

Lessons from a retrospective look at India's upstream sector

P. Elango

In May 2014, a general election in India resulted a single party holding a parliamentary majority for the first time in 25 years. This has rekindled hopes of a revival in India's domestic oil and gas sector, which has had an erratic history of performance and decision-making. However, the realization of these hopes will depend on policymakers' ability to harmonize upstream and downstream policy in the energy sector. This article provides an overview of the evolution and current status of India's upstream sector and its linkages to the downstream economy, set against the context of India's broader energy challenges.

.....
'TODAY, IT IMPORTS OVER TWO THIRDS OF ITS OIL, A THIRD OF ITS GAS, AND ROUGHLY 22 PER CENT OF ITS COAL REQUIREMENTS.'

Three decades ago, India was able to meet 75 per cent of its oil consumption through domestic production, and was importing neither gas nor coal. Today, it imports over two thirds of its oil, a third of its gas, and roughly 22 per cent of its coal requirements, resulting in an energy import bill in excess of US\$150 billion per annum (p.a.). Oil is the single largest imported commodity, and government data shows that India's growth in oil demand has closely followed its economic growth, implying that its oil requirements may need to double in order to achieve growth rates in excess of 7 per cent p.a. in the future. Importantly, a more general about-turn – reversing India's recent decline in upstream (oil and gas) investments – will rest upon altering investor perceptions of India, away from regarding it as a small potential resource producer towards seeing it as a large potential energy market.

Underexplored upstream potential

India's first oil discovery was made in 1867 in the north-eastern state of Assam just a few years after Edwin Drake had drilled the world's first commercial oil well in the USA. Yet, while the first US oil strikes led to a frenzied search for 'black gold', India has remained largely underexplored to date. India's 26 sedimentary basins are spread over an area of over 3 million square kilometres covering on-land, offshore, and deep water areas. The government of India estimates a 'prognosticated' hydrocarbon resource potential of over 200 billion barrels of oil equivalent. Thus far, volumes of 80 billion barrels have been established as 'hydrocarbons-in-place' through limited exploration, implying that 120 billion barrels are potentially 'yet-to-be-found'. These volumes are estimates of the 'size of the pot' (the oil and gas resources that the Indian sedimentary basins potentially hold), but have yet to be proven.

Unlike many other countries where National Oil Companies (NOCs) were set up following the discovery of hydrocarbon resources by International Oil Companies (IOCs), India's efforts at upstream exploration began with the establishment of the Oil and Natural Gas Corporation (ONGC) in 1956. Its early ventures were relatively successful, with oil and gas discoveries onshore in the Cambay Basin in Gujarat in the early 1960s, further boosted by a large offshore oil and gas discovery (Bombay High) in the 1970s. Domestic production went up from 62,000 barrels/day in 1965 to roughly 700,000 barrels/day in 1989. The Indian Oil Company (later Corporation) Limited was established in 1959 to handle marketing and refining requirements. These initiatives arguably

laid a strong institutional foundation for India's oil and gas sector.

However, these early successes were not consolidated, and production began plateauing in the 1990s. This inertia was due to the shortage of risk capital in the sector as it was dominated by the NOCs – still the case today despite liberalization. The situation is reflected in the statistic that just 15,000 wells have been drilled in 60 years of upstream exploration compared with one million wells on production at present in the USA.

In recognition of this and as part of economic liberalization in the 1990s, some offshore fields containing undeveloped discoveries were auctioned to the private sector (IOCs) on the basis that NOCs retained a 40 per cent carried interest. This strategy was relatively successful; for example, the redevelopment of the Ravva ('diamond') shallow water field resulted in an increase in its production from 3,000 barrels/day to over 50,000 barrels/day and it has produced oil and gas valued over US\$25 billion.

A major step forward in upstream exploration occurred with the liberalization of the sector in 1999 through the New Exploration Licensing Policy (NELP), under which NOCs and private companies competed for acreage under a transparent bidding regime based on Production Sharing Contracts (PSCs). On paper, the NELP has attracted US\$20 billion in investments over nine auction rounds and logged 130 oil and gas discoveries – including three major discoveries by the private sector: India's largest onshore oil discovery in Rajasthan and two major deep water gas discoveries in the eastern offshore basin. The figure (Upstream Investments and Oil and Gas



Discoveries in India, 2000–11) illustrates that major spikes in investments have coincided with spurts in discoveries.

