**Ramu C.M.***

# *Natural Gas as a Potential Game Changer in India's Energy Security*


## Abstract

*In the coming decades, natural gas is poised on the brink of gaining increasing salience in meeting international energy demands. As a moot case in point, its share in the global energy basket continues to maintain an upward trajectory vis-à-vis the conventional dominance of coal and oil. The persisting mismatch between the cost-effectiveness and the energy-efficiency, plaguing most renewable energy resources, gives the cleaner, natural gas burning an added advantage as a bridge-fuel. Being a rising power with accentuating economic credentials to speak for, India seems to have actively embraced the growing importance of natural gas. This has translated into efforts aimed at raising the proportion of natural gas in its domestic energy mix. The fact that the country has insufficient conventional hydrocarbon reserves to feed its expanding consumer and industrial base makes it heavily dependent on imports of the conventional hydrocarbons from abroad. Nevertheless, it would be unjust not to mention some of the far-sighted measures being taken to dovetail hydrocarbon imports (particularly natural gas) with a targeted boost in domestic production.*

*This article attempts to assess the current and prospective role of natural gas in meeting the demands of India's energy security. It seeks to evaluate the potentialities for accelerating natural gas induction in the country's energy mix, with a focus on domestic production as well as imports. By highlighting the challenges confronting the Indian hydrocarbon sector in general and domestic exploration-and-production in particular, this paper makes a critical assessment of the manifold reforms that have been initiated to address this concern. Through a perusal of the major local, regional and global*


* **The author** is a Ph.D. Candidate at the Department of Geopolitics and International Relations, Manipal Academy of Higher Education, Karnataka, India.

*determinants that shape India's outlook towards natural gas, a modest attempt has been made to try to help in the evolution of a roadmap for the country in terms of transitioning to a largely gas-based economy.*

For years since the advent of oil exploration, the natural gas from hydrocarbon reservoirs was either burned away or injected back into the fields to force out oil that ran out of natural pressure. Commercially-optimised extraction of the gas was an overlooked idea not only because of inadequate technology but also because the usability of gas as a significant energy source was not a priority back then. It was only towards the close of the last century that the economic viability of natural gas as a cleaner, safer and efficient energy source was recognised the world over. Being the cleanest burning fossil fuel, it already constitutes, and is touted to play an increasingly vital role in the global energy supply. Perhaps, judging from the world energy outlook for the foreseeable future, natural gas is likely to pervade the global energy consumption mix as the demand for coal and oil begins to peak. With the inevitable delays plaguing the renewable energy industry in terms of bridging the gap between cost and energy efficiency, the era of fossil fuels is likely to persist longer – albeit with better sustainability – provided natural gas acts as the game changer.

India is no stranger to the rising prominence of natural gas in the global energy lexicon. From negotiating import contracts for Liquefied Natural Gas (LNG) with multiple suppliers, Indian decision makers are seriously contemplating transnational gas pipeline projects from gas-rich countries in its proximate neighbourhood. There is a visible, concerted effort from the national oil companies to expand their footprints across a number of onshore and offshore hydrocarbon prospects, even on foreign soil. From what had hitherto been investments confined to the exploration and production of (mostly) equity oil from participating interests abroad, Indian oil majors have over the years, now diversified their portfolio to include significant investments in gas exploration and LNG projects too.

## Assessing India's Natural Gas Reserves

India is not a resource-scarce nation per se. But insofar as hydrocarbons are concerned, the consumption rate of petroleum-based by-products and fuels far outweighs the rate of domestic exploration and production. It would be wrong to assume that the country's gas reserves have been optimally exploited. Domestic challenges – ranging from techno-logistical to environmental and sociological – have scourged the progress of oil and gas exploration within the country, since independence. Political expediency and bureaucratic complacency have only added to the woes of a disincentivised domestic exploration campaign.

Of the 26 identified hydrocarbon-bearing sedimentary basins within the country's territorial limits, only seven have been explored – with many lagging behind their target production capacities. This means that almost 75 percent of India's sedimentary reservoirs that are conducive to petroleum formation still remain mostly unexplored, or at the most, partly-explored (GE, 2017).

Since the liberalisation of the Indian economy in the early 1990s, there have been concerted efforts to reform the country's energy sector, particularly the petroleum and natural gas industry. In contemporary times, there appears to be a strong incentive to push for Greenfield and Brownfield investments in the upstream segment of the oil and gas sector. What is pertinent is that the country's rapid economic growth warrants a concrete policy of meeting energy security with a combination of domestically-sourced and imported fuels. India's commitment to the Intended Nationally Determined Contributions (INDCs) declared as part of the 2015 Paris Agreement on Climate Change, further calls for a gradual shift to cleaner forms of energy. This goes in direct conjunction with the need for scaling up the percentage of natural gas in the domestic energy mix. In the course of fulfilling its long-term sustainable energy targets, select policy reforms and business strategies are being considered, with the end result slated to be a rejuvenated and empowered energy sector with an augmented emphasis on natural gas promotion.

Since the inception of hydrocarbon prospecting in independent India, an estimated 69 trillion cubic feet (tcf) of proven and probable conventional gas deposits have been prospected and identified as recoverable. A sizeable chunk of these recoverable reserves await judicious extraction and full-fledged development, with a considerable number of reserves yet to see lucrative production. Apart from the already discovered hydrocarbon reservoirs, more recent geophysical surveys have revealed the existence of recoverable traces of natural gas trapped either in shale rock formations or between coal seams (in the form of shale gas and coal-bed methane gas respectively) (GE, 2017). Much of the domestic oil and gas production had long come from the Bombay/Mumbai High offshore field (discovered in 1974 by the Oil and Natural Gas Corporation) off the north-western coast of India. However, with the oil platform (installed as part of the first phase of field-development) moving past its peak production capacity within a decade and a half since discovery, the declining production from the western offshore is being gradually compensated with new production capacities coming online in the more promising eastern offshore segment (Offshore-technology, 2017). The good news however is that the Bombay High offshore basin has more to offer, and the second phase of field redevelopment

has already been met with some success in the form of a sizeable oil and gas find in close proximity to the existing one (Reuters, 2017).

On top of the continuing efforts to develop ageing and mature fields, new onshore gas prospects – both conventional and from coal beds – are being commissioned and made operational following successful pilot projects by the public sector undertakings (PSUs) and also a few private sector companies, not to mention joint-venture undertakings. Shale gas assessment was carried out on a pilot-basis in many prospective regions, with assistance from the United States Geological Survey (USGS, 2011).

