Electric Power and
Natural Gas Practice

Powering India

The Road to 2017

McKinsey&Company

Executive Summary

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Rapid economic growth has increased the burden on India's infrastructure, one of the country's weak spots. An infrastructure deficit is widely considered to be one of the factors that could severely impede India's economic growth. In the past few years, policy makers have recognized this and have made concerted efforts to accelerate infrastructure development.

Much progress is evident in sectors like telecommunications, roads, airports and ports. But the power sector continues to lag behind despite the introduction of progressive measures. Shortages, tariffs and the dependence on imported fuels are on the rise, while the poor health of distribution continues to inhibit the inflow of investments. Unless this changes, India's economic growth will be at risk.

India's power demand is likely to cross 300 GW, in the next 10 years earlier than most estimates. Meeting this demand will require a fivefold to tenfold increase in the pace of capacity addition. The profile of planned capacities will also need to be suitably modified to fulfil peak demand, keep emissions under check, reduce dependence on imported fuels and provide affordable power. A step-up of this magnitude is unlikely to materialise with a traditional approach. A radically new approach is required.

A RADICALLY NEW APPROACH IS REQUIRED

In the past five years, strategic measures such as the Electricity Act 2003 and the Ultra Mega Power Projects (UMPPs) have been introduced, and a number of administrative steps, like tripartite agreements between the central government, central generators and the states and recapitalisation of State Electricity Boards (SEBs) have been taken to unleash the potential of the power sector. Though progressive and necessary, these measures have been insufficient.

By 2017 demand will be substantially higher than expected

Our analyses suggest that if India continues to grow at an average rate of 8 per cent for the next 10 years, the country's demand for power is likely to soar from around 120 GW at present to 315 to 335 GW by 2017, 100 GW higher than most current estimates. Four key factors will drive this demand: (i) India's manufacturing sector growing faster than in the past; (ii) residential consumption growing at 14 per cent over the next 10 years; (iii) the connection of 125,000 villages to the grid

through several programmes that aspire to provide power for all by 2012; and (iv) the realisation of demand supressed due to load shedding.

India's pace of capacity addition must increase fivefold to tenfold

To fulfil its power requirement of 315 to 335 GW by 2017, India will require a generation capacity of 415 to 440 GW, after adjusting for plant availability and a modest 5 per cent spinning reserve. This implies a tripling of installed capacity from the current level of about 140 GW, which, in turn, translates into an annual addition of 20 to 40 GW. This is fivefold to tenfold the 4 GW per year that was achieved in the last 10 years.

Furthermore, an evaluation of India's projected profile of capacity addition suggests that much needs to be done to alter the mix. In particular, India needs to shift its predominant focus from building base-load plants to a more balanced mix of base-load and peaking plants. This is imperative in order to ensure that the country can meet peak demand. Further, the current plans will significantly increase emissions, double India's energy imports, and increase input cost volatility.

The magnitude of the task at hand shows that piecemeal measures will not be enough. To achieve this quantum of increase in the pace of capacity addition, and to suitably modify the profile of fresh capacities, India needs to adopt a radically new approach. The 10-point programme presented in this report is our view of the comprehensive set of measures necessary to transform the sector.

A 10-POINT PROGRAMME

Our study and discussions with stakeholders—private and public-sector players, government officials across the centre and states, regulators, fuel suppliers, financers and other infrastructure providers—suggest that four issues plague the progress of the power sector: viability and market risks; a slow pace of capacity addition; inadequate fuel supplies; and operational inefficiencies. The 10-point programme described below aims to address these issues.

Address viability and market risks

To keep pace with soaring demand, India's power sector will need investments of about US$600 billion or Rs 24 lakh crores by 2017. Raising this amount of capital will require financially viable projects, which in turn, will entail addressing distribution and market risks. The first two elements of the 10-point programme focus on addressing these issues:

1 **Reduce AT&C losses to 15 per cent by 2017.** This can be achieved by systematically implementing a series of distribution reforms, including separating agricultural feeders that allow SEBs to distinguish agricultural from non-agricultural supply; partial or complete privatisation of distribution circles in tier 1 and tier 2 cities; lowering industrial tariffs by driving open access and setting up multi-year loss-reduction targets for SEBs and franchisees; using modern technologies, e.g., smart cards, to limit theft and target subsidies to agricultural consumers and consumers below the poverty line; and building consensus among stakeholders on loss-reduction measures.

