competitive non-traditional energy will decrease.

Figure 7: Subsidies to fossil fuels and renewables



For corporate social responsibility policies, legal liabilities, public relations, marketing or awareness, oil companies are showing interest in joining against climate change with more eco-friendly measures. They are supporting technology developments to promote renewable energy and reduce GHG emissions.

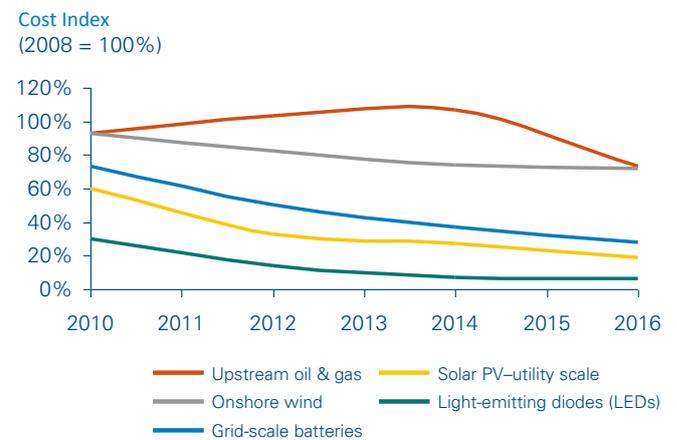
This private initiative even led to the creation in 2014 of the Oil and Gas Climate Initiative (OGCI) between Statoil, BP, Saudi Aramco, CNPC, Repsol, Reliance, Total, ENI, Pemex and Shell. Its main objective is to pool expert knowledge and collaborate on actions to reduce greenhouse gas emissions.

The technological race

Technology developments are heavily influencing energy supply and end use in both efficiency and cost.

As oil prices' downturn cycles pushed oil companies to focus their efforts on reducing finding-and-extraction costs – mostly with technology improvements in unconventional, deepwater and EOR –even greater cost reductions simultaneously took place for renewable sources of energy and electricity-related technologies, making them increasingly competitive alternatives.

Figure 8: Cost reduction by technology/industry



Technology developments are allowing significant improvements in both energy-storage capacity and costs. Breakthroughs in battery technologies will represent a game changer for EV and electric power.

In 2016, customer products accounted for ~45 GWh of total storage capacity for lithium-ion batteries, while electric vehicles reached ~25 GWh. Cumulative production capacity from the main manufacturers is expected to triple in the next three years.

As new technologies extend globally and become more accepted and used, economies of scale make them cheaper and less dependent on subsidies and political initiatives.

Several other technological breakthroughs that are not yet commercially viable could disrupt the energy industry in years to come:

- **Algae biofuels:** Since 2009, ExxonMobil and Synthetic Genomics have been researching modified algal strains to achieve higher oil production while maintaining desirable rates of growth.
- **Fusion reaction:** Small-scale nuclear fusion reactors are being built to “replicate the sun in the earth” under R&D efforts led by MIT, Tokamak Energy, Lockheed Martin, Tri Alpha Energy and EUROfusion. A commercial stage is expected beyond 2040.
- **Fuel cells:** Energy from electricity can be stored, converting water into hydrogen and oxygen via electrolysis and consuming these products later in fuel cells to obtain electricity again – with higher efficiency rates than most alternatives. This opportunity is increasingly attracting attention, mostly to be applied with renewable sources of power. Also, new types of cells and fuels are being designed as alternatives to hydrogen by companies such as Apple, Toyota and Lexus, which are trying to add them to their products.

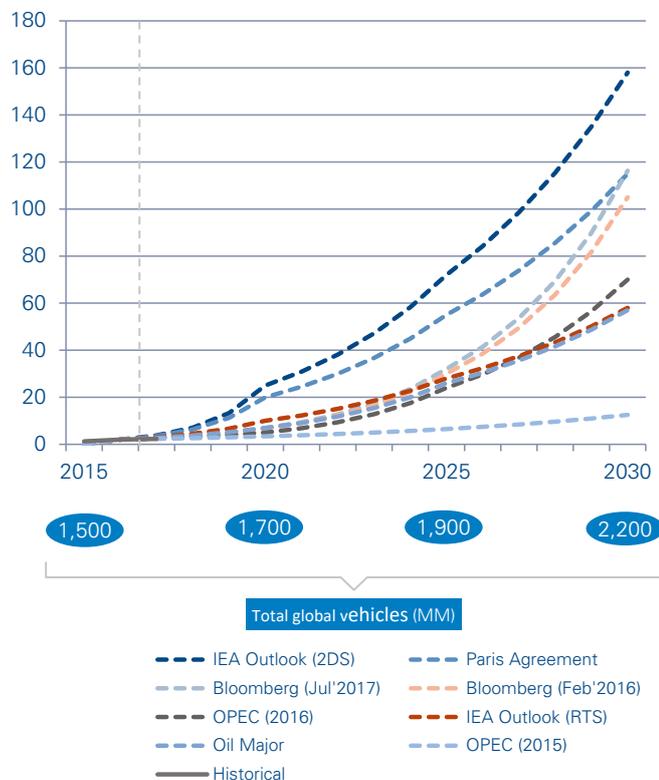
While new alternative energy options are developed, much effort is still dedicated to improving the efficiency of traditional ones. Even though electric cars are widely perceived as one of the main threats to oil demand, vehicles' efficiency gains will have equivalent or even larger impact.