Another important category of identified 'unconventional hydrocarbon basins' falls in the deepwater segment – off (implying offshore) the western and eastern peninsular seaboard – and further off the Andaman island chain. These deepwater basins are found beyond the 400 metres depth range along the continental margins. Nevertheless, the majority of contemporary domestic gas production is met by the offshore segment, with deepwater exploration made increasingly sustainable with the advancements in hydrocarbon engineering and offshore oilfield technology. Complementing these improving prospects offshore are augmented production levels from existing onshore gas fields (Brownfield projects). This is made possible with increasing foreign investments, which facilitated the entry of the latest state-of-the-art cutting-edge technologies. For instance, the last few years have seen an uptick/ upward trend in Brownfield investments targeted at ramping up gas extraction and recovery from mature fields in the traditional producing regions of Assam, Gujarat and Andhra Pradesh; besides having Greenfield investments in hydrocarbon basins in Tripura, Rajasthan and Tamil Nadu (Ministry of Petroleum and Natural Gas, Governmnet of India, 2017).

On the upside, coal-bed methane (CBM) extraction is another fast emerging mode of unconventional gas production in India. For a country blessed with abundant coal deposits (albeit mostly of poor or average grades), technological developments permitting the extraction of methane/natural gas trapped between coal seams have irrefutably come as a breakthrough. Other than CBM, successful pilot projects are signalling the possibility of shale gas extraction from risky, recoverable shale entrapments that are widely disseminated across India's rich alluvial floodplains and adjoining river basins (Ministry of Petroleum and Natural Gas, Governmnet of India, 2017). However, despite the innovations in hydrocarbon exploration harbingered by the arrival of horizontal drilling, it remains to be seen how the fallouts from fracking/hydraulic fracturing (the flagship technique used in shale gas extraction) would potentially impact a

country like India, given its sensitive environmental and demographic constitution.

## The Hydrocarbon Majors

Oil India Limited (OIL) and Oil and Natural Gas Corporation Limited (ONGC) are the two premier state-held oil and gas exploration companies (or PSUs) in India. While ONGC is a multinational company in its own right, ONGC Videsh Limited (OVL) is the exclusive overseas arm of the former. These companies are more or less restricted to upstream operations (exploration, production and development) while the bulk of the downstream operations (refining/processing, distribution and marketing) within the country are a monopoly of the other three state-owned giants, namely Indian Oil Corporation Limited (IOCL), Hindustan Petroleum Corporation Limited (HPCL) and Bharat Petroleum Corporation Limited (BPCL). The midstream operations (includes operations ranging from transporting processed and unprocessed petroleum to building and operating the necessary transportation infrastructure such as pipelines) are carried out predominantly by IOCL and Gas Authority of India Limited (GAIL) – the latter being the largest state-owned gas processing and distribution company in India. On the other hand, Indian-origin private companies like Reliance Industries Limited (RIL), Cairn India (a subsidiary of UK-based Cairn Energy), Essar Oil Limited and Tata Petrodyne have over the years made praiseworthy strides in the petroleum business; transcending multiple segments of the industry (India Brand Equity Foundation, 2017).

Within the realm of natural gas, LNG imports have been gaining traction on a scale of greater magnitude in comparison with the envisioned plans to expedite indigenous natural gas extraction and recovery. Petronet LNG Limited – a joint venture-cum-consortium of India's premier state-owned petroleum companies – has over the years evolved into a top-notch company catering exclusively to LNG import operations. Its portfolio ranges from contracting LNG containers to building and operating LNG terminals for gas liquefaction, not to mention regasification terminals for converting the cryogenic (chilled) liquefied gas back to dry gas (Petronet LNG Limited, 2016). Under the stewardship of GAIL and its subsidiary Petronet, India has been seeking to expand its footprint in the global LNG market. This is by virtue of forming joint ventures and consortiums for LNG commerce with other foreign multinationals and national oil companies, in addition to acquiring equity stakes in foreign oil and gas blocks (following the lead of India's most successful overseas oil exploration giant, OVL) (LNG World News Staff, 2016). The latter has garnered sufficient experience in participating in Production Sharing Contracts (PSCs), refers to the legal contract

between the government (the rightful owner of the land and the resource underneath) and contractor (the company) that enables the latter to explore and produce equity oil from working interests held in oil and gas blocks. However, with an added preference for natural gas in the evolving paradigm of India's energy consumption, OVL is slowly expanding its ambit of operations to focus more on exploration and development of natural gas blocks on foreign soil (Patey, 2014, pp. 123-157). Though OIL has not emulated OVL's feats in the overseas component, of late, there is an increasing realisation of the need to set right its dismal record abroad (Oil India Limited, 2014).

With an eye on the shifting sands in energy geopolitics, India's priorities lie in safe and lucrative access to the various sources of natural gas that abound its geostrategic radar. As mentioned previously, a key element here is facilitating its oil companies (most importantly, OVL) in acquiring working interests abroad through PSCs. Secondly, India is simultaneously diversifying its LNG imports by signing lucrative contracts with its traditional suppliers, while at the same time, seeking new suppliers with whom it is negotiating flexible contract options. Furthermore, long-lasting global geo-economic spinoffs from the protracted era of low oil prices have opened the window for buying LNG in the spot market, and incipiently in the speculation-driven futures market. This has given net importers like India a better leverage in negotiating the prices of short-term, medium-term and long-term LNG supply contracts with rising LNG exporters such as Australia and the United States – apart from revamping already existing contracts (in keeping up with the changing contours of the global geo-economic environment) with traditional suppliers like Qatar (Slav, 2017).

## Role of Regulatory Regimes: Challenges and Prospects

A significant breakthrough in the petroleum and natural gas sector began with the gradual deregulation of the pricing regime for the hydrocarbon-based fuels. For a long time, the Administered Pricing Mechanism (APM) was the standard modus operandi followed by the government in fixing the price of oil and natural gas. This necessitated the oil and gas marketing companies to sell the product at government-mandated prices to the favoured consumer base, which in the case of gas chiefly constituted the fertiliser industry and the power plants, following which came the less-privileged masses for whom LPG (Liquefied Petroleum Gas) and kerosene were heavily subsidised by the government – in conjunction with the Supreme Court's welfare-centric mandates (Government of India, 2014). Such socialistic measures, though altruistic, nevertheless increased the debt burden on the government by virtue of incessant subsidisation and subsequent liability accrual.