2 **Create market mechanisms.** Two measures necessary to stimulate investments, especially in peaking plants, are creating a deep and well-functioning wholesale electricity market and introducing multi-year differential peaking tariffs. Investments in peaking plants are vital for India to meet its potential peak deficit of 70 GW by 2017.

Accelerate capacity addition

It takes five to six years to build a thermal power plant in India in contrast to two to three years taken in China, and less than four years in most other countries. Delays in acquiring sites and obtaining necessary approvals, as well as equipment shortages and EPC bottlenecks are constraining the pace of capacity addition. Continued global tightness in capital equipment is resulting in further delays. To accomplish a step change in the rate of capacity addition, it is imperative to:

3 **Prepare and bid over 140 project sites by 2012, with end-to-end approvals in place.** These project packages must include land with access to water, basic connectivity and site-related approvals.

4 **Create 30 GW per year capacity for equipment manufacturing and related supply chain.** To accomplish this, it is necessary to augment manufacturing capacity and standardise plant modules. This will also require reviving mothballed component capacity, unshackling PSUs by revamping internal approval norms and encouraging participation by local and international players.

5 **Train and develop 300,000 skilled and semi-skilled workers.** Resolving the severe shortages in manpower will require a host of new training and development service providers. The government can help by strengthening the Industrial Technical Institutes (ITIs), setting up certification standards for a range of roles, enabling public-sector companies to expand their training programmes and encouraging new entrants into training and development.

Secure fuel supplies

Though India has the world's fourth-largest reserves of coal, and has recently made gas discoveries that are notable even by global standards, inadequate fuel supplies are constraining the growth of its power sector. In the past few years, India's fuel imports have increased substantially and are likely to continue to do so if the current situation prevails, subjecting electricity prices to volatile international fuel prices and shortages. To deal with this problem, the government needs to:

6 **Accelerate captive mine development and create the requisite infrastructure capacity for 100 MMTPA of coal imports.** This entails levying higher penalties and enforcing deadlines similar to NELP for already allotted captive coal blocks, and streamlining the approval processes across multiple agencies in the central and state governments; and setting up an independent body to approve mine development plans. Meanwhile, it is imperative that efforts to deregulate the coal sector continue.

7 **Secure natural gas supplies for peaking plants.** This must be done by reviving LNG projects and making regional pipelines a strategic priority, building fertiliser plants in the Middle East, and examining the possibility of accessing ship-based supplies of compressed natural gas.

8 **Launch a renewable energy programme to generate 30 GW by 2020.** In particular, the focus of this programme should be on solar power by accessing international capital, and on biomass by devising viable business models to promote the use of this renewable source.

Improve efficiencies

Adding capacity alone will not suffice as a response to India's soaring demand for power. International and Indian experiences confirm that demand-side management (DSM) can reduce electricity consumption and operational measures can substantially improve the productivity of existing assets. To achieve these goals India must:

9 **Create an action plan for an over 10 per cent gain from DSM.** The plan should include the following initiatives: (i) mandating consumption standards and standby power standards for consumer durables; (ii) replacing incandescent lamps with CFL bulbs; (iii) establishing and enforcing energy-efficient standards for new constructions; and (iv) introducing real-time metering for heavy users.

10 **Extend the PiE programme to realise an additional 7 GW by improving the productivity of existing generation plants.** The programme has been limited to a few plants and has been successful where implemented. However, it has not

been crafted to attract private participation. To do so will require devising a profit-sharing model, which allows the profits earned from incremental generation to be shared between state-owned generation companies and private players.

The 10 point programme could transform India's power sector and accelerate economic prosperity. However, the current governance structure and mechanisms need to be strengthened to ensure its successful execution.

Strengthen governance to drive implementation

Accountability for the power sector is currently fragmented. Discussions with policy makers and the industry highlight the need for an empowered and accountable leadership group that can effectively steer the development of the sector. Based on past experiences, one of the following models, or a combination of them, may be optimal:

- **Strengthened Energy Coordination Committee (ECC)** to facilitate decision making on important matters pertinent to energy and to debottlenecks key issues.
- **Empowered Group of Ministers (EGoM)** could be an effective way to bring together multiple ministries at the central government and to invite relevant participation from states.
- **Cabinet Committee on Energy** that draws participation from the power, oil and gas, coal, foreign affairs, shipping and finance ministries.
- **National Power Commission** with the necessary resources and control over relevant agencies and PSUs could be an effective option.
- **Integrated Energy Ministry** whereby the responsibility for all energy-related issues are integrated within a single ministry.
- **Independent nodal ministry or agency** like the Planning Commission or Ministry of Finance that assumes responsibility for monitoring, reviewing and debottlenecking the sector.

