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It's our turn now
E&P partnership for India's energy security

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“If you can dream it, you can do it.”
– Walt Disney

Introduction

The promise of energy security is alluring. For an import-dependent country like India, energy security is no longer just a desire, but a critical imperative for an economy which is at the threshold of maturity as a growing one. A task seemingly impossible to achieve, yet worth pursuing; a dream realisable only when the country starts producing hydrocarbons in sufficient quantities.

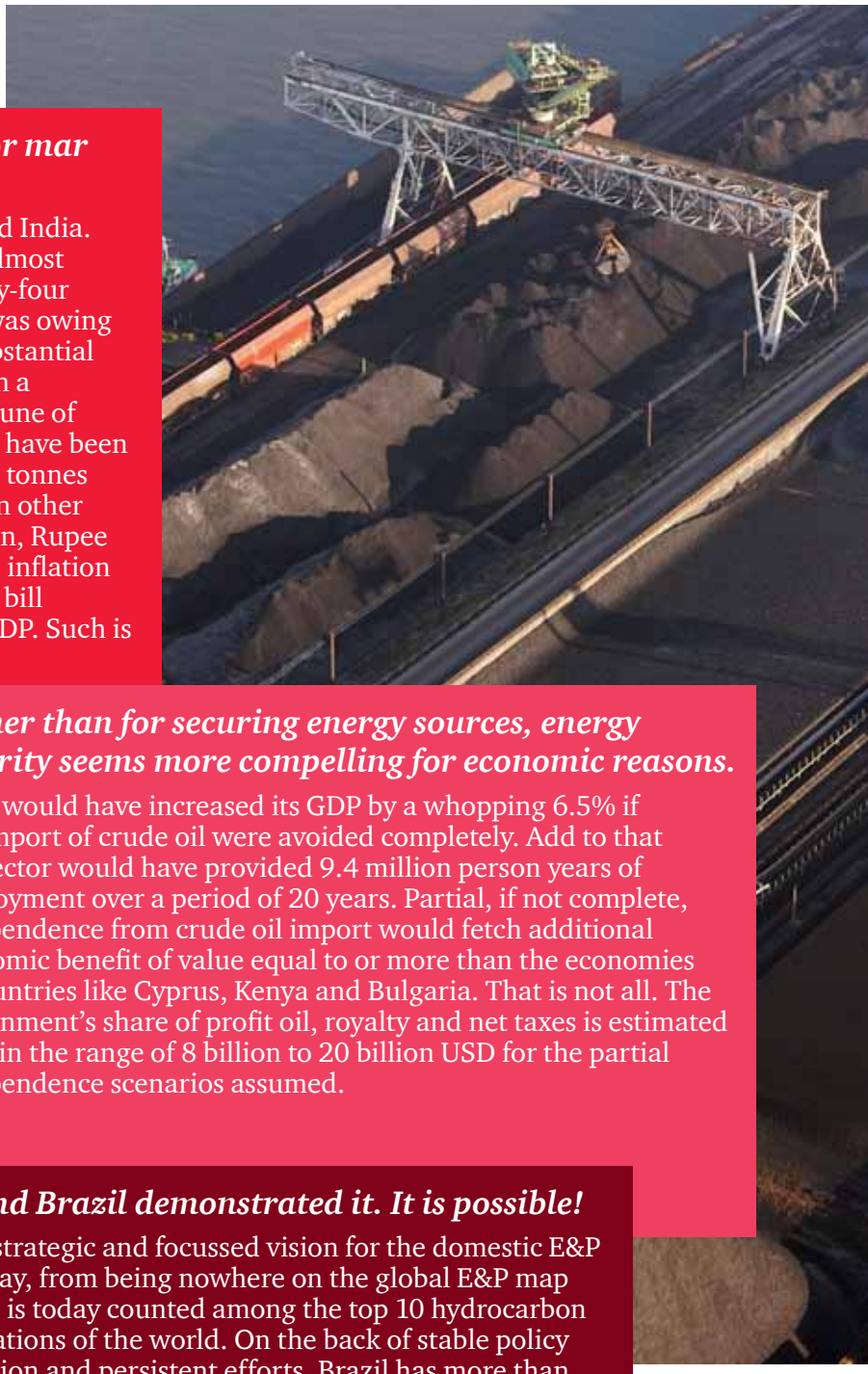
Hydrocarbon exploration successes over the last decade have given India the confidence of achieving this dream. Though the hydrocarbon exploration sector takes decades or more for policies to result into outcomes, it is never too late to look forward. Industry captains often state that the challenge of dealing with energy security is immense, but they also agree that so are the rewards if we achieve energy security. The sector is promising both for investors as well as the nation. The *It's our turn now* initiative was taken up by PwC in order to analyse why and how it is possible to put in efforts to assess and unlock India's hydrocarbon potential.

The research first assumed that the policies and practices of the oil and gas sector will maintain status quo for decades to come. The implications of this were analysed. The effect of shortfall in domestic energy supply was assessed. Primary energy sources were then analysed to assess which among them would respond to the ever growing needs of the country. In this context, the role of the oil and gas sector was analysed. The role domestic oil and gas production plays in curing the economic ills of the country was also studied. The results support the merit of enhancing domestic hydrocarbon production. Countries which have successfully dealt with boosting domestic oil and gas sector were studied, and compared with the growth in India's exploration and production sector.

Developing the domestic exploration and production sector comes with a set of challenges. Therefore, the role national and private oil companies have been playing in the global arena to sustain oil and gas supplies was analysed. From India's context, the possibility of partnership between the government, service companies and private or inward investors was assessed from the perspective of how they contribute to achieving energy security. Also evaluated was the benefit the states would enjoy if the growth was to be secular and equitable.

In a climate where decisive and differentiated actions are necessary, *It's our turn now* provides insights into what can shape the exploration and production sector. The objective of this paper is to initiate a debate. It intentionally highlights the upsides of actions with a hope that it will stimulate thought and lead to a constructive approach to India's ability to dream energy security.

Key messages



Hydrocarbon sector can make or mar the economy.

Energy import dependence has crippled India. Oil imports in 2011-12 accounted for almost 50% of the country's total exports. Fifty-four per cent of the country's trade deficit was owing to the oil trade deficit. This fuelled substantial weakening of the Rupee and resulted in a drawdown of foreign exchange to the tune of 12.8 billion USD. The drawdown could have been avoided had India produced 17 million tonnes over its current domestic production. In other words, with higher domestic production, Rupee depreciation could have been arrested, inflation could have been contained, the import bill reduced–all translating into a higher GDP. Such is the power of the E&P sector.

Rather than for securing energy sources, energy security seems more compelling for economic reasons.

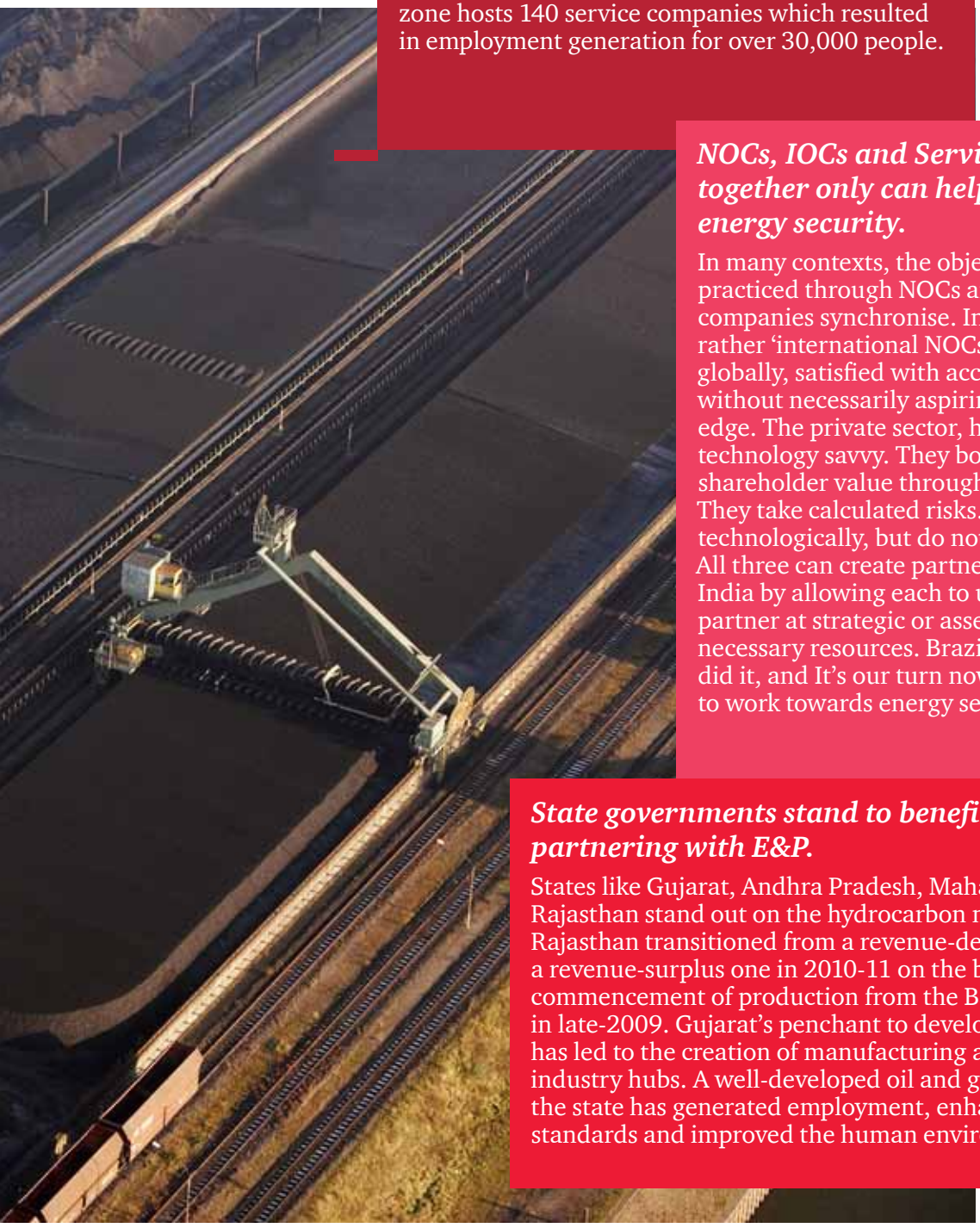
India would have increased its GDP by a whopping 6.5% if the import of crude oil were avoided completely. Add to that the sector would have provided 9.4 million person years of employment over a period of 20 years. Partial, if not complete, independence from crude oil import would fetch additional economic benefit of value equal to or more than the economies of countries like Cyprus, Kenya and Bulgaria. That is not all. The government's share of profit oil, royalty and net taxes is estimated to be in the range of 8 billion to 20 billion USD for the partial independence scenarios assumed.

Norway and Brazil demonstrated it. It is possible!

Following a strategic and focussed vision for the domestic E&P sector, Norway, from being nowhere on the global E&P map in the 1970s, is today counted among the top 10 hydrocarbon producing nations of the world. On the back of stable policy implementation and persistent efforts, Brazil has more than doubled its oil reserves every 10 years consistently over the last three decades. India was no different from Brazil and Norway then, and has the opportunity to focus on domestic exploration for energy independence.

Hosting services industry, the backbone of the E&P sector, has triple effect.

More than 60% of the E&P spend is for specialised services. They form the backbone of the E&P industry. In order to achieve energy security, developing the sector in India will be rewarding. It will avoid delays and premiums in obtaining services, save on foreign exchange drain, and promote employment. The Nigeria promoted free zone hosts 140 service companies which resulted in employment generation for over 30,000 people.



NOCs, IOCs and Service Companies together only can help dream and achieve energy security.

In many contexts, the objectives of governments practiced through NOCs and those of private companies synchronise. Indian NOCs are rather 'international NOCs' seeking reserves globally, satisfied with accreting reserves, without necessarily aspiring to gain a technical edge. The private sector, however, aspires to be technology savvy. They book reserves and increase shareholder value through efficient operations. They take calculated risks. Service companies excel technologically, but do not take underground risks. All three can create partnerships in a country like India by allowing each to utilise their strengths, partner at strategic or asset levels, and bring in the necessary resources. Brazil, Norway like countries did it, and It's our turn now, together the partners, to work towards energy security.

State governments stand to benefit by partnering with E&P.

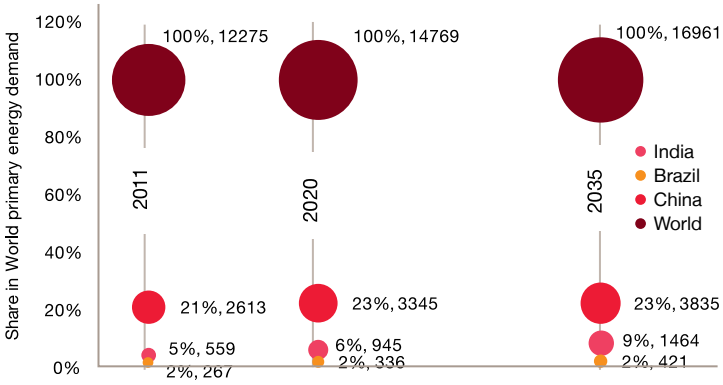
States like Gujarat, Andhra Pradesh, Maharashtra and Rajasthan stand out on the hydrocarbon map of India. Rajasthan transitioned from a revenue-deficit state into a revenue-surplus one in 2010-11 on the back of the commencement of production from the Barmer facility in late-2009. Gujarat's penchant to develop a gas market has led to the creation of manufacturing and process industry hubs. A well-developed oil and gas economy in the state has generated employment, enhanced living standards and improved the human environment.