Global electrification trend

Several countries have announced their plans to put an end to gasoline- and diesel-fueled cars: Norway by 2025, Germany and India by 2030, France and the UK by 2040, and many others to follow.

Figure 9: Number of EVs in total car fleet, by year

Million Evs, in circulation.



Source: IEA EV Outlook 2017, National Renewable Energy Laboratory, Bloomberg, OPEC, BP, Morgan Stanley, Arthur D. Little analysis

Even disregarding regulations pushing electric vehicles (EVs), their share of the global car fleet is expected to significantly grow in the next decades due to citizens' increasing environmental awareness, safety concerns and possible economic advantages. Total cost of ownership for EVs is getting closer to matching that of internal combustion engine cars in some developed regions, and with further technological improvements, it is expected to be significantly lower in the near future.

With the automotive industry partially moving to the EV trend for a low carbon world, charging electric vehicles will bring significant demand for additional power generation and, as a counterbalance to oil-demand force, part of the new power generated will use gas or oil products, which will become cheaper to compete in the generation sector. Electric utilities are enjoying the global electrification trend, including transportation-sector consumers, but some renewable sources are boosting opportunities for distributed generation and decentralized grids. These also represent a significant menace, with new players in the electricity business, including global automotive companies.

In any case, car-manufacturing companies are aiming towards EV expansion, and electricity will be increasingly generated from renewable sources; both of these facts threaten the traditional oil industry. Another challenge for oil companies is that natural gas is being displaced from houses in favor of electric appliances, with an emerging trend toward all-electric homes.

The evolution of urban mobility

The world is looking forward to having cleaner, more energy-efficient and less crowded cities, and all these factors are driving changes in urban transportation infrastructures, vehicles and mobility behavior.

Urban planners and policy-makers around the world are thinking of ways to create more space for pedestrians and lower CO2 emissions in their cities. Car sharing is expected to grow as a mobility model in the future, supported by real-time operations such as mobile apps and usage-based pricing, also affecting the corporate segments and increasing costs for those not adopting such models.

Banning of parking places and internal combustion engine (ICE) taxis, congestion fees applied in peak hours, and priority roads for public transportation are supporting the decrease in use of fossil fuels in most developed countries, including cities such as Oslo, Copenhagen, London, Hamburg and Brussels.

Energy self-sufficiency of oil-importing countries

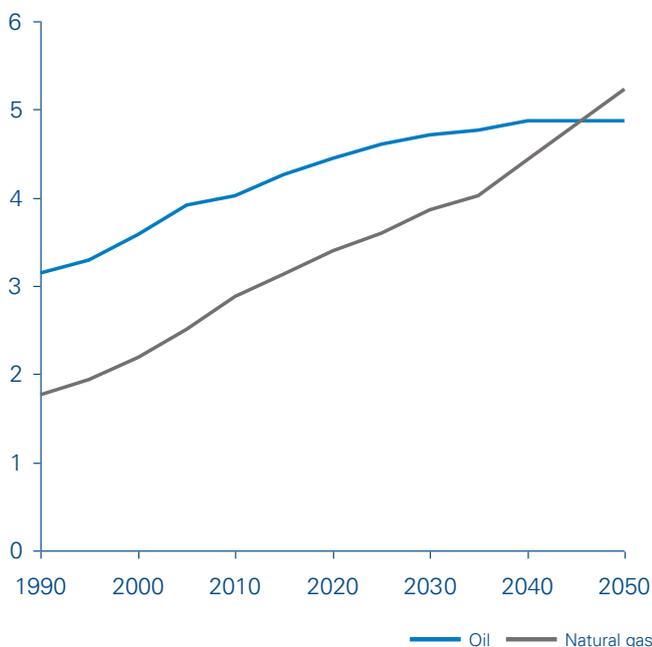
The fact that global oil supply – and still the world's energy security – is highly dependent on oil output levels from OPEC countries in the Middle East that are subject to frequent periods of political instability has always been a major concern for many countries – especially large oil importers such as European countries and China. This reinforces the trend of government incentives for alternative energy sources through subsidies or implementing higher carbon penalty rates. The development of renewable energy sources is key to reducing dependence on hydrocarbons, in particular from major oil-producing countries.

The future energy matrix

As environmental policies gain ground, the energy mix is shifting in favor of cleaner energy sources. The share of traditional sources such as coal and oil in the energy matrix is expected to continue decreasing, with significant support coming from end-use substitution of hydrocarbons by electricity.

Demand for natural gas as an energy source and petrochemical feedstock will continue growing. The "gas-prone" trend is also supported by technological developments that have added massive reserves of gas at unconventional reservoirs and lowered field-to-customer supply costs.

