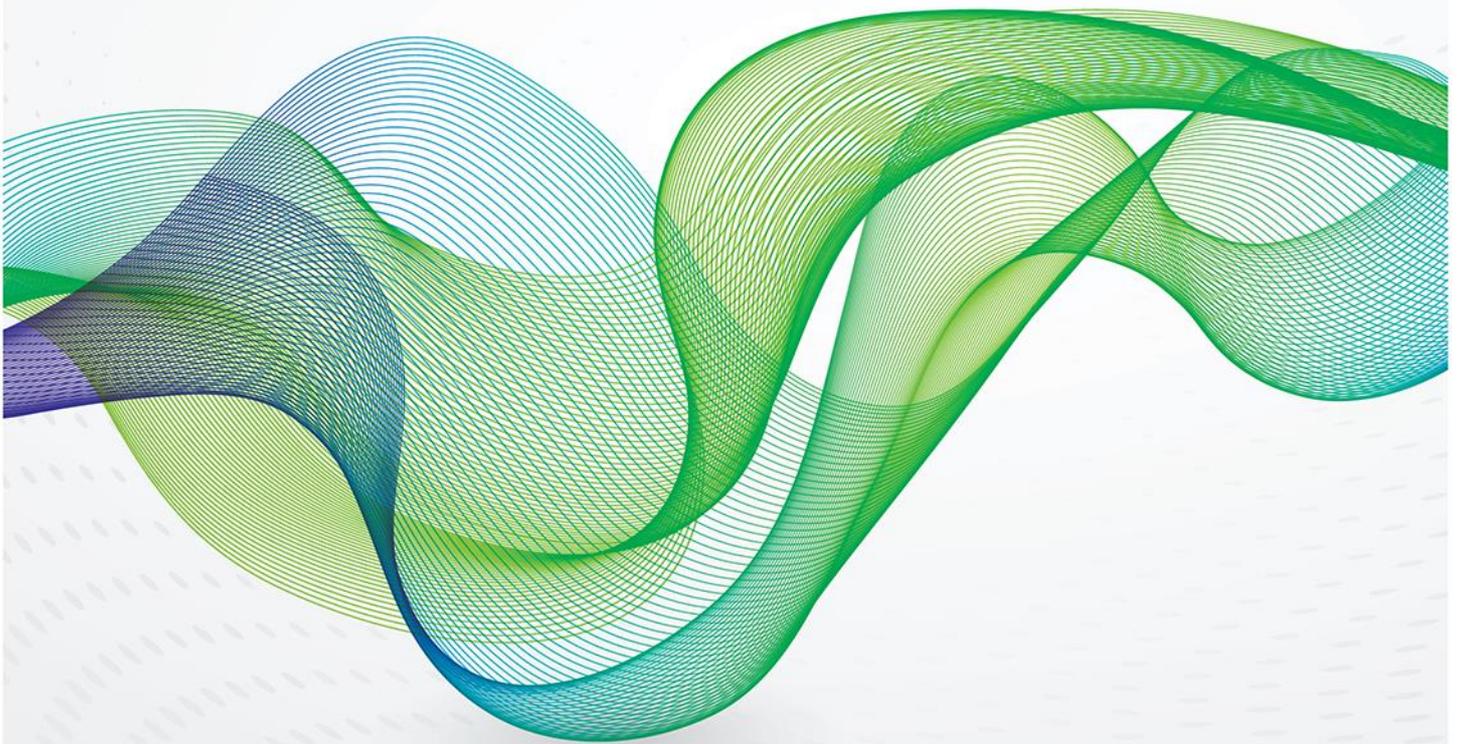


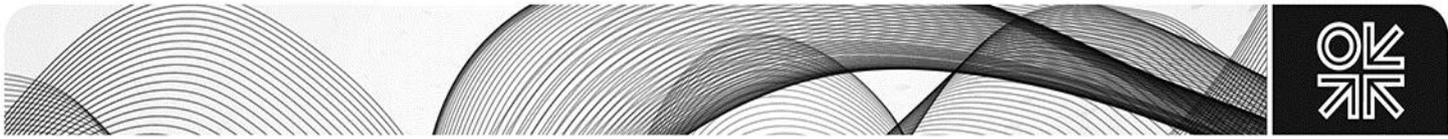


THE OXFORD
INSTITUTE
FOR ENERGY
STUDIES

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India's Upstream Revival – HELP or Hurdle?





1. Introduction

Following several years of stagnation, India's government is attempting to revive its upstream exploration sector through the launch of a new Hydrocarbon Exploration Licensing Policy (HELP).¹ This has four features: first, a single or 'uniform' licence for the exploration and extraction of all conventional and unconventional hydrocarbons from an entire contract area – with the aim of reducing administrative costs. Second, 'open acreage licensing' which permits public and private sector exploration companies (international and domestic) to identify and bid for acreage all year round, rather than limiting this to periodic government-administered bidding rounds (that often end up being delayed) for acreage. Open acreage licensing, a longstanding objective of the Indian oil ministry, is meant to shift the onus for momentum in exploration activity onto companies, but it has been continually delayed due to the absence of a national repository of geological data (a requisite component of such a policy) which is now reportedly nearing completion (Sen and Chakravarty, 2013; DGH, 2014).² A third feature is the replacement of the Production (profit) Sharing Contract (PSC) with a Revenue Sharing Contract (RSC) under which the government will receive a share of revenues, rather than a share of profits, from production. This, along with biddable work programme commitments, will be the main parameter for the awarding of licences under HELP. This particular change to the fiscal regime is primarily intended to prevent the recurrence of past disputes and arbitration relating to cost recovery prior to the sharing of profits,³ but arguably it also reflects India's former, limited capacity to regulate and administer PSCs.⁴ Finally, under HELP, companies have commercial freedom to sell their production at market-oriented prices within the domestic economy (PE, 2016).⁵

The first test of the new regime is a round of auctions for 67 'marginal' fields spread out over 46 contract areas, which are estimated to contain roughly 625 Mboe of in-place reserves.⁶ These fields previously formed part of the legacy assets⁷ held by India's National Oil Companies (NOCs) but they have never been developed – for reasons such as the lack of 'niche technologies and specialized project management skills' (PE, 2016). However, despite the launch of the new policy – the most significant reform of the country's upstream fiscal regime seen to date – India's upstream sector is still characterized by certain features which have impeded past performance and which could yet be a hurdle to implementation. The new policy also raises the important, broader, question of the role of the upstream sector within the country's long-term energy mix.

The author is grateful to Bassam Fattouh, Amrita Sen and Ieda Gomes for comments/help on a previous draft.

¹ See Resolution O-32011/4/2013-ONG-I, Ministry of Petroleum and Natural Gas, Government of India, 30 March 2016. [Available at www.petroleum.nic.in/docs/HELP.pdf.]

² See National Data Repository, Directorate General of Hydrocarbons. [Available at www.ndrdgh.gov.in/NDR/.]

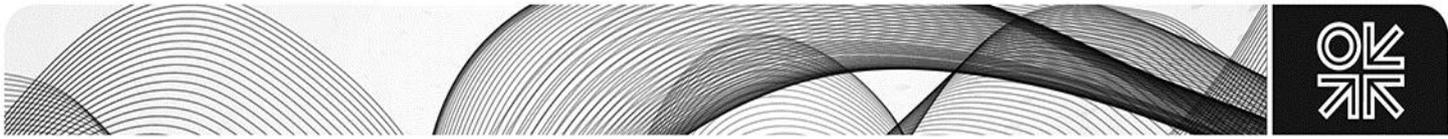
³ See Jain (2012; 139–41).

⁴ Johnston and Johnston (2015) provide a critique of profit sharing versus revenue sharing fiscal systems in the Indian context.

⁵ The benchmark for crude oil pricing is the Indian crude basket price (published free on board prices of averaged Oman/Dubai crude oils for sour grade and Brent (dated) for sweet grade) and for gas pricing, a formula consisting of a weighted average of international benchmarks is used (see Sen, 2015).

⁶ These include oil, and oil-equivalent gas (O+OEG). India's proved oil reserves are estimated at 5.7 billion barrels and its gas reserves at 1.4 trillion cubic metres.

