POLICY PERSPECTIVES FOUNDATION

Towards a Sustainable and Affordable Power Sector

Approach Paper

October 2015

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Contents

Foreword

Policy Perspectives Foundation (PPF) extends a warm and hearty welcome to all the speakers and delegates to the seminar. The Foundation is a Delhi based non-profit and non-political organization committed to promote, support and stimulate objective and well-researched debates on matters of national interest. It passionately believes in generating sensitivity and awareness in civil society, media, academic groups, think-tanks, decision-makers, legislators etc., on current and potential problems affecting vital national interests. The Foundation seeks to achieve this by undertaking studies and analyses of various issues and by organizing or participating in conferences, seminars and even informal debates on various perspectives on topical problems.

It is a matter of great concern that the geography of economic growth and that of social discontent follow different geographical trajectories in India. Serious efforts are necessary to bring benefits of economic growth to all areas. Electricity has a great potential to change the moribund economies of underdeveloped and remote regions of our land. The Prime Minister in his Independence Day speech referred to over 18,000 villages which are yet to receive electricity. There are more villages that suffer from inadequate or lack of reliable supply even though theoretically having access to electricity.

Peace and stability are both an outcome and facilitator of economic growth which in turn allow resources to flow into desired sectors that would boost national power and economic growth, such as education, manufacturing, etc. India is urbanizing fast, and half of India might be urbanized by 2050. Energy, food and water threaten to be major concerns as the nation industrializes and population grows. Are our systems adapting fast enough? There is a need for convergence of efforts. Renewables harnessed in an innovative manner can be game-changers in remote areas.

The seminar 'Towards a Sustainable and Affordable Power Sector' is a modest effort by the Foundation to stimulate a debate on various constraints and options before the power sector. The objective of the seminar is to encourage and evolve such policy framework that optimizes the reach of and access to electricity by an innovative mix of energy options that is conscious of the social needs as well. An attempt has been made to convene technocrats, policy-makers, stakeholders, observers and regulators together for a holistic exchange of views. The current constraints of space and time, however, forced the Foundation not to include representatives of some of the major sectors connected with the generation of power.

Meeting the demands of a growing economy of rapidly urbanizing India, a growing population of mostly young people, and the social need of making electricity available to all at an affordable price while keeping

the operations viable are, however, no easy challenges. No single stakeholder can deal with such challenges in isolation. This calls for a transformational change in the manner in which we think and manage such challenges. This will require identifying available resources and leverages as well as obstacles that have to be negotiated.

There is no doubt that giant strides have been made in generation and transmission of power in India but there are serious questions of viability, particularly as one moves down the Generation-Transmission-Distribution chain. Cross-subsidies and pricing are stubborn and complex problems. Perpetually loss-making entities cannot be viable and therefore, pose a threat of a messy future to the sector as a whole in the long term. The sector requires good regulatory governance and legislative support.

The Foundation hopes there will be constructive and free exchange of views amongst the stakeholders in the seminar. Such exchanges of views, expertise and knowledge have the potential of making strong contributions towards developing/promoting connecting principles, and complementary sectoral goals of an overall strategy of providing power to all in a meaningful manner.

Policy Perspectives Foundation

1. Operations improvement in conventional generation

Operational efficiency has become an important area of focus in the light of the new norms in the tariff regulations and for competitive projects to meet investor expectations

Generation sector has been facing multi-faceted challenges both from project execution and operations perspective. During the XII plan progress the country has kept pace with the planned capacity addition program. However, it has been observed that on certain operational performance, the stations have not been able to achieve the desired objectives.

Power sector plays a vital role in growth and economic development of any economy. Realizing its importance, the Government of India has launched several initiatives to foster the holistic development of power sector and committed to provide 24X7 reliable & quality power to citizens at an affordable cost in order to bring about all round development and improvement in quality of life.

The capacity addition target of 118 GW[6] for the XII plan is progressing well with the country adding more than 20 GW a year consistently. Besides, more than 1 lakh ckm of transmission line and 2.8 lakh MVA transformation capacity addition in the T&D segment is being monitored closely. The government has announced several flagship schemes to provide adequate funding to meet these targets. It is worthwhile to note that more than half of these targets have already been achieved in the beginning of 2015. Key schemes include Deen Dayal Upadhyay Gram Jyoti Yojna (DDUGJY) and Integrated Power Development (IPDS) Scheme for rural and urban sectors respectively. These schemes will focus on improving the reliability and quality of power by upgrading and adding new capacity for last mile connectivity.

The Government has also announced a scheme for utilization of Gas based power generation capacity for the year 2015-16 and 2016-17 by supply imported spot RLNG “e-bid RLNG” to the stranded gas based plants as well as plants receiving domestic gas upto the target PLF. The total outlay has been fixed at Rs.3,500 cr and Rs.4,000 cr for the year 2015-16 and 2016-17 respectively[2].

The Government is also gearing ahead to meet the challenges of 1 billion ton of coal by 2019-20. Key initiatives undertaken to realize this goal include

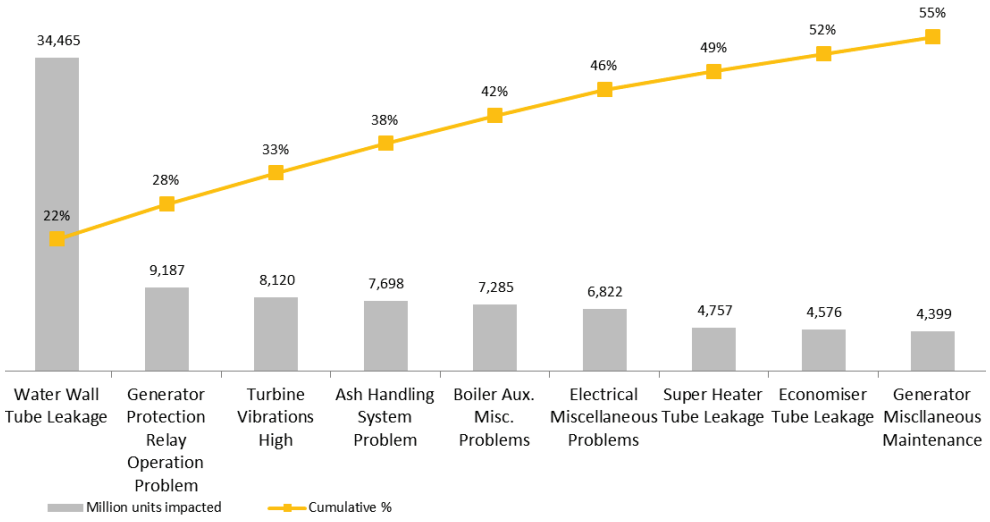
- Setting up of three critical railway lines,
- Switching over to mechanization and technology adoption,
- Contract mining,
- Skill up-gradation,
- Land acquisition and environment clearance and state level clearances.

Focusing on improving the generation can further improve the supply – demand gap and may potentially have an impact on lower operating costs. The energy availability for the country in FY 2014-15 was 1048673 MUs and going forward without further capacity addition would result into energy deficit of 33.6% (10% CAGR – EPS projections) by 2018-19 severely impacting the development agenda.

1 CEA
2 http://powermin.nic.in/upload/Scheme_for_utilization_of_Gas_based_power_generation_capacity.pdf

The performance (as shown below) of coal based power plants for FY15 reveals that around 200 Billion units (BU) of generation got impacted due to forced outages alone (excluding planned outage). Of these outages, 54% are could be reduced through better planning and maintenance.

