

Building a new energy security architecture

Prepared for FICCI's fourth national conference on energy security

11 May 2017



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Introduction

The Honourable Prime Minister of India, while sharing his expectations from the hydrocarbon sector and the government's endeavour to achieve energy security, laid out his vision for India's energy future in the form of four pillars—access, efficiency, sustainability and security.

These are befitting for the Indian context. India cannot be energy secure if “access” to modern energy, e.g., electricity, liquefied petroleum gas (LPG) or piped natural gas (PNG), is not provided to every Indian. While “efficiency” measures would ensure that our demand growth is contained, “sustainability” measures would be essential to combat climate change and ensure a sustainable future. Steps to ensure “supply security”, by increasing domestic production and providing access to low risk international supply, complete the overall push required to ensure India's overall energy security.

In this white paper, we have defined energy security as “securing energy access for all Indian citizens in an efficient and environmentally sustainable manner”. While the paper presents a comprehensive view of India's energy security, its primary focus is to identify the implications for the upstream oil and gas (O&G) sector, aligned with the theme of the conference.

The paper is divided into two chapters:

1. “Rethinking, recasting and rebuilding India's energy security”, which covers the conference's themes of “Towards Gas-Based Economy: Managing Energy Security as Import Dependency Mounts” and “Oil and Gas Assets Overseas: Growing Dependence on a Volatile World”.
2. “Steps towards building a new energy security architecture”, which offers suggestions that could be considered for ensuring a more energy secure future for India.

This paper is a thought starter, intended to offer a set of directional options rather than a singular prescription. We look forward to feedback, suggestions and dialogue.

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Rethinking, recasting and rebuilding India's energy security

Energy's centrality to India's economic growth is well recognized. The Honourable Prime Minister provided a clear and simple structure to this push (as part of his opening speech for Petrotech 2016) when he shared his vision for India's energy future in the form of four pillars—access, efficiency, sustainability and security (Exhibit 1)¹.

Exhibit 1

Four pillars of India's energy future

Focus of this paper

"India needs energy which is **accessible** to the poor. It needs **efficiency** in energy use. As a responsible global citizen, India is committed to combatting climate change, curbing emissions and ensuring a **sustainable** future. Given global uncertainties, India also needs **energy security**"



Access

- Village and household electrification
- Modern cooking fuel access
 - LPG connections
 - City gas distribution/gas connections



Efficiency

- End-use efficiency
 - Freight modal mix
 - Fuel efficiency of vehicles and biodiesel
 - Industrial process (e.g., PAT scheme)
 - LEDs, efficient appliances
- Refining process efficiency



Sustainability

- More renewables in fuel mix
- Shift to a gas-based economy
 - Power and other end uses
 - Gas pipeline infra



Supply security

- Increasing domestic coal and O&G production
- Acquiring international O&G assets
- Reducing risks of import (e.g., infra-linked contracts diversification)

Over the last few years, there has been a significant push on all four pillars. "Access" of modern energy to all Indians is witnessing a historic ramp-up through the village electrification programme, i.e., Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY)², and the LPG distribution programme, i.e., Pradhan Mantri Ujjwala Yojana (PMUY)³. Demand reduction through "efficiency" measures is ongoing through the use of LED bulbs, green buildings and ethanol blending. There is also a huge push on "sustainability" through renewables capacity addition and building a "gas-based economy". While domestic O&G production has fallen, the G2G engagement has ensured increase in equity production from overseas assets.

¹ <http://www.petrotech.in/documents/PM-address-at-the-Inaugural-Session-of-PETROTECH-on-December-5-2016.pdf>

² DDUGJY: The scheme was launched with the objective to achieve 100 percent village electrification by 2019 (18,500 un-electrified villages to be connected) and provide electricity connection to 42 million BPL households. Sourced from DMU reports, Ministry of Power.

³ PMUY: This scheme was launched to provide around five crore BPL households with access to clean cooking fuel by 2019. Sourced from www.pmuujwalayojana.com

This paper—while attempting to present a comprehensive view across all four pillars—focuses on two pillars, which continue to face the biggest challenges within the O&G sector:

1. **Sustainability**, especially building a gas-based economy: With the gas share in primary energy mix at 6 to 7 percent in 2015–16, against the world average of 21 percent and the stated aspiration of 15 percent in the next three to five years⁴, efforts to increase gas consumption are paramount to ensure sustainability of the environment.
2. **Supply security**, through increase in domestic production and overseas O&G assets: With decrease in domestic production and increase in consumption, dependence on crude oil import has grown to 82.1 percent in FY17, against the Honourable Prime Minister’s stated aspiration of reducing import dependence by 10 percent by 2022⁵.

It would be important to “rethink, recast and rebuild” India’s energy security and future along the four pillars of access, efficiency, sustainability and supply security and take measured steps to “build the new energy security architecture” to make India truly “energy secure”.

ACCESS

The last few years have seen significant progress in this area. For example, village electrification is nearing completion with over 13,000 villages electrified in the last two years⁶. Since May 2016, LPG access has been given to more than two crore households under the PMUY⁷. There has also been considerable improvement in the reliability of power and expansion in city gas distribution (CGD) networks.

