

PetroFed

THE JOURNAL OF PETROLEUM FEDERATION OF INDIA



Voice of Indian Oil & Gas Industry

October-December 2016 | Vol.15 Issue 4

Pre – Budget 2017: Direct tax expectations from the Oil & Gas Industry (Cover Story)

Petrol pumps as the epitome of cashless economy

New Market Dynamics : Price Differentials and Octane Values

Special Feature on
PETROTECH 2016



Announcement
of **PetroFed**
Oil & Gas Awards
2016



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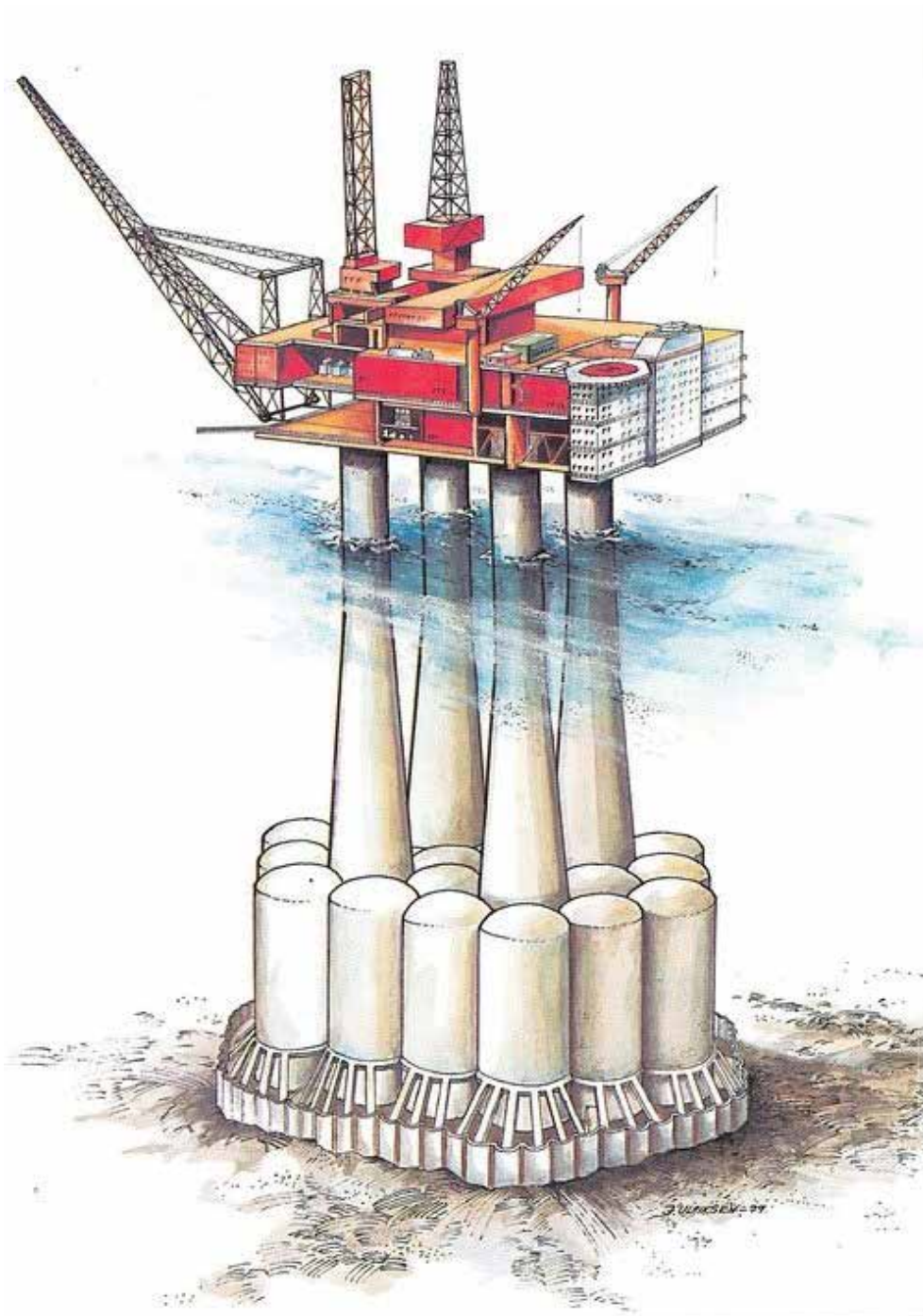
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2nd Floor, PHD House, 4/2, Siri Institutional Area,
August Kranti Marg, New Delhi-110016
Tel. No.: 91-11-26537483, Fax No.: 91-11-26964840
E-mail : dg@petrofed.org, nkbansal@petrofed.org,
droy@petrofed.org, Website : www.petrofed.org

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From the Director General



The year 2016 saw many initiatives taken by the Government of India to promote Oil and Gas sector. Ministry of Petroleum & Natural Gas announced several policy initiatives in the last year to encourage the industry and investors with the objective to accelerate the exploration and production activities in the Hydrocarbon sector. Some of the policy decisions included a forward looking Hydrocarbon Exploration and Licensing Policy (HELP), Marketing and Pricing freedom for gas produced from Deepwater, Ultra Deepwater and High Pressure-High Temperature areas subject to certain conditions, Extension of the Production Sharing Contracts of 28 Small and Medium sized discovered blocks, The Discovered Small Field Policy, etc.

The above policy initiatives aimed at increasing the domestic production of Oil and Gas are also expected to increase the confidence of the investors in the Indian market. Government is also following principles of "Minimum Government - Maximum Governance" to attract investment, improve transparency and minimize administrative discretion.

In another unique development in 2016, Sh. Dharmendra Pradhan, Minister of State (I/C) for Petroleum and Natural Gas released the Hydrocarbon Vision 2030 for North East India, with the objective of leveraging the North-Eastern region's hydrocarbon potential; enhance access to clean fuels, improve availability of petroleum products and facilitate economic development and to involve local population in the economic activities in this sector.

In the coming years, India's oil demand is expected to grow at a CAGR of 3.6

percent to 458 Million Tonnes of Oil Equivalent (MTOE) by 2040, while demand for energy will more than double by 2040 as economy will grow to more than five times its current size, as stated by Hon'ble Minister of State for Petroleum and Natural Gas. Gas production is likely to touch 90 Billion Cubic Metres (BCM) by 2040, while demand for natural gas will grow at a CAGR of 4.6 percent to touch 149 MTOE.

Last year PetroFed had submitted various recommendations and representations to the Government on various issues which included BS VI fuels specifications and representation on Goods & Services Tax (GST) advocating that the exclusion of Crude Oil, Natural Gas, MS, HSD and ATF (excluded goods) from GST for the time being will hurt the petroleum industry badly. Apart from the recommendations, various workshops/ seminars / programmes were conducted on host of subjects like workshop on 'Getting Ready for the GST Regime', workshop on 'Changing Exploration Landscape of India', conference on Project Management in Oil & Gas Industry, training programmes like 'Analyzing Oil Markets', seminar on Smart Refineries, Seminar on Army's Fuelling Needs: Future Outlook, International Corrosion Impact Study: Learning for Oil & Gas Industry, Oil Market Outlook, Workshop on Totality of Project Management, Seminar on Hydrocarbon Prospects for India in Latin America and Caribbean, Symposium on Biofuels and Bioenergy: Enablers for Reducing Oil Import Dependence, Round table meeting on way-forward for enhancing biofuels availability, guest lecture on "Environmental and Health Benefits of LPG, the Clean Cooking Fuel", workshop on 'Impact of GST on Oil & Gas', conference on 'Executing Organisational Strategy: Leveraging the Power of Project Management', Interactive Session on 'Deliberating Oil Markets'.

We also held meetings with Prime Minister's Office and Ministry of Finance to discuss the Industry's

concern regarding service tax and GST issues faced by the sector and suggestions/recommendations in respect of tax issues pertaining to Oil & Gas sector.

On the sidelines of PETROTECH 2016, Youth Forum was successfully organised by us where around 200 students from leading college institutes across India participated in an interactive session with Sh. Jayant Sinha, Hon'ble Minister of State for Civil Aviation, Industry experts and young leaders. The Youth Forum was uniquely designed with a plethora of topics, live quiz and technical sessions for young people.

With the growing emphasis on gas based economy, PetroFed conducted several projects and workshops like Accelerating India Gas Market, Talk on Gas Hydrates, Gas4India campaign, Industry- Academia Workshop on A-Z of Natural Gas and LNG, Natural Gas Infrastructure and Markets in India and many more. We are simultaneously involved to develop Gas Roadmap Study: Gas Vision 2030 with the involvement of industry members as well.

Further, to develop a gas based economy in India, PetroFed in partnership with CII and Natural Gas Society has initiated a national campaign 'Gas4India', which was launched by the Hon'ble Minister on September 6, 2016. Gas4India is a unified cross-country, multimedia, multi-event campaign to communicate the national, social, economic and ecological benefits of using natural gas as the fuel of choice to every citizen who uses, or will use in the near future, gas in any way - to cook, travel, light their homes and power their businesses. The year long campaign also hopes to connect with youngsters, who will inherit this nation and inform them about this cleaner, greener fuel of the future. The Gas4India campaign includes social engagement via Twitter, Facebook, YouTube, LinkedIn and its official blogsite, as well as hyper-local, offline events to directly connect with consumers through discussions, workshops and cultural events.

PetroFed along with IHS and ICF International has also initiated a study for 'Accelerating India's transition to gas by enabling increased market access'. The study is focused on creating markets and connecting the last mile access to the gas consumer while learning from international best practices and for an effective policy implementation in the country to boost the gas markets.

It is felt that in order to increase the natural gas share, there is an urgent need to harness the domestic gas sources and expansion of infrastructure for LNG import terminals, floating storage, re-gasification facilities and gas transportation, etc. for catering to the growing demand of existing and new demand centres (viz. green corridors, smart cities).

Last year, we also witnessed Hon'ble Prime Minister Narendra Modi launching the massive Pradhan Mantri Ujjwala Yojana (PMUY) scheme to provide five crore LPG connections to Below Poverty Line (BPL) families in the next three financial years. Over 5 crore BPL women would be provided LPG

connections in the next three years, without having to pay any security deposit. The administrative cost of Rs.1600 per connection, pressure regulator booklet and safety hose would be borne by the Government. The government aims at achieving the objective of providing relief to 5 crore women from the scourge of smoke and disease by the time the country celebrates the 150th birthday of Mahatma Gandhi.


The landmark demonetisation drive has pushed cashless transactions for petroleum products to 25-30 percent. Demonetisation has given a 15 percent leap to cashless transactions in petroleum products. Before demonetisation, cashless transactions in the petroleum sector accounted for only 10 percent. The cashless economy initiative of the Oil & Gas sector would create an environment for a cleaner and transparent economy via digitalization in other sectors of economy.

This issue of PetroFed journal would be the last edition in the name of PetroFed. As you are aware, in an effort to give impetus to the Indian Hydrocarbon

sector, a major historical stride was taken in December, 2016 with the announcement of the amalgamation of two important entities in the sector namely Petroleum Federation of India (PetroFed) and PETROTECH Society.

The new body named 'Federation of Indian Petroleum Industry' (FIPI) is expected to be better placed to serve as a strong facilitator of continuous dialogue between various stakeholders of the upstream, midstream & downstream sectors of the Indian petroleum industry including global suppliers, technology providers, service providers, academic entities and relevant agencies for protecting and upholding the interest of Indian petroleum industry.

I am sure you will enjoy this issue of PetroFed as I take this opportunity to wish all our readers and their families a very happy and prosperous New Year.



Dr. R. K. Malhotra
 Director General

Petroleum Federation of India

Core Purpose Statement

- » To be the credible voice of Indian hydrocarbon industry enabling its sustained growth and global competitiveness.

Shared Vision

- » A progressive and credible energy advisory body stimulating growth of Indian hydrocarbon sector with global linkages.
- » A healthy and strong interface with Government, legislative agencies and regulatory bodies.
- » Create value for stakeholders in all our actions.
- » Enablers of collaborative research and technology adoption in the domain of energy and environment.
- » A vibrant, adaptive and trustworthy team of professionals with domain expertise.
- » A financially self-sustaining, not-for-profit organization.

For more details, kindly visit our website: www.petrofed.org

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Pre – Budget 2017: Direct tax expectations from the Oil & Gas Industry

Finance



Hiten Sutar

Senior Manager

BSR & Associates LLP in India



Neetu Vinayek

Partner

BSR & Associates LLP



Manmay Chandawalla

Manager

BSR & Associates LLP in India

Historic decision for reduction in production of crude oil by the Organization of Petroleum Exporting Countries (OPEC) may be a double edged sword for some countries. It had an immediate impact on the crude price in the global market. Oil and Gas (O&G) service companies around the world have withered with losses over couple of years and the rise in crude oil price may bring in hope that it would result in increase in exploration activities.

It may perhaps be the best time for the Government of India to consider providing a fillip by way of tax breaks, clarifications and assurance to the O&G companies. In this article, we have discussed few of the Direct tax expectations from the O&G industry perspective from the Union Budget 2017-18.

Tax holiday benefits for discovered small fields

A seven year tax holiday equal to 100% of taxable profits was available for undertaking engaged in commercial production of mineral oil pursuant to notified blocks licensed under New

Exploration Licensing Policy (NELP). In Budget 2015, the Finance Minister had indicated that over the next four years corporate tax rate will be reduced to 25 per cent, and to compensate for this reduction there will be rationalisation and removal/withdrawal of various tax exemptions and incentives. Accordingly, vide Finance Act, 2016, provisions granting tax holiday to Exploration & Production companies have been phased out with effect from 31 March, 2017.

In past couple of years, the Government has made tremendous efforts to bring-in investors for undertaking exploration activities in India. However, due to inherent risks associated with the exploration activities, the investors would require fiscal incentives to make huge investments in India. Thus, to incentivize companies into investing in the O&G sector, it is expected that the Finance Minister brings in some positive amendments with regard to the profit-linked or investment linked incentives to the new blocks which would be offered for exploration activities.

Exemption on account of storage of crude oil

The Finance Minister in the recent Budget introduced a special exemption provision applicable only for foreign companies who earn income on account of storage of crude oil in a facility in India and sale of crude oil therefrom to any person resident in India. A foresaid exemption is not applicable to domestic companies who are in the said business. Over couple of years with the sharp fall in crude price, the Government of India along with several domestic companies was involved in building strategic storage tanks / terminals for storage of crude oil / natural gas. These companies have incurred huge capital expenditure and have built strategic tanks / terminals in certain parts of India. It is expected that the Government of India provides similar exemption / deduction / allowance to such domestic companies who have been engaged in the business of storage of crude oil / natural gas in India.



Infrastructure status to the Exploration and Production (E&P) facilities

Approximately, around 85% of India's energy requirement is imported from foreign countries. Several efforts are being put in by the Government of India to make India a self-sufficient energy producing company. Companies within the country and from foreign countries invest significant amount of money / infrastructure which is required for exploration and production of mineral oil in India. At times due to failed exploration, such companies incur significant sunk costs. There is a need to treat such companies at par with infrastructure companies to enable access to funds and availability of other benefits which have been granted to infrastructure projects. The Finance Minister in the previous Budget has put a sun set clause in the tax holiday provision which was available to certain companies engaged in development and maintenance of infrastructure facility, and at the same time has granted a weighted deduction for development / maintenance of such facilities. With a view to treat E&P companies at par with infrastructure companies it is expected that the Finance Minister grants infrastructure status to E&P companies and allow aforesaid benefits.

Amendment in the Circular clarifying cases where consortium members shall not be treated as an Association of Persons (AOP)

Tax authorities in certain circumstances have alleged that consortium members jointly bidding and executing O&G turnkey contracts formed an AOP and accordingly their income were jointly assessed to tax. The joint assessment of the consortium members results in several harsh tax consequences. This issue was highly litigated as each contract needed to be analysed in entirety and objectively. Several High Courts decided and laid down certain principles which have now been accepted by the Central Board of Direct Taxes and it thereby issued a Circular No. 7/2016 dated 7 March, 2016 providing guidance / clarification on the subject. The Circular has provided various attributes which, if satisfied, would not trigger exposure on account of constituting an AOP. However, consortium between two associated enterprises are excluded from the purview of aforesaid Circular. It is recommended and expected that such exclusions be deleted where associated enterprises are able to demonstrate that the listed attributes mentioned in the Circular are satisfied in their individual cases.

Extension of Section 42 to some pre-NELP blocks

Section 42 is a special provision for companies engaged in the business of prospecting for or extraction or production of mineral oils in relation to which the Central government has entered into an agreement. It is a pre-requisite that each contract awarded for extraction or production of mineral oil needs to be tabled before each house of Parliament and allowance under this section shall be granted to only such contracts. It has been observed that some Pre-NELP contracts were not laid on the table of each House of Parliament and on this account benefit of Section 42 is denied to select such contracts despite President of India signing these contracts. In spirit, allowance under section 42 should be applicable even to such pre-NELP contracts and the Finance Minister is expected to come out with some amendment to clear the ambiguity.



Deduction for infructuous or abortive exploration expenses under Section 42

Currently, deduction for infructuous or abortive exploration expenditure is allowed only in respect of surrendered area. In other words, even when expenses are charged to the profit and loss account as per the accounting policies of the Company, the Company is not allowed to deduct these expenses for the purpose of computing taxable profits under the Act. Such a requirement of surrendering the area for availing the deduction of abortive and infructuous expenditure is not in the interest of industry.

Hence, it is expected that in the upcoming budget, the pre-requisite to surrender the area for claiming infructuous or abortive expenditure be deleted by the Finance Minister and such expenditure ought to be allowed as deduction in the year in which the area is abandoned as abortive.

Ceiling on profits for Site Restoration Fund (SRF) contribution

Section 33 ABA of the Act is a special provision which provides for deduction of the amount deposited in the site restoration fund scheme subject to ceiling of 20% of profits. Abandonment and site restoration of oil and gas installations involve capital intensive

activities and have considerable impact on the environment. Ceiling of 20% restricts the availability of tax benefit to valid business expenditure incurred for the purpose of site restoration. It is expected that in the Budget 2017, this ceiling of 20% should either be removed or increased to at least 50%.

Clarification on Section 44BB in case of income by way of Fees for Technical Services (FTSs)

Section 44BB is a special deemed income provision under the Act which provides for a special tax regime for non-resident service provider engaged in the business of providing services or facilities or supplying plant and machinery on hire in connection with prospecting for exploration or production of mineral oils. Under this section, at the option of the O&G service company, they can offer 10% of its gross receipts to tax on deemed income basis. Such companies are not required to maintain any books of accounts in India. The Finance Act 2010 amended the aforesaid provision to exclude applicability of this section to companies who earn income in the nature of FTS / Royalty.

Question of applicability of this section on this account was highly litigated. This issue was recently put to rest by the Apex Court. However, tax

authorities, on the basis of alternate interpretation of said decision in certain cases, still contest that certain services being in the nature of FTS are not eligible for deemed income provision of section 44BB of the Act. With a view to rest litigation on this account, it is expected that the Government provides necessary clarification or brings a suitable amendment in the provision.

Conclusion

The Government of India has not provided any sizeable incentive to the O&G industry over past few years. India heavily depends on imports for its domestic oil requirements. The Government of India, in order to incentivize investment into this sector, should consider providing some benefits / allowance / tax holiday to the O&G industry.

The information contained herein is of a general nature and is not intended to address the specific circumstances of any particular individual or entity. The views and opinions expressed herein are those of the author and do not necessarily represent the views and opinions of BSR & Associates LLP in India.

Petrol pumps as the epitome of cashless economy

Finance



Kaushiki Sinha Ray
Senior Assistant Director
Economic Research
PetroFed

We have literally come full circle. The country which was amongst the first issuers of currency in the world is on the brink of a new revolution – a new regime towards an economy independent of any shackles of traditional money.

While the smiling face of Mahatma Gandhi may have been repositioned from time to time, the fact is that intriguing rupee in your pocket is soon dwindling. History is witness to the turbulent journey of the Indian currency from coins of varying constitution depending on the age of introduction to the rupee motivated by diplomacy and political agenda. Today, as we cross over to a new form of payment, a noble idea seems to be guiding this change, a notion of a transparent economy and a nation focused towards its growth.

Cashless payment and economic growth

Whether this was the sole intention of the demonetization drive or a side effect, the fact is that the stage has been set for a new age drama – a cashless economy that is here to stay. While many have debated upon the premature nature of this campaign, few can dispute upon the fact that this is a crucial step in the direction of an economically developed nation. Electronic card payments have an immensely meaningful impact on the world economy. Moody's Analytics published by Visa states that greater usage of electronic card payments added \$983 billion in real U.S. dollars to the GDP of 56 countries they studied from 2008 to 2012. The global GDP grew by an average of 1.8% during this time period.

Diffusion of Innovation Theory (DOI) analyses the effect of cashless payment on an economy. Interpersonal networks act as catalysts for the adoption of a new idea or an innovation. So while in this case diffusion is the spread of cashless payment where consumers yearn for convenient and improved forms of transaction, businesses seek new profit opportunities. Hence, this means to say that diffusion of cashless payment will result in the adoption of cashless transaction subject to appropriate adopters and processes. Studies have shown that effective migration to electronic forms of payments would result in overall economic growth, consumption and trade due to transparency, accountability, reduction in cash related fraud and ease of doing business.