02

Energy security in India

India is poised to make a significant mark on the world energy map as its primary energy requirement at the very least more than doubles to 1,464 Mtoe[1] by 2035 from 559 Mtoe[2] in 2011. India is also expected to double its share in global primary energy consumption by 2035.

Primary energy demand forecasts (% share, energy demand in Mtoe)

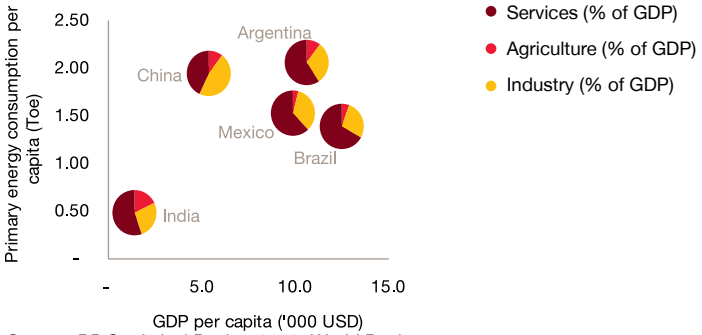


Source: International Energy Agency, BP Statistical Review 2012

Drivers for energy demand

India's per capita primary energy consumption is the lowest among all major developing economies in the world. Though, this can be majorly attributed to the service-oriented nature of the economy, it holds true even when India is compared to countries such as Brazil, Argentina and Mexico that have a GDP mix similar to that of India. The fact that India is dominated by a rural population, which largely depends on non-commercial sources to meet its energy needs also contributes to the low recorded per capita energy consumption. As the country moves towards urbanisation, the energy demand is set to go up significantly.

Comparison of India and its peers



Source: BP Statistical Review 2012, World Bank

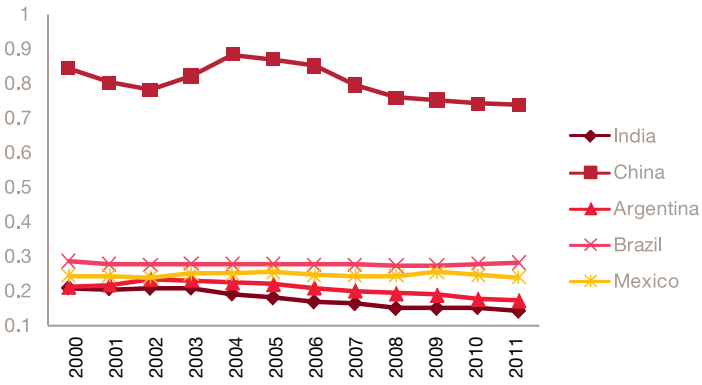
In the last decade, while India's GDP and primary energy consumption have grown at a CAGR of 7.6% and 6.5%, respectively, its energy intensity has decreased and is currently low as compared to its peers. The ability of India to grow at such attractive levels of energy intensity is laudable. Albeit it is ostensibly driven by energy deprival and forced structuring of the economy in order to suit growth in constrained energy availability. If India is to service the ambition of providing employment to growing employable demographic contituents and maintain social harmony, a modest growth is unaffordable. The growth needs to match the demand for economic activity. Consequences of not attaining growth are

1 *As per the "New Policy Scenario" forecast by International Energy Agency, 2011*
2 *BP Statistical Review, 2012*

dire. In a high economic growth scenario the demographic profile of India is an advantage, but that can turn into a challenge in a low economic growth scenario.

On the contrary, the chances are remote that the economy will be able to sustain the very low energy elasticity levels reached. Consequently, the rather necessary growth will need more energy than was required by equal growth. This increase in energy demand bodes adversely for the energy constrained country, and makes the challenges of sourcing severe.

Energy intensity of India and its peers



Source: World Bank, BP Statistical Review 2012

2.2. Potential for oil and gas

India's energy demand is expected to register a substantial rise in the coming decades. The supply of commercial energy will have to grow between 5.6 to 6.0% per annum if the country is to sustain its high GDP growth rate of 8% per annum.

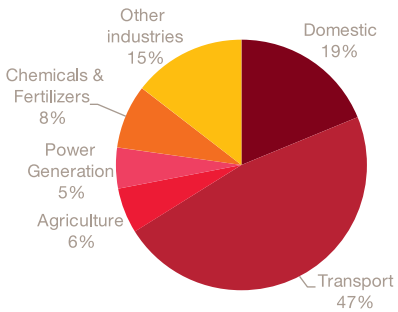
Substitutability of petroleum products and natural gas

Over 66% of the liquid petroleum products consumed in India find application in the transportation sector (47%) and the domestic (19%) sector. Besides, petroleum products are an important raw material for the chemicals and fertiliser industries.

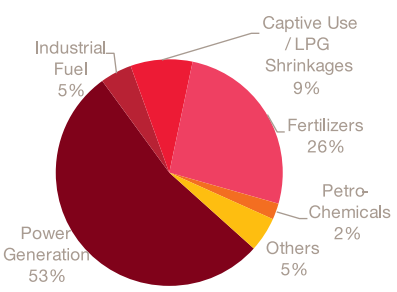
Technical solutions make liquid petroleum products and natural gas mutually substitutable. This is true in transport sector as well. However, substitution of liquid petroleum products and natural gas with conventional solid fuels is not preferred, not feasible in most situations and not possible unless a substantial capital cost is incurred. Though there may be economic reasons to change over to solid fuels no significant shift to solids is expected. Further, plug-in hybrid electric vehicles and purely electric vehicles are expected to constitute a mere 2.5% of the global market share by 2020. It can be further inferred that the penetration of these vehicles in India would be insignificant and the usage of electricity as a secondary energy source to fuel India's transport sector is hard to realise over the next decade.

Around the world, oil and gas have played the 'fill the glass' role; challenges faced in the sectors like nuclear, coal, renewable energy in meeting the demand for energy, have been resolved by the use of petroleum fuels produced from widely traded crude oil. Therefore, in the long term, if India's other fuels fail to be supplied adequately, they will place pressure on the demand for oil and gas.

End consumers of petroleum products (2010-11)[3]



End usage of natural gas (2010-11)



Source: Indian Petroleum and Natural Gas Statistics, 2010-11, MoPNG

2.3. Constraints with other fuels

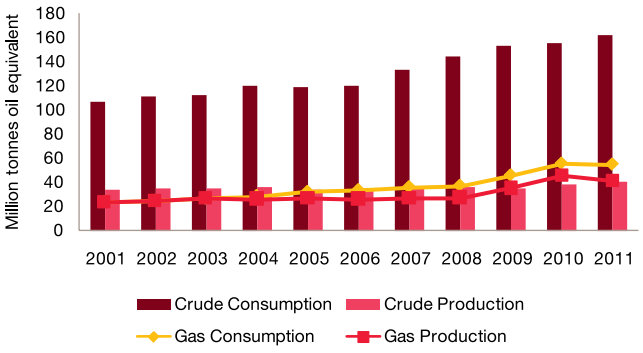
At present, coal dominates the country's energy mix with a robust 53% share in primary energy consumption. The country incurred huge losses (7.7 billion and 5.9 billion units of generation in 2010-11 and 2011-12, respectively) owing to the poor quality of Indian coal. Therefore, if India were to continue its dependence on coal, a substantial rise in imports will be required as reliance on domestic coal will prove to be inefficient. The price vagaries of imported coal coupled with domestic infrastructure constraints make this a difficult proposition.

While hydroelectric power plants account for 19% of power generated in India, developing them involves major rehabilitation and resettlement, land acquisition as well as environmental clearance. Nuclear power currently constitutes only 1% of the total primary energy consumption of the country and its share in the primary energy mix is expected to increase only marginally to about 3% in 2035 indicating limited potential for nuclear fuels in India.

2.4. Unlocking the hydrocarbon reserves

Oil and gas are, therefore, important for fueling India's growth story, given the constraints and limitations of other primary fuels. The gap between production and consumption of crude oil and natural gas has increased over the past decade, and that is further projected to widen leaving India vulnerable on the energy security front.

Figure 6: Crude oil & natural gas - Production and consumption trend

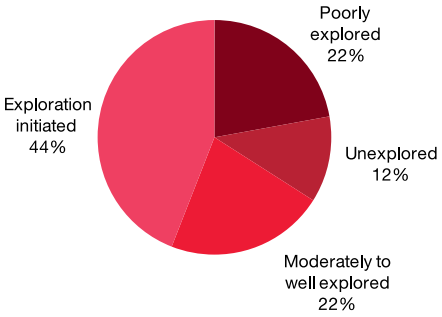


Source: BP Statistical Review of World Energy, 2012

Elsewhere in this report, the challenges faced by the import-dependent hydrocarbon sector in India are elaborated. These challenges are deep rooted and have had a significant impact on India's growth story. If India were to dream of a crude oil self sufficiency status, the potential of the domestic hydrocarbon reserves fulfil that dream, is necessary to be proven and unlocked. The bad news is that with the available information and data about the sedimentary basins, India is probably not in a position to conclude if that dream can be fulfilled. The good news, however, is that the discoveries announced thus far do not rule out that possibility.

Further, since significant efforts are still required to get a complete understanding of India's hydrocarbon prospectivity, sector optimists have hopes to fulfill this dream. As per the statistics issued by the Directorate General of Hydrocarbons (DGH) only 22% of the total sedimentary basins in India were moderately to well-explored at the end of FY 2010-11. For an oil enthusiast it is an indication of immense unlocked hydrocarbon potential.

Figure 7: Status of exploration of Indian sedimentary basins, FY 2010-11

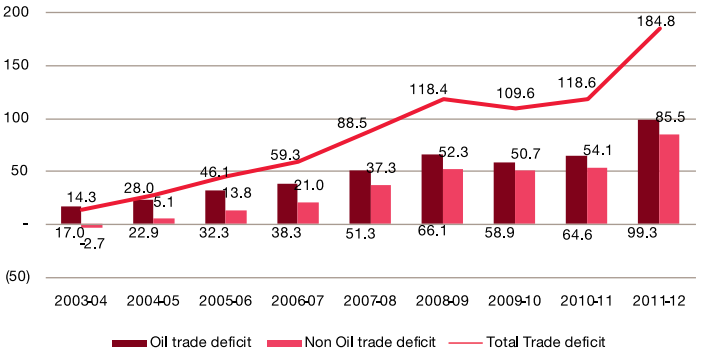


Source: Directorate General of Hydrocarbons

2.5. Price of India's dependence on energy imports

India pays a heavy price for its high oil import dependency. Oil imports, as a percentage of aggregate exports, have risen through the years implying that a large part of India's export earnings is being eaten away by oil imports. In 2011-12, oil imports accounted for almost 50% of India's exports. The oil trade deficit of India has risen over the years and currently accounts for around 54% of country's total trade deficit.

Oil trade deficit and non-oil trade deficit (in billion USD)

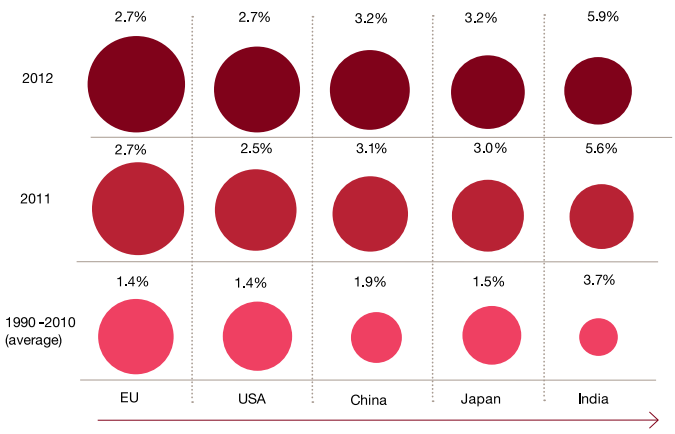


Source: RBI, PwC Analysis

India's spending on oil imports as a percentage of its aggregate GDP has increased over the years. The average spending on oil imports as a percentage of the country's GDP is higher for India as compared to other countries. The inelastic nature of oil imports imply that higher the percentage of GDP being spent on it, higher is the vulnerability of an economy to external shocks. This is corroborated by the fact that though the global turmoil and rise in the crude prices resulted in an increase in oil spending for all the major oil importing countries in 2011 and 2012, this increase has been the highest for India in relative terms.

The vulnerability of India owing to its high dependence on oil imports was exacerbated in 2011-12. The global crisis lowered investors' confidence, resulting in FIIs pulling out of the Indian markets, which caused the Indian rupee to depreciate against major global currencies. Depreciation of a currency is essentially thought of as a self-correcting mechanism as it tends to boost exports and suppress imports thereby causing the currency to strengthen again. However, in the case of India, this did not happen. The oil import bill during 2011-12 rose by over 45%, due to import of oil becoming costlier on account of the rise in global crude oil prices and depreciation of the rupee.