In spite of this positive momentum, an estimated eight crore households still rely on firewood and cow dung for cooking and an estimated four-and-a-half crore households do not have access to electricity⁸. This is one of the reasons why India’s per capita energy demand of 0.64 toe/capita is just one-sixth of the OECD average and one-third of the world average⁹.

Nonetheless, recent initiatives by the government in these areas, improved focus and robust mechanisms all point towards continued growth (Exhibit 2).

EFFICIENCY

Implementation and scale up of efficiency improvement measures in the residential, commercial, transport and industrial sectors could drive demand reduction of 160 to 200 MTOE by 2030 (Exhibit 3).

4 IEA, Key World Energy Statistics 2016, <http://www.thehindubusinessline.com/economy/india-to-double-Ing-import-capacity-in-a-year-says-pradhan/article9214559.ece>

5 PPAC—Snapshot of India’s Oil & Gas Data March 2017; Ministry of Petroleum and Natural Gas (MoPNG)

6 GARV dashboard, www.garv.gov.in, Ministry of Power

7 www.pmujiwalayojana.com, MoPNG

8 www.pmujiwalayojana.com, MoPNG and GARV dashboard, www.garv.gov.in, Ministry of Power; 10 crore households before launch of scheme and two to three crore connections achieved in the past year

9 IEA statistics for 2014, <http://www.iea.org/>

Exhibit 2

LPG and electricity access: Trends and targets

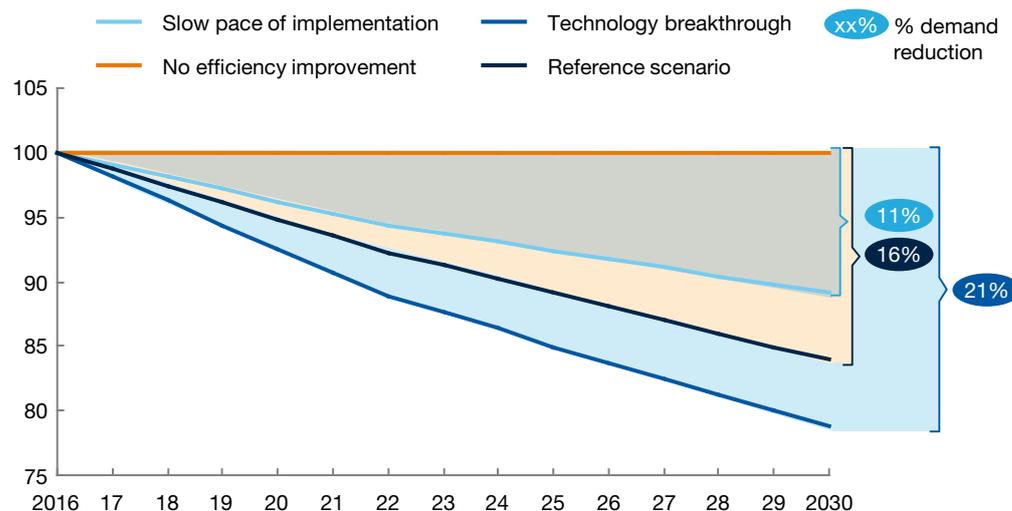
	Position in 2014–15	Progress in past 1–2 years	Target
 <p>Electricity access</p>	<p>18.5k Unelectrified villages in Aug 2015</p>	<p>13k Villages electrified in 1.5 years</p>	<p>100% Village electrification by May 2018</p>
 <p>LPG access</p>	<p>10 cr Households without LPG access in 2014–15</p>	<p>2.2 cr BPL households provided LPG connection</p>	<p>5 cr BPL households to be connected by May 2019</p>

SOURCE: GARV dashboard, Ministry of Power (www.garv.gov.in); www.pmujjwalayojana.com; Ministry of Petroleum and Natural Gas

Exhibit 3

Impact of demand reduction and efficiency improvement measures in various scenarios

Demand MTOE (as a percent of demand without any efficiency improvements)



SOURCE: *Transforming energy to transform India*, report presented at Petrotech 2016

These ongoing efficiency measures have shown positive momentum. Ethanol blending in petrol reached 3.5 percent in 2015–16 from 0.67 percent in 2012–13¹⁰. The government has plans to increase it to 10 percent and also introduce ethanol blending in diesel, which has the potential to reduce the oil import bill by more than INR 10,000 crore. The acceleration of the 12 second-generation ethanol plants, currently under construction, would also help in improving the ethanol blending percentage¹¹.

The LED scheme has achieved significant progress with distribution of 23 crore LED lamps in two years, resulting in potential peak demand savings of 6 GW¹². A decline of 4 to 5 percent has been registered in specific energy consumption under the Perform, Achieve and Trade (PAT) scheme in 2015¹³. Many government projects are currently underway to shift the freight modal mix towards fuel efficient means like the railways, e.g., dedicated freight corridors, and inland waterways, e.g., the Sagarmala programme.

In the O&G domain, demand reduction could also be achieved by enhancing the efficiency of the entire process—from hydrocarbon production to refining/conversion to transport to distribution to end use (including demand discipline). These include improving yields and energy efficiency of refineries, ensuring increased mileage in vehicles, reducing congestion on roads, accelerating the implementation pace of railways and inland waterways infrastructure and replacing diesel (used for power) with electricity generated from gas.