India's stalwart

The last two months have seen the Oil and Gas industry in the country, specifically the retail pumps become a yardstick as against which the measure of cashless economy initiative can be assessed. Starting from absorbing old notes to dispatching currency to the agonized masses, the retail pumps have in fact been the rock of the economy during this trying time period. And then they became the leaders of the next stage of revolution by encouraging and incentivizing the cashless mode of payment.

Cashless transactions have gone up by 2-3 times since the announcement of demonetization with Petrol Dealers' Association in Mumbai stating that the previous count of 650-700 customers who would prefer cashless payments has now gone up to 2400 customers per pump daily. The momentum of this movement is bound to gain further ground especially with OMCs expecting at least half of total transactions to turn cashless by March 2017. This is going to be a staggering amount considering that the three state run oil marketing companies together have 53000 pumps and over 78000 LPG agencies under their jurisdiction and these outlets on a daily basis churn out transactions worth Rs. 500 crore for petrol, Rs. 450 crore for diesel and CNG and Rs. 50 crore for LPG. This amounts to a total worth of 7.2-7.3 trillion transactions per day.

Demographically assessing the expanse that has been influenced by the digital mode of payment in this sector; petrol pumps in India experience traffic of about 4.5 crore on a daily

basis. Prior to the announcement on demonetization, only about 20% of Rs.1800 crore worth of petrol / diesel sold per day to the customers was through digital mode. This saw a marked increase to 40% in the month of November and as much as Rs. 360 crore per day. The cash back incentive of 0.75% of the sale price to consumers on purchase of petrol/diesel in case of payment through digital means is expected to shift at least 30% more customers to this form of payment.

The results of the incentive programs and the government aided campaigns to handhold the public into the digital era are definitely apparent. OMCs across the country are allying their goals with that of the government's. In spite of Bihar being predominantly a rural economy with 89% of the population in villages, out of 1294 petrol pumps both in urban and rural parts, 74% or 963 petrol pumps have now become cashless. This states a clear jump of 15.4 percent from 1.4 percent as far as cashless transactions are concerned.

In yet another manifestation of the significant nature of this campaign, IndianOil, Bharat Petroleum and Hindustan Petroleum have begun offering the price discount to cooking gas customers. This would enable them to avail a discount of Rs.5 on every refill booked and paid for online.

Economic digitization

Major motivation can be derived from the above statistics especially if you come to think that if one of India's largest sector can progress in such a drastic manner towards a cashless

initiative taking in stride with itself not just economically advanced states of the country, but also the relatively challenged ones; the goal of being a cashless economy is not far out of reach. In strict economic parlance, a very direct relationship has been observed between the nations which are cashless economies and their economic development. Countries like Belgium, France and Canada rank amongst the top most countries with largest non cash payments' share of total value of consumer payments. Significantly, these countries also rank high in terms of Human Development Index and with due credit since economic digitization increases the government's ability to enhance its taxation systems. India's informal economy roughly constitutes 45% of the GDP and 80% of employment. The harsh derivation of this fact is that billions are exchanged every year without the tax collector even knowing about it. This is the major reason as to why only 1% India's population pays income tax.

A digital economy will pave the way for a real time economy, one where every transaction can be tracked in real time. This will help increasing the tax net of the country, which in turn will have the potential to deliver untold benefits to its own people. The need of the hour is to take to guidance in this initiative from the Oil and Gas sector and create an environment for a cleaner and transparent economy via digitalization. This will act as the stepping stone for a conducive environment for foreign investment, boosting economic growth and propelling the country towards the next era of growth.



India transits to clean energy economy: where will the differentiated sustainable path lead to ?

Energy



Dr. D.C. Patra
Deputy General Manager,
Bharat Petroleum Corporation Limited,
Mumbai, India

INTRODUCTION

India will contribute to the single largest share of growth, around one-quarter, in global energy demand during 2013 to 2040, as estimated by International Energy Agency. India's 1.25 billion people consume abysmally low level of energy. There are 237 million people, constituting 19% (26% in rural and 4% in urban), who live without electricity. Indian cities will accommodate 315 million more people by 2040. As Government is focused to improve manufacturing activity, aiming at growth of income and employment, more energy will be consumed. Share of coal is likely to be 50% of energy mix.

The largest source of increase in world's coal use will come from India by 2040. Oil consumption will be at 10 million barrels per day in 2040 and that will be the highest increase, comparing to other countries. India is on move to decarbonize its energy system with urgency to meet its goal of having 40% share of non-fossil fuel capacity in the power sector by 2030.

Expanding energy sector is certain to exacerbate already serious challenges with climate change consequences, water stress and local air pollution. Integrated policies on land use and urbanization (the 'smart cities' initiative), pollution controls, technology development, and a relentless focus on energy efficiency can mitigate these risks.

India will strive to meet the 'Sustainable Energy for all' goal of United Nations, where it is envisaged that the following 3 goals will be achieved by 2030 on global space :

- Universal access to electricity and clean cooking fuels;
- Doubling the share of the world's energy supplied by renewable sources from 18 to 36 percent;
- Doubling the rate of improvement in energy efficiency.

India will be on watch for its ambitious INDC (Intended Nationally Determined Contribution) committed to United Nations Framework Convention on Climate Change (UNFCCC). The significant measurable commitments are:

- To reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.
- To achieve about 40 percent cumulative electricity installed

capacity from non-fossil fuel based energy resources by 2030 with the help of transfer of technology and low cost international finance including from Green Climate Fund (GCF).

- To create an additional carbon sink of 2.5 to 3 billion tonnes of CO₂ equivalent through additional forest and tree cover by 2030.

Government of India announced in 2014 its intention to have cumulative renewable power generation capacity of 175 GW by 2022 (excluding large hydropower). Out of this, solar will be 100 GW, wind 60 GW, biomass 10 GW and small hydro projects will be 5 GW. India launched international solar alliance of 120 countries in 21st Conference of Parties (COP21) at Paris

in December 2015, with commitment to contribute \$27 million and headquarter in India.

Challenges of energy systems in india

Energy systems in India have evolved over last six decades along with country's economic development, supporting the aspiration of 1.25 billion people, within the framework of democratic polity, globally integrated economy and environmentally sensitive regime.

Energy trilemma index by world energy council

Challenges on energy front in India are best captured by the energy trilemma index formulated by World Energy Council.

Table 1 Energy Trilemma Index Ranking and Balance Score of India

	2013	2014	2015	Score (2015)
Energy Security	76	76	53	B
Energy Equity	110	105	104	D
Environmental Sustainability	121	123	122	D
Overall Rank and Balance Score	115	122	107	BDD

Table 1 brings out that during 3 years, India's rank has improved on two indicators and also on overall, from 115 to 107. Impressive improvement is noted on energy security front and marginal fall is noted on environmental sustainability front. Overall score BDD, however, leaves much room for improvement.



Energy Architecture Performance Index by World Economic Forum

World Economic Forum has devised a composite index, Energy Architecture Performance Index (EAPI), as a measure of 3 key indicators of a country's energy system, which are again split into 18 sub indicators. EAPI index ranks 125 countries in descending order and gives score to the 3 key indicators on a scale of 0 – 1.

Broad Index	What the Sub-indices indicate
Economic Growth and Development	This sub-index measures the extent to which a country's energy architecture adds or detracts from economic growth
Environmental Sustainability	This sub-index measures the environmental impact of energy supply and consumption
Energy Access and Security	This sub-index measures the extent to which an energy supply is secure, accessible and diversified

Table 2 Energy Architecture Performance Index for India (score on the scale of 0 – 1)

	Rank out of 125 Countries	Composite Score	Economic Growth & Development	Environmental Sustainability	Energy Access & Security
2016	90	0.53	0.51	0.49	0.61
2015	95	0.51	0.50	0.42	0.61
2014	69	0.48	0.49	0.41	0.54

Table 2 brings out the fact that India has improved score on all fronts, during last 3 years, particularly with respect to energy access and security. There is marginal improvement in composite score over the years, though the rank scrolled down in 2015 and went up in 2016.



Shift in energy trajectory

Projected changes in energy basket in india 2030

India's demand for energy is contingent upon the following factors: a) growing population, b) growth in GDP, c) shift of economic activity from service to manufacturing, d) increasing use of energy intensive appliances, e) households switching from conventional bio-energy to modern energy carriers, climbing the energy ladder, f) preference for personalized automobiles and g) increasing urbanization.

In this scenario of prevailing optimism and activism, it is hard to project demand for energy in future. However, taking everything into account, two international agencies have projected long term demand for energy in India. Though each projection varies from the other, depending upon their inputs and assumptions, it is worthwhile to see the aggregate value to get a sense of volume that the projections make. (Table 3) We will however work for disaggregated analysis on the projection prepared by IEA (2015). 'World Energy Outlook 2015' by IEA, factors latest initiatives of Government of India including the announcements made on the eve of COP21. Two specific initiatives having significant bearing on energy systems have been accounted, namely: a) 'Make in India' campaign to promote manufacturing and b) universal and reliable electricity supply.

Table 3 Multiple Projections of Demand for India's Energy (MTOE)

Agency	Edition / Year	2013	2020	2030
BP	February 2015	595	807	1160
BP	February 2016	637.8 (year 2014)	841.0	1505.3
IEA	Mid 2015	770	940	1182
IEA	November 2015	775	1018	1440

India will experience significant shift in production and consumption of power from renewable sources. Projection made by International Energy Agency (IEA) in World Energy Outlook (WEO) 2015, taking into account India's commitment to UNFCCC, suggests that there would not be dramatic shift in energy mix in terms of percentage, though significant power will be made by deploying modern renewable technologies, led by solar and wind, as presented in Table 4.

Table 4 Primary Energy Demand by Fuel - Projection till 2040 (MTOE)

	2013	2040	Shares (%)		2013-2040	
			2013	2040	Change	CAGR (%)
Oil	176	458	23	24	282	3.6
Natural Gas	45	149	6	8	104	4.6
Coal	341	934	44	49	592	3.8
Nuclear	9	70	1	4	61	7.9
Renewable	204	297	26	16	93	1.4
Total	775	1908	100	100	1133	3.4

Two significant developments merit attention. Coal by virtue of indigenous resource endowment will continue to play significant role as fuel in industries and in power production. However, efforts are on to set up clean power plants, called supercritical power plants. Super critical power plants offer higher efficiency and lower carbon emission because it generates lesser carbon for the same amount of coal burnt. Currently, share of clean coal is about 10%, which is planned to rise

up to 24% by 2022. Secondly, gas will replace oil (in transport) and coal (in power generation) and will add volume. Thirdly, renewable will take a leapfrog use, particularly solar and wind. However, there are many supporting developments which are seriously being worked on to make renewable power a big break through. The Electricity Act of 2003 mandates State Electricity Regulatory Commissions to develop renewable energy projects and include the fixation of minimum quotas for the sourcing of renewable energy power, under renewable purchase obligations and determination of preferential feed-in-tariff. India has moved up to 3rd position (score 71.6) in 'Renewable Energy Country Attractiveness Index' (RECAI) in 2016 from its previous year position of 5th, formulated by Ernst & Young. RECAI represents a country's macro fundamentals, energy imperative, policy enablement, project delivery and technology potential.

Significant developments are taking place on technical, commercial and institutional front to generate solar power at grid parity price.

The current installed solar power generation capacity is 4,878 MW. India launched the Jawaharlal Nehru Solar Mission in 2010, with the aim of adding 20,000 MW of grid connected solar power to the country's energy mix by 2022. The current BJP led NDA government has revised the target of 20,000 MW capacity to 100,000 MW. (Solar parks will generate 20,000 MW roof-top 40,000 MW and distributed generation projects 40,000 MW.) The solar space has witnessed significant decline in tariffs. Government is hopeful to provide green power at less than Rs. 4.50 per unit.

A perennial problem on power sector is pricing of power by State Governments and financial sickness of State government owned power distribution companies (DISCOMs). Government of India has come out with an innovative scheme in November 2015 with the objective to improve the operational and financial efficiency of State DISCOMs. Till date (14.03.2016), 8 States have joined the scheme UDAY (Ujwal Discom Assurance Yojana), which aims to restructure the debt of State Discoms with federal funding.

India's Action Plan to Realize the INDC Commitment made at UNFCCC

Global carbon intensity fell by 2.7% in 2014, the steepest decline on record, while world GDP grew by 3.3%. During 2000 to 2014, carbon intensity declined by 1.3% per annum against 3.7% growth in GDP per annum. (Table 5)

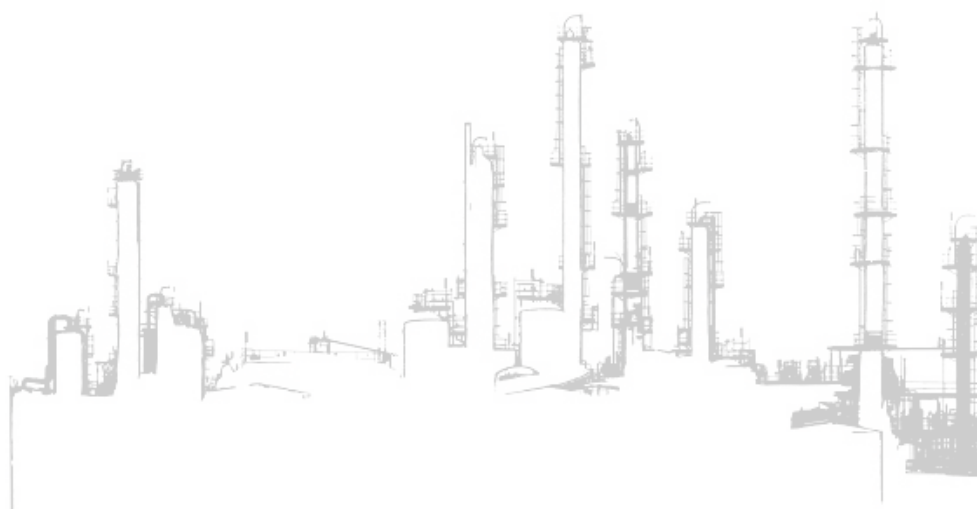
India witnessed the highest rate of emission growth over 2013 at 8.2% and contributed the most to the increase in global emission in 2014. India's de-carbonization rate has averaged 1.4% since 2000. Carbon intensity followed a mostly downward trend in the early 2000s, but it has fluctuated since the 2008 recession. (Table 5)

[Table 5 Low Carbon Economy Index](#)

	2013 – 2014			Trend this Century		
	Change in carbon intensity 2013-2014	Carbon intensity (tCO2/\$mGDP) 2014	Change in energy related emissions 2013-2014	Real GDP growth (PPP) 2013-2014	Annual average change in carbon intensity 2000 – 2014	Annual average change in carbon intensity
India	0.7%	268	8.2%	7.4%	-1.4%	7.2%
World	-2.7%	306	0.5%	3.3%	-1.3%	3.7%

India's Action Plan to Mitigate Carbon Emission

- All coal-fired power stations are required to have stringent emission standards and efficiency targets.
- Renewable power of 175 GW is to be produced by 2022, including 100 GW of solar PV and 60 GW of wind. Non-fossil fuel sources will constitute 40% of electric power installed capacity by 2030.
- Energy conservation program will attempt to save 10% of today's energy consumption by 2019. Over the longer term, industry, transportation, buildings and appliances will be required to achieve energy efficiency savings.
- The carbon tax has been increased four-fold to approximately \$6 per tonne of CO₂ and applies to coal, lignite and peat. Carbon tax revenue is redistributed through the National Clean Energy Fund and contributes up to 40% of project costs.
- Perform Achieve Trade (PAT) will have its second phase of energy intensity targets (which has achieved a 4-5% decline in between 2012 and 2015 for eight sectors; iron and steel, cement, fertilizers, textiles, aluminium, pulp and paper, and chlor-alkali).
- 100 'smart cities' with smart energy system have been identified for grant support
- Additional areas will be covered with forest and tree, saving 2.5 to 3 billion tonnes of CO₂ equivalent by 2030



Mission Renewable Energy

Presently, renewable energy accounts for approximately 12% of India's total installed power generation capacity and 5% of the total generation. India aims to reach a renewable energy capacity of 175 GW by 2022. 100 GW of this is planned through solar energy, 60 GW through wind energy, 10 GW through small hydro power and 5 GW through biomass-based power projects. Of the 100 GW target for solar, 40 GW is expected to be achieved through deployment of decentralized rooftop projects, 40 GW through utility-scale solar plants and 20 GW through ultra-mega solar parks. Considering these targets, renewables (solar, wind and hydro) will account for about 10% of the total energy mix, by 2022. [18]

Solar Mission – 100 GW

India has set an ambitious goal of providing uninterrupted power for all homes, industrial and commercial establishments and adequate power for farmers by 2022 through its "24X7 Power for All Program". India aims to achieve a "solar revolution" by installing 100 GW of solar power by 2022 - a thirty fold increase from 3.4 GW in early 2015.

The above includes an official target of installing 40 GW of grid connected rooftop solar PV (GRPv) by 2022. Further, 33 solar parks have been approved in 21 States with aggregate capacity of 19,900 MW. Solar Energy Corporation of India has released Rs.54.93 crore to respective States from the sanctioned amount of Rs. 374 crore.

Wind Power

India has the fourth largest installed wind power capacity, which is 27 GW, in the world, after China, USA and Germany. Wind power accounts nearly 8.5% of India's total installed power generation capacity and generated 28 GW power in 2014-15 which is nearly 2.6% of total electricity generation. Government of India has announced a revised estimation of the potential wind power resource (excluding off shore wind power potential) from 49 GW assessed at 50 m Hub heights to 102 GW assessed at 80 m Hub height at 15% capacity factor.

Conclusion

The issues analyzed and scenarios presented in this paper together portray a plethora of possibilities, conditioned on multiple favorable complementarities. Things have to turn positive at both macro and micro level and also at socio-political and behavioral level.

We are dealing with civilization, science and technology and nature at atmospheric level. One sixth of humanity, together with the balance, existing at heterogeneous level of development, have to carry a common mission, that is to grow the economy, produce and consume energy and sustain the environment.

The path outlined in this paper is just an opening in the subject for scholars and policy makers to view the issues in totality. Nothing in the realm of economy, energy and environment can be predicted. But every development has to be dealt with clarity, confidence and collaboration.

The paper concludes that India has made an ambitious beginning in 2015. The path ahead is both challenging and rewarding.



Oil producers move ahead to cut production – 2017 to experience market balance

Oil & Gas



N. K. Bansal

Director

Oil Refining & Marketing
PetroFed



To Start with

OPEC 14, on 29th September, 2016 declared in Algiers their intention to cut crude oil production to maintain output at 32.5–33.0 million barrel per day (mbpd) level. The announcement was provisional with nation wise quota and other details to be decided in Vienna meeting scheduled for November 2016. Though analysts expressed apprehension considering past experience with OPEC, situation at Iran and production by non-OPEC countries but the markets moved northwards immediately thereafter and Brent price crossed 53 \$ per bbl. on 10th October 2016 from about 46 \$ per bbl. on 27th September, 2016. There onwards, market regained equilibrium level of pre-announcement period. Our journal "PetroFed" carried a report in the last edition on this subject.

For our esteemed readers, OPEC is an organisation founded in 1960 with current membership of 13 countries which export oil. Indonesia, suspended its membership in the meeting of 30th November, 2016 as the country is now net importer of oil.

Non-OPEC Producers join the Bandwagon

With behind-the-curtain diplomatic efforts with rivals, non-OPEC countries in a pact, first in last 15 years, also joined the bandwagon. On 10th December, 2016, 25 nations (13 OPEC and 12 non-OPEC) declared, in Vienna, an agreement on nation-wise quota to cut production by 1.8 million barrel per day. Production from non-OPEC countries will reduce by 600,000 bbl. per day and balance from OPEC own members.

Market reports suggest following may be the cut from some major oil producing countries :

OPEC Majors

	Cut (bbl. per day)
Saudi Arabia	500,000
Kuwait	131,000
Iraq	210,000
UAE	139,000
Venezuela	95,000

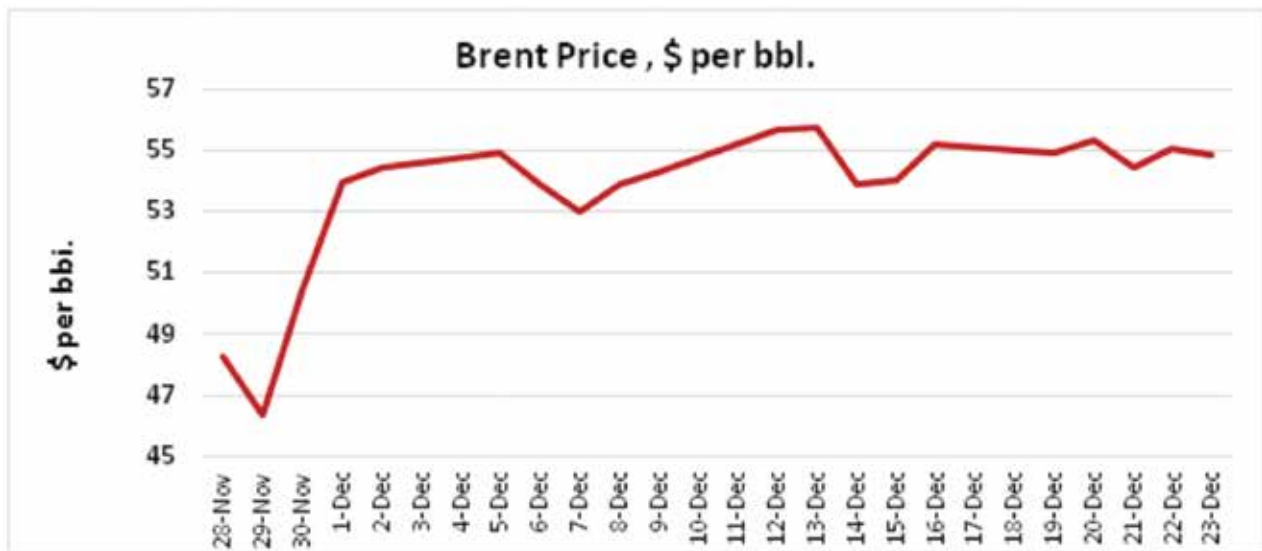
Non-OPEC Majors

	Cut (bbl. per day)
Russia	300,000
Mexico	100,000
Oman	45,000
Kazakhstan	50,000
Malaysia	35,000
Azerbaijan	35,000

Libya and Nigeria are exempted from the cut whereas Iran has some space for increase in production.