Oil imports as a % of of GDP of the respective countries

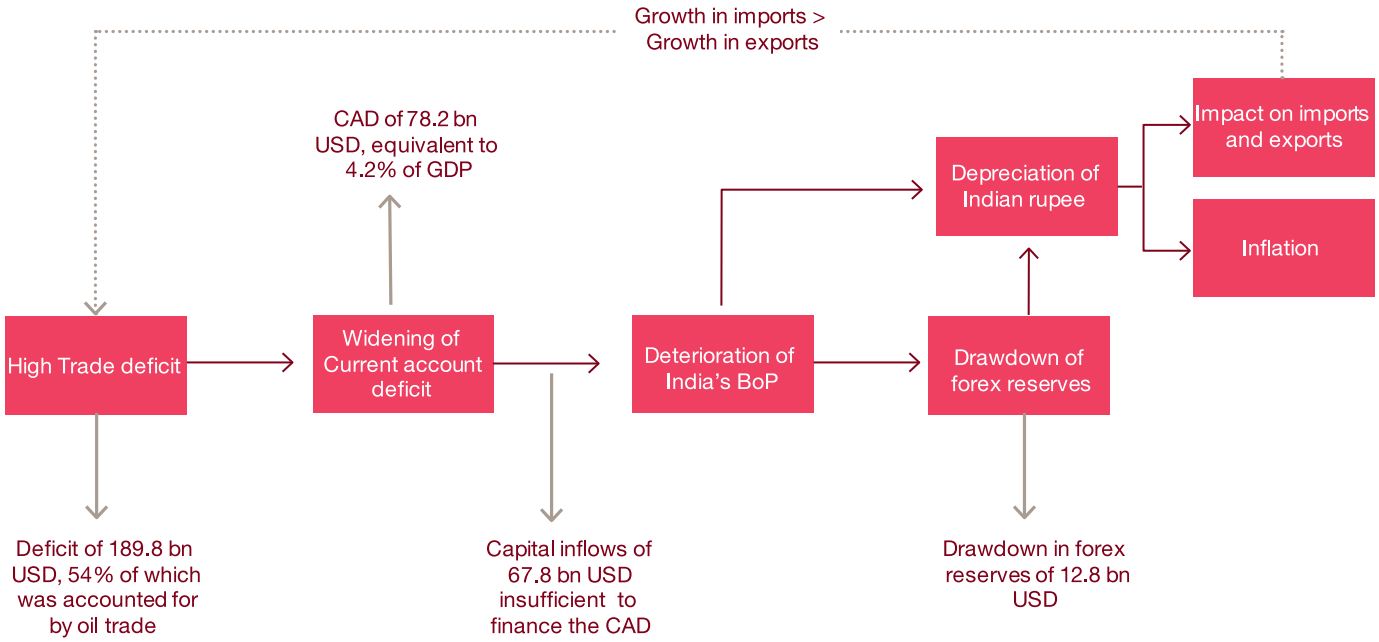


Source: World Energy Outlook, PwC Analysis

Though the growth in non-oil imports was lower as compared to the previous year, high oil imports caused a significant growth in the aggregate imports of our country. The exports failed to pick up significantly on account of low external demand and also owing to the fact that most exporters had covered themselves in the 45-46 INR range. All these ultimately translated into a higher current account deficit, which caused a further decline in the value of the rupee.

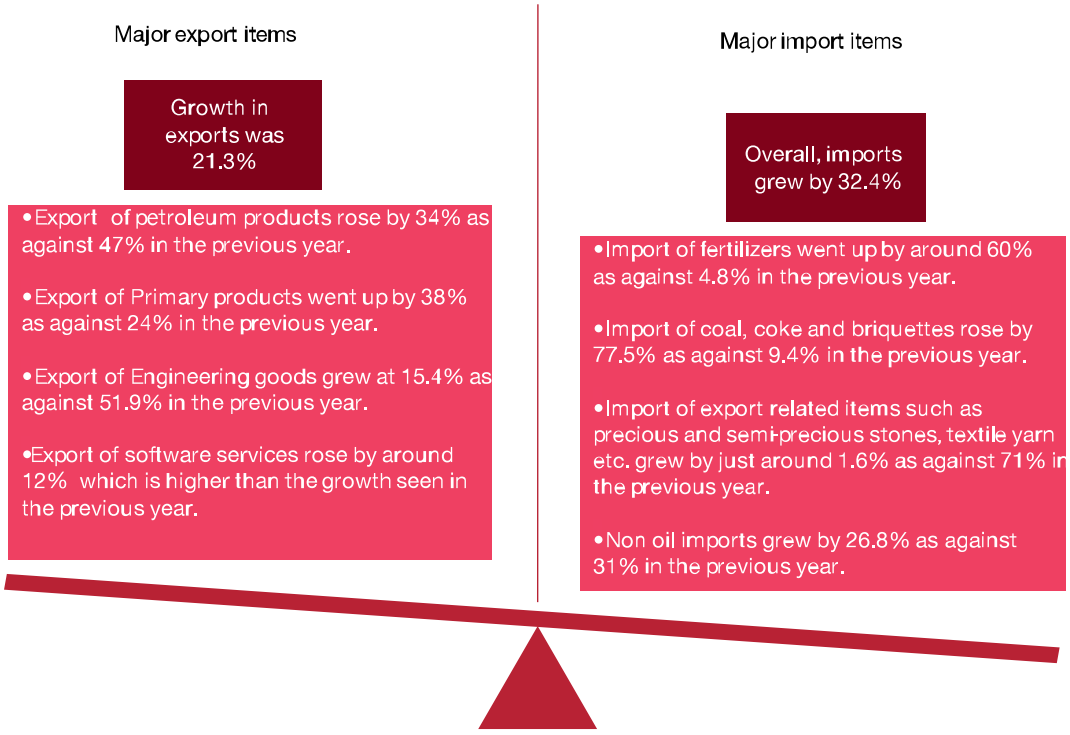
The following chart depicts the implications that high oil imports have had on India's economy in 2011-12:

Impact of high oil imports on our economy in 2011-12



Drawdown in foreign exchange reserves of 12.8 billion USD reduced the import cover of reserves to seven months. This could have been avoided had the oil imports been lower, meaning if India could domestically produce more crude, by around 17 million tonnes.

Impact of rupee depreciation on major import and export items



Source: RBI monthly bulletin September 2012

The economy has thus entered into a vicious circle that will break only if the capital inflows into the economy rise or if there is an improvement in the trade balance.

Given the current trend in the domestic oil production, dependence on imports is expected to reach 90% in the next two decades. It would require a higher percentage of GDP to be spent on oil imports, thereby further increasing India's vulnerability to external shocks. Though the economy cannot be fully insulated against external shocks, the impact of such shocks on the economy can be limited if dependency on oil imports is reduced, which essentially calls for an increase in the domestic oil production. Hence, it is necessary to explore the possibilities of enhancing the exploration and production of hydrocarbons by promoting investment in the sector.

2.6. Conclusion

The economic constraints are compelling India to reduce dependency on oil and gas imports and develop capabilities in domestic hydrocarbon exploration and production. Ostensibly, the oil and gas sector in India has untapped potential, calling for more intense exploration. Hence there is a meritorious case for catalyzing actions leading to the development of domestic hydrocarbon exploration and production industry.

03

Does promoting domestic E&P sector provide an effective solution?

3.1. Impact of increased domestic production on economy

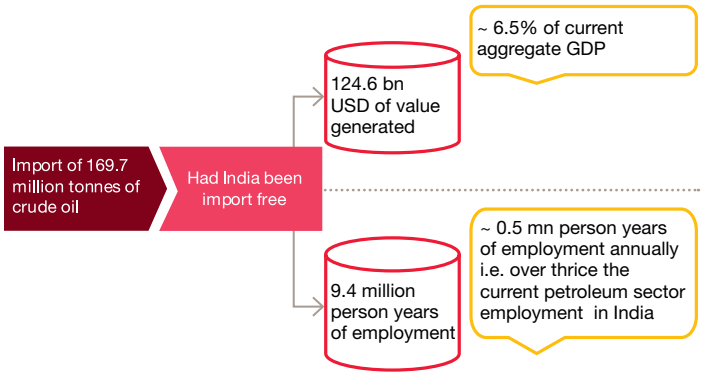
Taking a cue from the previous section that brought out the vulnerability of our economy due to its high dependency on oil imports, and given our imperative to achieve energy security, an analysis of the impact of promoting the domestic E&P industry on our economy becomes necessary.

For this, it is necessary to evaluate the impact of substituting oil imports by domestic production in terms of the gross value it would add to the economy and the employment that shall be generated. The linkages that exist among different sectors of an economy imply that any increase in one sector's output triggers off demand in other sectors with concomitant increase in output and employment in those sectors as well. Hence, an increase in domestic oil production would set up a chain reaction in the economy resulting in increases in output, employment and value added that are multiples of the original stimulus.

Two measures, namely the output multiplier and employment multiplier effects are worth analysing to quantify the economic impact of the increase in domestic oil production. The best data available for analysis is the Input – Output table for India (2003-04)[4]. The output multiplier for the crude oil sector based on this data works out to be 1.62.

It is not practical to consider immediate import substitution; hence, the analysis would assume that a reasonable domestic E&P effort would result in the start of commercial production after eight years. Although that analysis would bring to bear the benefits that will accrue due to import substitution, it will also be contextual to analyse the output and employment benefits that would probably have resulted had crude been produced domestically even today. India, in 2011, imported 169.7 million tonnes of crude oil. The following chart depicts as to what would have been the impact had the country been import free:

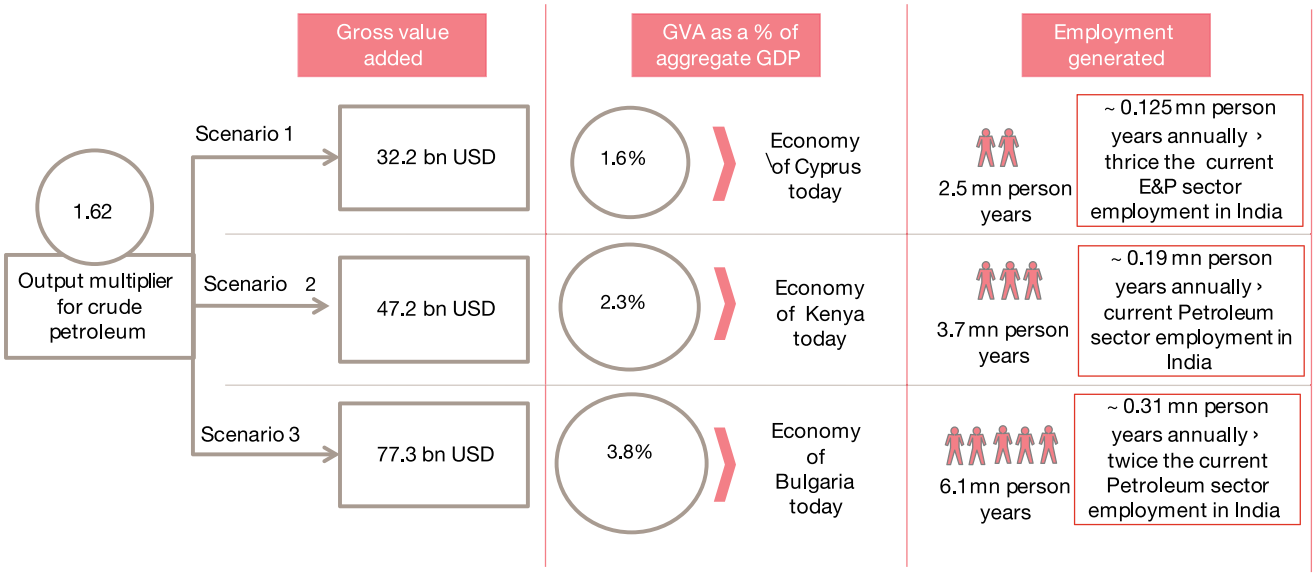
What if today India could substitute all its imports with domestic production?



The employment figure represents total employment generated over the average life span of an oil producing asset viz 20 years.

Knowing well that any investment made in the domestic E&P sector will take some time to show a tangible impact on the economy as well as on oil production, this analysis assumes year 2021-22 as the year from which the production starts. Based on IEA projections, the analysis assumes the total domestic demand for oil in 2021-22 to be 215 million metric tonnes (MMT). Given the current trends and projections for the XII Five Year Plan by the MoPNG, the domestic production in 2021-22 is estimated at 40 MMT, which would roughly be 18.5% of the total demand then.

4 *Source: Central Statistical Office*



The economic impact of any increase in production beyond 40 MMT has been analysed under three different scenarios. Under the first scenario, 40% of the domestic requirement is assumed to be met by domestic production, which would warrant an additional production of 46 MMT. Scenario 2 considers a situation wherein domestic production shall meet 50%of the domestic demand, requiring an additional production of 67.5 MMT. Similarly, Scenario 3 considers a situation wherein 70% of the demand shall be met by domestic production, requiring an additional output of 110.5 MMT. The oil price assumed is 100 USD per barrel (a midpoint of the reference case and low price scenarios projected by EIA). The outcome under each of these scenarios has been depicted in the chart above.

The nation's aggregate GDP for 2021-22 has been worked out assuming a CAGR of 7% to the current GDP value at constant prices.

The benefits that accrue to the economy would, however, be much higher, if we consider the perceived gains in terms of foreign exchange savings and better trade balance that would result owing to reduced oil imports. Moreover, as already discussed, reduction in import dependency would lower the vulnerability of our economy to external shocks.