SUSTAINABILITY

Sustainability refers to generating and using energy in an environmentally friendly manner to ensure a sustainable future. This would imply increasing the share of renewables and natural gas in the fuel mix vis-à-vis coal for power and diesel for vehicles. In this context, shifting to a gas-based economy would be significant given its lower emissions—around 50 percent CO₂ per unit as compared to coal—and convenience of use. Currently, the country's share of gas in the primary energy mix is just 8 percent—in spite of record growth, renewables contribute just 6.7 percent of electricity generation¹⁴.

Renewables

India has taken the lead in committing itself to reduce its carbon footprint by nearly 33 percent by 2030 (from the 2005 levels) by focusing on renewables and natural gas. It has also committed to 40 percent power generation from non-fossil fuel sources by 2030. The country has also set an aspirational target of 175 GW renewables capacity by 2022¹⁵.

Given this scenario, the growth has been quite encouraging. Over the past five years, renewables capacity has doubled from 28 GW in January 2013 to 57 GW in March 2017 (Exhibit 4). For the first time in 2016–17, growth in renewables capacity addition (about

10 <http://pib.nic.in/newsite/mbErel.aspx?relid=142357>

11 <http://pib.nic.in/newsite/PrintRelease.aspx?relid=155782>

12 National Ujala Dashboard, www.ujala.gov.in, Ministry of Power

13 *India's intended nationally determined contribution*, 2015, India INDC to UNFCCC report

14 Central Electricity Authority (CEA), power sector summary for March 2017; NITI Aayog's presentation to Hon'ble Prime Minister for FY17 Infra Progress Review (Tweets by NITI Aayog)

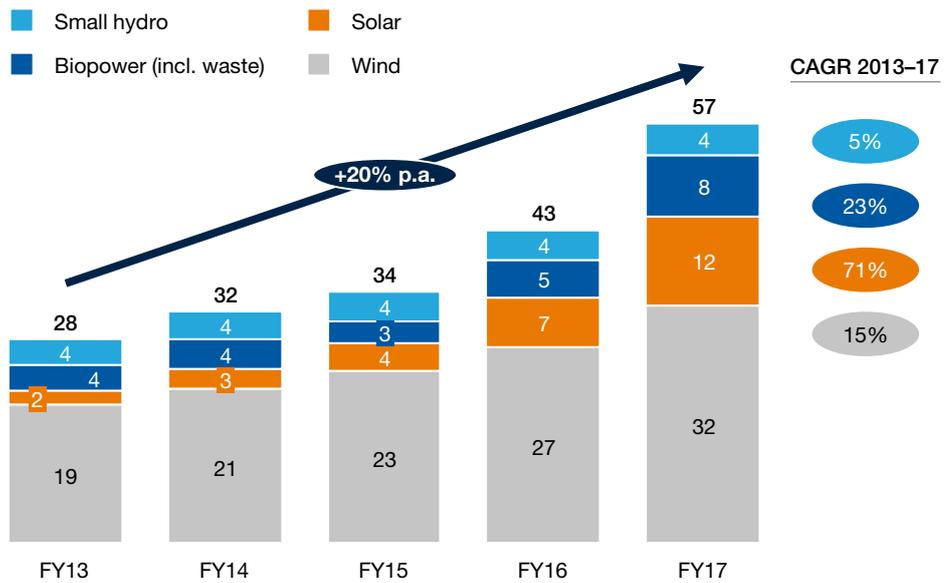
15 *India's intended nationally determined contribution*, 2015, India INDC to UNFCCC report

14 GW) crossed thermal capacity addition (11.7 GW). In the same period, the share of renewables in power generation increased to 6.7 percent¹⁶.

Exhibit 4

India's renewable capacity growth

GW



SOURCE: Ministry of New and Renewable Energy, Government of India

Gas-based economy

The government has declared its commitment to transform India into a gas-based economy with the ambitious target of increasing the share of gas in the energy basket—from the current 8 percent to 15 percent in the next three to five years. However, this will still be below the global average of 21 percent¹⁷.

Globally, the gas market is expected to be in a supply glut, with 40 to 50 mn tons of LNG coming online in the next three to four years¹⁸, e.g., from the US, Australia, Iran (Exhibit 5). This could be used as an advantage for India as many of these global projects would be scouting for a demand base.

In India, the gas market is currently in a logjam. While there seems to be conceivable latent demand for gas, a large part of the same is unable to afford LNG (Exhibit 6).