Impact on market

Although the price of Brent has been moving upwards since end of November 2016 as OPEC conference on 30th October, 2016 decided to implement 'Algiers Accord' (maintaining output at 32.5 mbpd) from 1st January, 2017, the agreement with non-OPEC producing nations has increased the intensity of ripples in the markets. Brent price crossed 55 \$ per bbl. mark on December 2016 for the first time and till the date of this report, is hovering around this level only.



(Source : Investing.com)

With all apprehensions expressed even about quota fixation on cut within OPEC, it is once again established that OPEC is a force to reckon with. While one more definite step has been made in the market balance, still more to cover and would be watched closely. Let us have a look at demand-supply balance (Source: OPEC - MOMR, December 2016)

	2014	2015	1Q16	2Q16	3Q16	4Q16	2016	1Q17	2Q17	3Q17	4Q17	2017
Total World demand	91.6	93.2	93.5	93.6	95.2	95.3	94.4	94.6	94.7	96.5	96.5	95.6
Non-OPEC supply	61.5	63.1	63.2	61.8	62.1	62.8	62.5	63	62.7	62.6	63.4	62.9
and												
OPEC NGL												
OPEC Production (secondary sources)	31.0	32.1	32.5	32.8	33.3							
Total Supply	92.5	95.2	95.7	94.5	95.4							
Over Supply	0.9	2.0	2.3	0.9	0.2							

What's More

Assuming OPEC production for 4Q16 at 33 mbpd, supply will be surplus by 0.5 mbpd in this period. If OPEC maintain supply at 32.5 mbpd from 1Q17 onwards, the supply will still remain surplus in 1Q17 and 2Q17 and will become deficit by 3Q17 only. However, higher production from Libya, Nigeria and Iran may disturb this balance even in 3rd and 4th quarter of 2017. Moreover, piled up inventories will also delay the deficit balance period further. The extent of compliance by these 25 nations also needs a watch. However, a group comprising of Algeria, Kuwait and Venezuela from OPEC and Oman and Russia from non-OPEC will oversee the compliance to this agreement.

Another major factor, which is likely to impact supply in near terms is

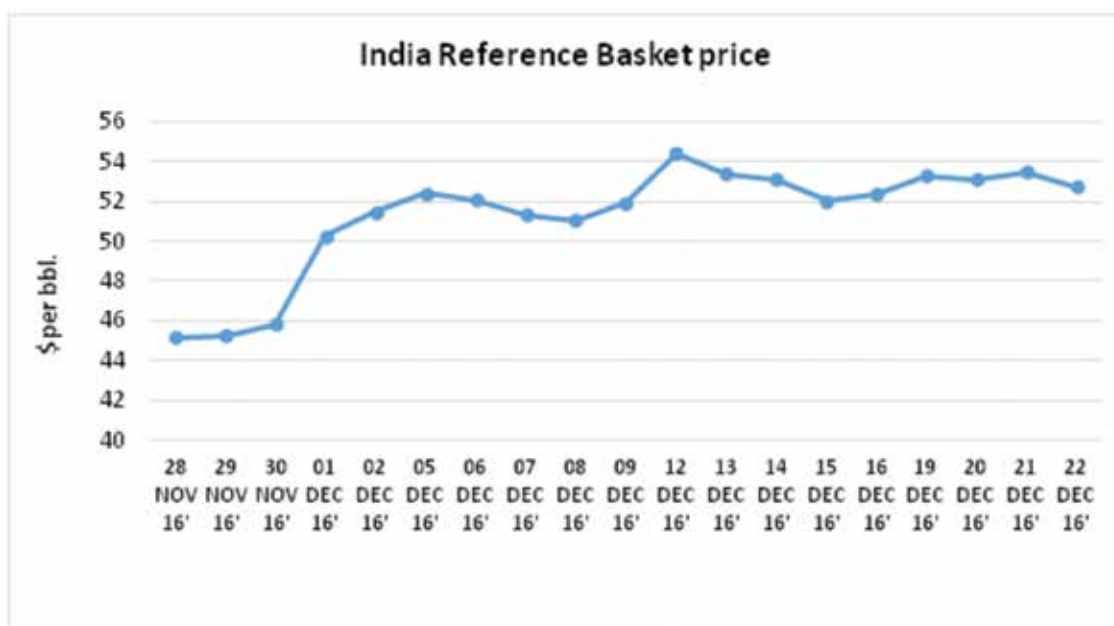
the higher shale production. Reports indicate that rig count in U.S. is on rise signalling that shale production is set to go higher.

Nevertheless, 2017 will definitely see balancing forces acting more prominently in oil market.

Indian Basket

Indian crude basket which includes 71% Oman & Dubai average and 29% Brent, has been fluctuating with international market. During November 2016, it touched 49.25 \$ per bbl. average. On 12th December, 2016, it crossed 54 \$ per bbl. and currently moving around 53 \$ per bbl. The rise of about 18 % since September 2016 will significantly impact import bill.

Price of Indian Reference Basket (\$ per bbl.)	
APRIL 2016	39.88
MAY	45.01
JUNE	46.96
JULY	43.52
AUGUST	44.39
SEPTEMBER	44.41
OCTOBER	49.25
NOVEMBER	44.46
DECEMBER (up to 22nd)	52.41



Biofuels: Should We Stay or Should We Go?

Energy



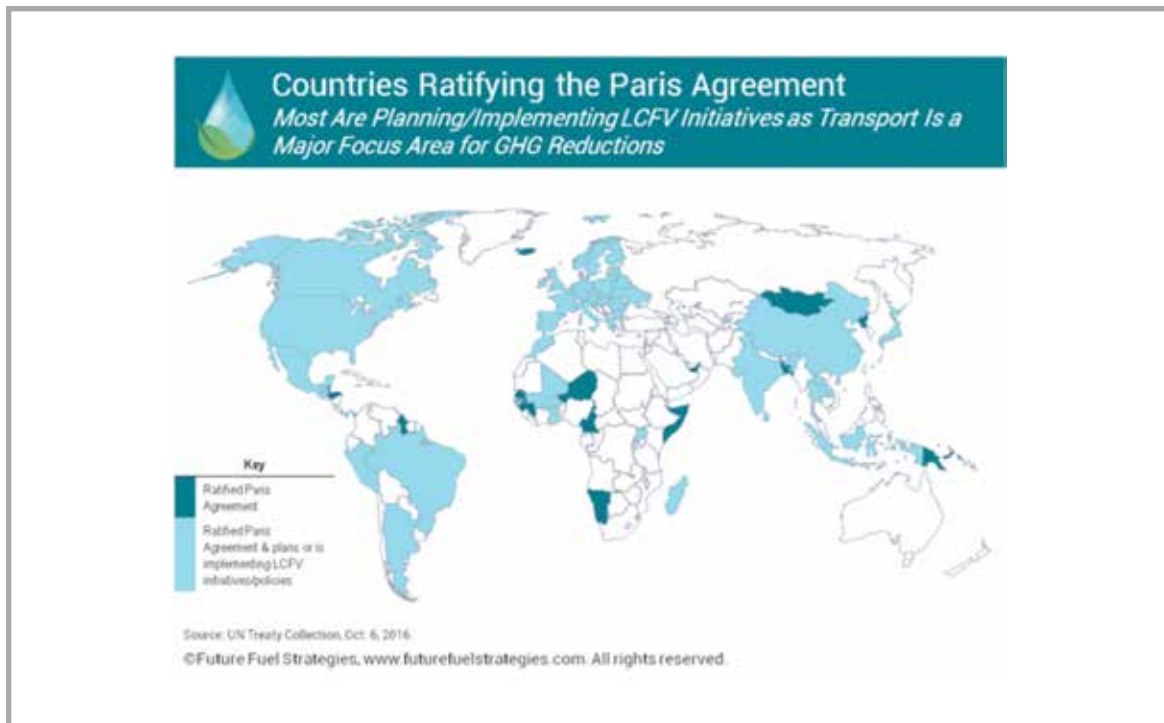
Tammy W. Klein

Strategic Adviser,
Global Fuels Market Intelligence & Insight

Despite a prolonged period of low crude oil prices that may last another year or two at least, citizens and policymakers in many countries have never been more serious or committed to combating climate change in all sectors, including transport. Transport currently

contributes 25% of energy-related greenhouse gas (GHG) emissions and 20% of energy use and is expected to double by 2030. Passenger transport accounts for nearly 60% of total transport energy demand and 60% of this is in OECD member countries. And it is the least diversified energy end

use as oil products account for 93% of final energy consumption as of 2012. With the Paris Agreement now ratified, countries are committed to reducing GHGs from all sectors and many are specifically targeting transport, as the figure below shows.



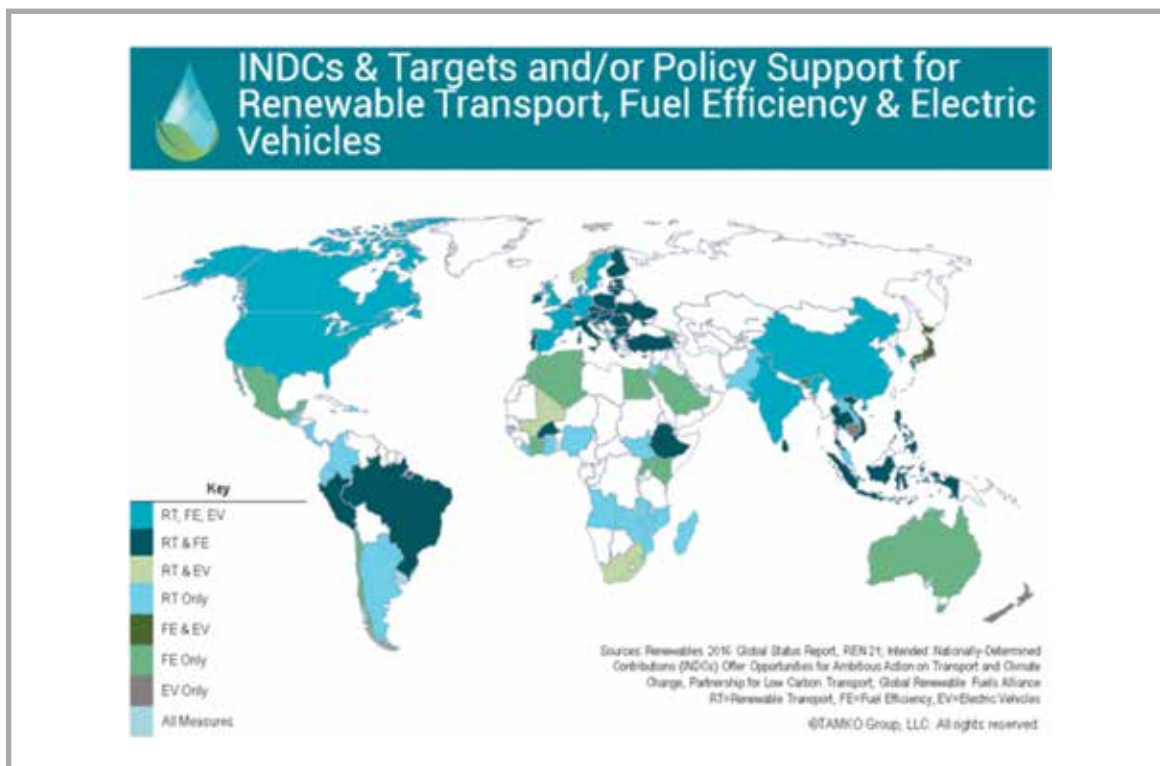
Low Carbon Transport Policies Countries are Considering

What kind of measures are these countries intending? The answers so far have revolved around promoting tougher fuel efficiency standards

in light and heavy-duty vehicles and increasing renewable energy in transport. Policymakers in many countries such as the U.S., Canada, Japan, China, India, South Korea, Mexico and the EU are pushing tough new fuel efficiency standards for

gasoline and diesel-fueled vehicles. For renewable energy in transport, the top options encouraged by governments and favored by some citizens are electric and hydrogen fuel-celled vehicles and biofuels. As battery prices continue declining,

electric vehicles sales are projected to take off with some studies bullishly projecting they will represent 35% of all new global car sales by 2040. Hydrogen fuel-celled vehicles sales are expected right now to grow more slowly, representing not even 1% of new vehicle sales by 2020. While the GHG emission reductions with these vehicles are substantial, the challenge with these two options are cost of the technologies used, consumer interest and acceptance but most especially fueling infrastructure. The figure below shows the countries that are planning or are already implementing these strategies. Some are planning to use them (or a combination of them) in their Intended Nationally Determined Contributions (INDCs) to meet their Paris Agreement commitments.



Biofuels as the Only True Viable Renewable Energy Transport Pathway

Biofuels are arguably the only true viable renewable energy transport pathway right now that is compatible with existing fueling infrastructure with a more straightforward implementation. Recognizing this, a "biofuels gold rush" erupted in 2004 as policymakers around the world began to see biofuels as a way to kill many birds with one stone (or silver bullet). They could: reduce harmful air pollutants, combat GHGs, enhance energy security, support their agricultural industries and provide jobs, particularly to the poor. Some countries were still phasing out lead and saw the additional ethanol as a viable octane replacement.

Many governments moved quickly to require biofuels blending in gasoline and diesel, setting ambitious targets, and consumption grew substantially.

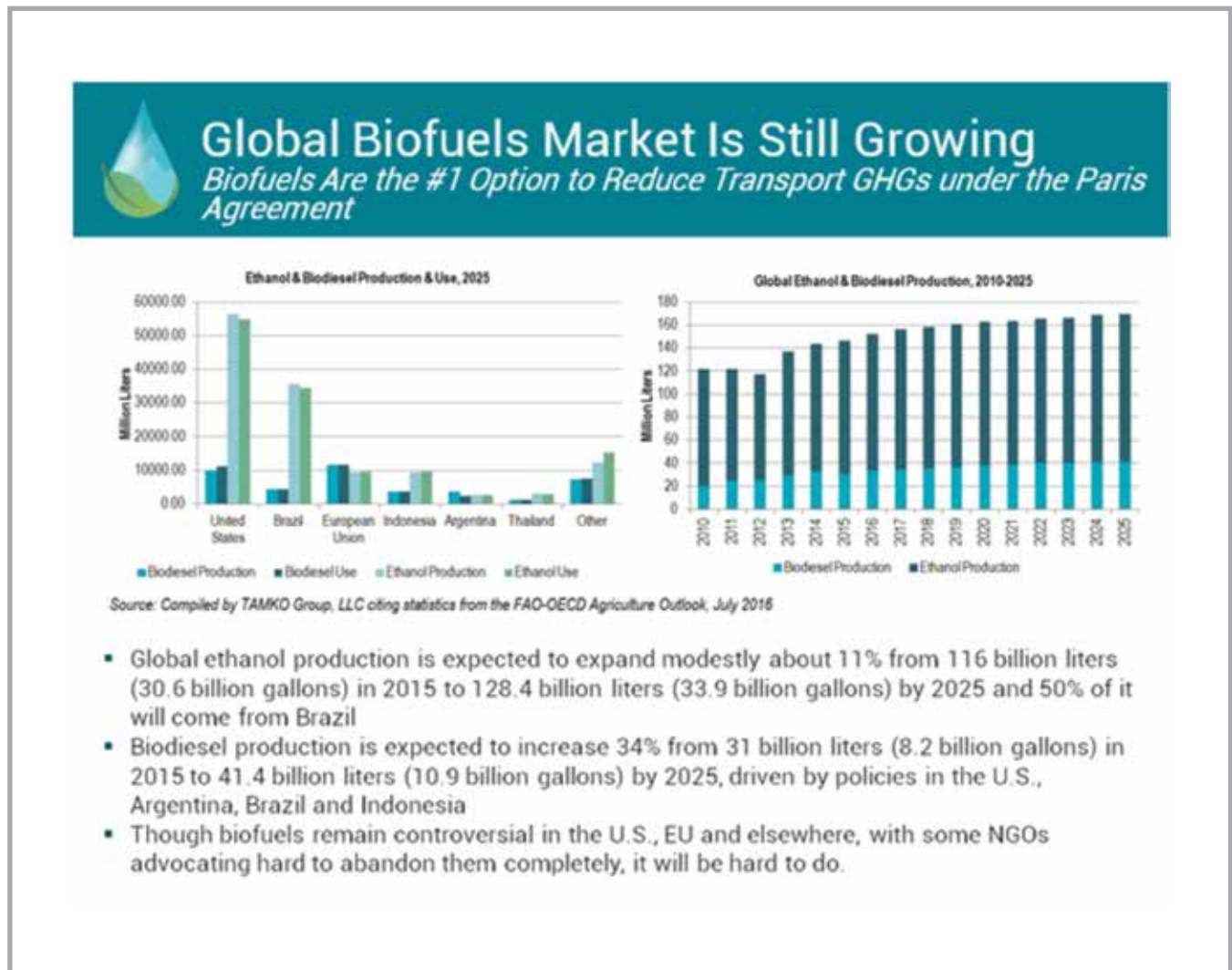
Some countries, such as the U.S. experienced a massive build out and scale up of biofuels production, particularly for ethanol, that happened over a short period of time (less than five years). Other countries, faced with the reality of moving from aspiration to implementation, struggled and as a result, targets were delayed. For example, policymakers in some countries realized they had inadequate infrastructure to facilitate biofuels blending. Others struggled with skyrocketing feedstock prices which made domestic biofuels blending uneconomical.

Complicating implementation in some countries further concerns about sustainability. For the last 7-8 years, biofuels have been dogged by concerns about whether biofuels really reduce GHGs at all and thus whether it makes sense to grow biofuels feedstocks over food or clear forests and other

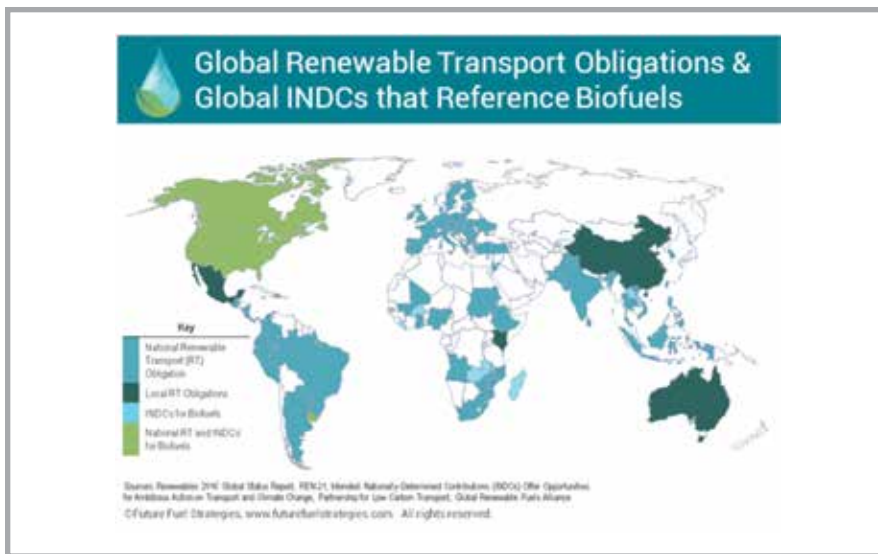
carbon sinks for fuel. Mainly these questions concerned "first generation" biofuels made with food crops such as corn, sugar, soy and palm oil. These questions and conflicting analyses and different methodologies used to investigate the true environmental impacts of biofuels have, in part, caused policymakers to question the wisdom behind their biofuels programs, particularly in Europe and whether they should be rescinded or scaled back. This tended to produce an environment of regulatory and investment uncertainty for producers and blenders (generally refiners) charged with complying with biofuels mandates and programs and which had invested billions in scaling up production, distribution and storage of biofuels. Some first-generation biofuels producers responded by making aspects of their production processes and feedstock sourcing more efficient.