Figure 5: Key reasons for outages in thermal power plants



Source: EY Database

A reduction of 15-20% in outage hours can be targeted by identifying controllable factors under a focused program In order to unlock the value from operational efficiency following initiatives can be undertaken for underperforming assets:

- Performing MTTR, MTBF and capacity loss analysis to improve plant performance
- SOP benchmarking and refinement along with standardized process checks
- KPI based review of workforce across levels for compliance, usage and understanding
- Feasibility and cost benefit analysis for incorporating new technology
- Inventory cost optimization and norms establishment based on demand and consumption of items
- Implementation of effective maintenance practices to reduce downtime

Initiatives	Potential Impact
Reducing downtime to improve output from existing power stations	- A 15-20% reduction in outage hours can be targeted by identifying controllable factors under a focused program can help generate more than 10 BUs– reducing the energy deficit - A focused approach on cost optimisation covering aspects of procurement, inventory, contract management, logistics and maintenance can further reduce the cost and regulatory disallowances leading to better financial sustainability of the utilities.

A focused program on achieving operational excellence is the required involving all stakeholders. The role of the state/ central government should be to identify focused plants and develop a road-map defining the scope of initiatives, resource allocation, and budgetary requirement to fund the program. The Genco management and respective plant heads may set goals on targeted improvement initiatives and measure the impact of the initiatives at regular intervals. The State/ Central Regulator should be involved an active role in consultative matters on road map and monitoring of the initiatives. The Regulator may consider the results of initiatives to set the performance benchmarks / norms.

2. Transmission sector – The need to catch up

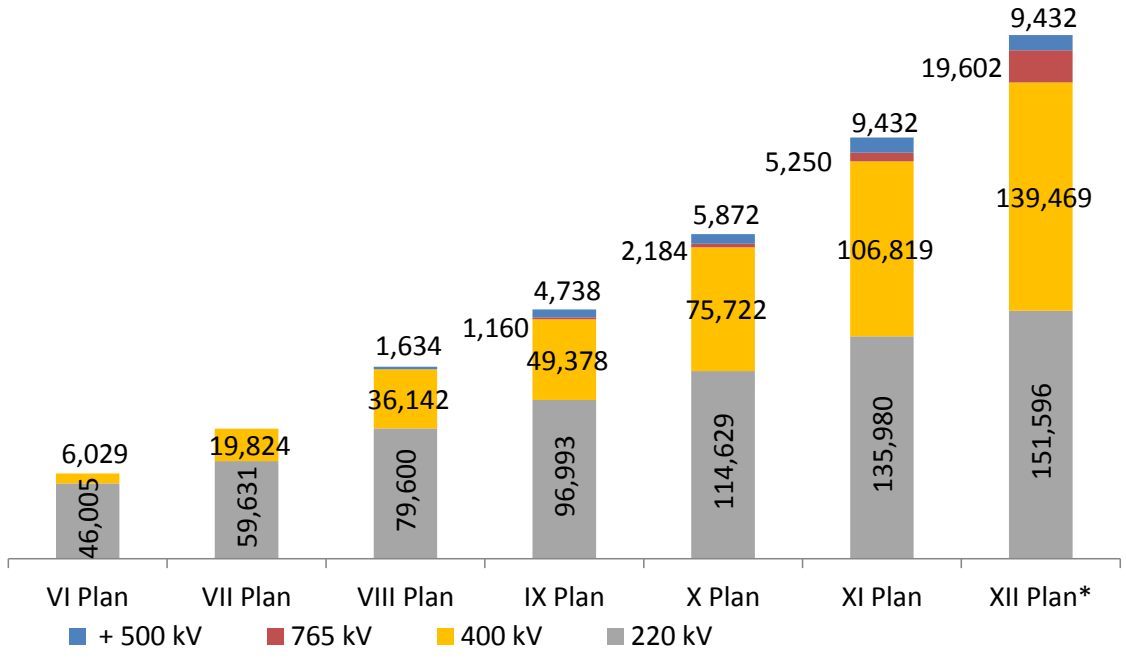
While the generation capacity and the consumer demand has more than doubled over the past decade, the transmission sector has not been able to keep pace with this growth leading to strain on existing resources.

The transmission sector in India has been dominated by the central transmission utility, Powergrid (PGCIL), which owns and operates more than 90% of the inter-state transmission capacity of India. The objective of forming a separate transmission entity has been fulfilled to a great extent, as Power Grid has been instrumental in the growth of transmission system in India. With the commissioning of 765 kV Raichur-Solapur transmission line by Powergrid on Dec-2013, the transmission grid of the entire nation has been synchronized to a single frequency. The interconnection has helped achieving a pan-India synchronous grid of 249GW[3], which makes it one of the largest synchronous operating grids in the world. While the inter-state transmission capacity is under the purview of the PGCIL, the intra-state transmission is carried out by the respective state transmission utilities which have been operating as separate entities in most of the states.

The load dispatch centres (Central, region based and state-wise) help in coordinating the transmission of power on a daily basis across the nation. The regulators (Central and state) assist in developing and enforcing regulations regarding operations, investments in repair and maintenance and charges payable to the state and private transmission utilities.

The Government of India took certain initiatives to facilitate private sector participation in transmission by bringing about certain enabling changes in the legal framework.

Figure 6: Growth in Indian Transmission sector (CKM)



3 CEA

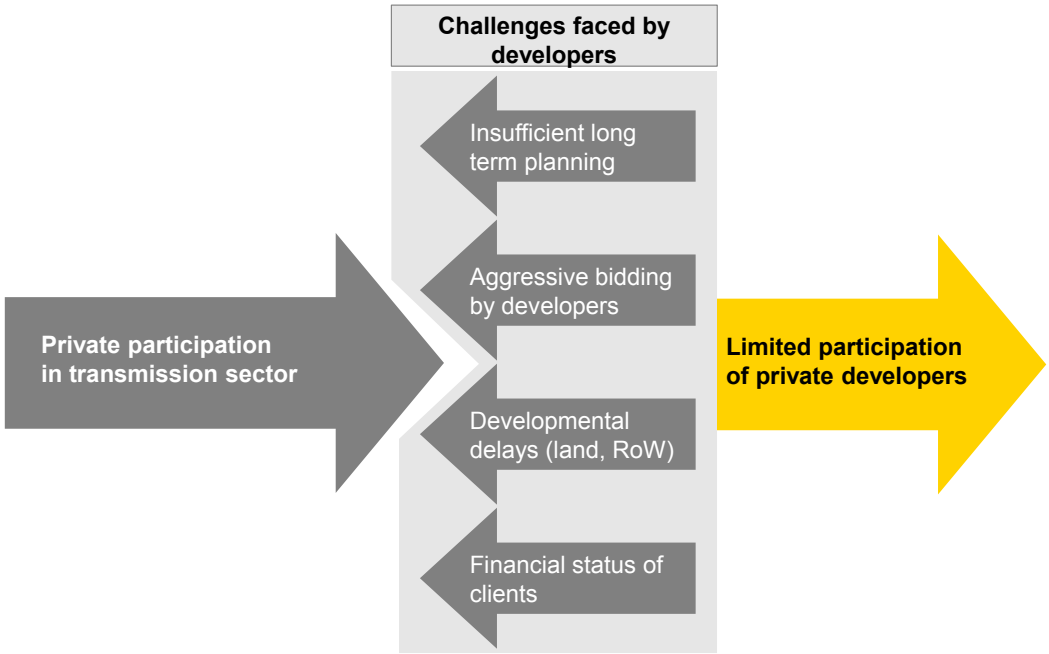
Thereafter, Power Grid Corporation of India Limited, which was notified as a Central Transmission Utility (CTU) spearheaded implementation of a few transmission projects through Public Private Partnership (PPP) model i.e. Joint Venture (JV) route as well as Independent Private Transmission Company (IPTC) route.