The APM had its own shortcomings that got illustrated in the form of a state-supported stymieing of competition in the hydrocarbon exploration, production and retail/marketing business. The government-approved nomination of specific hydrocarbon blocks to state companies held back the entry of the private sector in the oil exploration business while quota-denominated marketing dissuaded private players from partaking in the downstream segment, which primarily involved distribution and retail. This in turn created debt-burdened public sector giants which had to resort to unrestricted borrowing to make up for their growing capital expenditure and outstanding dividend payments. Unrestricted borrowing by the state companies from commercial banks naturally gave the government a free hand to intervene in the monetary policies of the Reserve Bank of India. As a consequence, these companies were many a times given loans on government-mandated fixed interest rates, further exacerbating the huge pile of bad debt accumulation (*GKToday*, 2015).

The APM was a prime contributor to India's balance of payments crisis that force-started the liberalisation of its economy. Following the liberalisation reforms of the 1990s, the successive governments tried to rid the oil sector of the regulatory clutches of the APM; albeit with partial success. The result was a failure to whittle down the convoluted bureaucratic system built around the agenda of petroleum subsidies. This compounded the acrimony of the state exploration companies, which were unable to optimise the profits from the decade-long era of high oil prices that lasted until mid-2014. Multiple efforts from previous administrations to move towards a market-based pricing regime either got stonewalled or produced only partial results owing to bureaucratic constraints and a lack of political will. Nevertheless, the incumbent administration of Narendra Modi has been exercising concerted efforts at expediting this long-sought transition, and the fruits of these efforts are panning out in the form of nascent reforms in the overall pricing mechanism for hydrocarbon fuels. Needless to say, the government enormously benefited from the sudden fall in global crude oil prices (since mid-2014). A top-down approach is being implemented on the basis of the Hydrocarbon Exploration and Licensing Policy (HELP), coupled with a market-based pricing methodology for the consumer-retailer interface distributed across the country.

With a focus on restructuring the regulatory regime that had hitherto dominated the hydrocarbon sector, the new regime has been designed to transcend the multiple strata of the beams and pillars that make up India's massive petroleum industry. The latest overhaul is designed to trickle down the multiple vertical compartments in the upstream sector – all the way from the award of exploration licenses and production contracts to the pricing of the extracted

hydrocarbons at the well-head. This will eventually help in determining the selling price of these fuels at the various retail outlets and fuel stations spread across the country (Press Information Bureau, Government of India Cabinet, 2016).

The HELP was promulgated keeping in mind the manifold challenges facing India's oil and gas sector. HELP is a modification of the already existing New Exploration and Licensing Policy (NELP). The former was conceived to address the criticisms generated by the latter because the reformatory character of NELP suffered attenuation from inherent limitations rooted at the policy level. Under NELP, the Indian state-owned upstream companies, OIL and ONGC, were no longer to be given preferential treatment in the allocation of exploration blocks. Although the policy formally came into effect in 1999, for many years, it could only be implemented in bits and pieces, and such haphazardly execution was the by-product of political and bureaucratic complications triggered by short-sighted domestic compulsions. Nevertheless, the year 2017 saw the phasing-out of the final vestiges of the APM that had continued to plague the effective implementation of the NELP. The roll-out of the HELP was a concomitant response to the inability of NELP to catapult India's domestic hydrocarbon production to meet the rising energy demand (PTI, 2017).

It is imperative here to understand that the purported objective of HELP is to effect the transformation from a quasi-liberal hydrocarbon regime to a fully-liberalised one. Nevertheless, NELP had its own share of reforms and partial deregulation to speak of; 100 percent Foreign Direct Investment (FDI) had been allowed in the upstream segment with no mandatory participation of state majors in PSCs. The state companies would also have to compete with other Indian private and foreign companies in an open international bidding; and acreage royalties (to be paid to the government) were fixed at 12.5 percent for onshore regions and 10 percent for offshore locations. Furthermore, companies no longer needed to pay an import tariff for machinery (for operations) shipped from abroad; and near-complete autonomy was granted to the Indian private and foreign companies to market the oil and gas in the domestic market which had hitherto been a privilege of the state marketing majors. With regard to PSCs, the same fiscal and contractual terms would apply to every company (regardless of whether it is state-owned or not) that has been awarded a working interest in select blocks – barring the only caveat that the PSCs would nonetheless be structured and customised in consonance with applicable Indian Laws, subject to an India-centric regulatory and jurisdictional framework (Ministry of Petroleum and Natural Gas, Government of India, 2015).

So where did NELP fail to deliver? The simple answer is that most of what was penned on paper was not possible to be put into action on the ground. For one, complications arose from having disparate licensing policies for different hydrocarbon resources and different exploratory blocks (classified into NELP and pre-NELP). So, in the event of an overlapping of the resources between separate contracts, the government is caught off-guard in terms of administering the producer price of the extracted resource. Since the clauses have already been set, there is no window for accommodating unanticipated externalities and cost overruns. Since the PSCs under NELP have relied on the 'profit-sharing' logic for government revenue generation, unless and until the discovery is made, the company just needs to pay the acreage royalties and corporate tax to the government – and not the mineral/resource royalties. (or profits). However, hydrocarbon exploration is a risky business and it generally takes a long time for production to begin; or sometimes, there are cases where no oil (or gas) is struck. Owing to such uncertainties, the governmental polity and the bureaucracy gets inadvertently attuned to a long gestation period, wherein the ruling machinery tends to use its discretionary powers to micromanage the contractor's contractual obligations. This incipient friction could lead to unwarranted delays in the development of the discovered hydrocarbon reserves. Legal disputes would ensue between the contractor and the government, resulting in an environment that is not investor-friendly (Press Information Bureau, Government of India Cabinet, 2017).

The government's share of the profit is normally computed on the basis of a predetermined percentage rate agreed upon during the bidding. Nevertheless, in case of a commercial discovery, the contractor has the right to recover the input costs before sharing the profits with the government. However, if the rate of extraction/production of the resource is below the level estimated by the contractor (during initial prospecting), it can have spill over consequences for the sharing of profits with the government. But the contractor would have already incurred massive expenditures in the exploration phase and the NELP gives it the right to recover these costs regardless of the output rate. It is only during the profit-sharing phase after production that the loopholes in the NELP really start unravelling. The profits would naturally dwindle as the output declines whereas the contractor would still have to pay the government its share on the basis of the already predetermined rates. This results in time-consuming disputes between both the parties, which in turn impacts the stock value of the contractor company and exacerbates investor fear. The protracted legal tussle between the government on the one side and RIL and British Petroleum (BP) on the other, over the issue

of under-productivity from RIL's KG-D6 gas basin, is but one example of the pitfalls associated with the profit-sharing principle (PTI, 2017).