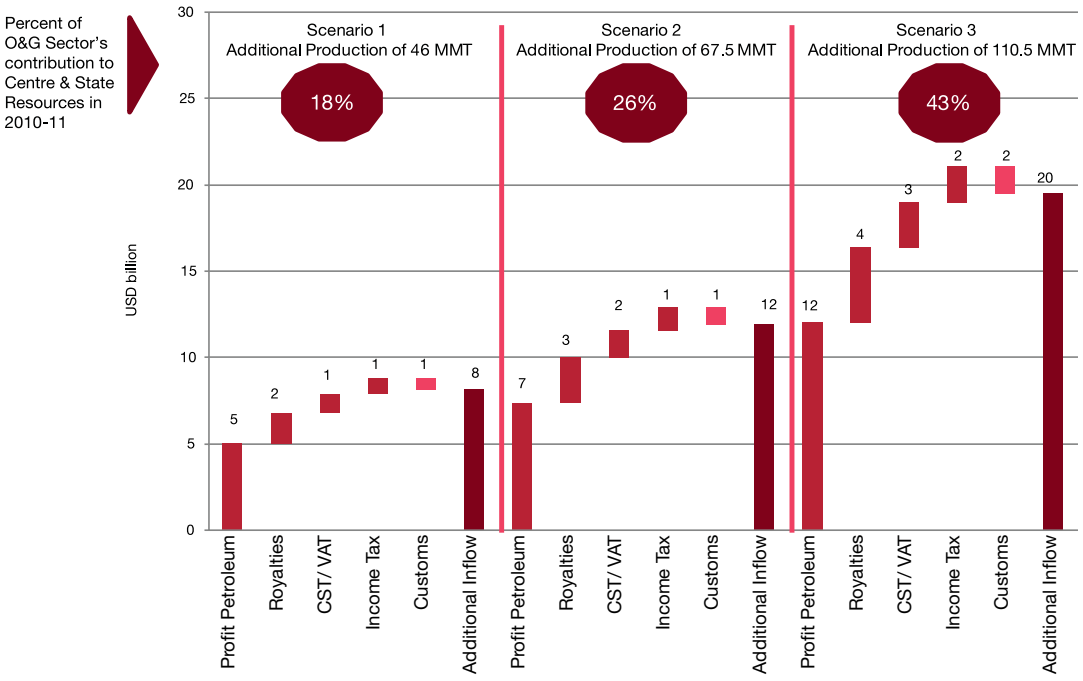
3.2. Impact of increased domestic production on government take

Due to the increased domestic production, the monetary impact on the exchequer will be significant. The inflows accruing to the government will be in the form of profit petroleum, royalties to the state and central government, central sales tax (CST), state value added tax (VAT) and income tax. The domestic production will reduce dependence on oil imports resulting in reduced inflows to the government in the form of customs duty.

To estimate the government's take on the increased domestic production assumptions have been made based on trends observed in the Indian E&P industry. All incremental flows to the government are assumed to accrue from fields awarded under the NELP regime. The split of incremental domestic production between crude oil and natural gas is assumed at 40% and 60% respectively. The on-land and offshore split of the incremental domestic production is assumed at 30% and 70% respectively. Based on bidding patterns under the NELP for calculating profit petroleum, we have assumed that 50% of the annual production value will be applied towards cost recovery, government's revenue share at a pre-tax investment multiple (PTIM) of < 1.5 is 50% and government's revenue share at a PTIM > 3.5 is 60%.

Royalties, CST and VAT, income tax and customs duty were calculated at rates applicable as on date. Exploration, development and production cost for onshore blocks was assumed at 3 USD per bbl, 5 USD per bbl and 3 USD per bbl, respectively. For offshore blocks, the cost was assumed at 5 USD per bbl, 10 USD per bbl and 3 USD per bbl, respectively. The price of crude oil price is assumed as 100 USD per bbl. The natural gas price is assumed at 4.2 USD per MMBTU.

Additional inflow to government from production growth scenarios



Source: Indian petroleum and natural gas statistics 2010-11, PwC Analysis

The additional inflows to the exchequer for the three different scenarios based on these assumptions are presented in the figure. We compared the inflows on account of incremental domestic production in 2021-22 with the government's earnings in 2010-11 from the petroleum sector. The total earnings of the government from the sector in 2010-11 was 45 billion USD. This included earnings from both the upstream and downstream sectors.

Under Scenario 1 the inflows to the government in 2021-22 (8 billion USD) on account of additional domestic production is estimated to be 18% of the government's total receipts from the petroleum sector in 2010-11. Under Scenario 2 and Scenario 3, the inflows to the government in 2021-22 are 26% (12 billion USD) and 43% (20 billion USD) out of the government's total receipts from the petroleum sector in 2010-11. The major chunk (around 75%) of the government receipts comes from the downstream petroleum sector.

3.2. Conclusion

The dream of India's energy security originates from the possibility of double rewards. Not only would India stop fearing being dependent on energy supplying nations, but would gain windfall.

If the economic output benefit that would have resulted had India been import-free today is equivalent to more than a whopping 6% of India's current GDP, the major trade balance challenge will be averted. A scenario of 50% of the domestic requirement met by domestic production analysed, is projected to generate an additional value of 47.2 billion USD, a value that is greater than the economy of Kenya today. In this scenario, 3.7 million person years of employment are expected to be generated. In addition to the economic benefit, it will generate an additional inflow for the government of an amount equivalent to almost 25% of the current total revenues that accrue to the government from the petroleum sector. The benefits that accrue to the economy would, however, be further higher, if we consider the perceived gains in terms of foreign exchange savings and better trade balance that would result owing to reduced oil imports.

The actions for converting the dream of energy security into a reality, can hardly wait.

04

Lessons from the past

4.1. Introduction

The India E&P story is not a recent one. The year 1889 saw the first commercial discovery in Digboi, Assam. The progression since then is a telling story of how India lost and found its way multiple times in the past. Factors such as regulatory policies and market determinants are among the primary agents of change in the E&P landscape and while in India's case, these factors have been opposing in nature, some nations have demonstrated that these factors can be aligned and made complementary in nature.

To set the background, while Norway and Brazil have been selected as reference points owing to the presence of certain similar conditions and challenges as those existed in India, by no means, it implies that three countries are identical and that the sample space cannot be extended to other countries.

To reiterate the first point, as also depicted in the charts, Brazil and India had similar production levels during the 1970s, with a slight head start when compared with Norway. As shown in the table titled "Race to energy security", all three of them had almost similar proven reserves even 10 years later. During the oil shocks of 1973, Brazil had an import dependency of ~80%[5] similar to India's 62%[6]. Similarly, Norway[7] did not have technology or know-how to self-start its domestic E&P industry and was dependent on international oil companies for stimulating domestic production. In addition, while Norway was running a discernible currency deficit prior to its first discovery in 1969, Brazil suffered heavily at the hands of double oil shocks in the 1970s. India too had a Balance-of-Payment deficit during the 1970s. However, the three countries scripted their own story of promoting domestic E&P industry at differing levels of proven effectiveness.

The box below describes the progression of India's E&P sector. Charts at the end of this section present the production trend for the three countries for both crude oil (marked in dark brown) and natural gas (marked in red) in million tonnes of oil equivalent (Mtoe) for the period 1970 to 2010. Some of the key events are also highlighted against the year of occurrence.

Pre-1960s: Tryst with nationalism

The pre-1950s saw India taking steps towards the domestic E&P sector, culminating in the creation of ONGC in 1956. OIL, the other National Oil Company (NOC), which had already been created as a JV with Burmah Oil was incorporated in 1959 post discovery in north-east.

1960s–70s: Initial success

ONGC met with initial success in Gujarat in 1961 but the second discovery took more than just efforts. In 1973, the global oil shock (due to OAPEC oil export embargo) forced GOI to intensify its exploration efforts, which resulted in the offshore discovery of Mumbai High in 1974 and the Bassein field in 1976.

1980s–90s: Spurt in hydrocarbon production

Production nearly quadrupled from 1980 to 1990 due to exploratory efforts and witnessed the rise of natural gas production due to realisation on part of the government to set up the associated pipeline infrastructure. Early the 1990s saw the commissioning of the HVJ pipeline by GAIL. On the other hand, the Pre-NELP regime introduced in 1979 started on a slow note as only four rounds were conducted in 12 years (1979-91).

5 *How brazil achieved energy independence and the lessons the united states should learn from brazil's experience – Footnote 4, Page 331*
6 *World Bank: Appraisal of Bombay High Offshore Development Project India*
7 *Page 16, Norwegian oil experience: Helge Ryggvik.*

1990s–2000: The lost decade – search for attractive E&P policy

Oil production saw a plateau in the 1990s with ONGC's production witnessing a dip and with no major discoveries. It started with the restructuring of ONGC and the setting up of DGH as the E&P regulator in 1993. The first half also saw desperate attempts by India to attract foreign investment via six consecutive Pre-NELP rounds in four years (1991-95), which resulted in 27 signed contracts out of a total of 270 blocks that were offered. Overall, Pre-NELP had a dismal performance. Finally, in 1997, to accelerate the pace of development in the E&P space, GOI introduced the New Exploration and Licensing Policy (NELP), which ushered in major reforms such as cancellation of the erstwhile mandatory state participation through NOCs, abolition of the nomination of exploration licences to NOCs, introduction of a competitive bidding regime and various fiscal incentives such as tax holidays, exemption of import duty on goods meant for petroleum exploration, cessation of signature, discovery bonus, etc.

2000–Present: Private sector contribution

Since 1998, nine rounds of NELP have been concluded, which have brought down the unexplored and poorly explored area from 58% in 1998-99 to 34% in 2010-11. The latest decade witnessed a spurt in private-sector contribution to domestic E&P industry through new discoveries (KG-D6 gas discovery) and collaborative effects of the private-public sector collaboration. Major milestones during this period include Panna-Mukta-Tapti (PMT) crossing 500 million barrels in cumulative production and Cairn's Rajasthan block reaching 100 million barrels in cumulative production in less than five years.

4.2. Regulatory policy: Too many cooks spoil the broth?

Referring to India's E&P progression chart, it can be observed that key reforms have been brought about at regular intervals throughout the four decades (1970-2010). One may ask whether a long-term regulatory strategy may have been favourable to India, as in the case of Norway and Brazil. For instance, could GAIL have been set up prior to 1984, preventing an entire decade of useable natural gas from being flared? Similarly, would the presence of a dedicated upstream and downstream regulator, right from the beginning been more effective in resolving many questions related to ONGC's role in the selection of blocks for bidding during the pre-NELP regime? Finally, had the government rolled out NELP reforms after the conclusion of the fourth round of the pre-NELP regime, given the poor response, would India have been in a better position today? Notwithstanding the benefits the regulatory reforms have brought about, some of these critical interventions seem to be a delayed reaction rather than proactive action.

Additionally, in many instances, policy changes may have missed the cue and hence may not have had the desired additive or multiplier effect. Instances of this include the freedom (notional) to market gas in the domestic market, given the extant gas utilisation and allocation policy of the government and the arm's length process for the discovery of gas pricing, given the interventions and restrictions on the sample space.

Reflecting on the past : Unlocking domestic E&P

- Did India take too much time in its search for right set of regulatory policies?
- Has this delay cost India investor confidence?
- Did India drag on Pre-NELP for too long?
- Did India have a clear E&P strategy implementation plan?

Execution of the Mumbai High project benefited from the procedures to by-pass the usual processes involved in getting import licenses and foreign exchange allocations. Mumbai High started production within two years of discovery.

- World Bank in its Report No. 1569a-IN, titled "Appraisal of Bombay High Offshore Development Project India"

4.3. Key lessons from Norway and Brazil

4.3.1. The start – Can it be quick, realistic and on a firm footing?

One of the common factors in the approach towards promoting E&P sector adopted by Norway and Brazil, which incidentally doubles up as a major point of distinction from the Indian E&P sector progression, is the agility demonstrated by the two countries in understanding their domestic E&P environment, devising a clear strategy to tap its potential and implementing it with stable decision- making approach.

Norway E&P genesis – a case of doing business everyday

Norway's progression in the E&P sector, as depicted in the chart titled "Norway E&P progression timeline", is due to its simple structured way of doing business. By 1964, Norway had settled the maritime boundary with neighbours Denmark and the UK. In the following year it had resolved the legislation applicable to the E&P industry. Key highlights of the legislation such as a concession agreement lasting for 46 years with royalty of 10% levied on production rather than profits, granting of exception to the rule of setting up of local subsidiary in cases where it helped the foreign participants, no mandatory state participation as it brought no value-add to the table indicated that the decision-making was completely aligned to ensure full commitment of foreign participants. It is no surprise then; Norwegian stake in the first major discovery in Ekofisk field was a miniscule 6.7%. Additionally, unlike India where gas flaring continued for the entire 70s, Norway, owing to its socially-oriented resource management attitude, mandated (1971) that useable gas should not be burnt-off. Similarly, the country quickly imbibed the lessons of controlling the economic rent associated with large trunk pipelines from America's petroleum industry and refused to give Phillips (operator of Ekofisk) the right to operate the pipeline as well.

A general lesson for all oil producing states is that the strategic agreements and decisions which are made in an early phase of an oil region's development can have decisive implications for the future

-Helge Ryggvik, in the report "Norwegian oil experience"

Brazil E&P progression – a case of firm decision making

In Brazil's case, the decision of the government to proclaim an early national monopoly over hydrocarbon assets was backed by an unwavering support to its national oil company Petrobras. For instance, during the 1980s, the government ensured Petrobras consistent financial support for its research and development in deepwater related operations. The stand taken by the government paid rich dividends because it catapulted Petrobras in the elite league of deepwater operators and not just as a marginal player but as a market leader. Additionally, the government ensured that the company continued to have a free hand in managing its operations despite the early hiccups in the form of global oil shocks.

4.3.2. Nationalistic ambitions – can they be afforded?

In another point of similarity, Brazil, India and Norway, at some of point in history, have asserted ownership and control of hydrocarbon resources via policies and creation of national oil companies. Norway managed to do so gradually at the back of successive hydrocarbon discoveries. Brazil took on the challenge and justified the decision four decades later (discussed below). In India's case, however, the policies governing the petroleum sector have moved from total reliance on foreign oil companies (post-independence) to a phase of strong emphasis on self-reliance post the government's Industrial Policy Resolution of 1948 and 1956 and then back to opening of the sector in the 1990s and 2000 with some of the most attractive reforms till date (NELP policy). While Norway's case emphasises the circumstances, timings and long-term vision of such a decision, Brazil's example highlights the importance of a persistent attitude with which the reforms are implemented.