Many power generation developers have undertaken transmission projects to ensure timely availability of evacuation infrastructure for their generation projects. Transmission EPC players have bid for transmission projects to build their order books. Private sector investment is still in a nascent stage, with lack of players with a strong/large portfolio.

The need of the hour is the development of transmission system with a reasonable tariff either through tariff based competitive bidding or PPP route. However, the private developers have been facing several challenges which has led to a slow absorption in the Indian transmission space.

Typically, the development of transmission lines is completed before the completion of conventional generation projects. However with the short developmental cycle of renewable projects, the problem in evacuation could get more significant. In addition, the intermittent and distributed nature of renewables poses design challenges for the development of transmission system.

Figure 7: Challenges in the transmission sector



The Union power ministry and the Regulatory Commissions have made several efforts to improve private sector participation (PSP). These include issuance of guidelines for encouraging PSP (Private Sector participation) in the transmission sector; development of the national grid and large capacity dedicated transmission corridors; notification of competitive bidding guidelines and standard bidding documents for selection of private developers through tariff based bidding; streamlining of processes and bringing clarity to issues related to transmission ; grant of connectivity regulations; open access regulations and new transmission pricing (Point of Connection mechanism) to alleviate the accumulation of zone access charges which is also called pan caking.

Non-discriminatory open access to transmission lines has been a key driver for the growth of private generation sector in India as it provides options for the Independent power projects (IPP) to sell power in the open market at market defined rates.

Coordinated efforts is being carried out by Powergrid, respective states and the central government to prepare a framework for a green corridor covering eight potential rich states[4].

Figure 8: Govt. initiatives in the Transmission sector[5]

Current initiatives	Future outlook
▸ The North Eastern Region Power System Improvement Project (NERPSIP) is for strengthening of the Intra State Transmission and Distribution System of NE states at an estimated cost of INR 5,111 cr ▸ Awarded 9 transmission projects under tariff based competitive bidding with value of over INR 12,000 cr ▸ Setting up Power System Development Fund (PSDF) for installation of protection systems in the power grid at a cost of INR 7,500 cr	▸ 20 year Perspective Plan for integrated transmission network ▸ MoEF has modified guidelines enabling private developers to be treated similar to public utilities ▸ Enhancement of payment security and exit routes for BOOT projects ▸ Agreement with Nepal for cross-border transmission of power

In conclusion, the transmission sector forms the backbone of the power sector and a collaborative approach is required between the various stakeholders to realize its full potential as below

Figure 9: Responsibility of key stakeholders

Central Government	► Outlook for transmission sector ► Setting up supporting environment ► Budget allocation
Monitoring Organisations (Regulators and Dispatch Centres)	► Enforcement of non-discriminatory open access ► Determination of charges for State Utilities and PoC charges
Central and State Transmission Utilities	► Bidding and monitoring of projects ► Efficient operations and lean structure ► Inputs and coordination in central planning
Power Generators	► Coordination for development of transmission plan ► Co-development of evacuation lines
Transmission Developers	► Constant monitoring of ongoing projects ► Learning and adopting International leading practices

4 PGCIL, MoP
5 http://powermin.nic.in/overview-1

3. Distribution Utilities – Indian Power Distribution sector is a leaking bucket

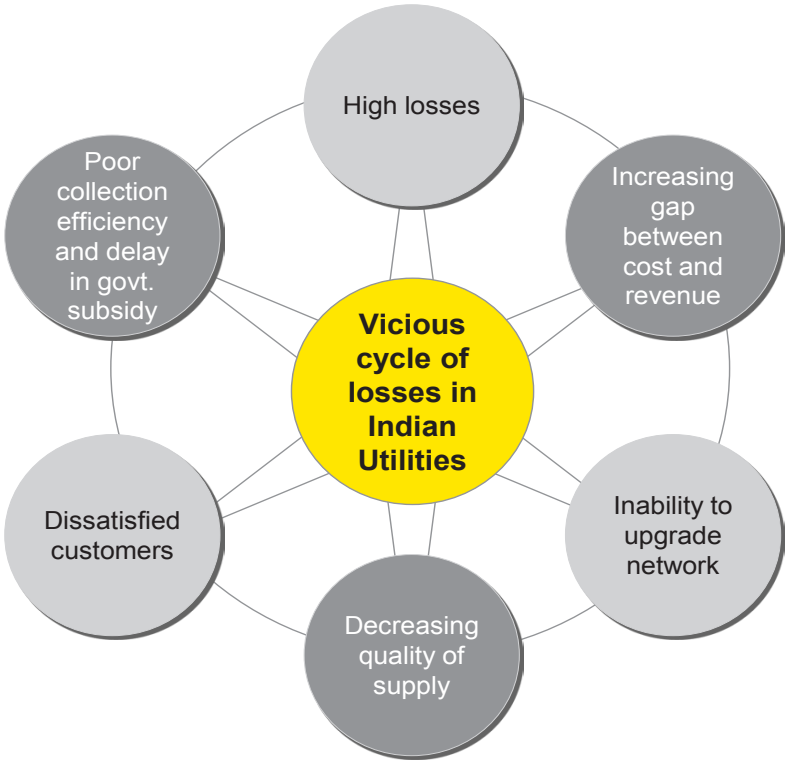
Organizational transformation needs to become the cornerstone on which the sector needs to reinvent itself

Indian electricity distribution companies cater to nearly 200 million consumers with a connected load of about 400[6] GW that places the country among the largest electricity consumer base in the world. The consumers are served by around 73 distribution utilities – 13 electricity departments, 17 private distribution companies, 41 corporatized distribution companies and 2 State Electricity Boards. The nature of relationship includes both licensee as well as Distribution franchisee.

Distribution Sector coverage is urban areas and approx. 97% villages of India. Per Capita consumption is approx. 1000 Units per annum which has been increasing significantly in last 4 years (but still quite less as compared to many other countries). While the country has an installed generation base of 250GW +, still the country faces an average power deficit (August-2015) of ~ 3.6% and a peak deficit of 4.7%[7].

The key issues in the sector can be summarized as below

Figure 1: Financial health of discoms



6 Indianpowersector.com
7 CEA – August -2015

High AT&C Losses: The average AT&C losses in the country are hovering around 24%[8]. Higher technical losses are due to old and dilapidated conductors, longer lines serving distant and remote loads, old and inefficient distribution transformers and incorrect configuration leading to load imbalances. Higher commercial losses are due to power theft, inadequate meter reading, inaccurate billing, low collection efficiency and faulty metering. In the absence of a proper energy accounting and auditing system in place for most of the utilities, the actual figures for the AT&C loss could be higher than what gets reported (especially when agriculture consumption and subsidies are inbuilt as well in the calculations).