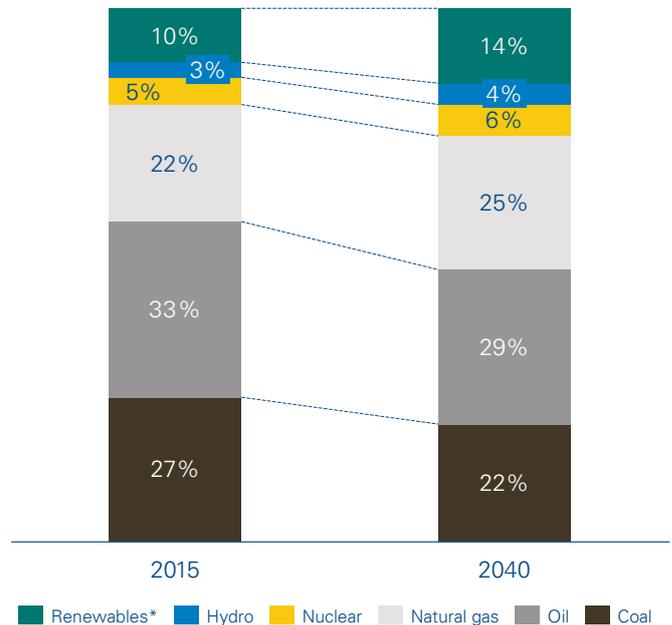
Figure 10: Natural gas versus oil demand MMTOE



Source: Arthur D. Little analysis. MMTOE: million tons of oil equivalent

The share of non-traditional renewables will grow substantially, facilitated by their increasing competitiveness. Nuclear generation's declining activity in Europe will be compensated by China's nuclear expansion program. With limited potential for capacity additions, hydroelectric generation is expected to maintain its share of the global energy matrix.

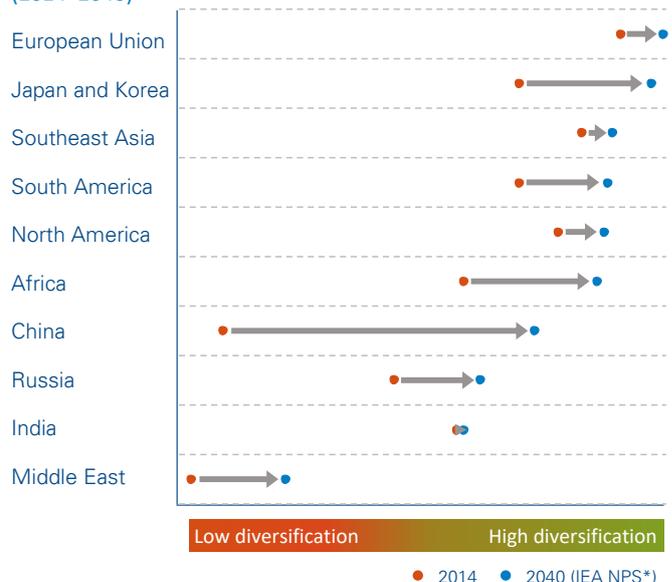
Figure 11: Energy demand mix forecast



*Non-traditional renewables including biomass and biofuels
Source: Arthur D. Little analysis

The energy mix is expected to globally diversify by 2040. The biggest shift will be seen in China, moving away from coal and betting on different energy sources. The Middle East, where almost all demand is covered by oil and gas, will also run through an important transition, but would not reach the average diversification index.

Figure 12: Diversity of the primary energy mix by region (2014–2040)



Note: Diversity calculated by IEA using a Herfindahl-Hirschmann Index fed by the share of each energy source (oil, gas, coal, nuclear, hydro, bioenergy and other renewables).
Source: IEA World Energy Outlook 2016

3. Already a different profile for Oil Co.'s

Up to 1970, the universe of the petroleum industry was dominated by seven Anglo-American fully integrated and influential companies called the “Seven Sisters,” which exercised strong power over resources, markets and politics of oil-producing countries in the third world.

At some point, governments from countries rich in reserves gained control over national resources for both economic and geopolitical reasons. With the rise of OPEC, the traditional business model was challenged, resulting in the empowerment of new NOCs, disintegration and new independent units inside large companies.

In the early 1990s, as industry technology boomed, changes in companies’ structures primarily came, not from shifts on the natural resources, but from efficiency requirements that led to decentralization, creation of shared services centers and outsourcing. Both the level of oil prices and the pressure for maintaining the return on capital employed promoted consolidation, and a wave of mega-takeovers took place, with the upsurge of majors such as Exxon-Mobil, Chevron-Texaco and BP-Amoco. At the start of the new century, globalization appeared to be the major trend in most industries, and oil & gas was no exception. Oil production became even more international, and companies started horizontal expansion. In addition, integrated companies made significant shifts from capital employed in downstream to upstream, with some, such as ConocoPhillips and Marathon, exiting the downstream business entirely.

We learn from the past that changes in oil companies come from challenging context conditions. Today, on one hand there is a highly concentrated resource base that provides scale advantages, but on the other, the energy matrix shift and technological developments are advancing faster than ever with new entrants in the ecosystem, so the industry business model is once again being challenged.