¹⁶ Renewables capacity addition includes large hydro capacity addition; sourced from the Ministry of New and Renewable Energy (MNRE) and Central Electricity Authority (CEA), Ministry of Power

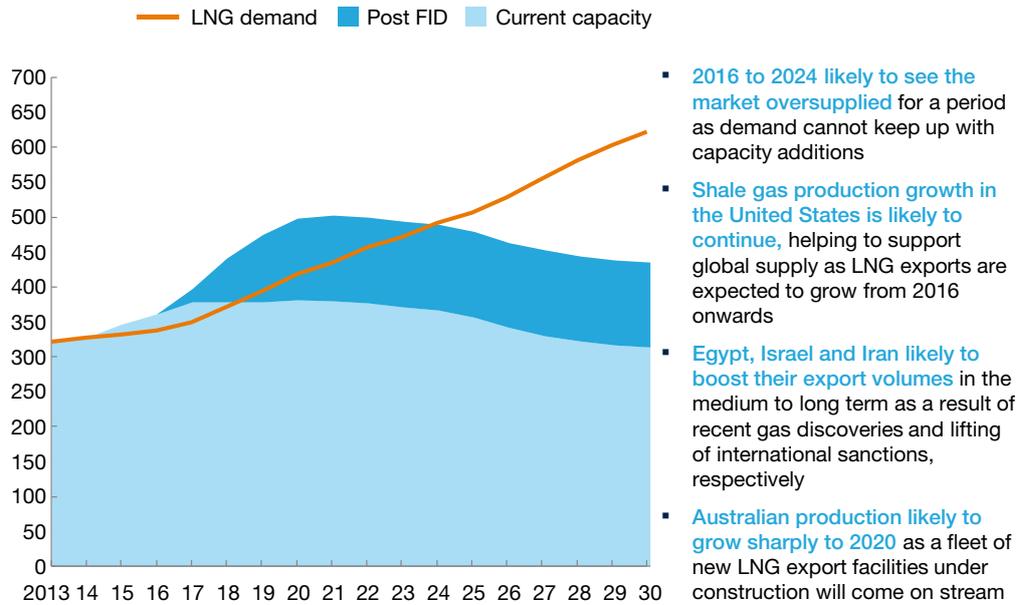
¹⁷ IEA, Key world energy statistics 2016

¹⁸ <http://oilprice.com/Energy/General/Can-India-Become-An-LNG-Juggernaut.html>

Exhibit 5

Global LNG supply and demand balance till 2030

bcma

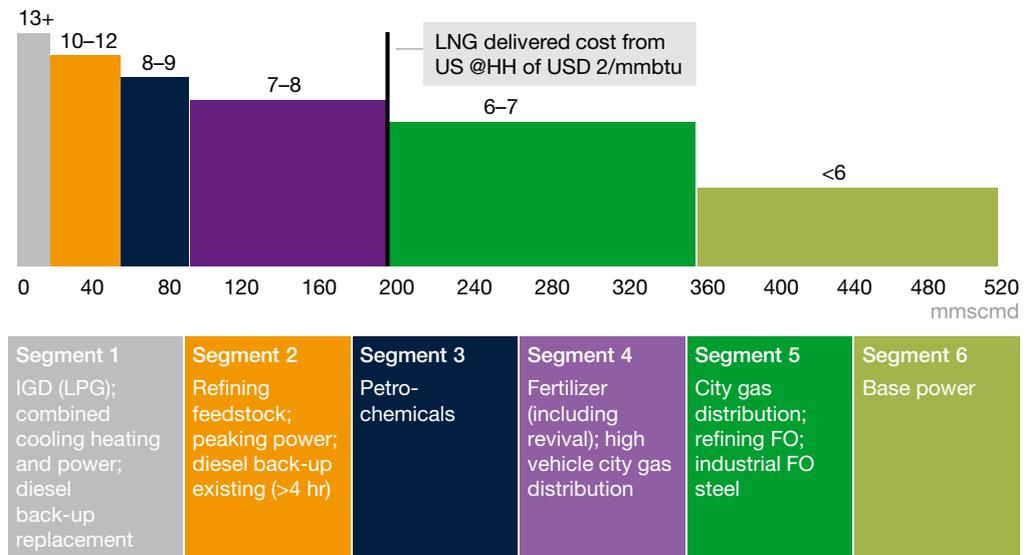


SOURCE: Energy Insights' Global Gas Model

Exhibit 6

India demand curve based on delivered costs¹

USD per mmbtu at customer doorstep



¹ Alternate switching cost at USD 50 per barrel, exchange rate 67

SOURCE: McKinsey India gas model

As a result of affordability, consumption is limited and so is the outlook for consumption going forward. Given this, infrastructure builds, like pipelines, LNG regasification terminals, etc., are being postponed because of expected low utilization and consequently poor economics. Therefore, several potential demand areas are not reachable in the absence of infrastructure, thereby creating a vicious circle of lower demand.

The following five potential steps could help the country overcome this logjam:

1. Creating policy actions to unlock gas demand in several sectors, especially those that can afford LNG:
 - a. **LNG industrial:** These actions would range from increasing reach through laying of steel/PE pipeline to connect new consumers in existing clusters, e.g., Agra and Firozabad, adding spur lines or using truck-based transportation to new clusters to making clusters larger by promoting the development of new industries, which are typically LPG based, e.g., ceramics, tiles and glass, around existing clusters like Bulandshahr and Firozabad
 - b. **Auto petrol and diesel:** CNG consumption could be further augmented in existing CGD cities by increasing pump penetration, ensuring quality kit availability, technology to move to lighter cylinders. Economics vs petrol and diesel could be enhanced through rationalization of taxes. The government could also plan CNG corridors along major national highways with high traffic, e.g., Noida-Agra, Delhi-Jaipur, Mumbai-Pune
 - c. **Diesel power:** Introducing “time of day tariff” or “reliability surcharge” for assured continuous power could help discoms buy peaking power. Pooling of LNG with domestic gas could also help increase the plant-load factor of gas-based power plants
 - d. **Industrial:** The government could consider mandating the conversion of FO-based plants to gas for environmental benefits
 - e. **Fertilizer:** The government could consider expediting revival of fertilizer plants to increase gas demand
 - f. **Domestic cooking:** The government could consider extending direct benefit transfer (DBT) to PNG beyond top cities to improve viability and establish equity with LPG.
2. Developing selective gas pipelines with viability gap funding (VGF) in some cases: The government has already provided a fillip to connect East India with the national gas grid using VGF for the Jagdishpur–Haldia/Bokaro–Dhamra pipeline¹⁹. Building more pipelines to connect areas of demand selectively may be considered with VGF for some of these.
3. Using transportation beyond pipelines, e.g., trucks, inland waterways, the railways: Trucks are already being used to reach LNG demand centres where scale does not permit pipeline builds. Other countries use various transportation measures like inland waterways and railways. For example, Alaska started shipping LNG by rail in 2016,

19 <http://pib.nic.in/newsite/PrintRelease.aspx?relid=153957>

while Japan has been doing it since 2000. India could also consider these options with the objective of providing gas to customers who can afford LNG but do not have pipeline connectivity.

4. Reviewing the CGD bidding process and parameters—consider including past experience and changes to improve financial viability. Also, consider providing public utility status to CGD and working with states to rationalize taxes.
5. Enabling increase in domestic gas production: This is possibly the most important step in driving up consumption of gas, since it could provide more affordable gas, given the savings in liquefaction, seaborne freight and regasification as compared to imported LNG. The next section on supply security provides suggestions on how to increase domestic production, which the government could consider. However, a large part of the solution could come from changes in the pricing policy of domestic gas.

Building a gas-based economy has shown marginal progress over the last few years. The government could consider adopting an integrated approach in mission mode to accelerate progress and take India towards a much more sustainable energy future.

SUPPLY SECURITY

Supply security refers to reliably sourcing sufficient energy to meet India's growing energy needs, while mitigating the associated short and long-term risks. India imported over a third of its energy needs and spent more than 50 percent of its total export earnings as a result of the stagnant domestic production²⁰.

To improve the country's O&G supply security, increasing domestic production is an important step. However, since it is not likely that India would be self-sufficient through domestic production in the foreseeable future, de-risking imports by increasing production from international equity reserves or through other means like long-term and infrastructure-linked contracts might be needed.

Boosting domestic production

There has been a steady decline in India's domestic O&G production—oil production fell by 4.7 percent in the last four years, i.e., 37.8 MMT in 2013–14 to 36 MMT in 2016–17, while natural gas production fell by 7.7 percent, i.e., 97 MMSCMD to 87.4 MMSCMD²¹. Therefore, increasing domestic production is critical to reduce India's import bill and to build a gas-based economy. The Honourable Prime Minister's aspiration for the industry is to reduce crude oil import dependence by 10 percent between 2014 and 2022.

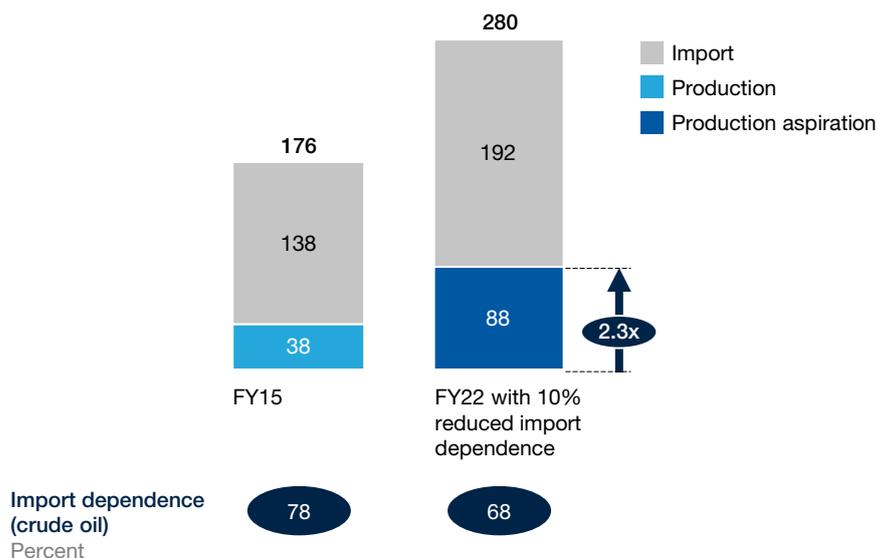
Domestic production would need to more than double to meet this aspiration (Exhibit 7).

