



The Evolving Energy Landscape in India
Opportunities for investments

April 2018

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विदेश मंत्री
भारत



सत्यमेव जयते

सुषमा स्वराज
Sushma Swaraj

Minister of External Affairs
India



MESSAGE

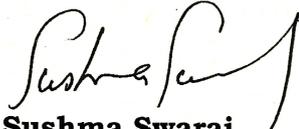
The world of energy is undergoing transition, and so is the geopolitics of energy. In our interconnected World, developments such as lowered cost of solar power, increased move towards de-carbonizing economies, abundance supply of fossil fuel, and move towards Electric vehicle (EV) etc. are changing the way we produce and consume energy.

However, even today around 1.2 billion people still do not have access to electricity and many more do not have access to clean cooking fuel. At one end, advanced economies are now thinking about autonomous vehicles, large sections of the developing world still lack basic amenities. We want a situation where people have universal access to clean, affordable, sustainable and equitable source of energy and we maintain a balance between interests of producers and suppliers.

India is also seeking partnerships with global majors in technology development and adoption. India has taken a lead in International Solar Alliance with 60 solar rich countries. We plan to generate 100 GW solar power in next five years.

India is also undergoing a massive transformation under the leadership of Prime Minister Shri Narendra Modi. India has launched several programs to increase local manufacturing, improve human skill sets and build energy infrastructure to provide affordable energy to all.

I welcome all the participants for this IEF dialogue and wish all the countries, successful deliberations over the next two days. This book released during the 16th IEF Ministerial Forum provides a peek into the Indian energy sector and the opportunities that exist. Together we can build a better world with universal access to clean energy.


Sushma Swaraj



धर्मेन्द्र प्रधान
धर्मेन्द्र प्रधान
Dharmendra Pradhan



सत्यमेव जयते

मंत्री
पेट्रोलियम एवं प्राकृतिक गैस ;
कौशल विकास एवं उद्यमशीलता मंत्रालय
भारत सरकार, नई दिल्ली
Minister
Petroleum & Natural Gas ;
Skill Development & Entrepreneurship
Government of India
New Delhi

MESSAGE

India is the fastest growing large economy in the World. India is the world's third largest energy consumer, its energy use is projected to grow at a rapid pace to fuel economic development, urbanization, improved electricity access and improved manufacturing base.

Our Government believes in integrated approach to energy planning. Our energy agenda is inclusive, market based, and climate-sensitive. In the last four years of the government led by Hon'ble PM Mr. Modi, we have come up with several supporting policies to promote investments and support the energy infrastructure development in India. Across, electricity, cooking fuels, petroleum products & gas, the Government has focused on improving access and ensuring access to all in a time bound manner.

Indian energy scenario is also undergoing a large change due to adoption of energy efficiency, future of mobility, increased share of renewable energy in the supply mix and an overall shift in the global energy market towards de-carbonization.

As this report brings out, the Indian energy sector will require investment of \$250 Billion in Power sector, \$325 Billion in Oil and Gas and \$175 Billion in renewable sector by 2027! This will require investments from both Indian and global investors for bringing in the best technologies and World class management practices.

This report prepared by Deloitte Touche Tohmatsu India LLP and released on the eve of the 16th IEF Ministerial Forum showcases the India as an investment opportunity. I invite all the major companies to invest in India and you will find supporting policies, regulations and a welcome from Indian Government. Come Invest in India! Make in India!


(Dharmendra Pradhan)

New Delhi
April, 2018





Executive Summary

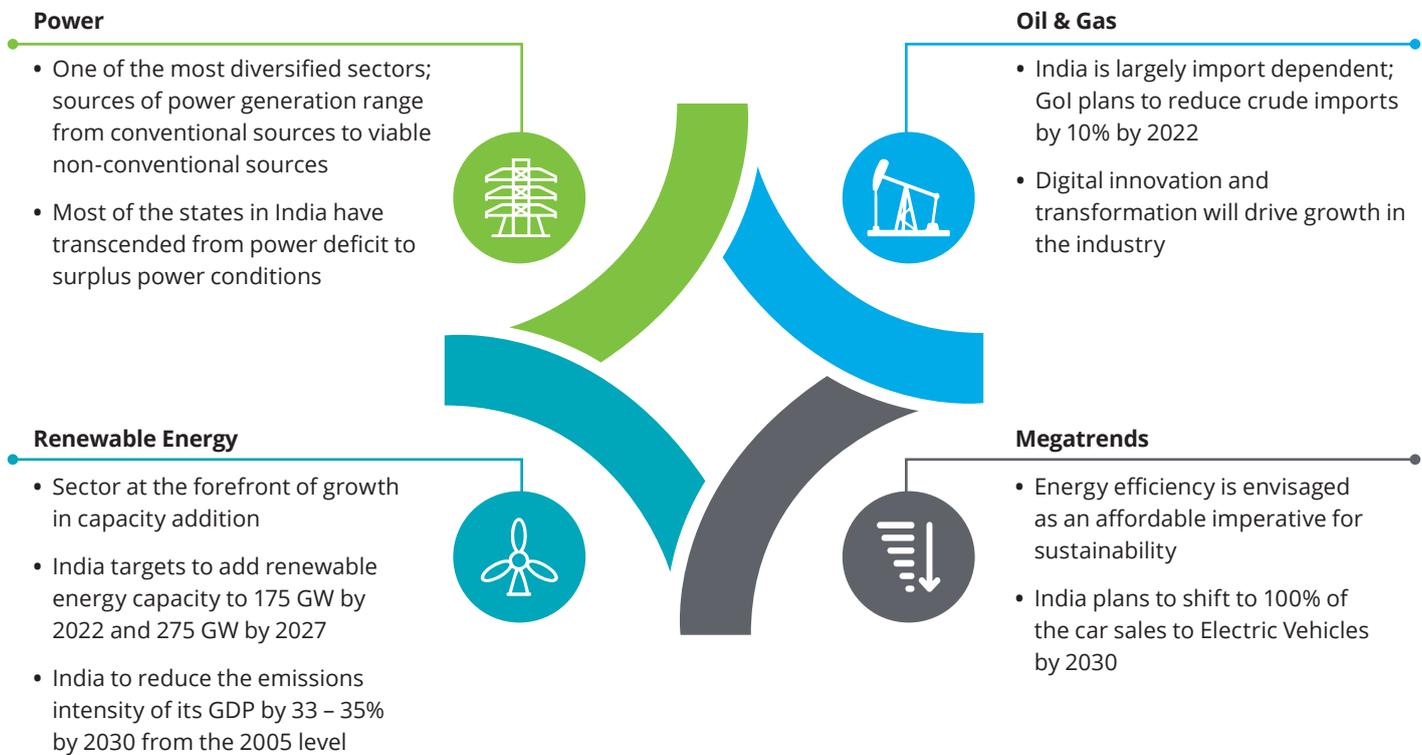
India, home to 18% of the world's population, uses only 6% of the world's primary energy. This, however, is rapidly changing and the energy landscape in India is evolving like never before.

Energy, today, is considered crucial to achieve India's development ambitions, to support an expanding economy, to bring electricity to rural areas, to fuel the demand for greater mobility and to develop the infrastructure needed to meet the demands of what is soon expected to be the world's

most populous country. India's energy consumption has almost doubled since 2000 and the potential for further rapid growth is enormous.

Given the huge opportunity for growth in the sector, an overall investment of close to \$750 Bn could potentially come in over the next decade.

The paradigm shift in the Indian energy sector will increasingly influence and shape the global energy economy.



Source: International Energy Agency, India Energy Outlook (2015); UNFCCC; MoPNG, Government of India; Deloitte Analysis

India: Energy landscape

The India opportunity; India's current footprint on the world energy map and how it is likely to emerge as one of the most prominent energy consumers over the next decade



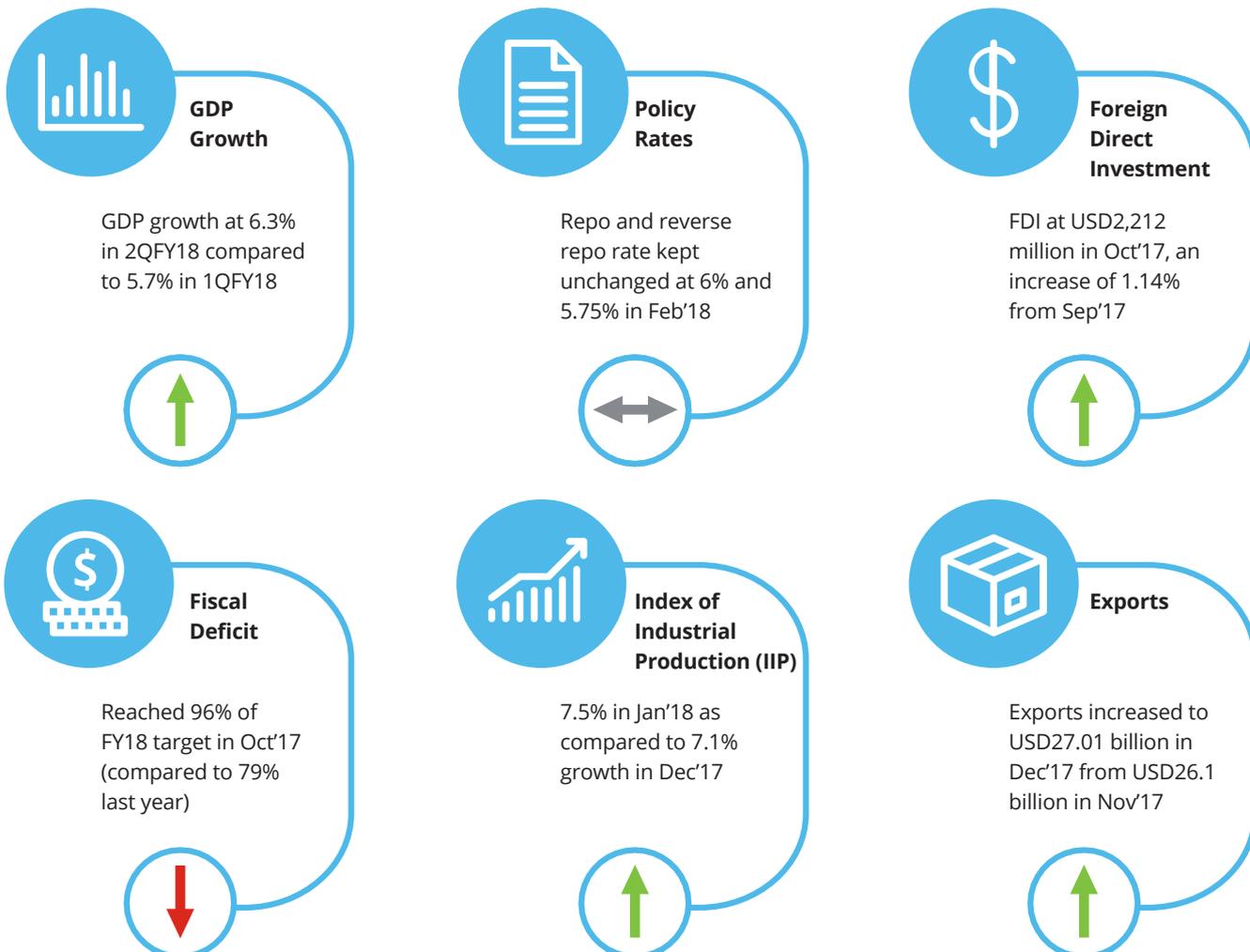
Economic Overview

Systemic reforms, focus on growth and a consumption driven economy – a compelling case for investments

Economic growth of around 6-7% annually since 1991 makes India one of the fastest-growing economies globally. The acceleration of structural reforms, the move towards a rule-based policy framework and relatively low commodity prices have provided a strong growth impetus. Recent deregulation measures and efforts to improve the ease of doing business have boosted foreign

investment. However, investments are still held back in some cases due to high corporate tax, land acquisition issues, high non-performing loans which weigh on banks' lending, and infrastructure bottlenecks. Policy measures to iron out these issues, and strengthen macroeconomic resilience, are being designed to propel the next leg of growth.

Key economic indicators



Source: MOSPI, Deloitte Analysis

GDP and Consumption Expenditure Growth (y-o-y, %)



Source: CEIC, Deloitte Analysis

India						
 Top FDI destination USD 60.1 Bn in FY 2016-17	 Reforms on Ease of doing business Jump of 30 ranks in 'Ease of Doing business' study by World Bank	 Robust GDP growth Expected to exceed 7.5% in FY18 and 8% in FY19	 Sound fiscal discipline Achieved fiscal deficit target of 3.5% of GDP in FY'17; targeting 3.5% for FY18	 Banking Reforms Bankruptcy code, Re-capitalization of banks, Jan-Dhan accounts	 Biggest tax reform since independence Goods and Services Tax (GST) implemented (One Nation, One tax, One large market)	 Infrastructure development Swachh Bharat Mission, Affordable Housing, Sagarmala, Make in India, Smart City, etc.
Democracy	Legal/Regulatory Framework	Large Market	Demographic Dividend	Stable Government		

Source: Commerce & Industries Ministry

The positive outlook on the economic growth no longer hinges on market sentiment, but is backed by strong fundamentals. The growth over the next decade will be driven by factors such as urbanization, evolving demographics and a favourable policy regime backed by an investor friendly and stable government.

The trend towards urbanization, which is going to increase consumption power massively, as well as lend economic leverage, is one of the growth engines. Current urbanization rates across most states cross tethers at around 35%, which is widely considered to be the

inflection point. That is typically when the productivity benefits kick in, there is a higher GDP per capita as the cities get better connectivity to the markets. Going forward, the urbanization rate will cross this threshold and may reach approximately 50% for many of the states.

On the governance aspect, the policy framework increasingly leans towards empowering the states more and decentralizing the decision making for funding etc. Urbanization coupled with dynamic and vibrant states competing with each other for resources, will result in an exponential economic growth.

Energy Landscape

India: World's fastest growing energy market for the next two decades

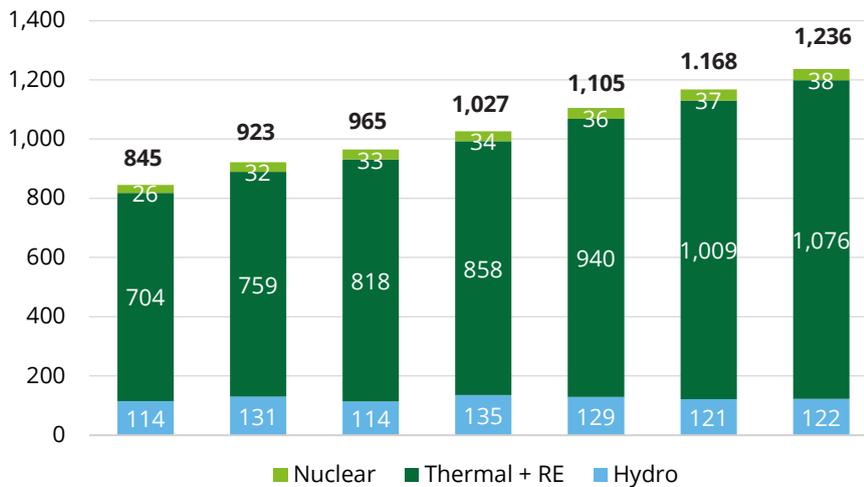
India is the third largest energy consumer in the world and accounted for ~5.5% of the global primary energy consumption in 2016.

India accounted for 11% of the global coal consumption in 2016; for the second consecutive year, India remained the second largest coal consumer in the world. The country experienced its largest increase in oil consumption, increasing by

325 Kb/d in 2016; further, India was the third largest oil consumer in the world (4.6% of the global total).

While energy use has doubled since 2000, the energy consumption per capita is only around one-third of the global average and ~240 million people still have no access to electricity, indicating significant growth opportunities.

Energy Generated by Source (Billion KWH)



Source: Ministry of Power, CEA

Increasing consumption of oil, coal, gas, and renewables in power far outweighs the declines in hydro and nuclear. Oil consumption in 2016 increased by 325 Kb/d, a record high, increasing its share in India's primary energy consumption for the third successive year (to 29%). Coal remains the dominant fuel, accounting for ~60% of India's energy consumption. India's gas consumption rose in 2016 after three consecutive years of decline. Renewables currently stands at by 29.2%,

its largest increment ever. India is now the 7th largest renewable power generator in the world.

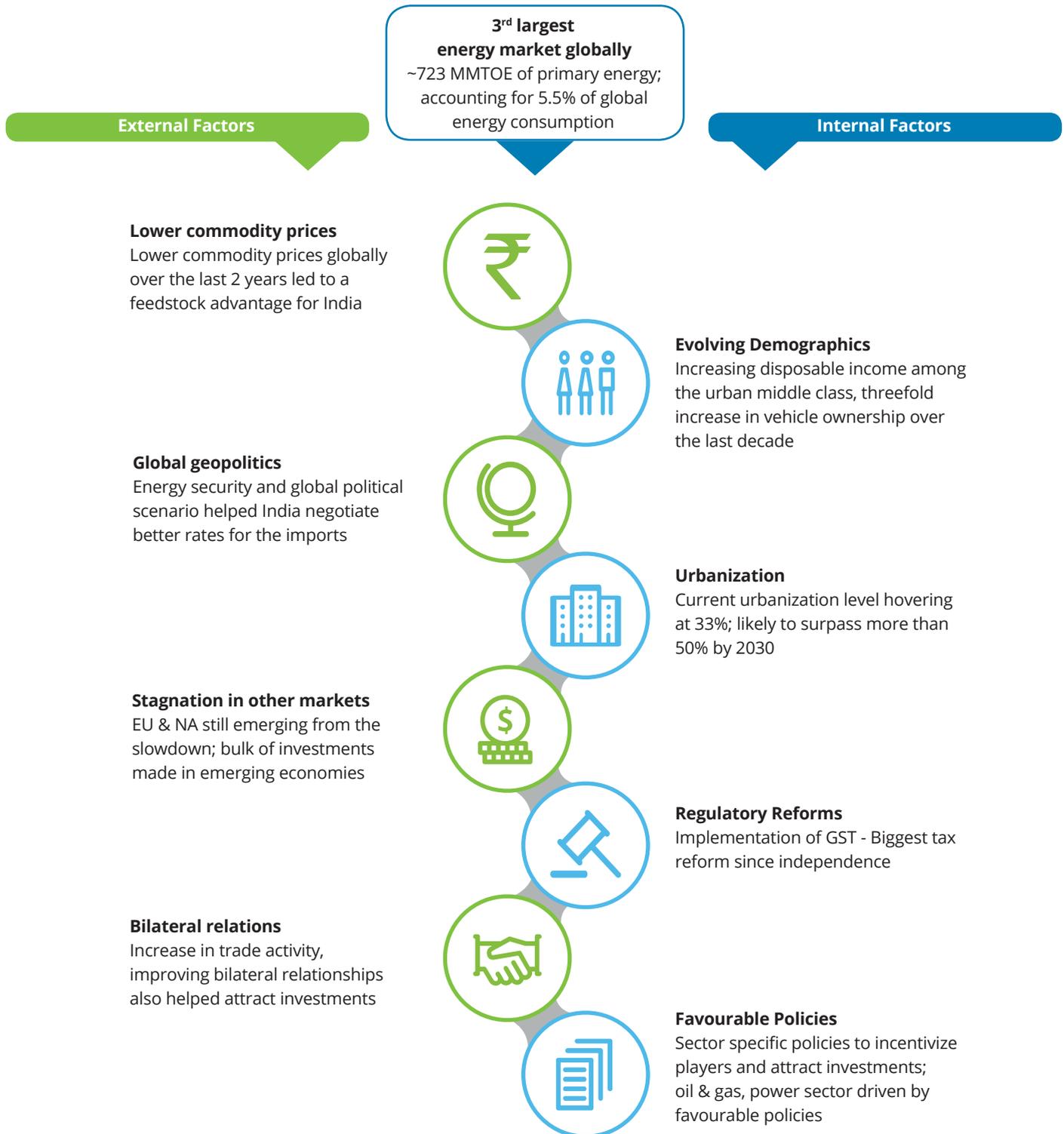
India's crude oil imports rose to 4.8 Mbpd in 2016, the highest level ever. Natural gas imports rose from 21.4 BCM in 2015-16 to 24.7 BCM in 2016-17. Meanwhile, there has been a sharp growth in India's refining capacity and throughput, contributing 72% to the net growth in global refining capacity.