Figure 13: Evolution of oil companies’ business models



Source: Arthur D. Little

Despite difficulties in predicting the predominant model to succeed, traditional oil companies need to consider why they exist and for what, and rethink their business models to prevail in the future energy ecosystem by redefining their value propositions.

There are five clear angles from which traditional oil companies are investing efforts to progress, considering energy sector trends: diversification, integration, specialization, partnerships and adaptation of reserves/production profiles.

Diversification beyond petroleum

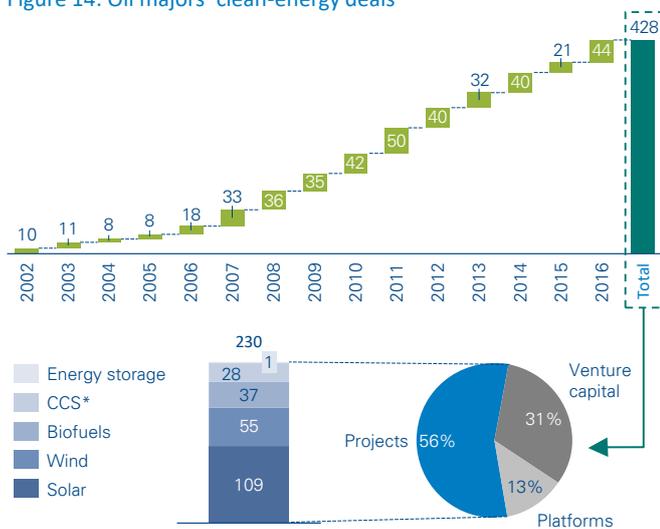
Following BP’s early attempt to go “Beyond Petroleum,” other oil companies – mostly majors and other IOCs – have started to pursue similar goals defining not only attractive, but also hard-to-live-up-to slogans, adding new business units associated with alternative energy sources.

Statoil defines itself as an “energy company” and has already decided to change its name and image to leave the “state” and “oil” references. In 2010, it started exploring the market of renewables, building a strong position in offshore wind farms, expanding to the solar and onshore-wind value chains. It also created the Statoil Energy Ventures fund, investing in renewable energy and exploring for high-impact technologies and business models that could disrupt the market in the future, including an EV charging network, a “technology-neutral” energy asset developer in the utility and industrial sector, and a solar technology company.

Shell plans to spend \$1 billion a year on its “New Energies” division by 2020, and Total has announced that by 2035 it plans to have 20 percent of its energy output from low-carbon energy sources such as wind and solar PV.

Both Shell and Total have been investing in small companies and start-ups in the renewables sector with potential disruptive power. In the last 15 years, oil majors have completed more than 400 deals and spent more than \$6 billion in clean-energy ventures, with solar power attracting most of the investments, followed by wind.

Figure 14: Oil majors’ clean-energy deals



*CCS: carbon capture & storage
Source: Bloomberg New Energy Finance

A future promising low-cost supply of natural gas has become more tangible with the shale-gas boom in North America and its expansion to other regions after a steep reduction in extraction costs.

The strong and continuously increasing demand for natural gas from the Asian petrochemical industry, and the fact that GHG emissions from natural gas are significantly lower than other fossil fuels, are influencing governments to further promote capacity additions for natural gas-fired generation.

Other forces promote the “gas-prone” nature of traditional oil companies: availability of commercial resources; a clean image of gas; ability to sign long-term supply contracts to petrochemical, liquefaction, regasification and power plants; and the fact that natural gas prices could be, to some extent, detached from oil-price volatility in some projects.

Physical downstream & petrochemical integration

Many NOCs are investing in refining and petrochemical capacity in ways that secure outlets for their crude oil, get the most from

the produced barrels or industrialize their home countries. That’s particularly the case with Saudi Arabia’s Aramco and Kuwait’s KPC, and many Gulf companies are looking for downstream investment opportunities in their home countries and abroad.

Even if peak oil demand limits the long-term attractiveness of building new refining capacity, new, large-scale plants will displace smaller plants in the market and are usually planned in advance with integrated petrochemical complexes. The petrochemical industry has been growing, and is expected to continue faster than oil-products demand. Saudi Aramco and Dow Chemicals, the two leading companies in their respective fields, have partnered and are investing \$20 billion in the development of Sadara, the world’s largest chemical complex, which is expected to produce more than 3 million tons of products per year.

On the other hand, IOCs have passed through a process of divesting in refining and fuel distribution, with companies such as Shell, Exxon-Mobil and Chevron-Texaco progressively leaving those segments, concentrating their growth focus in others.

Specialization niches

While very large companies were expanding on international or integrational quests, other small, specialized, niche companies stood up to the challenge, leveraging their agility and flexibility to succeed in very specialized niches.

Deepwater

Since 1990, many small, niche, independent companies have been diving into the Deepwater Gulf of Mexico after several majors reduced their exploration budgets and spending on technology and outsourced research functions that were previously done in-house.