20 India Energy Security Index, Shakti Sustainable Energy Foundation

21 PPAC – Snapshot of India's Oil & Gas Data March 2017; MoPNG

Domestic production of crude oil will need to more than double to meet Hon'ble Prime Minister's 2022 aspirations

MMT



SOURCE: PPAC Mar 2017 O&G snapshot, MoPNG; Annual O&G demand growth assumed to be 5% CAGR from FY17

For this purpose, many investor-friendly policy initiatives and reforms have been announced in the last few years. These include:

- Hydrocarbon Exploration Licensing Policy (HELP) that provides a revenue-sharing regime to replace the older cost recovery-linked Production Sharing Contract (PSC) regime. HELP also provides for marketing and pricing freedom for natural gas
- Open Acreage Licensing Policy (OALP) to give freedom to operators to select blocks all year round rather than specific exploration rounds with pre-selected blocks
- Discovered Small Field round 2016 wherein 31 contracts have been signed with a potential peak production of 15,000 BOPD of oil and 2 MMSCMD of gas over the economic life²²
- Higher gas price for difficult fields, which have resulted in projects like 98/2 moving ahead²³
- Policy framework for relaxations, extensions and clarifications at the development and production stage under PSC regime, aimed at early monetization of hydrocarbon discoveries²⁴.

22 <http://pib.nic.in/newsite/PrintRelease.aspx?relid=159971>

23 <http://pib.nic.in/newsite/PrintRelease.aspx?relid=13764>

24 http://dipp.nic.in/English/Investor/Make_in_India/sector_achievement/OilandGas_AchievementReport_18January2017.pdf

These policy measures have the potential to increase investments and activity in Exploration and Production (E&P), resulting in increased domestic supply. However, more concerted efforts may be required to increase domestic production of O&G. Most of these actions are related to improving the economic viability of investments or reducing risk by improving the “ease of doing business”.

The following actions could potentially help to increase domestic production:

- **Increasing recovery from mature producing fields:** Recovery of India’s mature fields is close to 35 percent vs the global benchmark of 40 to 45 percent²⁵. Induction of technology and enhanced oil recovery (EOR) techniques have been quite effective worldwide in this regard:
 - Offering incentives for specific investments to increase mature fields production, in line with international precedents, could help drive EOR investments and increase in recoveries associated with EOR. These include lower production tax/cess, e.g., Canada; investment allowance/credit, e.g., Colombia, the US, the Netherlands; income tax breaks, e.g., the UK, Russia, Malaysia, China; and fixed returns, e.g., Mexico.
 - Using innovative methods to induct technology while reducing risk for NOCs may be considered, e.g., mechanisms to offer mature fields on Integrated Project Management (IPM) basis with risk-reward sharing.
- **Accelerating development of discovered fields:** Multiple NELP discoveries have not been monetized on account of several reasons, primarily because of economic viability²⁶. Many of these discoveries are gas fields. The country could consider alternate gas pricing methods to make these fields viable and also ensure that necessary approvals from different agencies are not delayed.
- **Driving exploration activity:** New exploration blocks have not been awarded in India since NELP IX in 2012. As a result, exploration activity has primarily been driven by NOCs. With only 23 percent of India’s sedimentary basins moderately or well explored, there is an urgent need to advance exploration activity. This could be done by:
 - Taking all necessary approvals, e.g., environment, defence, before allotment of exploration acreages, to ensure that exploration activities start immediately.
 - Accelerating the “Open Government Data Platform” process by making relevant energy data available to investors and to the public in an analysis-friendly format as soon as possible.
 - Ensuring that the mapping of sedimentary basins for completing the National Data Repository (NDR) is completed by 2019.

25 https://www.chemtech-online.com/O&G/Tapas_april_may12.html

26 <http://www.financialexpress.com/economy/red-tape-stifles-indias-energy-dream-just-15-psc-discoveries-yield/53978/>

Creating an enhanced technology, manufacturing and services ecosystem by attracting higher global investments for O&G manufacturing/services under the “Make in India” initiative would also help in enhancing production across mature, discovered and new fields. To do so, it might be necessary to improve the ease of doing business and provide specific incentives, e.g., petroleum economic zones (as recommended by the Kelkar committee).

However, relying on domestic sources alone will not ensure full supply security as India is expected to be dependent on imports in the foreseeable future. India’s proven domestic 2P²⁷ reserves are only 800 MTOE for oil. Therefore, meeting the production target would mean reducing the oil reserves to production (R/P) ratio from the current 18 to 8²⁸. Given this scenario, reducing risk of access to international production, through equity assets or long-term contracts, would be as critical.

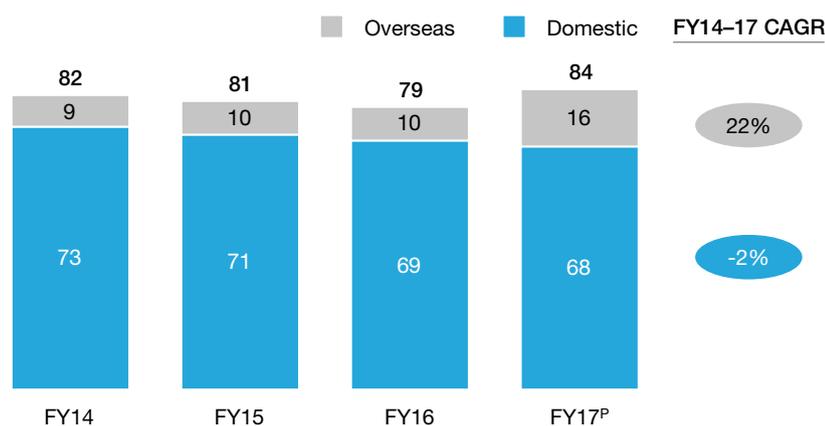
Securing overseas assets

International acquisitions of O&G assets, or increasing control over the import supply chain through infrastructure-linked (e.g., pipelines) and long-term contracts would be helpful to achieve India’s energy consumption targets. In 2016–17, Indian companies increased O&G production from overseas assets from 10 MMT to 16 MMT on the back of fresh international acquisitions, including in Russia (Exhibit 8). This is, however, still under 10 percent of India’s O&G imports.