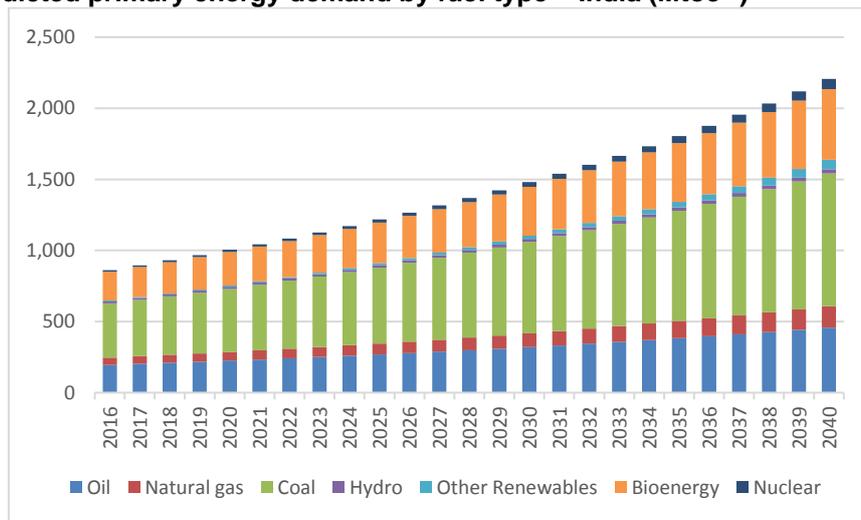
⁷ Legacy assets were part of the earliest field offerings under a fiscal system called the 'Nomination Regime' under which NOCs 'nominated' acreage which they wished to explore; they were then awarded these directly by the government. This Regime did not permit private participation and NOCs operated under a cost-plus model. The Nomination Regime was replaced in the early 1990s with the 'Discovered Fields' Regime which was based on PSCs; private participation was permitted, with 30% carried interest by NOCs. This was followed by the liberalized New Exploration Licensing Policy (NELP) regime in 1998/99 (also PSCs) and in 2016 this was replaced by HELP (RSCs). See Jain (2012) for a discussion on the evolution of India's upstream fiscal regime.



2. The upstream sector within India’s energy policy – how relevant?

A question that immediately arises is: why is India attempting to revive domestic oil and gas exploration, particularly after years of stagnation,⁸ and at a time of low oil prices? Combined with the fact that the country is also engaged in one of the world’s largest attempted expansions in renewable energy (especially solar),⁹ this presents a particularly pertinent query. Part of the answer is that the two potential energy sources (renewables and hydrocarbons) are not seen as being mutually exclusive by Indian policymakers. The underlying goal for Indian energy policy is to meet its massive predicted expansion in primary energy demand as the country enters a threshold level (\$4,000–\$10,000) of per capita income (beyond this point, energy consumption begins to grow exponentially, before eventually plateauing¹⁰). Another goal is to resolve government concerns over a potential rise in energy imports (and their associated fiscal costs) concurrent with rising demand (Ghosh, 2016). The IEA¹¹ predicts that India’s primary energy demand will more than double by 2040, accounting for a quarter of the rise in global energy demand by the same time (Figure 1). The shares of coal and oil (the two largest commercial energy sources) in primary energy demand are predicted to continue to rise (to 49 and 24 per cent, respectively) marginally from 2013 levels. Barring a massive injection of investment into upgrading India’s energy infrastructure, supported by extensive electricity reform (Sen, 2016), the share of renewables (excluding hydro and bioenergy) is predicted to rise from below 1 per cent in 2013 to 3 per cent within primary energy demand by 2040 – very low relative to other sources.¹² These shares are out of line with current policy ambitions on renewables, implying that India could default to a continuing dependence on fossil fuels.

Figure 1: Predicted primary energy demand by fuel type – India (Mtoe¹³)



Source: Author; using assumptions from IEA (2015, 465)

These long-term forecasts show a continuing role for hydrocarbons in India’s future energy mix. However, it can be argued that forecasts are at best based on a set of assumptions and do not consider any mandatory carbon constraint on energy consumption – for instance via the imposition of a ‘peaking emissions’ (or similar) target on India through international climate treaties. Such a target, if accepted by India, would primarily impact upon India’s plans for coal, the share of which remains disproportionate

⁸ For example, actual expenditure on exploration and development declined from \$12.4 billion in the first round of NELP to \$0.07 billion by the ninth and final round (DGH, 2014).

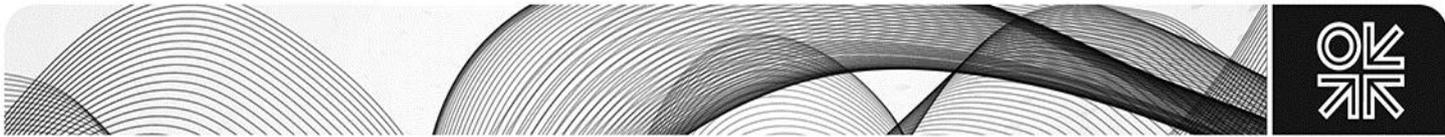
⁹ See Sen (2016).

¹⁰ This is most evident in relation to oil consumption in transportation, as higher per capita income leads to exponential growth in the vehicle ownership fleet. Empirical studies have modelled this as an ‘S’ curve (Dargay et al., 2007).

¹¹ See New Policies Scenario (IEA, 2015, 462).

¹² This is despite an assumed expansion in non-hydro renewable installed power capacity: for solar PV from under 1% to 17% by 2040, and for wind from 8% to 13% by 2040. See IEA (2015, 638).

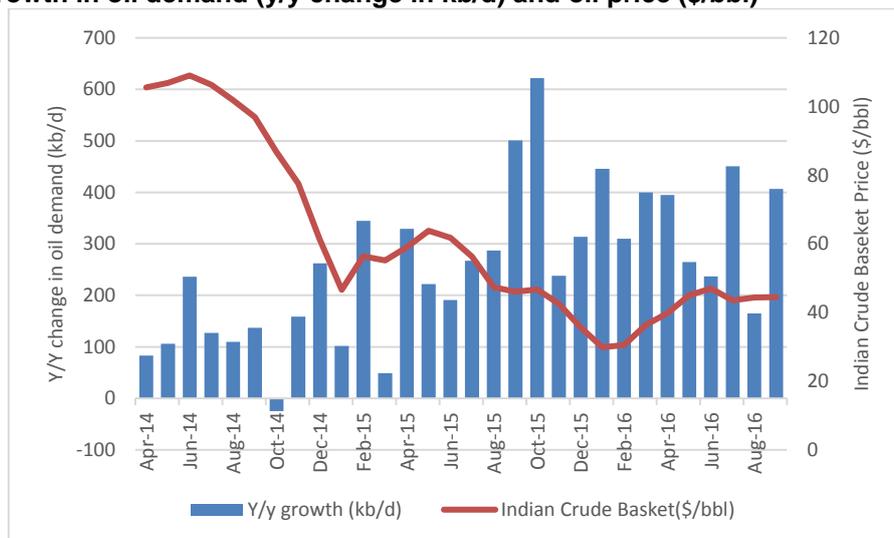
¹³ Million tonnes oil equivalent.



to other fuels in the planned energy mix. Recent growth in year on year (y/y) oil consumption, however, already appears to reflect the expected surge in demand. In 2015, India overtook China as the driver of non-OECD (and by extension, global) oil demand growth, with y/y growth doubling to 0.3 mb/d (see Figure 2) from a previous 10 year average of 0.1–0.15 mb/d.¹⁴ Although some of the upsurge can be attributed to lower prices (and hence the increased affordability of oil to consumers), this has occurred despite the removal of oil product subsidies and the imposition of excise duties on oil consumers, which implies that Indian consumers had been paying prices at the pump that were higher than the international crude price.¹⁵ Sen and Sen (2016) identify three underlying drivers of oil consumption in India:

- The motorization of its economy as India enters the stage of per capita income (\$4,000–\$10,000 PPP) after which vehicle ownership begins to grow exponentially before peaking and plateauing.¹⁶
- The push to increase manufacturing from 15 to 25 per cent of GDP by 2022 is expected to increase oil consumption in manufacturing by at least a third from current levels, based on a conservative linear estimate.¹⁷
- The government’s current infrastructure building programme (which targets the building of 30 km of roads per day until the end of the decade) could also lift oil consumption in transportation.¹⁸

Figure 2: Growth in oil demand (y/y change in kb/d) and oil price (\$/bbl)



Source: Petroleum Planning and Analysis Cell (Government of India)

IEA (2015) estimates that even under a ‘low oil price’ scenario,¹⁹ rising demand and inadequate domestic production (proven reserves stood at 5.7 billion barrels out of total remaining recoverable

¹⁴ See Sen and Sen (2016).

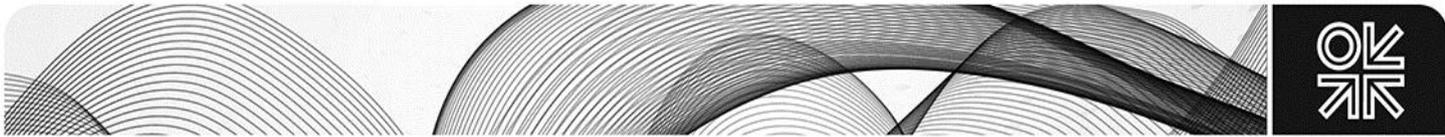
¹⁵ Retail prices in India from November 2014 to January 2015 stabilized at around \$70/bbl (Sen and Sen, 2016).