Despite Uncertainty, Biofuels Consumption Continues to Increase

Despite the lack of regulatory uncertainty and concerns over sustainability, biofuels consumption continues to increase. Between 2014-2025 and 2025-2040, biofuels consumption is expected to grow 38% and 48%, respectively, representing 4% of total energy demand by 2025, according to ExxonMobil. About 80% of production is located in North and South America. The following figure, with data taken from the UN Food and Agriculture Organization also shows biofuels consumption growing through 2025.



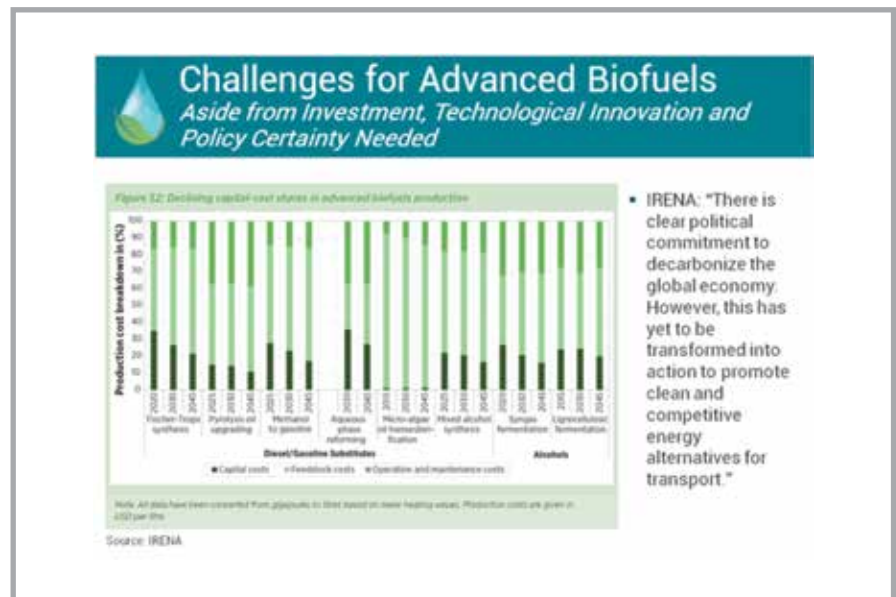
As of January 2016, more than 60 countries have put into place some kind of biofuels program or mandate. Moreover, many countries have or plan to use or mandate biofuels as a GHG mitigation strategy as part of their Paris Agreement commitments made in December 2015, shown in the figure. As a matter of fact, and shown in the above figure, biofuels are the number one strategy countries are planning to use in their INDCs.



Meantime, different R&D efforts from government, academia and industry globally began to show that biofuels could be commercialized using non-food feedstocks that would reduce even further GHG emissions, depending on the production process used. These “second generation”, “next generation” or “advanced” biofuels show enormous promise in reducing or even eliminating these sustainability concerns. But for the most part, production scale up has been slow, as the figure below shows. Many companies promised that advanced biofuels would be commercialized by now and price competitive with gasoline and diesel and that has not happened — not yet, anyway.

Biofuels programs such as the U.S.’ Renewable Fuels Standard (RFS) program were created in part to support the large scale penetration of advanced generation biofuels into the gasoline and diesel pool to reduce GHG emissions and enhance energy security. More than 7 billion gallons are required under the statute this year; however, only a fraction of that was produced last year. The technical barriers and constraints have proven larger than expected. These constraints, the lack of actual commercial production, the fallout from the sustainability debate and most importantly, the lack of clear, long-term policy signals and support from the U.S., EU and other countries, along with other factors generated a climate of investment uncertainty that has crippled the industry.

As a result, some companies shut down as capital dried up, which only generated further negative impacts for the industry. In fact, the U.S. industry association BIO has estimated the lack of regulatory certainty has cost the industry \$13.7 billion in investment over the past several years. Current oil prices have only worsened the situation. Ironically, this has happened at a time when some companies are making real progress and movement toward commercialization.



Should We Stay or Should We Go?

With such a dreary outlook, should we all give up and call it a day? Should we focus on other strategies? Does it matter to society whether biofuels and especially advanced biofuels are really commercialized? It depends on your frame of reference. If you believe that climate change is an issue and accept the statistic noted above about transport’s contribution to it, then the answer is yes. Nevertheless, it is clear that governments in many countries do believe climate change is an issue, that GHGs in transport do need to be cut and that biofuels are a strategy to achieve these cuts. That brings us back to the low-carbon options presented above. The reality is that a combination of these strategies will be needed to reduce transport GHG emissions but their development and commercialization are at different stages. Both first-generation and advanced biofuels are important, and in fact, some studies have shown that it is difficult to near impossible to achieve a low-carbon transport future without their use. Staying the course may be the best and “most responsible” option for policymakers.

Tammy Klein is a strategic adviser to global automotive and oil industry clients, as well as governments on fuels policy issues, with 20 years of experience on conventional fuels, biofuels and alternative fuels policy and market issues.

Future of R&D (Alternative Energy) in India and Major Challenges

Research & Development



Sunil Sachdev
Senior Research Officer
IOCL



Rajesh M. Badhe
Chief Research Manager
IOCL



Alok Sharma
DGM I/C (Alternative Energy)
IOCL



G. K. Acharya
GM (TPF &AE)
IOCL

Introduction

Considering the limited availability of fossil fuel resources, development of Alternative Energy sources is the imperative and necessity in the present time. The Alternative Energy sector is undergoing a paradigm shift and new technologies are being developed worldwide at a much faster rate. It is pertinent to be future ready by harnessing, developing, demonstrating & deploying alternative energy and cleaner technologies through innovative products, processes & plants / funding mechanism.

R&D in Alternative/ Renewable Energy

The focus on R&D is needed to be directed towards long-term improvements in alternative / renewable technologies so as to achieve breakthrough technologies with a decisive advantage in energy markets. Efforts are required to ensure that alternative / renewable energy can compete successfully, without subsidy, once external environmental costs and other contributions to social goals such as access, security, etc. are taken into account. Medium or long-term R&D efforts in this area can largely be developed through public / private partnerships.

Various broad areas of focus for R&D activity can be thought of as :

- Improvement in performance, including conversion efficiency, reliability, durability and lifetime
- Advanced cost effective manufacturing processes for various sub components
- Sustainable production processes
- Reduced material requirements – reuse & recycle wherever possible
- Better integration of renewable energy into electricity grids and other distribution systems
- Conducive policy measures to encourage the deployment of renewable
- Concerted efforts to enhance public acceptability of new energy technologies
- Capacity-building for trained scientists, engineers and others

Alternative Energy Drivers for India

India is one of the world's fastest growing economies and its demand for energy is increasing at a faster rate. Demand is always exceeding supply and thus the security of energy

supply has been a prime challenge. Besides energy security, there is also need to develop and replace / harness environmentally-friendly clean energy resources in line with the global trend. Energy security for India pertains to the availability, affordability, accessibility and adaptability of all fuel sources.

The fast paced growth of Indian economy, the third largest in terms of GDP based on purchasing power parity, has resulted in a surging demand for energy which is projected to grow at the rate of 3 % over next three decades (2010-2040)

With the national and global status of climate change and green house gas emissions, Renewable Energy has become a priority level agenda in country's planning process. This is evident from the set targets and plans of MNRE for the next 5 year and 10 year terms. Moreover, the whole mission is also supported by the government by initiating several incentive schemes for renewable energy at centre and state level. Considering aforesaid, it becomes utmost important to have the right direction and investment in the research and development of new technologies and also for the improvements in existing technologies.

Current R&D in Alternative / Renewable Energy

Many public & private corporate R&D centres, research laboratories and academic institutions have been working in various aspects of alternative energy. In order to get the "first mover" advantage, there is an urgent need to validate these technologies at a reasonable scale of operation, in cases where, the technology developers are ready to co-invest in such ventures, especially with industrial partners who can be potential users as well. If a complete utility based complex can be established, validation & up scaling of newer technologies can be carried out with provisions of revenue sharing mechanism or even IP sharing in selected cases.

The Renewable Electricity Futures study found that an 80% renewable future is feasible with currently available technologies, including wind turbines, solar photovoltaics, concentrating solar power, biopower, geothermal and hydropower. Therefore, as mentioned earlier, orienting efforts in the direction of existing technologies can yield fruitful results. India has one of the strongest intellectual workforces along with some of the most premier research and educational institutes. India holds the potential to drive the renewable technologies from current level to the required benchmarks for commercialization. However, the most obvious and foremost challenge in this scenario is the identification of strengths at national level and then to deploy required amount of resources for conducting the research in various fields related to renewable energy. In the past, several initiatives have been taken up by government agencies by designing research programmes for young and experienced scientists. But programs being conducted only at the level of academia do not seem to fulfill the task of reaching commercialization benchmarks. The whole programme therefore needs relevant inputs from the industries about the gaps and lacks of the technology which then can be further translated into the problem statements for the research.

R&D initiatives in Alternative / Renewable Energy

Several R&D initiatives have been taken by various research organizations for development, deployment and harnessing of different alternative / renewable energy sources. Some of these have been described in short in the subsequent sections. Further, in line with our corporate vision of "The Energy of India", IndianOil R&D has also taken a number of specific initiatives in order to supplement our main business of production, marketing and transportation of fossil fuels and has embarked upon various research initiatives in the field of alternative energy. Few of these have also been included in the following general status and future scope of various alternative energy sources.

Gasification

One of the most compelling challenges of 21st century is finding a solution to meet national and global energy needs while minimizing the impact on the environment. Gasification is one of such technologies which can provide clean, abundant and affordable energy. This technology has been evolving and recently acquired renewed interest due to its versatility and environmental friendliness. Gasification allows to use wide variety of feedstock such as coal, biomass, petroleum coke, petroleum residue, etc. to generate clean energy in an energy efficient way.

Worldwide, coal is the most abundant fossil fuel available accounting for 69% of world's fossil fuel reserve (against only 17% for oil). India is the third largest coal-producing country in the world (after China & USA) with an estimated reserve of about 245 billion tonnes. Coal is a solid with high carbon content but hydrogen content of typically 5%. In comparison with liquid fuels, it is difficult to handle and not suitable for some applications. Most notably, it cannot be used directly to fuel the internal combustion engines and turbines that dominate transportation, power and infrastructure worldwide.

In India, given the gradual depletion of oil reserves, decline in self-sufficiency, existing infrastructure based on oil and pollution hazards of direct coal burning, it becomes imperative to produce clean fuels from coal. Conversion of coal to clean liquid fuels is a proven technology and has been practiced extensively at Sasol in South Africa since more than last 50 years. Essentially, it comprises two technologies, Gasification of coal to produce synthesis gas and conversion of syngas to liquid hydrocarbon through F-T process.

Considering the importance of gasification as an important alternative energy source, IndianOil R&D has proactively initiated research work in the area of multi-feed gasification. The process and technology for downstream gas cleanup, hydrogen generation and other chemical processes are fairly mature and



Fluidized bedgasification pilot plant



Hydrogen based Fuel Cell for Teletowers and Automotive Applications

commercially available. However, gasifier from different licensors is feed specific and still evolving. IndianOil R&D, recognizing the importance of gasification and likelihood of integration of gasification with refining, has taken proactive action to develop knowledge base in this area. We have set up various research facilities such as fluidized bed gasifier, high pressure Thermo-Gravimetric Analyzer (TGA) and various feed characterization facilities to understand kinetics and develop gasifier design for multi-feed application including petcoke, biomass, high ash Indian coal, etc. These facilities are being used for characterization of various feedstocks and generation of kinetic data for gasification process. We have developed a novel concept on

'Integrated Gasification' for optimal use of available gasifier designs by segregation of feedstock according to reactivity and ash content. The U.S. patent for the same has also been granted and now we are in the process of setting up of a demonstration unit to validate the concept and further scale up.

Hydrogen

In the era of global uncertainty, geopolitical tensions and global warming, the need for an alternative, clean energy source that can be produced anywhere is becoming reality. Hydrogen is one of the alternatives receiving much attraction both from the scientific community and governments. Hydrogen is considered as energy carrier rather than a fuel, because like

electricity, it takes energy from one source and delivers it to end user / application. Hydrogen is a clean energy carrier that can be produced from any primary energy source and together with fuel cells, which are very efficient energy conversion devices, is attracting the attention of public authorities and private industry. The emergence and growth of the so-called 'hydrogen economy' holds great promise of meeting simultaneously concerns over security of energy supply and climate change. Hydrogen opens up access to a broad range of primary energy sources, including fossil fuels, nuclear energy and increasingly, renewable energy sources (e.g. wind, solar, ocean, and biomass), thus enhancing energy security through increased diversity. Renewable energy industry would



Oil Shale

benefit from Hydrogen because it can serve as a means of storing electricity and reduced emissions upon its utilization make it an environmentally friendly way to transmit / distribute energy.

Going forward, Hydrogen & Fuel Cell is expected to be a major area of research & technology deployment for ushering in clean fuel & technologies. IOC R&D has developed a novel cost effective 'Single Step Compact Reforming' process for producing HCNG from natural gas which is being seen as an intermediate step for moving towards hydrogen. This would lead to fuel economy improvement as well as environmental benefits in terms of reduction in CO, HC & PM emissions. Neat Hydrogen based IC engine and Fuel Cells are likely to occupy significant share in future energy scenario. The hydrogen market is expected to grow both as an Industrial product as well as for fuel cell / IC engine applications. Initially, the thrust is expected in the area of stationary segment with gradual potential in the automobile sector. The fuel cells in India are being considered as a potent replacement for DG sets especially for backup power for telecom towers.

The fuel cells sales globally have grown from 86 MW/yr to 275 MW/yr of installed capacity during 2009 to 2014. With the automotive manufacturers joining the drive for clean energy, the technology is expected to grow at a faster pace. In India, deployment of fuel cells is at a very nascent stage of commercialization and the demonstration sites / vehicles are set to grow in the coming years. During the next 5 years, around 1 lakh mobile towers are expected to be converted to fuel cell based systems. The energy savings of the tune of 50% diesel equivalent for the DG set market can be achieved on the fuel side due to the higher efficiencies of fuel cells. During the next 10 years, the DG set market is set to be converted to fuel cell based power systems. With the automotive electrification plan in place, huge potential on energy savings can be expected. Although produced from fossil fuels, this hydrogen if used in fuel cells can reduce the net energy imports by 17% (if produced from naphtha with 73% process efficiency and considering the fuel cell efficiency to be 40-45% and DG set efficiency to be 23%).

Oil Shale

In the recent past, non-conventional energy sources such as Shale Gas and Shale Oil have really moved up at an amazing speed within the "Resource Triangle". While gas hydrate still remains to be a truly unconventional fuel, the emergence of shale gas and shale oil on the U.S. horizon has helped its refineries in improving their refining margins to such an extent that they are able to compete with the modern refineries in Asia Pacific. With this strength, U.S. has transformed itself into a net exporter of petroleum products from that of a net importer. A serious look on the non-conventional energy sources, on whatever opportunities are available within our country and elsewhere, is also considered as a business opportunity for the company. Aligning with this objective and since India is bestowed with some good reserves of Oil Shale, as a strategic initiative, our Centre has plans to develop this resource as alternative energy source and has tied up with Directorate General of Hydrocarbons who is the nodal agency for assessing its reserves and potential in the country. Research facilities such as super critical extraction and retorting have been recently set up at R&D Centre to facilitate our endeavour in this direction.

Wind Energy

India has the fifth largest power generation portfolio in the world and its current renewable energy contribution stands at 44.812 GW which includes 27.441 GW of Wind power and 8.062 GW of Solar power installed capacity in the country. Country has set an ambitious target of 175 GW of renewable power by 2022 which will include 100 GW of Solar power, 60 GW from wind power, 10 GW from biomass power and 5 GW from small hydro power.

Wind is commercially and operationally the most viable renewable energy resource and accordingly, emerging as one of the largest source in terms of the renewable energy sector. Basic technology to generate power from wind consists of Wind turbine coupled to electric generator which converts kinetic energy available in wind to electrical energy by using rotor, gearbox and generator. Although generation of power from wind is an established



Parabola Dish



Parabolic Trough Power Plant

technology, a lot of incremental research is required in development and demonstration of effective turbine technologies and overcome key barriers related to deployment. There is scope in assessing and addressing cost, performance and engineering challenges associated with small and medium wind turbines by focusing on design optimization, testing, certification and manufacturing. A lot of concerted efforts are required on enhancing the performance and reliability of next-generation wind technologies through prototype, component and utility-scale turbine research & development. Grid integration is another aspect for research. To promote research, several incentive based programmes have been initiated by the government and is also providing funding through various departments such as Ministry of New & Renewable Energy (MNRE) and DST to conduct research in the area of wind energy. To promote optimum utilization of wind energy resources repowering policy has also been issued by the government.

Solar Energy

Solar Energy has tremendous potential in bridging India's energy demand-supply gap in the future. There are various challenges for this industry, including lowering cost of production, increasing research, consumer awareness and financing infrastructure. It is important to overcome these challenges for fast growth and mass adoption of the technology. Research & Development (R&D) in technological innovations that improve the efficiency of current solar energy systems are necessary to harness the solar energy potential in India. Currently, R&D in this sector is on developing mode due to increasing of collaborative and goal driven efforts on this front. In order to facilitate this, MNRE has framed comprehensive R&D schemes in new and renewable Energy Sector to be supported in consonance with the aim of "energy self - sufficiency".

Subsequently, the Ministry has launched a comprehensive programme on "Research, Design and Development of Solar Photovoltaic Technology (SPV) and Solar Thermal Technology (ST)" during financial year 2014-15. Government appraised and recommended over 500 R&D projects in Renewable energy sector to be supported in different institutions across the country.

Several R&D projects in solar photovoltaic and solar thermal are sanctioned by the Government of India for increasing the production capacity of solar power. During last three decades, MNRE has been supporting R&D projects and technological evolution in solar technology. The solar photovoltaic R&D projects at various research organizations of central and state government, universities, recognized colleges, industries and IITs, etc. are physically and financially supported by MNRE. Various research organizations are also taking the R&D projects by their own fund and own technology. Like solar photovoltaic, MNRE has taken the initiative to increase the solar power generation by using the solar thermal projects. There are several R&D solar thermal projects continuing their operation all over India. Major factor restricting the growth of this sector is the lack of standards, resulting in the fragmentation of the

market among manufacturers and suppliers. There is immediate need of standardization of systems which will lead to rationalization of cost as companies can invest in R&D and newer technologies to meet common specification. Facilitating closer industry – government cooperation and increasing consumer awareness about the benefits of solar energy are some of the other main challenges currently faced by the industry. IndianOil's R&D activities in the solar space encompass areas such as Solar Hydrogen, Solar Thermal & Solar Photovoltaics. A three-pronged R&D approach of infrastructure creation & expertise development; product development & technology evaluation and basic research is in place.

Conclusion

It is need of the hour to be future ready by harnessing, developing, demonstrating & deploying alternative energy and cleaner technologies through innovative products, processes & people. This can be achieved through concerted R&D efforts in emerging clean energy technology areas.

The challenge before the nation is to focus R&D on technologies that seek to achieve progressively higher levels of efficiency covering all the different stages and forms of energy conversion, as well as those that seek to improve the efficiency at the end use stage. It seems that it is necessary to develop alternative energy sources for transportation to replace fossil fuel. Two promising technologies are Electric Vehicles (EVs) and Fuel Cell Vehicles (FCVs). Development & deployment of these two key technologies will bring about a decisive change in future transportation and would significantly reduce our dependence on crude oil. At the same time, this would also help in cutting carbon dioxide emissions.

Right policies and framework are required to be in place to significantly ramp up alternative / renewable energy from its current status. R&D has a vital role to play if the potential of renewable energy is to be fully harnessed. Policy measures, such as taxation, fund availability, regulation & obligations for feed-in tariffs will contribute to faster deployment. Further, environmental impacts and in particular, the social

cost of carbon dioxide emissions will also has to be taken into account. However, investment in R&D will not come entirely from businesses, but extensive support at the national and international levels is essential to accelerate the development of alternative / renewable technologies.

India as a country is very rich in terms of availability of diverse renewable energy sources such as solar and wind. As discussed, it requires concerted efforts in right direction to utilize these energy sources for the proper utilization as per the current needs and demands of future. We also have required intellectual resources to address the current challenges for the research and development in new and existing technologies. India is very aggressive in deployment of already existing technologies such as Wind, Solar, Biomass, Waste-to-Energy & Hydro and plans to quadruple the installed capacity by 2022. India is the first country, to setup a Ministry of Non-conventional Energy Resources. This shows very high level of dedication at national level to bring alternative energy sources in the country's power portfolio. Recently, the Government has consolidated this effort by keeping / bringing MNRE and Ministry of Power under the same Cabinet Minister so as to strengthen / supplement the grid by pumping additional power from solar & wind power. As already stated, a lot of efforts in terms of policies have been initiated at the national level to promote research in alternative energy at the level of academics. However, drastic change in energy scenario requires planned research in both new and existing technologies. A thorough landscape assessment of available resources is required for the research and further a mapping is also required for the justified deployment of the allocated resources for necessary research. There is also a need of initiating research ventures into new technologies which can be disruptive and provides a possibility to construct future economy. Overall India as a country is very potent and capable of developing technologies in the field of alternative energy. India can be an international player if necessary efforts are guided in the direction of development of new technologies.