“in a nutshell...”

Power 	Oil 	Environmental commitments 	Energy for All 
<ul style="list-style-type: none"> • 3rd largest country by power generation (after US and China) • Utilities undergoing transformation; adoption of technology, smart grids etc. • One of the leading consumers of coal today; the dependence on coal likely to continue in the coming years 	<ul style="list-style-type: none"> • Witness fastest growth in oil demand in the world; demand driven by personal mobility and industrial growth; and increased petrochemicals demand • \$300 Bn investments planned in the oil & gas sector • HELP - Revenue sharing mechanism for E&P with marketing and pricing freedom • Industry increasingly adopting digital / tech innovations 	<ul style="list-style-type: none"> • India to surpass COP21 commitments through RE adoption, energy efficiency measures and use of clean fuels • Targets to achieve all India solar capacity of 100 GW by 2022 and 175 GW by 2027 • Ujala - Program launched to promote use of energy efficient appliances by residential users - distributed about 770 million LED bulbs, 20 million pump sets over last 2-3 years 	<ul style="list-style-type: none"> • Ujjwala - 80 million LPG connections to Below Poverty Line families with subsidy as per the revised guidelines • 15,000 km gas pipeline in India • 300 city gas distribution • Gas reforms being initiated • Power for All - A joint initiative by central and state governments to ensure 24x7 availability of power by 2019 – 40 million new connections • India's energy consumption is expected to grow the fastest among all major economies by 2035, according to the BP Energy Outlook 2017



Key growth drivers



Source: IEA, Deloitte Analysis

Megatrends Shaping the Energy Landscape

Rapid urbanization, evolving demographics and market dynamics are going to shape the energy market going forward



Urbanization

- There has been considerable growth in urbanization over the last two decades and approximately 33% of the population is currently urban
- With economic growth and increase in employment opportunities across industrial corridors, the urbanization is likely to increase in tandem
- Power demand, vehicle penetration and various consumption side factors are closely linked to urbanization



Demographic

- India is likely to account for more than half of the increase in Asia's workforce in the coming decade, which consequently will have considerable impact on the already burgeoning middle class disposable income. With increase in income levels, consumerism is also likely to grow
- As white goods and vehicle penetration levels go up, the energy demand will largely be shaped by this evolution of working class population



Market Dynamics

- Over the past two decades, the energy market dynamics has evolved considerably. Oil supply in the recent past saw an unprecedented influx driving the prices sharply down. Gas has been plentiful in supply, though limited by application areas, and remained a low priced commodity.
- Changing demand patterns which are closely linked to prices, coupled with climate change and global geopolitics will dictate the market dynamics going forward

Other Megatrends Shaping the Energy Landscape in India

Energy Efficiency



Future of Mobility



Geopolitics in Energy



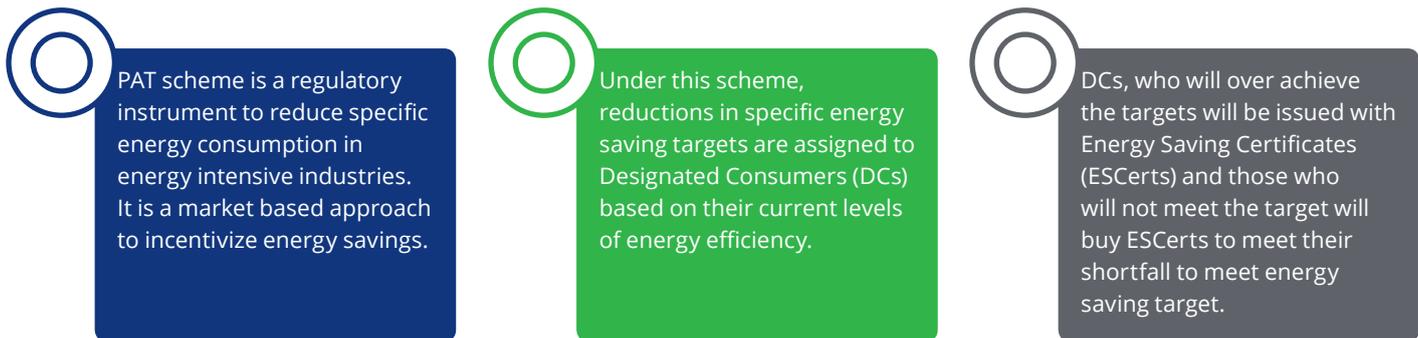
Energy Efficiency

Envisaged as an affordable imperative for sustainability

Energy efficiency is key to ensuring a safe, reliable, affordable and sustainable energy system for the future. It is the quickest and least costly way of addressing energy security, environmental and economic challenges. In view of this, the National Mission for Enhanced Energy Efficiency (NMEEE) aims to strengthen the Indian

market for energy efficiency by creating conducive regulatory and policy regime and has envisaged fostering innovative and sustainable business model. This section covers key regulations / policy measures indicating emerging trends specific to energy efficiency.

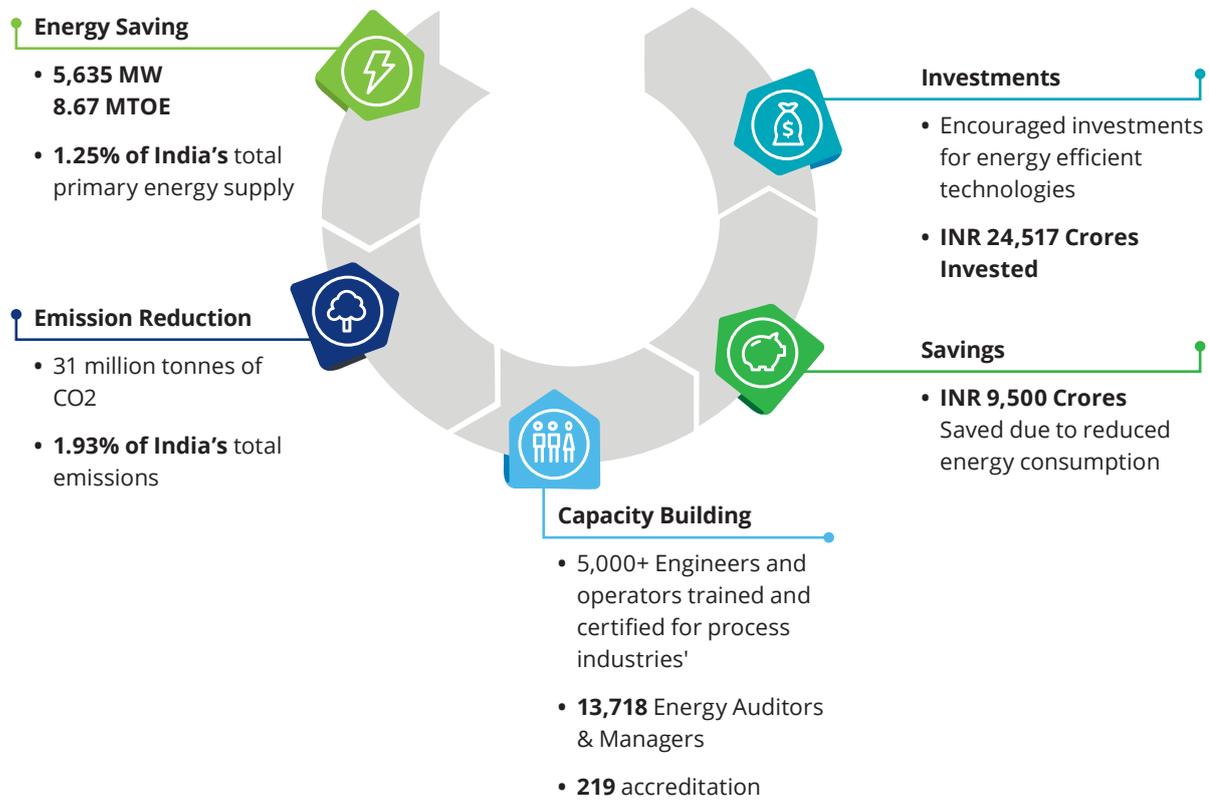
Perform Achieve and Trade Scheme (PAT) for Industrial Energy Efficiency



	PAT Cycle I	PAT Cycle II	PAT Cycle III
Time line	2012-13 to 2014-15	2016-17 to 2018-19	2017-18 to 2019-20
Industry Sectors	Aluminium, Cement, Chlor-Alkali, Fertilizer, Iron & Steel, Paper & Pulp, Thermal Power Plant and Textile	PAT Cycle I + Railways, Electricity DISCOMs and Refineries	
Number of DCs	478 from eight sectors	621 from eleven sectors	737 from eleven sectors
Energy Saving Target	6.686 MTOE	8.869 MTOE	1.06 MTOE (for 116 DCs)

Source: BEE India, Deloitte Analysis

Outcome of PAT I



Source: www.beeindia.gov.in, accessed as on 5th March 2018

The state-run energy service company (ESCO) of the Government of India's LED bulk procurement under UJALA has transformed the LED market in India.

Unnat Jyoti by Affordable LEDs for All (UJALA), the world's largest lighting replacement program, aims to replace 770 million old wasteful lamps by 2019 with modern, efficient and longer lasting LED lamps, without the need for any government subsidies.

UJALA's LED bulbs cost only INR 50 and UJALA allows the consumers to buy them for an initial payment of INR 10, and the balance is paid through the consumer's electricity bills in equal monthly instalments of INR 10.

290 million LED Bulbs distributed under UJALA as on 5 March 2018 has led to:

- 38 billion of annual energy savings;
- INR 15,102 crores cost savings per year;
- 7,559 MW of avoided peak demand;
- 30.6 million tonne CO₂ reduction per year.

Source: www.ujala.gov.in/, accessed as on 5th March 2018

Increasing Demand for LED is Transforming the Energy Landscape

Economies of Scale at Work

The state-run energy service company (ESCO) of the Government of India's LED bulk procurement contributed to the reduction in LED retail market prices from approximately INR 400 per LED bulb in 2012 to INR 80 per LED bulb in 2016, leading to one of the fastest LED price reductions in the world. This has helped improve acceptance and availability of LEDs in the Indian market.

Fastest Growing LED Market in the World

The Indian LED market value grew by 10 times in just five years and annual domestic production increased from approximately 3 million LED bulbs in 2013 to 62 million in 2015 as the second largest LED market in the world worth INR 21.4 billion in revenues.

High Quality Is Priority

The state-run energy service company (ESCO) of the Government of India's specifications, including the three year warranty requirement, have ensured that the LED bulbs procured meet high quality standards with current failures at only 0.3%. This is helping build market confidence in the product.

Domestic LED Market on the Rise

In 2014, LEDs had only a share of 0.1% of the annual residential lighting market in India. In 2016, the LED share of the market jumped to a remarkable 25%.



Source: BEE India, Deloitte Analysis



On similar approach, the state-run energy service company (ESCO) continued to deliver multiple benefits to other Indian manufacturers with the introduction of new energy efficiency initiatives to transform the markets for residential fans, street lighting and agricultural pumps.

Other Key Policies by Central Government

Policy	Policy/ Program Type	Policy Target	Estimated Target / Impact
Energy Conservation Building Code (ECBC)	Regulatory Instruments, Codes and standards, Strategic planning	New buildings, Commercial/ Industrial Equipment, Multi-Sectoral Policy	Resulted in large energy savings for large corporates, public sector, etc.
The Standards & Labelling Programme	Information and Education, Performance & Comparison label, Regulatory Instruments- Codes and standards, Policy Support -Strategic planning, Monitoring & Verification with Obligation schemes , Other mandatory requirements	Residential Appliances, Energy Utilities-Demand-side management/End-use services, Multi-Sectoral Policy, Commercial/ Industrial Equipment	21 Equipments covered , with 8 mandatory appliances and 13 voluntary appliances
Procurement of energy efficient appliances for Government Undertakings	Strategic planning, Policy Support	Commercial/Industrial Equipment- Heating ventilation and air conditioning (HVAC), Water & Refrigeration	250 MW Demand Reduction

Sample State level initiatives

Policy	Implementing Agency	Policy/ Program Type	Policy Target
Scheme on Energy Conservation in Agriculture Sector in Haryana	Department of Renewable Energy, Government of Haryana (HAREDA)	Economic Instruments, with Fiscal/financial incentives as Grants and subsidies integrated with S&L program of Bureau of Energy Efficiency (BEE)	Agricultural Sector - Subsidy to farmers on energy efficiency 4 star and above rated agricultural pump. Subsidy @ INR 400/- per horsepower (H.P.) of the pumps with maximum limit up to INR 5,000/-
Mandatory Public Street Lighting Systems in Rajasthan	Rajasthan Renewable Energy Corporation Limited (RRECL)	Economic Instruments>Market-based instruments, Policy Support, Regulatory Instruments	Public sector Lighting - Municipal Corporations, Municipal Councils and Municipal Boards for the efficient use of energy and its conservation in the Public Street Lighting
Mandatory Use of Energy Efficient Appliances in Chandigarh	Science & Technology Department in Chandigarh Administration	Regulatory Instruments, Codes and standards	Commercial/Industrial Equipment, Residential Appliances

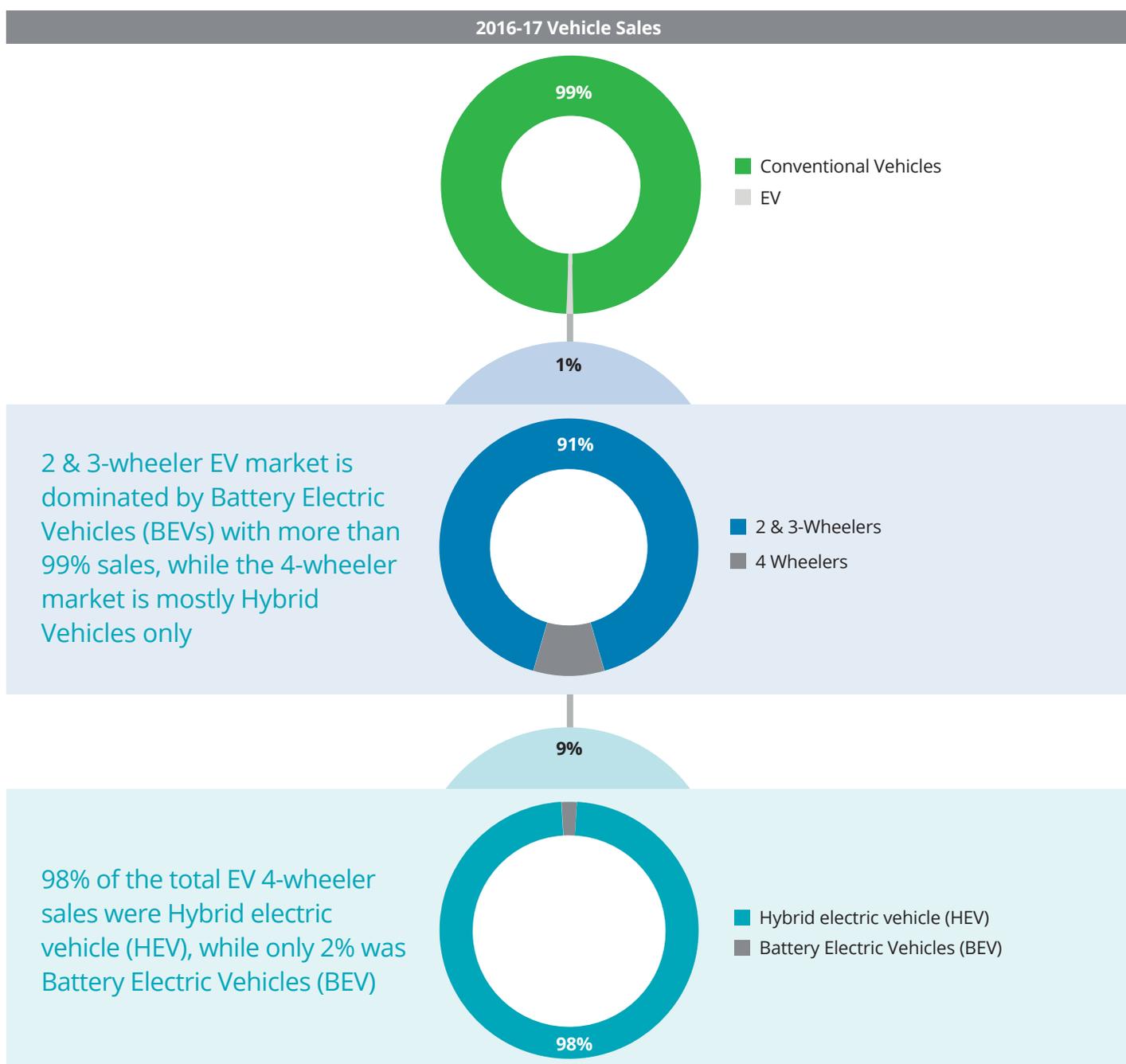
Source: BEE India, Deloitte Analysis

Future of mobility

India has an ambitious target to shift to 100% of the car sales to EV by 2030

To maintain pace with India's commitments to COP21, India has set an ambitious target to convert 100%

of the car sales to E-Vehicle by 2030. 2 and 3-wheelers to play a key role in the E-Vehicle segment



2 and 3-Wheelers hold 91% of EV market share in 2016-17 with a total sale of around 20,000 sales while 4-wheelers were only ~2,000

Source: RMI, Niti Aayog, SIAM

Going forward, the switch to EVs is expected across all category of vehicles to achieve India's 2030 target of 100% EV Sales



Source: RMI, Niti Aayog, SIAM

Electric vehicles will dominate the new sales across all segments of automobiles by 2030



It is estimated that there will be around 15.91 million EV sales for the 4-wheeler segment by 2030, completely eliminating the need for Internal combustion engine (ICE) vehicles



A major switch to EVs is also expected in the 2 and 3-wheelers segment



India is leapfrogging in mobility space through central and state policy support

Policy support by Central Government

National Electric Mobility Mission Plan (NEMMP)
 Unveiled by Government of India in 2013, NEMMP involves development of mission plan and roadmap for promoting electric mobility solutions in India with an aim to deploy 6-7 million electric vehicles by 2020.