In addition to these, under the NELP, despite the base price of crude oil being pegged to market rates, the price of natural gas was still subject to government approval generally dictated by inflexible parameters articulated in the PSC. Lastly, the royalty rates under NELP do not take into account, or specific detail the topographical classifications within offshore locations, namely shallow, deep and ultra-deep water basins – thus providing a recipe for further complications (Press Information Bureau, Government of India Cabinet, 2016).

The operational challenges faced by the contractors and the government under NELP paved the way for the appointment of two important committees (during Manmohan Singh's second term as Prime Minister) to study and offer solutions to the underlying problems. First, the Rangarajan Committee (RC) in 2012, and then the Kelkar Committee (KC) in 2013, came up respectively with specific sets of recommendations. The RC proposed a revenue-sharing model in place of the pre-existing cost-recovery and profit-sharing one. Accordingly, the government would receive a share of the contractor's resource revenues immediately after the royalty payments are made. The committee batted for shunning the cost-recovery mechanism by appealing to the contractors to improve technological and logistical efficiency, and thereby bring down the cost of exploration and production. The government would in return incentivise the contract terms to enable the contractor a hassle-free operating environment – implying that the former would remain a passive facilitator and not an active stakeholder in operations. It must be borne in mind that the RC based its rationale on the then contemporaneous exorbitant global oil prices. Hence, it believed that the contractor could easily make up for the risk involved in foregoing cost-recovery and could at the same time optimise its oil sales' profits into improving efficiency and enabling cost-effective operations (Government of India, 2014).

However, the following year, debates ensued with regard to the efficacy of relinquishing the cost-recovery and profit-sharing model. Thus, the KC was constituted, specifically with the agenda of chalking out a strategy to bring down the excessive reliance on expensive hydrocarbon imports and scale up domestic production. Emphasis was laid on Brownfield investments aimed at revitalising ageing and mature fields and reverse the trend of stagnating – or otherwise – dwindling production. The KC argued that cost-recovery would be better suited as it had a more lucrative appeal to the contractor who will need to incur additional costs to develop India's ageing fields and enhance resource-recovery. Further, the government's role as passive overseer would be completely

eliminated and the contractor would enjoy the liberty to decide the cost of exploration and production without a governmental imposition of a ceiling. One major recommendation of KC was to provide a window for the government to assess the contractor's computation of the profit share; meanwhile, until the contractor sees an enormous jump in profits earned through sales, government revenue would be confined to receiving royalty payments and corporate tax collection. KC's argument for complete deregulation was based on the logic that the exchequer is committed to pay the highest price for the consumption of a precious commodity that is also a prerogative of the future generations to harness (Coventus Law, 2016).

As for pricing, while RC supported only partial deregulation of prices, KC gave the contractor the freedom to peg producer prices at market rates, giving way to arms-length pricing. RC, although accepting crude oil price deregulation, did not vouch the same for natural gas – since it believed that India was then still in the fledgling stages of injecting natural gas into its energy mix and competition in the gas sector was still nascent. For the same reason, it insisted that the base price of natural gas be computed on the basis of the weighted average of the three major global crude benchmarks. KC on the other hand suggested complete deregulation such that the producer has the freedom to determine selling prices of the extracted commodity. It reinforced the cost-recovery and profit-sharing mechanism which was a hallmark of the Production Sharing Contract (PSC) legacy, whereas the RC had suggested scrapping the PSC model in favour of the Revenue Sharing Contract (RSC) model. Notwithstanding the bold recommendations of both the committees, NELP could not be fully refined as the government itself found the going tough in terms of segregating the terms and conditions for pre-NELP blocks (which were previously nominated by the government to private players, albeit with mandatory participating interest held by either ONGC or OIL) and associated contracts from those contracts negotiated under the NELP regime (Coventus Law, 2016).

The Narendra Modi administration has had to tread carefully through the quandary that was presented by the regulatory regimes, both of the present and the past. Following a thorough reassessment of the situation, a new mechanism was devised– albeit one that tries to toe a fine balance between both committee recommendations. Thus was born the HELP, accompanied by certain unprecedented reforms and fundamental recalibrations to the existing and previous exploration and pricing regimes. Some of the basic parameters of the new regime were synthesised from the recommendations given by the abovementioned committees. Commensurate with the RC findings, the principle

of revenue sharing (RSC) was adopted. Meanwhile, a single uniform licensing policy was introduced that works on the open acreage licensing model. This was a brainchild of the KC. On a similar vein, complete freedom has been granted to the licensee/contractor in terms of marketing and pricing of the oil, while special consideration has been extended to high-risk undertakings such as High Pressure High Temperature (HPHT), Deepwater (DW) and Ultra-deepwater (UDW) finds. However, the freedom to fix gas prices does come with certain restraints, whereby the government would still maintain a price ceiling computed every six months on the basis of thoroughly chalked-out formulas (linked to prices in established global gas hubs) separately for normal discoveries and high-risk ventures. Nevertheless, the complete deregulation of gas prices may be in the offing, as trading in the commodity is expected to gather pace. (Press Information Bureau, Governmnet of India Cabinet, 2016).

The open acreage licensing system espoused by HELP seemingly gives a morale boost to companies that were hitherto willing to invest in Brownfield and Greenfield ventures in India's upstream segment, but were wary of the excess red-tape and governmental oversight. The bellwether for a desirable change in the contractors' attitude could perhaps be the unveiling of the first ever National Data Repository (NDR) by the Union Minister for Petroleum and Natural Gas, Dharmendra Pradhan. The NDR, prepared by the Directorate General of Hydrocarbons (DGH), contains geophysical and seismic data about the various hydrocarbon prospects disseminated across India's 3.14 square kilometres of sedimentary basins. Interested contractors can make use of the NDR and choose basins they wish to explore – be it a producing mature field requiring additional investment, or even, heretofore unexplored regions. The contractor also gets to delineate an area of its preference for exploration, from unlicensed blocks. The chosen areas are put up for auction by the government and the highest bidder (the one offering the highest share of the resource revenue) is awarded the licence for the block (PTI, 2017).