Delay in Tariff hike: Even after unbundling and corporatization of utilities, state discoms are under the influence of state governments and hence are unable to recover the cost of supply and subsidy. This delay in getting their dues in terms of proper hike in the Tariff has led to a growing gap between ACS & ARR. Therefore, financial situation of the Discoms are worsening with time.

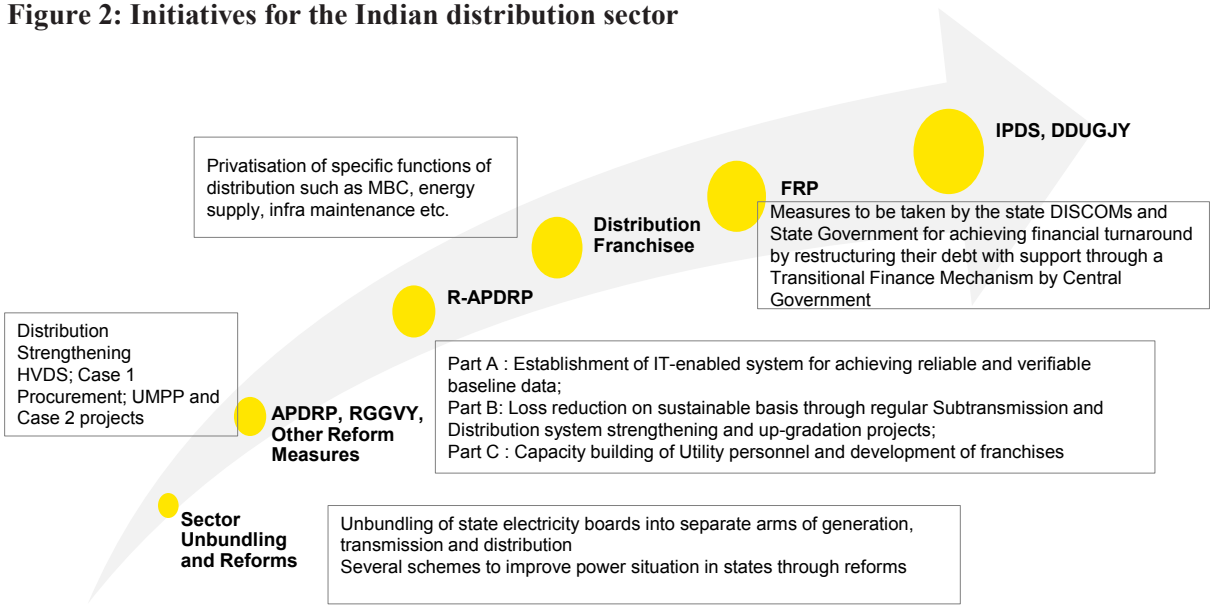
Weak Financial health of Discoms: Govt. Distribution Cos. are sitting on a debt of an estimated 300 Thousand crores (6 Discoms of UP, Rajasthan, Haryana, Madhya Pradesh, Tamil Nadu & Punjab constitute more than half of this amount) which has doubled in last 4 years. Inspite of Govt's various bailouts programs / schemes, financial health of the govt. distribution utilities is still to recover and give confidence to lenders. This has made it difficult to invest in network maintenance and up gradation leading to further deterioration of quality of supply.

Customer satisfaction: Reliable and quality power is not available on a continuous basis beyond the key urban centres in the country. Given the priority of power for all, Discoms are not able to focus on quality of supply and customer satisfaction. This is reflected from the poor SAIFI and SAIDI numbers of most state discoms as compared to private discoms.

Desired benefits of past schemes: This sub-sector has witnessed various investments (loan or grant or combination thereof) in last 5 years like R-APDRP, NEF, RGGVY, FRP, IFI funds. However desired benefits are yet to be realized due to delay / execution issues.

The Central Government, over the years, has taken many initiatives to strengthen the system, improve the financial health of the Discoms and create accountability in Discoms.

Figure 2: Initiatives for the Indian distribution sector



8 PFC report on state utilities – FY13

Integrated Power Development Scheme (IPDS): This is a scheme with a total outlay of Rs 32,612 crore which includes a budgetary support of Rs 25,354 crore from Govt. of India[9].

Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY): Scheme approved on 20.11.2014 with a total outlay of Rs 44,033 crore which includes a budgetary support of Rs 33,453 crore from Govt. of India[10].

National Electricity Fund (NEF): To promote investment in the distribution sector, GoI has set up NEF (Interest Subsidy Scheme) in March 2012 to provide interest subsidy on loans disbursed to the Distribution Companies (DISCOMS) – both in public and private sector, to improve the distribution network for areas not covered by RGGVY and R-APDRP project areas.

Financial Restructuring Scheme: GoI has notified the scheme for Financial Restructuring of State Distribution Companies (Discoms) in October 2012 for achieving their financial turnaround by restructuring their short term liabilities with support through a Transitional Finance Mechanism from Central Govt. UP, Haryana & Rajasthan.

The current state of affairs of the power distribution sector can be attributed to operational lacunae and policy-related deficiencies. Therefore, salvaging the sector calls for a set of time-bound, quantifiable remedial measures, which can help overcome key hurdles, and broad strategies to realize a lasting solution. Notwithstanding, the complexity of the issue and the persistence of the problems over the years, the Discom executives and policy-makers may need to pay attention to less tested fundamental solutions to achieve the results.

Therefore, Discoms should focus on:

1. **Change in mind-set of utilities:** The utilities would need to modify their thinking from a government entity providing a free service to consumers to the practices of a corporate entity which has systematic processes and practices in every aspect of its operations. Such a change will take time and effort to accomplish and due inspiration may be taken from government entities which are operating at an optimum level (such as NTPC, Power grid etc.).
2. **Institutional re-designing:** In the long term, the State governments may explore privatizing some part of electricity distribution. Maintaining status quo of the ailing public units could lead to draining of public funds and devaluation of assets. However, in absence of cost-reflective tariff setting, improved regulatory structure, subsidy realization mechanism and functional autonomy of the sector (i.e., free from governmental interference), it would be difficult to attract interest of private players.
3. **Promoting competition:** The government may explore bringing reforms in the Electricity Act whereby more than one Discom can serve the same neighbourhood and thus, the consumers can exercise their right to choose their distributor. The first step towards this is the separation of carriage and content businesses of the distribution sector. The Ministry of Power has proposed to bring amendments in the Electricity Act necessary to separate distribution and the retail supply business, each having separate license to operate. However, the Ministry can only introduce requisite provision in the Act; the implementation largely depends on the State governments.
4. **Discipline in tariff-setting:** The SERCs should comply with the guidelines of the National Tariff Policy in letter and spirit with regard to fixing tariff. Cost-reflective tariff-setting is necessary to avoid accumulation of revenue deficits. As stated in the Tariff Policy, SERCs should avoid taking into account the subsidies “promised” by the State governments while fixing tariffs unless and until the subsidy is realized by the discoms upfront before the issue of tariff orders. The regulators should also enforce the utilities to meter all supplies so that the appropriate subsidy may be obtained from the state government.