Notwithstanding the governance model adopted, the leadership group will need to deal with a complex range of issues and manage multiple conflicting interests at the centre and state level. The charter of this group should be to ensure the successful execution of a comprehensive programme by focusing on the following three elements:

- **Improve the effectiveness of review and monitoring mechanisms.** To ensure efforts translate into visible results, a comprehensive five-step mechanism to review and monitor the progress of the sector is critical. First, conduct regular and cascading reviews on weekly, monthly, quarterly and annual basis across various levels. Second, establish a project monitoring centre or 'war room' at the central government within the power ministry that acts as the programme secretariat. Third, use inputs from independent third parties to assist the programme secretariat in its monitoring efforts by coordinating reviews, preparing timely analyses and conducting audits to ensure 'on-the-ground' performance is accurately reflected. Fourth, define a set of consistent parameters to track and measure the performance of each project. And finally, prepare a state-wise performance scorecard and widely disseminate it through mass media on a monthly basis.

- **Offer states the incentive to act.** The performance of the sector largely depends on progress made by state governments to improve the financial viability of state-owned distribution companies (discoms) and develop new projects. However, the central government can take several steps to incentivise and support states as they improve performance. The first step is to make the Accelerated Power Development and Reform Programme more effective. The proposed National Electricity Fund could play this role. Soft loan disbursals need to be linked to achievement of distribution performance improvement milestones by the states. Loans granted by the programme should become grants when discoms reach a minimum loss-reduction threshold determined by a sliding scale and independent audits. Other measures, such as preferential allocation of central power pool[1] reserves, particularly from the 35 GW of new capacity being developed by central PSUs, and preferential allocation of coal linkages and captive coal blocks will also help. Finally, it is important to motivate host states to set up fast-track approval processes by defining a standard framework of benefits to the states. Possible ways to do this include increasing royalties on coal mining and supplying a part of the power generated for the resource-rich states at variable cost.

- **Unshackle public-sector units (PSUs).** Over the next five years, PSUs will account for the majority of power capacity created. To ensure they are suitably empowered to accelerate their capacity addition efforts, it is important to alter procurement processes and policies, offer greater flexibility to re-award or modify contracts in case of non-performance by vendors and contractors, and provide decision rights on matters related to joint ventures, mergers and acquisitions. These steps must be accompanied by means to strengthen the leadership of the Navratna companies, including five-year tenures for CMDs and Directors, reviews to assess

1 Accounting for 15 per cent of the unallocated power from central PSU power plants.

the effectiveness of the boards, processes to ensure the quality of independent directors, and measures to clarify board roles and contributions.

OPPORTUNITIES, RISKS AND WINNING APPROACHES

To meet India's growing power demand, investments of US$600 billion will be required across the value chain. Of this, around US$300 billion will be necessary for generation, about US$110 billion for transmission, and the balance US$190 billion for distribution. By 2017, the sector will present an annual profit (EBITDA) pool of US$135 billion to US$160 billion.

Substantial and rewarding opportunities across the value chain

Many traditional opportunities, such as the development of generation capacity, as well as non-traditional opportunities will emerge across the value chain. Some of the more exciting opportunities that will unfold across each segment are discussed below.

- **Generation.** Besides traditional opportunities in thermal power projects there will be many others such as:
  - Building merchant peaking plants located near load centres in northern or western India—while large base-load capacities are being built in eastern India, demand is growing faster in the northern and western regions.
  - Investing in over-sized captive plants by players in process industries, e.g., cement and chemicals could help raise the value of such projects by about 20 per cent.
  - Setting up group captive plants to access relatively price insensitive and creditworthy customer segments.
  - Participating in trading activities by leveraging the various arbitrage opportunities that will emerge.
- **Fuel and related infrastructure.** Companies that can mine coal at lower costs will be sought after as most allocated captive mines in India have not yet been developed. Significant imports of coal will also make it lucrative to participate in its trade and construction of import and handling infrastructure. Resource holders should consider integrating forward to realise higher prices for their resources. This is particularly relevant for gas, the price of which is capped at the moment, and could provide higher earnings if utilised to produce peak power, tariffs of which continue to spiral upward.