Total investment till 2021: ~ INR 23,000 crores

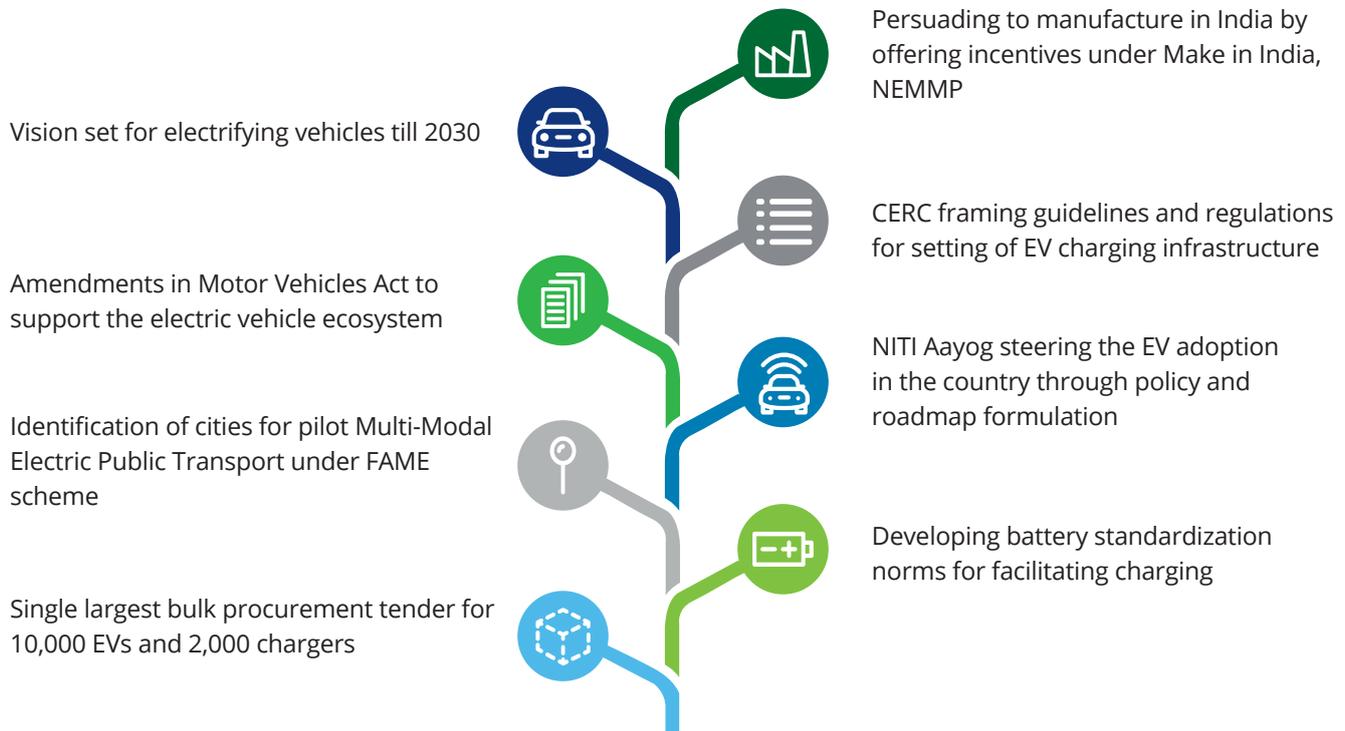
Covers demand incentives, R&D support and building charging infrastructure

Faster Adoption and Manufacturing of (Hybrid &) electric vehicles (FAME)
 Flagship scheme under the NEMMP 2020 mission plan (provided till FY 2020)
 Total support provided till date (INR 795 crores)

Vehicle Segment	Incentive in INR per vehicle (under FAME)
2W	7,900-25,000
3W	11,000-61,000
4W	76,000-1,38,000
LCV	1,02,000- 1,87,000

Includes GoI support for demand incentives (purchase of 2,3 and 4-wheeler and buses), charging infrastructure, pilot projects, etc.

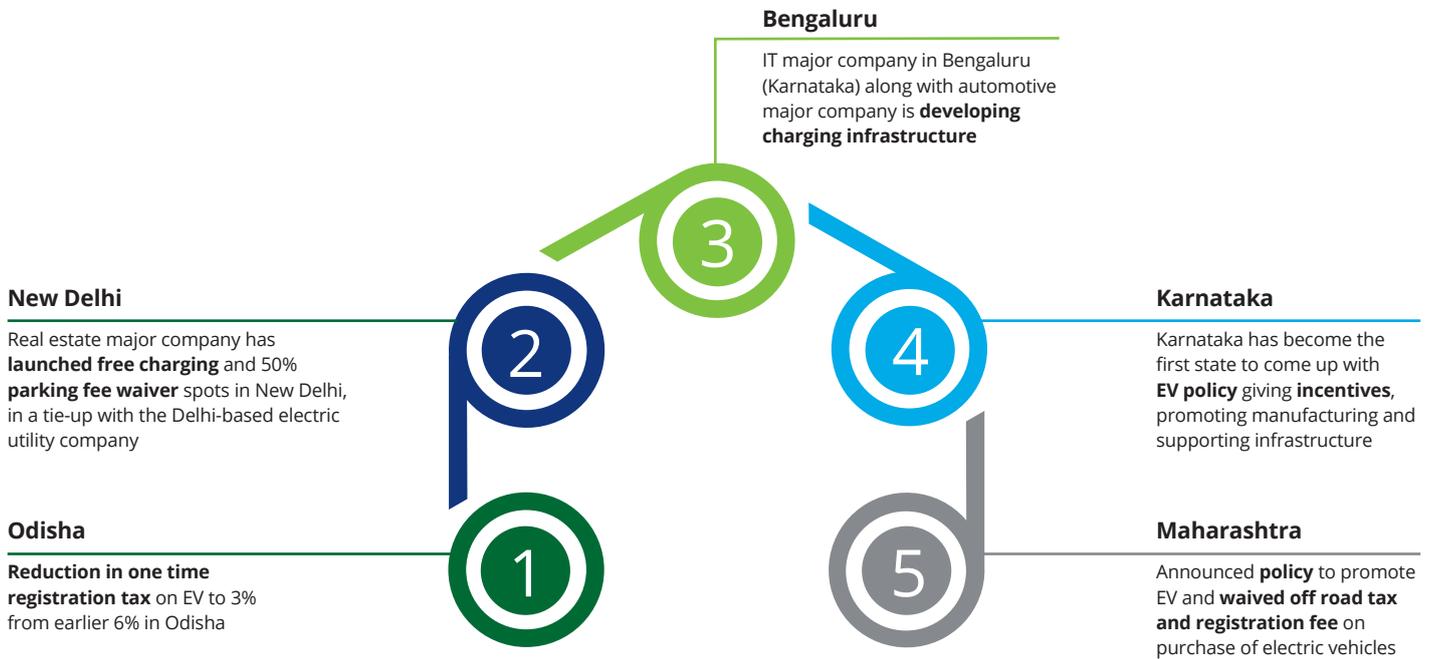
Source: NEMMP, FAME



Innovation and collaboration	Financial incentives
<ul style="list-style-type: none"> Indo-German Joint Working Group (JWG) for development of efficient automotive technologies and alternate fuels and drives Member country of EV initiative (a global forum of governments for promoting clean energy) Increasing PPP in R&D 	<ul style="list-style-type: none"> Reduced GST for EVs (12%) Exemption from Basic Custom Duty for the manufacture of lithium ion battery packs for supply to manufacturers of hybrid and EVs

Source: Make in India, Niti Ayog, Deloitte research

State level initiatives



Source: Deloitte Research

There has been overwhelming progress at central and state level for procurement of electric vehicles and charging infrastructure

Single largest tender for 10,000 electric vehicles and 250 chargers carried out for replacement of ICE vehicles in Government departments

State run energy service company (ESCO) of the Government of India, in September 2017, placed an order for acquiring 10,000 electric four wheelers for leasing the same to various government departments. The purchase price per car has been discovered to be INR 11,87,595 through open tendering. The procurement was done from automotive majors in the country. Procurement was also carried out for 200 AC and 50 DC chargers to be set up at different locations.

State run energy service company (ESCO) further plans to procure additional 10,000 electric cars for various government agencies during March-April 2018.

Source: Energy Efficiency Services Ltd.
Source: Press releases

There is increasing focus of government on deploying charging stations on the back of successful pilot projects

Several large CPSUs who have infrastructural access have forayed into EV Charging business and have set up charging stations in few locations in India. Many partnerships have also been forged in this space to expand footprint and get access to infrastructure and technology. Car aggregators have also plans to set up their own charging infrastructure to promote EV adoption.

Geopolitics in Energy

Energy geopolitics is increasingly shaping trade and market dynamics globally

Energy geopolitics refers to the intersection of energy, security, and international politics; it involves policies and interactions among different nations with a focus on development, sales and acquisition of essential energy supplies.

Some examples of the Geopolitical issues related to oil and gas are:

- Physical shortage due to interruption of supply chain or boycott by energy rich states
- Political blackmail under the threat of interruption of energy supplies
- Price spikes due to tight market conditions or curtailment of energy supplies
- Economic development fostering wealth creation and jobs
- Environmental impact including climate change, global warming etc.

Currently, India depends on imports for more than 80% of its crude oil needs and around 86% of the crude and 70% of its natural gas is imported from OPEC member states

Diversifying Imports

- US became India's latest oil supplier with arrival of state-owned oil company's 1.6 million barrels oil requirement from the US.
- Improving India's energy security by diversifying sources of supply is a key motivation for initiating crude imports from the US.

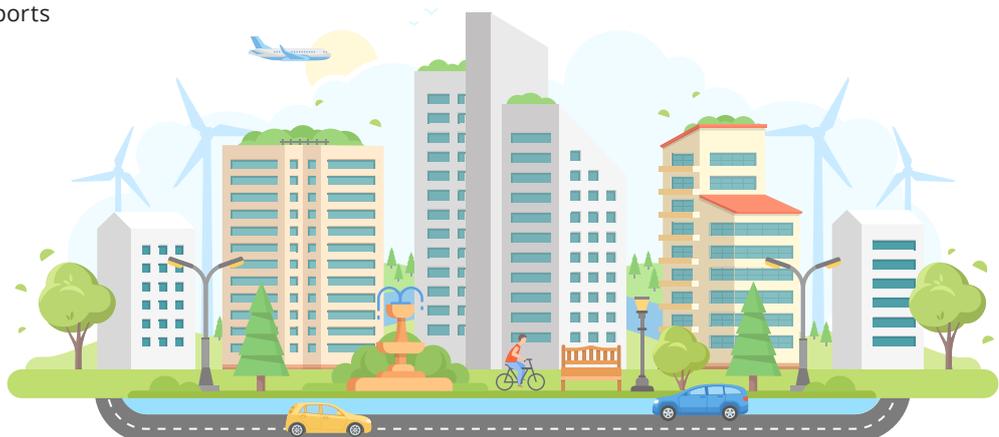
- The shipment is a two-pronged strategy by Indian firms to improve energy security and bargain for a better deal from OPEC. India has long complained about paying a premium for its imported crude from OPEC members, compared with the European and the US importers.

Strategic Reserves

- The GoI commissioned the strategic oil reserves to maintain nation's energy as well as economic security.
- The government has already built three such reserves at Visakhapatnam, Mangalore and Padur in Kerala — with a combined capacity of 5.33 MMT.
- GoI announced that it will build two more strategic oil reserves with a combined capacity of 10 MMT — at Chandikhole in Odisha and at Bikaner in Rajasthan.

Global Investments

- India has invested in several global upstream assets under partnership with local companies e.g. ONGC Videsh has invested \$2.2 billion in Russian Vankor Cluster of oil fields
- It has also invested heavily in neighboring countries - interested in LNG terminals in Sri Lanka and Bangladesh, Supplying petroleum products and electricity



India: Sectoral Trends

Key insights on emerging trends across the key energy sectors – oil & gas, power, and renewables



A. Power sector outlook

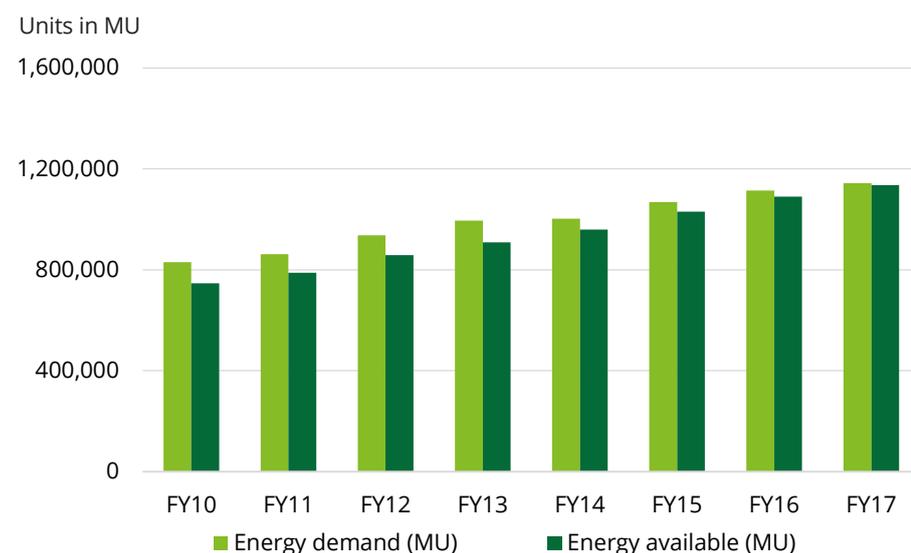
Power Sector – Demand Supply Overview

India has transcended from an era of chronic power shortages into an energy surplus scenario over the past 2-3 years

The major reason for this transformative shift is the unprecedented addition of conventional generation capacity under the 12th Five Year Plan period. As against a target of 88.5 GW for conventional

generation, actual capacity addition was close to 100 GW. While demand continued to be in line with the macro-economic trends, generation capacity addition outpaced the demand growth.

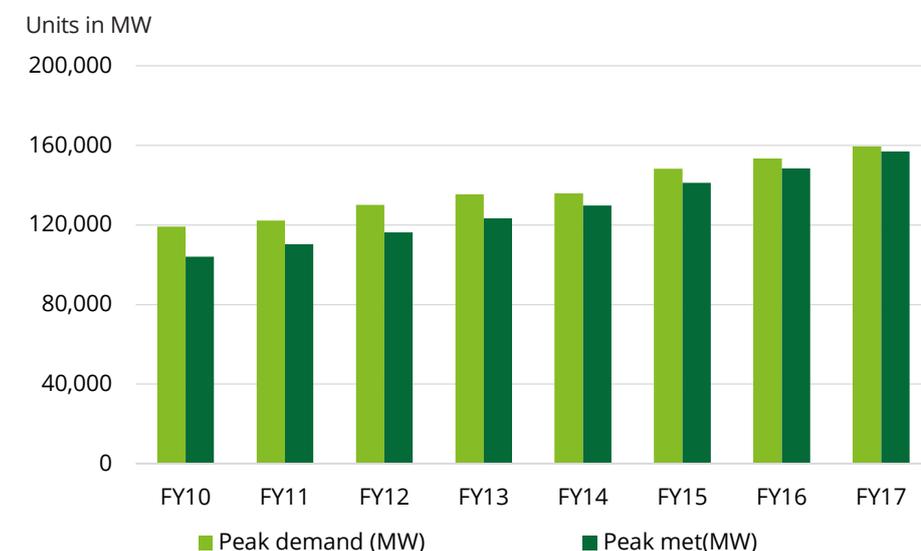
Historical All India Energy Scenario



~6% YoY growth in energy available over FY 10-17

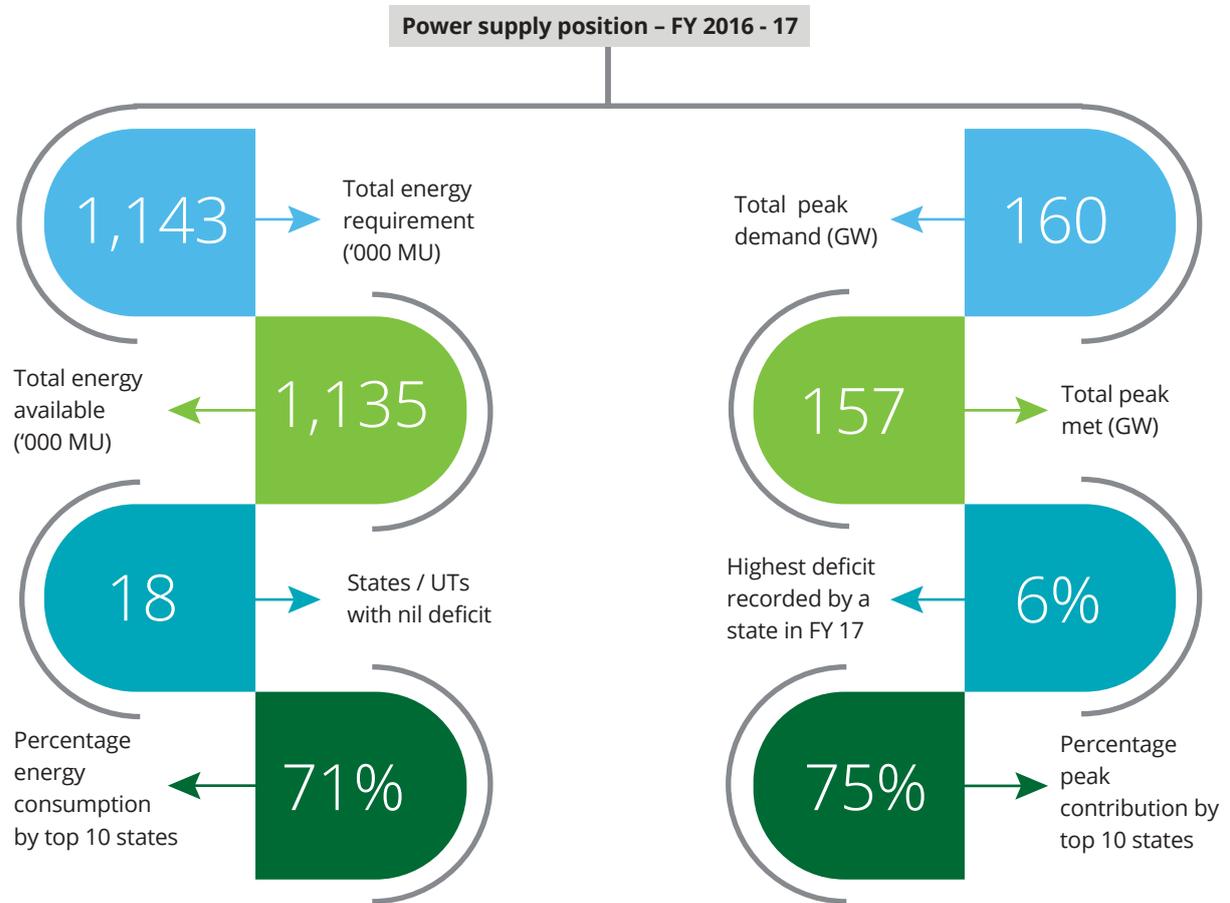
Source: Central Electricity Authority; MU = Million kWhr

Historical All India Peak Demand Scenario



~4.3% YoY growth in peak demand witnessed over FY 10-17; ~6% YoY growth in peak met over FY 10-17

Source: Central Electricity Authority



Demand Supply Scenario in India

Demand supply scenario has improved considerably for most of the states across India. From an era of deficits, the states have moved considerably towards a

situation where the average deficit has narrowed down significantly. Key states contributing the maximum amounts of energy consumption are illustrated below:-

Percentage Share of India Consumption



- 13 states (mainly in the Western and Southern region) contribute to ~83% of the annual energy consumption
- Most of the states have transcended from power deficit to surplus situations
- States such as Uttar Pradesh, Bihar, Rajasthan, J&K and few North Eastern regional states continue to reel under energy / power deficit situations

Source: Ministry of Power
Boundaries shown in the map are representative and not authentic

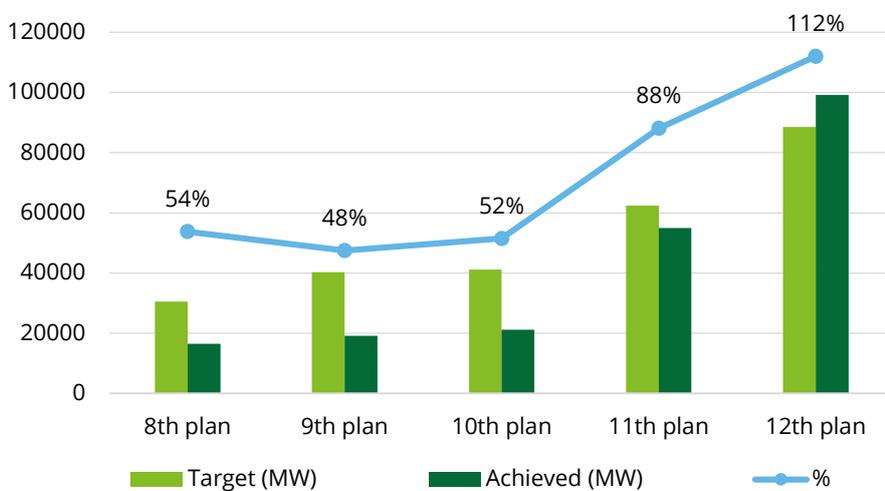


Capacity Addition and Demand Increase

The country has witnessed a combination of unprecedented coal-based generation capacity additions (led significantly by the private sector) as well as lower than expected demand growth which has led to improvement in the power deficit

situation over the years. Factors such as policy clarity, political push as well as administrative reforms have helped in aggressive addition of generation capacities (predominantly coal based) in the recent years.