Many offshore independent producers are now as technologically advanced in deep-water as majors, which allows them to take advantage of their deep-rooted competitive position developing their own E&P activities. Small independent operators from the US, such as Anadarko, Devon Energy, Hess, Marathon Oil, Murphy Oil, Noble Energy and Vanco, and other independents including Australia-based BHP Billiton and UK-based Tullow have significant deep-water operations in distant regions such as the east and west coasts of Africa and Southeast Asia.

In the last decade, Brazil has also become an attractive target for deep-water activities after immense additions of pre-salt reserves, which has led to the creation and/or expansion of several local companies, including OGC Petroleo e Gas, Petra Energia, Queiroz Galvao and HRT.

■ Shale and tight oil

In the last decade, IOCs have been challenged by a number of small, independent companies in E&P for unconventional resources in the US. These smaller companies have managed to gain a competitive advantage in their field of expertise – shale gas, tight oil – by mastering low-cost operations and higher agility, degrees of integration and information exchange between exploration and production departments.

EOG Resources and Pioneer Natural Resources lead the annual investments in shale, and are two of the largest independent E&P companies in the US.

■ Oil sands

Oil sands – also known as tar sands or bituminous sands – can be found in several locations, including Venezuela, the US and Russia, but the oil sands deposits in Alberta, Canada contain the third-largest oil reserves in the world, accounting for 164 billion barrels as of 2016. The Athabasca deposit in Alberta is the largest and most developed one, and the most technologically advanced production processes can be found there.

During past periods of high oil prices, the vast and appealing volumes of oil reserves located in Alberta prompted the creation of several Canadian companies specializing in tar sands, including Suncor, Cenovus, Athabasca Oil Corporation, MEG Energy, Osum Oil Sands, Laricina and Sunshine Oilsands, among others.

■ Enhanced oil recovery

There is a group of companies specializing in tertiary or enhanced oil recovery (EOR) opportunities in traditional mature oil fields, which are now also expanding to unconventional oil fields. The list of independent companies with EOR operations also includes Denbury Resources, Kinder Morgan, Devon Energy, EOG Resources, Husky Energy, Occidental Petroleum (Oxy), Suncor Energy and Wintershall, among others.

The largest EOR operator in Permian is Oxy, with more than 19,000 wells and approximately 145 Mbpd of production after purchasing Hess' EOR assets.

Independent companies from the US have been active in deepwater, unconventional (shale/tight and oil sands) and EOR operations, leading the way in best practices and becoming pioneers in technology development.

Once independents' success became noticeable to the oil industry, big oil companies tried to mirror their operating models and practices. However, history holds the proof that despite their lack of diversification, boutique/niche specialized

companies can be resilient enough to survive in competitive markets. Consequently, majors and NOCs ended up appealing to M&A transactions or partnership schemes with these small but now largely acknowledged companies

Partnerships: “You can't do everything on your own”

The broadness and diversity of resources, know-how and management capabilities, as well as the speed of change in the industry, require partnerships to enable companies to capture and develop the right mix of business opportunities. Key drivers for partnerships are:

■ Access to resources

The oil industry is a story of partnering between NOCs, with their advantageous positions regarding access to subsurface resources, and IOCs, with their better access to capital.

■ Technology, best practices and know-how

Partnerships allow companies to learn about new technologies, management of large CAPEX projects, operational practices, people management, cost efficiency and relations with communities, among other practices.

A strong lever that has empowered majors and independents as partners to NOCs is their broad expertise in highly complex practices and application of state-of-the-art technology.

To some extent, with NOCs already incorporating technological and operational know-how, as well as easier access to technology and best practices through service oil companies, the level of IOCs' protagonism in partnerships could be decreasing.

■ Risk management

Usually, projects of higher prospectivity are associated with high capital requirements and operational and/or economic risks. To reduce the risk of any individual opportunity and diversify the risks among regions, basins, and technologies, oil companies are constantly exploring opportunities to partner.

Many partnership efforts have also been driven by the need to access different types of resources, geologies and locations in order to diversify asset portfolios, participate in high-risk/high-yield activities or be covered under safe bets.

■ Access to capital

Partnering with another company provides the chance to combine capital resources and access projects that require major investments, which could exceed a company's budget or impact the desired risk profile of its portfolio if the company pursued them alone.

Furthermore, a company can benefit from indirect access to its partner's creditors, with possibly lower interest rates or larger capital availability, whether from governments or national or private institutions.

A clear example of partnerships in the oil industry is that of ExxonMobil with Qatar Petroleum through their RasGas and Qatargas joint ventures, which were created to develop the North Field – the world's largest non-associated natural gas field. While Exxon can gain access to vital reserves, Qatar Petroleum ensures vital access to large-scale markets as well as technological know-how to help develop and expand its LNG projects.

In the US, and more recently, Argentina, joint ventures for shale oil and gas are attractive to companies that are eager for know-how about unconventional E&P and fracking best practices. In parallel, companies that possess such know-how pursue joint ventures as opportunities to expand their horizons and access to international resource bases.

In some cases, the partnerships are purely technical-/operational-focused with oil-field services (OFS) companies.