¹⁶ India’s car ownership levels are 20 per thousand people (similar to China in the early 2000s), compared with 850 per 1000 for advanced countries such as the USA. Two-wheeler ownership (indicative of new entrants to the personal transportation fleet), has been growing at double digit rates through 2015 and 2016.

¹⁷ From roughly 13 million tonnes (Mt) to 17 Mt. A more sophisticated forecast may yield different results. The ‘Make in India’ policy particularly targets energy-intensive sectors (Sen and Sen, 2016).

¹⁸ Sen and Sen (2016) state that these drivers are, however, subject to growing environmental pressures arising from concerns over urban air pollution.

¹⁹ This scenario assumes an oil price of \$50–\$60 until the mid-2020s, rising to \$85/bbl by 2040. The fiscal impact of rising imports is naturally lower in this scenario.

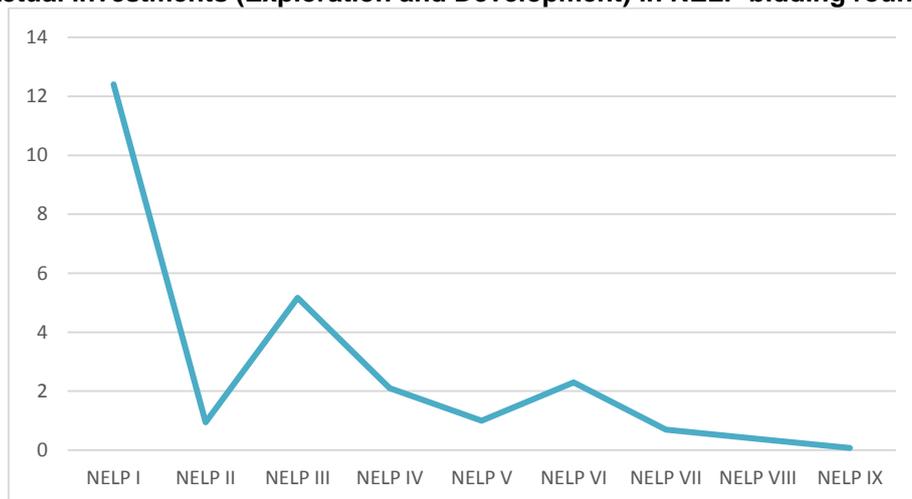


reserves of 24 billion barrels, while annual crude demand was 1.4 billion barrels in 2015) will increase India's net oil import dependency from roughly 74 per cent of domestic consumption to 91 per cent by 2040. Consequently, oil price volatility resulting from uncertainty in the global supply curve could potentially leave the Indian economy exposed.²⁰ These factors, along with promises to boost growth (and employment),²¹ have collectively prompted a drive towards energy independence within India's administration; this aims to reduce the country's oil import dependence by 10 per cent by 2022, and by 50 per cent by 2030, from current levels.²² One part of this strategy, for instance, has been to focus on expanding and filling up its Strategic Petroleum Reserve which, when completed, could hold roughly 40 Mboe (equivalent to around 10 days of imports, compared with 90 days in OECD countries).²³ Another part of this strategy has been to seek overseas investments in oil assets through its NOCs, which has not been very successful.²⁴ A third part has been to attempt to revive upstream oil (and gas) exploration through a reform of the fiscal regime.

3. Assessing past performance

India's previous attempts to attract upstream sector investments (particularly from the private sector) have been largely unsuccessful (see Figure 3), despite the fact that it presents a large and growing domestic energy market.²⁵

Figure 3: Actual investments (Exploration and Development) in NELP bidding rounds (\$bn)



Source: DGH (2014)

Two interrelated obstacles have arguably impeded past efforts to revive the upstream sector. The first is geology (the reserve base), and the second policy around the design of the upstream fiscal regime.

Geology and the Reserve Base

On geology, there continues to be considerable uncertainty over India's hydrocarbon resource potential, as a major proportion of its 3.14 million km² sedimentary basin remains unexplored. As shown in Figure

²⁰ Fattouh et al. (2016) analyse the dynamics of shale oil in relation to OPEC production strategy, arguing that uncertainty over the elasticity of the shale response implies that Saudi Arabia – OPEC's *de facto* leader – is unlikely to unilaterally cut output in order to maintain its market share, but that this strategy could change as new information arrives in the market. The 'loss of OPEC feedback' to balance the oil market could point to more volatile price cycles.

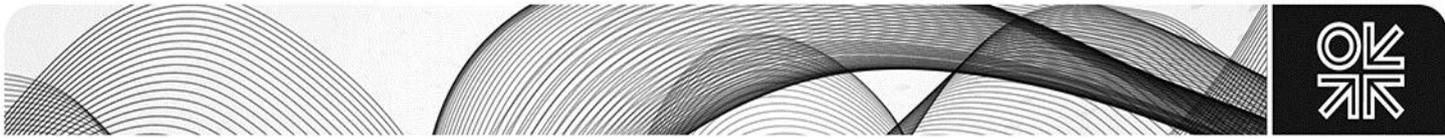
²¹ See 'Key Features of [Indian] Budget 2016–2017'. [Available at <http://indiabudget.nic.in/ub2016-17/bh/bh1.pdf>.]

²² See 'Modi calls for slashing oil, gas imports by 10% in next 7 years', *Hindu Businessline*, 27 March 2015. [Available at www.thehindubusinessline.com/economy/pm-says-india-should-try-to-cut-oil-imports-by-10-in-2022/article7039287.ece.]

²³ See Narula (2015).

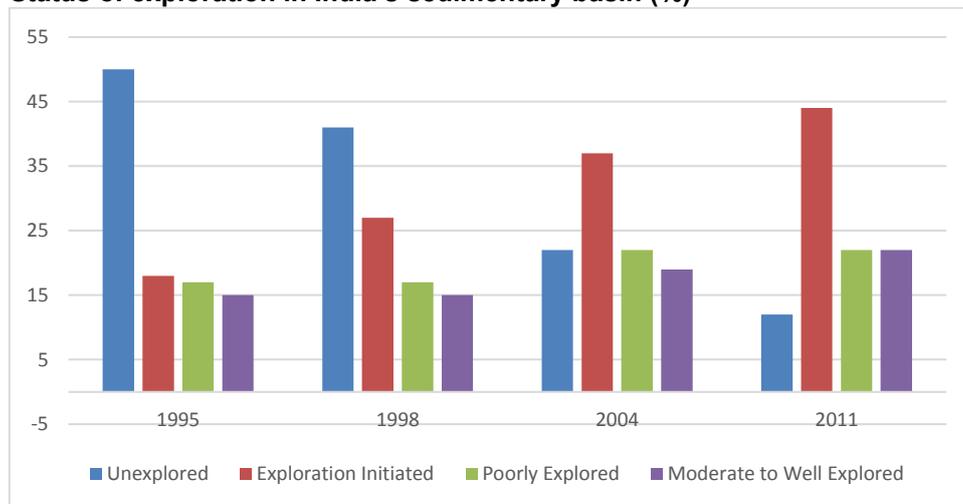
²⁴ See Mahajan. A. (2012) 'World Wide Woe', *Business Today*, 19 August, [Available at <http://www.businesstoday.in/magazine/features/overseas-problems-of-ongc-videsh-other-oil-companies/story/186797.html>]

²⁵ IEA (2015) estimates that 240 million people live without access to electricity.



4, the proportion of ‘unexplored’ acreage has reduced over the last two decades, with much of this being re-categorized as (or swapped into) the category ‘exploration initiated’. However, the proportions of ‘poorly explored’ and ‘moderately explored’ acreage have risen by a small amount over the same period; this implies that progress towards firmly determining the resource potential in the unexplored areas since exploration in them was initiated, has slowed.²⁶ For 2011, Figure 4 shows that the sum of ‘unexplored’ (12 per cent) and ‘exploration initiated’ (44 per cent) categories indicates that 56 per cent of the sedimentary basin remains unaccounted for; this rises to 78 per cent when ‘poorly explored’ acreage (22 per cent) is added in.²⁷ Of India’s ‘ultimate recoverable reserves’ (URR) of 34.4 billion barrels of oil, 5.7 billion barrels have been proven, and for gas, proven reserves are 1.4 trillion cubic meters (Tcm) out of 8.8 Tcm of URR (IEA, 2015).