Targets and Achievements of Capacity Addition in Plan Periods (in MW)



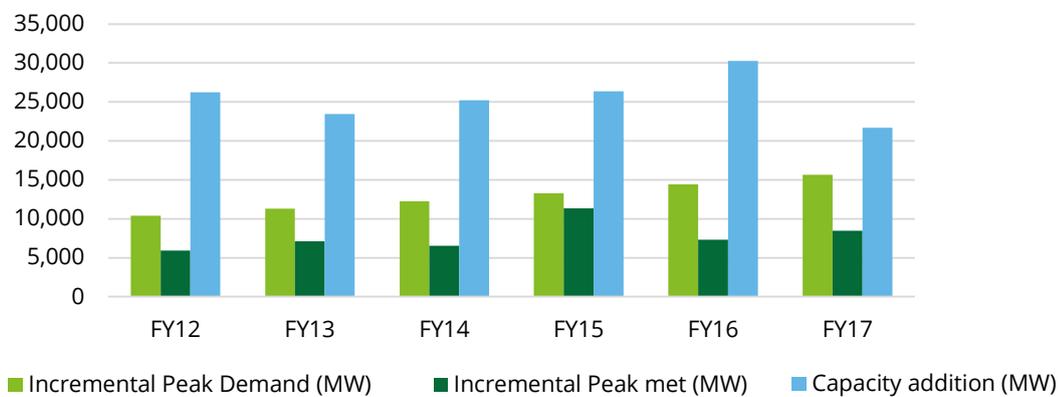
112% achievement of capacity addition targets in 12th Five year plan

Source: Ministry of Power, Central Electricity Authority

While average demand increased by ~7,800 MW, the capacity addition was to the tune of ~25,000 MW, far outpacing the domestic demand. Moreover, India became the net exporter of power for

the first time and exported close to 5,800 Million units to Nepal, Myanmar and Bangladesh during 2016-17 (April-February).

Capacity Addition vs Demand Increase



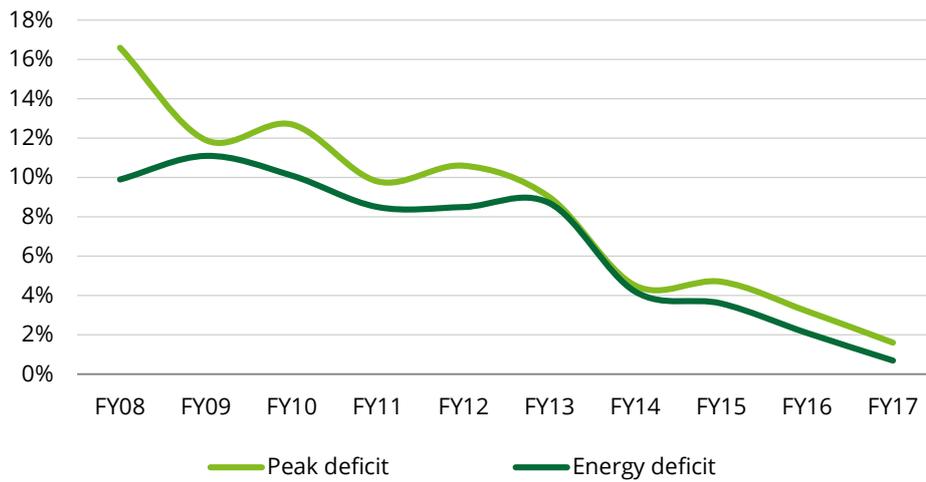
Source: CERC, Central Electricity Authority, Deloitte analysis

Peak and Energy Deficit

Peak deficit for the country as a whole has thus reduced from ~17% in FY 2007-08 to ~1.6% in FY 2016-17. Similarly, energy

deficit has reduced from ~10% in FY 2007-08 to ~1% in FY 2016-17. The system peak demand met by India during 2016-17 was ~159 GW.

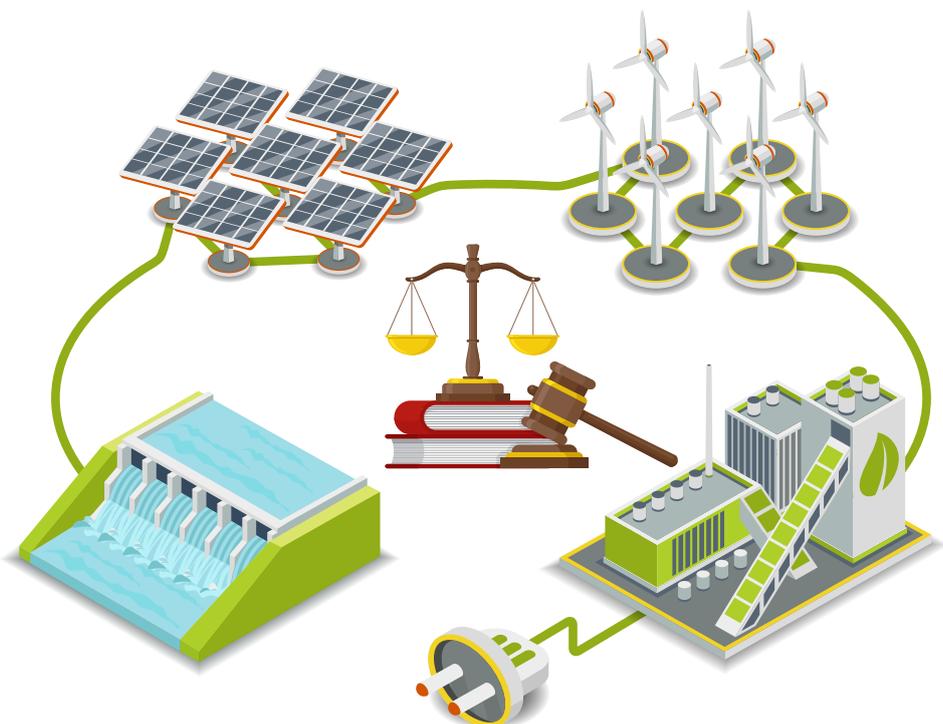
Peak & Energy Deficit



Source: CERC, Central Electricity Authority, Deloitte analysis

Regulatory Landscape

The sector is prominently guided by the Electricity Act 2003 (EA 2003) or (the Act), National Electricity Policy 2005 and National Tariff Policy 2006 and 2016. The Government of India (GoI) has emphasized that an efficient, resilient, and financially robust power sector is essential for growth of the Indian economy. Series of reforms in the 1990s and the EA 2003 have moved the power sector towards its vision of a competitive market with multiple buyers, sellers supported by regulatory, and oversight bodies. In context to this, organizations have been formed both at the central and state government levels to facilitate development of the power sector.



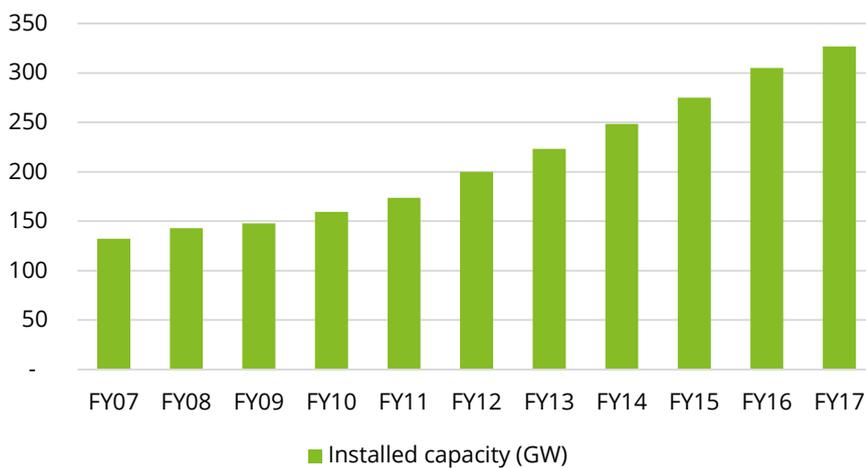
Power Sector – Generation Growth

The share of thermal generation capacity has been considerably stable at ~70%. RE capacity has increased steadily to reach ~18% share

Thermal generation capacity accounts for almost 67% of installed capacity of the country. Coal based power generation contributes to around 35% of the total all India CO2 emission. Reliance on coal-based power is expected to continue in

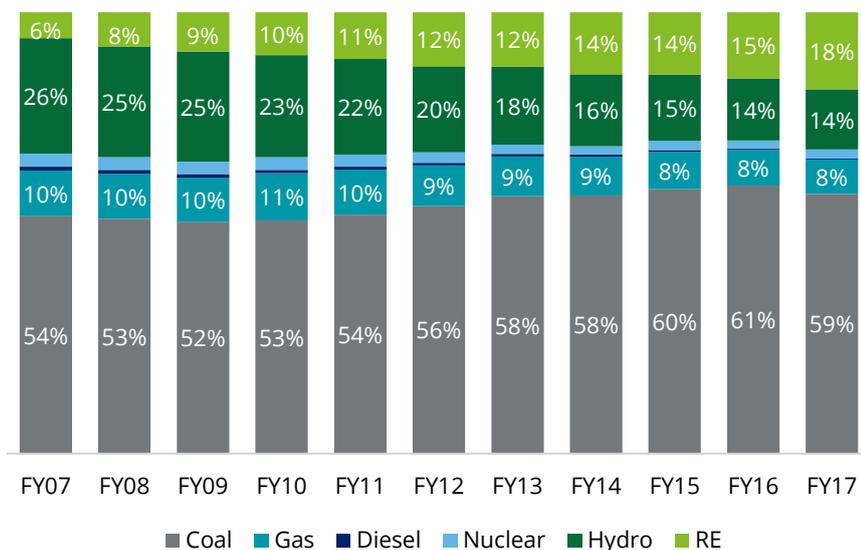
the coming years. In line with the same, India is running one of the largest and most ambitious renewable capacity expansion programs in the world. Newer renewable electricity sources are projected to grow massively by 2022.

~10% YoY Growth in Installed Capacity over FY17



Increasing Share of Renewables in the Overall Capacity Mix

Installed capacity mix



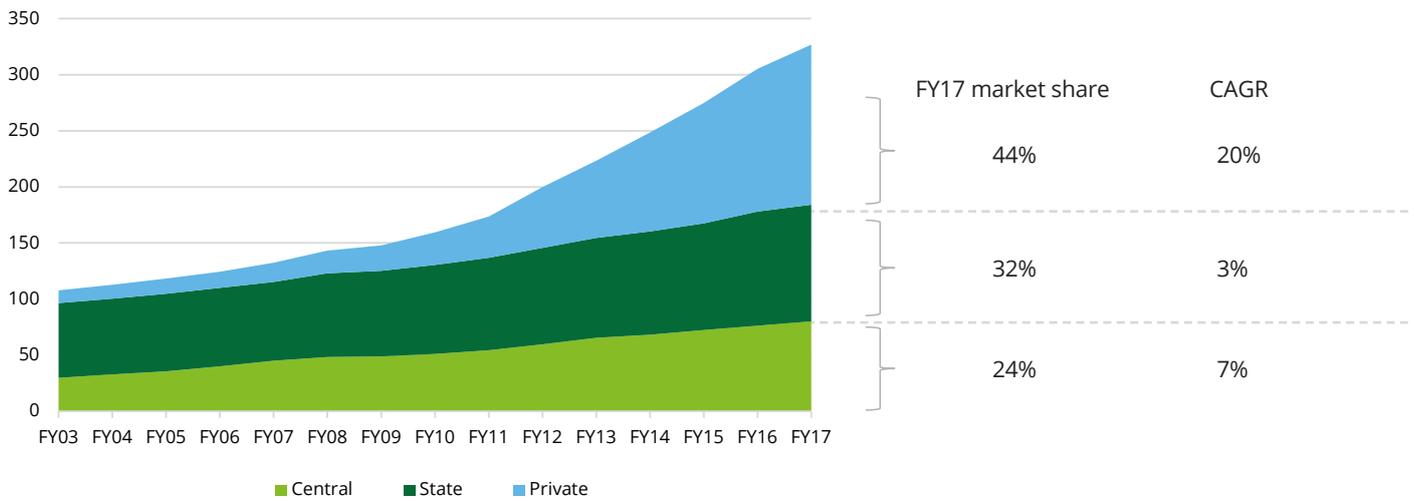
Source: Ministry of Power, Central Electricity Authority

Private sector leads installed generation capacity with 44% share

Unprecedented private sector investments in power generation coupled with projected growth in industrialization and economic activity has encouraged power

distribution utilities to tie up with several generators through power purchase agreements (PPAs). Private sector has contributed ~55% of the total capacity addition in the 12th five year plan.

Generation Capacity Addition (GW)



Source: Ministry of Power, Central Electricity Authority



Power Sector – Transmission

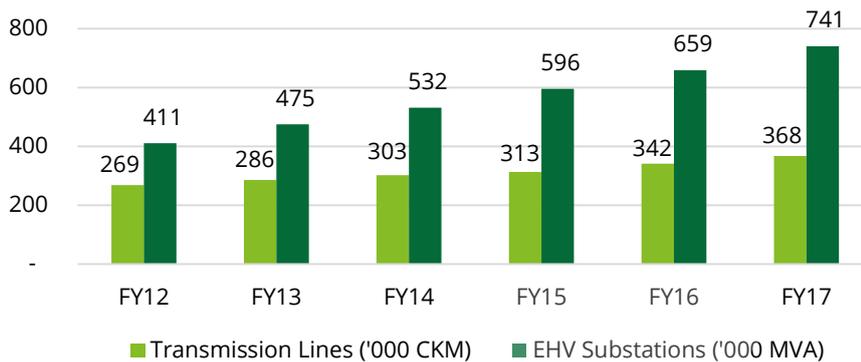
India has become an integrated grid with large investments in high voltage (HV) lines and substations

The Indian transmission sector has seen a robust growth in the last 5 years. The sector is largely dominated by the state utilities while the private sector currently accounts for only 3-4% of the total transmission capacity. The Central Electricity Authority (CEA) estimates that

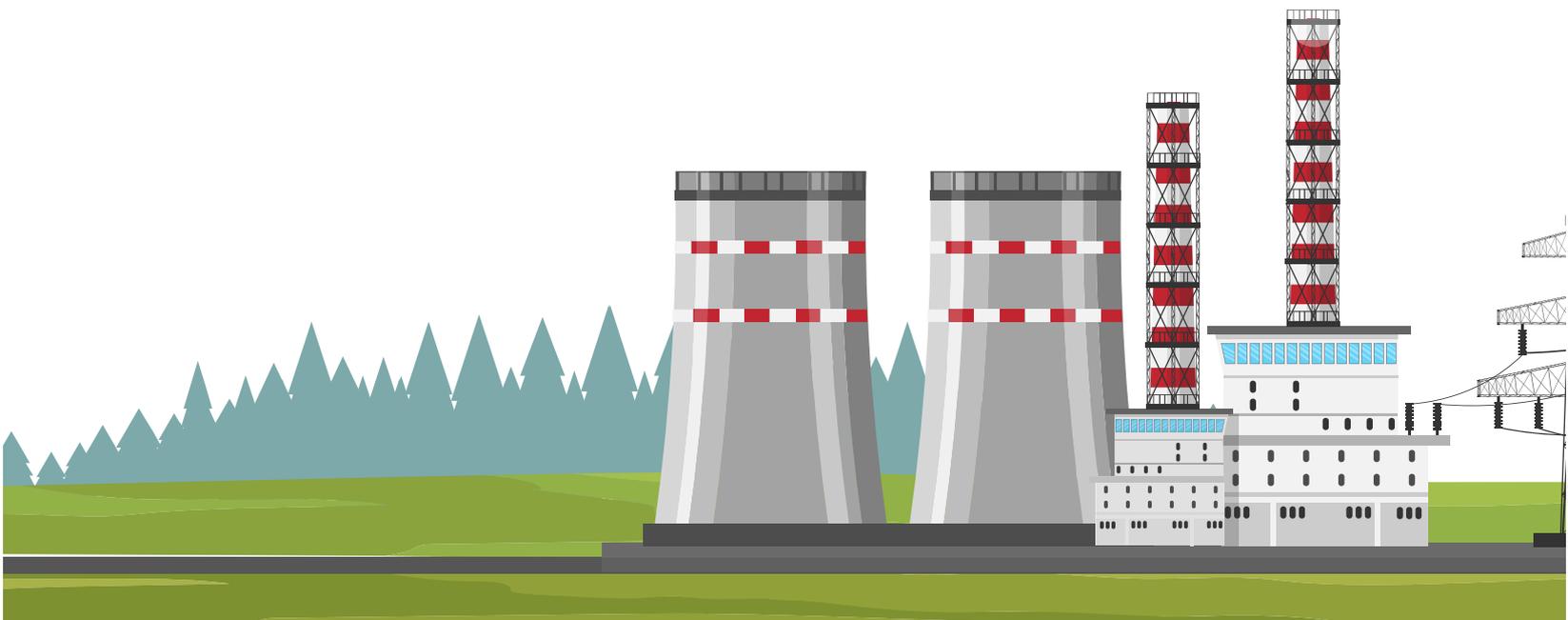
an investment of INR 2.6 lakh crore will be made between FY 18 and FY 22. The investment will be used for the 100,000 circuit km of transmission lines and 2,00,000 MVA transformer capacity of substations at 220 kV and above voltage by the end of 13th five year plan.