- **Transmission.** Transmission will offer a limited number of opportunities with stable returns, many of them in partnership with central or state transmission utilities.

- **Distribution.** As and when partial or complete privatisation gathers momentum, distribution will become a very large and potentially profitable opportunity. Large investments in agricultural feeder separation and metering could provide opportunities for equipment makers and project executors. There will also be demand for turnaround specialists—players with expertise in specific areas like network management, billings and collections, and for smart technology providers—players who can develop, commercialise and support technologies such as prepaid cards, real-time meters, tamper-proof meters and smart grids.

- **Equipment and EPC services.** With the creation of 300 GW of generation and related capacity, India will be among the largest markets in the world for equipment and component suppliers. Attractive opportunities include the supply of key components, such as heavy castings and forging, special steel pipes, balance of plant and engineering, procurement and construction services.

- **Solar power.** With one of the world's highest solar intensities and low cost manufacturing, India has the potential to become a global force in solar energy. An emergining regulatory regime and high peak prices make this opportunity real and attractive.

- **Demand-side management.** Growing focus on demand-side management with resultant shifts to compact fluorescent lamps (CFLs), enforced building and appliance codes, will create rewarding opportunities for professional services firms with expertise in the design and construction of green buildings and in the development and implementation of energy management solutions and products.

Inherent risks will need to be managed

Significant development risks, uncertainty of key regulations and potential market failures are inherent risks in the power sector—it is critical to recognise and proactively manage these risks. The evolving cost curve, volatility in fuel markets, uncertainty of nuclear capacity creation, and potential transmission bottlenecks will create dispatch risks. Continuing losses in distribution could lead to payment security risks. Bottlenecks across the value chain including delays in obtaining sites and approvals, coupled with committed fixed tariffs will create project execution risks. Similarly, there will be fuel supply risks resulting from restricted access to fuel supplies, underexplored sedimentary basins and soaring demand. Managing these risks will require a clear understanding of the impact of each risk on the project and

mitigation plans to ensure that projects remain viable under most outcomes. Finally, players will need to develop business models that overcome some key risks.

Winning approaches

Winning in this sector will require tailoring business models to Indian needs and conditions. Among many, three business models are likely to win and create sustainable value.

- **Integrators.** Market inefficiencies and bottlenecks suggest that integration by players into critical bottlenecked parts of value chain will be beneficial. For example, large-generation players can win by integrating into fuel and EPC, which will allow them to bid aggressively, win competitive projects and establish a low-cost position. Similarly, regulated fuel markets will mean that owners of coal and gas resources can create additional value by integrating forward into power generation.

- **Specialists.** Specialists will come in two forms. First, players who have deep operational expertise and capabilities in a specific segment—such players will succeed because there is a need for significant performance improvement in a particular segment. Most opportunities will come with performance-linked returns and will have to be won by participating in a competitive bidding process. To win, players will need to have the ability to accurately value the performance improvement potential on hand, and have the confidence to execute. Such specialists will include world-class O&M players in distribution, generation or mining and project specialists.

  Second, players who focus on relatively small and potentially valuable opportunities to build a strong position—examples include companies that develop load centre-based peaking plants, serve the captive power markets, or provide specialised services, such as demand-side management.

- **Regional entrepreneurs.** These play in multiple parts of the value chain but predominantly work in a few geographies. Such companies will create value by developing a deep understanding of conditions in the region and leveraging their strong relationships with stakeholders, and get access to privileged resources.

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The power sector will provide one of the biggest avenues to participate in the development of India's infrastructure. Undoubtedly, it is fraught with multiple challenges and risks. To overcome these, players will need to craft business models that will allow them to capture value in such an environment. The payoff of making

an early entry will be significantly higher compared to entering when the sector has been reformed—the development of India's telecommunications and infrastructure development industries serve as evidence of this.

Powering India is imperative to sustaining economic growth and will require a concerted effort by all stakeholders. If successful, the power sector will contribute to the wellbeing of more than one billion Indian citizens and in the process it will also create some of the world's largest energy companies.