With the transformation from NELP to HELP in the upstream segment, the Indian government is placing its bets on increased foreign investment, particularly in the domain of natural gas extraction and recovery. The essence of such a transition is to hasten the switch to a full-fledged liberal fiscal regime dictated primarily by the market forces of demand and supply. At the same time, one of the immediate priorities has been to add fresh momentum to the operating capacity of the state exploration giants – ONGC and OIL. These upstream companies, along with its (state-held) oil and gas marketing counterparts and transport facilitators have been earmarked for a major revamp. Merger is one of the outstanding plans floated by the government for upgrading

the efficiency of these companies. Correspondingly, the government has announced the possibility of a merger between ONGC and HPCL on the one hand, and OIL and IOCL on the other. The objective is to create world-class vertically integrated hydrocarbon majors that will be able to balance the losses suffered by the upstream segment with the windfalls made by the downstream segment under the persisting era of low oil prices – and vice-versa, as the trend shifts (FE Online, 2017). To further increase the stock value of these publically-listed companies, proposed step-by-step divestment of government-held shares is expected to fetch the desired outcome of reinvigorated public companies financed more on equity and less on debts.

## LNG Diplomacy: Transcending Oceans and Terminals

With domestic oil consumption soaring year after year, India's share of net natural gas consumption has however, not maintained a similar trajectory over the last half a decade. (Boersma, et al., 2017). This inconsistency was mainly attributed to depleting domestic production, cost-ineffectiveness and above all, the mismatch between installed power generation capacity and installed transmission-cum-distribution capacity that disincentivised power utilities from buying the expensive gas (Ernst & Young, 2015). Through initiating reformatory legislations in the hydrocarbon sector, the Modi administration has evinced interest in expediting the transition from coal and oil to natural gas. Along with the restructuring of the domestic hydrocarbon industry in the quest for augmented natural gas production, a red-carpet strategy is being modelled with respect to LNG imports. Capitalising on the timely advent of low oil and gas prices, besides banking on the 'fresh blood' injected into the global LNG trade, India has been negotiating lucrative import contracts (and renegotiating previously signed ones) with multiple suppliers (*The Hindu*, 2017). Among these are new and existing contracts that range from 'long-term' in nature, to medium as well as short-term. The price slump has also pushed India to buy LNG in the spot market (ICIS, 2017).

Moreover, some of the long and medium term contracts for which the price was already set, have been renegotiated on account of the low spot prices. Such signs are a clear indication that there is a strong buyer's market for LNG emerging in Asia, with countries like India, China, South Korea and Japan ramping up their imports of the fuel. With never-before-seen volumes of spot LNG cargoes replacing long-term contract-based shipments to India and the Northeast Asian economies (especially as oil prices reached a nadir in 2016), LNG traders are looking to hedge themselves from unexpected price fluctuations. This has harbingered the growth of futures trading contracts for LNG, focusing on the

Asian markets, and lately with a keen eye on India in particular (*LNG World News*, 2017).

Qatar has long enjoyed the privilege of being the world's undisputed LNG export machine. The small Persian Gulf monarchy even managed to reprise its role as a reliable exporter amid the mid-2017 diplomatic standoff with Saudi Arabia and its cohort of nations (Sergie, Inajima, & Dipaola, 2017). Of late, thanks to its booming offshore gas and CBM discoveries, Australian gas exports have surged, as new LNG terminals are going on-stream along its west-to-north-western coast. However, the most formidable long-term challenge to the undisputed export monopoly of Qatar and the invigorated LNG boom in Australia comes from the United States (US). Aided by the domestic shale revolution and the introduction of cost-effective oilfield technologies by companies operating on and off the Gulf of Mexico, the US is on the course to becoming one of the world's leading exporters of LNG. The reversal of the 40year-long moratorium on hydrocarbon exports (by the Barack Obama administration in 2015) has transformed the US' role from that of a net petroleum importer to one of a rising net exporter. To top it off, the 'pro-drilling' policies of the incumbent Donald Trump administration has propelled the United States to the top echelons in terms of domestic gas production. The accentuated vigour in the construction of new gas liquefaction facilities along the Louisiana and Texas coastline is only a natural forerunner of increasing American LNG exports to come by (Kraus, 2017). Apart from the exporting giants, traditional petro-producers like Malaysia, Indonesia and Nigeria have also made decent strides in the LNG export business. Massive gas discoveries off the Eastern Mediterranean in recent times have further pushed countries like Egypt and Israel to consider exporting LNG in a big way (International Gas Union, 2017).

LNG trade has indeed become more cost-effective over the times, and improved technological innovations appear to justify this argument. Nevertheless, the construction of liquefaction and regasification terminals continues to be a relatively, costly and time-consuming process. Whatever cost-minimising technological and logistical progress has been made so far, it has been a result of the surplus windfalls pocketed by the oil companies in the bygone boom-time of oil prices. Notwithstanding the fact that the global oil prices have nose-dived since mid-2014, the price rally over the past few months have seen crude prices rebound to the USD 70 per barrel mark, only to stabilise around the USD 60s. On an average, following the price nadir of early 2016, the oil glut was somewhat counterbalanced by a rallying demand from the Asian economies, coupled with continuing compliance to the oil-production-cuts espoused by Saudi-led Organisation of the Petroleum Exporting Countries

(OPEC) and non-OPEC Russia. Rather than actual per-capita demand being the chief determinant, the driving forces behind this demand surge now are the respective governments (and their petroleum marketing companies) that are opportunistically importing large quantities of cheaper oil and gas to pay off the fuel subsidy burdens accrued over the years of higher prices (Corbeau, Braaksma, Hussin, Yagoto, & Yamamoto, 2014). Though several small oil and gas producers went bust in this short span of time, the bigger and resolute ones were able to absorb the manifold shocks of incessant price fluctuations.

Besides, these producers have gradually got acclimatised to the new highs and lows in crude oil prices. In responding to these new price realities, there is a natural impetus on the part of the producers to reduce their break-even costs by improving operational capabilities. However, one crucial area where gas trumps oil in a big way is the projected rise in long-term demand for the former vis-à-vis the latter. On top of that, with the burgeoning international commerce in dry natural gas and LNG, new pricing benchmarks/indexes are being adopted that de-hyphenate gas prices from global crude oil prices (*The Maritime Executive*, 2017). The over-arching scenario has awakened the conventional natural gas exporters (heretofore relying mainly on dry gas shipments through pipelines) to the growing prominence of LNG. The writing on the wall is that in the upcoming era of natural gas, one will have to complement pipeline shipments with the ocean-faring and longer-distance-covering LNG carriers.

Some optimism may be expected in the way the Modi administration, particularly the Ministry of Petroleum and Natural Gas (MPNG) headed by Dharmendra Pradhan, is taking steps to revitalise India's otherwise more or less stagnating hydrocarbon sector. True that the low oil prices have been a blessing for the government in initiating groundbreaking reforms, and in the meantime, increasing fiscal revenue by maintaining higher taxes on an incontestably polluting commodity.