In 2013, Southern Region was connected to Central Grid, thereby achieving 'ONE NATION'-'ONE GRID'-'ONE FREQUENCY'

6% CAGR Growth in EHV lines, 13% CAGR Growth in EHV Substations

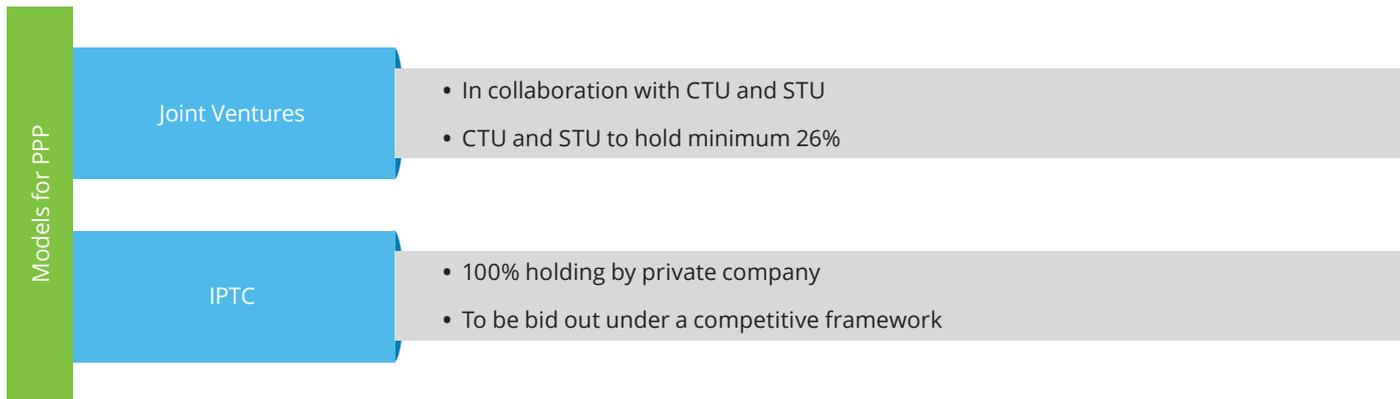


Source: Central Electricity Authority



In 2015, the Ministry of Power (MoP) announced the mandatory procurement of transmission services through tariff

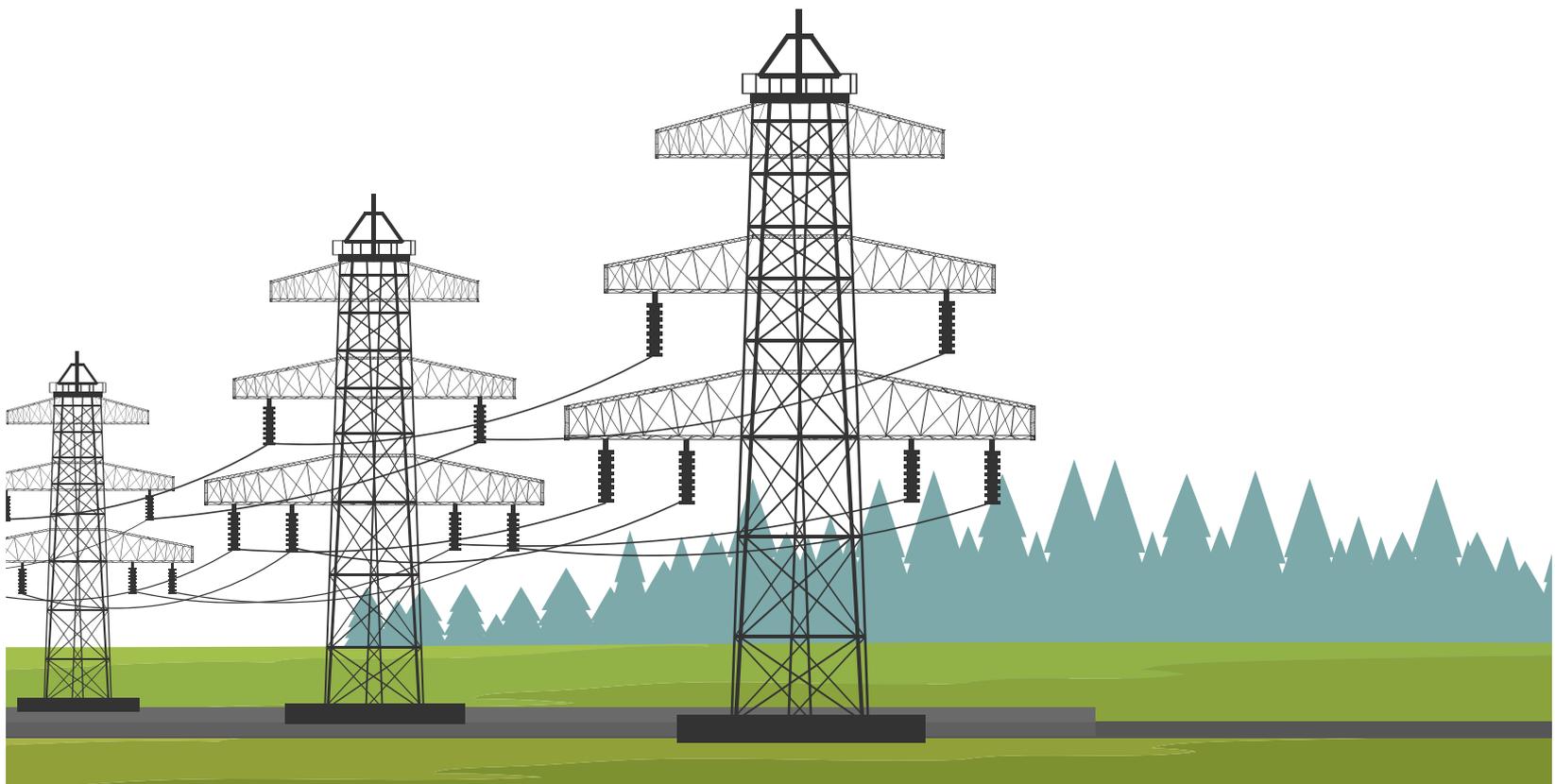
based competitive bidding, thereby attracting private investments in the recent past.



Government is also planning to set up high capacity transmission corridors to ensure un-interrupted evacuation of power

- 11 high capacity corridors have been planned at an estimated cost of INR 750 billion

- These projects are aimed at bulk evacuation of power from independent power producers (IPPs)
- Total transmission capacity to be constructed at around 34,000 MW
- Likely to be commissioned by 2021



Power Sector – Distribution

Power distribution in India has shown considerable improvement, though there is significant scope for future interventions

The power distribution segment is similarly dominated by state utilities with presence of private players only in few cities across India.

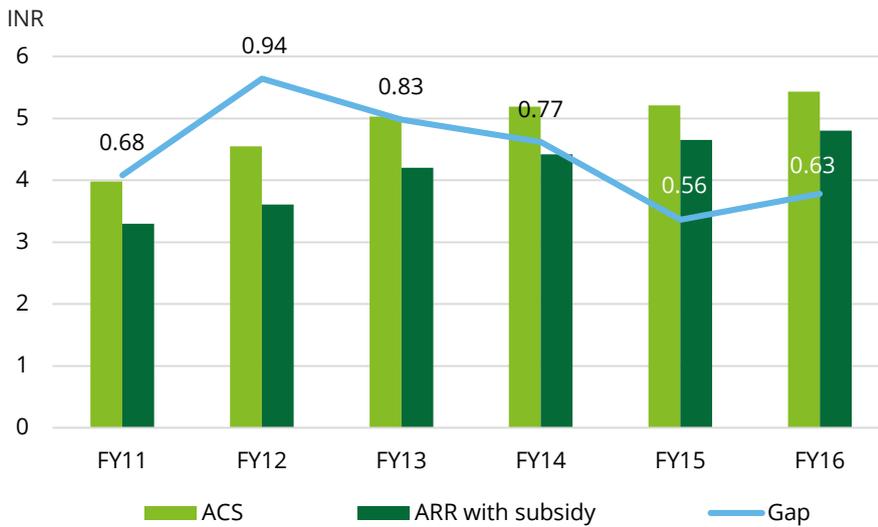
Recently the government has tried to increase private participation in electricity

distribution through distribution franchise model and sub-contracting of non-core operations.

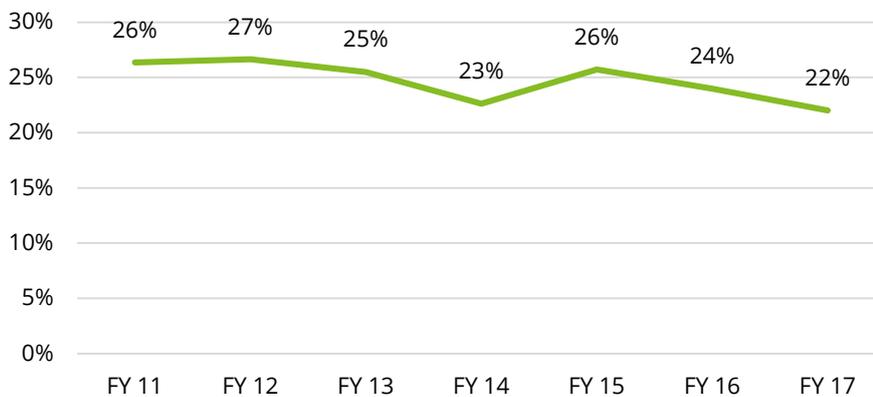
However the sector still remains inefficient with high AT&C losses and poor financial health of distribution utilities.

Financial Performance of Utilities

All India Gap between Average Cost of Supply and Average Revenue Realization



Aggregate Technical and Commercial (AT&C) Losses



Source: PFC report on Performance of State Power Utilities

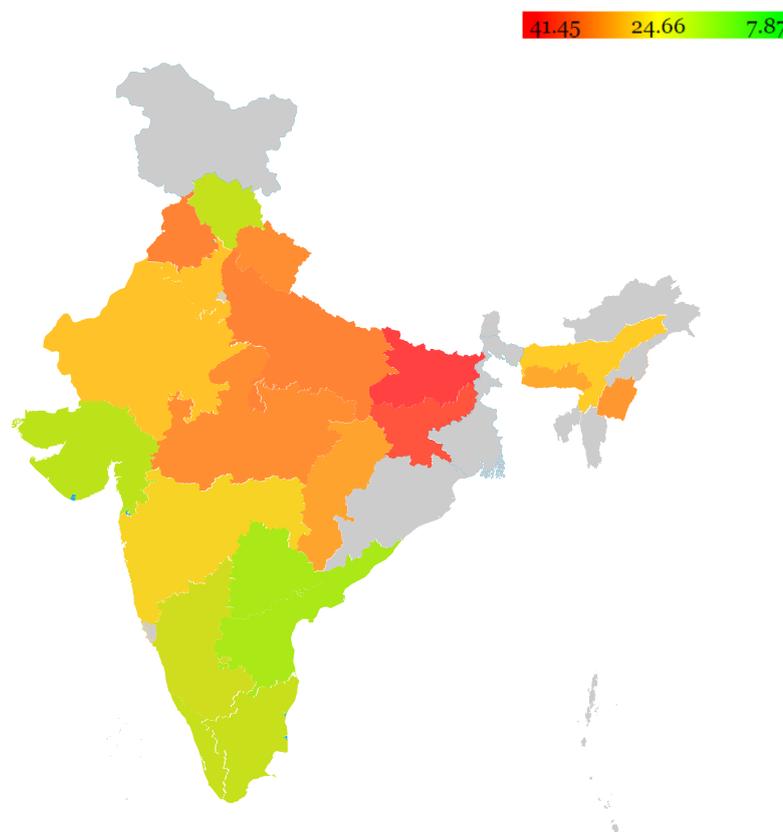
There has been a substantial reduction in the gap between the average cost of supply and the average revenue realized due to the tariff revision carried out for 25/27 States and Union Territories (UT). The move resulted in increased realization of cost of supply as well as increase in operational efficiencies of discoms. Overall Aggregate Technical and Commercial (AT&C) losses stood at ~22% for the entire country in 2017.

Ujwal DISCOM Assurance Yojna (UDAY) was launched by GoI in order to improve operational efficiency, reduce cost of generation and for financial turnaround of financial utilities. It envisaged several initiatives to be undertaken by the utilities to achieve these goals.

The state power distribution utilities have made substantial amount of capital investments in the following:

- Feeder metering, metering of distribution transformers, increasing access to unconnected households, etc.
- System strengthening schemes (these have improved overall operational efficiency as well as led to reduction of overall system losses)

AT&C Loss levels



Boundaries shown in the map are representative and not authentic

Progress made by Distribution Utilities on various operational / technical parameters under UDAY	
Smart Metering (200 – 500 kwh)	1%
Smart Metering (above 500 kwh)	3%
Feeder Segregation	62%
DT Metering Urban	57%
DT Metering Rural	48%
Feeder Metering (Urban)	100%
Feeder Metering (Rural)	100%
Electricity access to unconnected HHs	82%

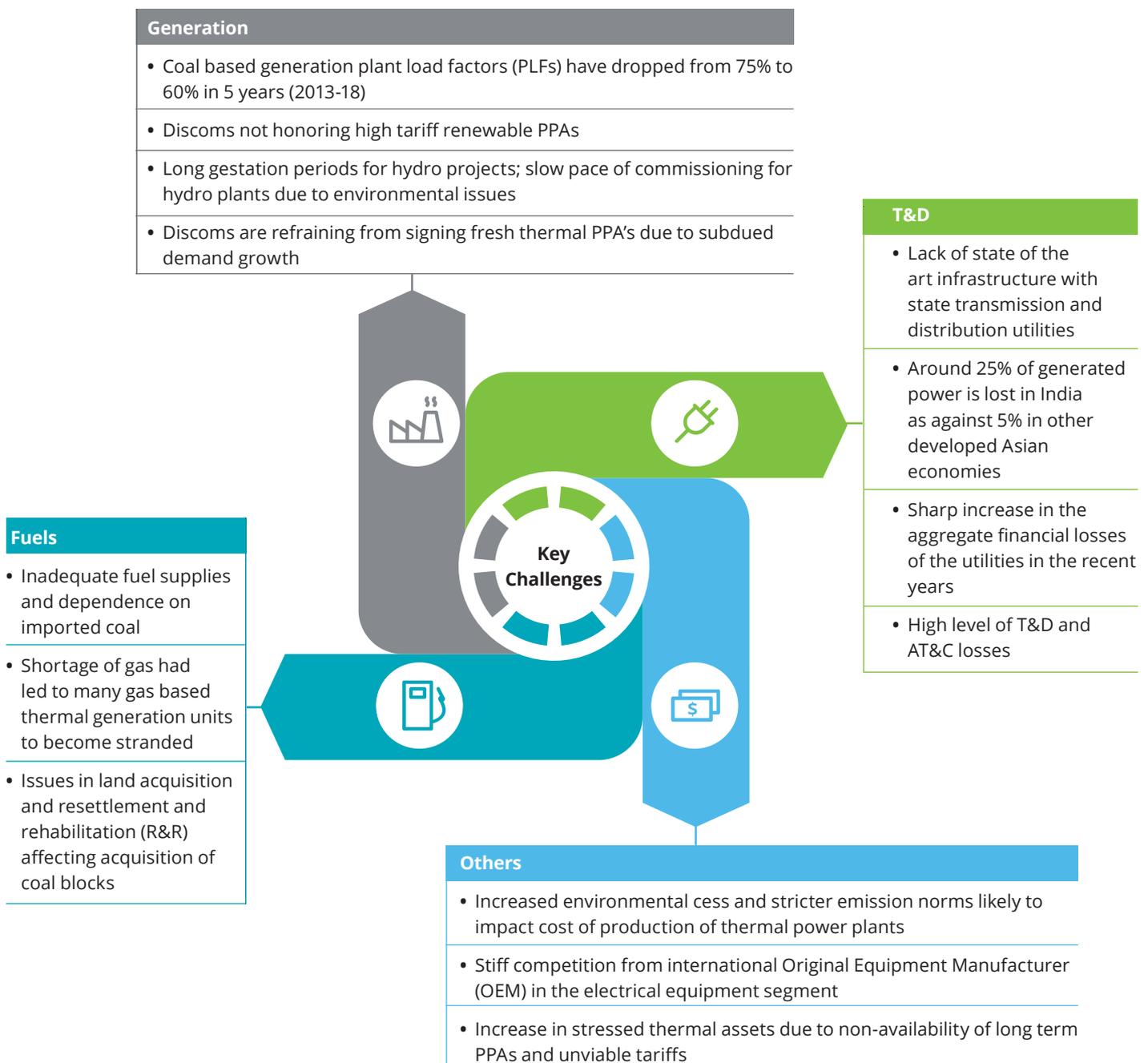
Source: UDAY dashboard

Power Sector – Key challenges

The Indian power sector, which plays a key role in the current government’s ‘development plan’ is facing certain challenges

The power sector is facing challenges around to fuel issues, statutory obligations, emission levels, water scarcity, power theft, low power demand

growth, poor quality of coal, availability of transmission corridors, low performance of old power plants, and financial crisis of private power generators/IPP’s etc.



Source: Deloitte analysis

Power Sector – Government Initiatives

Government has undertaken several marquee initiatives to support growth of the Power sector

Power System Development Fund (PSDF)

Operationalization of Power System Development Fund (PSDF): To be utilized for the projects proposed by state utilities for

- Create necessary transmission systems of strategic importance
- Install shunt capacitors for improvement of voltage profile
- Install standard and special protection schemes
- Renovate and modernize T&D systems for relieving congestion, etc.

Fuel supply

- Coal usage flexibility / coal swapping from inefficient plants to efficient plants
- Rationalization of coal linkages to optimize transportation cost and materialization of coal at thermal power plants
- Introduction of a new and more Transparent Coal Allocation Policy for Power Sector, 2017 - SHAKTI (Scheme for Harnessing and Allocating Koyala (Coal) Transparently in India)

- Government of India (GoI) targets to produce 1 Bn tonnes of domestic coal by 2019-20

24 X 7 Power for ALL

- Joint initiative by the Government of India (GoI) and the state governments, aiming to achieve 24X7 availability of reliable power to all households, industrial, commercial and all other electricity consuming entities by the end of FY19
- Preparation of state specific action plans for '24X7 Power for All' covering adequacy of generation, transmission capacity and distribution system. '24X7 Power for All' documents have been signed for 35 States/UTs
- All states have been onboarded

- Total generation capacity by 2019: **389 GW**
- Total investment in system strengthening: **INR 3,15,582 crores**
- No of household to be provided access: 60.5 million

Ujwal Discom Assurance Yojna

- Ministry of Power, Gol launched Ujwal DISCOM Assurance Yojana (UDAY) which was approved by the Union Cabinet on 5 November 2015
 - Under UDAY schemes states will takeover 75% of the DISCOM debt as on 30 September 2015 (50% in FY16 and 25% in FY17), in order to give a fresh opportunity to debt trapped DISCOMS to transform
 - Till date, 32 states and union territories have joined this scheme for financial and operational turnaround
 - About 97% of total outstanding debt of all state Discoms have been covered under this scheme, paving the way for financial turnaround
- Financial Turnaround of DISCOMs
 - Operational improvement
 - Reduction in cost of generation of power
 - Development of Renewable Energy
 - Energy efficiency and conservation

Integrated Power Development Scheme (IPDS)

- Aims at providing quality and reliable power to urban households
 - Financial assistance to strengthen urban infrastructure including sub-transmission and distribution networks in urban areas and metering of distribution transformers (DTs)/feeders/consumers
 - IT enablement of distribution sector and strengthening of distribution network component has been subsumed under IPDS
- Projects worth **INR 24,836 crore** have been sanctioned for 3486 towns
 - Total outlay of **INR 32,612 crore** aimed at ensuring 24X7 power for all

Deen Dayal Upadhyay Gram Jyoti Yojna (DDUGJY)

- Launched in December 2014 with a goal to provide continuous supply of electricity to rural India
 - Key areas include separation of agriculture and non-agriculture feeders, strengthening and augmentation of sub-transmission and distribution infrastructure including metering at distribution transformers, feeders and consumers and rural household electrification
- 590,791 villages (98.8%) in India have been electrified
 - Free electricity connections provided to 2.5 crore BPL households (Out of total 4.27 crore connections sanctioned)

SAUBHAGYA

- The Pradhan Mantri Sahaj Bijli Har Ghar Yojna (SAUBHAGYA) was launched by the Ministry of Power (MoP) to achieve universal households electrification by providing last mile connectivity and electricity connections to all households in rural and urban areas
- Solar photovoltaic based standalone systems to be provided for remote and inaccessible villages
- Total cost of INR **16,320 crores** including Gross Budgetary support of INR 12,320 crores from the Gol

Demand Side Management (DSM) and Energy efficiency

- There is significant push for increased adoption of energy efficient products through schemes, directives/ regulations and policies
- National light-emitting diode (LED) programme was launched on 5 January 2015
- Domestic Efficient Lighting Programme (DELP) and Street Light National Programme (SLNP) have been initiated through which household lighting and street are being replaced with LEDs
- Over 18.5 lakh LED tube lights distributed as of May 2017
- Over 20 lakh LED street lights installed under SLNP as of May 2017

Green Energy corridors

- Launched by the Gol in 2013; envisages grid connected network for the transmission of renewable energy produced from various renewable energy projects
- Involves construction of the inter-state transmission network for connecting 43 GW of RE capacity under Green Corridor-I
- Green Corridors-II programme involves connectivity for 20 GW solar parks in different states including Andhra Pradesh, Madhya Pradesh, Karnataka, Rajasthan and Gujarat
- Total expected investment: ~ INR **43,000 crores** in intra-state and inter-state transmission systems

Smart Grids / Automation

- National Smart Grid Mission (NSGM) established for **planning and monitoring of implementation of smart grid related activities**
- Provides capital subsidy support to larger implementation projects; 4 projects at bidding stage, 20+ Detailed Project Reports (DPRs) have been received for approval
- Inclusion of Smart Grid / Smart Metering investments in IPDS, UDAY, other schemes and mandates of GoI are accelerating early adoption of new technology solutions