Figure 4: Status of exploration in India’s sedimentary basin (%)



Source: Directorate General of Hydrocarbons

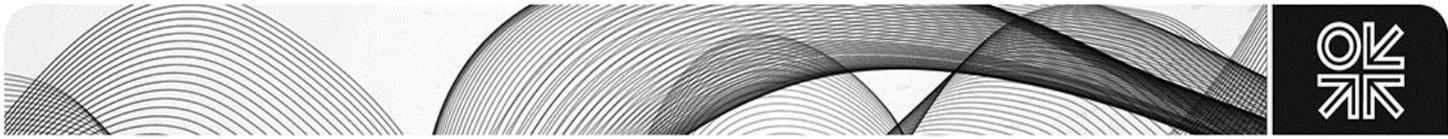
Policies relating to design of the upstream fiscal regime

Another underlying factor explaining the slow pace of exploration and discovery has been the design of policy around the upstream fiscal regime for auctioning acreage and monitoring progress. India’s fiscal system has evolved over the last few decades, with adjustments having been made to minimum work programme commitments and to technical and financial criteria for bidders. The earliest upstream policy regime was a closed ‘Nomination Regime’ under which NOCs could exclusively ‘nominate’, or express interest in, acreage that was perceived as potentially prospective, and were then allocated this by the government. NOCs operated in a cost-plus environment and no private participation was permitted under the regime. Until the elimination of most petroleum product subsidies (as of 2016), production from the Nomination Regime was also utilized to serve low-income consumers through its sale, at a discount, to Oil Marketing Companies in order to support retail subsidies. This further constrained NOC investments in exploration (but did not deter NOCs from participating in the NELP auctions in which they would arguably have faced similar financial constraints). Acreage held under the Nomination Regime is therefore akin to ‘legacy holdings’ of the NOCs and has been subject to different procedures from the competitive bidding rounds which later followed.

In the early 1990s, as production from nomination acreage began to plateau and NOCs came up against capital and technology constraints, the Nomination Regime was replaced by the ‘Discovered Fields’

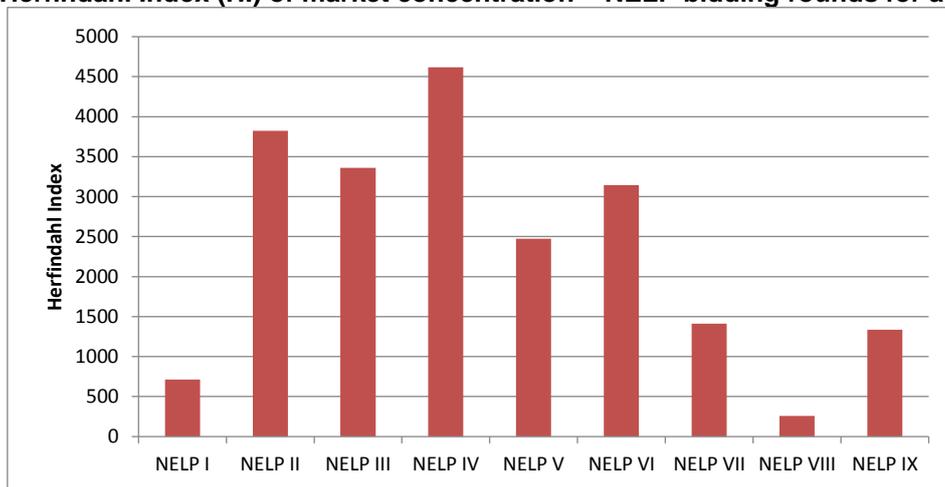
²⁶ Limited by data availability. However, Figure 4 covers most of the pre-NELP and all 9 NELP bidding rounds for exploration acreage. The government’s National Data Repository website maintains that ‘unexplored’ areas constitute 15% of the sedimentary basin as of 2016. See ‘Major Sedimentary Basins in India’, NDR website. [Available at https://www.ndrdgh.gov.in/NDR/?page_id=603.]

²⁷ Shallow water and onshore acreage makes up 1.8 million km² and offshore deep water acreage makes up 1.3 million km² (IEA, 2015).



(pre-NELP) regime. Under this new regime, areas of former nomination acreage which were thought to contain discoveries that had not been developed due to the aforementioned constraints, were auctioned to private companies with the NOCs retaining a 30 per cent carried interest. This was replaced by the liberalized NELP auctions from 1998/99 under which nine rounds of auctions were conducted between 1998/99 and 2009/10. The 2016 reform replaces NELP with the RSC-based HELP regime. Whilst it was intended that the NELP regime would provide a 'level playing field' for both NOCs and private exploration companies to bid for acreage, a large proportion of acreage under the nine NELP rounds was won by the NOCs – in addition to their existing (nomination) holdings. This led to a high level of concentration in upstream acreage – illustrated for the NELP rounds in Figure 5, which shows the (static) Herfindahl Index (HI) of Market Concentration for each NELP bidding round.²⁸ A market with $HI < 1000$ can be described as 'competitive'; as 'moderately concentrated' if $1000 < HI < 1800$; and as 'highly concentrated' when $HI > 1800$ (Iledare et. al., 2004). As seen in Figure 5, five out of nine rounds resulted in a highly concentrated market for upstream acreage (NOCs won a majority of the acreage on offer in at least three rounds²⁹). The HI was low in some rounds partly because a significant proportion of the acreage on offer did not attract any bids (around 50 and 60 per cent, for NELP I and VIII, respectively).³⁰

Figure 5: Herfindahl Index (HI) of market concentration – NELP bidding rounds for acreage



Source: Sen and Chakravarty (2013)

From the discussion above, it can arguably be inferred that NOCs have accounted for a considerable share of upstream (Nomination, pre-NELP, and NELP) acreage. The decline in investments illustrated in Figure 3, while reflecting a general decline in investor interest, could also be seen as a potential outcome of a highly concentrated market in upstream acreage – when investment commitments made by a small number of fiscally constrained players have a higher chance of remaining unfulfilled.

²⁸ The HI is defined as the sum of the squares of the market share of all participating firms in the lease auction market in a given period and can be described by the formula $HI = \sum_{i=1}^n (s_i)^2$ where s_i is firm i 's market share. The HI for each NELP round was calculated by looking at the winning bids in blocks for each NELP round and using the participating share in a block (measured by the percentage ownership in the total area of the block) of each company in any winning bid to work out its total share of acreage won in each NELP round.

²⁹ ONGC won roughly 60% of acreage on offer in NELP II, IV, and VI, and 40% in III.

³⁰ In NELP IX, although 34 blocks were bid out, 14 PSCs were signed, and around half of these went to NOCs. Four more PSCs were later signed (See 'Government signs 4 more oil and gas block contracts under NELP-9', *Economic Times*, 30 August 2012. [Available at http://articles.economictimes.indiatimes.com/2012-08-30/news/33499572_1_exploration-blocks-oil-and-gas-blocks-shallow-water-blocks.])

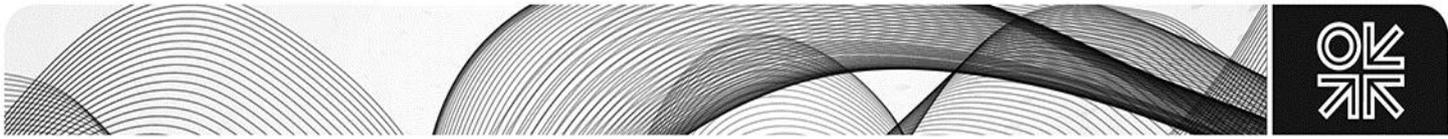
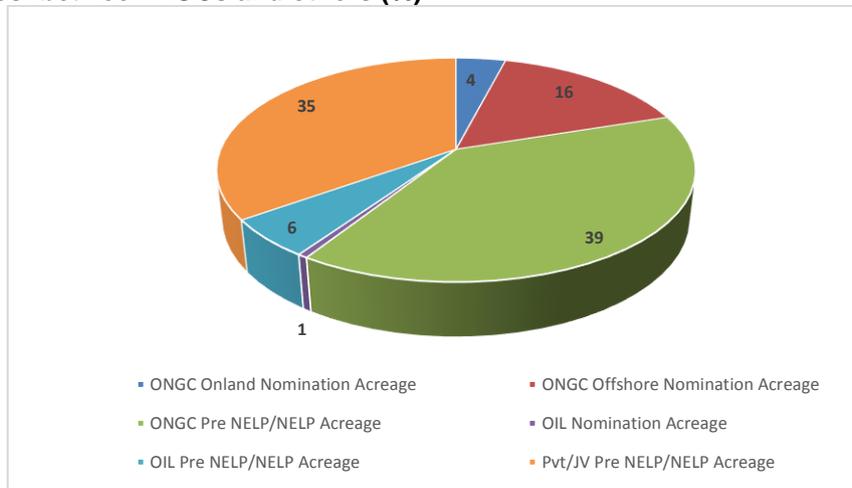


Figure 6: Distribution of petroleum exploration licences under Nomination, pre-NELP, and NELP Regimes: between NOCs and others (%)



Note: Covers approx. 214,881 km² of acreage
Source: Author, using data from DGH (2014).³¹

Figure 6 further demonstrates this concentration, showing that the majority (roughly 65 per cent, as of 2015) of licensed acreage was held by the NOCs – with Oil and Natural Gas Corporation (ONGC) accounting for around 60 per cent of this. Nomination acreage held by the NOCs formed a little over 20 per cent of total licensed acreage in the figure above. Nomination acreage made up around 34 per cent of ONGC’s acreage holdings (going by the figure above) and around 10 per cent of Oil India Limited’s (OIL) acreage holdings. The NELP regime arguably failed to improve the diversity of operators in India’s upstream, leading to a ‘holdup problem’.³²

The holding of a majority of acreage by the NOCs would not necessarily be an impediment were it not for the fact that NOC production has actually plateaued since the 1990s, and reserve accretion has been slow, with no new significant discoveries.³³ As the first part of Figure 7 shows (for ONGC), the accretion of ‘in-place’ reserves has been declining since 2009, while ‘ultimate’ (recoverable) reserve accretion has remained relatively static every year for the last decade. This has been accompanied by a gradual decline in capital expenditure since around 2010. The second part of Figure 7 also shows that NOC domestic production (of which ONGC accounts for roughly 70 per cent³⁴) of oil and oil-equivalent gas has remained relatively static over the last decade.