Exhibit 8

Growth of O&G production from domestic and overseas assets

MTOE



SOURCE: PPAC snapshot of O&G data, March 2017; Ministry of Petroleum and Natural Gas

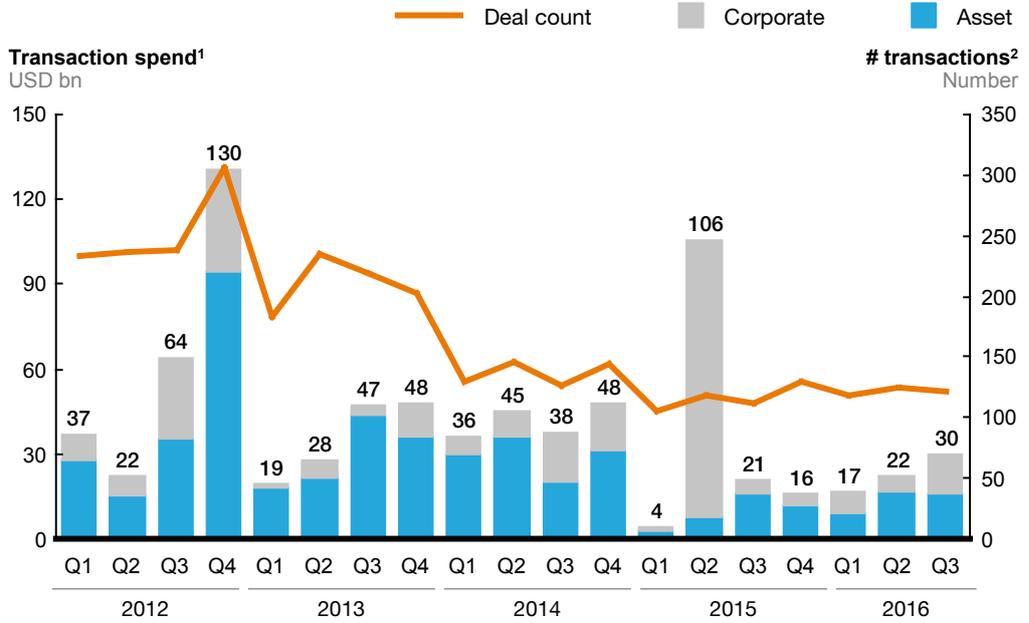
Globally, M&A activity is picking up after a dip in Q1 2015. With oil prices widely expected to stay under USD 60/bbl by various agencies, M&A activity is expected to sustain the momentum, providing an opportunity for Indian companies to further increase their presence globally (Exhibits 9 and 10).

27 2P reserves stand for “Proved + Probable” reserves

28 BP Energy Statistics 2016

Exhibit 9

Deal count is up after the dip in Q1 2015

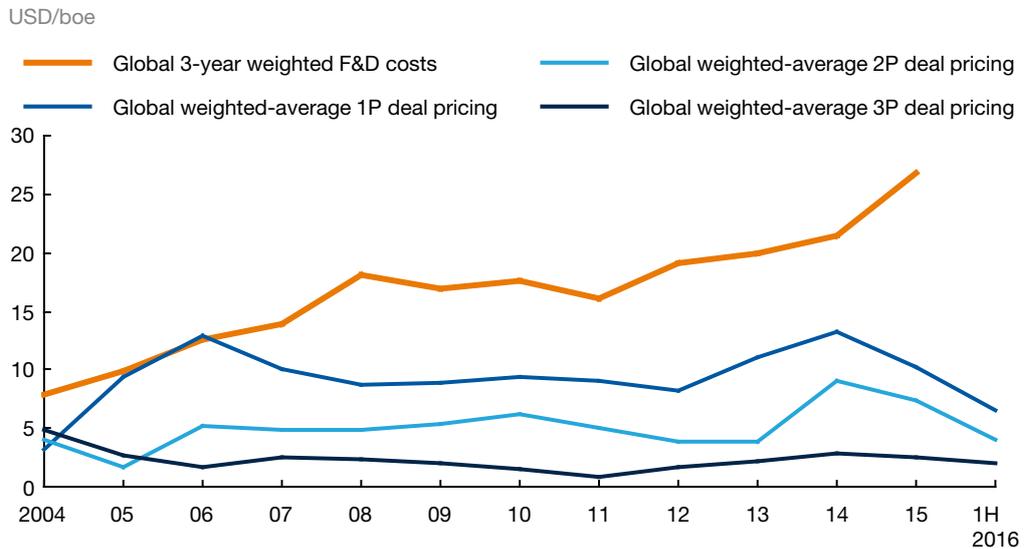


1 All upstream acquisition, merger, swap reserve/resource and acreage transactions with value disclosed
 2 All upstream acquisition, merger, swap reserve/resource and acreage transactions including transactions with no disclosure on reserves/production