However, few of these discoveries have translated into higher production. Although private sector gas production briefly overtook that of NOCs in 2010, there have been no significant new oil discoveries under the NELP and India experienced its largest volumetric decline in gas production in 2013/14 (*BP Statistical Review of World Energy*). Further, investment has been falling both in absolute terms and in terms of attracting a diverse portfolio of investors – a closer look at the distribution of acreage auctioned under the NELP shows that most acreage is split between the two largest domestic exploration companies, with IOCs showing very little interest in the bidding rounds.

There have been two main constraints affecting upstream performance. The first relates to problems in the administration of the contractual regime, with bureaucratic procedures taking precedence over the original objective of encouraging exploration in order to boost domestic production. Contractual impasses and frequent arbitration have been partially responsible for

the slowdown in production and the attempted exit of some international firms from their Indian acreage holdings. These have related to controversies over the extension of exploration periods, procedures for the approval of operating decisions, and, most importantly, pricing (for gas). A recently proposed reform to the upstream contractual regime – potentially changing it from a PSC to a Revenue Sharing Contract (RSC) – risks repeating some of these negative outcomes. The RSC makes the sharing of revenues with the government mandatory at varying levels of production, as opposed to the sharing of profits from production; this is likely to discourage investors from sinking risk capital into the Indian upstream sector.

The second constraint relates to India’s struggle to operationalize its national geo data repository, although technological advancements are progressing this endeavour.

Technology – slow progress, substantial opportunities

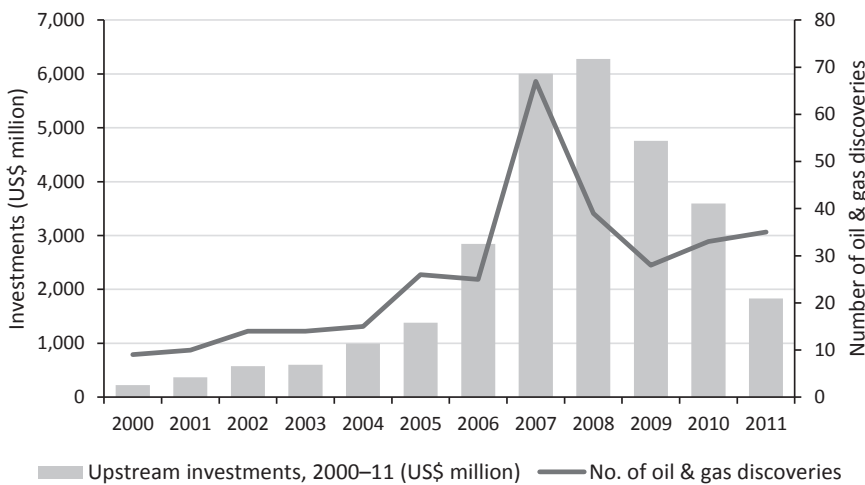
Most survey data is antiquated, having been collected by NOCs in the pre-liberalization era. This data is released

to bidders by the Directorate General of Hydrocarbons, the upstream regulator, prior to each bidding round, but an updated and consolidated database has yet to be established. This is further reflected in the fact that 3D seismic surveys have been conducted in just 15 per cent of the entire sedimentary basin.

On the subsurface front, advanced spectral decomposition technology, useful in surveying thin and isolated reservoirs, has been successfully applied in Ravva (a shallow water offshore field) to highlight drilling channels. An advanced method of acquiring, processing, and interpreting repeated 3D seismic surveys at different time intervals – the 4D seismic survey – is a relatively young technology in India. A 4D Ocean Bottom Cable (OBC) seismic survey was executed for the first time in India in the Ravva field, enabling it to achieve a recovery rate of more than 50 per cent, while the average for other fields in India is less than 35 per cent.

.....
‘MOST SURVEY DATA IS ANTIQUATED, HAVING BEEN COLLECTED BY NOCS IN THE PRE-LIBERALIZATION ERA.’

Similar to its independent foray in space technology, Indian NOCs have largely had to develop their maiden offshore oil and gas discoveries without international partnerships. Following the liberalization of the upstream sector to private investment, domestic companies have made visible gains through the adoption (through procurement as well as partnerships with international firms) of world-class technologies. A large oil and gas field with a billion barrels of recoverable liquids (valued over US\$100 bn) was developed in the desert region of Rajasthan, while D6 (a deep water gas development) was executed in record discovery-to-delivery time by the private sector. India is also home to the world’s longest heated crude



Upstream investments and oil and gas discoveries in India, 2000–11

Source: Directorate General of Hydrocarbons; Ministry of Petroleum & Natural Gas

oil pipeline system (600 kilometres); this system generates 32 Megawatts of power to continuously heat and keep the waxy and high pour point crude flowing through the pipeline.