9 http://powermin.nic.in/upload/pdf/Integrated_Power_Development_Scheme.pdf
10 http://www.rggvy.gov.in/rggvy/rggvyportal/memo/DDUGJY-OM.pdf

5. **Appropriate Metering:**

   a. **Feeders Segregation:** It is reported that feeder separation for catering to different power requirements can help regulate power consumption, especially in agriculture. To prevent over usage of irrigation pumps and to limit power demand, currently many State governments have reportedly stipulated a certain hours per day of power supply (3-phase) to the irrigation pumps with a cap on the rated capacity of the pumps.

   b. **Establishment of effective "Revenue follow-up" cell:** While Metering and billing are done to whatever accuracy, it is equally important to have a focussed revenue follow-up cell to

      i. Identify revenue leakage through analytics,

      ii. Clear strategy and accountability to tap these leakages on a sustainable basis,

      iii. Strengthen vigilance to create a culture (internally as well as externally) of timely and appropriate payment recovery.

   c. Pre-Paid Metering & Smart Metering: Under smart metering, Discom can monitor the actual level of losses at real time basis and can take a corrective measure on real time basis. This will also help the utility for proper load forecasting and load management. The availability of data from smart meters will also help the utilities respond more efficiently to the changes in consumption pattern and design tariff schemes to incentivize (and discourage) certain behavioural patterns. Under, Pre-paid scheme, a low income household can claim free credits in a month which will allow it to draw electricity up to the monthly threshold (entitlement) of free electricity; however, the household will be allowed to draw power beyond the threshold of free electricity if the former is willing to buy credits for its total monthly consumption. Thus, the mechanism will allow the government to provide subsidy to households up to a stipulated consumption.

6. **Reduction in cost of operations:** Establishment of power procurement portfolio whereby enough intelligence and tool is available to purchase power at an optimal cost on short / medium as well as long term basis.

7. **Identification of non-regulated revenue opportunities:** So as to improve the bottom-line. This will ultimately benefit all the stakeholders like consumers as well as utilities.

8. **Creating public awareness:** Informed consumers are the key for quality service delivery in an economy. Public participation is central to make the aforesaid strategies and measures effective which necessitates strong and apolitical public awareness programme, especially since tariff has been a contentious issue in political circle. The regulatory commissions should make use of the electronic and print media and information technology to reach out to the consumers to let them know the true cost of power and the impact theft and pilferage would have on their electricity bills. The government may stay away from such public awareness programmes to avoid politicization of the issue.

4. Telangana Power Sector

The state of Telangana has set a mission to ensure 84,496 MU is available to the people of Telangana by FY 18-19 on 24X7 basis. By systematic planning of power procurement, reduction in outage hours of state generating plants and focusing on renewable energy, Telangana can address its supply side challenges within 2 years.

The newly formed Telangana state has embarked on a journey to provide quality power and committed to provide 24X7 reliable & quality power to all consumers at an affordable cost in order to bring about all round development and improvement in quality of life. However, they have also inherited the challenges faced by the erstwhile Andhra power sector i.e. supply-demand gap, high financial losses, delays for under construction projects.

Leveraging on central schemes such as IPDS and DDUGJY will provide Telangana with opportunities to improve the financial position of its state distribution utilities and allow it to focus on newer technologies such as smart grid and analytics to further improve its revenue.

Fuelled by growth in demand from agriculture, domestic, industrial sectors and metro city of Hyderabad, the per capita consumption of Telangana state stands at ~1,350 units against a national average of 1,010 units in FY 2014-15. The state expects the energy requirement to increase substantially over the next five years mainly by increase in domestic consumption and increase in economic and industrial activities in the newly formed state.

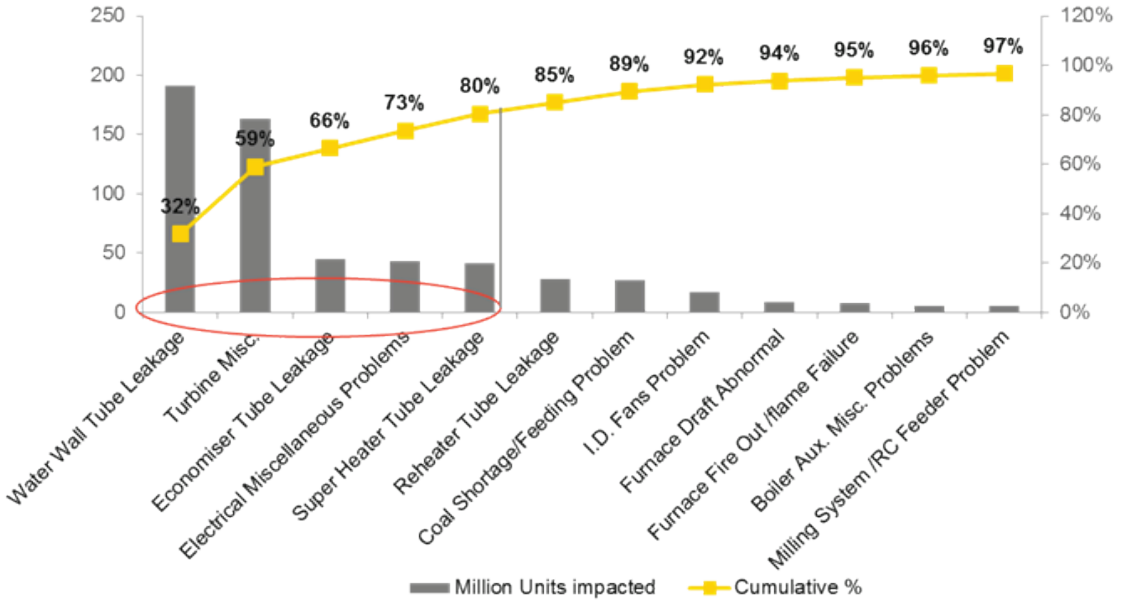
Measures such as capacity addition, continuity of PPAs, coal supply enhancement from SCCL, efficiency improvement of generation sector, access of international coal assets, linkage rationalization, mine developer & operator route, have been proposed to meet the energy requirement of 84496 MUs on 24X7 basis and reduce energy deficit to ~9% by FY 18-19. Focusing on improving the generation can further improve the supply – demand gap and may potentially have an impact on lower operating costs.

Figure 10: Focus areas for the Telangana power sector

Perspective	Targets
Distribution	▸ Phasing out of **19.2 lakh mechanical meters**. ▸ Smart meters on **16 lakh three-phase connections**. ▸ HVDS implementation to cover **19.1 lakh agri consumers** ▸ Comprehensive MDAS in remaining towns ▸ Target of **10% of total supply on a pre-paid arrangement** ▸ **SCADA at 11KV level**
Supply Side	▸ NCE to contribute around 7,529 MU in FY 19 (**8% of energy available**) ▸ Capacity addition of **7,280 MW is planned** by TSGENCO ▸ SCCL target **113 MT by the year 2017**
Transmission	▸ Transmission corridor augmentation to ensure evacuation from upcoming generation centres **should be monitored proactively**
Energy Efficiency	▸ Reduce peak demand through customer awareness and differential tariff during peak hours.

The performance analysis (as shown below) of coal based TSGENCO power plants for FY15 reveals that around 602 MUs are impacted due to forced outages

Figure 11: Key reasons for outages in TSGENCO



Outage analysis in FY 15 shows ~21% (indicated in red above) of problems are contributing to 80% of impacted million units for TSGENCO plants. A 15-20% reduction in outage hours can be targeted by identifying controllable factors under a focused program can help generate more than 250 Mus – reducing the energy deficit.

Portfolio Optimisation and Continuity of PPAs Due to Expire in Next 5 years

There is potential to reduce the costly purchase and bundle the requirement in long term tenders. Contribution of the expiring PPAs to the cost of supply should be taken into account while renegotiating. More than 400 Mus in the current merit order stack is being procured at more than Rs.5.00/kWh. Telangana may also consider substituting these with long term procurement.