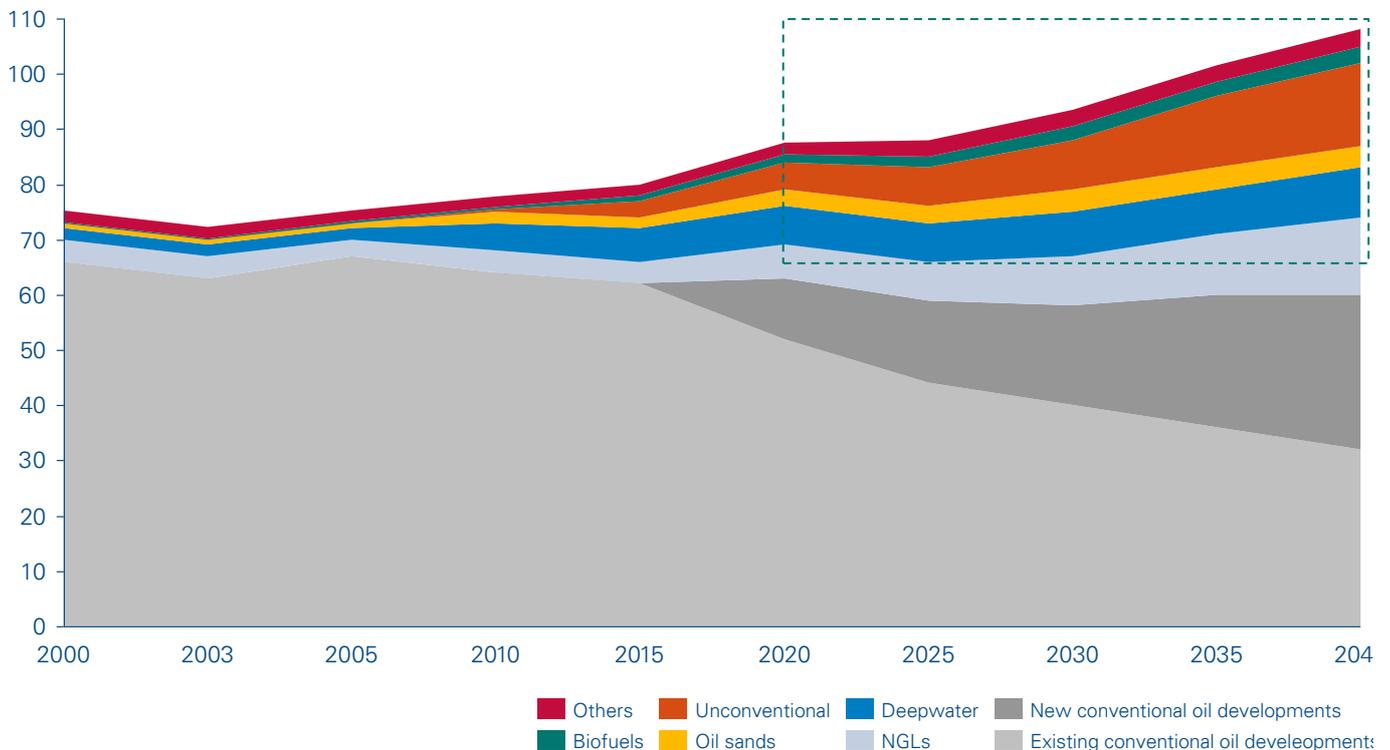
Regarding the downstream business line, many refining investments are held as joint ventures. For example, Saudi Aramco, the biggest oil producer in the world, has its most important refinery as a joint venture with China's Sinopec – its largest crude oil partner and purchaser – and other refining assets in Saudi Arabia are held as joint ventures with oil majors such as ExxonMobil and Shell.

Adapting reserves/production profiles

In response to the expected energy mix shifts, some oil companies have already changed their focus to natural gas. Following this trend, Shell acquired BG (British Gas) and left Iraq's upstream oil assets.

Unconventional and deepwater oil production are expected to more than double, to represent almost 40 percent of global production by 2040. Traditional oil companies understand the need to readapt their profiles and investments: in 2017 major oil companies dedicated almost 70 percent of their global investments to the offshore and unconventional segments.

Figure 15: Estimated liquid hydrocarbons global offer
MM boe/d



Source: ExxonMobil Outlook

4. New players in the oil ecosystem

The traditional-player oil value chain is being challenged by new players on quests to pursue profitable and sustainable business opportunities.

While IOCs and NOCs still lead the oil market, traders and independents are competing intensely, all along the value chain.

Trading houses have been taking positions through the oil value chain to get optionality and leverage their places in a trade segment that has been growing as regional demand-supply has unbalanced: some have taken physical positions in emerging countries and regions, in some cases investing in upstream assets. As an example of the position that traders already have in the oil industry, Vitol and Trafigura together trade more than 550 million tons of oil, an amount similar to Saudi Arabia’s production.