One of the world's largest Enhanced Oil Recovery projects is underway in Barmer basin in Rajasthan; it is being undertaken by Cairn India Ltd, targeting recovery rates close to 50 per cent, and its success is expected to be replicated elsewhere in India.

Linkages with the downstream sector

Historically, the downstream sector has been developed without regard to upstream policy objectives and the upstream sector has, in fact, long been used to support downstream objectives related to poverty reduction, through the pricing system. Indeed, the slow progress in upstream exploration is partly attributable to constraints posed by its historical linkages with downstream policy. Subsidies on petrol, diesel, kerosene, and LPG to retail consumers were borne by the NOCs, Oil Marketing Companies, and federal government, at a significant fiscal cost. This also reduced the capital available to the NOCs for investments in upstream exploration.

.....
'INDIA EXPORTS OVER 60 MILLION TONNES OF PETROLEUM PRODUCTS ... 20 PER CENT OF TOTAL EXPORTS.'

However, an unprecedented reform of this system is currently underway. A series of reforms aimed at the removal of petroleum subsidies has resulted in the total elimination of subsidies on petrol and diesel and their liberalization at the retail level. This has brought petroleum subsidies as a percentage of the total subsidy bill down to 33 per cent in 2013 from 38 per cent in 2012, and as a percentage of GDP from approximately 1 per cent in 2012 to 0.75 per cent

in 2013. These figures are expected to fall further to 24 per cent of total subsidies and 0.5 per cent of GDP in 2014. Additionally, a social security system has been put in place in which all citizens are assigned a unique social security number; this system separates subsidies from the pricing system and ensures that subsidies will be paid directly to eligible recipients. The 2014 decline in international oil prices expedited these reforms as the government liberalized diesel prices at the retail level, and it is estimated that every US\$10/barrel reduction in the oil price adds US\$15 billion in annual savings to India's import bill.

Despite fiscal constraints, there has been tremendous growth in downstream infrastructure and capacity in the oil sector – specifically in refining – facilitated by a targeted programme of expansion through government funding. India has built a very robust refining sector by establishing over 20 refineries across the country to refine 215 million tonnes (Mt) of petroleum products. India consumes over 150 Mt of liquid petroleum products every year. Over 70 per cent of diesel is consumed in transportation, with the 65,000 km railway network accounting for much of this. Over the last five years, a space has been created for private refiners to import crude for product exports. Thus India exports over 60 Mt of petroleum products, constituting 20 per cent of total exports. The boom in refining has also led to the construction of over 150,000 km of liquid pipeline transportation networks, a large fleet of oil tankers, and a vibrant domestic downstream services sector

The success of the Indian oil sector's expansion of downstream infrastructure has yet to be replicated in natural gas, where expectations for a transformation of the country's natural gas landscape, following its largest offshore gas discovery (in the eastern offshore basin), have failed to be met. The use of natural

gas through imports has met similar outcomes – of a total of eight LNG terminals (operating, under construction, and planned), just two are currently in full operation. The potential for natural gas arguably lies in the city gas sector, and particularly in transportation.

However, in the absence of nationwide environmental legislation (such as that enacted in Delhi, where the entire fleet of public transportation runs on CNG), this potential will remain unfulfilled.

Arguably, the state with the greatest success in natural gas is Gujarat, which has successfully harmonized its downstream and upstream sector policies. It has India's best developed City Gas Distribution network, over 3,000 km of gas pipelines, and access to two LNG terminals – Dahej and Hazira. This robust gas infrastructure has driven the share of gas in Gujarat's energy consumption to 24 per cent, the highest of any Indian state and higher than the share of gas in India's primary energy consumption (roughly 10 per cent). India's new government, led by former Gujarat Chief Minister (now Prime Minister) Modi, is keen to replicate the 'Gujarat model' across India through the construction of a national gas grid, via Public-Private Partnerships.

High expectations

With 0.3 per cent of the world's oil reserves and 0.7 per cent of its natural gas reserves, India can hardly be described as a 'resource rich' country. But with 17 per cent (1.2 billion) of the world's population, it cannot be ignored as an important and growing player on the international energy market. Perhaps the biggest lesson from past experience comes from the lack of harmonization between upstream and downstream sector policies, which have been pursued to different ends. This is slowly changing, but much is contingent upon the speed with which India's new government pushes through reforms.