Energy Efficiency: Efficient street lighting offers a potential to save 700 Mus by 2018-19. Use of efficient lighting infrastructure could help reduce the energy usage between 25-60%. Appropriate measurements before tendering will help faster implementation.

Renewable capacity addition: There is a significant potential for renewable in the southern districts of Telangana. A total solar potential of 2500 MW can be realized over the next 3-4 years. Rooftop PV can also be used to boost energy supply in urban areas. Solar pumps can help alleviate the financial crunch of paying subsidy to the discoms on account of agricultural consumers.

The newly formed state of Telangana has immense potential and learning from past experiences to embark on a truly transformative journey to become one of the leading lights in the Indian power sector.

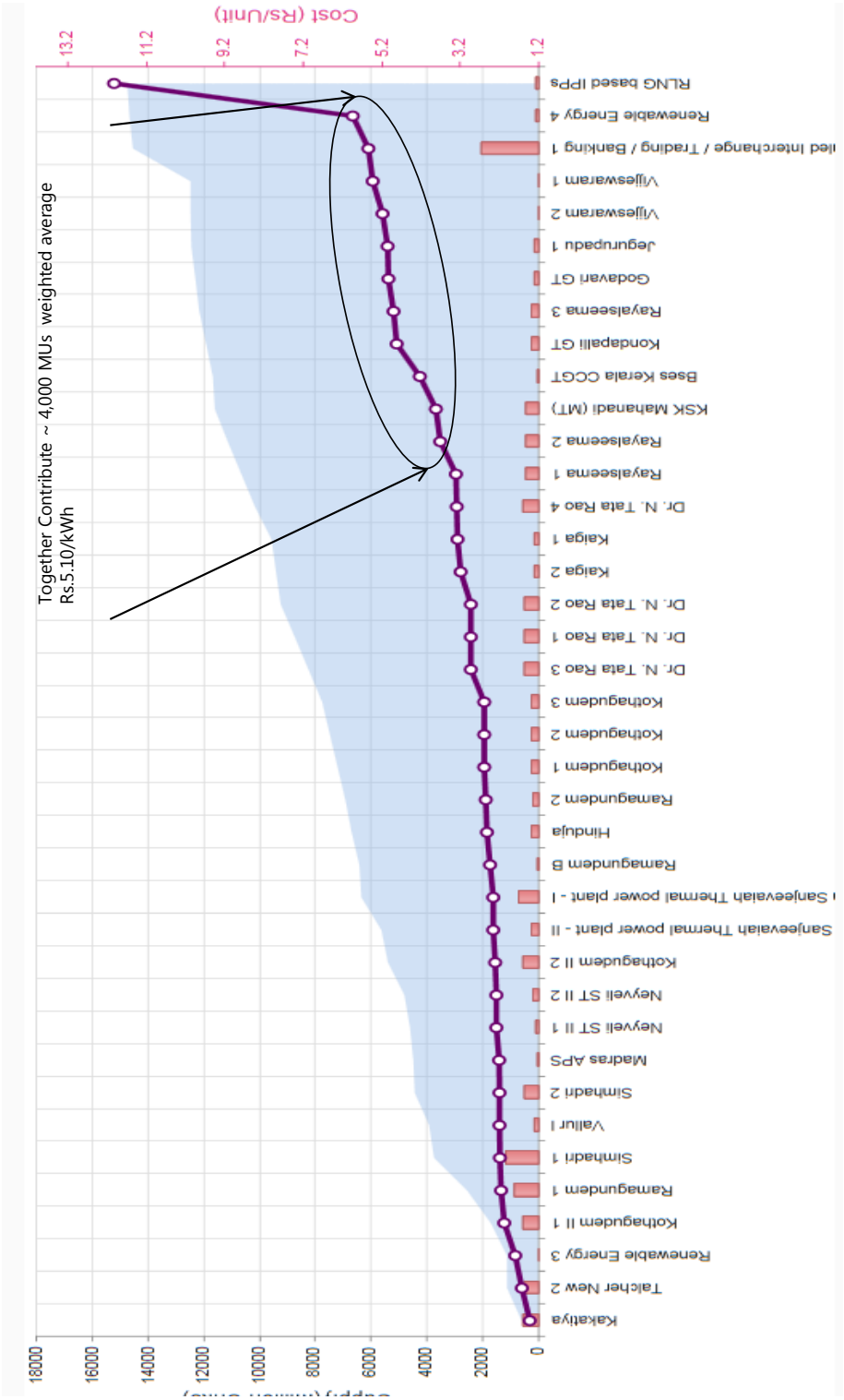


Figure 12: Merit order of Telangana power sector

5. Social aspects

Any discourse on energy security usually looks at the big picture. At the other end of this energy debate continuum lies the question of access to energy in its commonest form—that is electricity at the ground level. India has no doubt made tremendous progress in this sphere from the time the first power plant was set up in 1889 at Calcutta, just a few years after Edison started the first power plant in the US in 1882. India's electricity generation capacity in 1947 was a mere 1,362 MW which has now increased to 250 GW. India's power generation capacity was inadequate in 1947 and it is inadequate now. India is still struggling to provide adequate and reliable access to electricity to its citizens. Increasing demands from a growing economy, rapid urbanization and increasing population have absorbed most gains, with constant hunger for more electricity.

India has the fourth largest grid in the world and yet the per capita consumption of electricity is about one-third of the global average. A combination of 'Access' and 'Consumption' metrics reveals the lack of penetration by the power sector. Data reveals that nearly 80 million Indian households lack access to electricity. Roughly half of India will be urbanized by the middle of this century, but a large part of the country will still consist of rural and semi-urban areas. Estimates put the number of villages that are yet to be electrified at 18,500. Remoteness and constraints of geography hinder the linking of a large number of villages to the grid. There is pressing need to align policy regarding the power sector and other sectors related to rural development for a just and equitable solution to bring tangible benefits to neglected communities. Rapid rural electrification does not necessarily translate into higher consumption of electricity. Despite greater rural electrification, old disparities persist. This form of energy poverty denies those affected, their fair share of economic growth including livelihood, education, healthcare, etc.

Systemic attention to evaluate and expand the social impact of the power sector is necessary. India's achievement in pulling people out of poverty has been tremendous in absolute terms, yet the number of poor remains unacceptably large—in fact it is larger than the population of some of our immediate neighbours and other nations of the world. The presence of disadvantaged people in such large numbers is a source of social discontent. It is not a mere coincidence that most traditional pockets of social discontent are poorly or inadequately served by electricity. In fact even proximity to the grid alone does not assure access—several other factors including affordability come into play—which is true for both urban and rural areas. Some of these areas have unsurprisingly emerged as breeding grounds for various forms of social discontent with many getting attracted to toxic ideologies based on armed violence. It is worrisome that the geography of economic growth in India and incidence of social discontent are following different trajectories. India's national well-being is threatened by regional inequities in growth. Social discontent breeds easily under conditions of deprivation and faltering rural economies. The power sector can and must play a critical and pro-active role in transforming backward and underdeveloped pockets which are entrapped in poverty and consequential social discontent. The need for increased road connectivity in remote and discontent-affected areas are justifiably and frequently heard but equally important is to cover these areas in a meaningful manner with reliable and adequate electricity supply. Iniquitous development unless arrested speedily may lead to a new and differently stressed landscape of megacities/cities/towns/urban agglomerations and rural hinterland with pockets of marginalized communities.