Norway: a case of strategic vision for the petroleum industry

The E&P progression chart of Norway clearly depicts a series of early discoveries which helped them assert their nationalistic ambitions in the period that followed. Also, these ambitions were not abrupt and were executed in a structured manner. To start with, a separate state oil company – Statoil was established in 1972. In 1973, the Norwegian government ensured the company 50% participation in a field which was adjacent to the British block where oil had been recently discovered. This field was the Startfjord field with almost four billion barrels of oil equivalent (BBOE) in proved reserves. During the same period, the Norwegian Petroleum Directorate (NPD) was created, and soon after support for developing a national contractor was expressed through *Whitepaper No 25, Role of Petroleum Activities in Norwegian Society*. Norway's nationalistic ambitions spread beyond amassing a greater fiscal share in production or imposing more taxes on foreign companies. It entailed within this a vision to expand the role of Norwegian oil sector by creating a new industrial sector. E.g. role of contractor industry, strategic vision for Statoil on the lines of international majors were all part of the nationalistic ambitions. Finally, although Statoil was created as a state oil company, it had an independent management.

Brazil: a case of taking up the gauntlet

In Brazil's case, the sector was open to private participation from second half of the nineteenth century to 1953. Similar to India, Brazil did not attract many foreign oil companies and the exploratory efforts during the initial period were sparse. E.g. between 1939 and 1953, only 52 wells were drilled in the country. Additionally, post-World War II, nationalistic slogans such as "O Petroleo e Nosso" emerged as the 'vox populi' and these combined factors led to state monopoly with the creation of Petrobras.

As we know now, what followed is what will be remembered. For initial phases from 1954-61, Petrobras was dependent on large contingent of foreign technicians and experts. However as shown in table titled 'Race to energy security' and chart titled 'Brazil E&P progression timeline', post discovery of Campos basin in 1974 (establishment of deepwater potential), followed by double oil shocks of 1973 and 1979, exploratory efforts were intensified with Petrobras alone drilling 885 onshore and 750 offshore wells from 1975 to 1984. The drilling was not only intense but also at the right place as it led to more discoveries despite having almost twice the sedimentary area of that of India. This is what helped Brazil continue on this chosen path whereas India did not get the confidence it required in the early stages. The above comparison becomes even starker given Brazil's success with ethanol production and other renewable means of energy production; even today, Brazil's primary energy mix has almost 50% of its energy consumption being contributed by renewable and hydro-electricity. Notwithstanding the above, it could still put in such intense efforts on the conventional E&P front.

Eventually, when Brazil did open their E&P sector to private and foreign participation, like India, in 1990s Petrobras had acquired the necessary skills and taken enough lead to ensure that late entrants were always running to ensure a tough competition during the licensing rounds.

4.4. Conclusion

Today, Norway and Brazil have set an example for India's E&P sector by not only being self-sufficient in their hydrocarbon quest, but also commanding a place of respect in the global E&P sector. The three countries are commendable; given their unique political, social and economic milieu at the time they started and provide enough lessons for any new emerging hydrocarbon sector player to imbibe for the future role it wishes to play in this space.

Petrobras has been able to remain successful in large part due to… ***(ii) managerial and political independence from the national government.***

- Andrew D Fishman in his report Petroleum in Brazil: Petrobras, Petro-Sal, Legislative changes & the role of foreign investment.

India E&P progression timeline

Pre-1950s: Attempts to attract IOCs to set up E&P base in India

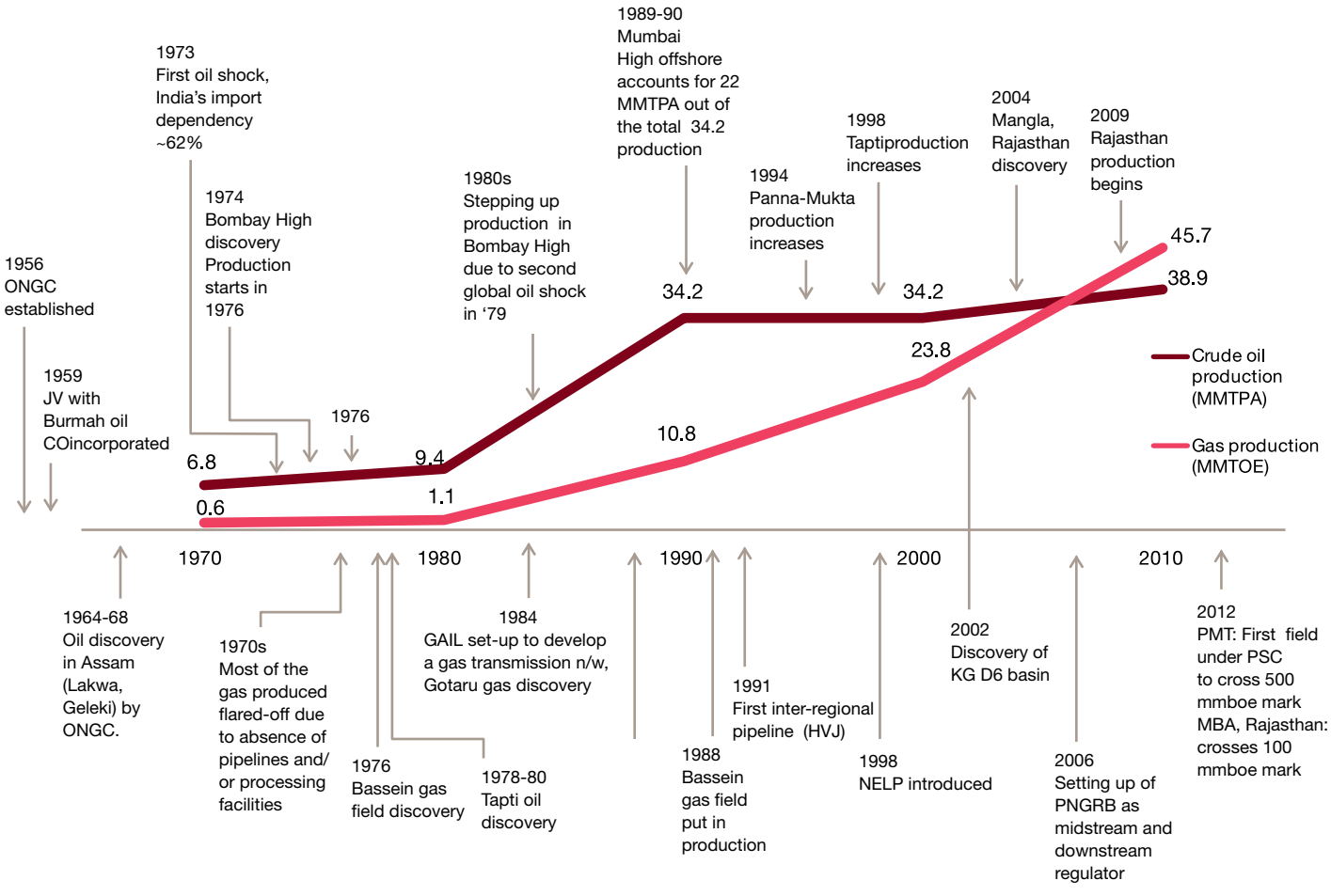
50s & 60s: Growth of NOCs, India gains significant experience in petroleum industry

70s : Impact of global oil shocks, stepping up of Mumbai High development

80s : Rise of oil and gas production and associated infrastructure

1990s: Plateau in Oil production, Era of regulatory reforms

2000: Discoveries & Controversies



Norway E&P progression timeline

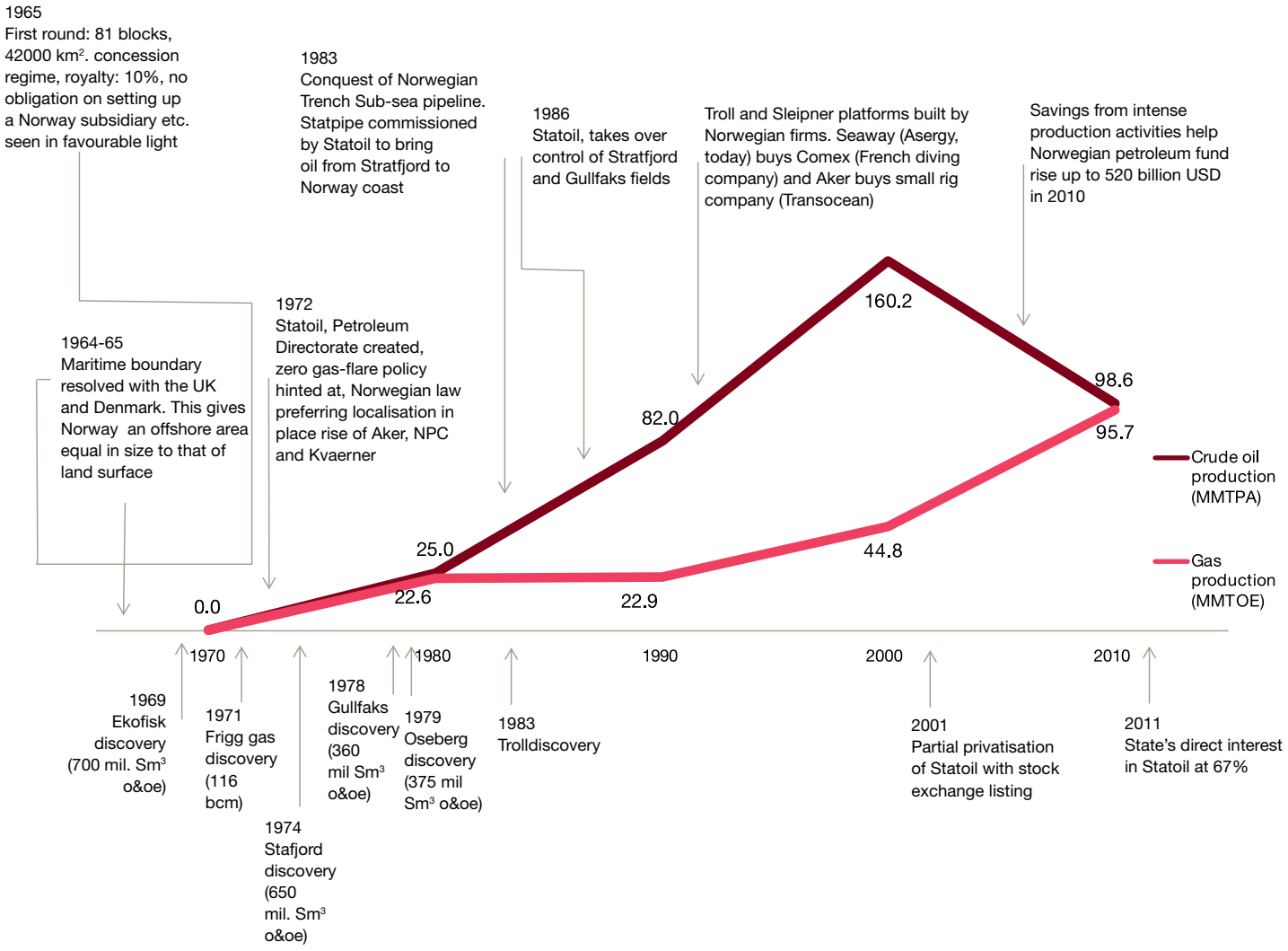
1960s: Attractive Exploration phase

1970s: Dawn of Nationalistic ambitions

1980s: Strengthening phase for state players

1990s: Rise of Norwegian contractor industry

2000s: Decline in oil production compensated by rise in gas production



Brazil E&P progression timeline

Pre-1960s: "O Petróleo é Nosso" - Brazil asserts national control over petroleum

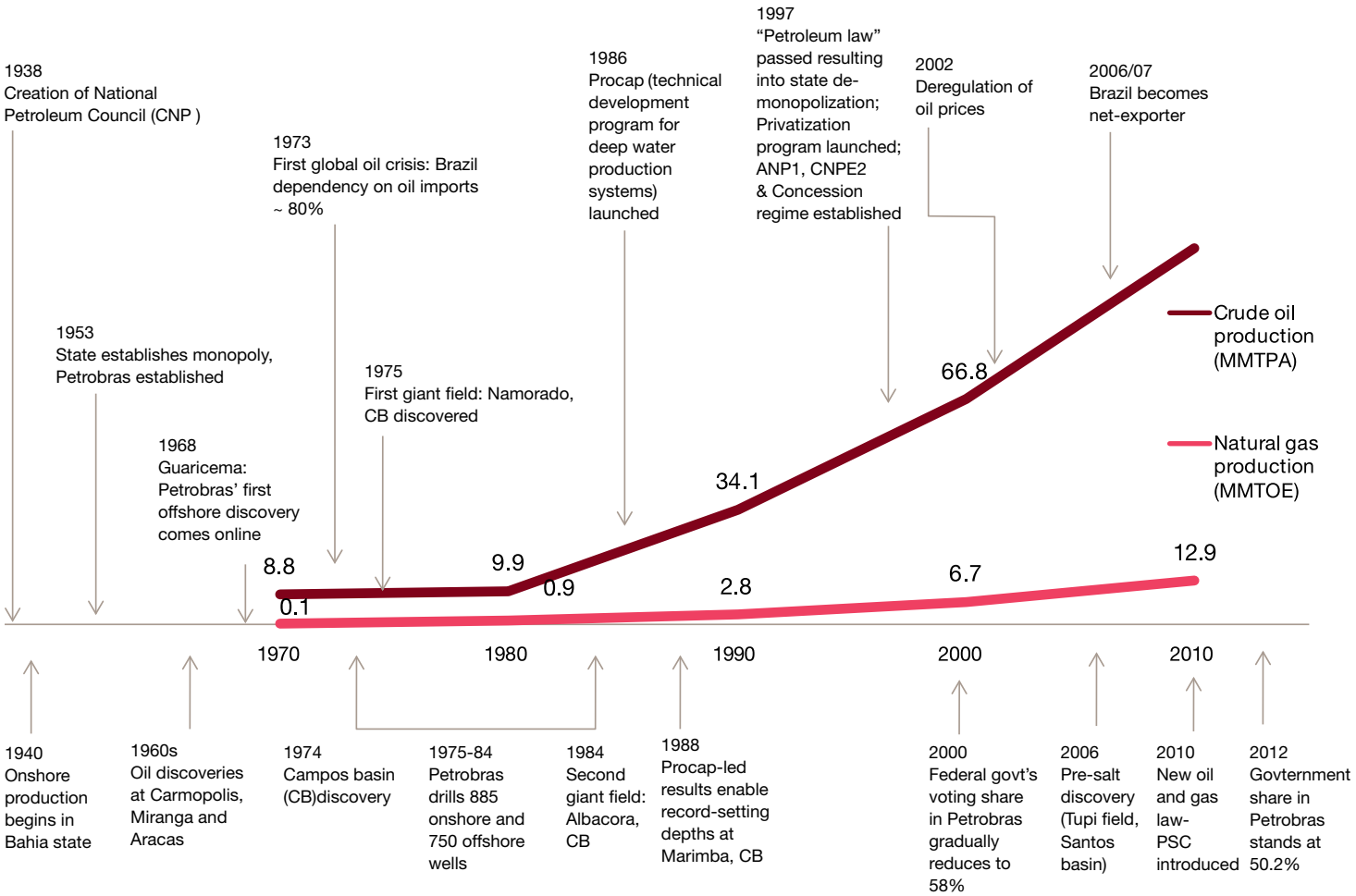
1960s: Petrobras contracts foreign firms, Offshore exploration begins