However, in the long run, in signalling a shift to a gas-based economy, the possibility of a complete deregulation of the domestic gas market exists in the pipeline. As a starting point to this, India plans to establish its very own natural gas hub / trading platform in the near future. However, such a possibility is contingent on a proactive programme of ramping up domestic gas production alongside building a well-integrated transport infrastructure network linking the country's multiple distribution points with its producing fields and LNG import terminals (ET Bureau, 2017). The materialisation of an India-centric gas trading hub is a crucial element in the creation of a regional pricing index that ensures competitive pricing of natural gas in the domestic consumer market.

Once accomplished, this would follow on the lines of established global gas-pricing benchmarks like the US Henry Hub, UK NBP, Average German Import Price cif (Cost Insurance and Freight) and the Japan LNG cif (*The Maritime Executive*, 2017).

Gauging the rising clout of the Asian LNG market, India has also sought to forge mutually-beneficial marketing alliances with fellow importers like Japan. Such an alliance would help ensure maximum flexibility as a net buyer in the booming LNG business. In light of the low LNG spot prices, GAIL of India had already renegotiated the supply contract terms with the oil Super-major Exxon Mobil over shipments from the latter's Gorgon Project in Australia. In return for lowering prices, GAIL agreed to increase the volume of gas it would buy as part of the twenty-year contract. This was followed on the continuing run of success stories as the renegotiation of contract terms between India's Petronet LNG (a subsidiary of GAIL) and Qatar's RasGas (Slav, 2017).

In future, GAIL intends to modify the existing arrangements for LNG imports with US-based companies and Russia's Gazprom too. In the case of the US, there is already an agreement in place between GAIL and Chenerie Energy for LNG shipments from the latter's Sabine Pass terminal in the Gulf Coast. The Indian gas major has also signed up for LNG imports from Dominion Energy's to-be-commissioned Cove Point liquefaction plant (LNG World News Staff, 2017). In addition to imparting amicability to the contract terms, tactful exercise of consumer advantage has brought India and Japan closer in terms of securing more lucrative supply deals and concessions from their respective sellers. As per their understanding, both countries are expected to swap shipments from each other's contracts depending on real time logistical profitability. This will help do away with the 'Destination Restriction Clause' – a stringent caveat underscoring most supply contracts that prevent the buyer from re-exporting the imported volumes to a third party. Such a competitive model will be beneficial to a transparent LNG market and should ease out India's prospects for a regional gas trading exchange based on actual supply and demand (Reuters, 2017).

## Transnational Gas Pipelines: A Pipedream or a Reality?

Sourcing gas from outside the sovereign does not stop with maritime LNG commerce. In India's case, the need for a transnational gas pipeline remains a time-tested proposition. In the years that have passed by, three major transnational gas pipeline projects were proposed, which eventually found their way to the doldrums, i.e. they never achieved fruition. These projects are as follows: The IPI (Iran-Pakistan-India), TAPI (Turkmenistan-Afghanistan-Pakistan-India) and the MBI (Myanmar-Bangladesh-India). However, given the momentum in the

transition to a gas-based economy, there is again a strong revival of interest in pursuing these projects, which may or may not come into action.

With a keen eye on the massive Galkynysh (also known as Dauletabad) gas field in Turkmenistan's Amu Darya Basin, India has expressed its commitment to bringing TAPI online. Replete with doubts about the transit of the pipeline through the restive regions of Afghanistan and Pakistan, the daunting question of the times is whether economics will ultimately trump geopolitics. And if so, will the question of energy security see the light of the day? What is path-breaking is the agreement reached between the Afghan government and the Taliban, wherein the latter vowed to safeguard the passage of the pipeline within its strongholds. With the completion of the Turkmenistan portion of the pipeline and the Taliban's commitment to the safe operationalisation of its Afghan section, TAPI may no longer be written off as a pipedream (Alikozai, 2018).

As for IPI, the proposal remained in a state of dormancy for so long, primarily on account of India's apprehensions to the pipeline's transit through Pakistan. Even an alternate proposal to reroute the pipeline through the shallow continental-shelf of Pakistan has not picked up steam. However, hopes of a gas pipeline from Iran has remained in suspended animation with the conception of a second alternative, which is one that traverses the deep seabed of the Arabian Sea between Oman and the western Indian state of Gujarat. This is the proposed Iran-Oman-India Deep-sea gas pipeline project. South Asia Gas Enterprise Private Limited (SAGE), a joint venture between a New Delhi-based logistics firm and UK-based deepwater services-provider, along with a consortium of other multinationals, that have already expressed a fervent interest in undertaking the ambitious project. The project has been officially christened the 'Middle East to India Deepwater Pipeline' (MEIDP) (Press TV, Iran, 2017).

Bereft of the Pakistan-challenge, but replete with logistical challenges, the pipeline, once materialised, will create a new chapter in the South Asian energy security landscape. The MEIDP project would in fact complement any breakthroughs expected from the promising Chabahar Port complex, besides giving some thrust to the proposed multi-modal International North-South Transport Corridor (INSTC) that links India, Iran and Russia via the logistically shortest trade route. Another eventuality that deserves mention is an integrated gas corridor connecting Turkmenistan, Iran and India; given that Iran already imports Turkmen gas via an inbuilt pipeline network. A feeder pipeline is already being constructed to link Chabahar Port with the gas lanes from Turkmenistan. This, coupled with proposed gas swaps between Russia and Iran (via the Caspian Sea or routed through Azerbaijan), could offload more Iranian gas (from its

southern fields) for supply to India through the MEIDP (Vaid, 2016). The crucial US support for TAPI, over an Iranian gas-sourced pipeline project, has created a looming cloud of uncertainty for the latter. Given the threat of US sanctions, major western oil companies and service/technology providers remain cautious about partaking in any venture that boosts Iran's economic leverage in the South Asian region.

The MBI pipeline project has withstood the test of time, going on from 'the pipeline that wasn't', to the 'pipeline that could be'. India had shelved the project, a decade back citing opposition from Bangladesh's then leader Khaleda Zia. However, with Sheikh Hasina in power, India has received an immense morale boost in terms of executing its economic projects that inter alia focuses on the development of its Northeast region. The MBI pipeline may get a second lease of life from the Hydrocarbon Vision 2030 – the MPNG's flagship proposal for bringing economic development in the Northeast using the hydrocarbon sector as an important facilitator (Press Information Bureau, Government of India, 2016). This pipeline, along with the multi-modal Kaladan Transit Transport Project, presents an opportunity before India to make up for the lethargy that had cost it a fruitful energy partnership with resource-rich Myanmar. Where India had once lost its golden opportunity, China seized the prize for itself when it successfully constructed a gas pipeline (supplementing the previously built oil pipeline) from the promising Shwe offshore gas field (Engh, 2016). Perhaps it is time for India to recalibrate its flawed strategies and indulge in some serious energy diplomacy.