Fuel retail, which once was owned by major oil companies, has been progressively controlled by NOCs and independent retailers. These independent retailers may work as branded or unbranded stations. Many traditional supermarkets have diversified their activities and now sell fuels to take advantage of the vehicle flows through their sites. Kroger and Walmart, for example, hold more than 2,000 fuel sites.

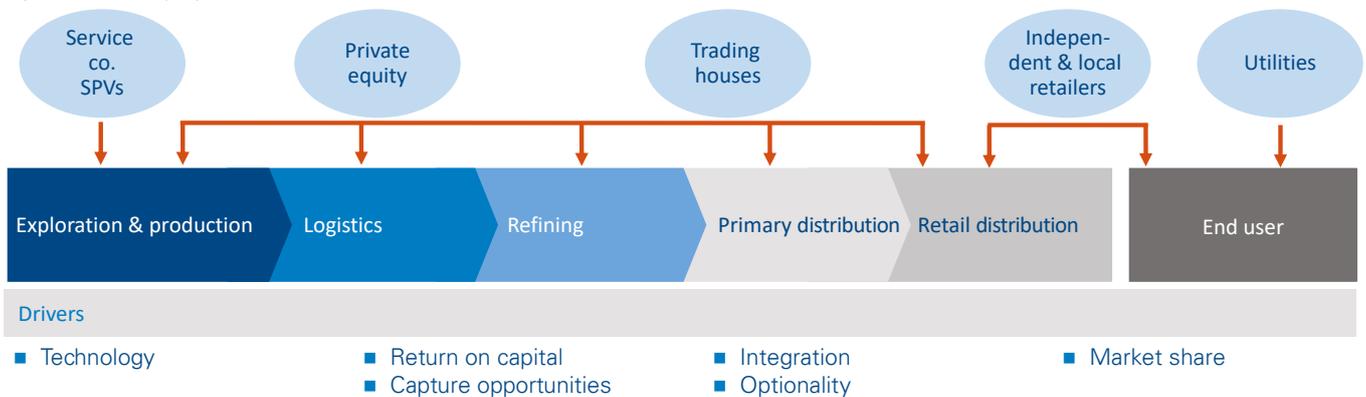
The American shale drillers that have upended the energy industry will capture much of the growth in oil demand in the coming years. The crowd of United States unconventional sector players will have a swinger role in global supply since they could rapidly react to price variations by idling production capacity.

Oil-service companies are increasingly gaining importance within the oil industry by expanding their offerings, selling highly integrated service packages and establishing new partnerships. Schlumberger is the largest company in this area, mainly dedicated to oil fields, with reported earnings of above \$1 billion a year. It has already acquired Cameron International Corporation, a leading worldwide provider of oilfield equipment.

At the same time, new models of oil companies are breaking with the classic industry schemes. Different forms of alternative financing vehicles are growing in popularity. SPACs (special-purpose acquisition companies), also called “blank-check companies”, are a new vehicle in which the management team, with credibility and proven track record, goes out looking for investors without defining what asset they will allocate the money they collect to in advance. More than \$3.5 billion has been raised by these types of companies in the last two years. Anadarko’s ex-CEO is now leading Silver Run Acquisition Corp. II, which successfully raised \$1 billion on its IPO. Recently, Vista Oil & Gas became the first SPAC in Latin America, led by the former CEO of Argentina’s NOC, and has the backing of Riverstone, one of the largest investment funds in energy assets. Also, private equity funds are getting more involved in the oil and gas sector.

Competition will come from multiple energy and non-energy business segments, and oil companies must find ways to adapt to maintain their competitive positions.

Figure 16: New players in the oil value chain



Source: Arthur D. Little analysis

5. Traditional oil companies' core competences

The petroleum industry ecosystem will change drastically, and traditional oil companies will face the need to leverage their core competences in order to successfully outline their future profiles to survive in the new ecosystem. Traditional oil companies' core competences include:

- **Executing large projects:** Traditional oil companies are used to managing billion-dollar projects, which is unlikely to be an extended competence for some of the newly emerging players in the industry.
- **Relations with governments:** As a key success factor in accessing resources and running operations in diverse political and social environments, oil companies have proven their ability to develop long-lasting relationships with governments.
- **Geological interpretation and modeling:** With their ability to find and develop increasingly difficult resources, oil companies have been leading the most revolutionary geological science developments.
- **Relations with local communities:** After decades of conflicts in operations, oil companies have learned how to develop trusting relationships with local communities, including their projects' workers and suppliers, from very early stages.
- **Portfolio management dynamism:** Price cycles and periodical changes in the regional and resource focus of the industry, as well as diverse levels of risk exposure, have forced oil companies to manage their portfolios in highly dynamic ways, being very active in farm-ins, farm-outs, swaps, and M&A operations.
- **Joint venturing:** Joint ventures have been an extended tool to facilitate access to capital, technology and operational know how, and risk balance.
- **International brands and geographic reach:** IOCs and, to lower extent, NOCs have international operations and/or brand presence through retail sites, fuel and lubricant brands, or institutional positioning with governments and communities in countries where they have interests. Tapping into their core competences, national oil companies will have the chance to harness their business lines in a redefined oil industry, making use of their "innate" competitive advantages.