Transparency and Monitoring initiatives

- **GARV (Rural Electrification) App:** Provides updates related to the electrification of villages and households in India
- **Ujala App:** Provides real-time updates on the LED distribution
- **Vidyut Pravah:** Gives real-time information on electricity price and availability
- **URJA (Urban Jyoti Abhiyaan) App:** Helps enhance consumer connect by showing DISCOM's performance in cities and gives data of the Integrated Power Development Scheme (IPDS)
- **TARANG (Transmission System Monitoring) App:** To monitor the progress of Transmission System in India
- **Ujwal DISCOM Assurance Yojana (UDAY):** Gives the progress of the UDAY yojana
- **Urja Mitra APP:** Enables consumers to access real time and historic outage information for DISCOMs
- **DEEP (Discovery of Efficient Electricity Price):** e-Portal for short and medium term power procurement through transparent bidding and e-reverse auction

Source: Deloitte analysis



B. Oil & Gas

Oil & Gas – Upstream Demand Supply Overview

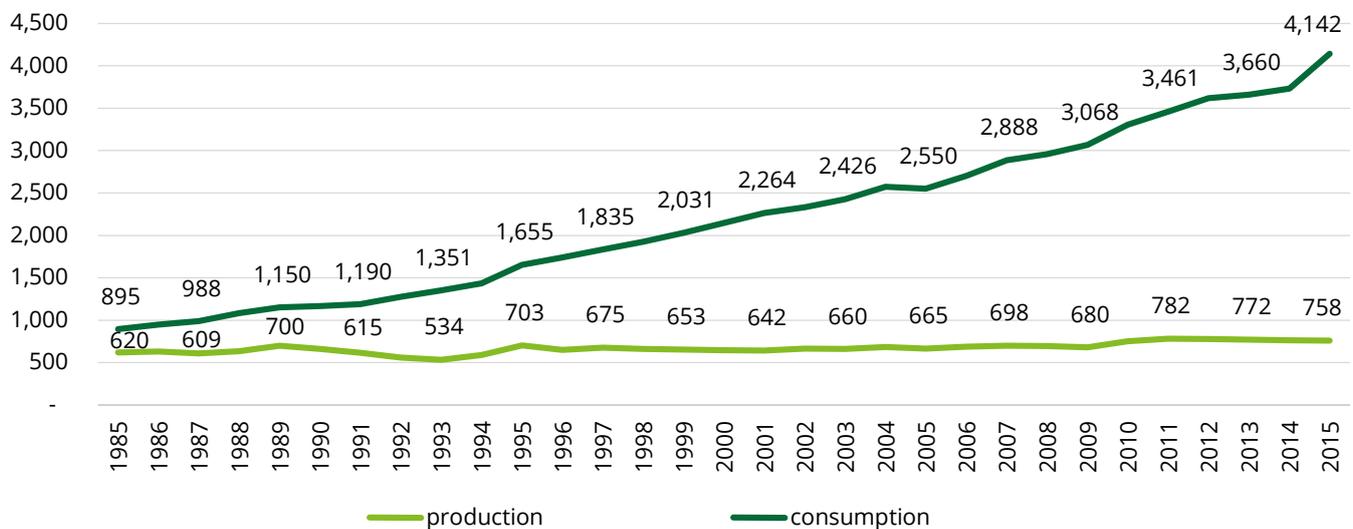
Oil and gas consumption has grown at CAGR of ~6% over the last decade, but India remains largely import dependent

India is the 3rd largest global consumer of oil and its energy requirement is expected to grow at a CAGR of 4.6% through 2030, making it the fastest growing energy consumer in the world. Over the past two decades, the Indian oil and gas industry has had a major transformation triggered by liberalization and increasing demand for oil and gas products. While

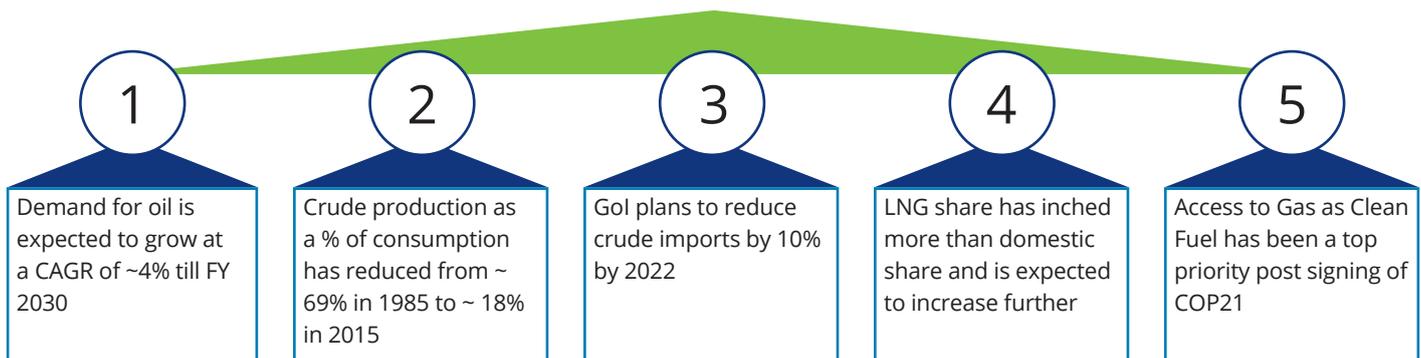
India has become a regional leader in the downstream refining sector, the upstream and gas midstream sectors have lagged behind, resulting in India importing approximately 80% of its crude oil requirement; and 49% of its natural gas requirement and gas accounting for only 7% of the energy mix.

India - Crude Oil Consumption-Supply Scenario (kb/d)

'000 bbl/ day



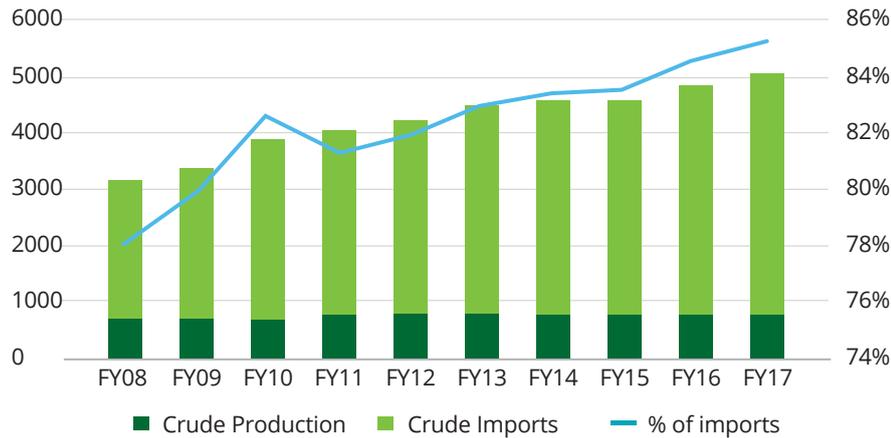
Source: PPAC, MoPNG, Deloitte Analysis



The Indian oil and gas sector continues to be dominated by large public sector undertakings (PSUs) as they continue to

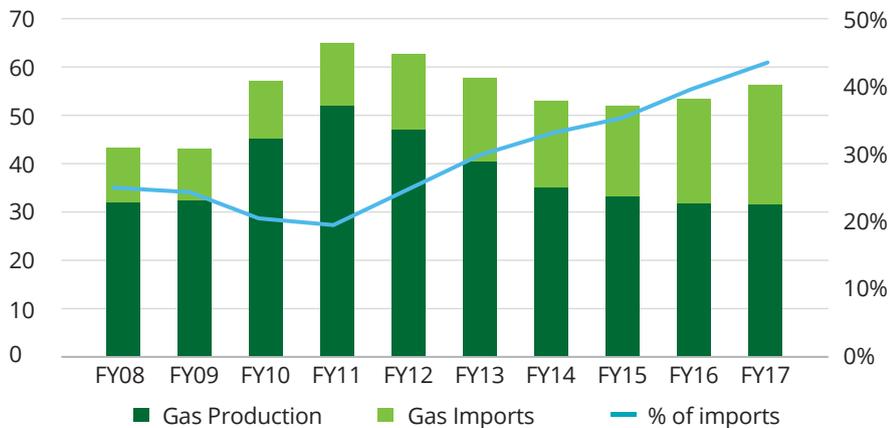
have a higher market share across the value chain upstream, midstream, and downstream.

Historical Oil & Gas Consumption and Supply
Indian Crude Oil Production and Imports, '000 bpod



Indian Natural Gas Supply, bcm

Import growth for Crude Oil and Natural Gas has been more pronounced in the last decade, though production has stagnated for oil and declined for natural gas

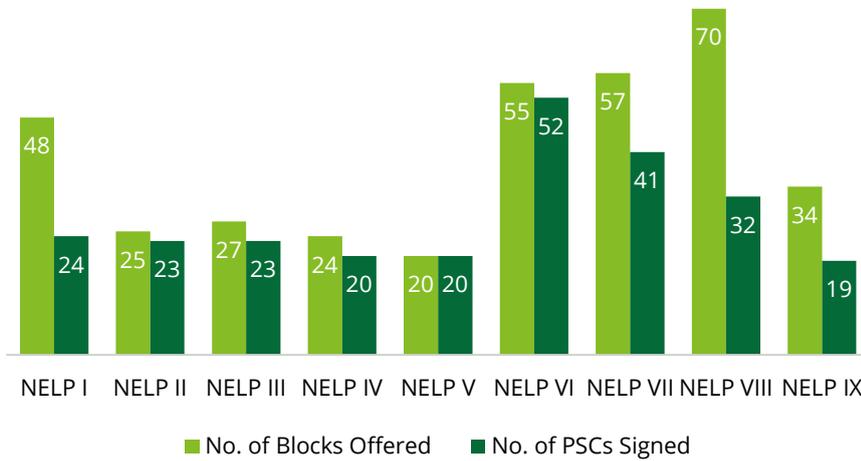


Source: PPAC & DGH

- There has been a decline in the production from the domestic fields in the recent years. Oil production experienced a 4.4% decline post 2011 mainly due to the fact that major oil fields are reaching their maturity stage level and require enhanced oil recovery (EOR) technologies to boost and maintain production. Further, there has been a 39% decline in gas production post-2010 due to sub-optimal performance of KG-D6 block and delays in development of other gas assets.
- The decline witnessed due to maturing fields has been further exacerbated by lower than expected outcome of the New Exploration Licensing Policy (NELP) rounds and limited exploration activity in India. Currently, only 22.8% of the Indian sedimentary basin has been explored. Further, out of 360 blocks offered under NELP 84 are active, 170 have been relinquished and 106 were not awarded. In the NELP blocks, 152 discoveries have been made in 50 blocks, however, production has commenced only in 11 fields in 4 blocks over the last 10 years.

Status of Exploration Activity in India

Exploration Blocks Offered and PSCs Signed Under 9 Rounds of NELP



The Government has ironed out a number of rigidities related to various regimes in order to push investments in the exploration & production sector. These

initiatives are largely directed towards early monetization of resources and focus on ramping up exploration activities in future.

Key Regulatory Interventions



Marketing and Pricing freedom

- Formula linked to alternate fuels and imported gas for production from High Pressure High Temperature, Deepwater and Ultra Deepwater areas
- Expected to support the players in exploration & production (E&P) activities of difficult areas



Open Acreage Licensing Policy (OALP) & Hydrocarbon Exploration & Licensing Policy (HELP)

- OALP allows companies to directly approach government for unlicensed territory
- Revenue sharing model adopted through HELP



Extension to the Production Sharing Contracts and proposed EOR policy

- These policies will enable the contractors to extract remaining reserves by providing incentives to use latest technologies
- Government is in the process of drafting a policy to incentivize E&P players to undertake enhanced recovery techniques

Source: Directorate General of Hydrocarbons (DGH)

Oil & Gas – Infrastructure & LNG Outlook

Coordinated development of LNG terminals and pipeline infrastructure critical for uptake of gas projects

India imports liquefied natural gas (LNG) to supplement the domestic gas for its downstream industries and the City Gas Distribution (CGD) network (referring to city or local natural gas distribution

network). Robust demand growth of natural gas is expected due to increasing focus on lower emissions, competitive pricing and improved connectivity due to expansion of pipeline infrastructure.

Natural Gas Demand

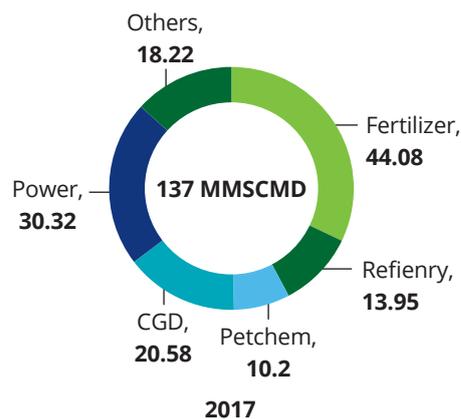
Natural gas demand is expected to grow due to expansion of core consuming sectors. Refinery capacity is expected to reach 438.65 MT by 2030 through several brownfield and greenfield expansion projects. In Fertilizer, 5 urea plants are being revived to reduce India's import dependency whereas the Petrochemical sector is expected to grow at 8-9% over the coming decade in line with the economic growth. For City Gas Distribution (CGD), 23 CGDs are under construction and additional 90 GAs are expected to be commissioned by 2030.

Innovative applications of LNG usage in transportation, marine and bunkering are not expected to alter demand to a wide extent but will set the trend for greater penetration of natural gas.

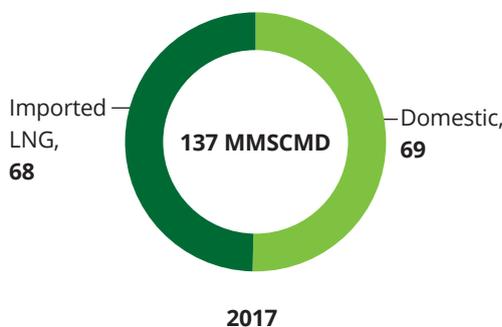
Natural Gas Supply

Depending upon uncertainties in the exploration and production activities (E&P), the incremental domestic gas supply could range between 35 to 55 MMSCMD from conventional sources in east coast (KG-D5, D6) and through some Coalbed methane (CBM) and Marginal fields.

Natural Gas Demand by Segment, 2017



Source: PPAC, MoPNG, Deloitte Analysis



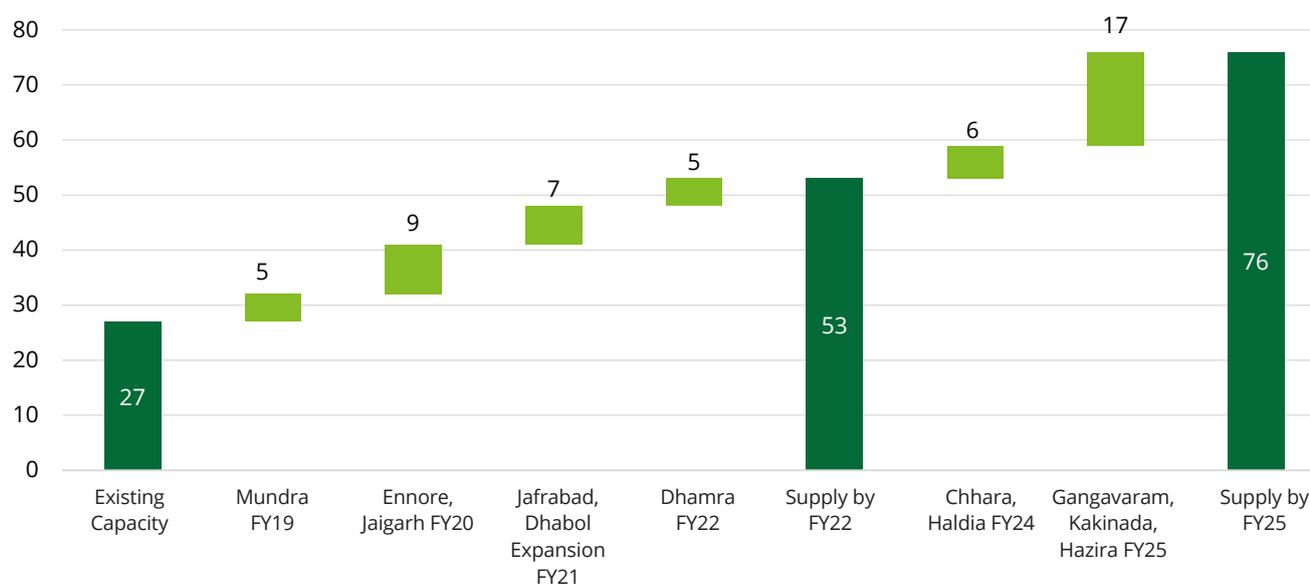
Source: MoPNG, Deloitte Analysis

LNG Import 2030

Considering the demand and supply for natural gas, the total LNG demand by 2030 could be between 32 MTPA to 59 MTPA.

Considering this potential, many industry players are looking at establishing LNG terminals in the country and about 13 such projects have been announced.

Expected LNG Import Capacity by 2025 (MMTPA)



Source: MoPNG, Deloitte Analysis

Along with the increase in LNG capacity for gas imports, growth in pipeline infrastructure is critical to provide country wide access to gas. Currently, India has a natural gas pipeline network of 17,753 km with a capacity of 451 mmscmd. However, pipeline distribution is uneven across the country with maximum penetration in the western and the northern regions.

Gas Pipeline Network in India

By the end of FY 2022, the natural gas pipeline network is expected to cover 31,432 km with a design capacity of 782 mmscmd forming the nation-wide gas grid and providing uniform pipeline network coverage. This will predominantly comprise of interstate pipeline network. Additional investments are also expected to be made in intra state and distribution pipelines.

Expected Growth in Pipeline Infrastructure

	Length (km)	Capacity (mmscmd)
Current network	17,753	451
Expected addition by end of FY 2022	13,679	331
Incremental Capacity Additions till FY30	1,295	33
Total network by end of FY30	32,727	815

Source: PPAC, MoPNG, Deloitte Analysis

Oil & Gas – Downstream Sector Overview

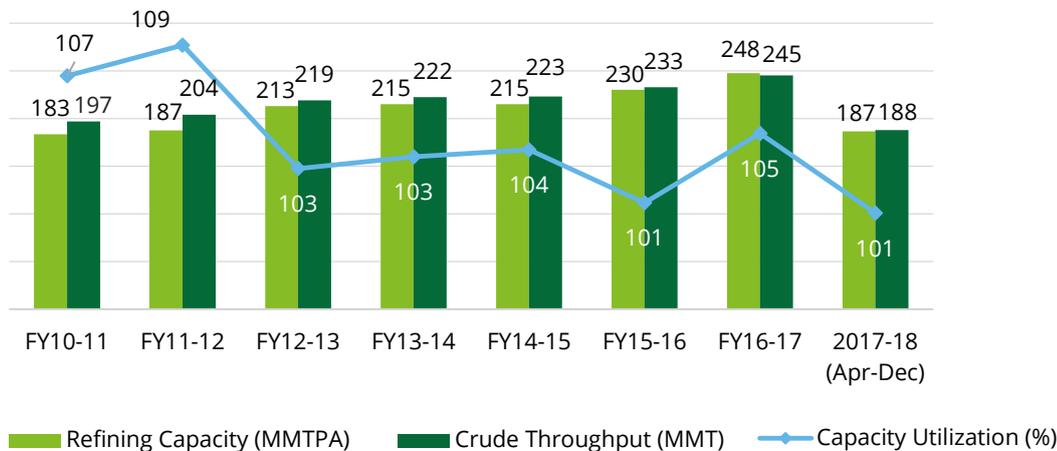
India is the 4th largest refiner globally – 23 refineries with a total capacity of 247.6 MMTPA

India is the 4th largest refiner globally and a net exporter of petroleum products. From a total capacity of 62 MMTPA in 1998, the Indian refining sector has increased nearly fourfold to reach a capacity of 247.6 MMTPA from 23 refineries. In FY17, India exported approximately 66 MMTPA (approximately one-fourth of the total refining capacity) of petroleum products valued at \$29 billion. These exports helped in offsetting

the large oil import bill incurred by the country.