New Market Dynamics : Price Differentials and Octane Values

Quality



Terrence S. Higgins
THiggins Energy Consulting

Oil markets have witnessed major change and volatility over the past decade. Crude oil prices experienced two periods of price run-up with annual increases in the range of 35 percent to 40 percent. These were followed by dramatic annual price declines, the latest amounting to nearly 60 percent. Accompanying crude price movements have been fluctuations in crude and

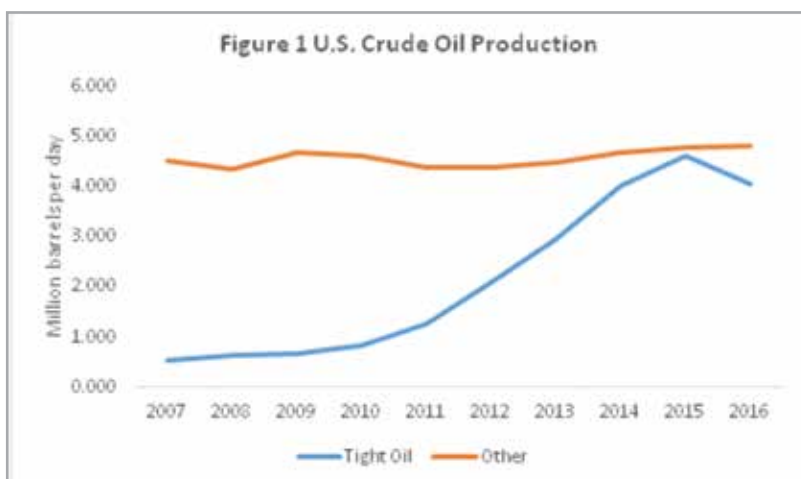
product price relationships, refining markets, international trade flow and trends in refined product demand. All have had significant impacts on various sectors of the market.

This article examines two specific areas of change and the resulting impact on markets: crude oil/natural gas/LPG price differentials and octane values. Crude/gas/LPG differentials

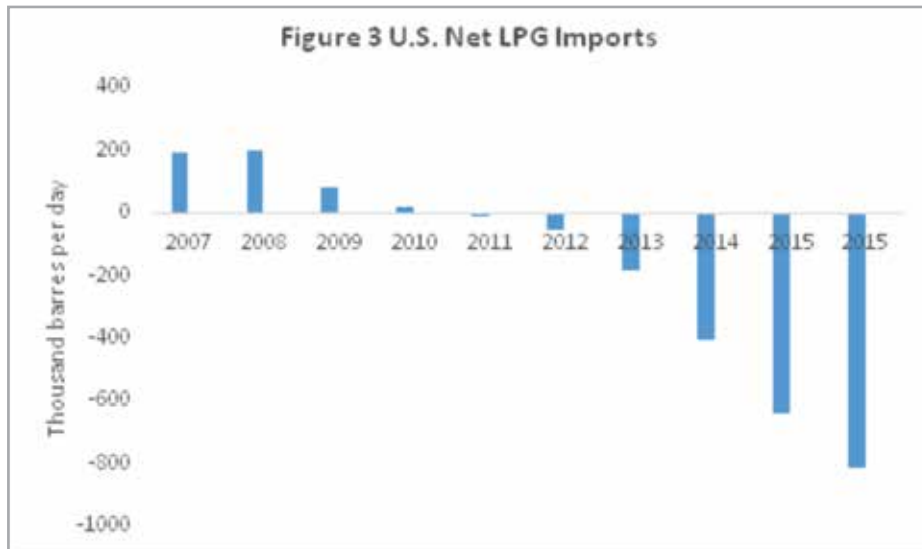
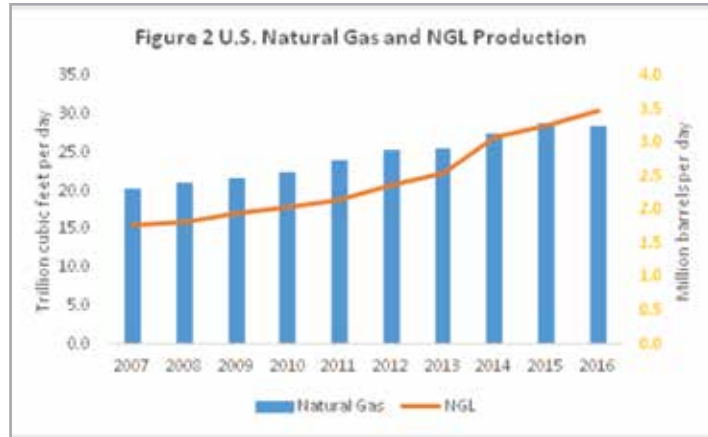
have departed from traditional relationships and to some extent have done so under both the high and low crude oil price extremes. Octane values, in part driven by the change in crude/LPG price differentials, have increased substantially, reaching historic highs in some markets. These price differential and octane value trends were initially focused in the U.S., largely been driven by tight oil crude and natural gas production. They have since impacted international markets as well. The changes in price differential and octane value relationships are also likely to persist in markets going forward.

Decoupling of Oil, Gas and LPG Prices

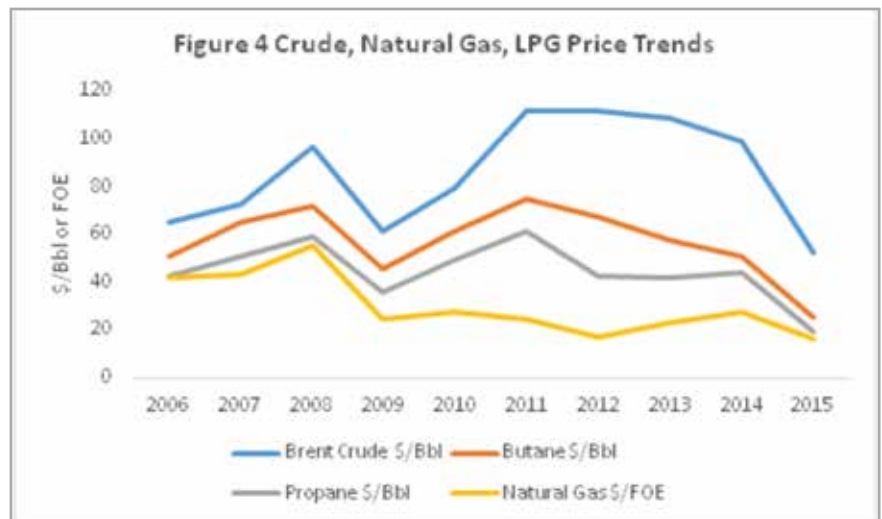
Production of tight oil and gas in the U.S has been the primary driver of the changing price relationships. As shown in Figure 1, crude oil production in the U.S. increased by more than 4 million barrels per day between 2007 and 2015. Over 90 percent of the increase was attributed to tight oil production. Production has declined some in 2016, but is still close to 4 million barrels per day above that of 2006.



At the same time, tight oil resulted in significant expansion of natural gas and Natural Gas Liquid (NGL) production in the U.S. Dry natural gas production for market increased by 8 trillion cubic feet per day or more than 40 percent (Figure 2). Meanwhile, NGL production nearly doubled, adding 1.7 million barrels of production between 2007 and 2016. NGL supply quickly surpassed demand and the U.S. shifted from an importer to major exporter of LPG. Figure 3 shows the progression of U.S. net LPG imports from 2007 to 2016. Over the period there was a million barrel per day shift in LPG trade, with the U.S. supplying 800 thousand barrels per day of LPG to the international market in 2016.



The large increases in natural gas and NGL production and the emerging surplus of NGL supply have substantially lowered prices for these commodities relative to their historic relationship and energy equivalent value to crude oil and refined products. Figure 4 tracks Brent crude oil price and U.S. natural gas and LPG prices between 2007 and 2016. The decoupling of oil and natural gas / LPG prices began around 2006/2007 and became more pronounced around 2009. As time progressed, the decoupling also became more pronounced with oil and LPG prices. With the more recent downturn in oil prices the magnitude of the differential has become smaller, but on a relative basis, the differentials are well above historic.



In addition to the trade and price differential impacts noted above, the expansion of tight oil and gas production has had other secondary, but significant impacts on U.S. markets. The resulting low ethane prices have led to a shift to lighter steam cracker feeds. This in turn has provided for a more positive competitive position for U.S. crackers. The lighter feed has resulted in a shift in ethylene/propylene production ratios, prompting initiatives for expansion of propylene dehydrogenation capacity. The lighter feeds have also resulted in lower aromatics byproducts (and a draw on refinery aromatics) with price pressure on aromatic markets. Finally, lower natural gas prices have provided U.S. refiners with a fuel and hydrogen cost advantages over non-U.S. refiners. U.S. refining has operated at high utilization with much of the incremental output dedicated to the export market.

The impacts of tight oil and gas on markets has been most predominant in the U.S., but have not been exclusively limited to this market. Lower priced LPG supply exported from the U.S. has placed some downward pressure on international prices as well. Furthermore, expansion of NGL production has not been limited to the U.S. NGL production has been increasing globally with the overall expansion of gas processing facilities. There has been roughly a 35 percent increase in global NGL production

between 2006 and 2015 versus an increase in crude oil production of less than 10 percent. This trend is expected to continue.

Rising Octane Values

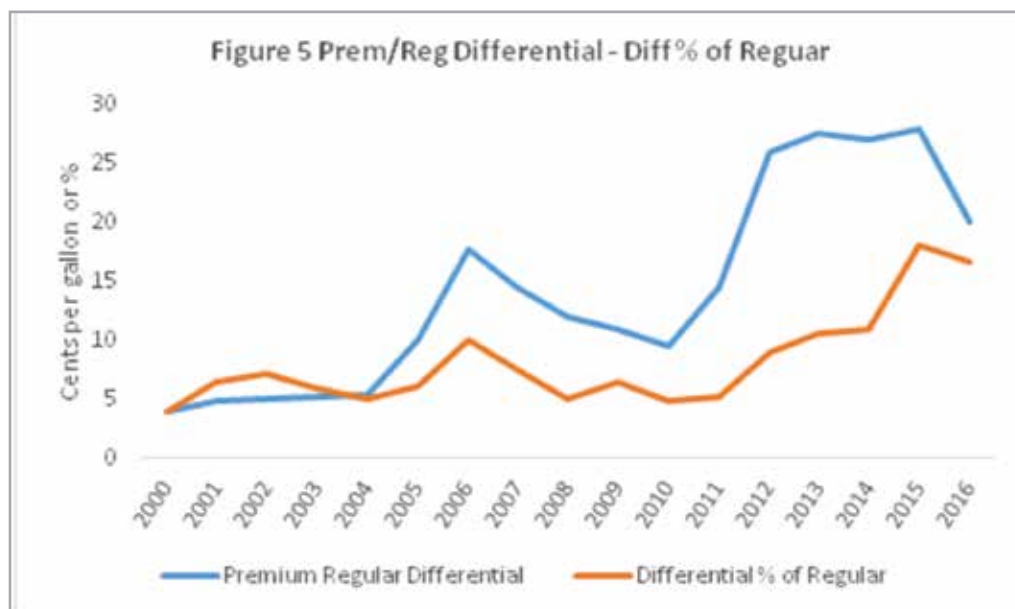
The past five or six years has witnessed a steep run-up in the market value of gasoline octane. As a result, octane economics have become a major issue affecting the refining industry, related petrochemical industries and gasoline trade. The rise in octane costs was largely unexpected. The prevailing view of octane values was that the values should remain relatively low as they have over much of the past decade. This view was shaped by the continued expectations of increases in ethanol and MTBE contribution to gasoline octane, forecasts of moderating growth in gasoline demand (expected decline in the U.S.) and very small growth in higher octane premium gasoline market share. The influence of tight oil/gas production and shifts in many of the expectations for traditional octane value drivers have altered the trend in octane values contrary to market expectations.

Figure 5 shows the annual average values of octane in the U.S. Gulf for the period 2000 through 2016. The value of octane is measured as the differential between the wholesale prices of higher octane premium grade versus lower octane regular gasoline. The graph also shows the octane differential relative to the absolute price of gasoline

(that is the premium/regular price differential divided by regular gasoline price, expressed as a percentage).

The premium/regular differential (octane value) remained at 10 cents per gallon or less during the first five years and (with the exception of one year), below 15 cents per gallon through 2011. Thereafter the differential remained above 20 cents per gallon, reaching a high of about 27 cents per gallon.

The relative octane differential removes some of the influence of crude and gasoline price movements. In this case, with the exception of an upward excursion in 2006, relative premium/regular price differentials stayed within a fairly narrow band, about 5 to 7 percent of the price of regular gasoline from 2000 to 2011. In 2012, the differential began to diverge from this historic norm. From 2012 through 2014, the premium/regular differential rose to about 10 percent of the price of regular. In 2015, when crude oil and regular gasoline prices abruptly declined by about 50 percent, the premium/regular price differential rose slightly in absolute terms but more in relative terms, reaching almost 18 percent of the price of regular gasoline. In the first half of 2016, when both crude oil and gasoline prices continued to decline, the premium/regular price differential declined by more than 7 cents per gallon in absolute terms, but only by 1½ percent in relative terms.



A review of refining, and gasoline markets over this period reveals that the rise in octane values was due to a combination of a number of factors, many of which are again related to the increase in tight oil/gas production. The factors are summarized below:

The expansion of oil/LPG prices increased the cost of marginal octane production by refiners. The reason for this is that marginal refinery octane is produced by increasing the severity of (or product octane of) the catalytic reforming process. Higher octane results in a shift in yield from gasoline to LPG. With higher gasoline-LPG price differentials the revenue loss as a result of the yield shift is greater and therefore the cost (opportunity cost) of higher octane increases.

- The rate of growth in ethanol use slowed significantly as did its contribution to octane. Ethanol growth outside the U.S. has slowed as well and MTBE has lost some marginal market share.
- Gasoline demand in the U.S. continued to grow beyond expectation. Elsewhere, growth in gasoline in a number of major markets also has been higher than expected.
- Premium gasoline market share in the U.S. has increased, largely in response to initiation of fuel economy requirements. Vehicle manufacturers have been relying more on turbocharged engines for fuel economy improvement and this technology generally is best optimized with higher octane fuel. Vehicle manufacturers have increased recommendations and/or requirements for use of premium octane in new vehicles.
- China has moved to low sulfur gasoline and phase down of MMT. Both these initiatives have placed strong pressure on China's octane market. China has been importing significant volumes of high octane blend components (largely from Europe). Changes in octane specifications and commissioning of new gasoline/octane capacity has eased the octane crunch, but the market will continue to experience some octane challenges.
- Octane requirements in most other major markets are increasing, not significantly, but the octane trend is upward.
- Tight oil/gas production has reduced available high octane aromatic blendstocks for gasoline blending.
- Tight oil (generally light paraffinic crude) production has generated increased volumes of low octane light naphtha for blending and low quality reformer naphtha. These have increased octane requirements and reduced reformer yields (increased reformer octane costs).
- Finally, for the U.S. the combination of demand growth, growth in gasoline exports, tight oil impacts and increase in octane requirement has led to an overall constraint on octane producing capacity. The supply demand impacts and

the fact that higher utilization involves greater use of less efficient marginal gasoline reformer capacity (with higher octane costs) have driven up octane values beyond the fundamental factors discussed above.

Looking Forward

The review and other analyses and conclusions are detailed in a recently released octane study produced by this author in conjunction with Oil price Information Service and MathPro, Inc.

With the recent rise in oil prices and expectation for continued, but modest price increases, tight oil and gas production will likely reverse the recent downturn and ultimately resume growth. Growth rates experienced in the past are not expected to return, but production is expected to increase. Recent field evaluations have indicated production potential from West Texas plays higher than past tight oil plays.

Natural gas and NGL expansion from both U.S. tight oil/gas production and international natural gas operations will continue to increase.

Oil/gas price differentials are expected to maintain their current patterns, with increased downward pressure on LPG. Octane markets should remain strong. Capacity and operational improvements by refineries may ease octane production constraints, but octane values should remain well above pre-2011 levels.



An analysis of energy outlook by WEO 2016 and WOO 2016

Energy

N. K. Bansal
 Director
 Oil Refining & Marketing
 PetroFed

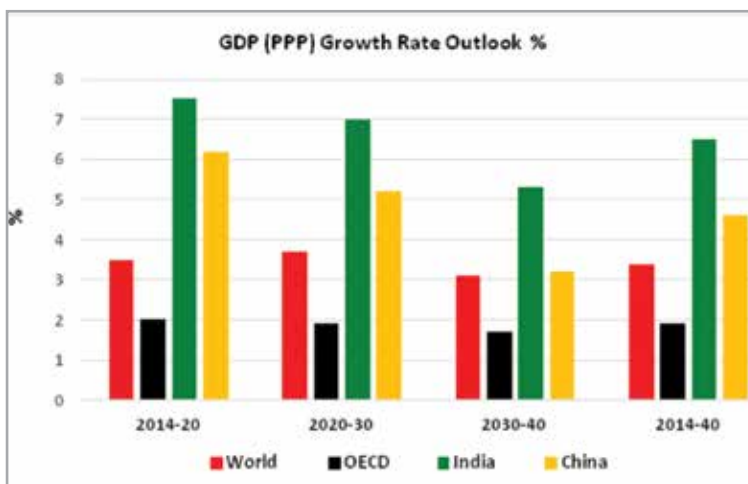
Two major regular annual forecast reports; 'World Energy Outlook 2016' (WEO 2016) by IEA and another 'World Oil Outlook 2016' (WOO 2016) by OPEC have been released in November 2016 almost during the same time. A combined brief on energy outlook scenario presented by the both is given in this document.

General & Economic Overview

Both the agencies present outlook based on some assumptions under different scenario. While prime focus of IEA scenarios relates to impact of energy consumption on environment (read Climate), concern of the OPEC is mainly the impact of international affairs on the demand and supply of Oil. However, both consider various primary sources of energy, regional growth factors and their overall impact, policy and technology frameworks across the globe and workout forecast. IEA give forecast under three scenarios. Their 'New Policy Scenario' (NPS) generally takes an optimistic view between other two scenarios, i.e. 'Current Policy Scenario' (CPS) where business as usual approach is maintained and '450 Scenario' in which stringent measures for climate control with very high investments are assumed. NPS is generally used for all reference purposes worldwide. OPEC use 'Reference Case' for all forecast which is closer to CPS of IEA, albeit a shade better than it. It is because of this difference in scenario assumptions, we note that energy forecast by WOO 2016 is more liberal than of WEO 2016.

WEO 2016 has primary focus on the outcome of Paris Agreement on Climate which has been adopted in November 2016 and NPS assumes that all nations will fulfill their NDCs targets. WOO 2016, on the other hand does not share this high optimism because many nations have not defined targets in definite tone and some others have given conditional targets. WOO 2016, therefore, keep margins in their forecast (higher consumption for same progress). Their main consideration is oil market dynamics, its impact on investments and economic growth.

Economic analysis of both the agencies show that global GDP growth rate will peak around 2021 and will move downwards towards sustainable rate. In long term (2014-2040) growth rate will be 3.4-3.5%. According to WOO 2016, global GDP will touch \$ 245 trillion (2011 PPP) which is 234% of 2014 GDP. IEA estimates that in global economy as a whole, service sector will increase its contribution in GDP from 62% to 64% in 2040 primarily due to rebalancing of Chinese economy from manufacturing to services.



India GDP (PPP) will, @ 6.9% CAGR will reach \$ 42 trillion by 2040 compared to 7.982 \$ trillion in 2015 (WB data).

China	19524348
U.S.	17946996
India	7982528
World	113653547

GDP (PPP) 2015 – Million Int. \$, Source: World Bank Data

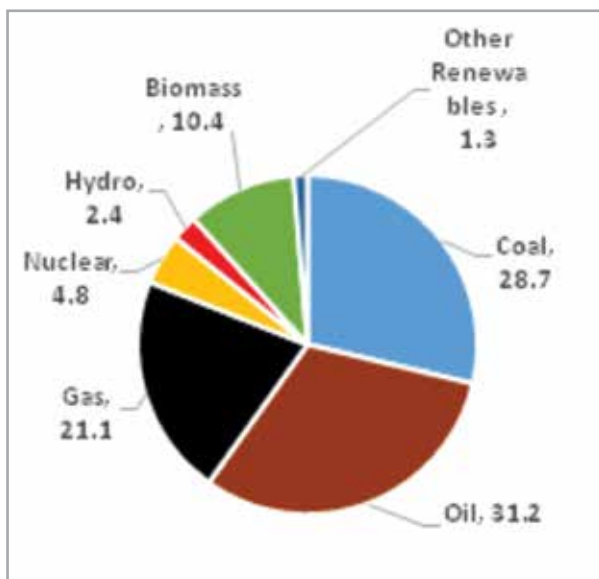
2.0 Energy Mix and Demand Outlook

As mentioned above, while NPS assume high compliance levels to NDCs of Paris Agreement, Reference case (RC) of OPEC adopt cautious approach and assume some slippages in compliance. However, post climate control awareness across globe, measures to improve efficiency in energy consumption, reduction in the use of fossil fuels, increased use of cleaner less carbon intensive fuels, renewable energy sources and alternate fuels are expected to pick up more pace in near future. Global response to Paris Agreement raises hope in this direction. Hence, a scenario in between WOO 2016 and NPS of WEO 2016 would be a scenario with higher achievement oriented probabilities.