## Conclusion

India's energy consumption is no doubt rising to exponential levels. For a nation invariably confronted with the challenges of balancing economic growth with social development, guaranteeing energy access to its multifarious population remains a daunting task. While on one side, there is a pressing need to bridge the gap between the rising, gross national energy demand and lagging supply, the flipside necessitates energy penetration and energy integration across the country's diverse geographic landscape with its multiple demographic tiers.

However, development does not strictly entail improving per capita energy consumption, if it does not involve a sustainable approach that promotes growth with less carbon footprints. Unlike coal and oil, as a resource still awaiting optimisation to its promised potential, natural gas fares well as a cleaner fossil fuel that qualifies as a bridgehead in the transition from coal and oil to renewable energy. More pertinently, in the fledgling renewable energy sector, given the problems of erratic power supply, (due to the inconsistent availability of the

energy generation source) and the nascent state of battery-based storage, gas-based power plants are more equipped to make up for any transmission losses during peak hours. This particularly holds true in India's case and hence, an urgent requirement arises to scale up the proportion of natural gas in the energy mix of a country, which is destined for strong growth.

Transcending regressive partisan politics, it must be acknowledged that the enthusiasm shown by the Modi administration in promoting natural gas usage holds India in good stead, both for now and the future. Be it in the areas of indigenous natural gas production, or overseas sourcing, there is a tangible demonstration of a proactive policy that pegs India's energy requirements to optimising gas usage. While foreign investment is crucial to rejuvenating India's ailing hydrocarbon sector, most importantly the upstream segment, India's foreign policy too needs to be calibrated with a streamlined energy diplomacy component. Oil companies need not be lectured on how to negotiate; but the government's pursuit of energy diplomacy could still largely influence the prospects of its oil companies abroad.

Therefore, by extending the required diplomatic support and leverage/ advantage, the Indian administration's overseas energy policy should work in tandem with the interests of its companies. The foremost priority in acquiring equity blocks overseas must be to fulfil India's energy requirements; but the companies ought to be given their basic share of autonomy in negotiating contracts and marketing their produce – an untradeable liberty that enables their maturation into top-notch majors with sufficient international experience. OVL is a classic example of how an Indian exploration major excelled overseas with the right mix of operational and managerial finesse, combined with the unwavering support of the Indian governmental apparatus wherever need be.

To conclude, India must make use of all possible means to raise the volume of gas in its domestic energy basket. The cascading reforms in the natural gas sector are a welcome sign as these are expected to bear fruit with the rising robust demand for the commodity from various sectors of the national economy. The policy-makers will have to walk the tightrope in terms of deciding whether to swiftly go for gas price deregulation or wait until the market attains full maturity with an empowered end-user base. As a matter of fact, there is justification to the subsidies extended towards the fertiliser industry – traditionally the top consumer of natural gas. To elucidate, it plays a substantive role in supporting agriculture as well as the Micro, Medium and Small Enterprises (MSMEs) – which are the mainstay of the unorganised sector that constitutes the backbone of the Indian economy. Said that, in a country with an inbred

penchant for thrift and frugality, and where process-based innovation trumps product-based innovation, natural gas is poised to have a bright future.

## References


1. H. D. Alikozai, "Taliban Vows to Protect TAPI Gas Pipeline Project", retrieved on from Voice of America, https://www.voanews.com/a/taliban-to-protect-tapi-gas-pipeline-project/4268767.html, 24 February 2018.
2. T. Boersma, A. Losz, A. Ummat, "The Future of Natural Gas in India: A Country at a Crossroads", *Columbia Global Energy Dialogues*, New York: Center on Global Energy Policy, 2017, p. 5.
3. S. Corbeau, A. Braaksma, F. Hussin, Y. Yagoto, and T. Yamamoto, *The Asian Quest for LNG in a Globalising Market.* Paris: International Energy Agency, 2014, https://www.iea.org/publications/freepublications/publication/PartnerCountrySeriesTheAsianQuestforLNGinaGlobalisingMarket.pdf
4. Coventus Law, *India - The Search For Hydrocarbons – A Regulatory Conundrum,* 16 September 2016, retrieved on 12 September 2017, from Coventus Law: http://www.conventuslaw.com/report/india-the-search-for-hydrocarbons-a-regulatory/
5. S. Engh, "India's Myanmar Policy and the Sino-Indian Great Game", *Asian Affairs*, 2016, pp. 32-58.
6. Ernst & Young, *Gas Market in India: Overview and future outlook,* 2015, retrieved on 21 September 2017, http://www.ey.com/Publication/vwLUAssets/EY-gas-market-in-india/$FILE/EY-gas-market-in-india.pdf
7. ET Bureau, "India to build natural gas trading platform: Dharmendra Pradhan", *The Economic Times,* 11 October 2017, https://economictimes.indiatimes.com/industry/energy/oil-gas/india-to-build-natural-gas-trading-platform-dharmendra-pradhan/articleshow/61028686.cms
8. FE Online, "Mega oil PSU: ONGC-HPCL deal not done yet, but here's government's next big merger move", *Financial Express*, 17 July 2017, retrieved on 4 September 2017, http://www.financialexpress.com/market/commodities/government-moots-indian-oil-oil-india-merger-ongc-acquisition-of-hpcl-yet-to-be-finalised/766451/
9. thowardqz, *India's massive untapped natural gas reserves could help free up $306 million a day on imported oil*, 22 July 2015, retrieved on 19 September 2017, https://qz.com/460957/indias-massive-untapped-natural-gas-reserves-could-help-free-up-306-million-a-day-on-imported-oil/
10. "Administered Price Mechanism", *General Knowledge Today*, 06 November 2015, retrieved on 3 October 2017, https://www.gktoday.in/administered-price-mechanism/
11. Government of India, *Report of the Committee on Gas Pricing – 2014,* New Delhi: Ministry of Petroleum and Natural Gas, Governmnet of India, 2014, http://petroleum.nic.in/sites/default/files/committee_report_on_gas_pricing_2014.pdf
12. ICIS, "India increases spot LNG demand ahead of monsoon", *Hellenic Shipping News*, 04 March 2017, http://www.hellenicshippingnews.com/india-increases-spot-lng-demand-ahead-of-monsoon/
13. India Brand Equity Foundation, *Oil and Gas Companies in India*, India Brand Equity Foundation, July 2017, https://www.ibef.org/industry/oil-gas-india/showcase
14. International Gas Union, *The World Depends on Natural Gas*, Barcelona: International Gas Union, 2017.