SOURCE: IHS Connect

Exhibit 10

With acquisition costs falling and finding costs at an all-time high, deal activity is likely to continue to build momentum



SOURCE: IHS Connect

Indian companies could consider the following suggestions in this endeavour:

- Focus international acquisition efforts on a few geographical clusters and engage on a G2G level to develop material and deep presence. Also, build on existing scale and applying previous learnings on which geographies to focus on. Finally, consider stepping up diplomatic presence in these select geographies including appointing “resource” attachés
- Enable energy companies to make-cross border corporate acquisitions for capability, presence and momentum, not merely assets
- Create stronger PSUs or consortiums with sufficient financial power to go after identified assets/companies
- Encourage PSUs to develop global talent pools that can seamlessly operate in multiple markets, and transfer capabilities across borders
- Strengthen processes and organization structures in energy companies to allow effective governance, capital and operating efficiency and monitoring.

While there has been positive momentum towards resolving the challenges in the O&G space, India still has a long way to go. Concerted efforts would be required across the four pillars of access, efficiency, sustainability and supply security to “rethink, recast and rebuild” India’s energy security.



Steps towards building a new energy security architecture

This chapter discusses possible action steps, which India could consider for the upstream O&G sector to build a new energy security architecture. While some of these have been discussed earlier, this chapter provides a comprehensive view of all possible action steps across five themes. As mentioned previously, these steps are intended as thought starters for various stakeholders rather than prescriptions.

1. Drive coordinated policy and regulations to ensure economic viability of investments:
 - a. Offer incentives for specific investments to increase production from mature fields, in line with international precedents, to help drive EOR investments and increase in recoveries associated with EOR, e.g., accelerated depreciation, tax breaks
 - b. Consider alternate gas pricing methods for making discovered fields viable, including moving towards market-linked pricing for gas and the freedom to market gas produced. This has already been announced under HELP for blocks to be licensed in future
 - c. Take policy steps to increase gas consumption in segments where LNG is viable, e.g., LPG industrial, diesel power, vehicles, and consider making gas viable in segments where it is currently not, e.g., industrial FO, LPG domestic
 - d. Maintain taxation/subsidy parity between liquids, gas and renewables—with adjustments for emissions where necessary—to ensure viability and economical fuel mix
 - e. Consider modifications in bidding parameters for CGD in order to bring in only serious players and ensure economic viability. Also consider proving public utility status to CGD.
2. Enable visible improvement in ease of doing business:
 - a. Maintain a consistent, reliable and transparent regulatory regime, ensuring no policies are enacted on retrospective basis
 - b. Further simplify contract administration with time-bound approvals, empowered management committees and codified practices in PSCs
 - c. Provide all necessary approvals, e.g., environment, defence, before allotment of exploration acreages, to ensure exploration activities start immediately
 - d. Accelerate the “Open Government Data Platform” process by making relevant energy data available to investors and to the public in an analysis-friendly format as soon as possible.
3. Stimulate infrastructure buildout to develop next-generation supply chains:
 - a. Drive selective pipeline builds, using VGF in some cases, until gas demand and pipeline utilization gather momentum
 - b. Streamline approvals and land acquisition for buildout of new infrastructure and terminals
 - c. Provide sufficient fiscal and infrastructural incentives to attract investment in supply chains and services.

4. Adopt a systemic approach and create an improved technology, manufacturing and services ecosystem to enable production in the Indian context:
 - a. Drive larger R&D investments to develop technologies and solutions, since Indian energy companies spend between half to one-fifth of their global counterparts on R&D, only on a per barrel basis
 - b. Improve R&D effectiveness through stronger R&D processes and approaches, dedicated research cadres, closer monitoring of outcomes and greater commercial orientation
 - c. Drive global and Indian collaborations, which could take the form of bilateral alliances, industry forums, academic alliances or venture investments in technology firms
 - d. Incentivize and attract local manufacturing in the energy value chain, including oil field services, specialized materials and chemicals, along with energy efficient storage and usage technologies.
5. Drive risk reduction in international supply by strengthening PSUs and creating partnerships with sellers:
 - a. Focus international acquisition efforts on a few geographical clusters and engage on a G2G level to develop material and deep presence, build on existing scale and apply previous learnings on which geographies to focus on
 - b. Enable energy companies to make-cross border corporate acquisitions for capability, presence and momentum, not merely assets
 - c. Create stronger PSUs or consortiums with sufficient financial power to go after identified assets/companies
 - d. Encourage PSUs to develop global talent pools that can seamlessly operate in multiple markets, and transfer capabilities across borders
 - e. Strengthen processes and organization structures in energy companies to allow effective governance, capital and operating efficiency and monitoring
 - f. Encourage international collaborations and partnerships, including long-term contracts and overseas infrastructure investments
 - g. Establish an energy fund together with private companies to enable consortium bidding for large international assets and corporate entities.

Following a comprehensive approach across the four pillars of energy security would require a coordinated institutional process—this would ensure multiple initiatives are aligned towards one common goal. This would also mean close coordination not just between various arms of the government, but also with the industry. The vision is clearly ambitious, but not unachievable!