1970s : Oil shocks, not-so successful attempts at overseas exploration & risk-contracting with IOCs. Campos discovery by Petrobras

1980s & 90s: Heavy R&D investment by Petrobras, acclaimed "undisputed leader in Deep & Ultra deepwater exploration"

Late 90s & 2000: De-monopolization and liberalisations of oil sector and prices, public sector disinvestment in Petrobras

2nd h-2000s: Pre-salt discovery, Brazil sets Petrobras on massive upscale of operations



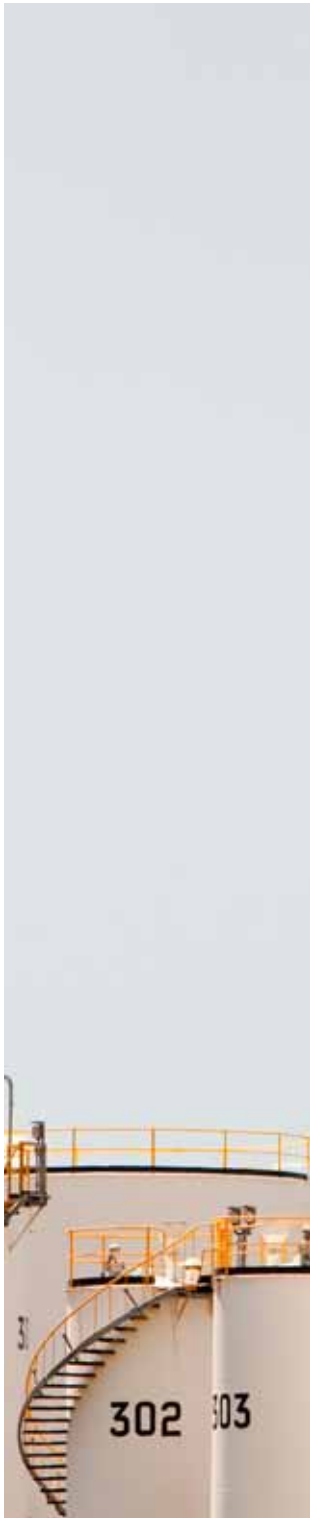
Race to energy security

Parameters	India	Brazil	Norway
Proven reserves – 1980	4.78 bboe	1.96 bboe	6.64 bboe
Proven reserves – 2011	13.62 bboe	18.4 bboe	20.55 bboe
Cumulative Production (since 1965 pfor oil and 1970 for gas)	12.5 bboe	15.01 bboe	35.2 bboe
FDI (last five years)	FDI for entire PNG sector: 4.65 billion USD (2000-12: 5.2 billion USD)	49.5 billion USD (over last 6 years)	-
E&P investment (last five years)	20 billion USD (From 2000-12, for all NELP rounds)	95.4 billion USD: Petrobras E&P investment (2006-11)	110 billion USD (last five years: 2007-11)
Total area covered under exploration	26 sedimentary basins comprising 3.14 million sq km (22% moderate to well explored)	29 sedimentary basins comprising 6.4 million sq km (granted area ~7.5%)	1.4 million sq km
No. of wells drilled	Between 1974- 85[1] 733 onshore, 324 offshore wells Between 2005-11[2] 2267 onshore and 732 offshore wells	Between 1974- 85[3] 936 onshore, 814 offshore wells Between 1996-99 1001 wells onshore, 559 wells offshore	Between 2005-11[8] ~286 exploratory and 1007 wells drilled (all offshore)
No. of producing fields	426[4] (as on April, 2011)	319	71
No. of E&P rounds	Nine	11	22
NOC R&D budget	ONGC[5]: ~70 million USD (FY 13)	Petrobras[6] 1.2 billion USD	Statoil[7]: 465 million USD (2012)
Administration responsibility	MoPNG: 235 blocks, 426 producing fields	ANP[8](end 2010): 344 exploratory blocks, 82 fields under development, 319 producing fields	NPD[9](End 2011): 495 active production licences, 71 producing fields, 14 fields under development
Petroleum fund financial wherewithal	Oil Industry Development Board (OIDB): Cumulative receipts since inception: 180 million USD (till December 2011)	-	Norwegian petroleum fund: Cumulative receipts since inception: 520 billion USD (as in 2010)

Source: [1,4]Indiastat, PNG stats | [2]DGH annual reports | [3,7]Hydrocarbons in Latin America – Case of Brazil | [5]Working Group Report on XII Five Year Plan | [6]Petrobras Technology 2011 | [7]Statoil annual report 2011 | [8]WSJ January 2012 article | [9]NPD: Shelf in 2011

05

Transformational role of synergistic coexistence



In 1999, the Indian government introduced the 'New Exploration Licensing Policy' (NELP). The policy was unambiguous in stating, *"…in keeping with the liberalised policy of Government of India for attracting Private investments in the oil and gas sector, Government of India has formulated the New Exploration Licensing Policy (NELP)."* The policy affirms that, albeit the pre-NELP efforts were to attract private investments, after nine rounds the necessity to step up investments in order to meet the demand for petroleum is expected to rise rapidly.

5.1. Co-existence of NOCs and private oil companies

The NELP had a positive effect with investors, private domestic companies, multinational corporations and intermediates viewing the policy and India as promising. Round one of the NELP started with 61% of the blocks awarded to private sector players, while NELP V witnessed an all-time high with 75% of the blocks going into private hands.

Post ninth NELP round, the picture has altered. PSU companies operate close to 58% of the total blocks (235) awarded in the previous eight NELP rounds. More than 54% of the total present acreage is held by NOCs. More than 56% of 3D seismic survey is done by NOCs. Excluding the s-blocks, the total percentage of blocks operated by PSUs is 60% of the total number of blocks awarded till the eighth round of the NELP.

In surveys after the fifth round of NELP, PwC received investors feedback stating that some blocks being offered had either been relinquished or recycled, were too small to effectively discharge exploration activities, without quality data evaluation of underground risks was becoming difficult, and so on. Ambiguity around tax breaks, ambiguity in operationalisation of PSC provisions, and such other issues made investors think twice before investing. The government has taken note, and is now evaluating from basics the mechanism of awarding and regulating E&P acreages. The need for respecting the roles to be performed by all – the government, the national oil companies, the private oil companies, the inward invested E&P companies, including the overseas national oil companies, the service companies, etc. – is being felt more prominently.

In this context, a look at the behaviour of NOCs and IOCs in the world reflects that the two have distinct objectives and capabilities.

A 2007 analysis by PwC, *The Wealth of Nations,* , revealed how well countries' petroleum strategies align with their hydrocarbon reserves and the following categorization of the E&P NOCs may still be relevant to the present era:

- Goup with a regime that favours restricted access to hydrocarbons– E.g. Saudi Arabia, Venezuela, etc.
- Group that has NOC's with international aspirations – China, India, etc.
- Group that has partnered with IOCs for gas technology and market needs – E.g. Algeria, Qatar, etc.
- Group with traditional PSCs and bid rounds – E.g. Indonesia, Angola, etc.
- Group with constraints related to infrastructure, policy formulation and hence with "work in progress" – E.g. Iraq, Turkmenistan, etc.

The synthesis of the groups indicates that any specific country's resource endowment has most certainly influenced and occasioned the countries to act in a particular manner.

Most of the countries in the restricted access group have restraints which limit ownership of hydrocarbons to state-owned enterprises. Such an arrangement precludes production sharing arrangements and booking barrels by contractors.

Group with the international NOCs, include countries that compete directly with the IOCs. The international NOCs strategy is occasioned by insufficient or declining reserves and/or production in their domestic markets. This group has incoming foreign investment via PSCs, and the majority has publicly listed arms to their NOCs. Clearly market factors are in play with this group to increase value through reserves replacement overseas as a part of these countries' strategies.

India was and can still be categorised under the 'international NOCs' bracket. The aspirations of NOCs in this category are no different from private and global E&P companies. However, it is pertinent to look at the other facets of NOCs.

The results of a survey undertaken by PwC during this study revealed the ecosystem created by NOCs, international oil companies (IOCs), private companies, and service providers in the global E&P industry.

The survey concluded that the continuum of capabilities displayed by these NOCs is fast becoming a topic of conversation in the world of petroleum policy, strategy, operations, finance and economics. In many respects the NOCs are similar to their private sector relatives, the IOCs, having the same general purpose of finding and developing hydrocarbons. But the manner in which the two develop their hydrocarbon resources often varies. Historically, the strategic drivers of the IOCs were distinct from those of the NOCs. The former were driven by pragmatism, production and profit, whereas the NOCs were influenced by politics, policy and procedural practices. The level of difference is surely changing, but the rate of change is not equal among all NOCs. Conversations with senior executives of several global NOCs revealed that they all faced similar issues, but had different perspectives, capabilities and priorities. The most important view was that many NOCs seek to have an arm's length relationship with their governments, but in practice get caught between goals of commerciality and the common good.

The challenges faced by NOCs are reflected in the way they operate. They have government backing and have much better bargaining power within the countries or when they venture out. They are satisfied with accreting reserves, without necessarily aspiring to gain a technical edge. They synergistically work with service companies and at times use their in-house resources to operate. They also share wealth with the nation through subsidies and dividends, and generate employment.

The private sector, however, aspires to be technologically savvy. They book reserves and increase shareholder value through efficient operations. They take risks, but in a very calculated manner. They have displayed much better performance while dealing with tough business conditions, geographical and topographical challenges, faster decision making, dealing with governments, asset operation, project managing large developments, and so on.

The service companies, whereas, have over the two decades relentlessly demonstrated strength in innovation, research and technological development. They have been at the forefront of unconventional hydrocarbon development. They, while being averse to exploration risk and therefore operating assets, have supported both national and international oil companies excel in accreting and exploiting reserves.

Therefore, in many contexts the objectives of governments practiced through NOCs – of holding reserves, protecting national wealth, developing equity oil for energy security, being politically and socially sensitive, and earning revenues – and of private companies of – being pragmatic, gain excellence in production efficiency and generating profit – and of service companies to excel technologically, hardly conflict. They can create partnerships in a country like India by allowing each to utilise their strengths, partner at strategic or at asset levels, and bring in the necessary resources.

The partnership for dreaming energy independence would be in the nature of co-existence, providing unbiased opportunity for growth to all three, respecting their respective objectives, making special efforts to welcome them and to let them deliver best within legal and contractual framework. In some sense, this is a mindset an aspiring government will need to live.

5.2. Shale gas: A story co-scripted by private and public partnership

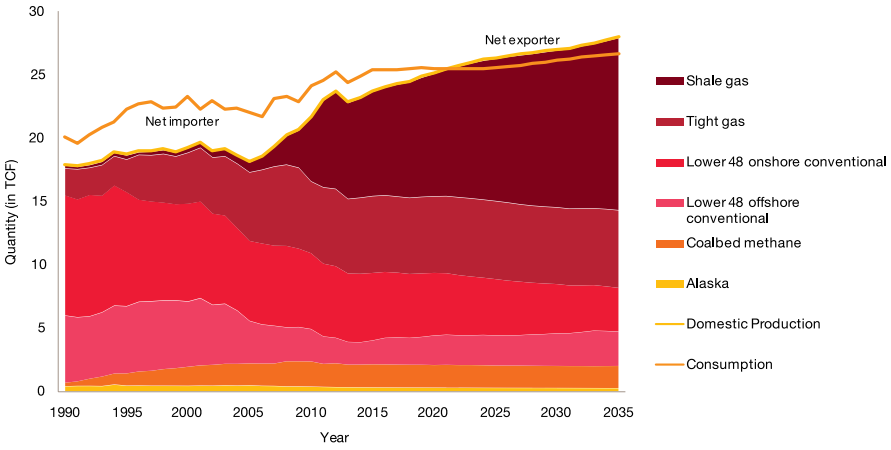
By 2022, the USA, a net importer of natural gas till now, is projected to be the net exporter of natural gas[8]. The primary reason for this turnaround was the unlocking of the shale gas resource potential. The shale gas success hinged upon the major technological advancements, primarily in the field of hydraulic fracturing and horizontal drilling, emanating out of the persistent support by the American government. Public private partnership resulted in cutting edge innovation and progress in development of hydraulic fracturing and other key gas recovery technologies. The Government support in R&D and cost-sharing with the private industry proved essential for the shale gas success.