³¹ The latest publicly available data was as of 1 March 2015 and hence this graph is dated. However, given the slow turnover of exploration acreage, the overall picture is unlikely to have changed much at the time of writing. It should be noted that the data does not include CBM blocks or other types of mining licences and therefore the numbers may be understated.

³² See Sen and Chakravarty (2013) for a deeper analysis of the ‘holdup problem’, where areas of acreage that were bid out were locked up in contracts with little progress made in exploring them.

³³ Further, accurate data on relinquishment and the enforcement of relinquishment deadlines is scarce.

³⁴ See ‘Corporates and government should not have acrimonious ties: Oil Minister Dharmendra Pradhan’, *Economic Times*, 1 November 2016. [Available at <http://economictimes.indiatimes.com/opinion/interviews/corporates-and-government-should-not-have-acrimonious-ties-oil-minister-dharmendra-pradhan/articleshow/55167025.cms>]

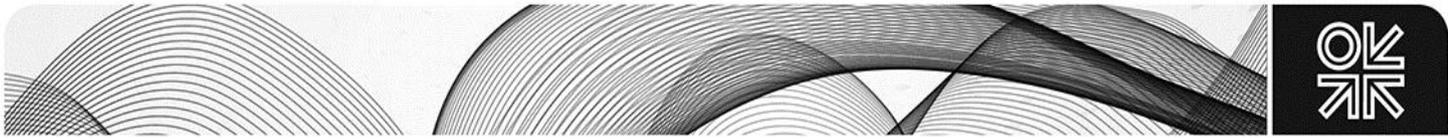
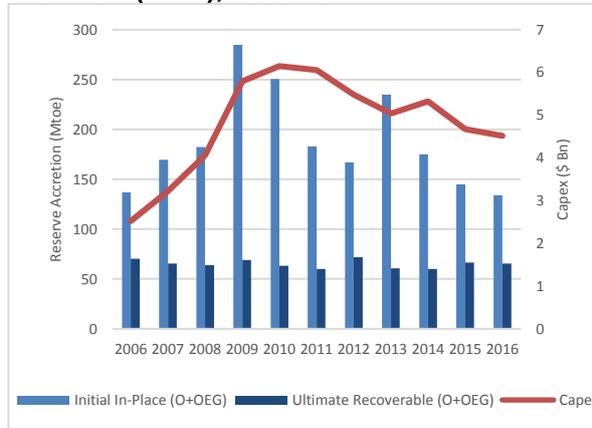
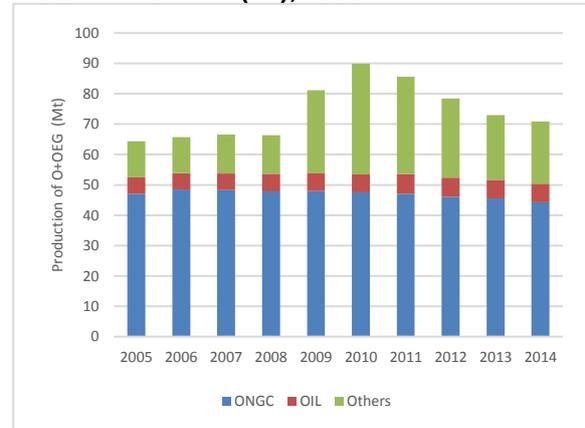


Figure 7:

ONGC capital expenditures (\$bn) and reserve accretion (Mtoe), 2006-16



Production of oil & oil-equivalent gas from NOCs and others (Mt), 2005-14



Source: ONGC Annual Reports (2007–15)³⁵; DGH (2005–14)

The map in Appendix 1 contains information on drilling intensity by basin – and Figure 8 shows wells drilled per basin (km² per exploration well). These show that the most intensive drilling activity is concentrated in basins with the most proven commercial productivity – Cambay, Cauvery, Krishna Godavari, Assam Shelf and Mumbai – and has also been largely limited to shallow water and onshore areas. Beyond these basins, the number of square kilometres per exploration well increases by nearly three times (for instance: from 593 in the Mumbai Saurashtra basin to 1,487 in the Rewa basin), indicating that insufficient exploratory work is being carried out beyond these areas to establish firm resource potential.³⁶

The map, together with Figure 8, suggest that the most ‘prospective’ basins (for instance, the Indo-Gangetic, Vindhyan, and Ganga sub-basin) have particularly sparse drilling activity, ranging from 1 well drilled per 16,483 km² in the Purnea-Brahmaputra-Indo-Gangetic basin to 1 per roughly 24,000 km² in the Ganga Basin.³⁷ Drilling intensity in India (as seen from Figure 8) is also low compared with other world regions; for instance, offshore drilling intensity in the US Gulf of Mexico basin has been estimated at around one well per 14 km² (IEA, 2015), in comparison with 261 km² for the Krishna-Godavari offshore basin. Procedures around drilling and relinquishment have also tended to affect the perception of the ‘quality’ of blocks, with mixed results. For instance, the rapid relinquishment of blocks following a failure to meet exploratory deadlines under the NELP may have led to those blocks being perceived as relatively less prospective. Conversely, Nomination Regime blocks that were relinquished by NOCs have subsequently been found to have significant discoveries of hydrocarbons when prospected by other non-state companies (Sen and Chakravarty, 2013).

³⁵ Data for financial years; ‘2P’ reserves.

³⁶ It should be noted that drilling density may differ within sub-basins as well, and the figures presented are basin-wide averages.

³⁷ In 2014, ONGC had roughly 8,592 km² of onshore nomination acreage; the majority (4,208 km²) of this lies in the Vindhyan basin, where drilling density at present is approximately 1 well per 17,364 km². Similarly, close to 50% of its offshore nomination acreage (totalling 34,324 km²) lies in the Kutch basin where drilling intensity at present is 1 well per 2,627 km² (DGH, 2014).

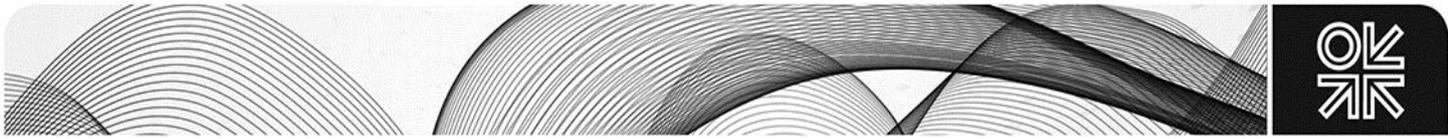
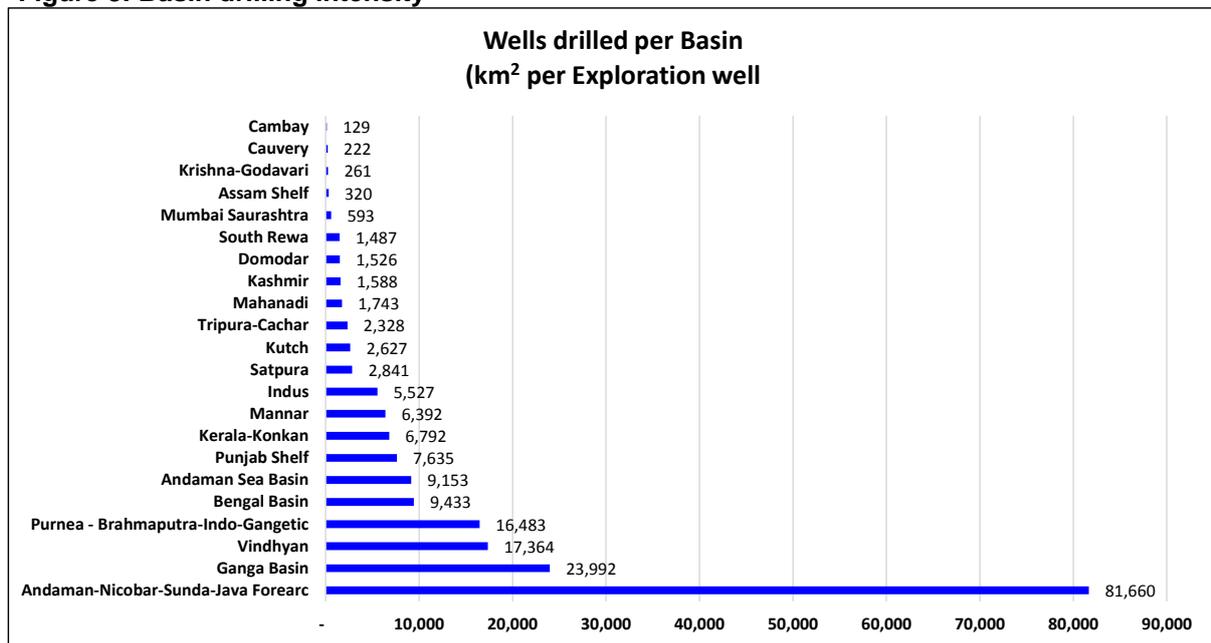