The Indian petroleum refining industry has a significant presence of both private and public sectors with private companies facilitating healthy competition in the industry. Of the total installed capacity 35.6% is operated by the private sector and the remaining 64.4% is operated by the public sector.

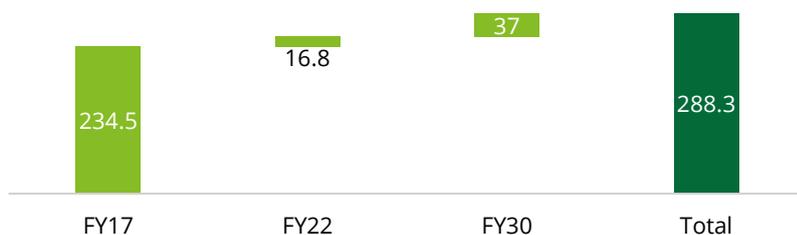
Refining Capacity, Crude Throughput and Capacity Utilization



Source: PPAC

Refinery upgrade to Bharat Stage VI (BS VI) by 2020 has been mandated and is expected to attract additional investments of \$6 billion by FY2030

Refining Capacity Forecast - MMTPA



Refining capacity is expected to reach 414.35 MMTPA by FY25 with investments of \$30 billion from the Oil Marketing Companies (OMCs)

Source: Company Annual Reports, MoPNG, Deloitte Analysis

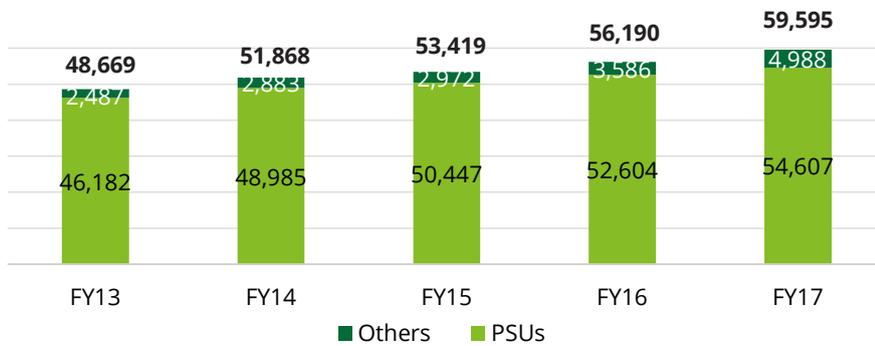
Oil & Gas – Downstream Sector

Downstream segments including fuel retail and city gas distribution have shown promising growth in recent past

The retail and marketing sector in oil and gas is largely held by public sector undertakings (PSUs) Oil Marketing Companies (OMCs) which own and operate 92% of the market. With the

recent deregulation of diesel, private sector companies have increased their interests in the domain and have announced growth plans.

Number of Fuel Retail Outlets in India



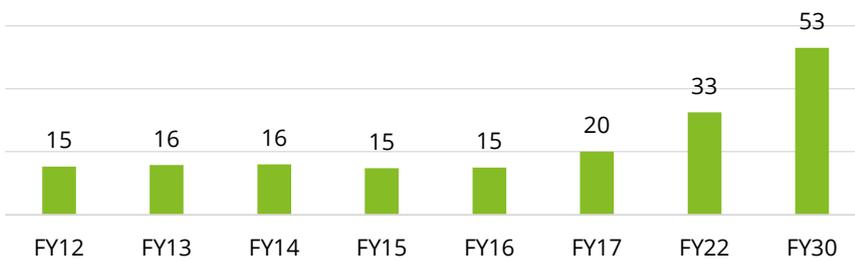
Share of Non-PSU retail outlets has grown from 5% in 2013 to 8% in 2017

Source: MoPNG

The City Gas Distribution (CGD) sector can play a crucial role of meeting the objective of increasing share of natural gas in the energy basket The City Gas Distribution

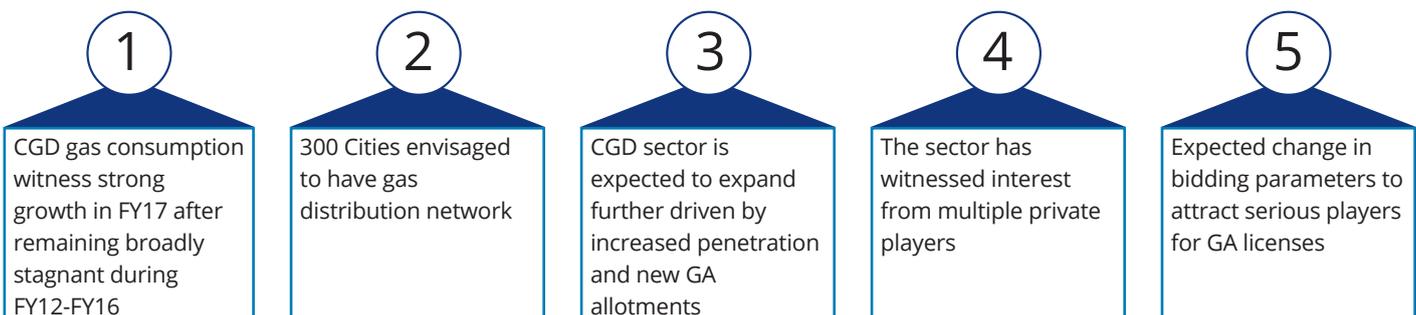
(CGD) sector can play a crucial role of meeting the objective of increasing share of natural gas in the energy basket

City Gas Distribution (CGD) GAs



Source: PNG Stat (2017), PPAC, Deloitte Analysis

Growth in CGDs expected to continue as new GAs come online



Oil & Gas – Government Initiatives

Discovered Small Fields

Discovered small fields are O&G fields which were discovered long back but these discoveries could not be monetized due to various reasons such as isolated locations, small size of reserves, high development costs, technological constraints, fiscal regime etc.

The Ministry of Petroleum and Natural Gas (MOPNG), in May 2016, put out a total of 46 contract areas (Discovered small fields) in 67 oil & gas fields through online international competitive bidding. A total of 42 companies submitted 134 e-bids. Contracts have been signed for 31 Contract Areas. It is expected that 40 MMT of oil and 22 BCM of gas will be extracted over 15 years.

Hydrocarbon Exploration Licensing Policy (HELP)

HELP (March 2016) provides uniform licensing system to cover all hydrocarbons such as oil, gas, coal bed methane etc. under a single licensing framework. Contracts, under HELP, are awarded based on "biddable revenue sharing". Bidders are required to quote revenue share in their bids and this forms a key parameter for selecting the winning bid. The bidder giving the highest net present value (NPV) of revenue share to the Government, as per transparent methodology, gets the maximum marks under this parameter.

Open Acreage License Policy (OALP)

OALP allows a bidder to apply to the Government, seeking exploration of any block not already covered by exploration. The Government will examine the expression of interest (Eoi) and justification. If it is suitable for award, Government will call for competitive bids after obtaining necessary environmental and other clearances. This will enable a faster coverage of the available geographical area. Under the new hydrocarbon exploration and licensing policy (HELP), Open Acreage License Policy (OALP) Bid Round 1 was launched on 19 January 2018. Six companies expressed interest for 55 bidder-selected blocks in promising basins in an area of about 60,000 sq. km by way of international competitive bidding.

Incentivizing Production from Ageing Fields

The upstream regulator Directorate General of Hydrocarbons (DGH) has proposed a draft "Policy Framework to Promote and Incentivize Enhanced Recovery Methods" for boosting oil and gas output from existing fields using Enhanced Recovery (ER) techniques. The incentive proposed includes 50% waiver of oil cess on gross oil production for EOR (and other unconventional oil production projects)

PAHAL - Direct benefit transfer in LPG (DBTL) subsidy

- PAHAL (DBTL) Beneficiaries*: 198.8 million
- Cash Given*: ~INR 68,352 crore
- Largest subsidy transfer scheme across the globe
- Jan Dhan was awarded a Guinness World record for opening the most bank accounts in a single week (18 million during 23-29 August 2014). Success of PAHAL is encouraging direct benefit transfer in other areas

UJJWALA YOJNA

UJJWALA – A social movement to improve women health by giving them freedom from sooty kitchens and hazards of collecting firewood. Targets to provide 80 million free connections to poor households by 2019-20. From 25.5% in 2005 to almost 80% Indian households have access to clean energy today.

Urja Ganga

The Government, in September 2016, had approved viability gap funding / partial capital grant at 40% (INR 5,176 crore) of the estimated capital cost of INR 12,940 crore for development of 2,539 km long Jagdishpur-Haldia and Bokaro-Dhamra Gas Pipeline (JHBDPL) project.

The pipeline will be connecting Jagdishpur in Uttar Pradesh, Bokaro in Jharkhand, Dhamra in Odisha and Haldia in West Bengal and will be used to supply natural gas to three Fertiliser Units along the route of this pipeline project.

The Government had also approved the simultaneous development of City Gas Distribution (CGD) networks in cities namely Varanasi, Patna, Ranchi, Jamshedpur, Bhubaneswar, Kolkata, Cuttack etc. en-route the JHBDPL project.

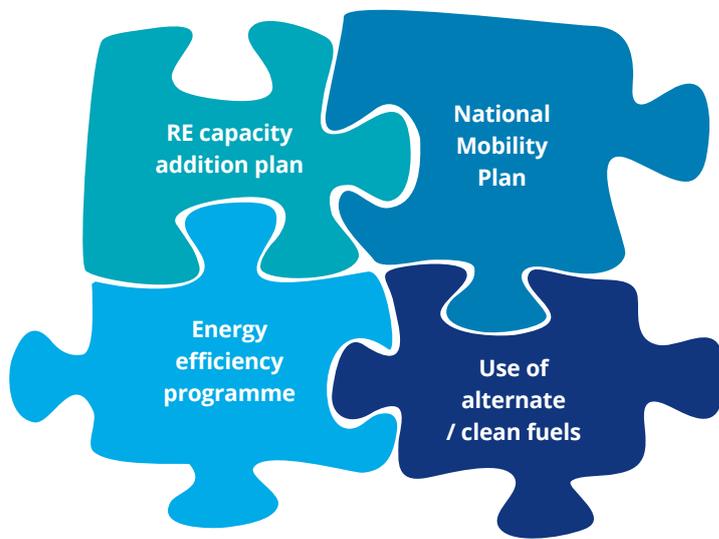
The pipeline is expected to improve the usage of gas in eastern India and reduce the disparity of gas use in India.

C. Renewables

Renewables Sector – Overview

India has set massive target of achieving 275 GW cumulative renewable energy capacity by 2027

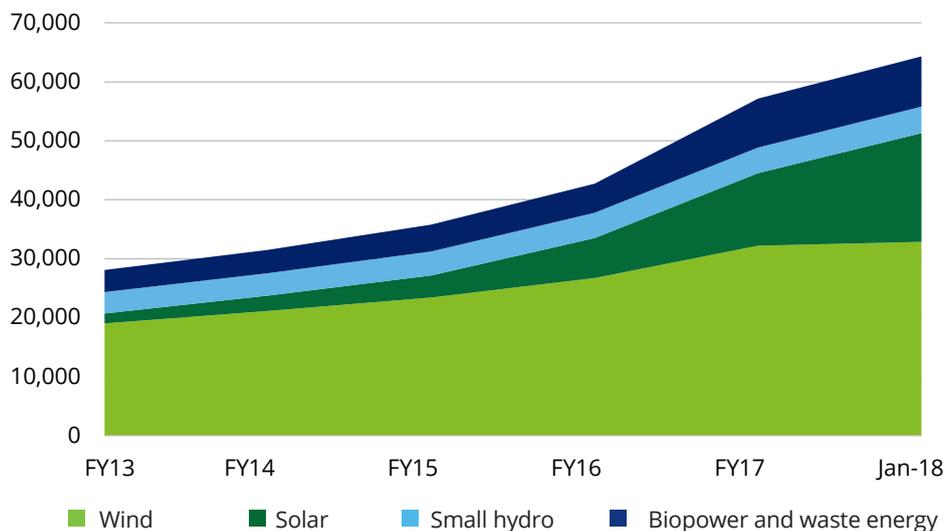
India's NDC strategies



India is committed towards global climate change initiative and has ratified the Paris Agreement on Climate Change. As part of the Nationally Determined Contributions (NDC), India has committed to reduce the emissions intensity of its GDP by 33 – 35%

by 2030 from the 2005 level. The major pillar in achieving the NDC commitment is the massive renewable energy capacity addition target of 175 GW by 2022 and 275 GW by 2027.

Renewable Energy Capacity Additions (MW)



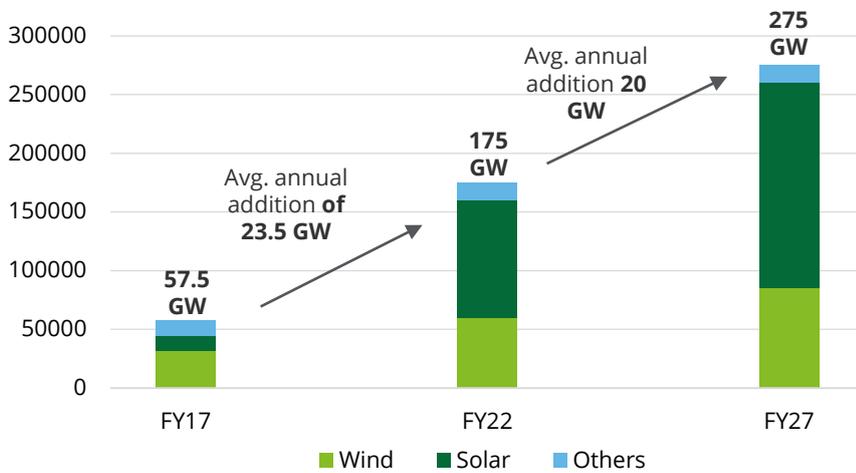
Source: MNRE

The renewable energy sector has been in the fore-front of growth in capacity development in India with the country's renewable energy installed capacity more than doubled in the last 5 years.

The growth momentum is likely to be maintained in the coming years. Of the total, 100 GW will be from solar, 60 GW

from wind, 5 GW from Small Hydro Power (SHP) and the remaining 10 GW from other technologies (such as biomass and Waste to Energy, WTE). It has drawn a roadmap to bid out 30 GW of solar and 10 GW of wind capacity in the financial year 2019 and 2020 respectively.

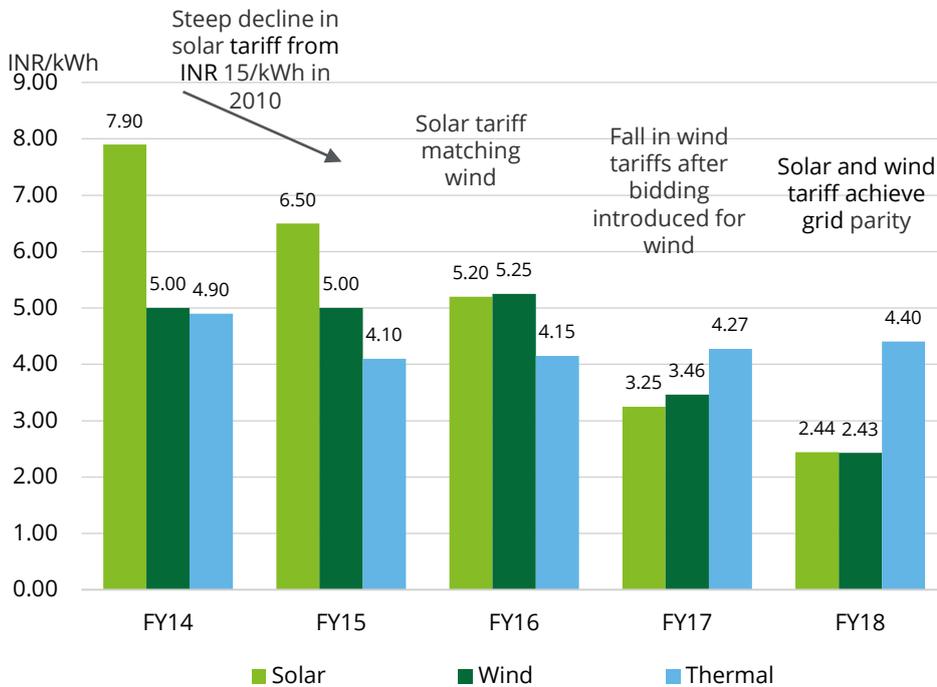
Renewable Energy Capacity Addition Targets



Source: MNRE and draft NEP



Renewable energy tariff achieving grid parity will aid in achieving these targets



Source: Bid results

The renewable energy sector in India was operated under the Feed-in-Tariff regime till 2010. Till that time, the renewable energy capacity was mostly dominated by wind energy (accounting for more than 70% market share). Solar energy was the first technology which adopted competitive bidding in 2010 (its market share was mere 1% of the total renewable energy capacity at that time).

The tariffs for solar energy have declined by around 80% since 2010. This steep drop has been facilitated by a combination of factors like decline in photovoltaic (PV) module cost, increase in scale of projects, innovative project development models like solar parks developed by the Government agencies, access to cheaper financing, and decline in return on equity expectation due to reduced risks, etc.

Competitive bidding in wind sector was introduced only in 2017. Since then, the tariffs for wind energy too have reduced by 50% in less than 1 year. Both wind and solar energy tariffs are now less than the conventional sources. Introduction of competitive bidding has helped the renewable energy tariffs to achieve grid parity.

With the solar PV module prices projected to decline further, improvement in wind technology and coal prices historically showing an increasing trend, price advantage of renewable energy over coal is expected to widen further. This will drive demand for consumption of renewable energy, thereby, aiding in achieving these massive renewable energy capacity addition targets.

Renewables Sector – Key challenges

Stakeholders are working on regulatory challenges, to ensure full realization of market potential

With renewables expected to take massive strides in the power sector, few investors and sector experts have raised concerns regarding the seamless integration of such huge capacities with the existing grid, utilities delaying payments for renewable energy purchases and viability of projects awarded recently over aggressive bidding by developers.

To overcome these challenges, renewable energy players and Government are taking incremental steps on technical and regulatory front for making this segment suitable for sustainable operation.

1

Grid integration

- Government is setting up green energy corridors to cater to huge renewable energy capacity additions in future.
- These green corridors with capacity of 55 GW will be set up in two phases.
- In the initial phase, renewable energy resource rich states will be targeted.
- Transmission utilities are working on upgradation of grid technology and operational protocols.

2

Scheduling and forecasting

- Renewable energy in India enjoys the “must run” status. With a huge influx of renewable energy planned in future, this may destabilize the grid, leading to curtailment of clean energy.
- Many states have come up with regulations on scheduling and forecasting in line with framework prepared by the Central Electricity Regulatory Commission (CERC).
- These regulations aim to overcome the challenges of demand and supply mismatch, and grid stability by better scheduling and forecasting mechanism.
- The Ministry of New and Renewable Energy (MNRE) in its recent wind and solar bid guidelines have provided partial compensation to renewable energy IPPs for curtailment / backdown of generation.

3

Financials of utilities

- Most of the utilities in India delay payments to renewable energy generators, which is due to poor financials of such utilities.
- Ujwal DISCOM Assurance Yojana (UDAY) scheme launched by GoI in 2015 aims to improve the financials of utilities and clean up their balance sheet.
- All the major utilities have signed up for this scheme. This has led to a decrease in losses of utilities by almost 40% since this scheme was launched.
- Solar and wind guidelines have provided provisions for payment security mechanism.

4

Honoring of high tariff PPAs

- Some investors are concerned that utilities may not honor the high tariff PPAs signed for earlier projects.
- PPAs don't have a provision to reopen commercial terms & conditions. This has been emphasized by the Appellate Tribunal in related cases.