As a result of the shale gas boom, natural gas prices dropped from around 9 USD per MMBtu in 2008 to less than 3 USD per MMBtu. According to the Energy Information Administration, the percentage of shale gas in the natural gas production is projected to more than double from its current 23% (2010) to 49% in 2035.

> *"It was public research dollars, over the course of thirty years, that helped develop the technologies to extract all this natural gas out of shale rock - reminding us that Government support is critical in helping businesses get new energy ideas off the ground."*
>
> - Barack Obama, President, USA in his Union Address

8 U.S. Energy Information Administration

Consumption and production of natural gas in USA



Source: U.S. Energy Information Administration

Major milestones in the shale gas success story[9]

1970s — Declining USA domestic gas production, MERC and the Bureau of Mines initiate the **Eastern Gas Shales** Project, a series of **public-private shale drilling** demonstration projects

1976 — Two **MERC** engineers patent early technology for **directional drilling** in shale

1977 — **Department of Energy** (DOE) successfully demonstrates **massive hydraulic fracturing** (MHF) in shale

1980 — USA Congress creates **Section 29 – Production Tax Credit for unconventional gas**, providing an incentive of **0.495 USD per MMBtu** of natural gas produced from unconventional resources (lasted till 2002)

1986 — **First successful multi-fracture horizontal well** drilled by **joint DOE-private venture** in Wayne County, West Virginia

1991 — **Gas Research Institute (GRI) subsidises** Mitchell Energy's **first successful horizontal well** in the Texas Barnett shale

1998 — **Mitchell Energy** engineers achieve **commercial shale gas extraction**

2000s — Natural gas generation grows faster than any other resource, boom in shale gas production pushes natural gas prices to record lows

9 *Where the Shale Gas Revolution came from: Government's role in the development of hydraulic fracturing in shale by Alex Trembath, Jesse Jenkins, Ted Nordhaus, and Michael Shellenberger*

Besides the above key milestones, development of the electromagnetic telemetry and three-dimensional microseismic imaging, a geological mapping technology by Sandia National Laboratories and the public-private partnership between General Electric and the Energy Research and Development Administration to develop advanced drill bits to be used through the tricky shale formations were the other reasons behind Mitchell Energy (the pioneer in shale gas operations) being able to crack the Barnett shale.

The response of Dan Steward, Former Vice President, Mitchell Energy on how did the government pay for the first horizontal well, reveals the immense support offered to private companies in overcoming shale gas production barriers. Steward stated ***"Money wasn't given directly, but like on the horizontal well, Mitchell paid the cost of a vertical well, and government paid the rest. If the horizontal well cost 1.5 million USD, but the vertical was 800k, the DOE contributed the difference between the two. I don't know the exact numbers. But there was a contribution of money towards that well."*** [10]

5.3. Public-private partnership is the future

It is evident that joint industry-government partnerships resulted in substantial increase in domestic natural gas production for the US. Public-private partnership is the key to energy security for any country. The fiscal incentives provided by the US government such as Section 29 – Production Tax Credit for unconventional gas clubbed with the technological innovations of the private companies resulted in effective public-private partnership. The trust reposed by the US government in the capabilities of private companies laid the foundation for the development of a successful public-private partnership which resulted in the shale gas success. Trust is the cornerstone of any relationship especially when the public and private players, with seemingly conflicting interests, come together to explore the natural resources of the country.

The NELP laid down the foundation by granting parity between NOCs and private sector investors with respect to fiscal and contractual terms in the Indian E&P sector. It is now time to build further on it by promoting partnership between the government through NOCs and the private sector. The objective is to develop the sector leveraging on the strengths of each participant–the NOC, private sector investors and service companies–and provide opportunity to all stakeholders to achieve their objectives within the four corners of policy and production sharing contract. We believe that an attempt to build such synergetic partnerships takes time, but are rewarding. The partnerships are proposed to be voluntary, not obligated, giving room to each of the participants in the market to evaluate prospective partners and in that sense, assess complementarities on a case-to-case basis.

"The government got it really right. In terms of a symbol of effective public-private venture, it's shale gas."

– Terry Engelder, Professor, Penn State and one of Foreign Policy's 100 global thinkers in an interview with The Breakthrough Institute.

10 *Dan Steward in an interview with The Breakthrough Institute (TBI)*

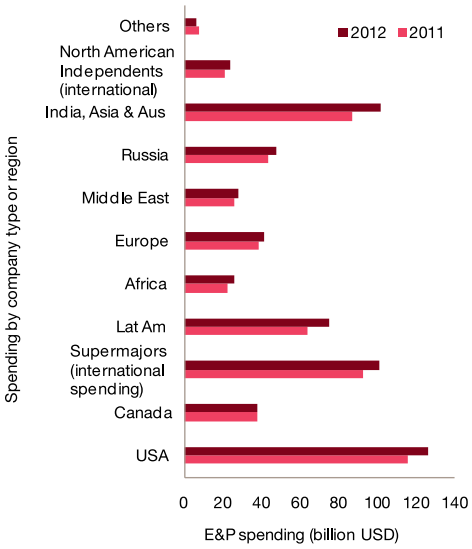
06

Role of the service sector in promoting the domestic E&P industry

6.1. Importance of services sector to E&P industry

The rising demand for crude oil has led to faster hydrocarbon resources development, thereby resulting in increased E&P spending. The global E&P spending is estimated to increase from 556 billion USD in 2011 to 614 billion USD in 2012[11].

Global E&P capital spending



Source: Barclays Global E&P Capital Spending Update

The typical spends of E&P operators on outsourced work to service providers is more than 60% of their total E&P costs which highlights the significance of service providers. The E&P service providers have played a key role in the success of E&P operators worldwide. India too relies heavily on the oilfield service providers. This reliance is expected to continue in the future if the country targets to explore and produce hydrocarbon resources from its vast sedimentary areas of 3.14 million square km[12].

In 2007, the Directorate General of Hydrocarbons (DGH) was forced to merge the duration of exploration phases-I and II in case of offshore blocks awarded during NELP III and NELP IV rounds. The reason was the non-availability of offshore rigs in the international market. For the same reasons the DGH was forced to push back the announcement of NELP VII round. This clearly establishes the importance of the service sector to the E&P industry.

Oilfield services cover a wide range of activities which originate from exploration and continue at every stage till the final delivery of crude to refineries. The E&P companies utilise the specialised services and latest technology offerings of the service providers to reduce the underground risks, thereby improving chances of success in E&P operations. The current oil and gas services market in India is dominated by foreign players such as Transocean, Schlumberger, Halliburton, Baker Hughes etc. The majority of the consumables and equipment or tools required in the different E&P activities are also imported. The Indian service providers and suppliers have a lot of catching up to do with their foreign counterparts in terms of technology, quality and skilled manpower.

11 Source: Barclays Global E&P Capital Spending Update
12 Source: DGH

The following inferences can be drawn as a result of India's underdeveloped local market for oilfield services:

- Hiring of services from outside India by the E&P companies so that the multiplier effect of this industry segment is absent in the national economy.
- India is missing an opportunity to claim its share in a market segment worth more than 300 billion USD[13].
- India is deprived of developing in-house skills within the sector due to the lack of recognisable presence of such an important industry segment in the country.

There are benefits to all the three stakeholders–the government, E&P and service companies if necessary steps are taken to promote oilfield services in India. The surge in investments as a result of foreign capital influx and the creation of numerous employment opportunities will benefit the government. It will result in better bonding between E&P and service companies. They will be able to develop a symbiotic relationship wherein E&P companies can get easy access to world-class technologies at affordable rates while the service companies will witness an increase in their revenues.

Key benefits to the stakeholders

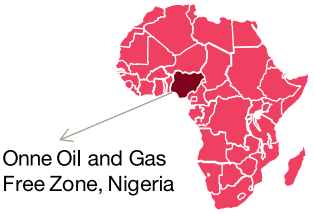
Government	E&P company	Service company
• Foreign investment • Capital growth • Technology transfer • Employment opportunities • Skills acquisition • Revenue generation • Industry diversification • Increased usage of local content	• Access to world-class technologies • Readily available trained manpower for various E&P services • Cost effectiveness • Time reduction in the procurement of equipment and services • Development of in-house skillset	• Reduced cost of operations • Increased revenues owing to the immense E&P potential in India • Establishing closer working relationships between E&P and service companies • Easy for service providers to understand the working environment

6.2. Steps taken by other countries to promote the oilfield service sector

There are many countries which are reaping the benefits of promoting the oilfield services sector. Some examples are as follows:

Onne Oil and Gas Free Zone, Nigeria

The Onne Oil and Gas Free Zone in Nigeria officially opened in March 1997. It was established by the Nigerian government to provide the ideal infrastructure to create a hub for oilfield services to assist not only the country's onshore and offshore fields but also to provide easy access to the entire West African oilfield operating regions. It is managed by DMS International Ltd and is the only free zone in the world dedicated solely to the oil and gas industry. It combines the effectiveness of the private sector with the required commitment and support of the Federal Government of Nigeria[14]. Following are the incentives available to the investors in setting up operations in the Onne Oil and Gas Free Zone:



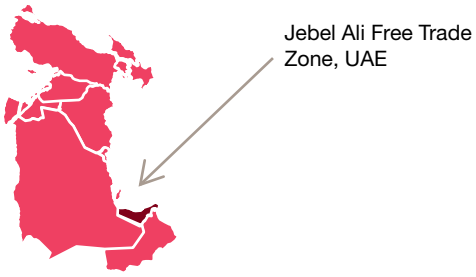
Specific advantages of Onne	• Strategic location • Good infrastructure facilities • Customs privileges for goods consigned to Onne Oil and Gas Free Zone, including goods in transit to other West African territories. • No pre-shipment inspection – goods are not consigned to Nigeria • Duty-free stock, equipment, spare parts and pipes • No double handling in and out of Nigeria • Access to major projects onshore, offshore and regional • Cost-efficient operations • Sophisticated oil service centre support
General advantages	• Quick and simple registration procedures • No red tape • Faster services • Easy cargo customs clearing procedures • Fast track procedures at port and airports for all visiting and Free Zone expatriate personnel
Standard free zone incentives	• Hundred per cent import and export tax exemption • Hundred per cent exemption from commercial levies • Hundred per cent repatriation of capital and profits • Hundred per cent foreign company ownership • Leases available from five to 21 years • No quotas for expatriate employees
Taxation	• No corporate taxes • No personal income taxes • No VAT • No withholding taxes • No levies
Logistics centre	• Easy clearing process • Duty-free status for imports • Pre-shipment inspection in the free zone • Duties paid on goods exported to Nigeria • Sea-air logistics • Minimal bureaucracy

As a result of the various incentives offered by the Onne Oil and Gas Free Zone, it has been able to attract over 140 major companies and create over 30,000 jobs (directly and indirectly). It has also resulted in the transfer of technological skills to Nigeria, increase of local content within the hydrocarbon industry and substantial revenue savings for the government.

13 Source: PwC Analysis and a Presentation on Oilfield Equipment & Service by Spears & Associates
14 Presentation given by the Onne Oil and Gas Free Zone

Jebel Ali Free Trade Zone, UAE

It offers customers world-class infrastructure combined with quality value-added services and incentives. The excellent facilities and the customer-centric approach at JAFZA resulted in it being honoured as the 'Logistics Hub of the Year' at the sixth annual Supply Chain and Transport Awards (SCATA) 2012. The World Bank has identified UAE as one of the least cumbersome countries to set up a new business[15].



- World-class infrastructure
- Strategic location
- Absence of red tapism and corruption
- Favourable tax benefits
- Hundred per cent foreign ownership allowed
- No restrictions on hiring foreign workers

Malaysia and Singapore

The countries are preferred by oilfield service providers to set up base locations as they are strategically located and provide some of the best infrastructure available in the world. The simplified legal framework adds to the countries allure. Malaysia is regarded as a hub for fabricating offshore platforms and decks, while Singapore acts as an oil rig building yard hub.

- Hub for fabricating platforms and decks
- Strategic location
- Low direct tax rate
- Simplified legal framework
- Companies in Free Industrial Zones (FIZs) allowed duty free import of raw materials, parts, machinery and equipment directly required in the manufacturing process
- Exemptions from import duty, sales tax and excise duty
- Fabrication facilities fall within the list of activities eligible for consideration of pioneer status or investment tax allowance under promotion of investment act 1986

- Oil rig building yards hub
- Cost-effective in terms of operational costs, property costs, taxation benefits
- Strategically located
- Logistics support
- Good infrastructure
- Minimum administrative procedures for imports and exports
- Keppel and SembCorp Marine, the world's largest and second largest builders of offshore oil rigs by volume, are located in Singapore

15 According to a recent report, the World Bank stated that only 29 days is needed to set up a new business in the UAE

6.3. The way forward

There are a number of deterrents in India becoming a hub for oilfield services. Red tapism and lack of proper infrastructure facilities are the main challenges faced by service companies in setting up shop in the country. Faster regulatory processes along with proper infrastructure will go a long way in attracting the champions of the service sector. Some of the problems faced by service companies in India and the possible ways to combat them are as follows:

Problem	Possible solution
1. Red tapism and slow cumbersome regulatory processes involving a lot of paperwork as follows: • Difficulties in obtaining essentiality certificate • A new essentiality certificate is required in case the tools/ equipments are to be used for a different operator in India	1. Faster regulatory processes such as the following: • Faster processing of requests for obtaining an EC • To overcome the inordinate delays in processing an EC for the same service equipment hired or used by more than one company, it can be granted at one go for the complete chain of contracts already tied up while importing the equipment
2. Poor infrastructure	2. Good quality road and rail links, quality housing for Indian and expatriate communities
3. Absence of ancillary fabricating and manufacturing industries	3. Setting up of medium and small scale ancillary fabricating and manufacturing industries to promote oilfield services sector
4. Lack of marketing of its true E&P potential	4. Marketing E&P discoveries to excite service companies to ramp up their activities in India
5. Lack of E&P related financial data in India	5. E&P related financial data to be made available in a more transparent manner so that service companies can assess the true market potential of India
6. High taxes and duties	6. Fiscal incentives to promote services sector

6.4. Conclusion

The oilfield services sector is the key stakeholder in the E&P landscape of a country. Service companies not only relieve the operators of the stress of having to develop in-house expertise around these operations, they also undertake proactive research and development bringing innovative ideas which result in increased operational efficiencies and lower overall costs. The absence of these service providers creates operational voids which in some cases have led the government to resort to policy level interventions to condone resulting delays in work programme and even postponing a NELP bid round. Therefore, India can ignore oilfield service providers only at its own peril.