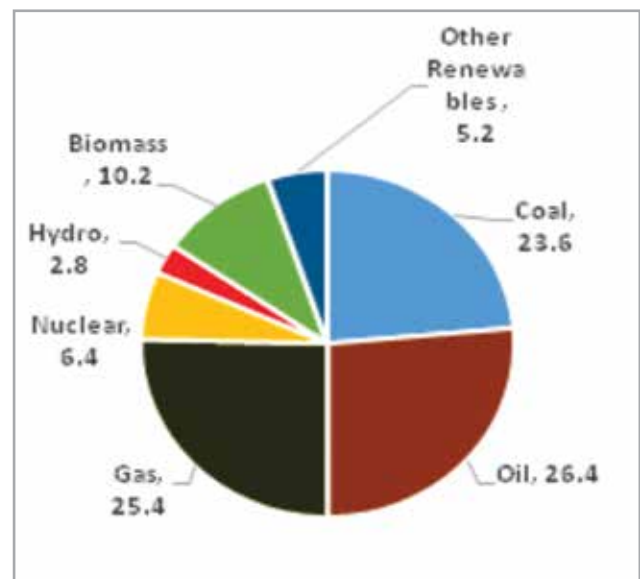
2.1 The Global energy mix and demand is derived from WEO 2016 (NPS) and WOO 2016 (RC) and is given below :

Fuel	2014		2040				
	Mboe / d	%	WEO 2016 NPS (A)	WOO 2016 RC (B)	Average A & B	%	CAGR %
Coal	78.9	28.7	83.2	91.5	87.4	23.6	0.39
Oil	85.7	31.2	96.0	99.8	97.9	26.4	0.51
Gas	58.1	21.1	86.7	101.7	94.2	25.4	1.87
Nuclear	13.3	4.8	23.7	23.4	23.6	6.4	2.22
Hydro	6.7	2.4	10.8	9.9	10.4	2.8	1.67
Biomass	28.6	10.4	37.8	38.1	38.0	10.2	1.09
Other Renewables	3.6	1.3	20.8	17.9	19.4	5.2	6.68
Total	274.9	100.0	359.0	382.3	370.7	100.0	1.16
% Share of Fossil Fuels		81.0				75.4	
CO₂ Emissions, Gt	32.2		36.3	42.0			

Energy Mix 2014 - Global



Energy Mix 2040 - Global



compared to 2014. WEO 2016 forecast indicate that economic progress and energy consumption and CO₂ emissions may show decoupling trends more prominently after 2025. Contribution of fossil fuels will reduce over 5 % in 2014-2040 period. Gas, a cleaner component among fossil fuels will find favour with rise in use by 4.3 % whereas use of coal will reduce by about 5%. Growth in the demand of coal, though slow at 0.4 % pa, is mainly due to positive economic outlook in emerging economies of South-East Asia and India, where coal is readily available as primary source of energy. Renewables with growth rate at 6.7 % will improve their presence

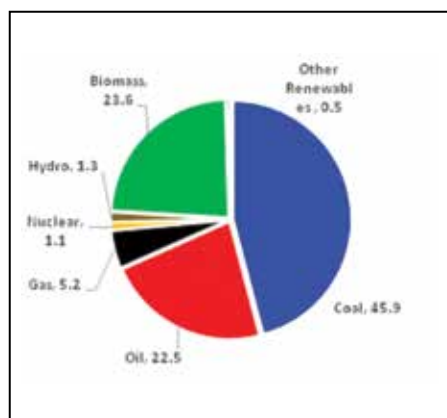
in the basket significantly and their contribution in the mix will increase from 1.3 % to 5.2 % in 2040. WEO 2016 estimates that 60% of capacity addition in power will come from renewables by 2040. In case of nuclear energy, major expansion programs in China, India and Russia overtake the sharp retirement plans from developed economies majority of which are from OECD.

2.2 Energy mix of India is substantially different due to ready availability of coal and high deficit in hydrocarbon resources for which India has to depend on imports. Demand in energy will grow at 3.5% pa during 2014-2040 period and consumption will be three times of 2014 levels. Import

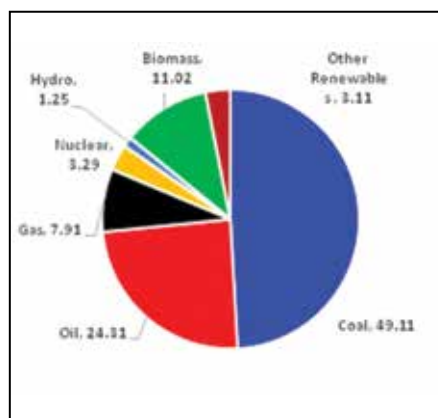
dependency in case of oil is 81 % and for gas was 41% in 2015-16. However, with rise in consumption in first seven months of current year, import dependency has crossed 82 % and 45 % for Oil and Gas respectively. Fossil fuels, coal, oil and gas will continue to have strong presence in the energy basket with growth rate close to 4 % pa. Coal will remain a robust constituent of energy basket in next 25 years. Estimates show that gas % in the basket may increase to 8 % from 2014 level of 5 % with growth rate over 5% pa. This scenario may change upwards with the impact of recent policy initiatives by the Govt. and special efforts to develop gas markets.

2040 Mboe / d							
Fuel	2014 (IEA) Mboe / d	%	WEO 2016 – NPS (A)	WOO 2016 – RC (B)	Average of A & B Mboe / d	%	CAGR %
Coal	7.60	45.9	18.80	20.50	19.65	49.11	3.72
Oil	3.72	22.5	9.35	10.10	9.73	24.31	3.77
Gas	0.86	5.2	3.23	3.10	3.17	7.91	5.14
Nuclear	0.18	1.1	1.43	1.20	1.32	3.29	7.95
Hydro	0.22	1.3	0.60	0.40	0.50	1.25	3.21
Biomass	3.90	23.6	4.12	4.70	4.41	11.02	0.47
Other Renewables	0.08	0.5	1.39	1.10	1.25	3.11	11.13
Total	16.56	100.00	38.92	41.10	40.01	100.00	3.45
% Share of Fossil Fuels	12.2	73.6			32.5	81.3	3.85

Energy Mix 2014 - India



Energy Mix 2040 - India



Use of biomass, a symbol of poverty in the economy will drastically come down from 24 % to 11 % by 2040. Growth of renewable sources in India is 11 % compared to 6.7 % at global level during the same period. Nuclear expansion program will cause growth of this source at 8 %.

Policy Scenario of WEO 2016 and WOO 2016

'Current Policies Scenario' of WEO 2016 of IEA

The accomplishment of announced new policy targets cannot be taken for granted.

The 'Current Policies Scenario' depicts a path for the global energy system shorn of the implementation of any new policies or measures beyond those already supported by specific implementing measures in place as of mid-2016. No allowance is then made for additional implementing measures or changes in policy beyond this point, except that – as with the New Policies Scenario – when current measures are specifically time-bound and expire, they are not normally assumed to lapse on expiry, but are continued at a similar level of intensity through 2040.

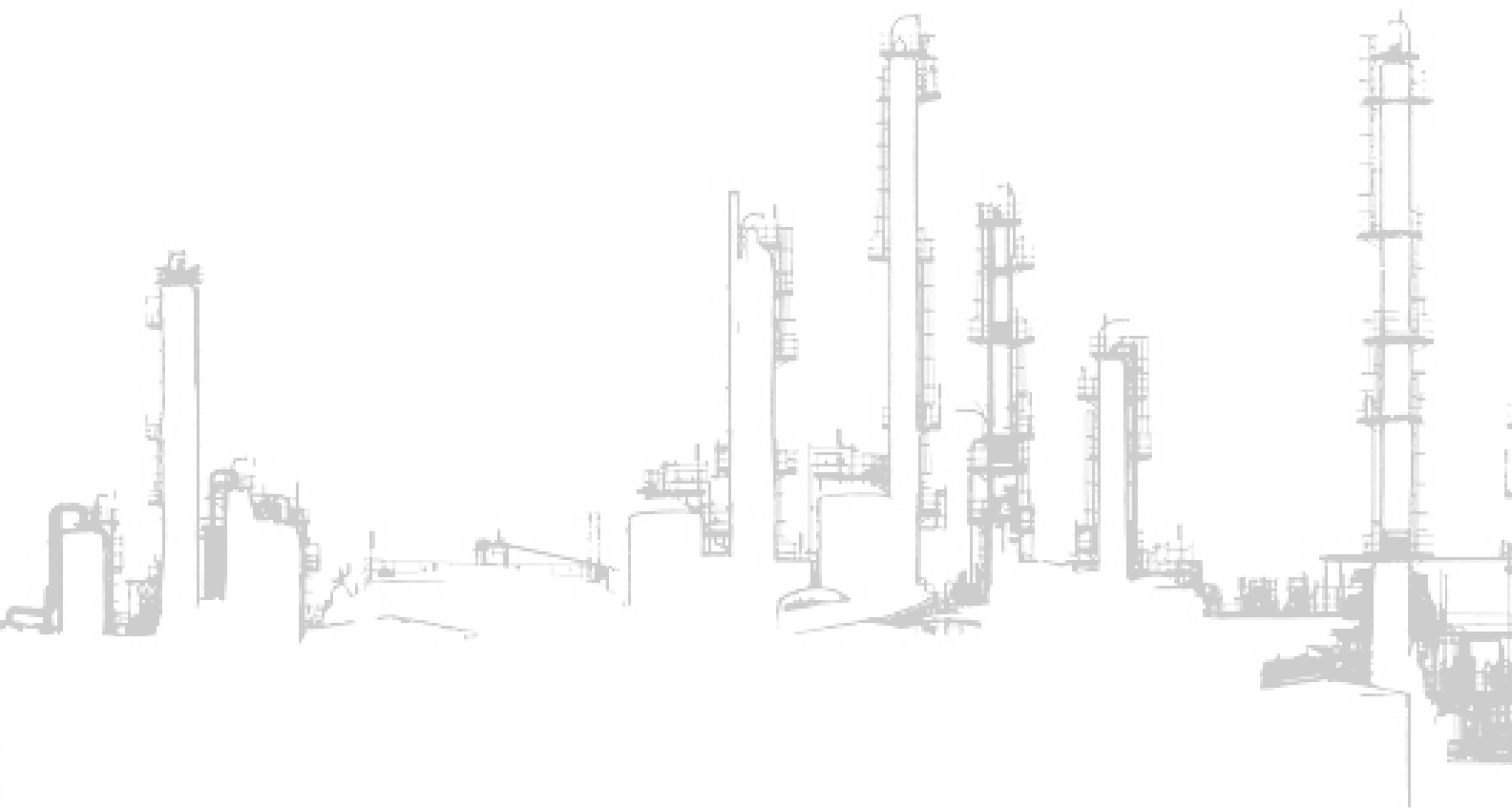
'New Policies Scenario' of WEO 2016 of IEA

Based on a detailed review of policy announcements and plans, the 'New Policies Scenario' effects the way that governments, individually or collectively, see their energy sectors developing over the coming decades. Its starting point is the policies and measures that are already in place, but it also takes into account, in full or in part, the aims, targets and intentions that have been announced, even if these have yet to be enshrined in legislation or the means for their implementation are still taking shape. The climate pledges, known as Nationally Determined Contributions (NDCs), that are the building blocks of the Paris Agreement provide a rich and authoritative source of guidance for this scenario. They have been carefully and individually assessed for this edition of the WEO.

Reference Case of WOO 2016 of OPEC

The Reference Case takes into account policies that are already in place, but it also assumes an extension of those policies beyond their current stage. Recent policy developments have continued to focus on emission reduction and increasing efficiency.

Reference Case assumes an evolutionary development of existing technologies. The cost of renewables is expected to continue decreasing while the efficiency of internal combustion engines will continue to improve. Technology development will also incentivize further powertrain electrification in the road transportation sector.



Will Cashless transactions at Retail Outlets Compromise safety?

Finance

Purchase of automobile fuels and lubricants at about 57000 Retail Outlets (ROs) in India represent a vast potential for cashless transaction. This is amply clear on the recent trend in our country where cashless transactions on ROs have shown sharp rise. Ministry of Petroleum & Natural Gas has introduced an incentive of 0.75% cash back on such transactions from December 13, 2016.

However, two equipments, i.e. POS & Mobile phone, required to operationalize the transactions, work on electrical batteries. In this respect, Govt. has cleared the doubts by providing following clarifications from the Petroleum & Explosives Safety Organisation (PESO). According to provisions of Petroleum Rules 2002, the extent of hazardous area is defined as:

Zone 1: The area 1.2 meters vertically above the base within the cabinet enclosure and 45 cms horizontally in all directions.

Zone 2: The area between 45 cms and 6 meters of cabinet/enclosure extending 45 cms vertically above floor/grade level.



It is desirable that in spite of boundaries of hazardous area defined closure to cabinet (Zone 1), use of POS and mobile phone is avoided in this zone. Mobile phone and POS beyond 45 cms from the cabinet enclosure and at height more than 45 cms from the grade / floor level are usable for the purpose of cashless transaction. Needless to mention that the health of equipment and component functions should always be in sound conditions.



COP 22 – Next step towards climate control and sustainable development

N. K. Bansal
Director
Oil Refining & Marketing
PetroFed

Climate

Marrakech, the capital of African country Morocco witnessed during 7th November, 2016 to 18th November, 2016, the first session of the Conference of the Parties serving as the Meeting of the Parties to the Paris Agreement (COP 22). By 18th November, 111 countries had ratified the Agreement.

On 12th December, 2015, Paris Agreement was adopted in COP 21 at Paris. 196 parties to United Nation Framework Convention on Climate Change (UNFCCC) adopted the agreement. India signed the agreement on 22nd April, 2016 at New York and ratified it on 2nd October, 2016. Quick ratification by the nations and crossing threshold number required to enforce the Agreement before twelve months of adopting it created a pressure and environment for faster move to develop necessary rules and procedures to support the agreement. COP22 in November 2016 at Marrakech was the outcome of this. Meetings under the convention and Kyoto Protocol were also held in this period at Marrakech as well.

Marrakech Action Proclamation bring out the full commitment of all States to UNFCCC to implement Paris Agreement. "Momentum is irreversible – it is driven not only by governments but by science, business and global actions of all types at all levels" Proclamation adds.

As mentioned above, the main focus of COP 22 was to facilitate operationalisation of Paris Agreement



by evolving rules and advance framework on pre - 2020 actions. A timeline of 2018 is set to frame and agree rules and procedures. While political will is rising across the globe, proclamation recognise scientific work with technical practicalities to set the implantable path and achieve goals set in Nationally Determined Contributions (NDC). Submissions will be invited from the countries and technical workshops will be held to bring clarity on the issues. This may also put pressure on some parties to raise the level of their goals set in NDCs. Need not to mention that transparent implementation, monitoring and reporting are the key processes to achieve real-time results and duly emphasised in the proclamation. A five year work plan on Loss and Damage is agreed. Mobilisation of 100 billion \$ per year fund from developed countries to developing countries is key element of the proclamation.

India led by the MoS (I/C) of Ministry of Environment, Forests and Climate Change (MOEFCC) participated in COP 22. Participation by India with other developing countries was to ensure that the conference follow the rule of equity and Common But Differentiated Responsibilities (CBDR) and climate justice. Principles of 'Differentiation' between developed and developing economies was clearly recognised in Paris Agreement. Hence, it was essential that operationalising rules for Adaptation, Mitigation, Financing and Technology transfer must be framed with this principle in focus.

With lot more and better understanding and commitment to move ahead and implement the agreement and deliver the results, COP 22 at Marrakech is a significant milestone in the Climate Control management. Countries are looking towards 2018 for more concrete steps.

Oil & Gas in Media

First LNG fuelled bus launched in Kerala



8th November, 2016 witnessed another event that may bring out major changes in road transportation in India in near future. First LNG fuelled bus was launched by the Minister of Petroleum & Natural Gas MOP&NG, Shri Dharmendra Pradhan in the presence of Chief Minister of Kerala at Thiruvananthapuram. This event, part of plan of MoP&NG to introduce eco-friendly fuels, was an outcome of a cooperative effort of Petronet LNG Ltd. (PLL), Indian Oil Corporation Ltd. (IOCL) and Tata Motors Ltd. and is considered a major step in our country to introduce LNG as a fuel in commercial vehicle.

This bus was fuelled at Petronet LNG Terminal at Kochi and fuel tank was provided by M/s Chart Industries, USA. This is a pilot project and the bus will run on trial basis before it can be certified for commercial application.

LNG is an environment friendly fuel with low emission of Nox, Sox and particulate matters, as compared to the convention fuel, Diesel. For long haul, it is cheaper than diesel. Hence, introduction of LNG In transport segment will directly contribute towards India's commitment to reduce Green House Gas emissions.

Ministry of Road Transport and Highways (MORTH) has already released draft notification for use of LNG as an automotive fuel. Petroleum and Explosives Safety Organisation (PESO) has formed a committee to prescribe regulations for installation of LNG fuel tanks and its dispensing stations.

Parallel actions by various Government agencies will make possible the use of LNG in the commercial vehicles in near future.



EPCA recommend ban on furnace oil and petroleum coke fuels in NCR

N. K. Bansal
 Director
 Oil Refining & Marketing
 PetroFed

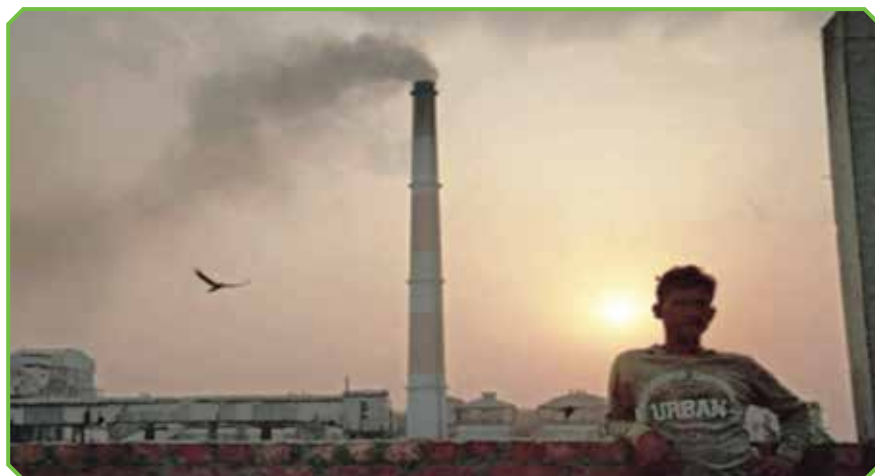
Rise in the level of air pollution, especially of particulate matter PM10 and PM 2.5 both, in national capital has been alarming. Different measures taken so far may have given a temporary relief but problem at epidemic level persists. At the time of writing this report, status of Mandir Marg monitoring station of Delhi Pollution Control Committee (DPCC) in Central Delhi is given to illustrate the criticality of the situation.

Parameter	Value at 3:00 pm on 25th December 2016	Status (Ref.- SAFAR)
Nitrogen Dioxide , ug/m3	58.3	Moderate
Carbon Monoxide, mg/m3	2.8	Moderate
Ozone , ug/m3	11.4	Good
PM 10 , ug/m3	406	Sever
PM 2.5, ug/m3	295	Sever

(Source : www.dpcc.delhigovt.nic.in)

Air Quality Index (AQI) is around 390 which is also in 'Very Poor' (301-400) category.

Environment Pollution Control and Prevention Authority (EPCA) has now recommended to Supreme Court, the ban on use of Furnace Oil (FO) and petroleum coke (petcoke) as industrial fuels in National Capital Region (NCR – see box).



FO and Petcoke are heavy residue products and generally sulphur compounds, present as impurities in crude oil concentrate in heavy residue. As such, samples tested by EPCA in NCR found to have sulphur contents between 1.5 – 2.0% in FO and 6.9-7.4 % in petcoke. Use of heavy fuels with high sulphur contents in industrial applications cause emissions and

formation of secondary particles which along with other sources contributes to 25-30 % in winter air pollution in Delhi, according to study report by IIT-Kanpur.

The consumption of FO in NCR, as per EPCA report, in 2015-16 was 3.2 lakhs MT and show a rising trend in the current year. On pro-rata basis, estimates for consumption in the current year may be around 3.5 lakhs

MT. No specific data was available for use of petcoke in NCR as fuel.

Reasonably good calorific values combine with lower price of these fuels compared to other available alternative fuels (low sulphur coal, BS IV diesel, CNG, etc.) in the domestic and international markets make these fuels attractive for industrial use. Easy and regular availability also improve their viability. EPCA, however, giving priority to pollution control, recommends explicit ban on FO and pet coke use in NCR as fuels. Even for use of pet coke in cement industry, permission from CPCB and EPCA has been suggested. In line with existing notification of 1996 by DPCC on 'acceptable fuels' in NCT, EPCA has revised this outdated list and recommends a fresh list of 'acceptable fuels' that can be used in entire NCR. To streamline the system, EPCA recommends that for inclusion of any material as fuel, BIS to lay down specifications and test reports must be considered by CPCB and EPCA.

What Constitutes 'NCR' ?