Renewables Sector – Government Initiatives

Policies and Regulations act as a catalyst for development of renewable energy sector

India's Nationally Determined Contributions (NDC)

The Paris agreement 2015 has defined the NDC framework with contribution from participating countries to reduce greenhouse gas (GHG) emission. India's NDC commitments for 2030, which impacts power sector, are as follows:

- Reduce emissions intensity of its GDP by 33 – 35% by 2030 from the 2005 level
- 40% installed capacity from non-fossil fuel based energy resources – most of this would be met through renewable energy

Renewable Purchase Obligation (RPO)

Electricity Act 2003 notified the State Electricity Regulatory Commissions (SERCs) to promote renewable energy by setting yearly RPO targets for obligated entities (utilities and consumers procuring conventional power from other sources) GoI has set an indicative target for respective states based on their electricity demand to achieve 175 GW by 2022. Based on these targets, SERCs have set yearly RPO for the obligated entities.

National Tariff Policy 2016

The National Tariff Policy takes into account 100 GW of solar capacity target and mandates the State Electricity Regulatory Commissions (SERCs) to revise the solar renewable purchase obligation (RPO) target to 8%. The Ministry of New and Renewable Energy (MNRE) has already notified SERCs to increase RPO to 17% by FY 2022, of which 8% is solar RPO. It also mandates utilities to procure all renewable energy sources except waste to energy (WTE) through competitive bidding process. It mandates utilities to compulsorily procure 100% power produced from all the waste-to-energy plants in the state at tariff determined by respective SERCs.

The potential for renewable energy technologies vary across states, thereby, restricting uniform RPO across states. In order to overcome this bottleneck, the policy waived off the inter-state transmission charges and losses for solar and wind energy procured through competitive bidding.

Renewables Sector – Government Initiatives

Solar parks and other initiatives have reduced the development risks, thereby, attracting foreign investments

Solar Parks

Solar energy projects require contiguous land, which could sometime be challenging to acquire, thereby, delaying the development process. Therefore, GoI introduced the solar park scheme. GoI has planned 40 GW of solar parks by 2022. Under this scheme, park developer (joint venture between State Government nodal agency and Central Government nodal agency/private player) is responsible for identifying and acquiring the land, obtaining clearances, building the common infrastructure, making water available, transmission network from the park to nearest grid substation, etc., thereby, reducing the development risk for solar project developers.

Open Access Regulation

Renewable energy generators are allowed to sell power to third party and captive consumers. SERCs provide concessions on open access charges like transmission and wheeling charges and cross subsidy surcharge for sale of renewable energy to third party. Many SERCs also provide energy banking facility to promote third party sale of renewable energy.

Financial Support and Incentives

Renewable energy has been given various incentives and subsidy from MNRE and tax authorities i.e. capital subsidy of 30% - 70% on benchmark cost for rooftop solar projects for certain category of consumers, home loans to include loans for rooftop solar installations, accelerated depreciation, concessional loans, etc.

Other initiatives Must run status:

Central Electricity Regulatory Commission (CERC) and all SERCs provide must run status to all solar and wind energy projects.

Viability Gap Funding (VGF): Under VGF scheme, GoI provides capital subsidy to promote solar capacity addition in the country. For grid scale projects is it INR 10 Mn./MW.

Bundling of power: Solar power is bundled with the unallocated thermal power from NTPC coal based power plants. Further this power is sold as bundled power to Utilities to reduce the cost of power.

India Investment Opportunities

Emerging themes and investment opportunities in India across the various segments within energy



Investment Themes Across the Key Energy Sectors

Opportunities in Power sector

Overall investment in power sector across generation, transmission and distribution likely to be in the tune of USD 250 Bn over the next decade

Adoption of technology to improve overall efficiency will be the key focus area for the sector, going forward



Grid integration of renewables

- Government of India has target of addition of 175 GW of RE by 2022
- Currently, India has 220 GW of thermal capacity, of which only 25 GW is gas-based
- MoP is currently focusing on various pilot initiatives for demonstration of benefits



Smart Grids and Automation

- Smart Grid initiative is being focused upon by MoP through targeted schemes to incentivize utilities.
- Primarily aimed at distribution utilities with implementation of smart metering and grid side automation measures



Digital transformation

- Improving asset utilization and life is priority
- Organizations are looking at improving access to information through digital play and analytics
- Assessment of existing infrastructure and identifying the right tool- IoT, Predictive Analytics, Modeling tool, Optimization tools, Customized software suit, Blockchain, etc. is pertinent for utilities to transition to the future



Storage systems

- The deployment of Battery energy storage systems in the country is at nascent stage and pilot facilities are being tested by various stakeholders
- Overall economic value of storage is yet to be established and a collaborative approach for execution of pilot initiatives can lead to enhanced outcomes
- Given India's push for Electric Vehicles and National Electric Mobility Mission (NMEP), there is a opportunity for battery storage across the entire supply chain



Carriage and content segregation

- Key amendment to the existing Electricity Act, 2003 as proposed by the Union Cabinet, through the Electricity Amendment Bill, 2014, is the separation between distribution and supply function
- Consumers would have the option to get supply from the retailer of their choice, inducing utilities to innovate to differentiate

Opportunities in Oil & Gas

Riding on the back of favourable policy regime and accelerated demand, the oil & gas sector, across upstream, midstream and downstream could attract USD 325 Bn by 2030



Upstream

According to the Ministry of Petroleum and Natural Gas, a cumulative investment of \$40 Bn is expected in the Indian E&P sector in the near term over a medium term horizon. This will largely be driven by a host of favourable policy measures benefiting the E&P players and other industry incumbents. Further, with the recent recovery in the crude oil prices globally, the E&P activity, in general, is likely to pick up and garner more interest from global players looking into India.

Oil Field Services and Equipment (OFSE)

Investments worth \$102 billion are expected in upstream equipment and services over the next 10 years. Drilling and drilling-related services are likely to account for 35 - 40% of the total spend followed by oilfield equipment with 18 - 20% and completion and stimulation equipment and services with 18 - 20%.



Midstream

Ministry of Petroleum and Natural Gas estimates close to \$136 Bn investments in the Indian gas sector by 2025, a large part of which includes strengthening of infrastructure – RLNG terminals, pipeline projects etc. - and expansion of City Gas Distribution network. The government's push towards a gas-based economy has given significant thrust to liquefied natural gas (LNG) imports, given the low domestic natural gas output, which in turn will inevitably lead to significant investment towards infrastructure development.





Downstream

India has emerged as a refining hub in Asia, serving a massive domestic market for refined petroleum products and even exports.

Some of the key areas of focus in the downstream value chain include overall energy efficiency, upgrading the quality of fuel while upgrading facilities to produce BS-IV and BS-VI compliant fuels and so on. Petrochemicals also offer a great opportunity for the incumbents and the sector is likely to grow at a CAGR of ~10% over the next five years to reach the \$100 billion mark by 2022. Government has also recognized the potential in this area and it is one of the priority sectors under the Make in India program. Government of India has launched several schemes and initiatives to encourage growth of the sector which include:

Petroleum, Chemical and Petrochemical Investment Region (PCPIR): a cluster approach to promote petroleum, chemicals and petrochemical sectors in an integrated and environmental friendly manner on a large scale. PCPIRs have already received investments worth \$ 24.68 Bn till now, and are expected to attract investment in the tune of \$ 117.42 Bn over a long term horizon.

Plastic parks: cluster development scheme aims at setting up of need based plastic parks, an ecosystem with state of the art infrastructure and common facilities. Under this scheme Govt provides grant funding up to 50% of project cost with a ceiling limit of \$ 5.97 Mn per project. 10 parks have been approved by central government and "in principle" approval has been given to 8 more in 2015.

LPG

Given the robust growth of LPG, increasing market share of LPG in India and neighboring regions can be considered. Consumption expanded more than 8% to nearly 23 million tons last year, with imports making up more than half those requirements. India raised its target for providing free cooking gas connections to the poor by 60% to 80 million families.

Fuel Retailing

Government is encouraging global players to have a play in the retail growth story. Retail sales have become more viable for private-sector refiners ever since the current government scrapped diesel-price controls in October 2014. Pricing freedom coupled with record oil consumption is increasing competition in what IEA predicts will be the world's fastest-growing oil consuming nation through 2040.



Digital transformation in oil & gas

Digital Innovation and Transformation can help drive excellence and maximize value in the oil & gas sector. It has potential to increase oil production and recovery, reduce operational cost and minimize risk. Adoption of technology can help reduce development cost per Barrel of oil equivalent (BOE). While there is considerable adoption of technology and digital by Oil & Gas value chain players globally, the sector is just opening up in India and could offer huge opportunity for stakeholders.

Opportunities in Renewables

Renewable energy sector may see investments of over USD 175 Bn over 10 years; Solar & wind contributing to more than 90% of the investments



Solar Sector

India has a solar potential of 750 GW spread across all the states. Of the total renewable energy installed capacity of 64.31 GW in the country, solar accounts for around 28%, which was less than 1% five years back. Govt has set a target of achieving cumulative solar installed capacity of 100 GW and 175 GW by FY 2022 and FY 2027 respectively, which is expected to scale up the solar market share to 60% of the total renewable energy capacity.

Development of solar projects is mainly through competitive bidding process wherein the state or central agency invites bids from developers and tariff is discovered through the bidding process. Under this mechanism, Government was successful in discovering tariff as low as INR 2.44/kWh.

MNRE has announced a clean energy rollout trajectory that will require awarding a mammoth 80 GW of solar contracts by FY 2020 such that developers will have the time to construct these projects. MNRE along with the states, will lay out bids for ground-mounted solar parks for 20 GW in FY 2018, 30 GW will be bid out in FY 2019 and 30 GW in 2019-20.

Many regions in India have potential to generate both solar and wind energy. Government has identified certain locations, where it is planning to come up with bids for solar-wind hybrid projects. This will help in optimum utilization of transmission network and managing the demand.



Wind Sector

Wind potential of India is estimated as more than 300 GW at a hub height of 100m. Currently, wind technology dominates renewable energy sector in India, contributing around 51% of the total renewable energy installed capacity in the country.

Govt has set about a target of achieving 60 GW of wind installed capacity by 2022. Till last year, wind energy projects were allocated through Feed-in-Tariff (FIT) regime. With introduction of competitive bidding, wind energy tariffs have reduced to INR 2.43/kWh from more than INR 4.50/kWh tariffs in most of the states.

Govt has planned to auction 10 GW each in FY 2019 and FY 2020. MNRE issued National offshore wind energy policy to promote off-shore wind after considerable deliberation with several stakeholders. Initial assessments suggest around 1 GW of off-shore wind potential in the southern coast of India.



Small hydro

Small hydro capacity account for around 7% of the total RE capacity. Small hydro installation did not pick up in comparison to other renewable energy technologies due to lower FIT and high execution risk. However, Gol is in process of coming up with hydro power policy to boost the sector. The policy aims to create market for small hydro by setting separate hydro purchase obligation, making the tariffs competitive by providing interest rate subvention and expedite the approval and development process.



Biopower

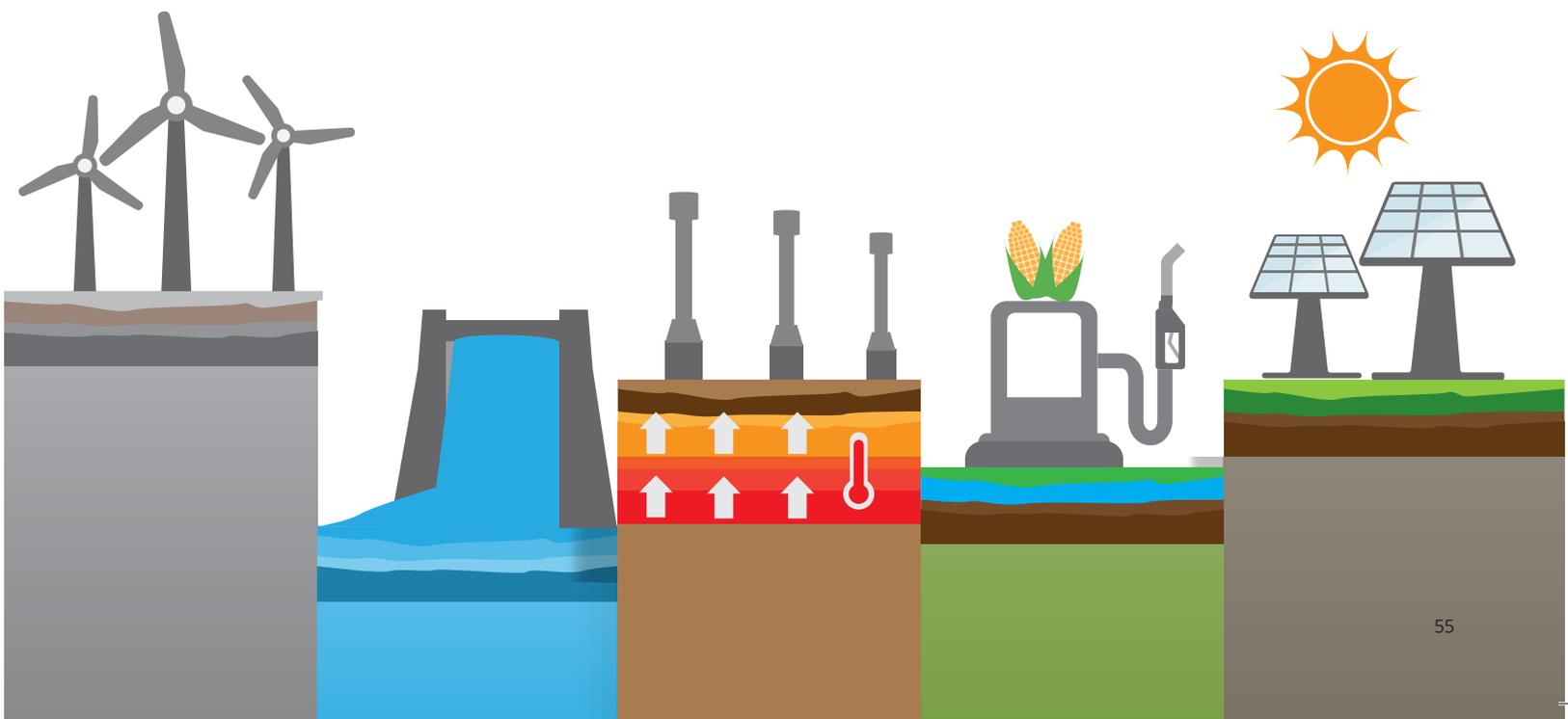
Biomass generation has a potential of 18 GW, restricted to few states with strong agricultural activities. India has around 8.5 GW installed capacity of biopower. The environmental concerns around National Capital Region (NCR) has prompted companies to plan investment in biopower in neighboring states.



Waste to Energy

India has Waste to Energy (WTE) units with installed capacity of around 300 MW. Under Swachh Bharat Mission, the Government has set target to achieve scientific solid waste management in 4041 cities/towns by FY 2019. The National Tariff Policy has also made it mandatory for utilities to procure 100% of power generated from waste-to-energy projects. The power is procured at tariffs approved by respective SERCs (project specific tariff/ FIT).

Source: Deloitte Analysis



Enabling mechanism to encourage investments

A collaborate effort towards ensuring greater integration, developing infrastructure and ensuring a conducive fiscal and regulatory landscape will be instrumental in attracting investments across the Energy sector

Ease of Doing Business

Regulatory and policy measures are required to further improve the ease of doing business in India. India has already moved several notches up in the Ease of Doing Business index and initiatives around key aspects are in various stages of consideration or implementation:

- Single window clearance and linking of inter-ministerial requirements
- Stability of incentives / policies over the long term: Ensuring stability of policies, contracts and incentives instated over the long term is key to building faith amongst the industry players.
- Ease of policy around land acquisition
- Need for PSU's to adopt new technologies and focus on efficiency

Setting up of key enablers for economic growth and supporting infrastructure

Infrastructure forms the backbone of the Indian economy, including the oil and gas industry which involves manufacturing and hauling of heavy equipment. Measures to improve the Indian infrastructure can expedite the development of manufacturing in the oil and gas sector

- Enhancement of ports for handling heavy equipment and developing shipyards having capability for building offshore equipment and LNG ships
- Creation of fast track freight corridors and development of the road network and overall connectivity
- Fiscal incentives, particularly around reduction of duties on import of feedstock
- Tax incentives to attract downstream processing units and large scale energy projects in close proximity to supply centers

Industry Associations

- Creating a platform for stakeholders to come together and deliberate on challenges; ensure representation to the authorities on various matters
- Ensuring learnings from global markets is translated effectively to Indian counterparts
- Need for a collaborative effort from the Government, Academia, Corporates and Industry Associations to work with communities to educate them about the benefits of using Renewable Energy and generally increase awareness
- Government to push for more rural electrification and using renewable energy to power schools, colleges and other institutions

Academia

- Institutional ecosystem is essential to support economic growth and they play a vital role in stitching the social fabric to support development
- As employment levels increase, institutions need to ensure availability of skilled resources locally





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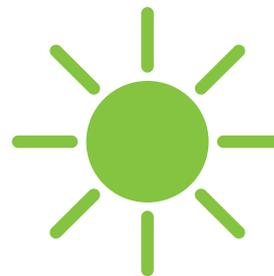
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Contact

Debasish Mishra

Partner - Deloitte (India)
debmishra@deloitte.com



Abbreviation

AT&C	Aggregate Technical and Commercial	INR	Indian Rupee
BCM	Billion Cubic Metres	LED	Light Emitting Diode
BEE	Bureau of Energy Efficiency	LNG	Liquefied Natural Gas
BEST	Brihanmumbai Electric Supply and Transport	LPG	Liquefied Petroleum Gas
BEV	Battery Electric Vehicles	MMSCMD	Million Metric Standard Cubic Meter per Day
BMC	Brihanmumbai Municipal Corporation	MMT	Million Metric Tonne
BMTC	Bangalore Metropolitan Transport Corporation	MMTOE	Million Metric Tonne Oil equivalent
BP	British Petroleum	MNRE	The Ministry of New and Renewable Energy
BRICS	Brazil Russia India China South Africa	MoP	Ministry of Power
CERC	Central Electricity Regulatory Commission	MoPNG	Ministry of Petroleum and Natural Gas
CGD	City Gas Distribution	MTPA	Million Tonnes per annum
DISCOM	Distribution Companies	NDC	Nationally Determined Contributions
E&P	Exploration & Production	NELP	New Exploration Licensing Policy
ECBC	Energy Conservation Building Code	NMMT	Navi Mumbai Municipal Transport
EHV	Extra High Voltage	OALP	Open Acreage License Policy
EOR	Enhanced Oil Recovery	OEM	Original Equipment Manufacturer
ESCO	Energy Service Company	OPEC	Organization of the Petroleum Exporting Countries
EV	Electric Vehicle	PAT	Perform Achieve and Trade
FAME	Faster Adoption and Manufacturing of (Hybrid &) electric vehicles	PPA	Power Purchase Agreement
FDI	Foreign Direct Investment	PPP	Public Private Partnership
FY	Financial Year	RPO	Renewable Purchase Obligation
GA	Geographical Area	SERC	State Electricity Regulatory Commissions
GDP	Gross Domestic Product	SHAKTI	Scheme for Harnessing and Allocating Koyala (Coal) Transparently in India)
GoI	Government of India	SIAM	Society of Indian Automobile Manufacturers
GST	Goods and Services Tax	UDAY	Ujwal DISCOM Assurance Yojana
GW	Gigawatt	UJALA	Unnat Jyoti by Affordable LEDs for All
HELP	Hydrocarbon Exploration & Licensing Policy	USD	United States Dollar
HEV	Hybrid electric vehicle	UT	Union Territories
ICE	Internal Combustion Engine	VAT	Value Added Tax
IIP	Index of Industrial Production	VGf	Viability Gap Funding



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