15. C. Kraus, "Boom in American Liquefied Natural Gas Is Shaking Up the Energy World", *The New York Times*, 16 October 2017, retrieved on October 19, 2017, https://www.nytimes.com/2017/10/16/business/energy-environment/liquified-natural-gas-world-markets.html
16. "LNG futures contract trading for Dubai, Kuwait, India spot cargoes starts in Singapore", *LNG World News*, 18 September 2017, retrieved on 27 September 2017, http://www.lngworldnews.com/lng-futures-contract-trading-for-dubai-kuwait-india-spot-cargoes-starts-in-singapore/
17. LNG World News Staff, "Petronet LNG targets investment in projects abroad, GAIL seeking six LNG cargoes", *LNG World News*, 11 July 2016, retrieved on 30 August 2017, http://www.lngworldnews.com/petronet-lng-targets-investment-in-projects-abroad-gail-seeking-six-lng-cargoes/
18. LNG World News Staff, "Report: India's GAIL looking to alter US, Russia LNG supply deals", *LNG World News*, 04 October 2017, retrieved on 4 October 2017, http://www.lngworldnews.com/report-indias-gail-looking-to-alter-us-russia-lng-supply-deals/
19. Government of India, *New Exploration Licensing Policy (NELP),* Ministry of Petroleum and Natural Gas, 2015, retrieved on September 1, 2017, http://petroleum.nic.in/sites/default/files/2exp.policy.NELP2015.pdf
20. Governmnet of India, "About Exploration & Production", Ministry of Petroleum and Natural Gas, 14 April 2017, retrieved on 03 September 2017, http://petroleum.nic.in/exploration-production/about-exploration-production
21. "Mumbai High Field, India", Offshore-technology, 2017, retrieved on 11 September 2017, http://www.offshore-technology.com/projects/mumbai-high/
22. Oil India Limited, "JVs / PSCs / Alliances", July 2014, retrieved on 10 September 2017, http://www.oil-india.com/JVs.aspx
23. L. Patey, *The New Kings of Crude,* Noida: HarperCollins, 2014.
24. Petronet LNG Limited, "About Petronet LNG", 2016, retrieved on 07 September 2017, https://www.petronetlng.com/Company.php
25. Government of India, "Petroleum Minister releases Hydrocarbon Vision 2030 for North-East", Press Information Bureau, 09 February 2016, retrieved on 28 September 2017, http://pib.nic.in/newsite/printrelease.aspx?relid=136255
26. Government of India, "Hydrocarbon Exploration and Licensing Policy (HELP)", Press Information Bureau, 10 March 2016, retrieved on 16 September 2017, http://pib.nic.in/newsite/PrintRelease.aspx?relid=137638
27. Government of India Cabinet, "Hydrocarbon Exploration Licensing Policy", Press Information Bureau, 7 March 2017, retrieved on 1 September 2017, http://www.iasparliament.com/article/hydrocarbon-exploration-licensing-policy
28. Governmnet of India, "Major Policy initiatives to give a boost to Petroleum and Hydrocarbon Sector", Press Information Bureau, 10 March 2016, retrieved on 7 September 2017, http://pib.nic.in/newsite/printrelease.aspx?relid=137661
29. Press TV, "Iran, Indians push for undersea gas pipeline from Iran", *SAGE Middle East to India Gas Pipeline*, 6 September 2017, retrieved on 26 September 2017, http://www.sage-india.com/index.php?option=com_news&view=detail&Itemid=85&news_id=67
30. PTI, "India switches to liberal regime for oil, gas exploration", *The Economic Times*, 28 June 2017, retrieved on 28 August 2017, https://economictimes.indiatimes.com/industry/energy/oil-gas/india-switches-to-liberal-regime-for-oil-gas-exploration/articleshow/59355581.cms

31. PTI, "Reliance, BP drop gas price arbitration against govt", *Rediff.com*, 23 June 2017, retrieved on 20 August 2017, http://www.rediff.com/business/report/reliance-bp-drop-gas-price-arbitration-against-govt/20170623.htm
32. Reuters, "India, Japan to Team up to Get More Flexible LNG Deals", *News18*, 11 October 2017, retrieved on 12 October 2017, http://www.news18.com/news/business/india-japan-to-team-up-to-get-more-flexible-lng-deals-1543589.html
33. Reuters, "ONGC strikes 'good' offshore oil, gas find off Mumbai High", *Business Today*, 20 September 2017 retrieved on 20 September 2017, http://www.businesstoday.in/current/economy-politics/ongc-strikes-good-offshore-oil-rigs-gas-find-bombay-high/story/260647.html
34. M. Sergie, T. Inajima, & A. Dipaola, "OPEC's LNG Giant Keeps Exporting Gas and Oil as Saudis Cut Ties"*, Bloomberg Technology*, 6 June 2017, retrieved on 25 August 2017, https://www.bloomberg.com/news/articles/2017-06-05/saudi-led-isolation-of-lng-giant-doesn-t-stop-gas-or-oil-exports
35. Slav, "Exxon Lowers LNG Prices for India", OILPRICE.com, 11 September 2017, retrieved on on 12 September 2017, https://oilprice.com/Latest-Energy-News/World-News/Exxon-Lowers-LNG-Prices-For-India.html
36. The Hindu BusinessLine Bureau, "GAIL (India) working on renegotiating LNG supply deals", *The Hindu BusinessLine*, 04 October 2017, retrieved on 05 October 2017, http://www.thehindubusinessline.com/companies/gail-india-working-on-renegotiating-lng-supply-deals/article9886430.ece
37. "Asia Ready for LNG Pricing Hub", *The Maritime Executive*, 27 March 2017, retrieved on on 23 September 2017, https://maritime-executive.com/article/asia-ready-for-lng-pricing-hub
38. United States Geological Survey, *Assessment of Potential Shale Gas Resources of the Bombay, Cauvery, and Krishna–Godavari Geologic Provinces, India,* World Petroleum Reources Project, November 2011, retrieved on on 13 September 2017, https://pubs.usgs.gov/fs/2011/3131/pdf/fs2011-3131.pdf
39. M.Vaid, "Revisiting India's gas pipeline diplomacy: Clearing blockages in India's energy plans", *Asia & The Pacific Policy Society Policy Forum*, 14 November 2016, retrieved on on 23 September 2017, https://www.policyforum.net/revisiting-indias-gas-pipeline-diplomacy/