Figure 8: Basin drilling intensity



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It is evident that the underlying problem India has had with the slow pace of upstream exploration over the last decade is, in large part, related to the continuing lack of diversity amongst operators. The forthcoming 2016 marginal (oil and gas) fields auction represents an attempt by Indian policymakers to release some of the areas of former Nomination acreage held, but arguably underexplored,³⁸ by the NOCs. However, these marginal fields make up a small proportion (around 1,500 km²) relative to overall acreage and they are unlikely to impact exploration in a significant way. This has raised questions around the need to resolve the wider issue of reviving India's upstream sector – potential investors have questioned the economic viability of small fields³⁹ in a low-price environment. This has prompted the government to consider ways in which adjoining areas of acreage could also be opened up, particularly as – with the near-elimination of all petroleum product price subsidies⁴⁰ and the associated requirement for NOCs to sell 'nomination' crude at discounted prices to Oil Marketing Companies – the distinction made between the Nomination Acreage and acreage awarded under other (previous) fiscal regimes, is arguably less clear.⁴¹

4. Is India unusual? International experience in NOC-led upstream activity

The challenges faced by India in its efforts to revive upstream activity are informed by a set of characteristics which can be summed up as follows:

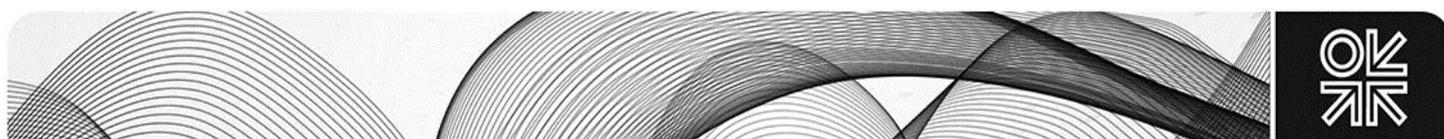
- India is a net oil importing/oil dependent country.
- The country has a high concentration of acreage with a small number of players (such as the main NOCs).
- There is declining upstream activity.
- Oil production (usually from NOCs) is stagnating.

³⁸ For various technical and economic reasons, as discussed earlier.

³⁹ 30 out of 47 blocks measure less than 25 km² and the rest less than 10 km².

⁴⁰ Barring kerosene and LPG for low-income households. Subsidies have been replaced by direct cash transfers.

⁴¹ See 'India mulls options to sweeten deals for marginal oil, gas fields', *Mining Weekly*, 11 October 2016. [Available at www.miningweekly.com/article/india-mulls-options-to-sweeten-deals-for-marginal-oil-gas-fields-2016-10-11.]



A question that then arises is whether there is comparable international experience. Table 1 lists world regions by their average production-to-consumption ratio of crude oil. This ratio is meant to depict *net oil dependence* – that is, to capture not just whether a country is a net importer of oil but also whether it is just ‘breaking even’ in terms of the production/consumption balance. Accordingly, in a preliminary exploration into comparable international experience, we focus on regions/countries which have a ratio of less than one, namely: within Europe, Asia Pacific, and the Americas.⁴²

Table 1: ‘Oil dependency’ ratios by world region

	production/consumption ratio (oil)
Europe	0.25
Asia Pacific	0.28
Americas	0.77
Africa	2.94
Russia & Central Asia	3.39
Middle East	3.53

Source: ENI (2013)

Table 2 depicts examples of drilling intensity (as indicative of upstream activity) from countries within regions which have ratios of less than 1, but focusing on basins with some of the highest exploration investments.⁴³ A very basic comparison of similarly sized basins in India⁴⁴ suggests that upstream activity in India is underperforming. For example, the Vindhyan (162,000 km²) and Ganga (186,000 km²) basins are comparable in size of acreage to the Pearl River Mouth basin in China. However, drilling intensity for the Vindhyan is 1 well per 17,364 km² and for the Ganga basin it is 1 well per 23,992 km², compared with a much more efficient 1 per 1,190 km² for the Pearl River Mouth basin.

Table 2: Drilling intensity – comparable international experience

Country	production/consumption ratios (oil)	basin	acreage (km ²)	drilling intensity (km ² per well)
Australia	0.42	Canarvon	500,000	2,347
China	0.43	Pearl River Mouth	175,000	1,190
Malaysia⁴⁵	0.93	Sarawak–East Natuna	8,028	69
Brazil	0.71	Santos	352,260	5,775
		Campos	100,000	901
USA	0.48	Alaska North Slope	240,000	1,600

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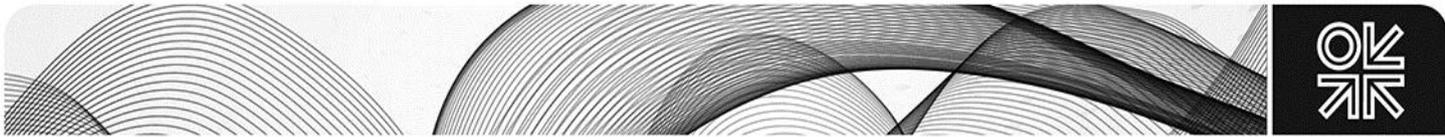
The role of NOCs relative to upstream activity in countries that are net oil dependent also gives some interesting pointers to India’s relative underperformance. Three countries in Table 2 have large NOCs

⁴² The use of international examples is also dependent, to an extent, on available data.

⁴³ These arguably represent a notional ‘benchmark’ amongst the countries.

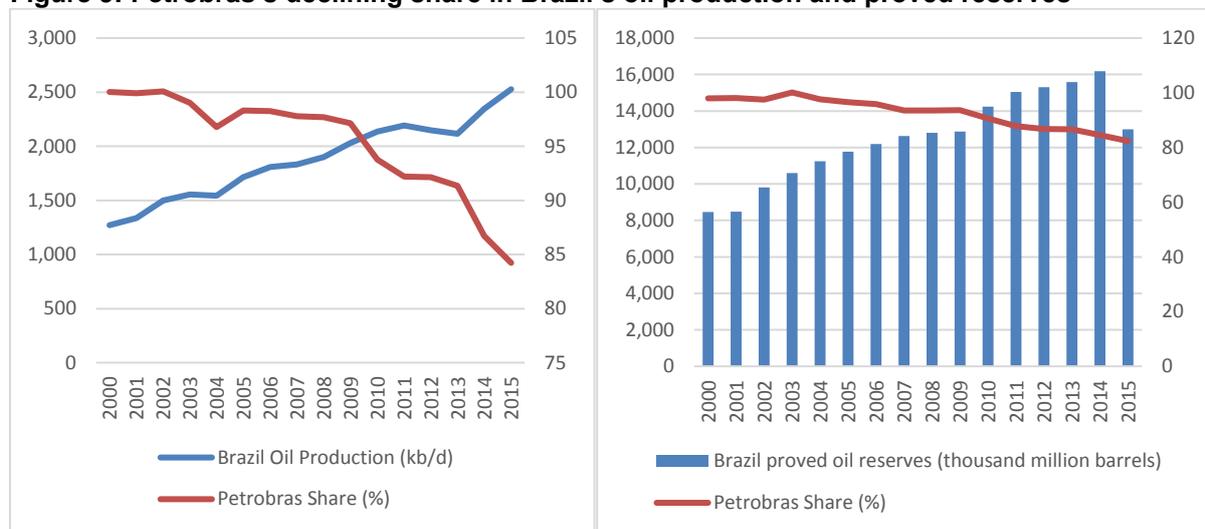
⁴⁴ We do not take into account geology in this basic comparison.