The National Capital Region as notified covers the territorial jurisdictions of National Capital Territory of Delhi, Haryana, Uttar Pradesh and Rajasthan. Sub-region wise area details of NCR are as under:

Sub-Region	Name of the Districts
Haryana	Faridabad, Gurgaon, Mewat, Rohtak, Sonapat, Rewari, Jhajjar, Panipat, Palwal, Bhiwani, Mahendragarh, Jind and Karnal (Thirteen districts)
Uttar Pradesh	Meerut, Ghaziabad, Gautam Budha Nagar, Bulandshahr, Hapur, Baghpat and Muzaffarnagar (Seven districts)
Rajasthan	Alwar and Bharatpur (Two districts).
Delhi	Entire NCT-Delhi

SAFAR – Categorization of AQI Ministry of Earth Sciences , Government of India

Description	AQI	PM10 µg/m ³ 24 hr avg	PM2.5 µg/m ³ 24 hr avg	CO ppm 8 hr avg	O ₃ ppb 8 hr avg	NO ₂ ppb 24 hr avg
Good + Satisfactory	0-100	0-100	0-60	0-1.7	0-50	0-43
Moderate	101-200	101-250	61-90	1.8-8.7	51-84	44-96
Poor	201-300	251-350	91-120	8.8-14.8	85-104	97-149
Very Poor	301-400	351-430	121-250	14.9-29.7	105-374	150-213
Severe	401-500	431-550	251-350	29.8-40	375-450	214-750

List of recommended fuels by EPCA

Coal with 1000 ppm or less sulphur for use in power plant (till switch over to gas)

Petrol / Diesel with 50 ppm sulphur

Natural Gas / CNG / LPG

Kerosene for domestic use

Naphtha (for power plants under strict enforcement for pollution)

Aviation turbine fuel for aircraft

Firewood (only for domestic use in rural areas and crematoriums)

Biogas



Petronet signs pact to set up \$950 mn LNG project in Bangladesh

India's largest LNG importer Petronet has signed an agreement to set up a \$950 million liquefied natural gas import project in Bangladesh.

Petronet signed a MoU with Petrobangla to set up a 7.5 million tonnes a year project to receive and regasify LNG on Kutubdia Island in Cox's Bazar and lay a 26-km pipeline to connect it to the consumption markets. "We intend to start marine survey work this month and are targeting 2020 for completion of the project," Petronet LNG CEO and Managing Director Prabhat Singh told PTI.

Singh signed the memorandum of understanding with Petrobangla secretary Syed Ashfaquzzaman on December 30.

The project envisions future expansion and can be used to supply LNG through small barges and LNG trucks to users

which are not connected by gas grid. While what has now been signed is just a preliminary agreement, a formal pact will be signed once a joint venture is agreed between Petronet and Petrobangla.

"We are keen that Petrobangla becomes part of the joint venture (building the LNG) project and are willing to offer them upto 26 percent stake. But they are not keen to invest due to fund constraints. So we would like them to keep a nominal interest of say five percent or so," he said.

Petronet, he said, is not looking at partnership with Petrobangla for funds but only for project securitisation. "We want an assurance that they will buy the gas we import," he said.

Singh said his company is also keen to rope in state gas utility GAIL India Ltd. in the project at some point of time to

help implement the pipeline that is to be laid to connect the import facility with consuming markets.

And others like Indian Oil Corp. too can join if city gas projects are to be developed, he said.

"GAIL may be wanting to sell LNG into Bangladesh and then there is this pipeline. So, it will be a great fit if they join the project," he said.

Bangladesh has a lot of unmet demand. Gas demand is projected to more than double to 45 million tonnes from current 20 million tonnes in next 20 years.

"The LNG projects planned will not be able to meet all of this demand," he said. Petronet's import terminal is expected to be completed within four years.

Excelerate Energy is looking at setting up a floating terminal at Moheshkhali.

IOC's Mathura refinery despatches BS VI fuel for testing

IOC's Mathura refinery has dispatched BS VI High-speed Diesel (HSD) to two auto companies to test viability and compatibility as part of its efforts to provide cleaner fuel for an eco-friendly environment.

"Though the government has set a very stringent target of April 2017 for meeting BS IV and April 2020 for BS VI standard fuel quality, the Mathura refinery has completed the target ahead of the set deadline," said S. M. Vaidya, GM, IOC Mathura Refinery. While Honda was supplied five barrels of BS VI standard HSD fuel, Mahindra & Mahindra Chennai received the same full one tanker (20 KL).

Vaidya said: "BS VI standard HSD will contain only 10 PPM sulphur and motor spirit will be of high standard also since

MS VI is also ready for testing, the refinery is having an interaction with automobile companies on this count."

He thanked Sanjiv Singh, Director Refineries, IOC, for helping complete the target ahead of the schedule.

BS VI standard HSD and BS VI standard motor spirit, according to Vaidya, were prepared in the refinery without addition of any machinery. By October 2017, a new unit will go on stream at the refinery, where only BS VI standard HSD and high quality motor spirit will be produced on a mass scale.

Expressing "time-bound commitment" of IndianOil BSE 2.56 % to provide required quantity of BS VI compliant HSD and MS fuel, he said it would enable automobile industries to

re-design and test their engines with upgraded BS VI fuel in Indian climatic and road conditions.

Interacting with reporters today, Vaidya felt that this would come as a moral booster for the entire automobile industry as oil companies are geared up to meet the target of BS IV and BS VI.

Vaidya said further that the refinery successfully demonstrated its preparation of first batch of BS-VI HSD on September 1 to serve OEMs (Original Equipment Manufacturers) efficiently.

"Refinery is also playing pivotal role in developing the loading bay at Mathura Marketing terminal to ensure consistent supply of BS-VI fuel to customers," he concluded.

PETROTECH-2016

Special Feature

Energy today, is the most important catalyst for achieving sustained and substantial growth for any nation. In the modern world, access to a varied energy sources should be a fundamental right of every human being and this is particularly true for India with a rapidly growing economy and ambitious population of over a billion. Government of India has taken several initiatives and reforms in Upstream, Midstream and Downstream sectors to drive the nation into a realm of exemplary economic growth on par with the world's leading countries. In this energy hungry situation, the mega conference & exhibition PETROTECH-2016 has been organized under the aegis of the Ministry of Petroleum & Natural Gas, Government of India and coordinated by Indian Oil Corporation Limited, a Fortune 500 company.

Over the years, the PETROTECH series of conferences has gathered momentum and emerged as a major energy conclave for think-tanks, and practitioners of the Hydrocarbon industry worldwide. Each PETROTECH conference has been unique in its approach in its aim to provide cleaner, greener and sustainable energy solutions. It has garnered an enviable reputation in the international circles as one of the coveted forums for the global hydrocarbon industry. With a plethora of topics and technical sessions, the 2016 edition engaged everyone in a memorable and eventful three days of extravaganza in India's national capital. Over 7124 delegates from across India and abroad attended this mega conference overwhelming even the organizers. This includes 18 Ministers, 31 Overseas Delegations and 442 Foreign Delegates.

In the Inaugural speech of Hon'ble PM, he spoke about the prospect of the high and rapid growth trajectory that India is traversing places a large responsibility on India's energy sector. Rather than short term solutions, the policies of the Government are focused on improving

The mega Conference and Exhibition concludes with aplomb



India's long term economic and social prospects. Vision for India on the Energy future is that it will stand on four pillars i.e. Energy Access, Energy Efficiency, Energy Sustainability, Energy Security.

He also spoke eloquently how India is committed to energy sustainability and we are taking steps for meeting the targets as committed in COP21 summit CNG, LPG and Bio-fuels which are cleaner fuels for transportation

The Conference

The PETROTECH conference had many pulse pounding speeches, lectures, sessions and interactions. Here are a few glimpses of the invigorating samplings. The first day saw the Ministerial session that went into debating on the theme "Hydrocarbons – Policy issues related to inter-country co-operation". Countries need to be cognizant of the four strategies regarding Energy of sustainability, affordability, availability and security. While all countries are working towards these strategies, the global challenges are the same for import dependent countries like India. Some of the challenges discussed were emerging oil substitutes, Gas and coal usage tradeoffs, managing oil volatility for importing countries.

While in the plenary session "Oil Price Volatility" was discussed with the current decline of oil prices is by far the longest compared to previous cycles since mid 1980s. Another parallel plenary session saw intense discussions on "India Rising – Resilience and Reforms" as India is committed to achieving its sustainable development goals. However, main challenge is that 46% of energy need of India is imported. Need to provide structures to achieve Government's goal for energy industry which is efficiency, accessibility, sustainability and security and also create resilience. Examples of Nigeria, Colombia, Indonesia, Argentina and Mexico were discussed to discuss the various ways that countries adapt to the challenges of reforms. Regulatory processes need to be vibrant to reflect ever

sector. Other options of bio-fuels are also being explored with intense participation of Indian R&D efforts in second and third generation bio-fuels. Proactive foreign policy and energy diplomacy is being pursued with like minded countries. Initiatives like Make-in-India, Startup India and Stand-up India will encourage the youth for entrepreneurial skills and innovative ideas and participate in enriching acumen for global thinking and local implementation.

changing environment and technology; Overarching policy needs to be redefined constantly.

The second day in the Theme session on "Natural Gas – Fuel of the future" Natural Gas is the fuel of the 21st century. Need to work towards a higher contribution in the energy basket in India. Gas would be the natural choice for power transport and chemicals as we move towards clean energy system. It is a low carbon flexible source option to make the transition. LPG and Gas are complementary fuels in a sense and both can share the market. Alternative Fuels - Beyond Fossil fuels as a theme session was also examined thread bare.

Theme session three happens to be a vital ingredient - Gearing for



transforming India cannot happen without transforming governance, good governance cannot happen without transforming mindset. The good ideas are to be implanted at right time. Good balance between economics and politics need to be maintained. Boost to renewable energy has to be accelerated.

Shri Suresh Prabhu, Hon'ble Minister for Railways said that improving the lifestyle of people and quality of life is our vision, not limited to income, but has to be implemented through various means of link between energy and environment. Railways are committed to utilization of various alternative renewable energy like Solar energy, Bio diesel and also wind. They will however continue to be largely dependent on Diesel and there is emphasis on improving efficiency in Railway engines.

Shri Anil Madhav Dave, Hon'ble MoS (IC) for Environment, Forests and Climate Change: Economic Development and environment can go hand-in-hand, they are complementary to each other and not contradictory.

growth: Talent requirement and Expectations with elaborate talkings on the need for Human Resource needs to be business function rather than support function that necessitates changes in talent management strategies of organizations. Three critical enablers in harnessing talent are – top leadership with vision quotient, business quotient and emotional quotient, Work culture, wherein positive work culture, respect and trust and more of recognition culture and finally People Processes, wherein losing access to 50% workforce by not employing many females.

In the Plenary Session, Transforming India, a manufacturing hub was mandated. India is the fastest growing economy in the world. Even when rest of the world is facing downturn in Oil & Gas, India is showing robust growth. India needs to grow at a very fast rate for next few decades to meet various socio-economic challenges. For sustained growth it is essential that the manufacturing sector grows and at commensurate pace as there is large pool of technically skilled people in India. This is strength for India. Improvement of infrastructure is important and there is need for further focus in this area. A suitable ecosystem needs to be developed for facilitating Make in India.

On the third day, a Ministerial Conclave was conducted on Transforming Energy to Transform India where political stalwarts from the GOI like Shri Piyush Goyal, Hon'ble MoS (IC) Power, New and Renewable Energy and Mines opined that



However, policies made should be India centric and not to copy blindly from other country. While utilizing energy one should take care of the environment, companies should volunteer for improvement of environment and should not wait for laws to tell them.

Shri Dharmendra Pradhan, Hon'ble MoS (IC), Ministry of Petroleum and Natural Gas: We need to ponder, Is the energy sector only to sell and economic commodity, Will the sector play a larger role on the social front? India has a global responsibility, and it will follow its own lead. Our 'Indian model' will definitely be a 'world model'. This will be 'Transforming energy to transform the world', instead of just India.

Shri Nitin Gadkari, Hon'ble Minister for Road Transport & Highways and Minister for Shipping: In order to remain competitive there is urgent need to reduce logistic cost in India. For this purpose special emphasis is being given on improvement of Road, Port and waterways.

Another interesting Theme session



was the Future of Upstream- A techno-managerial challenge where Technology solution will be game changer. The new mantra for survival and growth is "managing margin and running business at lower cost" going digital is very important in increasing margin. Three interconnected parts of digital opportunity are Big Data (Data analytics), Automation & Robotics and Visualization (predicting risk). Going digital is the only way. Given India's history of embracing and implementing technology, country is well poised for playing leadership role.

The growing prominence of Asian Refining was also introspected as Asia will drive demand growth - refining capacity also expected to grow with better conversion capacities leading to oversupply. Asia already leads with 34% of global refining capacity. No new refining capacity expected to be added till 2019 even globally. Closures have been seen in Australia and Japan and in China, established refiners are losing market share to small low quality refiners.

The Exhibition

PETROTECH-2016 Exhibition was one of the biggest Oil & Gas exhibitions with participation from World's top Oil & Gas companies & for the 1st time, exhibitors focused on Make in India, Renewable Energy and Skill Development. There were dedicated pavilions for Upstream and Downstream Exhibitors to demark the two entities.

This time the exhibition venue was Hall No. 14, 18 & Defence Pavilion in Pragati Maidan and was inaugurated on 4th December, 2016 at J&K Pavilion in Pragati Maidan Inauguration by MoS (I/C), P&NG, attended by over 750 dignitaries, Ministers from other countries Nepal, Bhutan, Iraq & Mauritius, Ambassadors of Australia, Qatar, Norway, Nigeria, Sudan & Malaysia and Commercial Counsellors from US, UK & Scotland.

While the gross exhibition area was 22,000 sq.m.; the net exhibition area was 11,850 sq.m with 691 exhibitors of which domestic were 313 & overseas were 378. The number of countries - 36 Country Pavilion - 15 of which included Australia, Canada, China, Germany, Iran, Japan, Malaysia, Nigeria, Norway, Qatar, South Korea, Saudi Arabia, UK, Scotland and UAE. At the end of the fourth day of exhibition, the number of footfall was 20,315 and extremely encouraging. Stalls with cutting edge technology: Halliburton, Schlumberger, GE Oil & Gas, Worldwide Oilfield Machine Pvt. Ltd., Cairn, Botil Oil Tools India Pvt. Ltd., Petronet LNG Limited, ONGC: Seavilization and IndianOil



5th IEF – IGU

Alongside the main PETROTECH-2016 was the 5th IEF – IGU Ministerial Gas Forum was "Gas for Growth: Improving economic prosperity and living standards". Where increasing role of gas in the energy mix foreseen to enable an orderly energy transition that strengthens energy security, stimulates economic growth and enhances healthy energy market functioning, prosperity and wellbeing globally.

Policy makers noted that while on one hand the future of gas is bright considering 21st century demographics that require economic prosperity and living standards to increase across societies, but that on the other hand, established policies and business models require closer consideration in light of current energy market projections.



Parallel Events

Also conducted was Buyers-Sellers Meet, a special Women Forum with the theme Women Leaders in Oil & Gas - The Emerging Trends where 370 participants indulged in discussing the pros and cons of women professionals in workplace and dealing with their achievements & shortcomings in the process.

Similarly, a special Youth Forum with 177 participants was also conducted to cater to their specific subjects, where numerous participants from all walks of life drawn from across the country were involved in energetic discussions. These discussions were conducted in a separate venue so that the youth can interact among themselves.

Another Special Track on Fuel Retailing, as a parallel event of PETROTECH 2016 was also conducted by FICCI in collaboration with BPCL at FICCI Auditorium where numerous participants put forth their opinions, grievances & suggestions.



Award Ceremony and Valedictory

The award ceremony and valedictory function saw the conclusion of PETROTECH-2016 where the best awards for exhibition were given away to Essar Oil Ltd., Ametek, Weatherford, Oil India Ltd., World Wide Oil and the runners up were Botil Oil Tools India Pvt. Ltd., ASKA, UK Pavilion, Schlumberger, IOCL (R&D).

While the Life Time Achievement Award given to Dr. Avinash Chandra – Upstream; Mr. P. S. Tekchandani – Downstream; Mr. Paul Ratnaswami, Igory Rosenet; Mr. P. S. Raghvan, Petrochem. Under special prizes section, the award for Rising Star – Planys Tech Limited; Sahyogi - L&T; Women in Hydrocarbon Sector (Ojaswani) – Sukla Mistry, IOCL and Jayalakshmi Nayar, ONGC; Special Technical Awards; Individual innovation – Rangarajan Sadagopan, BPCL; Project Team - Rewari Kanpur Pipeline Project, HPCL and Replacement of CDU-IV of Mumbai Refinery, BPCL; CSR – Crane India Limited (Water Project in Barmer, Rajasthan); Greening in Oil & Gas – ONGC.



Glimpse of PETROTECH - 2016



Statistics

India: Oil & Gas

Domestic Oil Production (Million MT)

		2013-14	2014-15	2015-16	April- November 2016	
					Qty.	% of Total
On Shore	ONGC	6.71	6.07	5.82	3.93	33.45
	OIL	3.47	3.41	3.23	2.15	18.30
	Pvt./ JV (PSC)	9.41	9.06	8.81	5.67	48.26
	Sub Total	19.59	18.54	17.86	11.75	100
Off Shore	ONGC	15.54	16.19	16.54	10.79	88.15
	OIL	0	0	0	0	0.00
	Pvt./ JV (PSC)	2.66	2.73	2.55	1.45	11.85
	Sub Total	18.2	18.92	19.09	12.24	100.00

	2013-14	2014-15	2015-16	2016	% of Total
Total Domestic Production	37.79	37.46	36.95	23.99	100
ONGC	22.25	22.26	22.36	14.72	61.36
OIL	3.47	3.41	3.23	2.15	8.96
Pvt./ JV (PSC)	12.07	11.79	11.36	7.12	29.68
Total Domestic Production	37.79	37.46	36.95	23.99	100

Source : PIB/PPAC

Oil Import - Volume and Value

	2013-14	2014-15	2015-16	April-November 2016
Quantity, Million Mt	189.2	189.4	202.1	143.81
Value, INR '000 cr.	864.88	687.42	415.36	296.43
Value, USD Billion	143	112.7	64.4	44.25
Average conversion Rate, INR per USD	60.48	61.00	64.50	66.99

Source : PPAC

Oil Import - Price USD / Barrel

	2013-14	2014-15	2015-16	April-Nov 2016
Brent (Low Sulphur - LS- marker)	107.5	85.43	47.46	46.13
Dubai	104.58	83.77	45.63	43.99
Low sulphur-High sulphur differential	2.88	1.4	1.68	1.72
Indian Crude Basket (ICB)	105.52	84.15	46.17	44.76
Av. Dubai Oman prices (High Sulphur - HS- marker)	104.62	84.03	45.78	44.41
ICB High Sulphur share %	69.9	72.04	72.28	71.03
ICB Low Sulphur share %	30.1	27.96	27.72	28.97

Source: PPAC/Oil Companies

Refining

Refining Capacity (Million MT on 1st April 2016)

Indian Oil Corporation Ltd.	
Digboi	0.65
Guwahati	1.00
Koyali	13.70
Barauni	6.00
Haldia	7.50
Mathura	8.00
Panipat	15.00
Bongaigoan	2.35
Paradip	15.00
Total	69.20

JV Refineries	
DBPC, BORL-Bina	6.00
HMEL,GGSR	9.00
JV Total	15.00

Private Refineries	
RIL, Jamnagar	33.00
RIL, (SEZ), Jamnagar	27.00
Essar Oil Ltd., Jamnagar	20.00
Pvt. Total	80.00

Bharat Petroleum Corp. Ltd.	
Mumbai	12.00
Kochi	9.50
Total	21.50

Hindustan Petroleum Corp. Ltd.	
Mumbai	6.50
visakhapatnam	8.30
Total	14.80
Other PSU Refineries	
NRL, Numaligarh	3.00
MRPL	15.00
ONGC, Tatipaka	0.07
Total PSU Refineries Capacity	135.07

Chennai Petroleum Corp. Ltd.	
Chennai	10.50
Narimanam	1.00
Total	11.50

Total Refining Capacity of India 230.066* (4.62 million barrels per day)

* Not includes capacity of 6000 TMT of Cuddalore refinery of Nagarjuna .

Source : PPAC/CHT

Crude Processing (Million MT)

PSU Refineries	2013-14	2014-15	2015-16	April-November 2016
IOCL	53.13	53.59	57.19	42.42
HPCL	15.51	16.18	17.23	11.58
BPCL	22.97	23.18	24.09	17.03
CPCL	10.63	10.78	9.63	7.42
MRPL	14.65	14.68	15.6	10.45
NRL	2.61	2.78	2.52	1.7
Sub Total	119.5	121.19	126.26	90.6

JV Refineries	2013-14	2014-15	2015-16	April-November 2016
HMEL	9.27	7.34	10.71	7.07
BORL	5.45	6.21	6.4	4.05
Sub Total	14.72	13.55	17.11	11.12

Pvt. Refineries	2013-14	2014-15	2015-16	April-November 2016
ESSAR	20.2	20.49	19.11	14.01
RIL	68.03	68.04	69.44	46.65
Sub Total	88.23	88.53	88.55	60.66

	2013-14	2014-15	2015-16	April-November 2016
All India Crude Processing	222.45	223.27	231.92	162.38

Source : PPAC

Crude Capacity vs Processing - 2016-17 April-November 2016

	Capacity on 01/04/2016 Million MT	% Share	Crude Processing Million MT	% Share
PSU Ref	135.07	58.71	90.6	55.80
JV. Ref	15	6.52	11.12	6.85
Pvt. Ref	80	34.77	60.66	37.36
Total	230.07	100	162.38	100

POL Production (Million MT)

	2013-14	2014-15	2015-16	April-November 2016
From Refineries	216.44	217.08	227.9	157.86
From Fractionators	3.87	3.65	3.38	2.78
Total	220.31	220.73	231.28	160.64

Distillate Production (Million MT)

	2013-14	2014-15	2015-16	April-November 2016
Light Distillates, MMT	58.81	59.54	63.60	46.58
Middle Distillates, MMT	112.85	113.41	118.31	81.03
Total Distillates, MMT	171.66	172.95	181.91	127.61
% Distillates Production on Crude Processing	77.17	77.46	78.43	78.59

International Price Ex Singapore, (\$/bbl.)