The imperative of having such service providers in your backyard is further strengthened with the ambition of India to explore and harness its unconventional hydrocarbon resources. Shortage of equipment and experienced service providers will serve as a major bottleneck for shale gas development in India. The benefits of promoting home-grown talent in the field of specialised services such as hydraulic fracturing and horizontal drilling, which are used extensively in tapping the shale gas reserves, laid the foundation for successful commercial production of shale gas in the US. Despite the importance and significant involvement in shale gas operations, the draft shale gas policy is silent on the oilfield services sector.

India, therefore, will do well to create an enabling environment for the service companies to set up base in India. The tangible and non-tangible benefits of such an initiative can be gleaned from the success stories scripted by Nigeria through promoting an oilfield services hub and by Singapore becoming a rig building yard hub.

07

Role of states in development of E&P industry

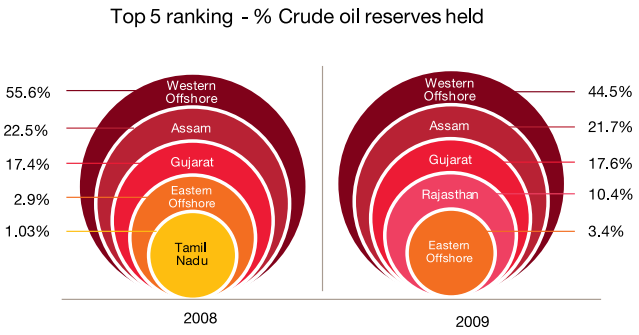
7.1. Success stories

The domestic upstream industry is capable of not only improving the energy security situation at hand but at the same time prove to be of great economic value. Since the discussions, till now, have largely been introspective or hypothetic, it becomes worthwhile to highlight real examples of how this sector has added and continues to add value to some of India's state economies.

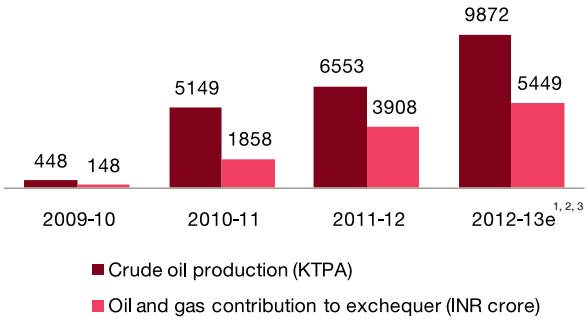
7.1.1. Rajasthan

As depicted below, Rajasthan was not on the map of petroleum producing states till recently when in 2009-10 it started producing crude oil from the Barmer district following the discovery in 2004.

Rajasthan in Top 5 crude oil reserves state ranking



Oil production and related state revenue receipts



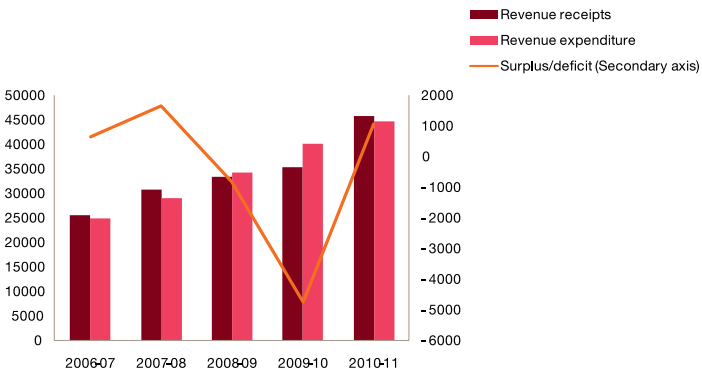
Source: Chapter 7, PNG statistics, 2009, MoPNG monthly productions, Directorate general of petroleum, Rajasthan website and Oxford Institute for Energy studies August 2011 publication - 'Oil revenues and economic development: The case of Rajasthan, India"

1 *Average state take in oil revenues expected to be around$9.6/bbl @ $100/barrel of crude oil price (Analysis drawn from Oxford study as mentioned in the chart)*

2 *Average production assumed for FY 13: 214 kbpd (60% - 40% weighting to current production levels (175 kbpd) and as estimated by the operator in CY 13 (240 kbpd) respectively.*

3 *Average state take in oil revenues expected to be around$14.8/bbl @ $100/ barrel of crude oil price (Analysis drawn from Oxford study as mentioned in the chart)*

Rajasthan state economy: revenue deficit to revenue surplus

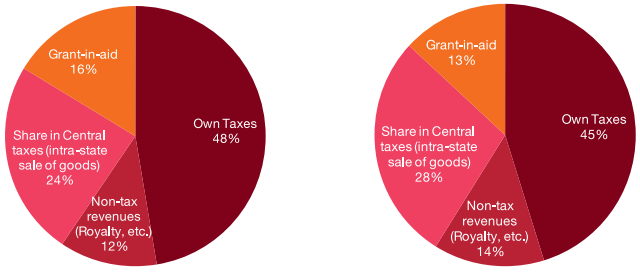


Source: Rajasthan Economic Review 2011-12

As shown in the figure above, the spike in revenue receipts in 2010-11 has helped the Rajasthan government tide over a huge revenue deficit and turn into a revenue surplus state. To prove this, consider royalty and central sales tax (tax on sale of inter-state sale of goods) which form two major components of oil production revenue for the state government. These are designated within the revenue receipts as part of the 'non-tax revenue' and 'share in central taxes'. Clearly, as depicted in the illustration below (pie-charts), there's a growing contribution from the above two components to the overall revenue receipts collected by the state government. It is no surprise then that over the last three years (2008-11), these two components have grown the fastest amongst the revenue receipt categories.

Pie trend showing revenue receipt break-up

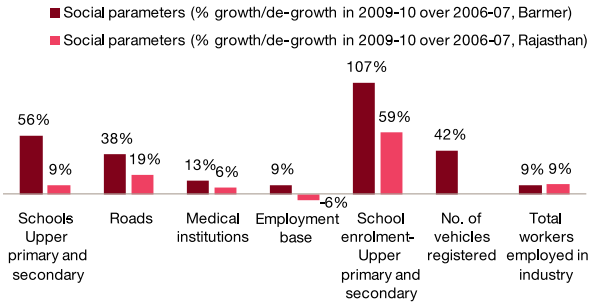
2004-05 **2010-11**



Source: Rajasthan Economic Review 2011-12, 2007-08

Besides the state economy, the district of Barmer has also done well as discussed in the socio–economic survey of 2010-11.

Barmer progress on social infrastructure (2006-07) vis-a-vis that of Rajasthan



Source: Socio-economic statistics (2010-11, 2006-07)

The state and central government have together played an equally important role via simultaneous rolling out of the National Rural Employment Guarantee Scheme (NREGS) policy which covered Barmer in the second leg (2007). This ensured, in some ways, an element of local content in the employment opportunities that have been generated and will continue to do so. Additionally, in Barmer, the oil operating companies have partnered with the multilateral funding agencies for the development and training in vocational skills and to provide alternative means for generating income. In future, these programs are expected to bring out the potential small-to-medium enterprise (SME) pool to service the oil operating companies in Rajasthan and elsewhere.

The case study, though a recent one, is not the only real example how a state can benefit from petroleum operations. Its neighbouring Gujarat can serve as another example where petroleum operations (upstream as well as downstream) have done a great service to the overall development of the state economy.

7.2. Emergence of state oil companies

While, regulation and development of oilfields and mineral oil resources; petroleum and petroleum products is a union subject under the Constitution of India, involvement of states in exploration and production of oil and gas can provide the much needed impetus to the growth of E&P industry and encourage participation by private sector players.

The oil and gas reserves as well as their production in India (excluding offshore locations) is limited to a handful states viz. Gujarat, Andhra Pradesh, Tamil Nadu, Rajasthan, Assam and the North Eastern States.

Lessons could be learnt from Andhra Pradesh and Gujarat where state-owned companies have done exceedingly well and are instilling confidence in the private investors regarding the government's commitment towards the development of E&P industry.

The government of Andhra Pradesh has formed the Andhra Pradesh Gas Infrastructure Corporation Limited (APGIC) with participation from the Andhra Pradesh Industrial Infrastructure Corporation (APIIC) and Andhra Pradesh Power Generation Company (APGENCO) for exploration and production in the Krishna Godavari basin. The APGIC has won four blocks in the KG Basin in the NELP VIII round. The APGIC owns 10% equity in all the blocks with other 90% being vested with partners such as British Gas, ONGC and NTPC. According to the estimates in the Socio-Economic Survey for FY 2011-12 of Andhra Pradesh, APGIC's share of spending in the four blocks is expected to be 40.5 million

USD. Further, the APGIC is also planning to participate in bids for city gas distribution networks proposed in Andhra Pradesh by the Petroleum and Natural Gas Regulatory Board, New Delhi. The APGIC has incorporated a wholly-owned subsidiary named Andhra Pradesh Gas Distribution Corporation (APGDC). It is expected that eventually the shareholding in APGDC will be offloaded to GAIL (25%), to public and private participants (50%) with the balance 25% being retained by the APGIC.[16]

In Gujarat, oil and gas production collectively constitutes around 80% of the monetary value of minerals produced in the state[17]. Its infrastructure development plan– 'Blueprint for Infrastructure in Gujarat 2020 (BIG 2020)' envisages an investment of 123,366 crore INR till 2020 in the development of gas sector. The sector constitutes over 10% of the total investment envisaged by BIG 2020. The state government owned Gujarat State Petroleum Corporation (GSPC) is an oil and gas exploration, development and production company that owns 64 oil and gas blocks - 53 in India and 11 internationally [18]. Within India, the GSPC is not only present in the state but also in the KG Basin, Andhra Pradesh. Further, Gujarat State Petronet Limited (GSPL), a group company of GSPC, is the nodal organisation responsible for development of gas grid on common carriage basis. Other group companies of GSPC such as GSPC LNG (set up to establish the Mundra LNG terminal) and GSPC Gas (distributor of piped gas) represent wide presence of GSPC across the supply chain.

7.3. Conclusion

Given the need to boost development of domestic oil and gas industry in an energy starved nation like ours, State Governments need to proactively participate in development of oil and gas industry to instill confidence of private participants in the State's endeavors and thereby ensure success of public/private partnerships.

16 Socio Economic Survey of Andhra Pradesh, 2011-12
17 Table 4.6, Socio Economic Survey of Gujarat, 2011-12
18 Socio Economic Survey of Gujarat, 2011-12

Appendix A: Abbreviations

ANP	Agencia Nacional de Petroleo
APGDC	Andhra Pradesh Gas Distribution Corporation
APGENCO	Andhra Pradesh Power Generation Company
APGIC	Andhra Pradesh Gas Infrastructure Corporation Limited
APIIC	Andhra Pradesh Industrial Infrastructure Corporation
BBOE	Billion Barrels of Oil Equivalent
CAD	Current Account Deficit
CB	Campos Basin
CNPE	Conselho Nacional de Politica Energetica
CST	Central Sales Tax
DGH	Directorate General of Hydrocarbons
DOE	Department of Energy
E&P	Exploration & Production
EIA	Energy Information Administration
FDI	Foreign Direct Investment
FIIs	Foreign Institutional Investors
FIZs	Free Industrial Zones
GAIL	Gas Authority of India Limited
GDP	Gross Domestic Product
GRI	Gas Research Institute
GoI	Government of India
GSPC	Gujarat State Petroleum Corporation
GSPL	Gujarat State Petronet Limited

HVJ	Hazira-Vijaipur-Jagdishpur
IEA	International Energy Agency
IOCs	International Oil Companies
KG	Krishna Godavari
KTPA	Kilo (‘000) tonnes per annum
LNG	Liquiefied Natural Gas
MBA	Mangla-Bhagyam-Aishwarya
MERC	Morgantown Energy Research Center
MHS	Massive Hydraulic Fracturing
MMBTU	Million Metric British Thermal Units
MMT	Million Metric Tonnes
MMTPA	Million Metric Tonnes per annum
MoPNG	Ministry of Petroleum and Natural Gas
Mtoe	Million tonnes of oil equivalent
NPD	Norwegian Petroleum Directorate
NELP	National Exploration and Licensing Policy
NOCs	National Oil Companies
NREGS	National Rural Employment Guarantee Scheme
OAPEC	Organisation of Arab Petroleum Exporting Countries
OIDB	Oil Industry Development Board
ONGC	Oil and Natural Gas Corporation
PMT	Panna- Mukta -Tapti
PNG	Petroelum and Natural Gas
PNGRB	Petroleum and Natural Gas Regulatory Board
PSC	Production Sharing Contract
PTIM	Pre-tax Investment Multiple
SCATA	Supply Chain and Transport Awards
SME	Small-to-medium enterprise
VAT	Value Added Tax

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