⁴⁵ Malaysia recently became a net exporter of crude, but has a low production/consumption ratio for oil. It also matches some of the features of the Indian situation – such as a large NOC – hence we include it.



with a predominant 'footprint' in upstream activity: Brazil (Petrobras), China (CNPC/CNOOC/Sinopec), and Malaysia (Petronas). Of these, Brazil presents a potentially comparable international case: its NOC, Petrobras, controls a majority of upstream acreage – it held exclusive operating rights until 1995, and then in 1997 Law 9,478 permitted participation from other companies. This was followed by eight bidding rounds for the awarding of concessions. However, a series of regulations in 2010 (and Laws 12,351, 12,304, and 12,276) were passed to re-establish Petrobras's dominant upstream role. Measures to achieve dominance included: operational exclusivity in strategic pre-salt areas⁴⁶ and an onerous relinquishment regime, under which 5 billion barrels of exploration rights were transferred to Petrobras with due compensation, arguably increasing the concentration of acreage with Petrobras (Chauhan et al., 2014). Petrobras's large 'footprint' in upstream acreage has been associated with production declines and lower reserve addition (Figure 9).

Figure 9: Petrobras's declining share in Brazil's oil production and proved reserves



Source: BP (2016); Petrobras

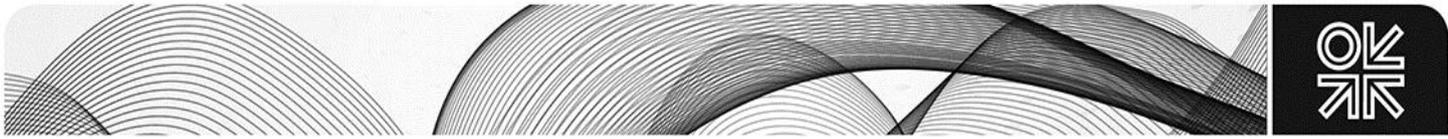
Although the company has been beset by external problems (such as recent political and economic turmoil, and crippling fiscal constraints from implicit price controls and the low oil price environment⁴⁷), the decline has also predated some of these problems. Chauhan et al. (2014) argue that Petrobras failed to meet its production targets for eight consecutive years – a major reason for this was that the onus was put on Petrobras to develop its promising pre-salt reserves through making heavy investments, whilst simultaneously managing rapid declines from its existing fields. Double-digit declines from existing fields were therefore offsetting any efforts being made upstream.

The Brazilian government's efforts to rescue and revive Brazil's upstream sector have included three elements. First, a review of legislation/regulation is underway to liberalize the fiscal regime and to remove both the 'sole operatorship' requirement for pre-salt areas and the high local content requirements, which are said to have contributed to Petrobras's problems with cost escalations (Chauhan et al., 2014). It is anticipated that bidding rounds for pre-salt reserves will be held in 2017, to open up Petrobras's pre-salt reserves to non-state and international companies, as Petrobras cannot sustain the investment required to bring the reserves into production.⁴⁸ Second, the government has in the past considered exchanging unsold acreage adjoining some of Petrobras's existing blocks for

⁴⁶ Requiring Petrobras to own at least 30% in pre-salt blocks.

⁴⁷ It is difficult to establish causality without a deeper investigation. See Fattouh et al. (2015) for a discussion on pricing reforms in Brazil.

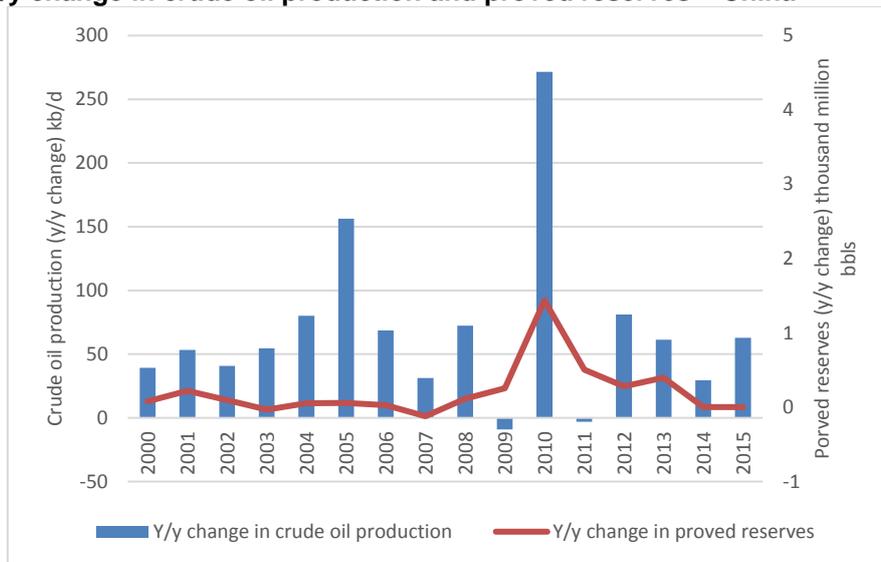
⁴⁸ Petrobras's debt has been estimated as being in excess of \$100 billion. See 'Brazil Oil Giant Petrobras Could Lose its Most Valuable Assets', 29 February 2016, Oilprice.com. [Available at <http://oilprice.com/Energy/General/Brazilian-Oil-Giant-Petrobras-Could-Lose-Its-Most-Valuable-Assets.html>.]



company stock, to ensure that some pre-salt acreage spread over multiple contract areas is ‘unitized’.⁴⁹ And third, a restructuring of Petrobras is planned, through divesting its midstream and downstream assets, enabling it to emerge as a ‘leaner, upstream-focused company’.⁵⁰

China provides another illustration of a net oil dependent country with concentration of acreage almost entirely amongst its NOCs. Whilst the NOCs contributed to an upsurge in production in the mid-2010s, crude oil production and proved reserve addition have been falling over the last six years (Figure 10) as the NOCs switch off ‘aging and high cost’ fields and cut capital expenditure on new production (Meidan, 2016).

Figure 10: Y/y change in crude oil production and proved reserves – China



Source: BP (2016)

Chinese NOCs’ overseas acquisition activities, in combination with the low oil price environment, have created additional constraints that have contributed to the current situation. In an attempt to resolve this, in July 2015 China’s government tendered a handful of blocks (amounting to 10,000 km²) on which limited exploration had been carried out, to private companies. The tender attracted bids from 13 domestic companies, but in general it received a lukewarm response as the quality of the assets was poorly perceived (Meidan, 2016). The government plans to continue opening up the upstream sector, while the NOCs are likely to focus capex on their lucrative segments rather than on marginal higher-cost production (Meidan, 2016).

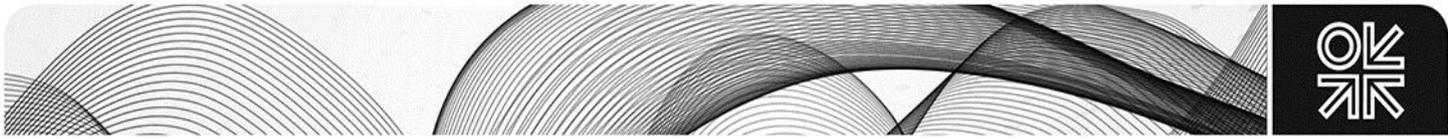
Preliminary evidence from international experience therefore shows that while India’s lack of success in its upstream sector is not entirely unique, it is arguably ‘lagging behind’ countries with similar challenges.

5. Summary and policy implications

In addition to the measures taken by other countries (discussed in the section above) to reduce the concentration of acreage amongst companies which cannot fulfil their exploration commitments, the experience of other net oil dependent countries *without* large NOCs (such as the UK, the USA, and Australia) provides useful references when considering policy options. All three of these countries have

⁴⁹ The Iara field was one such area under consideration for a ‘swap for leases’. Unitization of leases occurs when hydrocarbons are found in adjoining licence areas as it improves efficiency of operations.

⁵⁰ The company planned to divest at least \$14.4 billion of non-core assets in 2016. See ‘Petrobras divestment plan gaining momentum’ 10 August 2016, Argus. [Available at <https://www.argusmedia.com/pages/NewsBody.aspx?id=1291922&menu=yes.>]



announced, or enforced, post-acreage award monitoring measures, to ensure that licensees develop acreage within the timeframe committed, or divest their acreage with the option of it then being awarded to other companies to take activity forward. These measures primarily apply to large majors with significant holdings of unexplored or underexplored acreage. In Australia, 'use it or lose it' provisions are frequently exercised by states in relation to 'retention leases'. These leases are granted for periods of up to 15 years, subject to five year approvals if licensees can demonstrate that while a resource is not currently commercially viable, it has genuine development potential and is likely to become viable within the retention lease period. Following concerns that retention leases were being used to secure a competitive commercial advantage rather than being employed for the purpose of developing resources, rules were tightened up by introducing a 'use it or lose it' provision which required that the renewal of a retention lease was to be conditional upon licensees submitting a development plan within 120 days and making a final investment decision within three years.