India's population will surpass that of China in the latter part of the next decade and double itself in the second half of this century. In this context economic growth and job creation assume criticality to absorb ever-increasing numbers of youth in gainful employment and again the power sector can play a vital role. According to a projection in 'Integrated Energy Policy' (IEP) of the Planning Commission of India,

the nation will require generation capacity of 780 GW to meet an expected peak demand of 592 GW by 2031-32. There is a need to align policy efforts with our projected requirements as the growing population, economy and industry require larger inputs from the power sector.

There do not seem to be any simple solutions to enable sustainable electricity supply although renewable energy can play a big role in the hinterland with its relatively greater capacity to create jobs. Innovative thinking is needed to kick-start the rural economy through decentralized generation including standalone renewable energy generation. This can help power the local economic activities complemented by solar-based stand-alone home lighting systems to meet requirements of households. Such utilities can do so in a sustainable manner and contribute towards local skills training and kick-starting economic activities. Mini grids based on renewable energy are also an option. There have been such initiatives in Chhattisgarh, Ladakh and Uttarakhand and the results are encouraging. Both innovation in mixing different forms of energy and innovative financing will be required to make this sustainable. Promoting community ownership of renewable utilities through the PPP model with private entrepreneurs and local self-governments like Panchayats, etc., may have to be encouraged. Solutions will vary between states, depending on their terrain and need. Such efforts will also need robust national and state-level coordination to enable cross-sectoral collaboration.

Our policies must be aligned in full recognition of this need. A composite approach drawing upon a still greater degree of cross-sector complementarity will lead to optimal utilization of scarce national resources, avoid duplication, encourage local entrepreneurship and boost economic activities at the local level. An integrated approach will therefore be crucial. Bringing the various power ministries under one umbrella has been a welcome step towards developing a focussed strategy to cope with underdeveloped pockets. It is a good beginning but a lot more work needs to be done in terms of aligning various components of this sector into an inter-linked lattice of appropriate legislative and procedural linkages. At the end of the day, cold statistics should not measure achievements—impacts on the socio-economic well-being of the people should be taken into account.

6. The regulatory journey in Indian power sector

The regulators play a key role in complimenting the policy-makers by framing guidelines, enforcing them on the utilities and safeguarding the interests of the consumers

The electricity regulatory commissions with the exception of Orissa State Electricity Regulatory Commission which was set up earlier in 1995 were created subsequent to enactment of Electricity Regulatory Commissions Act, 1998. This was later replaced with the Electricity Act of 2003 which gave significant powers to the central and state regulatory authorities to set up and regulate the various aspects of the power sector.

The CERC (Central Electricity Regulatory Commission) regulates tariffs for Central Government-owned generation companies, inter-state transmission and grant licenses for inter-state transmission and trading. The respective state regulatory commissions, determines tariff for generation, transmission, wholesale and retail in a state and issues licenses for intra-state T&D and trading. The Forum of Regulators (FOR), is responsible for harmonization, coordination and ensuring uniformity of approach amongst the different Electricity Regulatory Commissions across the country.

Though, the regulatory mechanism has been in operation for more than 15 years, they continue to face certain challenges due to insufficient standardization and manpower availability.

Interests of the consumers vs. competition: The electricity regulatory commissions face a daunting challenge in undertaking their responsibilities and functions given the current financial problems of state distribution utilities and SEBs as well as the planned expansion of the power sector. It is necessary to attract investments and ensuring reasonable tariffs for the consumers.

Enforcement of regulations: While the EA 2003 states that the regulator has powers to suo-moto determine the tariffs and to enforce regulations on the utilities, most of the state regulatory bodies have not enforced them in spirit.

Integrated approach: As Electricity is a concurrent subject in India, several state regulators utilize varying methods to estimate key factors to determine various aspects of tariff such as loss trajectory, fuel pass through charges, cross subsidy surcharge etc. The unavailability of a single approach leads to differential tariffs across different states.

Estimation of unmetered sales: Since many States have still not achieved 100% metering at the end consumer level, determination of unmetered consumption (specifically for agricultural consumers) becomes critical. Most of the SERCs have followed different methodology/norms for determining the agricultural consumption. This delays the process of subsidy release further impacting the financial situation of the utilities.

Segregation between wires and supply charges: As the distribution utility is responsible for both maintenance of the network and supply of power, several costs are shared by both the wires and supply functions. With the advent of open access and its implementation, it is important for the regulators to

segregate the costs of both the wires and supply so that the costs of supply are not loaded on the network tariff (Wheeling charges) and vice-versa. As there are no standards on the maintenance of separate accounts, there is no single approach to calculate these charges.

Manpower and capital availability: Availability of manpower to discharge the duties has been a key challenge as several key positions in many utilities remain vacant due to unavailability of qualified personnel. The central government has recommended amendments to the Electricity Act 2003spanning across various sub-sectors to improve the health of the sector.

Operations of state regulatory commission

- Expeditious disposal of tariff petitions by regulators
- Review of performance of regulatory commission by a peer committee
- Interim nomination against vacancies in case of delay of more than 5 months in the appointment of Chairman/ members of the regulatory commission

Tariff determination

- Provision for suo-moto proceeding for determination of tariff to be implemented more strictly
- Changes to the tariff policy to encourage more competition in power distribution

Reforms in distribution sector

- Unbundling of the distribution sector and separation of wires and supply business
- Tariff for consumers not to be regulated – only ceiling tariff to be set by regulators

Penalties and grid security

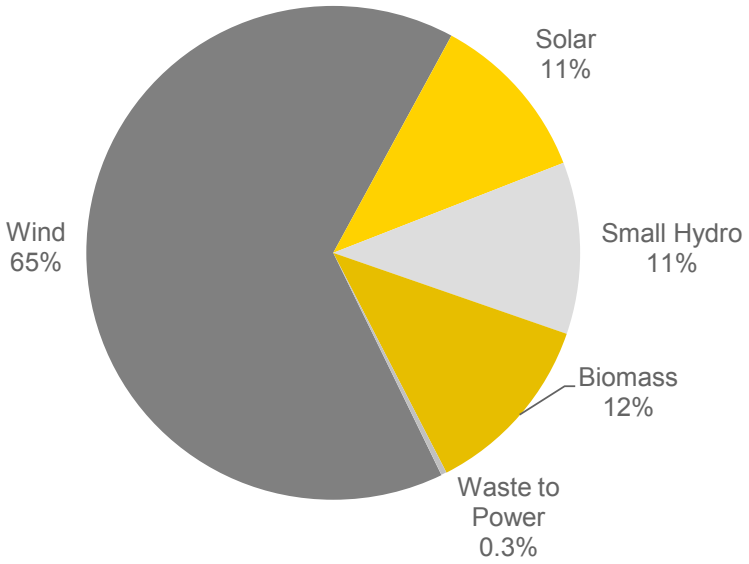
- Stricter penalties for failing to meet Renewable purchase obligations
- Introduction of renewable generation obligation
- Increase in penalty for non-compliance of orders relating to Grid discipline

The regulatory oversight in the Indian power sector gives a voice to the consumers and these proposed amendments can realize its true potential only if they are upheld in the right spirit by the regulators in a concerted effort.