6. The impact of industry convergence

Formerly distinctive industries are converging, altering the basis of competition by blurring the boundaries between previously separated industries.

Often, convergence disrupts traditional industry architecture and potentially undermines competitive advantages of established firms, while providing novel opportunities to new entrants, start-ups or well-established players in other industries.

We expect increasing convergence of the oil industry with others such as utilities, automotive, telecom, technology, agricultural and petrochemicals.

Even if oil companies continue leveraging their reserve positions and core competences, a broad number of sectors will source both new competition and cooperation, and the traditional boundaries will cease to exist.

7. Key sustainability/survival factors

The key factors to be taken into account to secure sustainability through industry ecosystem transformation are:

- Agility – agile organizations will have better chances to survive under a vertiginously mutating ecosystem.
- Early positioning in segments that are gradually displacing current products and services.
- Customer-centric business models.
- Digitalization.
- Fast adoption of new technologies.
- Horizontal collaboration.
- Dynamic management of highly diversified portfolios.

8. The future industry ecosystem

Peak oil demand and growing environmental concerns, as well as the technology revolution changing both industry value chain and customer profile and behavior, are definitely changing the energy ecosystem. However, these trends will not affect all players in the same way.

Even though oil demand may reach a peak in the next 20 years, fossil sources will still be an important business segment. NOCs, leveraging their strong concentration of global oil reserves, are still going to produce a significant portion of global oil. They are also still expected to have more integration throughout the value chain.

Since IOCs will be challenged in accessing major fossil resource bases and more exposed to environmental and customer profile changes, we expect them to lead the “beyond petroleum” trend. We also expect them to gain an important position throughout the utilities segments by producing and selling electricity to the end user and utilizing their current fuel station infrastructures to provide “all the energy you need” to their current customer bases.

The new emergent financing models, such as SPACs, are also expected to expand in the near future, creating a broader spectrum of both opportunities and competition.

Potential business models to succeed

- **Energy holding:** An energy holding will be a regional or global company with presence in production of a diverse range of energy sources. It will generate power from its own hydrocarbons and increasingly reach customers with a broad scope of energy products and related services, as well as with multiple ventures in non-traditional oil segments.
- **XXL oil company:** Dominating world hydrocarbon reserves and above 5 MBOED production, “XXL oil companies” will be larger majors or NOCs which, with or without influx of private capital, will be able to industrialize their own production through participation in world-scale refining and petrochemical complexes. They will offer some energy diversification, but prioritize the national agenda of country development through monetization of resources. There will be only a few with significant international presence.
- **Regional “mini-majors”:** These will be upstream-downstream integrated companies, with regional focus on processing their own crude and gas, and reaching the

market with refined and petrochemical products. They will accompany the gas-prone trend, as well as the development of cleaner energy sources such as biofuels and other renewables.

- **Global service companies:** These will leverage their position as oil-field service providers, with deep technology and digital know-how, and increasingly take responsibility for performance improvement initiatives within hydrocarbon producers’ operations. They will probably tackle the pending operatorship through the acquisition of IOCs, but face challenges from the risk-appetite side after shifting to global asset owners and operators.
- **American drillers:** These organizations are lean, highly efficient, and fast adopters of new technology and operational know-how. They have access to cheap financing and are able to leave wells idle as soon as prices make them unattractive to produce
- **Special-purpose vehicles:** These lean corporate organizations will be able to facilitate the capital influx into selected hydrocarbon-business opportunities and manage permanently adaptive asset portfolios, but will probably be challenged from the risk-taking side for continuous growth.
- **Trading houses:** These will increasingly take position through the value chain to get “optionality”; with limited presence in reserves and field operations.
- **Distribution companies:** These will be regional or global fuel and/or LPG distribution companies not involved in production. This will be a place for SHV and Puma Energy.

Insights for executives

- The energy resource base, the ownership of such a resource base, and the access to it will be different.
- The oil market will present new, challenging conditions, pushing industry leaders out of their comfort zones.
- Oil demand will peak, limiting growth opportunities and decreasing traditional oil companies' value if they do not reinvent themselves.
- The energy-demand mix will progressively change, and other energy industry players will be aggressive in taking positions from current oil-industry customers.
- Competition will come from multiple energy and non-energy business segments.
- Oil companies need to leverage their core competences (i.e., relations with governments and communities, execution of large projects and fast adoption of technologies).
- Scale will continue to be important, but niche/specialized companies will succeed.
- Early positioning for diversification will both protect a company's current position and provide access to future growth opportunities.
- Agility, digitalization and fast adoption of technologies will increase chances of survival in the new ecosystem.

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The oil company of the future –What does the future eco-system look like, and what are the potential business models to succeed?

Arthur D. Little

Arthur D. Little has been at the forefront of innovation since 1886. We are an acknowledged thought leader in linking strategy, innovation and transformation in technology-intensive and converging industries. We navigate our clients through changing business ecosystems to uncover new growth opportunities. We enable our clients to build innovation capabilities and transform their organizations.

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