	2013-14	2014-15	2015-16	April-November 2016
Gasoline	114.31	95.45	61.72	54.64
Naphtha	100.22	82.22	48.54	43.74
Kero / Jet	121.23	66.62	58.17	55.44
Gas Oil (0.05% S)	121.99	99.44	57.63	55.19
Dubai crude	104.58	83.77	45.63	43.99
Indian crude basket	105.52	84.16	46.17	44.76

Cracks Spreads (\$/ bbl.)

	2013-14	2014-15	2015-16	April-November 2016
Gasoline crack				
Dubai crude based	9.73	11.68	16.09	10.65
Indian crude basket	8.79	11.29	15.55	9.88
Diesel crack				
Dubai crude based	17.41	15.67	12	11.2
Indian crude basket	16.47	15.28	11.46	10.43

Source: PIB/PPAC/Oil Companies

Gas

Gas Production/Consumption/Import

	2013-14	2014-15	2015-16	April-November 2016
Net Gas Production (MMSCM)	34574	32693	31138	20445
LNG Imports (MMSCM)	17728	18536	21309	16852
Import Dependency (%)	34	36	41	45
Total Gas Consumption (MMSCM)	52302	51229	52447	37297

Domestic Gas Price (\$/mmbtu)

Period	Domestic Gas Price (GCV Basis)	Price Cap for Deepwater, High Temp High Pressure Areas
November 14 - March 15	5.05	-
April-Sept 15	4.66	-
Oct 15 - March 16	3.82	-
April-Sept 16	3.06	6.61
Oct 16 - March 17	2.5	5.30

Source: PPAC

News from Members

CVC Inaugurates the Vigilance Awareness Week 2016 at IndianOil

Mr. K.V. Chowdary, the Central Vigilance Commissioner inaugurated the Vigilance Awareness Week 2016 in IndianOil, in presence of Mr. B. Ashok, Chairman, Ms. C.K. Deshmukh CVO, functional Directors, Advisor Security and other senior officials of the Corporation.

The function was webcasted live all over IndianOil locations.

In his address, Mr. B. Ashok, Chairman, said "IndianOil has been in the service of the nation for over five decades now. Founded as a business entity in the spirit of a national trust for economic prosperity, it has catalysed growth in all sectors of the economy. And today, it is gearing to fuel a vibrant India as it emerges as a prime mover of global growth. Public participation, in a democracy like India, has immense significance in the ongoing process of socio-economic transformation. Today, the Government of India is actively promoting public participation in designing and implementing transparent models of governance that will facilitate the evolution of a strong and ethical India."

He welcomed the CVC and expressed his gratitude on behalf of all IOCIans

Earlier in her welcome address, Ms. C.K. Deshmukh lauded the efforts of Central Vigilance Commission under the visionary leadership of Mr. K.V. Chowdary. She said that the theme of this year "Public participation in promoting Integrity and eradicating Corruption" was most apt and timely. "Today, India is demographically very young, with 65% of the population under the age of 30 years. This is a great opportunity to connect with these young idealistic people and bring about an ethical revolution that will change the ambience in the country and mainstream values based way of life that will create a modern, honest and progressive society with transparent and just avenues for upward mobility."

Addressing IOCIans, Mr. Chowdary underscored the importance of probity and honesty in professional and personal lives. He congratulated IndianOil for its legacy of service to the nation and for pioneering several



Mr. K. V. Chowdary, CVC lighting the traditional lamp at the Vigilance Awareness Week 2016 Inauguration.

initiatives that would make vigilance an inherent ingredient for ethical decisions. During the programme, CVC launched five video clips on public awareness against corruption. The clips with the title "You have the Power to stop Corruption" is inspired by Gandhiji's famous quote, "Be the change you wish to see in the world".

Mr. K. V. Chowdary also launched a smart software SVMS (Smart Vigilance Management System) which leverages IT and will greatly improve analytics, tracking and reporting in the Vigilance domain. A Compendium of Vigilance Case Studies was also unveiled by CVC.



Mr. K.V. Chowdary CVC releasing a Compendium of Vigilance Cases in presence of Mr. B. Ashok, Chairman, IndianOil and functional Directors.

IOCL to deploy unique digital assistant app for field force as part of Digital India initiative

In support of the Digital India initiative, Indian Oil Corporation Ltd. (IndianOil) deployed a new technology initiative, a ChatBot, at the recently concluded PETROTECH-2016, the 12th International Oil & Gas Conference and Exhibition at Delhi held under the aegis of the Ministry of Petroleum & Natural Gas.

The ChatBot was deployed as a downloadable app. to serve as a digital assistant to the delegates, providing them with all the information on conference sessions, exhibition, speakers, special events, facilities and other useful information digitally on their mobile phones or on the event website.

ChatBot is an intelligent conversation tool between humans and machines, where people can ask questions in the natural language and the bot, using its natural language capabilities and artificial intelligence technology, understands the context and replies to the query by fetching relevant information from the database at the backend. The initiative was taken in partnership with M/s Microsoft.

In view of the huge success of ChatBot at the PETROTECH-2016 Conference, IndianOil is planning to deploy this technology for its internal stakeholders with an aim to assess its usefulness to the field force in their day-to-day working.



ChatBot Screenshot

BPCL launches Customer Awareness Program on "Cashless" transactions

BPCL launched a "Customer Awareness Campaign" on 26 December, 2016, at its state-of-the-art fully automated Company Owned Company Operated (COCO) retail outlet, BP-Churchgate in Mumbai for the benefit of the fuelling consumers and to promote usage of "Cashless" mode of payments at Petrol pumps. The event was graced by Mr. Ashish Shelar, Hon'ble MLA from Bandra (W) and BJP President, Mumbai

Unit, Mr. George Paul, Executive Director (Retail), BPCL and other senior dignitaries of BPCL. Various customer oriented schemes linked to Cashless transactions at BPCL's petrol pumps were shared on this occasion.

In keeping with Govt. of India's demonetisation policy, Public Sector Oil Marketing Companies under the aegis of MoP&NG has embarked upon

an intensive program to promote "Cashless" transactions at its Petrol pumps at all their Retail Outlets and LPG Distributorships. Out of total 53,522 retail outlets of Oil Marketing Companies, 31,879 outlets have been provided with POS machines to facilitate Credit and Debit Card transactions while drive is on to complete all retail outlets at the earliest. E- Wallet acceptance at all the Retail Outlets is nearing completion to enhance Cashless Transactions.

BPCL has enabled credit/debit card & mobile wallet payments at its petrol pumps apart from its pioneering Smart Card based loyalty program which can also be recharged using credit / debit cards / RTGS / NEFT & which is being used by a large number of fleet owners as payment management solution as well as by individual customers. Cashless transactions account for more than 25% of total OMC petrol pump transactions on all India basis.

In Maharashtra also, including on National / State Highways and rural markets, it is rapidly increasing.



In Mumbai, more than 55% of transactions in BPCL retail outlets are through Cashless mode. In Mumbai, Navi Mumbai, Thane and Raigad District, 100% of BPCL retail outlets have one or more mode of Cashless payment facility available for the benefit of customers.

BPCL has tied-up with SBI, HDFC Bank and other major Banks for placement of POS terminals to facilitate Credit/Debit card transactions and with PayTM, Freecharge, Oxigen, Reliance Jio, SBI

Buddy, Fino for enabling mobile-wallet transactions at its retail outlets. In order to promote cashless transactions at petrol pumps, Govt. of India has also announced a special incentive of 0.75% to customers on all digital payments made at petrol pumps. Fuel surcharge waiver on Debit Card transactions until 31.12.2016 has also been announced by the Government.

BPCL has taken several initiatives to create widespread awareness of digital mode of payments at petrol

pumps through Customer Education Campaigns at retail outlets, customers / transporters' premises, Training Programs for Retail outlet dealers and their staff, Advertisements in Print and Electronic Media, spreading awareness through Social Media – Twitter, Facebook, etc. and display of messages through standees, banners and posters at ROs.

CAIRN India conferred with PETROTECH-2016 Award for Sustainability & CSR

Cairn India bagged the prestigious award in Sustainability and Corporate Social Responsibility (CSR) (Corporate) in the Special Technical Award category during PETROTECH-2016. The award was presented by Mr. Dharmendra Pradhan, Minister of State for Petroleum and Natural Gas (Independent Charge), in the presence of the Hon'ble Union Finance and Corporate Affairs Minister Mr. Arun Jaitley and members of the industry during the recently concluded PETROTECH-2016 at New Delhi.

Cairn India won the prestigious award for its safe drinking water initiative, the Jeevan Amrit Project, which provides clean and safe drinking water to communities in the districts of Rajasthan through 333 'Any Time Water' kiosks. Speaking about the award, Mr. Sudhir Mathur, acting CEO,

Cairn India Limited, said, "We are very proud that our Jeevan Amrit Project has been recognized by the industry. Cairn India is committed to continue working for the millions of people of India, and this project is a step in that direction. Dedicated to communities in places we have pour operations, the Jeevan Amrit Project not only ensures clean and safe drinking water to the people but also provides members a sense of ownership and fosters rural entrepreneurship."

On completion, the Jeevan Amrit Project, which operates through water kiosks, will be one of the largest CSR community water initiatives in India, touching over a million lives. A model of the water dispensing unit was also showcased at the Cairn India pavilion at PETROTECH-2016.

Through its CSR initiatives, Cairn India

is transforming lives of communities in Rajasthan, Andhra Pradesh and Gujarat. Along with the Jeevan Amrit project, Nand Ghar is an initiative that rest on the edicts of inclusive development. Designed with an aim to develop and modernise Anganwadis, the Ministry of Women and Child Development and Vedanta signed a Memorandum of Understanding (MoU) to build 4000 next generation Anganwadis across the country. Besides supplementary nutrition and basic healthcare services, Nand Ghars also provide pre-school education through e-learning in villages they are instituted in. These modern Anganwadis are enabling village women to become entrepreneurs, thereby generating employment and enhancing incomes. A thematic model of the Nand Ghar was also exhibited at the pavilion at PETROTECH-2016.



Mr. Dharmendra Pradhan, Minister of State for Petroleum and Natural Gas (I/C), presented the award given in recognition of the company's CSR water project for community in Rajasthan.

GAIL Programmes & Events



Shri Narendra Modi, Hon'ble Prime Minister of India laid the foundation stone of the Varanasi City Gas Distribution (CGD) project on 24th October, 2016, heralding the start of construction of the project which will bring eco-friendly fuel natural gas to households, vehicles and industries in the holy city. The project is part of GAIL (India) Limited's Jagdishpur – Haldia and Bokaro – Dhamra Pipeline Project (JHBDPL), popularly known as 'Urja Ganga'.



Shri Narendra Modi, Hon'ble Prime Minister of India addressing the gathering after laying the foundation stone of the Varanasi City Gas Distribution (CGD) project on 24th October, 2016.



Upon the invitation of Shri Dharmendra Pradhan, Hon'ble Minister of State for Petroleum and Natural Gas (Independent Charge), Ministers, industry leaders, heads of international organisations and invited energy market stakeholders of the member countries of the International Energy Forum (IEF) and the International Gas Union (IGU) gathered at the 5th Meeting of the Biennial IEF-IGU Ministerial Gas Forum on 6th December 2016 in New Delhi. The meeting was hosted by the Ministry of Petroleum and Natural Gas and supported by GAIL (India) Limited.



Shri Dharmendra Pradhan, Hon'ble Minister of State for Petroleum and Natural Gas (Independent Charge) launched an awareness campaign in Kashipur (Uttarakhand) on 22nd December, 2016 to highlight the benefits of Natural Gas and the Pradhan Mantri Ujjwala Yojana under which LPG is provided to underprivileged households.

Oil India Limited signs MoU with University of Houston

Oil India Limited (OIL) with intent of augmenting its reserves base and maximising recovery from its aging oilfields has entered into a MoU with the University of Houston, one of the leading universities on Oil & Gas of the world. The MoU was signed on 5th October, 2016 in presence of Mr. Dharmendra Pradhan, Hon'ble Minister of State for Petroleum and Natural Gas (Independent Charge) at New Delhi.

Located in the energy capital of the United States of America, home to

the leading Oil & Gas operating companies and service providers, the University is a premier institute, involved in the quest of academic and translational excellence in the field of Oil & Gas through its outstanding faculty and research staff and has established well documented partnership with leading edge academia and industry subject matter experts.

The MoU, amongst others, is focused to collaborate in the fields of Improved Oil Recovery & Enhanced Oil Recovery for production enhancement from matured fields, seismic interpretation & reservoir characterization studies, improvement of drilling and well intervention practices and unconventional hydrocarbon studies.

It is envisaged that the collaboration will help OIL to further consolidate and upgrade the various initiatives the Company has undertaken to improve production and contribute significantly to the energy security of the country. This will also contribute towards national obligation as set by Hon'ble Prime Minister to reduce import dependency of Oil & Gas by 10% by 2022.



Oil India Limited signs MoU with University of Houston.

Oil India Limited announces INR 50 Crore Start-up Fund

Oil India Limited (OIL) has announced a Rs. 50 crore OIL Start-up fund to foster, nurture and incubate new ideas related to Oil and Gas sector. The proposal for setting up the OIL Start-up fund was approved in the 469th Board Meeting of the Company held on 30th September, 2016 and is in line with Government of India's flagship program 'Start-up India'. The key objectives of the OIL Start-up fund are : develop new innovative solutions, technologies and products through Start-ups, for solving

business problems, develop start-ups as an important channel for OIL for expanding into new related business sectors and create an entrepreneurial mindset and fresh thinking amongst employees and stakeholders by working with Start-ups, for revitalising corporate culture.

Speaking on the occasion, Mr. Utpal Bora, Chairman and Managing Director, OIL, said, "The Start-up fund shall focus on promoting entrepreneurship amongst youth, especially of the North-

East India, by enabling the growth of Start-ups for addressing various technical challenges and operational risks of the Oil and Gas industry and encouraging innovative thinking amongst the present and future generations".

Detailed scheme of the OIL Start-up fund is being worked out and when finalised, shall be uploaded on the OIL website for public viewing.

Honeywell launches new research chemicals business to optimize product partnerships with researchers

Honeywell has announced the launch of a new business, Honeywell Research Chemicals, that will now include several brands and solvent and inorganic chemical products that were acquired from Sigma-Aldrich in December 2015. Honeywell Research Chemicals combines more than 200 years of industry expertise and experience with a level of customization that meets

the fast-changing needs of advanced researchers, who require a reliable supply of critical reagents and solvents in the analytical testing, drug discovery and applied materials sectors. Advanced research has undergone significant changes in recent years, triggered by changes in the life science and drug discovery markets, and increasing consumer interest in

everyday science applications that affect their quality of life, such as food safety and air pollution. Researchers have come to expect chemical suppliers to provide a convenient e-commerce experience, along with innovative supply chain solutions, that are tailor-made to their exact specifications.

PetroFed Events



4th Stakeholder workshop on 'Raising the Voice of Gas - Building Gas Hub'

The 4th gas stakeholder workshop on 'Raising the Voice of Gas – Building Gas Hub' was organized by IHS Markit, ICF and PetroFed on October 13, 2016 at PDPU Campus, Gandhinagar, Gujarat.

The workshop was organized to recommend steps for facilitating building gas hub and obtain views on unbundling of gas infrastructure. Competition for Students was organized to develop gas hub. The best team shared their presentation on gas hub at the workshop.



Mr. Geoff Wain, Deputy High Commissioner, British High Commission of India delivering his address.



Ms. Gauri Jauhar, IHS and Mr. Gurpreet Chugh, ICFI - Project Recap.



Mr. S. Rath, Director (E&P), PetroFed moderating the panel discussion on 'Unbundling Infrastructure'.



A section of the participants.

Talk on "Impact of Shale Revolution on Oil Markets & Related Public Policy Issues"

Petroleum Federation of India organised a talk on "Impact of Shale Revolution on Oil Markets & Related Public Policy Issues" by Mr. Greg Priddy, Director, Global Energy & Natural Resources, Eurasia Group, USA.

During the session, Mr. Priddy spoke about the emergence of shale oil and gas in U.S. He also talked about how recent geopolitical supply disruptions have masked U.S. shale volume growth from 2012-2014. He further discussed about the role of market structural factors like OPEC and non-OPEC countries on the shale market outlets.

Speaking on the North America energy policy and regulatory update, Mr. Priddy highlighted key factors that will shape the future of shale oil in U.S. The talk which covered diverse political, regulatory & energy policy issues was well received by the industry participants.



Dr. R.K. Malhotra, Director General, PetroFed welcoming the participants.



Mr. Suresh Mathur, Founding CEO & MD, Petronet LNG Ltd. raising the query.



Mr. Greg Priddy, Director, Global Energy & Natural Resources, Eurasia Group making his presentations.



Dr. C.R. Prasad, Former CMD, GAIL sharing his views.

Talk on 'Gas Hydrates'

A talk on Gas Hydrates was organized by PetroFed and Energy Think Tank on October 27, 2016 at India Habitat Centre, New Delhi. Eminent members of Energy Think Tank and invited participants from DGH, ONGC, OIL, GAIL and IOCL, etc participated.

Dr. C. R. Prasad, ETT Convenor gave a brief account of status of Gas Hydrate exploration in India and introduced the speakers. Dr. Avinash Chandra, Dr. Pushendra Kumar and Shri. Sunil Kumar Singh made detailed presentation on 'Gas Hydrates' covering the initiative, present status, resources available and way forward.

The participants from different organizations conveyed thanks profusely for the informative session on Gas Hydrates and good work done so far.

Suggestions/ Recommendations arising out of the talk & discussion has been forwarded to MoP&NG, NITI Ayog & DGH.



Dr. Avinash Chandra, Former DG, DGH and Member ETT making a presentation on "Gas Hydrates in India & the National Gas Hydrate Program (NGHP 1999 to 2005)".



Mr. S. Rath, Director(E&P), PetroFed welcoming the ETT members, speakers and participants.



Dr. Pushendra Kumar, GM (Chem), Head-Gas Hydrate Research & Technology Centre (GHRTC) from ONGC delivering a presentation on "Gas Hydrate Technology & Developments".



Mr. Sunil Kumar Singh, HOD (Alternate Energy), DGH delivering a presentation on "Gas Hydrates, A potential energy source of 21st century".



Mr. B. C. Bora, ETT Member raising a point.

5th and final gas stakeholder workshop on 'Raising the Voice of Gas – Building Infrastructure and Technology'

The 5th and final gas stakeholder workshop on 'Raising the Voice of Gas – Building Infrastructure and Technology' was organized by IHS Markit, ICF & PetroFed on 22nd November, 2016 in New Delhi.

The workshop was organised to share the current status of gas pipeline infrastructure, city gas distribution in India and its implementation plan. The workshop also highlighted the recent technological developments happening in the gas sector, i.e. fuel cell technologies, use of LNG in transportation sector and development of efficient power generation system with the use of gas.

The workshop also highlighted the key issues encountered by gas players in India w.r.t. investment in gas pipeline infrastructure, issues related to acquisition of right of use to lay the pipeline and associated delays.

IHS Markit, ICF and PetroFed made a presentation on the above mentioned issues for highlighting the necessary changes / policy interventions needed for integrating new technology and development of gas pipeline infrastructure.



Mr. Daniel Bradley, First Secretary, Energy and Low Carbon Growth, British High Commission delivering the address.



Session on 'New Gas Technologies in India'.



Mr. R. S. Butola, Former Chairman IndianOil, giving his perspective.



A section of participants.



Session on 'Infrastructure : Issues and Best Practices'.



Conquering Newer Horizons

With a legacy traversing three centuries from the successful commercial discovery of crude oil at Digboi in 1889 and Independent India's first oil field in Naharkatiya - all in the north eastern state of Assam - Oil India Limited was born on 18th February, 1959 to increase the pace of exploration in Northeast India.

Dogged determination of some of the finest oil & gas explorers and a committed workforce has enabled OIL to expand its pan India presence and spread its wings overseas with footprints in countries such as Libya, Gabon Nigeria, Sudan, Yemen, Venezuela, USA, Bangladesh, Mozambique, Russia and Myanmar.

Today, as a Navratna PSU, Oil India Limited is fully committed to achieve the co-created vision of becoming "the fastest growing energy company with Global Presence" with special emphasis on carrying out its duties as a responsible corporate citizen.

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