7. Renewable energy - India's sunrise sector

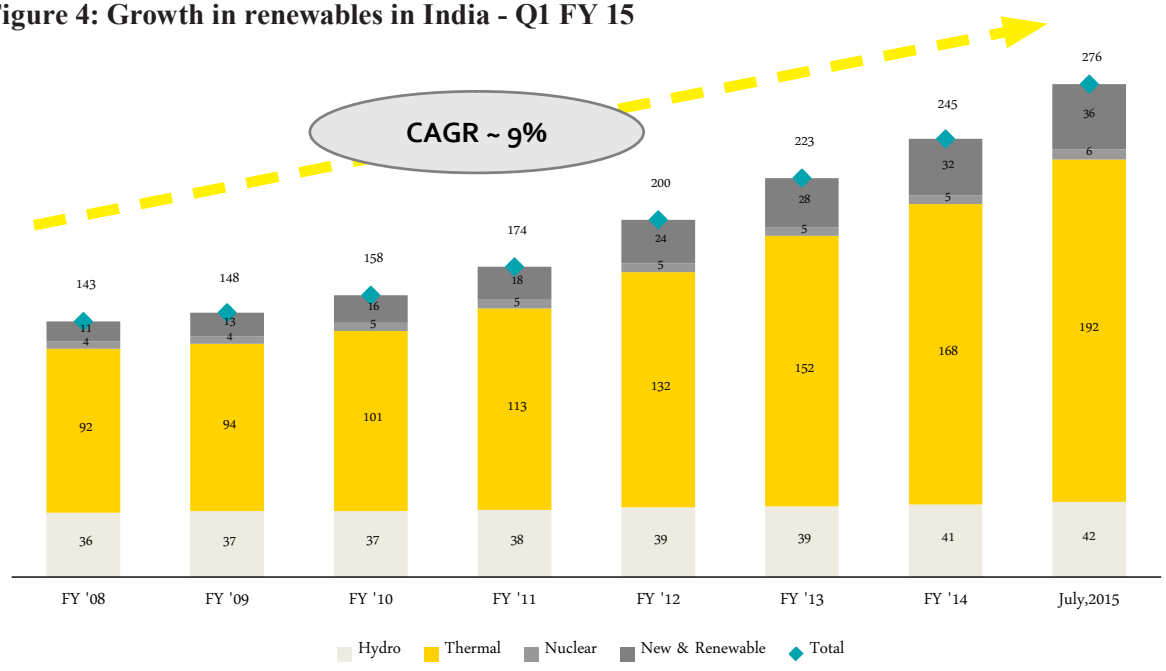
India is investing in clean energy- Solar and wind to increase power generation, reduce its reliance on fossil fuels and in turn create a better living world

Figure 3: Split of renewable energy in India - Q1, FY 15



The renewable energy market in India has grown significantly in the last decade. With increased awareness on climate change and its implications, there has been a determined effort in the country to utilize renewable sources of power generation to meet the energy requirements of the country and plug the deficit. This is evident from the fact that the share of renewable energy in the country's total energy mix has increased from 8% in 2008 to 13 % in 2015.

Figure 4: Growth in renewables in India - Q1 FY 15



The government has laid a target of achieving solar installed capacity of 100 GW and 60 GW of installed wind capacity by 2022. From the demand perspective the target seems right on the mark with energy deficit of 3.6% and peak deficit of 4.7% in 2014, but the implementation has its own set of challenges.
The key issues and challenges faced by the renewable energy sector can be classified across these major areas

Transmission bottlenecks – RE sources are typically located in areas far away from load centres and hence require significant investment in transmission infrastructure to evacuate power. We have seen this happen in Tamil Nadu to a certain extent. The transmission infra adds to the cost and is often seen as hindrance to timely commissioning as transmission projects have significantly longer construction periods than solar / wind projects and can lead to stranded assets if not properly planned. The green energy corridor is currently being planned to address these concerns but challenges to its financing remains. Many more such corridors would be required if renewables has to play a significant role in the country's energy mix.

Cost factor – Currently the cost of renewable procurement is higher than conventional power. While the costs are moving towards convergence ("grid parity"), the fact is that at the moment utilities may be required to pay a premium for renewable power which would place an additional burden on utility finances. This is not expected to be a factor in the long run but without any motivation at the moment (with RPO enforcement being slow), some utilities have expressed reservation to pay higher costs. Recent reverse auction for solar capacities in Punjab and other states has demystified this viewpoint though to a large extent.

Intermittency and Grid integration – RE power by nature is intermittent in nature (except biomass). This places the need to create adequate backup to meet variable generation. Additionally the variance could also pose problems to grid stability once renewables acquire significant scale. Currently this is not a big problem but may become one in the future unless redundancies are built into the system which would entail further costs.

Long term performance – Most of the renewable plants (especially solar, which is going to be the most dominant RE technology going forward) have a very short operational history in India which maybe a risk going forward especially as some developers may have compromised on quality to enhance competitiveness which can create problems for the long term viability of the sector.

Land Acquisition – RE technologies typically require more land than conventional projects. Given the current challenges around land procurement in the country, this is one area which has the potential to delay projects significantly and be a significant cause for concern for the sector.

Financing – The large amount of credit extended to the fossil fuel based power sector has caused banks to reach their respective exposure limits thus limiting their appetite for renewable energy projects. Banks are uncomfortable to finance renewable sector as they feel it is subsidy driven and are not too sure of the ability to generate cash flows. The limited bandwidth of the utilities to procure renewable power and also the risk of payment from them to the developer poses risk in financing renewable projects. Recognizing renewable as a separate segment for lending is needed.

To alleviate a few of the issues faced by the developers, the policy-makers have developed a few initiatives for the renewable sector.

The 100 GW Solar Scheme: The push from the government to increase the share of renewables in the energy mix and setting up of targets has resulted in commitment by a number of private and government companies, lending institutions to invest in clean energy.

Make in India Initiative: This along with “Make in India” has led to Several foreign firms are tying up with Indian firms to build solar manufacturing capacities in India. This augurs well for the Indian solar and renewable sector. While the case has recently been lost at WTO from DCR (Domestic Content Requirement) perspective but still there is a chance to go to next level.

State level policy push: A number of states have also come forth and have come out with their renewable policies so as to provide headway to private players who are keen to invest in the sector in the states. The states assist the developers in procuring the permissions and complete the process required to set up a power plant.

Financial benefits for setting up renewable capacities: To aid the environmental impact of renewables and to hasten its adoption, the Government has also announced several financial incentives such as accelerated depreciation, generation based incentives, Tax incentives for import etc.
Regulatory interventions: The government has also set out broad targets for adoption of renewable technologies by state utilities and large consumers. The regulators have also been active in setting out regulations for net metering and distributed generation thereby aiding the growth of off-grid renewable solutions.

India’s commitment to add sizable amount of renewable capacity needs adequate policy and regulatory support. The investments to support the target will require funding not only from conventional sources but also from innovative means such as green bonds, and other instruments which can provide low cost debt finance from global development banks. The amendments to Electricity Act, if carried out, which talk about stricter imposition of Renewable purchase obligations and mandatory setting up of renewable capacities by thermal sector players will also be a step in the right direction.

NHPC Limited

North Eastern Electric Power Corporation Ltd.

Bharat Heavy Electricals Limited

Techno Electric & Engineering Company Ltd.

GMR Group

Design and production:
Magnum Custom Publishing
New Delhi, India
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