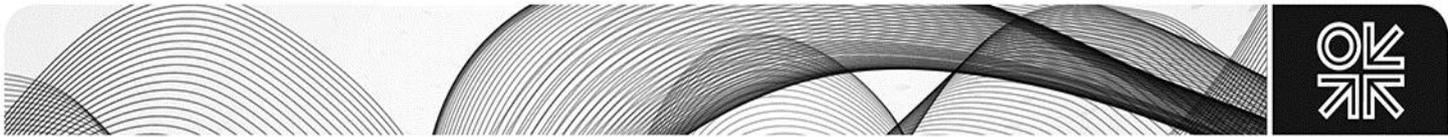
The UK Fallow Block initiative is a similar policy which was launched in 2003 to encourage activity in 'fallow' fields on the UK Continental Shelf, where no work has been carried out for a number of years. It was introduced to address the issue of acreage concentration related to licences awarded under the first to nineteenth Licensing Rounds, which had terms that allowed companies to retain acreage for between 36 and 46 years without further activity, if initial term work obligations were fulfilled and a development was included somewhere on the licence. Blocks are considered Fallow if no activity has been carried out for three years and blocks are classified as 'A' (licensees doing all that a technically competent group with access to capital could reasonably be expected to do) or 'B' (companies unable to progress due to commercial or economic constraints). 'A' blocks are allowed to be retained under annual review, whereas 'B' block licensees are given a year to submit a development plan or to market the assets. Fallow discoveries are given two years to be developed. If no acceptable activity is agreed, the block is relinquished and offered for re-licensing in the next open acreage round. Similarly, in the USA, vast amounts of 'idle acreages' prompted the introduction of a 'use it or lose it' provision in 2012 for public land.⁵¹

Policy options to address market concentration of acreage, based on international experience (Brazil, China, the USA, the UK, and Australia), can be summed up as followed:

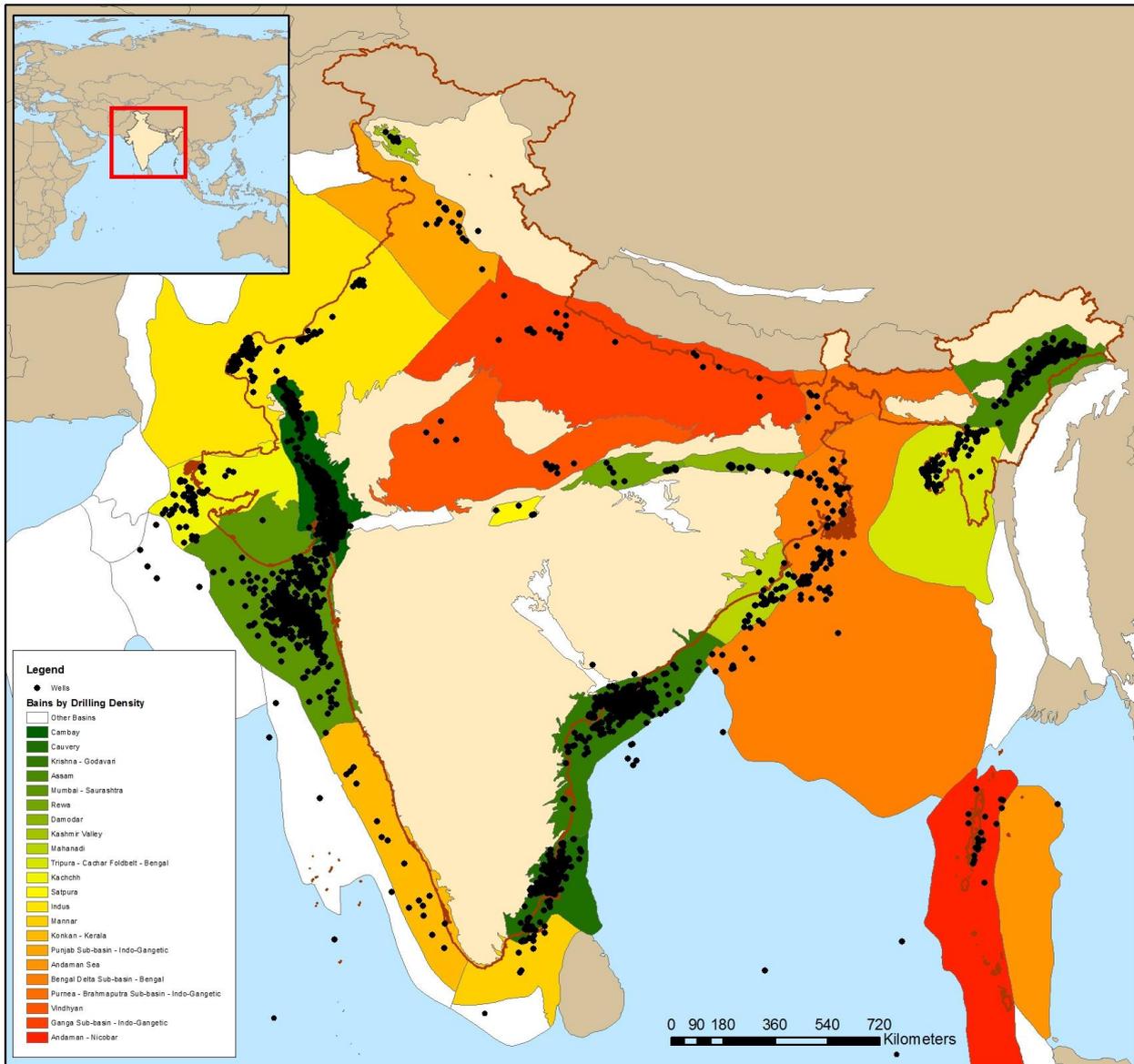
- Releasing NOCs from sole operatorship of marginal or high-cost legacy assets and tendering them through auctions involving value-sharing with the NOCs.
- The 'unitization' of adjoining acreages.
- Time-limited retention leases with 'use it or lose it' provisions.
- A 'fallow block initiative' equivalent which categorizes fallow blocks into categories based on the technical and financial competence of the operator, as in the UK.

Arguably, the marginal fields auction, which tenders out acreage which previously formed part of the 'Nomination Regime' assets of India's NOCs, could set a precedent for the adoption of one or many of these options. India's new Hydrocarbon Exploration Licensing Policy (HELP) represents a set of measures aimed at 'reviving' upstream exploration activity: a single licence for conventional and unconventional hydrocarbons, open acreage licensing, a revenue sharing model, and commercial and marketing (pricing) freedom. However, as discussed in this paper, past attempts at boosting domestic production have been relatively unsuccessful as a key issue – concentration – has remained unresolved. Consequently, HELP could end up being yet another hurdle if it does little to address the government's objectives for the upstream sector within broader Indian energy policy. This paper has shown that India is not unique – countries such as Brazil and China, which are net oil dependent and have large NOC 'footprints', have also faced situations of upstream decline. Finally, rather than solely considering focusing on 'energy independence', a well-considered upstream policy would be one that takes into account India's broader goals on meeting rising primary energy demand through a sustainable energy policy.

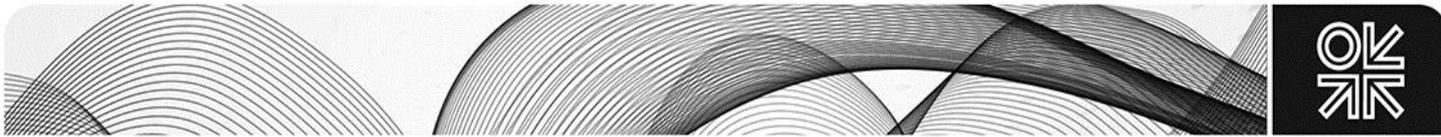
⁵¹ A 2011 Department of Interior report found that 57% of leased onshore acreage was idle at the time (OGJ, 2011).



Appendix 1: Basin drilling intensity (km² per exploration well)

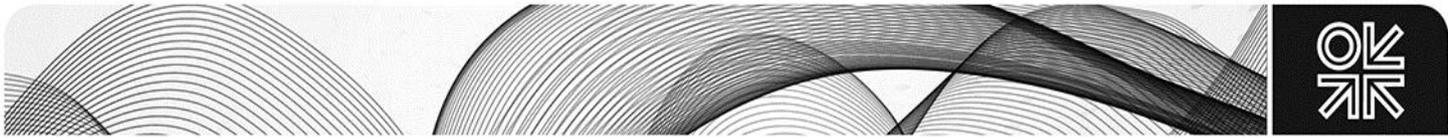


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